



SEDIMENT REMEDIAL INVESTIGATION WORK PLAN

Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221
Facility Site ID #21847524

Prepared For:

Guemes Channel Holdings, LLC

By:



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July 20, 2026

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ACRONYMS & ABBREVIATIONS

AET	Apparent Effects Threshold
AO	Agreed Order
ARL	Analytical Resources, Inc. laboratory
BEHP	Bis(2-Ethylhexyl) Phthalate
bml	below mudline
BT	Bioaccumulation Trigger
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
cm	centimeter
CSL	Cleanup Screening Level
CUL	Cleanup Level
DAHP	Washington Department of Archaeology and Historic Preservation
DCAP	Draft Cleanup Action Plan
DMMP	Dredged Material Management Program
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management system
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
F&B	Friedman & Bruya Laboratory
GCH	Guemes Channel Holdings LLC
HASP	Health And Safety Plan
IDP	Inadvertent Discovery Plan
IDW	Investigation Derived Waste
HPAHs	Sum of High-molecular-weight PAH compounds
L	Liter
LPAHs	Sum of Low-molecular-weight PAH compounds
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
MLLW	Mean Lower Low Water
MQO	Measurement Quality Objective
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
Property	Parcels of real property that are included in the Site area
QAPP	Quality Assurance Project Plan

QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
RL	Reporting Limit
ROCs	Receptors of Concern
ROPCs	Receptors of Potential Concern
RPD	Relative Percent Difference
SAP	Sampling & Analysis Plan
SCO	Sediment Cleanup Objective
SCUM-IV	Sediment Cleanup User's Manual (Ecology, Fourth Revision)
Site	Area of known or suspected contamination at Lovric's Sea Craft (3100 Oakes Avenue in Anacortes, WA)
SMI	Stabbert Maritime & Industrial, Inc.
SMS	Sediment Management Standards
SPS	Shannon Point Seafoods
SPT	Standard Penetration Test
SQS	Sediment Quality Standards
SVOCs	Semi-Volatile Organic Compounds
TBT	Tributyltin
TOC	Total Organic Carbon
USACE	United States Army Corps of Engineers
WAC	Washington Administrative Code
WES	Whatcom Environmental Services
µg/kg	micrograms per kilogram



July 20, 2026

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Re: Sediment Remedial Investigation Work Plan

Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221
Facility Site ID #21847524

Dear Ms. Allison:

This document presents a work plan to evaluate the marine sediments on the Lovric's Sea-Craft Site (Site) in Anacortes, Washington. The goal of the sediment remedial investigation work plan is to characterize the nature and extent of contamination in Site sediments. This proposed investigation is designed to comply with the state cleanup requirements under the Washington State Department of Ecology's Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS) for compliance with the necessary elements for a Remedial Investigation (WAC 173-204-550).

This work plan addresses sediments in the intertidal and subtidal portions of the Site. Remedial investigation activities addressing upland portions of the Site are addressed in a Remedial Investigation Work Plan dated January 15, 2025 and its approved addenda.

Should you have any questions concerning this work plan, please do not hesitate to contact us at (360) 714-9409.

Sincerely,
Stratum Group


Ben Carlson, M.Sc., L.G.
Licensed Geologist



Benjamin Carlson

1.0 INTRODUCTION

Stratum Group has prepared this sediment remedial investigation work plan for the Lovric's Sea-Craft Site (Site) located at 3100 Oakes Avenue in Anacortes, Washington (Property). The Property is defined as the parcels of real property involved in the project. The Site is defined by the area of known or potential environmental contamination on the Property. This work plan outlines the recommended steps to conduct a remedial investigation in aquatic areas of the Site.

The purpose of this investigation is to characterize the sediment quality in aquatic areas of the Site. The information gained from the proposed site characterization sampling will help establish and/or eliminate areas of environmental concern on the Site and inform future remediation activities and plans for modernizing the shipyard facilities at the Site.

The Site is located along the southern shore of Guemes Channel, a broad tidal channel of the Salish Sea between Fidalgo and Guemes Islands. Portions of the Anacortes shoreline, including upland portions of the Site, have been utilized for industrial purposes since the late 19th century. A glue factory was initially built on the Property in 1890, which was followed by a fish cannery in the mid-1910s that operated through the early 1960s. The Property converted to ship repair and moorage activities in the mid-1960s and has operated as an active shipyard since that time. Active operations include an industrial basin to the east with two marine railways, a concrete pier and floating pontoon complex, and multiple peninsulas with mixed moorage, and a recreational basin to the west with moorage for private vessels.

The Site became listed as a contaminated site by the Washington State Department of Ecology (Ecology) in 2019 due to the discovery of contaminated sediments within the commercial harbor area in 2017 (Facility Site ID # 21847524, Cleanup Site ID # 14900, [Site webpage](#)). Limited additional sediment sampling was completed in 2023 beneath the east pier. However, the nature and extent of Site sediment contamination remains poorly understood due to limitations within the 2017 data and a lack of subsequent sitewide assessment of sediments.

The Property was purchased by the current owners, Guemes Channel Holdings LLC (GCH), in February 2023 and the owners entered into Agreed Order (AO) No. DE 22368 with Ecology. The site is currently operated as the Guemes Channel Holdings Anacortes Facility. Numerous independent sampling events and cleanup actions have been completed on upland portions of the Site since 2023, and characterization of contamination on the upland portions of the Site is nearing completion.

This work plan includes a summary of previous sediment sampling work, identification of data gaps, a summary of upland contamination as it pertains to potential migration of contaminants into marine portions of the Site, and recommendations for further investigation of Site sediments including a combined sampling and analysis plan (SAP) and quality assurance plan (QAPP). This work plan will be submitted to Ecology for their review and approval under the AO.



2.0 BACKGROUND

2.1 Property Location

The Property is located within the city limits of Anacortes, Washington in Skagit County. The Property is located on the north shore of Fidalgo Island approximately 1.4 miles west-southwest of the historical downtown core of Anacortes, between Dakota Avenue to the east and Hartford Avenue to the west. The Property business utilizes the street address 3100 Oakes Avenue. Tax parcel records indicate the Property also utilizes the addresses 3006 Oakes Avenue, 3022 Oakes Avenue, and 1100 Dakota Avenue. The location of the Property is presented in Figure 1-1 in Appendix I.

The Property consists of ten tax parcels that cover approximately 8.7 acres, portions of which are submerged below the high-water mark of Guemes Channel to the north. The upland consists of a vegetated hillside and a relatively level shoreline industrial area that is developed with multiple buildings and marine railways. The elevation of the Property along Oakes Avenue is approximately 70 feet above mean lower low water (MLLW), with a 40-to-50-foot elevation drop to the nearshore and shoreline areas where the shipyard infrastructure development is present. A long, narrow strip of one parcel also extends approximately 700 feet along the Guemes Channel waterfront west of the west breakwater.

According to the City of Anacortes, all portions of the Property that intersect the shoreline and aquatic environments of the Site are zoned as Light Manufacturing (LM).

Current and historical use areas of the Site extend into marine waters of Guemes Channel, which consist of aquatic lands leased to the upland property owners from the Washington State Department of Natural Resources (DNR). The leased lands extend approximately 600 feet north-northwest from the Property's shoreline bulkheads and cover an area of approximately 13 acres.

The Property is bordered by single-family residential properties to the south along Oakes Avenue, undeveloped land to the east and west, and Guemes Channel to the north. A section of the Guemes Channel trail, a public walking trail managed by the City of Anacortes, terminates at the western tip of the property along the Guemes Channel waterfront.

An annotated aerial photograph of the Site and vicinity is provided in Figure 1-2 in Appendix I.

2.2 Key Site Features

A variety of structures are located on the Site which were constructed by prior owners to facilitate site uses including fish processing, a shipyard, and a marina. An aerial photograph of the Site with key features labeled is provided in Figure 1-3 in Appendix I.

Structures and key physical elements of the Site include the following features, generally presented from west to east:



- **West Breakwater** – A breakwater consisting of upland fill with rip rap slopes. The inner portion of the breakwater was created from a large ship known as the La Merced (~250 feet long by ~50 feet wide) that was beached in the 1960s and backfilled with unknown fill material. The outer portion of the breakwater was created from a barge (~140 feet long by ~40 feet wide) backfilled with unknown fill material. The west breakwater was constructed in the mid to late 1960s.
- **Recreational Basin** – A small to medium-sized boat marina with 40 slips able to accommodate moorage of boats ranging between 26' and 70' in length, occupies the western end of the site. The recreational marina consists of floating docks anchored to treated timber pilings surrounded by a rip rap shoreline. This area is used primarily for moorage with no significant vessel maintenance activities taking place. The marina area was dredged, and floats were constructed in the mid to late 1960s following the installation of the west breakwater. Floats were expanded to their present extent and layout by the late 1990s, including an additional float established between the west and center peninsulas.
- **West Peninsula** – An upland area and peninsula consisting of upland fill with rip rap slopes is located to the east of the recreational basin and to the west of the west warehouse. This area was created from a large barge (~250 feet long by ~50 feet wide) that was grounded and backfilled with unknown fill material. The west peninsula was created in the early to mid-1970s.
- **Central Peninsula and Pier** – An upland peninsula and pile-supported pier consisting of a land area with rip rap slopes on the nearshore end and a concrete and treated timber-pile supported pier structure at the outer end. The existing upland portion of the center peninsula is approximately 205 feet long and 50 feet wide. The center peninsula includes a large barge that was backfilled with unknown fill material bound to the east and west by rip rap slopes. The existing treated timber pile-supported center pier is approximately 26 feet wide and 105 feet long. The pier structure is in a deteriorated condition. Approximately nine older concrete pilings were previously used to repair the pier. The center peninsula appears to have been constructed in the late 1970s. The pier was built off the north end of the peninsula by 1989.
- **West Warehouse** – A three story wood framed building built in approximately 1913 and totaling approximately 21,000 square feet is located on the west side of the property. The west warehouse was constructed on a pile foundation that has been backfilled behind the bulkhead wall. The building is currently used for general storage and as a general workshop for the shipyard.
- **Marine Railway Facilities** – Two marine railways, a smaller west railway and a larger east railway, consist of steel rails supported by timber piling, concrete footings, and/or a gravel base. The marine railways are used to haul out and work on ships. The west railway was built in the mid-1960s, and the east railway was built in the mid to late 1930s.
 - The east railway is the most actively used on site. The railway includes a containment structure that limits seawater flooding of the work area and prevents stormwater and process water discharge from the work area to the marine



environment. Water collected when the containment structure is closed is pumped into totes for temporary storage until it can be properly disposed of offsite. The containment structure was built circa 2020.

- The west railway is open to the marine environment and is currently primarily used for on deck and interior vessel work, such that hazardous substances are less likely to fall to the ground and wash into the marine environment. However, this differentiation has likely been inconsistent through time, and it should be assumed that both railways were historically used for all boat maintenance and repair activities.
- The area around the perimeter of the railway facility consists of soil, rip rap, and concrete bulkheads. The center area between the two railways consists of a shed built on an old barge that was beached between 1989 and 1998 and left to decay in place.
- **East Pier** – A pier constructed in the early to mid-1990s of treated timber pilings with a timber superstructure and a concrete deck. The east pier varies in width and is approximately 315 feet long. The east pier is in a deteriorated condition.
- **Crane barge** – A steel barge that measures approximately 400 feet long and 75 feet wide is docked along the east side of the east pier and is used as a maneuvering surface for a large crane that cannot traverse the existing east pier from the Site upland to the floating pontoon breakwater.
- **Pontoon Dock** – The east pier connects via a vehicle gangway steel ramp to an outer concrete-pontoon floating moorage and breakwater system placed on the property in the early to mid-1990s. The floating concrete pontoon system is in good condition. The pontoon system is anchored to piles and anchors via a chain system.
- **Industrial Basin** – The aquatic area of the facility located between the floating pontoons, the east pier, the center pier, and the marine railway facilities that is used for maneuvering and moorage of primarily commercial vessels within the shipyard facility.
- **Floating dry dock** – A floating dry dock structure that measures approximately 130 feet long by 60 feet wide has been present on the Site since approximately 2011. The dry dock was historically tied up to the channel-side, northwest corner of the floating pontoon breakwater until it was moved inside the industrial basin by 2024. The dry dock has not been used since 2023 and is slated to be removed from the site.
- **East Warehouse** – A four story wood frame building built in approximately 1962 and totaling approximately 34,000 square feet. The building is constructed on a pile foundation with reinforced concrete pile caps. The building is currently a mix of warehouse storage of shipyard supplies and workshop space with some machine shop equipment.
- **Tin Building** – A two-story wood-framed building of approximately 4,300 square feet. The building is sided with metal corrugated panel siding and constructed with concrete footings and slab. The building is currently used for general shipyard storage.
- **Parking and Equipment Storage** – There is an existing asphalt roadway from Oakes Avenue down the west side of the property. The roadway transitions from asphalt to gravel as it moves from west to east. A gravel and asphalt driveway also descends from



the terminus of Dakota Avenue to access the east end of the Site. Gravel and soil areas on the site are utilized for vehicle parking and equipment storage.

- **Bulkheads** – A mix of timber, rip rap, and concrete bulkheads exist along the shoreline. These include the west warehouse bulkhead, marine railway bulkheads, and the east warehouse bulkhead.
- **Utilities** – The site has limited utility infrastructure. Due to the age of the facility, it has no sewer or stormwater management system. In addition, the power infrastructure is insufficient to provide commercial vessels with adequate shore power and support modern shipyard activities.

2.3 Development and Use History

The Property has been developed since at least the late 1890s, when the Russian Cement plant was constructed. This business included the existing structures on the eastern side of the Property, as well as a few docks and other structures that are no longer present. The business produced glue, fertilizer, and fish oil from fish waste gathered from nearby canneries.

Robinson Fisheries established a cod cannery on the west side of the Property circa 1912, which included the existing west warehouse building and several other structures and docks that are no longer present, including additional warehouse or commercial buildings that were built out on docks over Guemes Channel. The entire Property is believed to have operated as a fish processing and packing facility through the mid-1960s.

Lovric's Sea-Craft shipyard was established on the Property by 1965. One of the former docks, extending north from the west warehouse building, was removed by 1969. Shipyard activities are apparent on the Property by 1969, including the presence of two marine railways in roughly their present locations. Two old ships were beached within Guemes Channel along the western edge of the Property in the late 1960s to serve as a breakwater to provide protected boat moorage on the Property. Multiple additional docks were built on the Property and heavier industrial use is visible by the mid-1970s. Two ships or barges that would later be filled to create additional upland work areas west and northeast of the west warehouse building were emplaced by the mid-1970s. Filling of the waterfront areas of the Property occurred in the late 1970s and 1980s to create many of the existing flat areas surrounding the two main warehouses. The fill is suspected to consist of a mix of marine dredge spoils and upland-derived fill of unknown provenance. The existing docks, including the east pier and connected pontoon dock were constructed in their present arrangement by 1998. Multiple former docks or piers have been abandoned and removed from the Site over time, which has resulted in multiple areas of derelict treated wood pilings.

The Property has been in continuous operation as a commercial and industrial shipyard since the mid-1960s. Industrial activities have been primarily concentrated in the basin between the east and west warehouses since that time, currently defined as the industrial basin. The basin between the west warehouse and the west breakwater, currently referred to as the recreational basin, appears to have been used for some industrial shipyard activities in the mid-1970s and early



1980s but it appears to have been converted into the existing recreational vessel moorage by 1989.

Maintenance and repair activities conducted at the shipyard facility have included woodworking, metal fabrication, painting and high pressure washing of hulls, zinc replacement, sandblasting, and electrical and mechanical work. Hull painting and sandblasting activities have predominantly taken place on the marine railways on the Site upland. Other shipyard activities have taken place on the marine railways or onboard vessels moored in the industrial basin. No transport of vessels to other parts of the Site upland has been identified. Process water and sand blast grit from high pressure washing operations on the upland may have previously washed off the marine railways into the environment.

This ship repair facility was first permitted as a boatyard in 1997 under the Ecology's Boatyard General Permit no. WAG030090. After an inspection in November 2010, Ecology determined the ship repair facility should be categorized as a shipyard facility due to the size of ships handled and number of activities occurring. The ship repair facility was issued Industrial National Pollutant Discharge Elimination System (NPDES) Individual Permit no. WA0501491 on December 13, 2013, which became effective January 1, 2014.

The Property was owned and operated by the Lovric family from the late 1960s through early 2023. GCH purchased the Property in February 2023 and leased the Property to Stabbert Marine & Industrial (SMI), an affiliated entity, for expansion of its existing shipyard operations.

In tandem with investigations to characterize the nature and extent of contamination on the Site, SMI is in the planning stages to upgrade and modernize the shipyard. Preliminary modernization plans for the in-water portion of the Site include:

- Removal of multiple sets of derelict creosote piles.
- Replacement of the existing east pier that is used to access the floating pontoon docks.
- Removal of the west and central peninsula such that their waterward limits are in line with the existing bulkhead north of the west warehouse.
- Replacement of the existing, deteriorated bulkhead and extension of the bulkhead across the existing marine railways, with backfilling to create a consistent level upland work area.
- Dredging of the industrial basin to allow ships to float alongside the new bulkhead.

These plans are currently in preliminary feasibility and design stage and may be altered significantly prior to implementation.

2.3.1 Adjacent Property Use History

The east-adjacent property along the Guemes Channel shoreline was developed circa 1902 with a seafood processing facility that operated until a fire destroyed the facility in 1993. Multiple



redevelopment projects have been initiated since that time, but none have resulted in new development on the site. The property is currently a vacant lot, except for periodic overflow storage from the subject property shipyard.

Public roadways, undeveloped vegetated land, and/or single-family residential developments have bound the Site to the south and west since at least 1941. The Guemes Channel Trail was completed up to the western edge of the Site along the shoreline in 2015.

Guemes Channel is located further north of the Site, which is a navigable waterway of the State. No previous in-water development or use of areas north of the Site has been identified.

2.4 Geology

The following descriptions of the surficial deposits in the vicinity of the Property were interpreted from the Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington (Lapen, 2000). Lapen maps the upland portion of the Property as being underlain by surficial deposits of Vashon till (Qgt). Vashon till consists of an unsorted, unstratified mix of clay, silt, sand, and gravel deposited beneath and subsequently overridden by glacial ice. This results in a well compacted and relatively low permeability unit. Continental-derived sediment deposits including sand, silt and clay with lesser gravel and peat of the Whidbey Formation (Qcw) are mapped as lying below the till. These two geologic units are suspected to compose the majority of the shoreline bluff on the southern edge of the property.

Our interpretations of historical aerial imagery of the vicinity indicate that much of the land area north of the access road that runs along the base of the shoreline bluff consists of fill material imported to produce the existing breakwater, peninsulas, and industrial work areas. Fill material consists of a mix of dredge spoils from the harbor area (unconsolidated sand, silt and clay), imported fill (unconsolidated sand and gravel), and man-made debris, based upon upland sampling work that has been completed. The fill material has typically been loose and ranges from low to high permeability.

Soils observed in environmental borings completed on the upland to date have generally consisted of approximately 2 to 7 feet of fill material (sandy silt, silty sand, and silty gravel with trace organics and minor debris), with fill observed to be upwards of 14 feet thick in isolated areas of the Site. Fill is underlain by glaciomarine and/or glaciolacustrine deposits composed of interbedded silty sand and sandy silt to at least 50 feet below ground surface (bgs). A thin layer of suspected beach deposits (clean sand) is present in some locations between the fill and glacial deposits.

Borings completed through the west and central peninsulas encountered approximately 5.5 to 7.5 feet of fill material, similar to that observed in other upland borings, which was underlain by gray silty sand and sandy silt more consistent with marine dredge spoils. A continuous layer of wood was encountered at approximately 10 feet in the west peninsula and between 16 and 19 feet bgs in the central peninsula. The wood is inferred to represent the hulls of the former barges



that were grounded and filled to create these upland peninsulas.

2.5 Hydrology

The marine portions of the Site are located along the south shore of Guemes Channel, a marine (saline) waterway of the Salish Sea that connects Fidalgo Bay to the east with Rosario Strait to the west. The Site is located near the west mouth of Guemes Channel along a fairly exposed, linear stretch of shoreline with no natural protection within approximately 1.5 miles of the Site. The west breakwater provides significant protection for the entire recreational basin and much of the industrial basin from wind, wave, and tidal current effects. However, site observations indicate that at least the outer (northern) half of the industrial basin experiences strong east-west tidal currents on a daily basis. Tidal current predictions for the west entrance of Guemes Channel by the National Oceanic and Atmospheric Administration (site ID #PUG1734) indicate that current velocities in the vicinity of the subject property can meet or exceed 4.5 knots under normal conditions.

Freshwater input to marine portions of the Site is expected to be primarily surface runoff and possible groundwater seepage. The Property currently operates under an industrial stormwater permit (WA0501491). Stormwater management infrastructure on the Site is limited. The east railway possesses a process water capture system that includes a containment structure to both keep out seawater and contain rinsewater and a sump into which process water is collected and pumped into temporary storage totes for eventual offsite disposal. Floating booms are also placed outside the containment structure to collect debris and/or sheens that may escape the containment structure. The two marine railway pads constitute the only two stormwater discharge points covered under the active permit. A catch basin reportedly exists near the southeast corner of the site and discharges beneath the east pier. However, neither the catch basin nor the discharge point have been observed on site. Otherwise, stormwater that falls on the Site directly infiltrates into site soils or sheet flows into Guemes Channel.

Two municipal stormwater outfalls are located on the Property, according to City of Anacortes utility mapping. One outfall collects water from Dakota Avenue and adjoining streets in the residential developments to the south. The collected stormwater flows through a pipe that runs along the eastern edge of the Property, through a vault, and eventually discharges through the concrete bulkhead onto a riprap pile. A second set of pipes discharge stormwater collected from Oakes Avenue and several other streets in the residential developments to the south onto a pile of riprap near the west edge of the upland portion of the Property. The drainage then flows into a culvert and discharges onto a beach and into Guemes Channel west of the existing breakwater, outside of any historical use area of the Site.

2.6 Bathymetry

A bathymetric survey of the Site was completed by Gravity Marine in September 2022. The survey indicated that bathymetry drops gently and progressively away from the shoreline and bulkheads of the industrial basin, reaching approximately -20 to -22 feet mean lower low water



(MLLW) in the vicinity of the floating pontoon breakwater. Water depths increase more rapidly on the eastern, more exposed side of the east pier but generally begin to match depths inside the industrial basin around 250 to 300 feet away from the shoreline bulkheads.

The shoreline of the recreational basin drops rapidly to approximately -8 to -10 feet MLLW with the small intermediate basin between the west and center peninsulas approximately -4 to -6 feet MLLW. Contour lines showing site bathymetry are provided on Figure 1-3 in Appendix I.

Historical documents obtained from the Lovric family by GCH indicate that historical dredging is known to have taken place within the shipyard basins dating back to at least 1966. However, details of the dredging such as previous dredge depths, frequencies, and dredged material disposal methods are uncertain. Old site plans indicate that the west breakwater, west peninsula, and central peninsula were constructed in the 1960s and dredging had been taking place in the 1960s to maintain harbor depths in the west (recreational) basin of between 10 and 16 feet below MLLW. Dredged material was proposed to be placed on the Site uplands and placed within beached barges and ship hulls. Additional communications with the U.S. Army Corps of Engineers (USACE) indicate that rock riprap was also used to fill beached barges and ship hulls. No further details regarding historical site dredging are known.

2.7 Regulatory Framework

Agreed Order No. DE22368 was issued for the Site in accordance with the Model Toxics Control Act (MTCA), RCW 70A.305.050(1). The AO requires GCH to perform a Remedial Investigation and Feasibility Study (RI/FS) and to prepare a draft Cleanup Action Plan (DCAP) to address both upland and in-water contamination at the Lovric's Site. This Sediment RI Work Plan was prepared in compliance with WAC 173-340-350 and 173-204-550 for defining the nature and extent of contamination in the aquatic areas of the Site.

3.0 SUMMARY OF PREVIOUS INVESTIGATIONS

A few previous environmental investigations have been completed in aquatic areas of the Site and for the east-adjacent property. Key findings from those investigations are summarized below.

3.1 Limited Sediment Sampling – Whatcom Environmental Services (2016)

Following suspected violations of the site's NPDES stormwater permit (WA0501491), Ecology required collection of two sediment samples from the Site: one from along the water's edge of both marine railways. Whatcom Environmental Services (WES) collected the samples and delivered them to the analytical laboratory. Samples were analyzed for the full suite of contaminants of potential concern (COPCs) for marine sediments as outlined in the Sediment Management Standards (SMS) regulation, including tributyltin (TBT). Sample results were compared to SMS sediment quality standards (SQS) criteria (now referred



to as the sediment cleanup objective (SCO) criteria) and SMS's sediment impact zone maximum (SIZmax) criteria (now referred to as cleanup screening level (CSL) criteria). To maintain consistency with modern terminology, only the SCO and CSL labels will be used moving forward. SMS sediment criteria are broadly applicable, calculated, risk-based concentrations used commonly as a starting point for evaluating the presence of sediment contamination. SCO values represent chemical concentrations at or below which no adverse effects are predicted on the benthic community. CSL values represent chemical concentrations at or below which minor adverse effects are predicted on the benthic community and generally represent the highest allowable concentrations of contaminants on a site. Chemical concentrations above the CSL are predicted to have more significant adverse effects on the benthic community and/or human health.

Metals (copper, mercury, and/or zinc) exceeded CSL criteria in one or both samples, dibenzofuran exceeded the SCO criteria in one sample, and TBT exceeded the bioaccumulation trigger threshold established in the U.S. Army Corps of Engineers Dredged Material Management Program (DMMP) User Manual in both samples (DMMP, 2025).

Maps and data tables from this initial limited sampling investigation are provided in Appendix II.

3.2 Sediment Data Report – Whatcom Environmental Services (2017)

Based upon the exceedances from the 2016 limited sampling, Ecology required the former property owners to conduct sediment sampling in the submerged portions of the Site to determine whether historic and ongoing shipyard operations had more broadly contaminated nearshore sediments. WES collected samples in September 2017 in accordance with an Ecology approved sampling and analysis plan. A total of 13 samples were collected from two gridded clusters in the industrial basin (Figure 2-1). Sample cluster A was concentrated in the vicinity of the two marine railways and extended approximately 150 feet north of the bulkhead. Sample cluster B was focused in the vicinity of a permitted stormwater discharge beneath or adjacent to the east pier, as noted in the NPDES permit. All of the samples were collected from the upper 10 centimeters (cm) of sediment accumulated on the seafloor.

Two of the proposed sampling locations were unsuccessful. Location A-2, in the middle of the nearshore transect of the railways cluster, encountered a rocky substrate that prevented collection of viable sample material. Location B-2, located beneath the east pier, ended up being inaccessible by the sampling vessel and water depths were too great to reach by foot. The site substrate was generally found to be firm, requiring up to eight deployments of the sampling clamshell to collect sufficient sample volume. In locations B-1, B-3, and B-6 in the stormwater outfall cluster, the sampling clamshell was only able to penetrate the upper 5 cm of sediments. This was attributed to a greater exposure to tidal currents in this vicinity that likely limited soft sediment accumulation potential.

All thirteen samples were analyzed for the full suite of COPCs and conventional parameters outlined in the SMS regulation, including organotins (Whatcom Environmental Services, 2017).



Laboratory results were compared to SCO criteria for marine sediments, as presented in Table 8-1 of the Sediment Cleanup User's Manual revision IV (SCUM-IV) guidance document. Seven of the eight samples collected in the railways cluster exceeded SCO values for one or more COPC (one sample also exceeded for the CSL for at least one COPC). Two of the five samples collected in the stormwater outfall cluster, those located farthest to the west and within the industrial basin, exceeded SCO values for one or more COPC. COPCs that exceeded SCO values in one or more samples included copper, zinc, mercury, benzoic acid, bis(2-ethylhexyl) phthalate (BEHP), dibenzofuran, several polycyclic aromatic hydrocarbons (PAHs). TBT concentrations were compared to the DMMP bioaccumulation trigger (BT) threshold, as no SMS value exists.

Metals and TBT concentrations were greatest in the nearshore area by the west railways and in the middle of the industrial basin adjacent to the central peninsula. The only dibenzofuran exceedance was near the mouth of the west railways. Benzoic acid was elevated throughout most of the main industrial basin north of the marine railways, as well as north of the east warehouse. BEHP exceeded in the two subtidal locations adjacent to the central peninsula. PAH concentrations were greatest in the intertidal areas by both marine railways, as well as in intertidal and shallow subtidal areas north of the east warehouse. The highest PAH detections were notably adjacent to an area of derelict treated timber piles.

Ecology completed a detailed review of this sampling report and provided a response in February 2019. Ecology identified multiple issues with the report including: (1) sample results were only compared to the most restrictive SCO values and not the less restrictive CSL values. Thus, CSL exceedances were not reported; and (2) Practical quantitation limits (PQLs) and reporting limits of the analyzing laboratory were in several instances above the screening value results were being compared to, such that "non-detect" values did not necessarily meet the screening levels. Data from the report indicates that PQLs for several organic chemicals and phthalates were higher than their respective SCO. A revised copy of the data report was requested by Ecology. However, no resubmittal was identified.

Ecology listed the Site as a contaminated site in February 2019 due to the contamination discovered during the NPDES permit sediment sampling. Lovric's Sea-Craft Inc., the prior owner, was identified as a potentially liable party for the release.

The approximate sampling locations from the WES studies are indicated on Figure 2-1 in Appendix II. Data tables from this sediment sampling investigation are provided in Appendix II.

3.3 Limited Sediment Sampling Investigation – Stratum Group (2023)

Following GCH's acquisition of the Site in early 2023, additional investigations were undertaken by GCH as part of planning for modernization of the shipyard, as referenced in Section 2.3.

To determine geotechnical design parameters for a new east pier, two in-water borings were completed through submerged sediments underneath the existing pier using mud-rotary drilling techniques and a split spoon sampler. Stratum Group was engaged to observe the drilling



activities to look for indications of contamination and collect sediment samples for proposed dredge characterization purposes.

In-water geotechnical borings (PG-1 and PG-2; Figure 1-5) were completed on April 24 and 25, 2023. The locations were accessed from the east pier by removing concrete panels in the deck of the pier. Steel casing was then lowered through the hole in the pier by a drill rig to the seafloor and driven into the sediment. The in-water borings were completed to depths of 55 to 60 feet below mudline (bml).

Soil samples were collected using standard penetration test (SPT) sampling techniques to drive a modified California split spoon sampler with a 2.5" inner diameter, to allow for sufficient sample volume for the necessary analyses.

3.3.1 2023 Sediment Samples

Sediment encountered in both borings consisted of gray, interbedded silt, sandy silt, and silty fine sand to at least 55 feet below mudline. Soft/loose sediment was only present in the upper ~0.5 foot of the outer pier boring (PG-1) while soft/loose sediment made up the upper 5 feet of the sediment column in the inner pier boring (PG-2). Trace shells and bits of wood were observed in the upper 1 to 2 feet of both borings. These findings are consistent with stronger currents observed farther away from the shore, which likely limit the accumulation of fine sediments. However, as current strength decreases closer to shore, sediment deposition appears to correspondingly increase.

Samples from PG-1 were collected from the surface of the seafloor (0-0.5 feet bml), 6-6.5 feet bml, 11.5-12 feet bml, and 20-20.5 feet bml. Samples from PG-2 were collected from the surface of the seafloor (0-0.5 feet bml) and 10-10.5 feet bml. No obvious indications of contamination (e.g., odors, sheen, debris) were observed in sediment from either pier boring. After collection, samples were immediately placed into an ice-filled cooler and transported to an Ecology-accredited laboratory for analysis.

Though a suitability determination was not requested, sediment samples were analyzed for the full suite of marine sediment COPCs outlined in Table 8-3 of the USACE DMMP User Manual. Samples were also analyzed for the sediment conventional parameters described in Table 8-1 of the manual (total solids, grain size, total organic carbon, sulfides, and ammonia). The deepest sample from each location was selected to be below the anticipated maximum depth of proposed dredging ("Z-layer"), based upon preliminary dredging plans at the time of sampling.

3.3.2 2023 Sediment Sample Results Discussion

Due to the very low total organic carbon concentrations in samples from the pier borings, results were compared to the SCO and CSL levels within the SMS, as well as the apparent effects threshold (AET) SCO and CSL levels, per guidance in the SCUM-IV. AET values are empirically derived contaminant concentrations below which no adverse biological effects



(SCO) or minimal adverse biological effects (CSL) are expected. These values are sometimes the same as SMS values but in some cases are less restrictive than the SMS values.

All three samples from PG-1 and the deeper sample (10-10.5') from PG-2 met the SCO screening levels for all COPCs. The surface sample (0-0.5') from PG-2 exceeded the SCO screening level for 2,4-Dimethylphenol, dibenzofuran, phenanthrene, fluoranthene, chrysene, and benzo[a]pyrene, as well as the SMS CSL for naphthalene, acenaphthene, fluorene, 2-methylnaphthalene, and total low-molecular-weight polycyclic aromatic hydrocarbons (LPAHs). However, this sample only exceeded the AET CSL for total LPAHs.

Summary tables of the sediment analysis results are presented in Appendix II.

3.4 Shannon Point Seafoods (Golder, 1994 and Hart Crowser, 1995)

A seafood processing plant that included overwater piers and processing facilities operated on the adjacent property to the east from 1902 through 1993. The facility burned down in 1993, and containment booms were quickly placed in the water to limit the spread of debris. However, due to concerns of contamination of marine sediments as a result of the fire, two sediment sampling investigations were completed in 1994 and 1995. Samples were collected from the upper 2-5 cm of sediment from seven locations arranged in three transects leading from the shoreline bulkhead out into Guemes Channel.

Results from the initial 1994 sampling (Golder, 1994) indicated that multiple PAHs (acenaphthene, fluorene, phenanthrene) and dibenzofuran slightly exceeded the SMS CSLs in one location approximately 100 feet from the shoreline bulkhead along the west edge of the aquatic lease area (SP-2). BEHP also exceeded the marine CSL in five of seven locations sampled. Lastly, zinc concentrations exceeded the SCO in one location near the shoreline (SP-6). This exceedance was subsequently connected to a compromised battery that had been present on the shoreline near SP-6. The battery was removed along with surrounding sediments, which was believed to have effectively addressed that concern.

A second round of sampling was completed in 1995, which included resampling and both chemical and biological testing of five of the seven locations that had CSL and/or SCO exceedances in the initial phase (SP-2, -3, -4, -5, and -7). The 1995 investigation also included collection of four additional samples from outside the containment boom area (Hart Crowser, 1995). The following are the findings from the 1995 investigation:

- Bulk sediment chemistry testing of the sample locations with previous CSL and/or SCO exceedances met the biological effects criteria in each sample except HC-7 and HC-2. However, both of these exceedances were still below the AET CSL. These exceedances were deemed to not represent a station cluster of concern (where CSLs are exceeded over three contiguous stations) and therefore did not pose a risk to biological activity in site sediments.



- BEHP concentrations exceeding marine SCO and CSL criteria were detected in the resampled locations but did not exceed the biological effects CSL and are believed to be bound to small pieces of melted plastic debris from the fire and are not suspected to be bioavailable.
- Sediment samples collected from outside the containment boom area generally met SMS standards except for minor exceedances of fluoranthene and BEHP in one location (HC-10) located within the Lovric's Site aquatic lease area. However, concentrations did not exceed the marine CSL.
- Confirmatory biological testing results did not identify a station cluster that exceeded the CSL biological effects criteria (WAC 173-204-520(3)).
- Based on these results, SPS requested a no further cleanup action determination from Ecology.

Upon receipt and review of these reports, Ecology responded on June 26, 1995 stating that they accepted the reports and agreed that "additional actions need not be taken" (Ecology, 1995). The report continues that "field logs indicate relatively healthy sediments [on the site], with some debris from the fire though not as much as one might expect". This sampling work was completed and reviewed prior to Ecology publishing its contaminated sediment site list, therefore the site never became listed for contaminated sediments. A memo from the Washington DNR dated June 30, 1995 concurred with Ecology's findings and indicated that no further action was necessary.

The approximate locations of sampling locations from the Shannon Point Seafoods (SPS) site are indicated on maps in the 1994 and 1995 sampling reports, which are provided in Appendix III. A copy of Ecology's 1995 letter, which indicates that no further investigation or cleanup activities would be required on the SPS site, is provided in Appendix III.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

A schematic representation of the Conceptual Site Model for in-water portions of the Site is presented in Figure 1-4 in Appendix I. The schematic representation identifies the potential contamination sources in the marine portion of the Site, transport mechanisms, exposure pathways, and potential receptors.

GCH and SMI plan to continue operating the Site as an industrial shipyard and recreational marina for the foreseeable future and are investing heavily in property improvements toward promoting those uses. Therefore, future changes in property use that would significantly alter the potential receptors to contaminants on the site are not anticipated and are therefore not considered in the conceptual site model.

Sediments on the Site have been minimally characterized, and the previous sediment sampling has been primarily focused on surface sediment conditions in the vicinity of the marine railways



and east warehouse. Additional sediment sampling is needed to complete site characterization of the in-water portions of the Site and confirm the nature and extent of sediment contamination related to historical Site operations.

4.1 Potential Contamination Sources & Transport Mechanisms

Current and historical shipyard activities on the Site are spread across approximately 5 acres of shoreline and nearshore areas. The Site has operated as an active shipyard since at least the mid-1960s. Shipyard activities on the Site are believed to have remained largely unchanged since the mid-1960s. In-water industrial activities and structures have primarily been concentrated in the existing industrial basin between the east and west warehouses since the 1960s. However, operations have progressively expanded farther outward into Guemes Channel as additional piers and floating docks have been built. The current recreational basin may have historically been used for occasional industrial shipyard activities, but it was converted into the existing recreational marina by 1989.

Historical shipyard activities include fueling of shipyard equipment, boat hull and motor maintenance and repair, painting and paint stripping, sandblasting, boat hull anode installation and disposal, metal fabrication, woodworking, and heavy equipment operation. These operations along with weathering of scrap metal, creosote-treated timbers and heavy equipment that has been stored in upland shoreline areas may have resulted in releases of COPCs to aquatic areas of the Site. Additionally, many of these industrial activities may have historically occurred over water within the industrial basin. Prior to the adoption of modern best management practices, direct releases of COPCs may have taken place in the industrial basin as part of these historical overwater activities.

Multiple potential transport mechanisms exist for contaminants released on the upland and/or above the water to reach in-water portions of the Site, including:

- Spills or releases of hazardous substances from docks, dry docks, and vessels.
- Stormwater runoff from the marine railways work areas to the industrial basin.
- Historical process water runoff from the marine railways to the industrial basin.
- Untreated stormwater discharge from the eastern Site upland through the bulkhead beneath the east pier to the industrial basin.
- Soil leaching and groundwater migration from the upland into surface waters of Guemes Channel.

Hundreds of creosote-treated timbers are present across the property, both in active use in bulkheads, piers, and docks, and as derelict clusters of piles where former structures are no longer present. Treated timbers may leach chemicals to the surrounding marine water and sediment as they deteriorate. Additionally, breakdown products from old, potentially treated wood that may be present below the water table, particularly from the suspected beached barges that underlie the west and central peninsulas and the boat hull that comprises part of the west



breakwater, could leach to groundwater and migrate to surface water and sediment.

Beyond what is discussed above, little is known about the spatial distribution of industrial shipyard activities across the Site through time, making it difficult to identify likely point sources of sediment contamination aside from the most obvious pathway of runoff from the marine railways.

Once contaminants have reached the marine environment on the Site, they may be redistributed through natural or human-caused activities. Strong tidal currents routinely flow east and west through Guemes Channel. Although the recreational basin and the inner portion of the industrial basin are sheltered from most of these currents by the west breakwater, the outer portion of the industrial basin is fully exposed to these currents which could redistribute contaminants from the site particularly to the east. Propeller-generated currents (i.e., propwash) created by vessels maneuvering within the industrial and recreational basins may also contribute to local redistribution of surface sediments. The grounded and floating breakwaters appear to significantly attenuate wind and wave energy that reaches the shoreline of the Site, which in turn significantly reduces the ability of wind and wave energy to redistribute Site sediment or erode the Site shoreline and move upland contaminants to aquatic areas of the site.

4.2 Potential Receptors & Exposure Pathways

Human and ecological receptors are potentially exposed to contamination in the marine environment of the Site. Both intertidal and subtidal areas of the Site are considered for potential exposure. Subtidal areas are defined as those below -4 feet elevation MLLW. Intertidal areas are defined as those above -4 feet MLLW. The riprap bulkheads and relatively steep slopes of the bathymetry outside of the industrial basin means that the only functional intertidal area of the Site is located in the industrial basin north of the marine railways (see Figure 1-3 in Appendix I).

4.2.1 Potential Ecological Exposure

The Salish Sea, which includes aquatic areas of the Site, is host to vibrant communities of marine flora and fauna, which provide vital economic and ecological services that can be negatively impacted by sediment contamination. Although no site-specific studies have been performed, it is known that several receptor groups occur in and throughout the Salish Sea and would be expected to use the aquatic environs of the Site. Species that could directly or indirectly be exposed to contaminated sediments include the benthic invertebrate community, fish, birds, and mammals. Reptiles and amphibians are unlikely to be present on site because there is no persistent freshwater habitat present. Potential pathways for these receptors to be exposed to Site contamination include direct contact with contaminated sediment and surface water, sediment and surface water ingestion, ingestion of benthic flora and fauna, and ingestion of fish.

Figure 1-4 illustrates potential exposure pathways for receptors of potential concern (ROPCs). ROPCs are general, because insufficient information has been collected to identify specific species of concern. Further evaluation will be done as part of the sediment RI to determine



whether the group or a representative species should be identified as a Receptor(s) of Concern (ROC).

4.2.2 Potential Human Exposure

Shipyard workers may be exposed to Site sediments through normal work activities around piers, pilings, and boat bottoms. Occupational exposures may also occur during marine improvements and/or maintenance planned by GCH and SMI in the future. Most workers are typically aboard vessels and well above the water surface, such that worker exposure is likely to be relatively infrequent. Other occupational exposure, such as a biologist conducting field investigations for shipyard improvements, is likely but is expected to be infrequent and short in duration, resulting in a relatively low risk. Commercial workers are likely to utilize appropriate personal protective equipment (PPE) during work activities, further reducing their potential exposure risk.

Recreational direct contact with Site sediments could theoretically take place on the Site through activities like beach play, shellfish digging, launching small vessels, or shoreline fishing. There are no traditional beach or water access locations on the Site that would allow for small vessel launching, beach play, or shellfish digging. The only such publicly accessible beach in the vicinity of the Site is located on the west side of the west breakwater, where no historical industrial activities that could have caused sediment contamination are known to have taken place.

Historical shellfish, crab, or fish collection and/or consumption may have taken place on the site, particularly in pre-industrial times. However, industrial development makes the Site undesirable for such activities and no evidence of fish collection and/or consumption either currently or in the recent past has been identified. Additionally, the size of the aquatic areas of the Site are relatively small in comparison to the home range of fauna most likely to be consumed (e.g., fish, crabs) and harvesters have enormous areas unlikely to be impacted by Site activities that are accessible and more suitable for harvesting such fauna. Redevelopment plans for the Site to improve and modernize shipyard activities are not expected to improve or increase recreational use or fisheries access on the Site. Therefore, human exposure via these pathways is not expected to drive Site remediation decisions.

Although potential exposure to contaminants through activities like beach play and shellfish digging in intertidal areas, subsistence fishing (including tribal net fishing), and consumption of seafood is unlikely in aquatic areas of the Site under current and expected long-term future use, potential future use scenarios will be considered when evaluating potential Site risks. Therefore, these exposure pathways will be further evaluated in the Remedial Investigation report to help establish Site cleanup standards.

Humans may be exposed to Site contamination via direct contact with waters of Guemes Channel in both occupational and recreational settings. However, contaminants in the marine environment generally accumulate in sediments and are diluted in marine water bodies such that the exposure risk from surface water is expected to be minor when compared to the exposure risk



from Site sediments.

4.3 Contaminants of Concern

Based upon the current and historical activities on the Site and contaminants previously identified by upland and preliminary sediment sampling, COPCs for the in-water portions of the Site include the full suite of marine SMS chemicals (metals, PAHs, and other semi-volatile organic compounds (SVOCs) including polychlorinated biphenyls (PCBs; total aroclors and total congeners) and dioxins/furans).

Based on previous elevated detections and historical shipyard activities on the Site, sediment porewater samples will also be selectively analyzed for TBT.

A list of all site COPCs is presented in Section 6.5, below.

4.4 Site Cleanup Levels

Insufficient information exists to establish Site cleanup levels at this time. Additional data is needed to understand Site sediment quality and the potential exposure pathways.

For the purposes of this RI, SMS SCO and CSL values along with natural background values, secondary exposure values and SMS PQL values will be used as preliminary screening levels to allow initial evaluation of the nature and extent of sediment contamination and determination of Site COPCs (see Section 6.5).

An evaluation of appropriate cleanup levels (CULs) will be completed as part of the sediment RI report, as discussed below (Section 6.5). The findings of the sediment remedial investigation proposed below will also be used to update and refine the conceptual site model for the Site.

5.0 IDENTIFIED SEDIMENT DATA GAPS

Several data gaps remain in the understanding of sediment contamination on the Lovric's Site.

- Existing sediment data is insufficient to fully characterize the lateral nature and extent of Site sediment contamination.
- Existing sampling data is insufficient to establish Site COCs.
- Minimal subsurface sediment sampling has been completed on the Site, and the vertical nature and extent of Site sediment contamination remains insufficiently characterized.
- No biological testing of sediments has been completed to evaluate toxicity and/or bioaccumulation potential.
- The presence and location of the potential catch basin and stormwater discharge point beneath the east pier (separate from the City of Anacortes stormwater outfall), which could be a transport mechanism of contaminants from the upland to aquatic areas of the



- site, has not been confirmed.
- The makeup and extent of the marine railway foundations (e.g., concrete, gravel, pilings, etc.) in the deeper intertidal and subtidal areas of the site are unknown.

6.0 PROPOSED IN-WATER WORK PLAN

The work plan proposed herein was designed to address the identified data gaps and complete characterization of the nature and extent of sediment contamination on the Site, as well as determine Site COCs, appropriate CULs for identified COCs, and provide a baseline for evaluating potential cleanup options.

The work outlined below will create a baseline understanding of the Site's marine conditions, support identification of Site COCs, and determine the key areas of concern to help focus future supplemental evaluations. Work plan addenda may be prepared if supplemental sampling efforts are required to complete site characterization.

Stratum Group personnel will coordinate and be onsite to oversee subcontractors and collect sediment samples. Subcontractors will be utilized, as needed, during the project including sediment coring professionals and Ecology accredited laboratories for sample analysis.

Fieldwork, sampling, and sample analysis methodologies are presented in the project SAP/QAPP (Appendix IV).

6.1 Preparatory Activities

Prior to implementation of this work plan, written approval will be obtained from Ecology. Any necessary permits for in-water sampling work will be identified and obtained by GCH prior to the initiation of sampling activities.

6.2 Cultural Resources Assessment

The Site is undergoing remedial investigation under an Agreed Order with the State of Washington. Per WAC 173-340-815(3)(b), prior to ground disturbing activities on the Site, the Washington Department of Archaeology and Historic Preservation (DAHP) and affected Indian tribes must be consulted on the potential effects of the planned activities.

A cultural resources consultation form will be submitted to Ecology pertaining to the work proposed herein. If the initial consultation with DAHP and the tribes results in a required cultural resources survey for the Site, ground disturbing activities will not commence until the survey has been completed and/or permission for the proposed ground disturbing activities has been granted in writing by DAHP. Any supplemental requirements outlined in the final approval from DAHP, such as archeological monitoring during sampling activities, will be followed.



If items of potential cultural resource value are observed during ground disturbing activities, field personnel will follow the conditions of the Inadvertent Discovery Plan (IDP), a copy of which is provided in Appendix IV.

6.3 Sediment Sampling

We proposed collection of sediment samples from approximately twenty-seven (27) locations in the marine portions of the Site. Drilling and sampling activities will be conducted in accordance with an Ecology-approved SAP/QAPP, provided in Appendix IV.

Samples will be collected in each location via two methods: surface grab sampling and core sampling.

Grab samples will be collected using either a manual, Van Veen-type clamshell sampler or a power grab sampler deployed from a sample vessel. These devices target collection of relatively undisturbed sections of the upper ~10 cm of the seafloor, generally considered the bioactive zone, where the greatest potential for ecological impacts exists.

After collection of surface samples, subsurface sampling activities will be completed using vibracore sampling equipment mounted to a sampling vessel. This method extracts continuous cores of sediment to the desired depth. Previous sampling activities on this Site suggests that there is a clear distinction between soft and loose shallow sediments and underlying dense, native, glacial deposits. Each core will be advanced to approximately 12 feet bml and at least four feet into native glacial material, or until drill rig refusal. The 12-foot recommended termination depth is expected to reach at least 4 feet into native glacial material based on the current understanding of maximum loose sediment thickness at this Site.

For sampling stations located in intertidal portions of the Site where the substrate is firm enough for personnel to walk, samples may be collected using hand tools during extreme low tides. Surface samples may be collected directly from the surface using a shovel or spoon. Subsurface samples may be collected using a hand auger. If field conditions limit the ability to collect samples at depth using hand tools, these stations may be reoccupied at high tide and sampled using the vessel-based methods discussed above.

Samples will be collected in a continuous fashion from two-foot sections of the core until the termination depth is reached. For example, samples from a 12-foot-long core will be collected from 0-2 feet bml, 2-4 feet bml, 4-6 feet bml, 6-8 feet bml, 8-10 feet bml, and 10-12 feet bml.

The proposed locations and rationale for sediment sampling are provided in Figure 1-5 in Appendix I and in Table 1, below. The proposed sampling locations are identified as SED1 through SED27 in Figure 1-5. Generally, sample locations were selected in an effort to obtain good spatial coverage across the Site. Information detailing the location(s) of obvious point sources of sediment contamination is limited on this Site. Additionally, previously collected data is limited in its lateral extent and provides no information as to the depth of contamination in



those areas. Therefore, the investigation approach is centered on collecting samples across all in-water areas of the Site potentially impacted by current and historical industrial activities with a greater density of sampling in the intertidal areas by the marine railways, where contamination is suspected to be greatest and potential human exposure is most likely. Data collected from the proposed distribution of sampling locations should be sufficient to interpolate between discrete points and determine if and where additional sampling may be needed to support the RI.

Table 1. Boring Location Rationale

Boring ID	Location	Potential Contaminant Sources
SED1	Center of the inner recreational basin	- Pre-1980 industrial ship maintenance/repair - Post-1980s recreational vessel incidental releases
SED2	Center of the outer recreational basin	
SED3	Center of the recreational basin entrance	
SED4	Near the terminus of the finger pier between the west and central peninsulas	- Small vessel maintenance by the finger pier between the peninsulas - Potential leaching from derelict creosote piles to the east. - Evaluates outer extent of potential contamination in recreational basin (above).
SED5	Near the middle of the channel between the central peninsula and the west breakwater	
SED6	West of the southern end of the central peninsula	
SED7	Near the northwest tip of the central peninsula	- Leaching from derelict creosote piles - Small vessel maintenance by the finger pier between the peninsulas - Decaying wood from buried peninsula barges
SED8	Nearshore area between east and west railways	
SED9	Nearshore area of the west railways	
SED10	Nearshore area of the east railways	<u>Area of greatest current and historical shipyard activity:</u> - Direct releases during vessel maintenance activities on the marine railways (e.g., sand blasting, painting, metal fabrication) - Upland stormwater & process water discharge from marine railways. Evaluate changes from proximal to distal portions of intertidal zone. - Direct releases from the historical marine railway operations - Leaching from potential treated piles used to support the marine railways - Upland stormwater discharge through the bulkhead by the east pier (SED14 & 18) - Leaching from derelict creosote piles (SED 15 & 18) - Decaying wood from buried peninsula barges (SED9 & 15)
SED11	Nearshore area by the east warehouse bulkhead	
SED12	~90 ft northeast of the shoreline bulkhead between the east and west railways	
SED13	~75 ft north-northwest of the bulkhead west of the east warehouse	
SED14	~30 ft north-northwest of the east warehouse bulkhead	
SED15	Along the west railways by the south end of the east central peninsula's derelict piles	
SED16	Along the east railways ~120 ft north of the east warehouse bulkhead	
SED17	~120 ft north of the middle of the east warehouse bulkhead	
SED18	Within east pier's derelict pile area	



Table 1. Boring Location Rationale (continued)

Boring ID	Location	Potential Contaminant Sources
SED19	Near the northeast corner of the central peninsula	- Direct releases during vessel maintenance/maneuvering - Transport of nearshore contaminants farther from shore (natural or via prop wash) - Leaching from derelict creosote piles & decaying wood from peninsula barges (SED19)
SED20	~260 ft north of the east warehouse bulkhead in the middle of the industrial basin	
SED21	Adjacent to the east pier ~130 ft north of the derelict pile area	
SED22	North tip of the central peninsula pier	- Direct releases during vessel maintenance on central peninsula pier - Decaying wood from buried peninsula barge
SED23	In the middle of the entrance to the protected basins	- Direct releases during vessel maintenance on pontoon dock (including former use of dry dock) - Transport of contaminants (natural or via prop wash) - Anticipate establishing northern edge of contamination
SED24	Near the central inner edge of the pontoon dock	
SED25	Near the interior meeting point of the pontoon dock and the east pier	
SED26	~120 feet north of the shoreline bulkhead east of the crane barge	- Direct releases during vessel maintenance on east pier - Transport of contaminants (natural or via prop wash) - Anticipate establishing eastern edge of contamination
SED27	~300 feet north of the shoreline bulkhead east of the crane barge	

6.4 Sample Analysis

Environmental samples collected as part of this work plan will be delivered or mailed to a laboratory with the Washington State's Department of Ecology accreditation for the required analysis and capable of reaching the reporting limits outlined in the SAP/QAPP.

The surface grab sample and the first two core sample intervals (0-2 ft bml and 2-4 ft bml) will be analyzed at each sampling location. Samples from greater depths will be archived at the laboratory pending the results of the initial analyses.

Samples will be analyzed for the full suite of standard marine SMS chemicals as presented in Tables 8-1 of SCUM-IV, with selected samples being further analyzed for PCB congeners and dioxins/furans (see Table 2, below). Samples will also be analyzed for conventional parameters including grain size, total solids, and total organic carbon. Lastly, sediment porewater will be collected from all surface sediment samples and selected sediment samples at depth in the intertidal areas near the marine railways for TBT analysis. If the most restrictive initial screening criteria presented in Table 2 are exceeded at a given location, deeper samples from that location may be progressively analyzed until the screening criteria are met, or no additional samples remain.



Samples may also be archived for potential bioassays to evaluate sediment toxicity against biological effects criteria. Bioassays may be triggered based on chemical exceedances of the SMS criteria and the results may be used to further refine appropriate sediment CULs.

Further details of the sample analysis plan for this site are provided in the SAP/QAPP in Appendix IV.

6.5 Sediment Screening Levels

Sample results will be initially compared directly to the benthic SMS sediment cleanup objective (SCO) and cleanup screening level (CSL) marine sediment chemical criteria presented in Table 8-1 of the SCUM-IV for screening purposes. SCO criteria represent chemical concentrations at or below which no adverse effects are predicted on the benthic community. CSL criteria represent chemical concentrations at or below which minor adverse effects are predicted on the benthic community. Chemical concentrations above the CSL are predicted to have more significant adverse effects on the benthic community and generally represent the highest allowable concentrations of contaminants on a site.

Sample results for bioaccumulative substances will also be compared to screening levels that are protective of human health through the consumption of seafood (defaulting to the higher of natural background or PQL values presented in Table 10-1 and Table 11-1, respectively, in SCUM-IV) and secondary exposure scenarios such as child beach play, adult subsistence clam digging, and net fishing (Table 9-3 in SCUM-IV).

The Site's preliminary screening levels are presented in Table 2 below. Table 2 also presents the SMS PQL values for several SMS substances that may be used to develop final cleanup standards.

Note that the standard benthic SMS screening levels for several COPCs are normalized by total organic carbon (TOC) by dividing the detected dry weight chemical concentration by the decimal percentage of TOC detected in that sample. In the event that TOC concentrations are either very high (>3.5%) or very low (<0.5%), the dry weight chemical concentrations may also be compared to the dry weight AET SCO and CSL values (Barrick et al., 1988). Benthic AET SCO and CSL values for each analyte are also presented in Table 2.

Note that these screening levels will be used to conduct a preliminary evaluation of site conditions. Exceedances of screening levels do not, by themselves, indicate that remediation will be required. Following the screening evaluation and refinement of the CSM, preliminary Site COCs will be identified. For each preliminary Site COC, final SCOs and CSLs will be established as part of the RI, incorporating available laboratory data (including bioassays, if performed) and a more Site-specific evaluation of exposure scenarios and pathways consistent with SCUM-IV guidance. After the Site-specific evaluation, final Site COCs will be identified. A preliminary sediment cleanup level (CUL) and point of compliance will be established for each COC based on the CSM, including the exposure scenario(s), receptors of concern, and



appropriate spatial scale that represents each exposure scenario.

The Site boundary will be established in the RI based on the CSM and defined by the nature and extent of all COCs exceeding the applicable preliminary sediment CULs. Spatial data interpolation methods (e.g., use of Thiessen polygons or inverse distance weighting) may be used to support definition of the Site boundary, as well as calculation of area-weighted averages to support delineation of specific Site COCs, sediment cleanup units, or sediment management areas, which may warrant different CULs and/or points of compliance.



Table 2. Preliminary Sediment Screening Levels

Analyte	Contaminant Concentrations								
	Benthic Exposure Criteria (SCUM Table 8-1)				Natural Background (SCUM Table 10-1)	Human Health Secondary Exposure Scenarios (SCUM Table 9-3)			SCUM PQLs (Table 11-1)
	SMS Marine Sediment SCO	SMS Marine Sediment CSL	AET Marine Sediment SCO	AET Marine Sediment CSL		Beach Play (child)	Subsistence Clam Digging (adult)	Subsistence Net Fishing (adult)	
Metals	mg/kg dry wt		mg/kg dry wt		mg/kg dry wt				
Arsenic	57	93	57	93	11	0.098	0.039	0.088	0.3
Cadmium	5.1	6.7	5.1	6.7	0.8	220	1,100	2,500	0.07
Chromium	260	270	260	270	62	--	--	--	0.2
Lead	450	530	450	530	21	--	--	--	0.1
Copper	390	390	390	390	45	--	--	--	0.1
Zinc	410	960	410	960	93	--	--	--	1
Silver	6.1	6.1	6.1	6.1	0.24	--	--	--	0.1
Mercury	0.41	0.59	0.41	0.59	0.2	--	--	--	0.02
Organometallics	µg/L				mg/kg dry wt				
Tributyltin	0.05 ^a (pore water)	0.05 ^a (pore water)	--	--	--	34 (bulk sed)	180 (bulk sed)	440 (bulk sed)	3 µg/kg (bulk sed) 0.05 µg/L (pore water)
Organic & Chlorinated Organic Chemicals	µg/kg dry wt		µg/kg dry wt		--				
2,4-Dimethylphenol	29	29	29	29	--	--	--	--	--
2-Methylphenol	63	63	63	63	--	--	--	--	--
4-Methylphenol	670	670	670	670	--	--	--	--	--
Benzoic Acid	650	650	650	650	--	--	--	--	--
Benzyl Alcohol	57	73	57	73	--	--	--	--	--
Pentachlorophenol	360	690	360	690	--	--	--	--	--
Phenol	420	1,200	420	1,200	--	--	--	--	--



Table 2. Preliminary Sediment Screening Levels (continued)

Analyte	Contaminant Concentrations								
	Benthic Exposure Criteria (SCUM Table 8-1)				Natural Background (SCUM Table 10-1)	Human Health Secondary Exposure Scenarios (SCUM Table 9-3)			SCUM PQLs (Table 11-1)
	SMS Marine Sediment SCO	SMS Marine Sediment CSL	AET Marine Sediment SCO	AET Marine Sediment CSL		Beach Play (child)	Subsistence Clam Digging (adult)	Subsistence Net Fishing (adult)	
Organic & Chlorinated Organic Chemicals (cont.)	mg/kg OC		µg/kg dry wt		--				
1,2,4-Trichlorobenzene	0.81	1.8	31	51	--	--	--	--	--
1,2-Dichlorobenzene	2.3	2.3	35	50	--	--	--	--	--
1,4-Dichlorobenzene	3.1	9	110	110	--	--	--	--	--
Dibenzofuran	15	58	540	540	--	--	--	--	--
Hexachlorobenzene	0.38	2.3	22	70	--	--	--	--	--
Hexachlorobutadiene	3.9	6.2	11	120	--	--	--	--	--
N-nitrosodiphenylamine	11	11	28	40	--	--	--	--	--
Phthalates	mg/kg OC		µg/kg dry wt		--				
Bis(2-Ethylhexyl) phthalate	47	78	1,300	1,900	--	--	--	--	--
Butylbenzyl phthalate	4.9	64	63	900	--	--	--	--	--
Diethyl phthalate	61	110	200	>1,200	--	--	--	--	--
Dimethyl phthalate	53	53	71	160	--	--	--	--	--
Di-n-butyl phthalate	220	1,700	1,400	1,400	--	--	--	--	--
Di-n-octyl phthalate	58	4,500	6,200	6,200	--	--	--	--	--
PAHs	mg/kg OC		µg/kg dry wt		--				
2-Methylnaphthalene	38	64	670	670	--	--	--	--	--
Acenaphthene	16	57	500	500	--	--	--	--	--
Acenaphthylene	66	66	1,300	1,300	--	--	--	--	--
Anthracene	220	1,200	960	960	--	--	--	--	--
Fluorene	23	79	540	540	--	--	--	--	--



Table 2. Preliminary Sediment Screening Levels (continued)

Analyte	Contaminant Concentrations								
	Benthic Exposure Criteria (SCUM Table 8-1)				Natural Background (SCUM Table 10-1)	Human Health Secondary Exposure Scenarios (SCUM Table 9-3)			SCUM PQLs (Table 11-1)
	SMS Marine Sediment SCO	SMS Marine Sediment CSL	AET Marine Sediment SCO	AET Marine Sediment CSL		Beach Play (child)	Subsistence Clam Digging (adult)	Subsistence Net Fishing (adult)	
PAHs	mg/kg OC		µg/kg dry wt		µg/kg dry wt sum TEQ				
Naphthalene	99	170	2,100	2,100	--	--	--	--	--
Phenanthrene	100	480	1,500	1,500	--	--	--	--	--
Total LPAH	370	780	5,200	5,200	--	--	--	--	--
Benz[a]anthracene	110	270	1,300	1,600	--	--	--	--	--
Benzo[a]pyrene	99	210	1,600	1,600	--	--	--	--	--
Benzo[g,h,i]perylene	31	78	670	720	--	--	--	--	--
Chrysene	110	460	1,400	2,800	--	--	--	--	--
Dibenzo[a,h]anthracene	12	33	230	230	--	--	--	--	--
Fluoranthene	160	1,200	1,700	2,500	--	--	--	--	--
Indeno[1,2,3-c,d] pyrene	34	88	600	690	--	--	--	--	--
Pyrene	1,000	1,400	2,600	3,300	--	--	--	--	--
Total benzofluoranthenes	230	450	3,200	3,600	--	--	--	--	--
Total HPAH	960	5,300	12,000	17,000	--	--	--	--	--
Total cPAHs	--	--	--	--	21 _b	170 _b	120 _b	150 _b	9 _b
PCBs & Dioxins/Furans	mg/kg OC		µg/kg dry wt		ng/kg dry wt				
Total Aroclors	12	65	130	1,000	--	--	--	--	--
Total PCB congeners	--	--	--	--	3,500 _c	--	--	--	--
--					ng/kg dry wt sum TEQ				
Dioxin-like PCB congeners	--	--	--	--	0.2 _d	29 _f	12 _f	29 _f	0.7 _d
Total dioxins/furans	--	--	--	--	4 _e				5 _e

a = Value derived from footnote ** in Table 8-1 of SCUM-IV; b = calculated as the sum of the concentration of each cPAH constituent multiplied by their



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Lovric's Sea-Craft, Anacortes, WA

Sediment Remedial Investigation Work Plan

respective toxicity equivalency factor as presented in Table 6-1 of the SCUM-IV; c = calculated as the sum of the concentration of each of the 209 PCB congeners from the Bold study (DMMP, 2009); d = calculated as the sum of the concentration of each dioxin-like PCB congener multiplied by their respective toxicity equivalency factor as presented in Table 6-3 of the SCUM-IV; e = calculated as the sum of the concentration of each dioxin and furan congener multiplied by their respective toxicity equivalency factor as presented in Table 6-2 of the SCUM-IV; f = calculated as the sum of the concentration of each dioxin, furan, and dioxin-like PCB congener multiplied by their respective toxicity equivalency factor as presented in Table 6-2 and 6-3 of the SCUM-IV -- = no value identified.



6.6 Timeline

An estimated timetable of proposed work activities is provided in Table 3, below.

The proposed timeline is based upon an estimated final work plan approval date. If work plan review, cultural resources assessments, permit approval, or other project elements delay the start of field activities, the timetable will continue to provide the anticipated order of events and relative timing.

This timetable assumes that standard turnaround times for sample analysis will be used. Timetable dates are subject to subcontractor availability for drilling portions of the project.

Table 3. Estimated Project Timetable

Task	Approximate Date of Completion
Initial Submittal of Sediment RI work plan to Ecology for review	January 14, 2026
Work plan re-submittal to Ecology for final approval	Late April 2026
30-day cultural resources comment period	30 days after work plan approval by Ecology
Cultural resources permitting (if needed)	Q2-Q3 2026
Ecology approval of work plan	Upon end of comment period, OR 30 days after end of comment period if comments required revisions
Completion of RI fieldwork*	Within 12 months of final work plan approval by Ecology (anticipated to be completed within upcoming in-water work window of July 15, 2026 – February 15, 2027)
RI data entry into EIM	Within 30 days of receipt of final validated laboratory data
Preliminary Draft Remedial Investigation report	Within 90 days of receipt of final validated laboratory data

*Start timing of field activities dependent upon work plan and cultural resources permit approval, driller availability, Stratum Group availability, coordination for cultural resources oversight (if needed), and in-water work windows.

6.7 Quality Control/Quality Assurance

Quality control and quality assurance protocols will be implemented for this investigation in accordance with the QAPP provided in Appendix IV.

6.8 Reporting

The Draft Sediment Remedial Investigation report will be prepared in accordance with the Agreed Order for the Site and WAC 173-204-550(6). The RI report will document and summarize the results of previous environmental sampling, including sample data, maps showing the spatial distribution of the results, comparison of sample analysis results to initial screening concentrations, and a re-evaluation of Site contaminants of concern and the Site's conceptual



model. The results of the proposed investigation will be used to determine if additional investigation activities are warranted and develop final sediment CULs.

Addenda or revisions to the draft Remedial Investigation report will be prepared to document additional Site characterization efforts as needed.

The RI report will be submitted to Ecology for review and approval.

6.9 Data Submission

All data collected during this remedial investigation will be entered into Ecology's Environmental Information Management (EIM) system within 30 days of receiving the final validated laboratory data and prior to Ecology approval of the sediment RI.

6.10 Management of Investigation Derived Waste (IDW)

Excess sediment collected from surface grab sampling or subsurface sampling using hand tools that is not utilized for laboratory analysis or archiving will be placed back on the ground from where the sample was collected.

Excess sediment collected from vibracore sampling that is not utilized for laboratory analysis or archiving will be drummed and properly labeled and stored onsite at least until laboratory analysis is complete, and likely until cleanup activities commence. Waste sediment will be properly disposed of, and disposal receipts will be obtained to verify proper disposal.

Waste disposable personal protective equipment (e.g., gloves) and field supplies (e.g., sampling syringes) will be bagged and disposed of as general solid waste at the end of each field day.



7.0 REFERENCES

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- WAC (Washington Administrative Code), Chapter 173-340, Part III – Site Reports and Cleanup Decisions, Sections 300 through 390.
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APPENDIX I

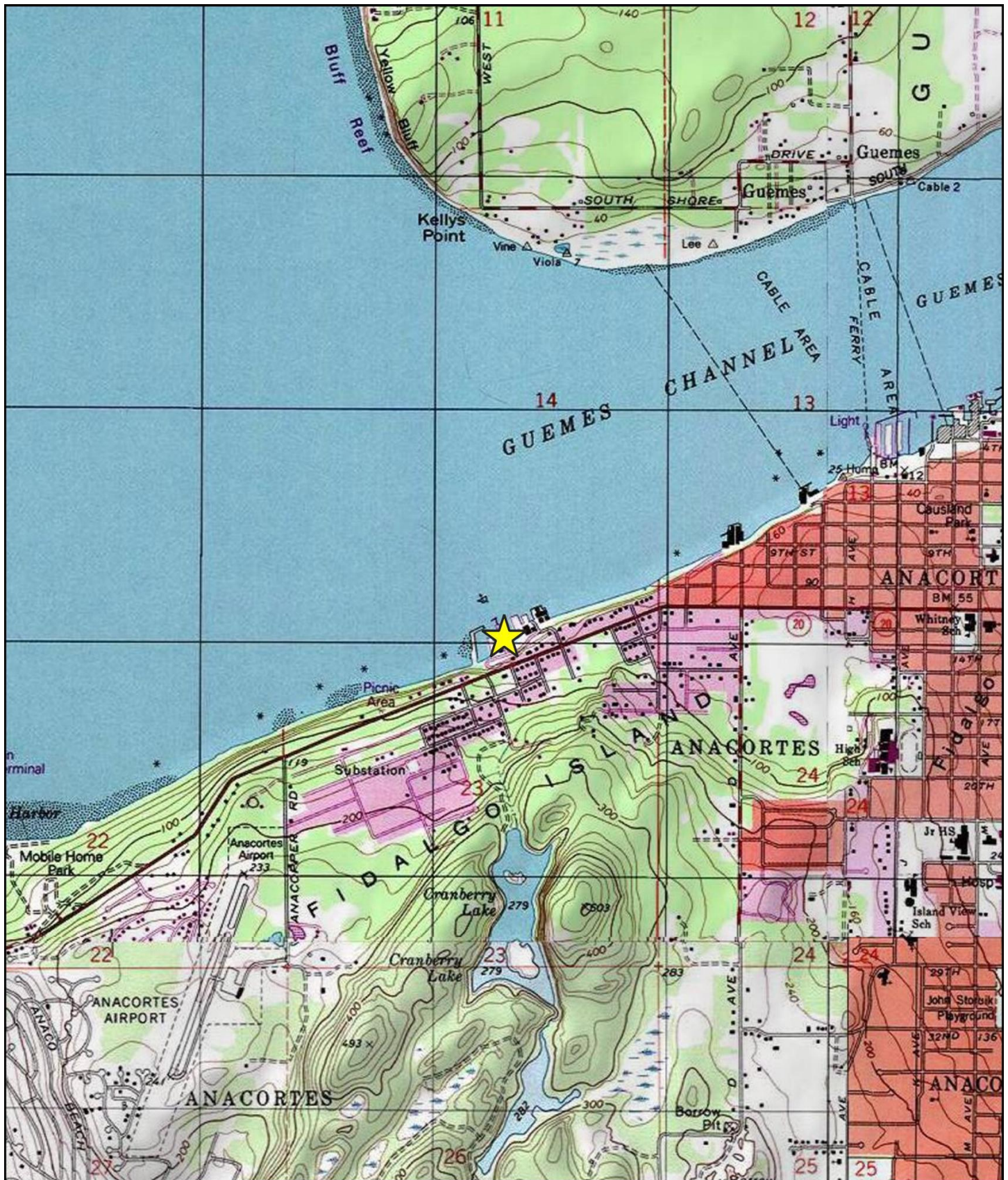
Figure 1-1 – Site Vicinity Map

Figure 1-2 – Annotated Aerial Photograph of the Subject Property & Vicinity

Figure 1-3 – In-Water Portion of Lovric's Site with Bathymetry

Figure 1-4 – Schematic Conceptual Site Model

Figure 1-5 – Proposed Sediment Sampling Map



Subject Property

Site Vicinity Map

Lovric's Sea-Craft
3022 Oakes Avenue
Anacortes, WA 98221

Figure 1-1

0 0.25 0.5 mi



N



APPENDIX I

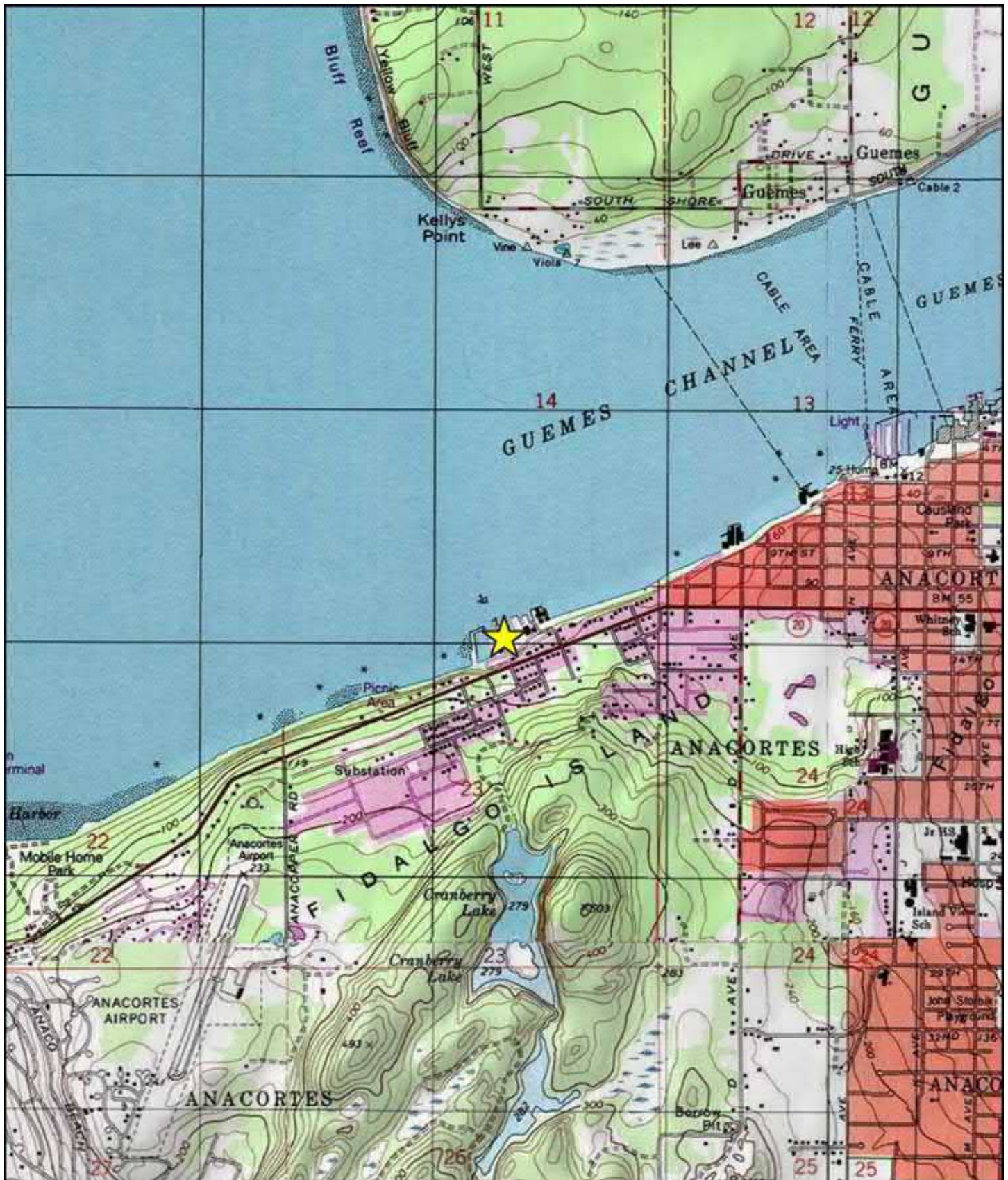
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Subject Property

Site Vicinity Map

Lovric's Sea-Craft
3022 Oakes Avenue
Anacortes, WA 98221

Figure 1-1

0 0.25 0.5 mi



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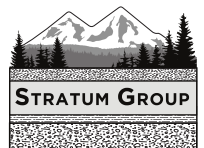


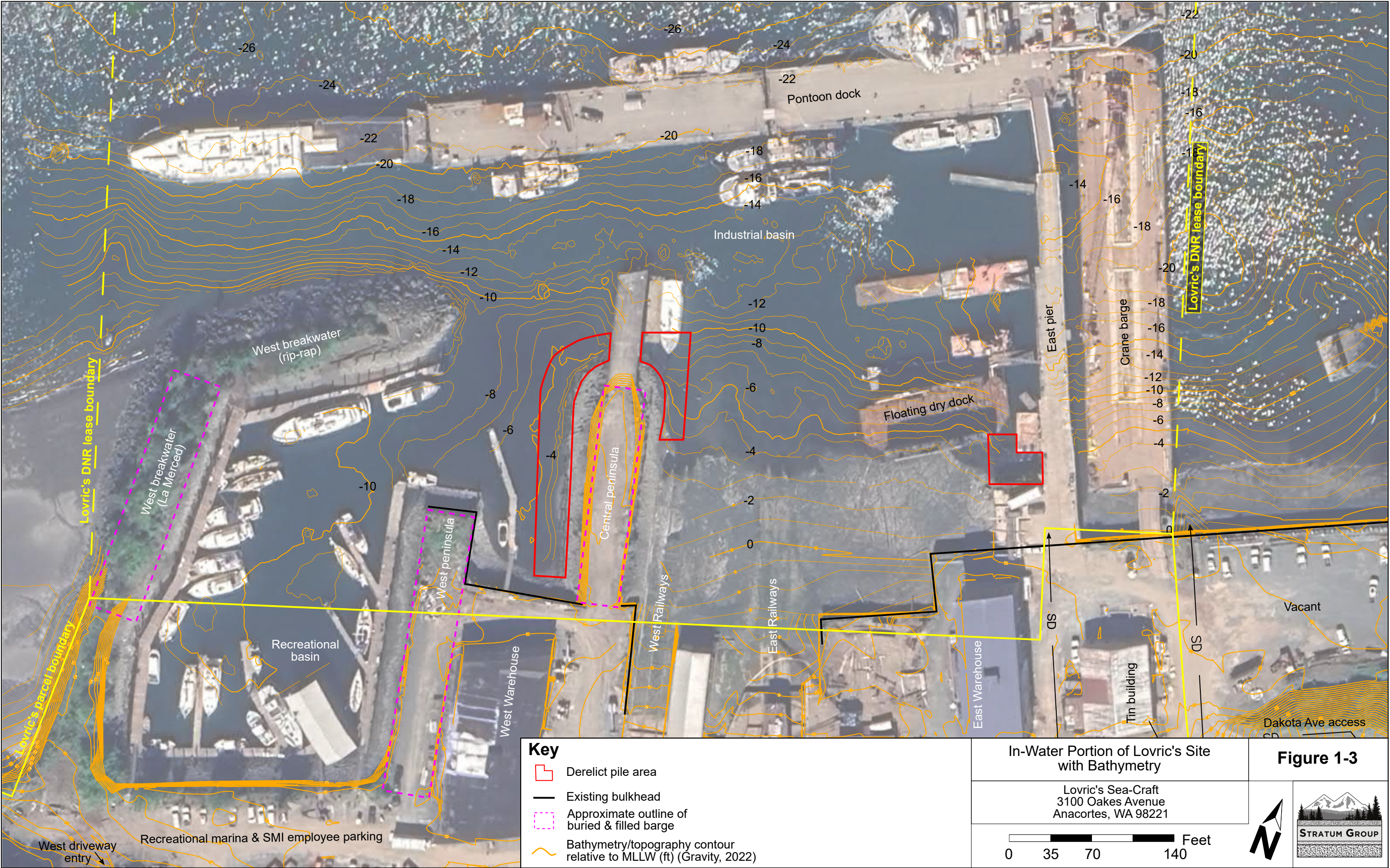
Annotated Aerial Photograph of
the Subject Property & Vicinity

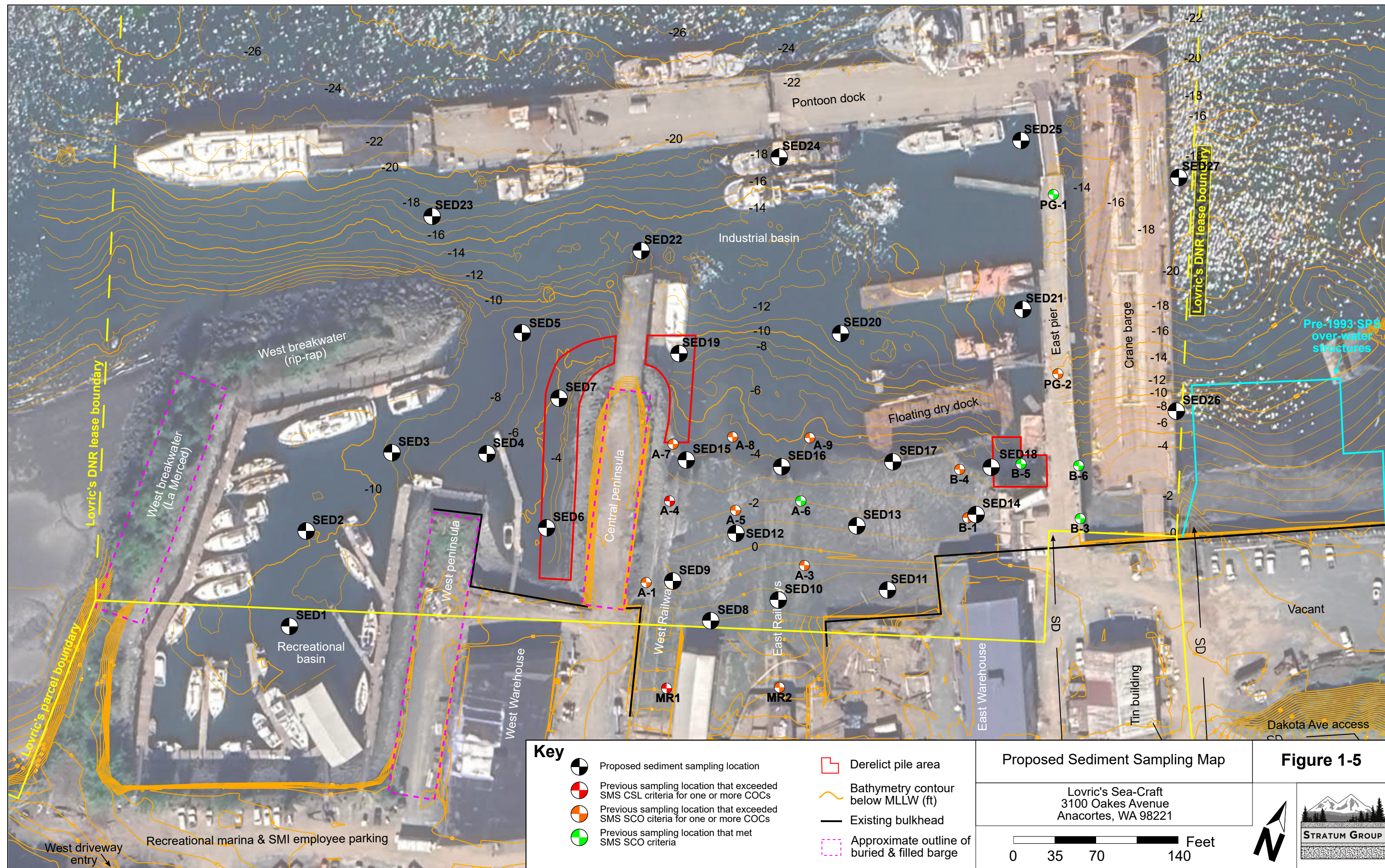
Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221

Figure 1-2

0 125 250 500 Feet







APPENDIX II – PREVIOUS SEDIMENT SAMPLING RESULTS

Figure 2-1 – Map of Previous Sediment Sampling Results

Lovric's Previous Sediment Sample Results – Conventionals

Lovric's Previous Sediment Sample Results – Metals

Lovric's Previous Sediment Sample Results – Organic Chemicals & Organotins

Lovric's Previous Sediment Sample Results – Phthalates, Organic Chemicals, and PCBs
(mg/kg normalized for organic carbon & µg/kg dry weight)

Lovric's Previous Sediment Sample Results – PAHs
(mg/kg normalized for organic carbon & µg/kg dry weight)

Lovric's - Previous Sediment Sample Results

Conventionals (mg/kg dry weight)

Sample Location	Sample ID	Sample Depth	Sample Date	Ammonia	Grain size	TOC	TOC %	Total Sulfides	Total Volatile Solids
W Rail	MR1	0-10 cm	5/9/2016	19	-	13,000	1.3	1100	3.6
E Rail	MR2	0-10 cm	5/9/2016	68	-	23,000	2.3	920	5.4
Railways cluster	A1	0-10 cm	9/26/2017	80	-	19,000	1.9	3,600	5.0
	A3	0-10 cm	9/26/2017	113	-	21,000	2.1	2,700	4.1
	A4	0-10 cm	9/26/2017	71	-	17,000	1.7	940	4.2
	A5	0-10 cm	9/25/2017	72	-	18,000	1.8	1,300	6.1
	A6	0-10 cm	9/25/2017	86	-	16,000	1.6	1,500	4.9
	A7	0-10 cm	9/25/2017	30	-	18,000	1.8	1,200	4.4
	A8	0-10 cm	9/25/2017	U<50	-	15,000	1.5	800	5.2
Stormwater outfall cluster	A9	0-10 cm	9/25/2017	52	-	16,000	1.6	1,500	5.2
	B1	0-5 cm	9/26/2017	37	-	29,000	2.9	1,200	4.3
	B3	0-5 cm	9/27/2017	U<18	-	5,700	0.57	340	1.5
	B4	0-10 cm	9/26/2017	56	-	16,000	1.6	2,400	5.7
	B5	0-10 cm	9/27/2017	20	-	16,000	1.6	570	2.1
East Pier Borings	B6	0-6 cm	9/27/2017	21	-	4,400	0.44	420	1.9
	PG1-0	0-0.5 ft	4/24/2023	2.38	-	-	0.246	U<26.3	3.8
	PG1-6	6-6.5 ft	4/24/2023	1.43	-	-	U<0.15	U<23.9	4.5
	PG1-11.5	11.5-12 ft	4/24/2023	1.48	-	-	U<0.15	U<24.4	2.7
	PG2-0	0-0.5 ft	4/25/2023	13.1	-	-	0.242	293	4.2
Screening Levels	PG2-10	10-10.5	4/25/2023	1.32	-	-	U<0.15	U<24.6	1.8
	SMS SCO			n/a	n/a	n/a	n/a	n/a	n/a
SMS CSL									

U< = analyte not detected below the listed reporting limit

D/DUP = Field duplicate sample

Lovric's - Previous Sediment Sample Results

Metals (mg/kg dry weight)

Sample Location	Sample ID	Sample Depth (ft)	Sample Date	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Silver	Zinc
W Rail	MR1	0-10 cm	5/9/2016	6.2	0.5	45.5	2203	33.8	0.77	0.5	983
E Rail	MR2	0-10 cm	5/9/2016	6.6	0.7	49.4	470	10.1	0.13	0.4	250
Railways cluster	A1	0-10 cm	9/26/2017	4.9	U<0.72	36	1143	41	0.24	U<0.72	743
	A3	0-10 cm	9/26/2017	6.5	U<0.45	34	278	23	0.21	U<0.45	157
	A4	0-10 cm	9/26/2017	3.2	U<0.59	30	367	21	0.15	U<0.59	186
	A5	0-10 cm	9/25/2017	3.1	U<1.05	41	243	19	0.14	U<1.05	141
	A6	0-10 cm	9/25/2017	2.2	U<0.47	33	94	13	0.1	U<0.47	87
	A7	0-10 cm	9/25/2017	4.3	U<0.84	42	419	28	0.16	U<0.84	471
	A8	0-10 cm	9/25/2017	U<0.97	U<0.97	38	131	14	0.11	U<0.97	99
	A9	0-10 cm	9/25/2017	U<0.90	U<0.90	43	62	12	0.07	U<0.90	103
Stormwater outfall cluster	B1	0-5 cm	9/26/2017	4.9	U<0.72	25	61	25	0.13	U<0.72 j	120 j
	B3	0-5 cm	9/27/2017	1.8	U<0.61	23	29	7.2	0.05	U<0.61	46
	B4	0-10 cm	9/26/2017	1.6	U<0.93	31	26	6.1	0.19	U<0.93	63
	B5	0-10 cm	9/27/2017	2.1	U<0.78	26	24	U<0.78	0.05	U<0.78	51
	B6	0-6 cm	9/27/2017	2.4	U<0.76	25	18	5.1	0.06	U<0.76	46
East Pier Borings	PG1-0	0-0.5 ft	4/24/2023	3.12	U<0.2	25	27.1	6.19	U<0.025	U<1	43.6
	PG1-6	6-6.5 ft	4/24/2023	2.31	U<0.2	15	20.4	2.59	U<0.025	U<1	30.8
	PG1-11.5	11.5-12 ft	4/24/2023	2.72	0.217	16.3	21.9	2.91	U<0.025	U<1	34.7
	PG2-0	0-0.5 ft	4/25/2023	3.63	0.355	9.79	22	3.25	U<0.025	U<1	35.3
	PG2-10	10-10.5	4/25/2023	2.25	U<0.2	15.1	21.2	2.61	U<0.025	U<1	32.7
Screening Levels		SMS/AET SCO		57	5	260	390	450	0.41	6.1	410
		SMS/AET CSL		93	7	270		530	0.59	6.1	960

U< = analyte not detected below the listed reporting limit

D/DUP = Field duplicate sample

j = Value reported is an estimate

ORANGE = exceeds SCO

RED = exceeds CSL (if distinct CSL value exists)

PURPLE = RL exceeds SCO and/or CSL

Lovric's - Previous Sediment Sample Results

Organic Chemicals & Organotins (ug/kg dry weight)

Sample Location	Sample ID	Sample Depth (ft)	Sample Date	2,4-Dimethyl phenol	2-Methyl phenol	4-Methyl phenol	Benzoic Acid	Benzyl alcohol	Phenol	Pentachlorop henol	Tetrabutyltin	Tributyltin	Dibutyltin	Monobutyltin
W Rail	MR1	0-10 cm	5/9/2016	U<20	U<20	U<20	U<50	U<20	U<20	U<0.65	-	1,400	-	-
E Rail	MR2	0-10 cm	5/9/2016	U<20	U<20	U<20	U<50	U<20	U<20	U<0.65	-	78	-	-
Railways cluster	A1	0-10 cm	9/26/2017	U<105	U<105	U<105	1705 j	U<105	U<105	U<530	U<76	650	200	33
	A3	0-10 cm	9/26/2017	U<120	U<120	U<120	800 j	U<120	U<120	U<600	U<96	60	27 j	U<19
	A4	0-10 cm	9/26/2017	U<95	U<95	U<95	1320 j	U<95	U<95	U<480	U<77	35	18 j	U<15
	A5	0-10 cm	9/25/2017	U<115	U<115	U<115	1190 j	U<115	U<115	U<580	U<89	30	30	9.9 j
	A6	0-10 cm	9/25/2017	U<105	U<105	U<105	560	U<105	U<105	U<530	U<95	U<17	U<31	U<19
	A7	0-10 cm	9/25/2017	U<100	U<100	U<100	950 j	U<100	U<100	U<500	U<73	160	37	5.9 j
	A8	0-10 cm	9/25/2017	U<100	U<100	U<100	1040 j	U<100	U<100	U<500	U<81	110	U<26	U<16
	A9	0-10 cm	9/25/2017	U<105	U<105	U<105	1030 j	U<105	U<105	U<530	U<98	U<17	U<32	U<20
Stormwater outfall cluster	B1	0-5 cm	9/26/2017	U<80	U<80	U<80	670 j	U<80	U<80	U<400	U<67	11 J	U<22	U<13
	B3	0-5 cm	9/27/2017	U<70	U<70	U<70	650 j	U<70	U<70	U<350	U<52	U<9	U<17	U<10
	B4	0-10 cm	9/26/2017	U<100	U<100	U<100	520 j	U<100	U<100	U<500	U<64	U<11	U<21	U<13
	B5	0-10 cm	9/27/2017	U<75	U<75	U<75	534 j	U<75	U<75	U<400	U<63	U<11	U<21	U<13
	B6	0-6 cm	9/27/2017	U<80	U<80	U<80	480 j	U<80	U<80	U<400	U<56	U<10	U<18	U<11
East Pier Borings	PG1-0	0-0.5 ft	4/24/2023	U<29 j	U<63 j	U<200	U<500	U<57 j	U<100	U<50	U<4.99	U<3.85	U<5.77	U<4.07
	PG1-6	6-6.5 ft	4/24/2023	U<29 j	U<63 j	U<200	U<500	U<57 j	U<100	U<50	U<4.98	U<3.84	U<5.75	U<4.06
	PG1-11.5	11.5-12 ft	4/24/2023	U<29 j	U<63 j	U<200	U<500	U<57 j	U<100	U<50	U<5.00	U<3.86	U<5.78	U<4.08
	PG2-0	0-0.5 ft	4/25/2023	57 j	U<63 j	U<200	U<500	U<57 j	U<100	U<50	U<5.00	7.43	14.5	5.82
	PG2-10	10-10.5	4/25/2023	U<29 j	U<63 j	U<200	U<500	U<57 j	U<100	U<50	U<5.00	U<3.86	U<5.78	U<4.08
Screening Levels		SMS/AET SCO		29	63	670	650	57	420	360	-	73*	-	-
		SMS/AET CSL						73	1,200	690	-		-	-

U< = analyte not detected below the listed reporting limit

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*No SMS value exists. Value is the bioaccumulation trigger threshold value established by the U.S. Army Corps of Engineers Dredged Material Management Program

ORANGE = exceeds SCO

RED = exceeds CSL (if distinct CSL value exists)

PURPLE = RL exceeds SCO and/or CSL

Lovric's - Previous Sediment Sample Results

Phthalates, Organic Chemicals & PCBs (mg/kg normalized for organic carbon)

Sample Location	Sample ID	Sample Depth (ft)	Sample Date	Phthalates						Organic & Chlorinated Organic Chemicals							PCBs
				Bis(2-Ethylhexyl) phthalate	Butylbenzyl phthalate	Diethyl phthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Dibenzofuran	N-nitrosodiphenylamine	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Hexachlorobenzene	Hexachlorobutadiene	(Total Aroclors)
W Rail	MR1	0-10 cm	5/9/2016	0.6	U<0.05	U<0.05	0.3	0.1	U<0.05	40	U<10	U<0.05	U<0.05	U<0.05	U<0.05	U<0.05	0.093
E Rail	MR2	0-10 cm	5/9/2016	0.6	0.1	U<0.05	U<0.05	0.1	U<0.05	U<10	U<10	U<0.05	U<0.05	U<0.05	U<0.05	U<0.05	U<0.2
Railways cluster	A1	0-10 cm	9/26/2017	38	U<5.5	6.4	8.6	20	U<5.5	5.3	U<5.5	U<5.5	U<5.5	U<5.5	U<5.5	U<5.5	3 j
	A3	0-10 cm	9/26/2017	28	U<5.7	5	U<5.7	U<5.7	U<6	4.5	U<6	U<6	U<6	U<6	U<6	U<6	U<6
	A4	0-10 cm	9/26/2017	230	U<5.6	7.7	8	19	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	3 j
	A5	0-10 cm	9/25/2017	21	U<6.4	6.5	22	16	U<6.4	U<6.4	U<6.4	U<6.4	U<6.4	U<6.4	U<6.4	U<6.4	U<6
	A6	0-10 cm	9/25/2017	17	U<6.6	7.5	U<6.6	29	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<7
	A7	0-10 cm	9/25/2017	61	U<5.6	5.9	U<5.6	31	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	U<5.6	3 j
	A8	0-10 cm	9/25/2017	13	U<6.7	6.9	U<6.7	17	U<6.7	U<6.7	U<6.7	U<6.7	U<6.7	U<6.7	U<6.7	U<6.7	2 j
	A9	0-10 cm	9/25/2017	15	U<6.6	11	U<6.6	26	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6.6	U<6
Stormwater outfall cluster	B1	0-5 cm	9/26/2017	7.9	U<2.8	3.6	U<2.8	12	U<2.8	14	U<2.8	U<2.8	U<2.8	U<2.8	U<2.8	U<2.8	U<3
	B3	0-5 cm	9/27/2017	28	U<12	16	U<12	U<12	U<12	U<12	U<12	U<12	U<12	U<12	U<12	U<12	U<12
	B4	0-10 cm	9/26/2017	16	U<6.3	10	U<6.3	21	U<6.3	7.3	U<6.3	U<6.3	U<6.3	U<6.3	U<6.3	U<6.3	U<6
	B5	0-10 cm	9/27/2017	10	U<4.7	11	U<4.7	30	U<4.7	5.6	U<4.7	U<4.7	U<4.7	U<4.7	U<4.7	U<4.7	U<5
East Pier Borings	PG1-0	0-0.5 ft	4/24/2023	U<65*	U<24*	U<41*	U<29*	U<41*	U<41*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<15*
	PG1-6	6-6.5 ft	4/24/2023	U<107*	U<42*	U<67*	U<47*	U<67*	U<67*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<24*
	PG1-11.5	11.5-12 ft	4/24/2023	U<107*	U<42*	U<67*	U<47*	U<67*	U<67*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<24*
	PG2-0	0-0.5 ft	4/25/2023	161*	U<26*	U<41*	U>29*	U<41*	U<41*	33*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<4.1*	U<15*
	PG2-10	10-10.5	4/25/2023	800*	U<42*	U<67*	U<47*	U<67*	U<67*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<6.7*	U<24*
Screening Levels		SMS SCO		47	4.9	61	53	220	58	15	11	0.81	2.3	3.1	0.38	3.9	12
		SMS CSL		78	64	110		1,700	4,500	58		1.8		9	2.3	6.2	65

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PURPLE = RL exceeds SCO and/or CSL

*Sample has TOC <0.5%; refer also to AET screening levels

Lovric's - Previous Sediment Sample Results

Sediment - Phthalates, Organic Chemicals & PCBs (ug/kg dry weight)

Sample Location	Sample ID	Sample Depth (ft)	Sample Date	Phthalates						Organic Chemicals							PCBs
				Bis(2-Ethylhexyl) phthalate	Butylbenzyl phthalate	Diethyl phthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Dibenzofuran	N-nitrosodiphenylamine	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Hexachlorobenzene	Hexachlorobutadiene	(Total Aroclors)
W Rail	MR1	0-10 cm	5/9/2016	7.8	U<0.65	U<0.65	3.9	1.3	U<0.65	40	U<10	U<0.65	U<0.65	U<0.65	U<0.65	U<0.65	1.2
E Rail	MR2	0-10 cm	5/9/2016	13.8	2.3	U<1.2	U<1.2	2.3	U<1.2	U<10	U<10	U<1.2	U<1.2	U<1.2	U<1.2	U<1.2	U<4.6
Railways cluster	A1	0-10 cm	9/26/2017	720 j	U<100	120	160	380 j	U<100	100	U<100	U<100	U<100	U<100	U<100	U<100	600 j
	A3	0-10 cm	9/26/2017	590 j	U<120	110	U<120	460 j	U<120	90	U<120	U<120	U<120	U<120	U<120	U<120	U<130
	A4	0-10 cm	9/26/2017	3,910 j	U<100	130	140	320 j	U<100	U<100	U<100	U<100	U<100	U<100	U<100	U<100	50 j
	A5	0-10 cm	9/25/2017	380 j	U<120	120	400	290 j	U<120	U<120	U<120	U<120	U<120	U<120	U<120	U<120	U<110
	A6	0-10 cm	9/25/2017	270 j	U<110	120	U<110	460 j	U<110	U<110	U<110	U<110	U<110	U<110	U<110	U<110	U<110
	A7	0-10 cm	9/25/2017	1,100 j	U<100	110	U<100	560 j	U<100	U<100	U<100	U<100	U<100	U<100	U<100	U<100	50 j
	A8	0-10 cm	9/25/2017	190 j	U<100	100	U<100	250 j	U<100	U<100	U<100	U<100	U<100	U<100	U<100	U<100	30 j
	A9	0-10 cm	9/25/2017	250 j	U<110	180	U<110	420 j	U<110	U<110	U<110	U<110	U<110	U<110	U<110	U<110	U<100
Stormwater outfall cluster	B1	0-5 cm	9/26/2017	230 j	U<80	100	U<80	350 j	U<80	410	U<80	U<80	U<80	U<80	U<80	U<80	U<90
	B3	0-5 cm	9/27/2017	160 j	U<70	90	U<70	330 j	U<70	U<70	U<70	U<70	U<70	U<70	U<70	U<70	U<70
	B4	0-10 cm	9/26/2017	260 j	U<100	160	U<100	340 j	U<100	120	U<100	U<100	U<100	U<100	U<100	U<100	U<100
	B5	0-10 cm	9/27/2017	160 j	U<80	180	U<80	480 j	U<80	90	U<80	U<80	U<80	U<80	U<80	U<80	U<80
	B6	0-6 cm	9/27/2017	180 j	U<80	190	U<80	410 j	U<80	U<80	U<80	U<80	U<80	U<80	U<80	U<80	U<80
East Pier Borings	PG1-0	0-0.5 ft	4/24/2023	U<160	U<63 j	U<100	U<71 j	U<100	U<100	U<10	U<10	U<10	U<10	U<10	U<10	U<10	U<36
	PG1-6	6-6.5 ft	4/24/2023	U<160	U<63 j	U<100	U<71 j	U<100	U<100	U<10	U<10	U<10	U<10	U<10	U<10	U<10	U<36
	PG1-11.5	11.5-12 ft	4/24/2023	U<160	U<63 j	U<100	U<71 j	U<100	U<100	U<10	U<10	U<10	U<10	U<10	U<10	U<10	U<36
	PG2-0	0-0.5 ft	4/25/2023	390	U<63 j	U<100	U<71 j	U<100	U<100	79	U<10	U<10	U<10	U<10	U<10	U<10	U<36
	PG2-10	10-10.5	4/25/2023	1200 j	U<63 j	U<100	U<71 j	U<100	U<100	U<10	U<10	U<10	U<10	U<10	U<10	U<10	U<36
Screening Levels		AET SCO		1,300	63	200	71	1,400	6,200	540	28	31	35	110	22	11	130
		AET CSL		1,900	900	>1,200	160				40	51	50		70	120	1,000

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Lovric's - Previous Sediment Sample Results

PAHs (mg/kg normalized for organic carbon)

Sample Location	Sample ID	Sample Depth	Sample Date	Naphthalene	Acenaph-thylene	Acenaph-thene	Fluorene	Phenan-threne	Anthracene	2-Methyl naphthalene	Total LPAH	Fluoran-thene	Pyrene	Benz[a] anthracene	Chrysene	Benzo[a] pyrene	Indeno [1,2,3-c,d] pyrene	Dibenzo[a,h] anthracene	Benzo [g,h,i] perylene	Total benzo fluoranthenes	Total HPAH
W Rail	MR1	0-10 cm	5/9/2016	0.1	0.2	0.1	0.1	1	0.4	0.03	2	4	5	2	2	1	0.8	0.1	0.5	4	19
E Rail	MR2	0-10 cm	5/9/2016	0.1	0.1	0.1	0.1	0.5	0.3	0.03	1	2	2	1	1	0.6	0.4	U<0.05	0.3	2	9
Railways cluster	A1	0-10 cm	9/26/2017	U<5.5	13	7.7	12	59	25	U<5.5	117	320	233	94	136	78	50	11	39	185	1146
	A3	0-10 cm	9/26/2017	6.7	5.7	5.6	9.3	55	17	4.6	99	163	125	47	84	50	30	7.1	30	109	645
	A4	0-10 cm	9/26/2017	U<5.6	10	U<5.6	3	18	9.2	U<5.6	40	78	86	27	47	30	18	U<5.6	18	79	382
	A5	0-10 cm	9/25/2017	U<6.4	U<6.4	U<6.4	U<6.4	29	12	U<6.4	41	89	76	32	59	33	19	5	21	26	360
	A6	0-10 cm	9/25/2017	U<6.6	U<6.6	U<6.6	U<6.6	19	13	U<6.6	32	74	75	33	56	37	20	U<6.6	20	85	399
	A7	0-10 cm	9/25/2017	U<5.6	U<5.6	U<5.6	U<5.6	17	6.6	U<5.6	24	53	63	21	35	25	17	4	15	61	294
	A8	0-10 cm	9/25/2017	U<6.7	U<6.7	U<6.7	5.5	41	14	U<6.7	61	111	98	34	48	34	19	U<6.7	20	79	445
	A9	0-10 cm	9/25/2017	4.5	U<6.6	U<6.6	3.8	18	11	5.8	350	90	82	30	42	23	14	U<6.6	11	59	37
Stormwater outfall cluster	B1	0-5 cm	9/26/2017	5.8	4.3	4.0	39	176	267	6.1	495	185	126	37	57	26	13	2.7	12	57	515
	B3	0-5 cm	9/27/2017	15	U<12	U<12	U<12	35	13	6.4	63	117	114	66	72	52	27	U<12	28	126	603
	B4	0-10 cm	9/26/2017	11	9	11	11	39	30	4.5	110	406	292	70	121	47	27	7	27	122	1117
	B5	0-10 cm	9/27/2017	7.5	6.4	8.9	10	42	20	3.0	95	122	92	32	85	27	15	U<4.7	14	66	452
East Pier Borings	PG1-0	0-0.5 ft	4/24/2023	U<4.1*	U<0.81*	1.4*	1.4*	5.3*	2.3*	0.98*	11*	11*	23*	5.3*	16*	6.9*	3.3*	1*	3*	17*	87*
	PG1-6	6-6.5 ft	4/24/2023	U<6.7*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<21*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<2.7*	U<13*
	PG1-11.5	11.5-12 ft	4/24/2023	U<6.7*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<21*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<2.7*	U<13*
	PG2-0	0-0.5 ft	4/25/2023	1900*	3.8*	100*	83*	220*	83*	150*	2500*	210*	250*	79*	130*	58*	21*	5.4*	17*	120*	890*
	PG2-10	10-10.5	4/25/2023	U<6.7*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<21*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<1.3*	U<2.7*	U<13*
Screening Levels		SMS SCO		99	66	16	23	100	220	38	370	160	1,000	110	110	99	34	12	31	230	960
		SMS CSL		170		57	79	480	1,200	64	780	1,200	1,400	270	460	210	88	33	78	450	5,300

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ORANGE = exceeds SCO

RED = exceeds CSL (if distinct CSL value exists)

PURPLE = RL exceeds SCO and/or CSL

*Sample has TOC <0.5%; refer also to AET screening levels

Lovric's - Previous Sediment Sample Results

Sediment - PAHs (ug/kg dry weight)

Sample Location	Sample ID	Sample Depth	Sample Date	Naphthalene	Acenaph-thylene	Acenaph-thene	Fluorene	Phenan-threne	Anthracene	2-Methyl naphthalene	Total LPAH	Fluoran-thene	Pyrene	Benz[a] anthracene	Chrysene	Benzo[a] pyrene	Indeno [1,2,3-c,d] pyrene	Dibenzo[a,h] anthracene	Benzo [g,h,i] perylene	Total benzo fluoranthenes	Total HPAH
W Rail	MR1	0-10 cm	5/9/2016	1.3	2.6	1.3	1.3	13	5.2	0.39	25	52	65	26	26	13	10.4	1.3	6.5	52	200
E Rail	MR2	0-10 cm	5/9/2016	2.3	2.3	2.3	2.3	11.5	6.9	0.69	28	46	46	23	23	13.8	9.2	U<1.2	6.9	46	168
Railways cluster	A1	0-10 cm	9/26/2017	U<100	250	150	230 j	1,120	480	U<100	2,000	6,080 j	4,430 j	1,790	2,590	1,480	950	210	740	3,520	21,800
	A3	0-10 cm	9/26/2017	140	120	120	200 j	1,160	360	100	2,200	3,420 j	2,630 j	990	1,760	1,050	630	150	630	2,290	13,600
	A4	0-10 cm	9/26/2017	U<100	170	U<100	50 j	310	160	U<100	700	1,330 j	1,460 j	460	800	510	310	U<100	310	1,340	6,500
	A5	0-10 cm	9/25/2017	U<120	U<120	U<120	U<120 j	500	220	U<120	700	1,600 j	1,370 j	580	1,060	590	340	90	380	470	6,500
	A6	0-10 cm	9/25/2017	U<110	U<110	U<110	U<110 j	300	210	U<110	500	1,180 j	1,200 j	530	900	590	320	U<110	320	1,360	6,400
	A7	0-10 cm	9/25/2017	U<100	U<100	U<100	U<100 j	310	120	U<100	400	950 j	1,130 j	380	630	450	310	70	270	1,100	5,300
	A8	0-10 cm	9/25/2017	U<100	U<100	U<100	80 j	610	210	U<100	900	1,660 j	1,470 j	510	720	510	280	U<100	300	1,180	6,600
Stormwater outfall cluster	A9	0-10 cm	9/25/2017	70	U<110	U<110	60 j	290	180	90	700	1,440 j	1,310 j	480	670	370	220	U<110	180	940	5,600
	B1	0-5 cm	9/26/2017	170	120	120	1,130 j	5,100	7,740	180	14,600	5,360 j	3,650 j	1,070	1,650	750	380	80	350	1,650	14,900
	B3	0-5 cm	9/27/2017	90	U<70	U<70	U<70 j	200	70	40	400	670 j	650 j	380	410	300	150	U<70	160	720	3,400
	B4	0-10 cm	9/26/2017	180	140	180	180 j	620	480	70	1,900	6,500 j	4,670 j	1,120	1,940	750	430	110	430	1,950	17,900
	B5	0-10 cm	9/27/2017	120	100	140	160 j	670	320	50	1,600	1,950 j	1,470 j	510	1,360	430	240	U<80	220	1,060	7,200
East Pier Borings	B6	0-6 cm	9/27/2017	70	U<80	U<80	U<80 j	270	130	60	500	700 j	940 j	420	640	310	170	U<80	150	660	4,000
	PG1-0	0-0.5 ft	4/24/2023	U<10	U<2	3.5	3.5	13	5.6	2.4	28	27	56	13	39	17	8	2.5	7.4	41	211
	PG1-6	6-6.5 ft	4/24/2023	U<10	U<2	U<2	U<2	U<2	U<2	U<2	U<22	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<4	U<20
	PG1-11.5	11.5-12 ft	4/24/2023	U<10	U<2	U<2	U<2	U<2	U<2	U<2	U<22	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<4	U<20
	PG2-0	0-0.5 ft	4/25/2023	4,700	9.3	250	200	530	200	360	6,200	520	600	190	310	140	50	13	40	280	2,100
	PG2-10	10-10.5	4/25/2023	U<10	U<2	U<2	U<2	U<2	U<2	U<2	U<22	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<2	U<4	U<20
Screening Levels		AET SCO		2,100	1,300	500	540	1,500	960	670	5,200	1,700	2,600	1,300	1,400	1,600	600	230	670	3,200	12,000
		AET CSL										2,500	3,300	1,600	2,800		690		720	3,600	17,000

U< = analyte not detected below the listed reporting limit

D/DUP = Field duplicate sample

j = Value reported is an estimate

ORANGE = exceeds SCO

RED = exceeds CSL (if distinct CSL value exists)

PURPLE = RL exceeds SCO and/or CSL

APPENDIX III – SHANNON POINT SEAFOODS SITE

Sediment Sampling and Testing Report (Golder, 1994)

Results of Phase II Sampling and Analysis (Hart Crowser, 1995)

Memo RE: Results of Phase II Sampling and Analysis (Ecology, 1995)

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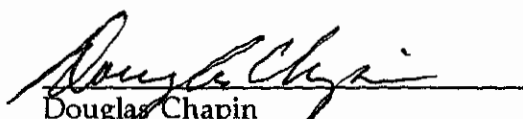
**SEDIMENT SAMPLING AND TESTING REPORT
SHANNON POINT SEAFOODS SITE
ANACORTES, WASHINGTON**

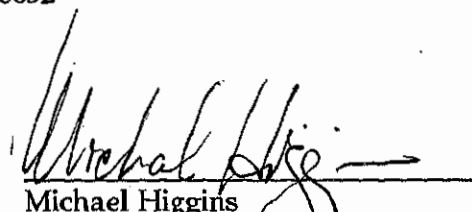
Prepared for

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APPENDIX C ARI Laboratory Reports for Sediment Samples

1. INTRODUCTION

1.1 Background and Regulatory Considerations

Samsung Washington dba Shannon Point Seafoods (Samsung Washington) retained Golder Associates Inc. (Golder) to perform sampling and chemical testing of sediments within a tideland and harbor area associated with the site of the demolished Shannon Point Seafoods (Shannon) fish-processing facility in Anacortes, Washington (Figure 1). The facility was destroyed by fire in late July 1993. The facility formerly operated as a year-round facility unloading and processing fresh salmon and bottom fish (cod, snapper, and sole). The facility was comprised of four main structures, including a concrete-covered dock area surrounding the buildings (Figure 2). An old packing building was built in the 1920's and functioned as a fish-processing and packing area. Several cold storage areas (freezers) were located within site buildings and were cooled by ammonia and freon refrigeration systems. The ground floor was also used as a fish scrap processing area (made into mink food). The mezzanine area was used for storage and as a lunchroom. A gravel surfaced area south of the buildings served as employee parking and equipment storage. From August through mid-October 1993, demolition of remaining structures and debris removal have been performed. Debris consisted largely of residual dock facilities including creosote pilings, concrete, and metal structures. At this time, Samsung Washington plans to replace and construct a new fish-processing facility at the site.

Samsung Washington owns approximately 1.85 acres of property, of which 0.84 acres are tideland and 1.01 acres are upland. The property fronts for approximately 452 feet on the inner harbor line of Guemes Channel (Puget Sound) in Anacortes. In addition to the 1.85 acre parcel, approximately 5.19 acres of tidelands, as a Washington State aquatic land area, is leased by Samsung Washington from the Washington State Department of Natural Resources (DNR). Property ownership is shown on Figure 3.

The City of Anacortes is the lead agency responsible for oversight of demolition and debris removal at the Shannon Site. In an August 24, 1993 letter to the City of Anacortes (Appendix A), the DNR, as the state's leaseholder of the Shannon site tidelands, stipulated their requirements for sediment sampling of the site's harbor area to "ensure that environmental damage has not occurred on the state's property as a result of the fire." Moreover, DNR's letter stated that "should results of these (sediment) tests indicate a cleanup of the sediments be necessary, a remediation plan must be prepared and jointly reviewed and approved by DNR and the Washington State Department of Ecology (Ecology)." Ecology administers several federal and state laws and regulations relating to the quality of sediments found on aquatic lands within Washington State. Washington State marine sediment quality standards (SQS) and Puget Sound marine sediment cleanup levels are respectively presented in Tables I and III contained in Chapter 173-204 of the Washington Administrative Code (WAC), Sediment Management Standards. In their August 19, 1993 letter to the City of Anacortes (Appendix A), Ecology agreed with DNR that "appropriate sediment sampling" was to be "conducted following demolition of the remaining structures and prior to replacement or construction of new in-water structures at

the site." Subsequently, DNR's position was confirmed in Gene Revelas' (DNR) telephone conversation with Douglas Chapin (Golder) on October 14, 1993 and a followup DNR memorandum dated October 15, 1993, which included an excerpt from the state's lease with Samsung Washington. Copies of Golder's October 14, 1993 telephone memorandum with DNR and DNR's October 15, 1993 memorandum are contained in Appendix A.

1.2 Sampling and Testing Plan Objectives

Sampling at the Shannon site was conducted by Golder in accordance with our November 15, 1993 sediment sampling and testing plan (STP) approved by DNR and Ecology. The STP was designed to assess potential chemical contamination of sediments resulting from the fire, and subsequent demolition and debris removal at the site (Appendix A). The STP was prepared in accordance with WAC 173-204-600, "Sampling and Testing Plan Standards." The STP discusses applicable state marine SQS chemical criteria; STP organization and responsibilities; sampling frequency and locations; positioning of sampling locations; sample collection and equipment; health and safety; sample documentation, handling, and chain-of-custody; sample analyses; field and laboratory quality assurance/quality control (QA/QC); and data evaluation and reporting. As required under WAC 173-204-600, sediment sampling and locations, appropriate testing protocols and interpretations will be performed in accordance with Puget Sound Estuary Program (PSEP) Protocols. These protocols are identified in Subsection 4.1.

1.3 Applicable Marine Sediment Quality and Cleanup Standards

WAC 173-204 contains Washington State marine SQS and Puget Sound marine sediment cleanup levels. The state marine SQS were established to provide a regulatory and management goal for the quality of sediments throughout the state so that sediment quality will result in no adverse effects on biological resources and no significant health risk to humans. The Puget Sound marine sediment cleanup levels are used by Ecology in evaluating site-specific cleanup actions. The state marine SQS and Puget Sound marine sediment cleanup levels potentially applicable to the Shannon Site are cited in Table 1.

1.4 Sampling and Testing Plan Organization and Responsibilities

Golder was responsible for implementing this STP, including field sampling, overseeing laboratory analyses, data validation, and reporting. Analytical Resources Inc. Laboratories (ARI), Seattle, Washington, was subcontracted by Golder to perform laboratory chemical analyses of the sediment samples. ARI is accredited by Ecology to perform sediment chemistry analyses. Leonard, Boudinot, and Skodje, Inc. (LBS), a civil engineering and Washington State-licensed surveying firm from Mount Vernon, Washington, was subcontracted by Golder to document sediment sampling locations.

2. SAMPLING

2.1 Sampling Date and Locations

An assessment of potential chemical contamination of sediments resulting from the fire, and demolition and debris removal at the site was performed by collecting an appropriate number of sediment samples to evaluate the degree of chemical contamination. Demolition at the site within the boundary of floating booms installed to contain floating fire and demolition debris most likely resulted in considerable, homogeneous disturbance of the sediments in this area. Therefore, seven sediment samples were collected from a rented, 18-foot (ft.) "C-Hawk" brand boat during a single sampling event on November 17, 1993 along three equally-spaced lines of position (transects) perpendicular to the shoreline, beginning at the sea wall to approximately 20 feet beyond the dolphin pilings located within the northeast area of the boom boundary. Sampling locations SP-1, SP-2, and SP-3 were located along the westernmost transect. Sampling locations SP-4, SP-5, and SP-8 (duplicate of SP-5) were located along the middle transect. Sampling locations SP-6 and SP-7 were located along the easternmost transect. The sampling locations are shown on Figure 3.

2.2 Positioning of Sampling Locations

Sampling locations were determined and confirmed on the day of sampling by geodetically surveying a fixed-shore location (a nearby survey monument) and measuring the distance of each location along a transect from the boat to the monument using the range-azimuth method and a short-range electronic measuring and distancing instrument (EMDI) positioned onshore. The EMDI ranges determined have a standard error of plus or minus 0.02 feet. The azimuth standard error was plus or minus 10 seconds. Once a sampling location was selected, the boat was anchored and the surveyors on-shore were contacted by using a hand-held, two-way radio. The EMDI generated and directed a carrier signal toward a reflector on the boat. Geographic positions of the sampling locations were computed from Washington North Zone State Plane Coordinate (SPC) System NAD29 Datum previously used for a project with the City of Anacortes. The SPC system datum were then converted to geographic coordinates (latitudes and longitudes) to document sampling locations and are included in Figure 3.

2.3 Sample Collection and Equipment

At each sampling location, a sediment sample was prepared as a composite from grab subsamples collected from the boat using a van Veen sample dredge. To avoid failure (leaking) of the primary dredge, a backup dredge was also brought on board the boat. Both primary and backup dredges had their sealing abilities confirmed prior to their uses. On the boat, the primary dredge was attached to a 100-ft. polypropylene line using a swivel. Use of the swivel minimized twisting forces on the dredge during lowering and

ensured that proper contact was made with the bottom. At each sampling location, the boat was anchored creating a minimal bow wake, and the dredge was lowered through the water column at a controlled speed of approximately 1 foot per second (ft/sec) to contact the bottom gently. To the extent practicable, the dredge was penetrated to a depth of 4 to 5 centimeters (cm) using its weight in order to evaluate the upper 2 cm of sediment collected (recommended for Puget Sound surficial sediments).

After a grab subsample was taken, the dredge was raised slowly off the bottom at a controlled speed of approximately 1 ft/sec and then retrieved. Before the dredge broke the water surface, the boat was maneuvered as best as possible to minimize swinging of the dredge after it breaks the water surface. The dredge was secured immediately once it was brought on board the boat. After securing the dredge on the boat, the grab subsample was inspected using the following criteria before being accepted:

- The dredge is not over-filled with subsample so that the sediment surface is pressed against the top of the dredge;
- Overlying water is present (indicating minimal leakage);
- Overlying water is not excessively turbid (indicating minimal subsample disturbance);
- The sediment surface of the subsample is relatively flat (indicating minimal disturbance or winnowing);
- The desired penetration depth has been achieved (i.e., 4 to 5 cm for a 2-cm deep surficial sediment subsample).

Once a subsample was accepted (all samples collected were satisfactory), the water in the dredge was slowly siphoned off near one side of the dredge. The subsample was then be removed from the dredge avoiding contact with the sides of the dredge and placed in a stainless steel bowl. Using a stainless steel spoon, sample containers (glass jars with teflon-lined lids) for laboratory analyses were filled as described in Subsection 3.1.

2.4 Health and Safety

To ensure the proper health and safety of field personnel, the following safety equipment and supplies were used during sediment sampling:

- Personal flotation devices;
- Steel-toe safety boots;
- Hard hat (onshore only);

- Plastic safety glasses;
- Solvex outer gloves;
- Latex inner gloves;
- First aid kit; and
- Hand-held radios for communications with shore surveyors.

3. SAMPLE DOCUMENTATION, HANDLING, AND CHAIN-OF-CUSTODY

3.1 Sample Preparation and Containers

At each sampling location, sediment samples were prepared in the following manner for laboratory analyses of the parameters listed in Table 2:

- Prior to preparing the composite sample, one of the grab subsamples used to form the composite was randomly selected. One 1.5-ounce (oz) glass jar containing zinc acetate (as a preservative) will be filled with the top 2 centimeters (cm) of the selected subsample for laboratory analysis of total sulfides.
- The top 2 cm of all grab subsamples collected at each sampling location was removed and mixed in stainless steel container to form one composite sample. One 16-oz glass jar and one 32-oz glass jar was sequentially filled with portions of the composite sample for laboratory analyses of particle (grain) size and the remaining Table 2 parameters, respectively. Upon receipt of the 32-oz jars from the seven sampling locations, the laboratory prepared 4-oz subsamples from each jar for the analyses shown in Table 2.

Each sample jar was labeled with the sampling location, a sample identification number, time and date taken, sampler, client, project number, and analysis required. Sample jars were placed in plastic zip-lock bags, and carefully packed and stored in an ice chest cooler (4°C). Ice packs used in the cooler were double-bagged to avoid water or moisture contact with sample jars. After sampling was completed, a chain-of-custody record and laboratory analysis request form was filled out for all sample jars (Subsection 3.4). The chain-of-custody document and sample jars were then delivered in the coolers within 24 hours to the laboratory for analyses.

3.2 Field Data Recording

All sampling locations were documented in field notes, referencing each position to a known on-shore coordinate location. When the sampling location was marked, the time, date, and water depth (corrected for mean tide elevation) were noted. When the sample was taken, the date, time, and water depth (corrected for mean tide elevation) was again noted, and a sampling location identification number assigned. This information was documented in the field notes. Once a sample was accepted (Subsection 2.3), the following observations were recorded in the field notes:

- Average penetration depth;
- Gross characteristics of the sediment sample (i.e., texture, color, biological structures, presence of an oily sheen, and odor);

- Gross characteristics of the sediment sample's vertical profile; and
- Miscellaneous comments related to sample quality (i.e., dredge leakage, boat winnowing, and sample disturbance).

3.3 Equipment Decontamination

The van Veen dredge, the stainless steel bowl, and stainless steel spoon were decontaminated prior to sampling and between sampling locations on the boat by performing the following procedures:

- Washed with potable water and non-phosphate (alconox) soap;
- Rinsed with potable water;
- Rinsed with 1:1 deionized water and reagent grade methanol; and
- Final rinse with deionized water.

After decontamination and prior to its use at a sampling location, the dredge was rinsed from side of the boat with seawater.

3.4 Chain-of-Custody Record/Laboratory Analysis Request Form

All samples submitted to the laboratory were accompanied by a chain-of-custody record/laboratory analysis request form. Sample information such as date, time, matrix, sample ID, number of containers, and analysis required were documented for each sample. The form was signed off by the Golder representative delivering samples, including date and time, and by the ARI laboratory custodian assuming custody of the samples. The ARI laboratory custodian then filled out the form upon receipt of the samples and noted the condition of each sample container received as well as questions or observations concerning sample integrity. Copies of the signed chain-of-custody record and laboratory analysis request forms are included in ARI's final analytical laboratory reports contained in Appendix C.

4. SAMPLE ANALYSES

4.1 Sediment Chemistry

Sediment samples were analyzed by ARI for the parameters listed in Table 2. The table also lists the method by which each parameter was analyzed, including sample type, container type and volume, preservation and storage requirements, holding times, and ARI's method detection limits (MDLs). ARI's MDL definition is included as a Table 2 footnote.

Analytical methods used by ARI (Table 2) are described in the following PSEP documents:

- PTI Environmental Services, 1989. Recommended Guidelines for Measuring Organic Compounds in Puget Sound Sediment and Tissue Samples. Contained in Puget Sound Estuary Program, Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Prepared for the U.S. Environmental Protection Agency, Region 10 - Office of Puget Sound, Seattle, Washington.
- PTI Environmental Services, 1989. Recommended Guidelines for Measuring Metals in Puget Sound Water, Sediment, and Tissue Samples. Contained in Puget Sound Estuary Program, Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Prepared for the U.S. Environmental Protection Agency, Region 10 - Office of Puget Sound, Seattle, Washington.
- Tetra Tech, Inc., 1986a. Puget Sound Estuary Program, Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound. Part of Final Report TC-3991-04 prepared for the U.S. Environmental Protection Agency, Region 10 - Office of Puget Sound, Seattle, Washington.
- Tetra Tech, Inc., 1986b. Puget Sound Estuary Program, General QA/QC Considerations for Collecting Environmental Samples in Puget Sound. Part of Final Report TC-3991-04 prepared for the U.S. Environmental Protection Agency, Region 10 - Office of Puget Sound, Seattle, Washington.
- Tetra Tech, Inc., 1986c. Puget Sound Estuary Program, Recommended Protocols for Station Positioning in Puget Sound. Final Report TC-3090-05 prepared for Resource Planning Associates for Puget Sound Dredged Disposal Analysis (PSDDA). Monitored by the U.S. Army Corps of Engineers, Seattle District, Seattle, Washington.

5. QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control (QA/QC) was performed to ensure the reporting of accurate, comparable, and precise data.

5.1 Field QA/QC

As discussed previously under Subsections 2.3 and 3.2, sampling locations and observations, the time, date, and water depth (corrected for mean tide elevation) were recorded in a field notebook. As discussed previously under Subsection 3.1, each sample jar was labeled with the sampling location, a sample identification number, time and date taken, sampler, client, project number, and analysis required.

One duplicate sediment sample (SP-8) was collected at sampling location SP-5. The identification number for this duplicate sample (SP-8) was different from the original sample (SP-5) taken at the same location so as to present the sample as a blind duplicate to the laboratory. The purpose of the field duplicate sample was to quantify field sampling and laboratory precision for each analyte.

5.2 Laboratory QA/QC

ARI submitted QA/QC reports for the analytical methods shown in Table 2 (per sample delivery group). The reports are contained in Appendix C and includes information on standard reference material samples, laboratory method blanks, laboratory surrogate spikes, laboratory duplicate and triplicate samples, and laboratory matrix spikes and matrix spike duplicates, and associated QC data. Table 3 presents a summary of field and laboratory QC. Details of the ARI's QA/QC procedures are published in their document titled "Quality Assurance Plan for Analytical Resources, Inc., Revision 6, dated June 30, 1993."

6. ANALYTICAL RESULTS

Presented below is a summary of laboratory analytical results of the Table 2 tests performed by ARI to meet the analytical requirements of state sediment management standards (WAC 173-204). A summary of ARI's analytical results, along with a list of state marine SQS and Puget Sound marine sediment cleanup levels used for comparison, are presented in Table 4. Eight sediment samples, consisting of seven field samples (SP-1 through SP-7) and one blind field duplicate (SP-8) taken at SP-5, were analyzed for the sediment parameters previously identified in Table 2. The parameters included the following:

- Conventional sediment variables, which included particle (sediment grain) size, total sulfides, total volatile solids (TVS), total solids, and total organic carbon (TOC);
- Ammonia (as nitrogen);
- Total metals, which included arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc;
- Polynuclear aromatic hydrocarbons (PAHs), which included low and high molecular-weight PAHs (LPAHs and HPAHs), and polychlorinated biphenyls (PCBs); and
- Phenols.

Specific chemical compounds associated with LPAHs, HPAHs, and phenols are identified in Tables 1 and 4. A summary of data evaluation performed by Golder is presented in Section 7.

6.1 Conventional Sediment Variables

No state marine SQS or Puget Sound marine sediment cleanup levels exist for particle size, total sulfides, and TVS. Particle size distribution results for SP-1 through SP-8 are summarized in a sediment grain size distribution table contained in Appendix C as part of ARI's analytical results. Results reported for total sulfides ranged from a low of 67.1 milligrams per kilogram (mg/kg) dry weight for SP-3 to a high of 702 mg/kg dry weight for SP-8 (for SP-5). Results reported for TVS ranged from a low of 21,400 mg/kg dry weight for SP-6 to a high of 33,500 mg/kg dry weight for SP-3. Total solids ranged from a low of 58.88 percent sediment dry weight for SP-8 to a high of 72.40 percent sediment dry weight for SP-6.

6.2 Ammonia (as Nitrogen)

No state marine SQS or Puget Sound marine sediment cleanup levels exist for ammonia (as nitrogen). Results reported for ammonia (as nitrogen) ranged from a low of 3.63 milligrams ammonia (as nitrogen) per kilogram (mg-N/kg) dry weight for SP-6 to a high of 20.7 mg-N/kg dry weight for SP-2.

6.3 Total Metals

State marine SQS and Puget Sound marine sediment cleanup levels existing for the individual metals arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc are presented in Tables 1 and 4. All results reported for metals were below Puget Sound sediment cleanup levels, with the exception of zinc results of 985 mg/kg dry weight reported for SP-6, which slightly exceeded the cleanup level of 960 mg/kg dry weight.

6.4 PAHs and PCBs

State marine SQS and Puget Sound marine sediment cleanup levels existing for LPAHs, HPAHs, and PCBs are presented in Tables 1 and 4. Results for LPAHs, HPAHs and PCBs were reported in concentrations of mg/kg, normalized and expressed on a TOC basis. To normalize to TOC, the dry weight measurement for each PAH and the PCBs analyzed was divided by the decimal fraction representing the percent TOC content of the sediment sample.

Results reported for TOC ranged from a low of 0.59 percent TOC for SP-6 to a high of 1.56 percent TOC for SP-8 (for SP-5). For SP-2, acenaphthene was reported at 73 mg/kg TOC, which exceeded the Puget Sound sediment cleanup level of 57 mg/kg TOC; fluorene was reported at 110 mg/kg TOC, which exceeded the sediment cleanup level of 79 mg/kg TOC; phenanthrene was reported at 600 mg/kg TOC, which exceeded the cleanup level of 480 mg/kg TOC; and dibenzofuran was reported at 74 mg/kg TOC, which exceeded the cleanup level of 58 mg/kg TOC. For all locations other than SP-1 and SP-6, results reported for bis(2-ethylhexyl) phthalate exceeded the Puget Sound sediment cleanup level of 78 mg/kg TOC. All other results reported for LPAHs, HPAHs, and PCBs were below Puget Sound sediment cleanup levels.

6.5 Phenols

State marine SQS and Puget Sound sediment cleanup levels existing for phenols are presented in Tables 1 and 4. Results for phenols were reported in concentrations of micrograms per kilogram (ug/kg) dry weight. For all sampling locations, all results reported for phenols were below Puget Sound sediment cleanup levels.

7. DATA EVALUATION

Evaluation of ARI's analytical results was performed by Golder using the following data evaluation guidelines:

- Bleyler, R., 1988a. Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses. U.S. Environmental Protection Agency, Hazardous Site Evaluation Division, Washington, D.C.
- Bleyler, R., 1988a. Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses. U.S. Environmental Protection Agency, Hazardous Site Evaluation Division, Washington, D.C.

7.1 Data Completeness

Data was complete for all of the tests performed by ARI to meet the analytical requirements of state sediment management standards (WAC 173-204).

7.2 Accuracy

Laboratory matrix spike analyses was performed for each parameter identified in Table 3. All target analytes were recovered within acceptable limits. In addition, surrogate analyses for all Table 3 organic parameters tested were performed and recoveries were within acceptable limits.

Data evaluation of the TOC result for SP-5 determined that this result was not accurate due to laboratory analytical or subsampling error, and the results for SP-8 should be substituted for subsequent evaluations of results reported for SP-5.

7.3 Precision

Results reported for all duplicate sample analyses were within acceptable limits. However, comparison of TOC results reported for SP-8 (blind field duplicate sample) with TOC results reported for SP-5 (field sample) indicated unacceptable TOC precision for this data set. Because PAHs and PCBs are normalized to TOC, precision results of PAHs and PCBs for SP-5 were effected. The relative percent difference (RPD) between the TOC result for SP-5 and the TOC result for SP-8 was 120 percent. However, the RPD criteria for TOC is not specified for the TOC analytical method. Nevertheless, a RPD of 40 percent for TOC is generally considered the upper limit. The relatively high TOC value for SP-5 resulted in lower PAH and PCB values reported for SP-5. Comparing results not normalized to TOC gives acceptable precision for PAHs and PCBs. This indicates that unacceptable precision was confined to only the TOC result reported for SP-5. The TOC result for sample SP-8 (field duplicate) appears to be the more reliable TOC result for SP-5. ARI's results of TOC

reanalyses for SP-5, which included TOC reanalyses of SP-8 for comparison, are included at the end of Appendix C. Reanalyses provided confirmation that all results reported for SP-8 represented acceptable data for SP-5 shown in Table 4.

TABLES

WASHINGTON STATE MARINE SEDIMENT QUALITY STANDARDS
AND PUGET SOUND MARINE SEDIMENT CLEANUP LEVELS

Chemical Parameter (mg/kg Dry Weight ¹)	Sediment Quality Standard ²	Sediment Cleanup Level ³
Arsenic	57	9.3
Cadmium	5.1	6.7
Chromium	260	270
Copper	390	390
Lead	450	530
Mercury	0.41	0.59
Silver	6.1	6.1
Zinc	410	960
Chemical Parameter (mg/kg Organic Carbon ⁴)		
LPAH ⁵	370	780
Naphthalene	99	170
Acenaphthylene	66	66
Acenaphthene	16	57
Fluorene	23	79
Phenanthrene	100	480
Anthracene	220	1,200
2-methylnaphthalene	38	64
HPAH ⁶	960	5,300
Fluoranthene	160	1,200
Pyrene	1,000	1,400
Benz(a)anthracene	110	270
Chrysene	110	460
Total benzofluoranthenes ⁷	230	450

WASHINGTON STATE MARINE SEDIMENT QUALITY STANDARDS
AND PUGET SOUND MARINE SEDIMENT CLEANUP LEVELS

Chemical Parameter (mg/kg Organic Carbon ⁴)	Sediment Quality Standard ²	Sediment Cleanup Level ³
Benzo(a)pyrene	99	210
Indeno(1,2,3,-c,d)pyrene	34	88
Dibenzo(a,h)anthracene	12	33
Benzo(G,H,I)perylene	31	78
1,2-dichlorobenzene	2.3	2.3
1,4-dichlorobenzene	3.1	9
1,2,4-trichlorobenzene	0.81	1.8
Hexachlorobenzene	0.38	2.3
Dimethyl phthalate	53	53
Diethyl phthalate	61	110
Di-n-butyl phthalate	220	1,700
Butyl benzyl phthalate	4.9	64
Bis(2-ethylhexy)phthalate	47	78
Di-n-octyl phthalate	58	4,500
Dibenzofuran	15	58
Hexachlorobutadiene	3.9	6.2
N-nitrosodiphenylamine	11	11
Total PCBs	12	65
Chemical Parameter (µg/kg Dry Weight⁸)		
Phenol	420	1,200
2-methylphenol	63	63
4-methylphenol	670	670
2,4-dimethyl phenol	29	29

WASHINGTON STATE MARINE SEDIMENT QUALITY STANDARDS
AND PUGET SOUND MARINE SEDIMENT CLEANUP LEVELS

Chemical Parameter ($\mu\text{g/kg}$ Dry Weight ⁸)	Sediment Quality Standard ²	Sediment Cleanup Level ³
Pentachlorophenol	360	690
Benzl alcohol	57	73
Benzoic acid	650	650
¹ mg/kg = milligrams per kilogram dry weight. ² From Table I of WAC 173-204 (Sediment Management Standards) ³ From Table III of WAC 173-204 (Sediment Management Standards) ⁴ Units are milligrams per kilogram normalized and expressed on a total organic carbon basis. To normalize to total organic carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment. ⁵ The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds as listed. ⁶ The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzo(a)fluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed. ⁷ The total benzo(a)fluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers. ⁸ $\mu\text{g/kg}$ = milligrams per kilogram dry weight.		

TABLE 2

SEDIMENT PARAMETERS, ANALYTICAL METHODS, AND SAMPLING PROCEDURES

Parameter (Units)	Analytical Method	Technique	Sample Type	Container Type and Volume	Preservation and Storage Requirements	Maximum Holding Time (Extraction) From Date of Collection	Method Detection Limit ²
Total sulfides (mg/kg ¹)	EPA 376.1	Iodometric	Grab	15 oz. glass jar with teflon lid	Refrigerated (4°C) Preservative 1N ZnAc	7 days	0.059
Particle size (Size distribution)	ASTM D-422	Mechanical Sieve Hydrometer/Pipette	Composite	16 oz. glass jar with teflon lid	Refrigerated (4°C)	6 months ³	N/A
Total volatile solids (mg/kg ¹)	EPA 160.4	550°C Gravimetric	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	6 months ³	N/A
Total solids (TS) (% Dry Weight and % Moisture)	EPA 160.3	104°C Gravimetric	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	7 days	N/A
Ammonia (mg-N/kg ⁴)	EPA 350.1	Automated Phenate	Composite	4 oz. glass jar with teflon lid	Refrigerated (4°C)	6 months	N/A
Total metals ⁵ (mg/kg ¹)	EPA 6010	ICP	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	2 years	0.05-10
Mercury (mg/kg ¹)	EPA 7471	CVAA	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	28 days	0.05
Total organic carbon (%C)	EPA 5310 B	Combustion with IR determination	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	6 months	0.03%
PAHs and phenols ^{5,6}	EPA 8270	GC/MS	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	1 year	— ⁷
PCB-arocors ⁵ (mg/kg ⁷)	EPA 8081	GC/ECD	Composite	4 oz. glass jar with teflon lid	Refrigerated (-18°C)	1 year	0.2-4.4

¹mg/kg = milligrams per kilogram dry weight.²Method Detection Limits (MDLs) to be reported by Analytical Resources, Inc. They define an MDL to be the lowest concentration of an analyte that a method can detect in either a sample or method blank.³Recommended holding time. No EPA criteria exists for preservation of this parameters.⁴mg-N/kg = milligrams ammonia (as nitrogen) per kilogram dry weight.⁵Refer to Table 1 of this document for specific chemical compounds.⁶Units for PAHs are mg/kg, normalized and expressed on a TOC basis; units for phenols are µg/kg = micrograms per kilogram dry weight.⁷The method blank MDL for PAHs was 1.0 mg/kg; method blank MDLs for phenols ranged from 17 µg/kg to 170 µg/kg.

TABLE 3

SEDIMENT SAMPLES QUALITY CONTROL¹

Parameters	Field Duplicate (SP-8)	Laboratory Method Blank	Standard Reference Material Sample	Laboratory Surrogate Spike	Laboratory Duplicate Sample	Laboratory Triplicate Sample	Laboratory Matrix Spike	Laboratory Matrix Spike Duplicate
Total sulfides	X	X	X		X	X	X	
Particle size	X					X		
Total volatile solids	X					X		
Total solids	X				X	X		
Ammonia	X	X	X		X	X	X	
Total metals	X	X	X		X		X	
Mercury	X	X	X		X		X	
Total organic carbon	X	X	X		X	X	X	
Semi-volatile organic compounds (PAHs/phenols)	X	X	X	X			X	X
PCB-aroclor	X	X	X	X			X	X

¹Laboratory quality control samples were performed at a frequency of one sample per 20 (5 percent) or once per sample delivery group, whichever was more frequent.

January 7, 1994

933-1341.003

TABLE 4
(Page 1 of 4)

SEDIMENT SAMPLE RESULTS

Chemical Parameter ¹	Units	State Marine Sediment Quality Standard ²	Puget Sound Sediment Cleanup Level ³	Sample SP-1	Sample SP-2	Sample SP-3	Sample SP-4	Sample SP-8 ⁴	Sample SP-6	Sample SP-7
Total Sulfides	mg/kg ⁵	-	-	479	257	67.1	173	702	88.8	580
Total Volatile Solids	mg/kg ⁵	-	-	27,500	27,300	33,500	27,800	30,600	21,400	27,100
Total Solids	% ⁶	-	-	70.03	62.08	58.97	63.77	58.88	72.40	65.06
Ammonia	mg-N/kg ⁷	-	-	9.20	20.7	8.11	11.3	17.0	3.63	7.37
Arsenic	mg/kg ⁵	57	93	10 U ⁸	10 U	10 U	10 U	10 U	10 U	10 U
Cadmium	mg/kg ⁵	5.1	6.7	0.8	0.7	0.7	0.4	0.5	0.7	0.6
Chromium	mg/kg ⁵	260	270	47	47	47	50	48	46	45
Copper	mg/kg ⁵	390	390	64.7	45.4	45.1	32.5	43.3	135	26.4
Lead	mg/kg ⁵	450	530	46	38	37	36	51	106	49
Mercury	mg/kg ⁵	0.41	0.59	0.06	0.07	0.07	0.07	0.09	0.06 U	0.11
Silver	mg/kg ⁵	6.1	6.1	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Zinc	mg/kg ⁵	410	960	146	124	124	76.6	104	985	95.4
Total Organic Carbon	% C ⁹	-	-	0.77	0.77	0.92	1.54	1.56	0.59	3.57
LPAH ¹⁰	mg/kg ¹¹	370	780	570	762	127	356	171	229	81
Naphthalene	mg/kg ¹¹	99	170	40	40	11	12 U	7.1	8.6	5.2 U
Acenaphthylene	mg/kg ¹¹	66	66	6.4 U	8.1	5.8	12 U	2.9	4.8	5.2 U
Acenaphthene	mg/kg ¹¹	16	57	48	73	12	28	12	19	5.2 U
Fluorene	mg/kg ¹¹	23	79	69	110	13	37	21	27	5.4

TABLE 4
(Page 2 of 4)

SEDIMENT SAMPLE RESULTS

Chemical Parameter ¹	Units	State Marine Sediment Quality Standard ²	Puget Sound Sediment Cleanup Level ³	Sample SP-1	Sample SP-2	Sample SP-3	Sample SP-4	Sample SP-8 ⁴	Sample SP-6	Sample SP-7
Phenanthrene	mg/kg ¹¹	100	480	280	600	87	180	130	220	41
Anthracene	mg/kg ¹¹	220	1,200	110	120	20	71	30	36	14
2-methylnaphthalene	mg/kg ¹¹	38	64	17	31	3.5	16	4.0	3.8	5.2 U
HPAH ¹²	mg/kg ¹¹	960	5,300	806	1,122	418	424	407	702	442
Fluoranthene	mg/kg ¹¹	160	1,200	300	520	130	160	160	340	160
Pyrene	mg/kg ¹¹	1,000	1,400	200	190	97	110	110	96	110
Benz(a)anthracene	mg/kg ¹¹	110	270	88	100	35	32	29	61	26
Chrysene	mg/kg ¹¹	110	460	98	120	48	38	35	70	50
Total benzofluoranthenes ¹³	mg/kg ¹¹	230	450	106	119	57	34	43	74	57
Benzo(a)pyrene	mg/kg ¹¹	99	210	35	41	26	14	16	33	18
Indeno(1,2,3-c,d)pyrene	mg/kg ¹¹	34	88	14	14	11	12 U	6.0	12	9.5
Dibenzo(a,h)anthracene	mg/kg ¹¹	12	33	8.7	7.7	5.5	12 U	3.2	6.6	5.2 U
Benzo(g,h,i)perylene	mg/kg ¹¹	31	78	10	10	8.3	12 U	4.7	9.3	6.5
1,2-dichlorobenzene	mg/kg ¹¹	2.3	2.3	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
1,4-dichlorobenzene	mg/kg ¹¹	3.1	9	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
1,2,4-trichlorobenzene	mg/kg ¹¹	0.81	1.8	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U

TABLE 4
(Page 3 of 4)

SEDIMENT SAMPLE RESULTS

Chemical Parameter ¹	Units	State Marine Sediment Quality Standard ²	Puget Sound Sediment Cleanup Level ³	Sample SP-1	Sample SP-2	Sample SP-3	Sample SP-4	Sample SP-8 ⁴	Sample SP-6	Sample SP-7
Hexachlorobenzene	mg/kg ¹¹	0.38	2.3	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
Dimethyl phthalate	mg/kg ¹¹	53	53	6.4 U	5.0 U	1.1 U	12 U	1.2	1.6 U	5.2 U
Diethyl phthalate	mg/kg ¹¹	61	110	6.4 U	7.4	1.1 U	12 U	0.6 U	1.6 U	5.2 U
Di-n-butyl phthalate	mg/kg ¹¹	220	1,700	6.4 U	5.0 U	1.1 U	12 U	1.1	3.2	5.2 U
Butyl benzyl phthalate	mg/kg ¹¹	4.9	64	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
Bis(2-ethylhexyl) phthalate	mg/kg ¹¹	47	78	22	130	130	120	410	16	220
Di-n-octyl phthalate	mg/kg ¹¹	58	4,500	6.4 U	5.0 U	18	12 U	0.6 U	1.6 U	18
Dibenzofuran	mg/kg ¹¹	15	58	39	74	9.1	22 U	8.4	17	5.2 U
Hexachlorobutadiene	mg/kg ¹¹	3.9	6.2	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
N-nitro- sodiphenylamine	mg/kg ¹¹	11	11	6.4 U	5.0 U	1.1 U	12 U	0.6 U	1.6 U	5.2 U
Total PCBs	mg/kg ¹¹	12	65	7.6 U	8.9	7.3 U	3.2 U	2.9	10 U	1.8 U
Phenol	µg/kg ¹⁴	420	1,200	76 U	250	34	330 U	79	16	290 U
2-methylphenol	µg/kg ¹⁴	63	63	76 U	66 U	17 U	330 U	18 U	13 U	290 U
4-methylphenol	µg/kg ¹⁴	670	670	76 U	390	36	610	87	21	290 U
2,4-dimethyl phenol	µg/kg ¹⁴	29	29	76 U	66 U	17 U	330 U	18 U	13 U	290 U
Pentachlorophenol	µg/kg ¹⁴	360	690	380 U	330 U	87 U	1,700 U	92 U	65 U	1,400 U
Benzyl alcohol	µg/kg ¹⁴	57	73	76 U	66 U	17 U	330 U	18 U	13 U	290 U

OK

TABLE 4
(Page 4 of 4)

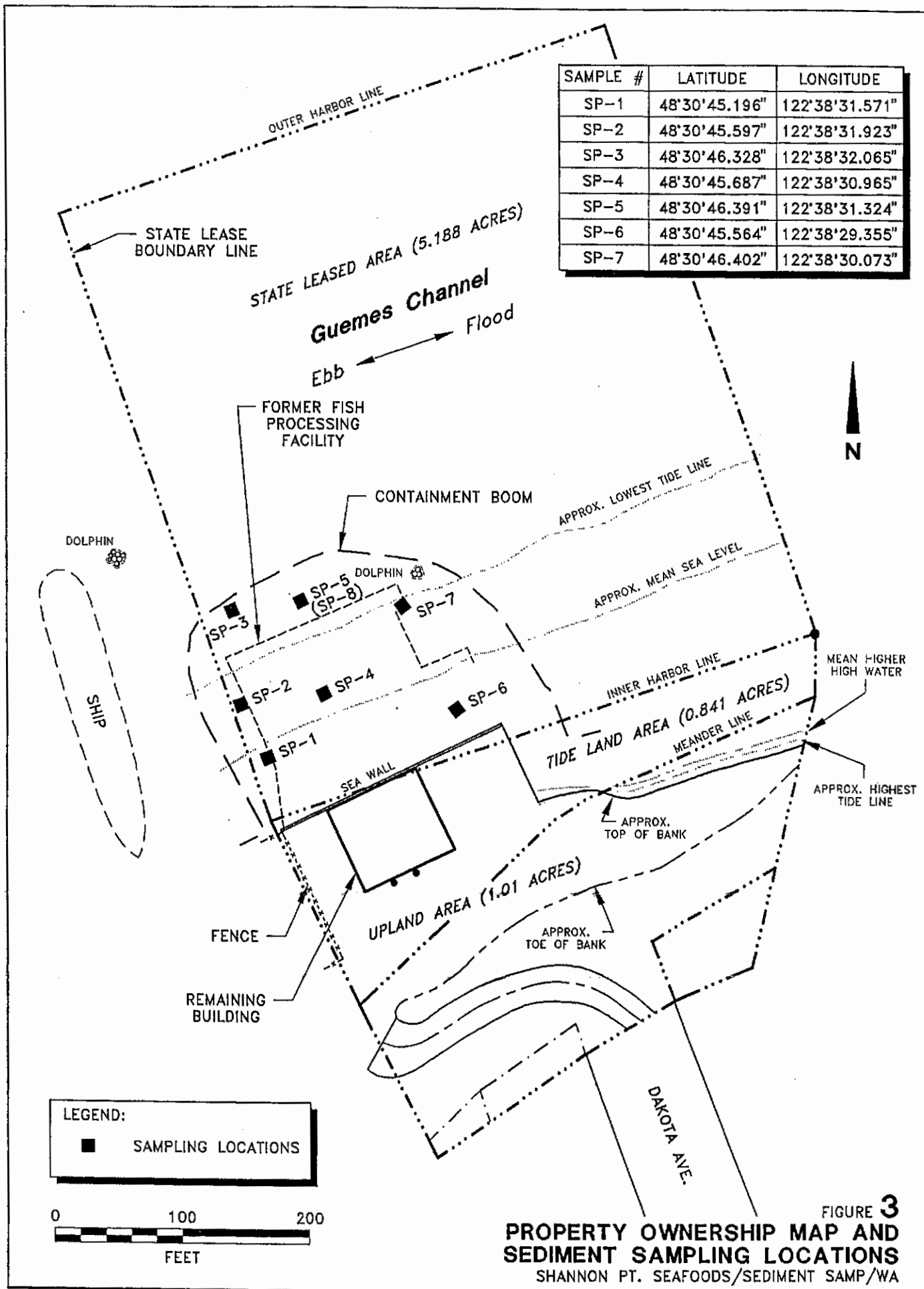
SEDIMENT SAMPLE RESULTS

Chemical Parameter ¹	Units	State Marine Sediment Quality Standard ²	Puget Sound Sediment Cleanup Level ³	Sample SP-1	Sample SP-2	Sample SP-3	Sample SP-4	Sample SP-8 ⁴	Sample SP-6	Sample SP-7
Benzoic acid	$\mu\text{g}/\text{kg}$ ¹⁴	650	650	760 U	660 U	170 U	3,300 U	180 U	130 U	2,900 U

Notes:

- ¹ Where concentrations for a parameter reported in this table represent the sum of individual compounds or isomers, and a chemical analysis identifies an undetected value for one or more individual compounds or isomers, the laboratory's method detection limit was used for calculating the sum of the respective compounds or isomers.
- ² From Table I of WAC 173-204 (Sediment Management Standards)
- ³ From Table III of WAC 173-204 (Sediment Management Standards)
- ⁴ Sample SP-8 was a duplicate taken at SP-5. Due to apparent laboratory inconsistencies reported for total organic carbon (TOC) for SP-5, results for SP-8 have been reported. Subsequent laboratory reanalysis of TOC resolved laboratory inconsistencies and provided confirmation that all results for SP-8 represented acceptable data for SP-5.
- ⁵ mg/kg = milligrams per kilogram dry weight
- ⁶ % = % sediment dry weight
- ⁷ $\text{mg-N}/\text{kg}$ = milligrams ammonia (as nitrogen) per kilogram dry weight
- ⁸ "U" indicates compound was analyzed for but not detected at the respective method detection limit reported by the laboratory.
- ⁹ %C = % total organic carbon dry weight
- ¹⁰ The LPAH value reported by the laboratory represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH value is not the sum of the values for the individual LPAH compounds as listed in the table.
- ¹¹ The listed parameter units represent concentrations in milligrams per kilogram, "normalized" and expressed on a TOC basis. To normalize to TOC, the dry weight concentration for each parameter was divided by the decimal fraction representing the percent TOC content of the sediment sample.
- ¹² The HPAH value reported by the laboratory represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3--c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH value is not the sum of the values for the individual HPAH compounds as listed in the table.
- ¹³ Total benzofluoranthenes is represented by the sum of the concentrations of the "B," "J," and "K" isomers reported by the laboratory.
- ¹⁴ $\mu\text{g}/\text{kg}$ = micrograms per kilogram dry weight.

SAMPLE #	LATITUDE	LONGITUDE
SP-1	48°30'45.196"	122°38'31.571"
SP-2	48°30'45.597"	122°38'31.923"
SP-3	48°30'46.328"	122°38'32.065"
SP-4	48°30'45.687"	122°38'30.965"
SP-5	48°30'46.391"	122°38'31.324"
SP-6	48°30'45.564"	122°38'29.355"
SP-7	48°30'46.402"	122°38'30.073"



APPENDIX A
AGENCY CORRESPONDENCE

August 19, 1993

FAX MEMO
PAGES 1 DATE 8/19 FAX #
TO Darryl Riddle Run 209
FROM Teresa Michelsen
CO. Dept. of Ecology
PH# _____ FAX # _____

Don Measamer
Building Inspector
City of Anacortes
P.O. Box 547
Anacortes, WA 98221

Subject: Sediment Sampling Requirements for Demolition at Shannon Point

Dear Mr. Measamer:

The Department of Ecology concurs with DNR that demolition may proceed at Shannon Point without prior sediment sampling, provided that appropriate sediment sampling is conducted following demolition of the remaining structures and prior to replacement or construction of new in-water structures at the site. Following demolition, Ecology and DNR will jointly review the sediment sampling plan and results to ensure that it meets state requirements. Please submit the plan to Bob Newman at Ecology, who will forward it to me.

If you have any questions, please contact me at (206)649-7257. I will be out of the office for a few days, but will be back in on Tuesday, August 24.

Sincerely,

Dr. Teresa Michelsen
Sediment Technical Specialist

cc: Bob Newman, Ecology WQ
James Isdell, DNR
Darryl Riddle, Dodd Enterprises

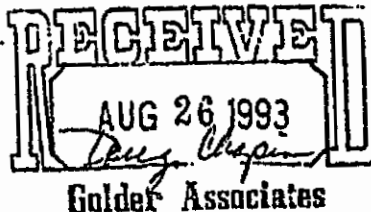


WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands

KALEEN COTTINGHAM
Supervisor

August 24, 1993



Mr. Don Measamer
City of Anacortes
Building and Codes
PO BOX 547
Anacortes, WA 98221

Subject: Shannon Point Seafoods Lease 22-002314, Demolition of Facility

Dear Mr. Measamer:

As you have requested, I am reaffirming the Department of Natural Resources' (department) position regarding the demolition of Shannon Point Seafood's facility at Anacortes. The department is enthusiastic about Shannon Point's interest in a speedy removal of the burned wharf and the remains of the processing plant.

The demolition plan that is required by the City of Anacortes must also include a condition that during the demolition process, any hazardous or toxic substances encountered will be identified on a site plan of the facility. This will assist the department and Department of Ecology (Ecology) in determining where sediment samples should be taken. This plan should give the general outline of the plant and the relationship of the harbor area and private tidelands. I suggest that the exhibit for the lease document prepared by John Vadai of Vadai and Associates be used for this purpose.

The department does not object to the lessee proceeding with demolition of the facility once the regulatory permits have been obtained. Prior to any reconstruction of the facility or wharf, an environmental assessment must be completed. As Dave Bortz and I indicated at the meeting, the department will require sediment sampling of the harbor area to ensure that environmental damage has not occurred on the state's property as a result of the fire. Should results of these tests indicate a clean up of the sediments be necessary, a remediation plan must be prepared and jointly reviewed and approved by the department and Ecology.

Golder Associates

TELECON/ CONTACT MEMORANDUM

☐ Personal Visit

☐ Telephone:

☒ Incoming

☐ Outgoing

ROUTE TO:

Files

☒ Project

☐ Business Development

☐ Mailing List

Company Name: Washington State Department of Natural Resources - Aquatic Lands
Address: 1111 Washington Street S.E. P.O. Box 47027
Olympia, WA. 98504-7027

Job No. 933-1341

Person: Gene Revelas

Telephone: (206) 902-1086 / (206) 902-1786 (FAX)

Date: 10/14/93

Job/subject: Sediment Sampling and Analyses
- Shannon Seaford's Site - Andacortes

Time: 2:45 pm

Remarks:

Mr. Revelas Telephoned Me Immediately After Finishing My Telephone Conversation w/ Tom Durkan Today

* DNR Legally Does Not Have Authority to Require Sampling outside of Lease Boundary - Acknowledged That Dave Bortz of DNR Had Spoken With Tom Today - -
* Concur w/ Golder That Sediment Sampling and Analyses Should Focus on Evaluating Sediment Impacts Resulting only From Fire and Demolition/Debris Removal - - Their Recommendation to Tom Was If Samsung/Shannon Elected to Do Additional Sampling Outside Lease Boundary, They Could Have It Done as an Optional Choice to Assist in Obtaining Data From Off-Site Sources to Protect Any Contamination Liabilities Down the Line - - However, It is Strictly optional - Not Required

* Each Sample to Be Analyzed for Chemical Criteria Listed in Table I of WAC 173-201-47
* Will Send Me Copy of DNR's Lease of the Property and Memo of Agreement Between DNR and Ecology Regarding Sediment Issues

* Sediment SAP Is to Be Sent to Him w/ a Copy Also - Once Approved by Ecology
Sent to Ecology's Teresa Michelsen - Coordinate w/ DNR on our Schedule

Action/Next Contact:

* If Tom Still Requires a Letter, DNR will Provide Him one
- Gene Acknowledged That I would Be Documenting our Telephone Conversation Today in this Memorandum

BY: Doug Chapin

Tom Durkan



RECEIVED

OCT 21 1993

Doug Chapin
Golder Associates

Memorandum

To Doug Chapin name location
From Cecile Revelas name location
Subject Info Requested name location Date 10/15/93

Enclosed:

1) Ecology/DNR MDA

2) Page 5 from DNR lease to Shannon Seafoods. Note item 3

Does speak to "adjacent property." As we discussed, your sampling plan should be designed to assess potential ^{sediment} contamination resulting from the fire/ demolition. If you feel, based on a review of the information, that sampling should extend outside the leased area, then the SAP should reflect this. DNR ~~we~~ will then pursue obtaining a right of entry to other leased areas, as needed.

APPENDIX B

LBS SURVEYING NOTES FOR SEDIMENT SAMPLING LOCATIONS

LEONARD, BOUDINOT & SKODJE, INC.

603 South First Street
P.O. Box 1228
MOUNT VERNON, WASHINGTON 98273

FAX (206) 336-3981
(206) 336-5751

LETTER OF TRANSMITTAL

DATE	11-22-93	JOB NO.	93270
ATTENTION	Doug Chapin / Greg Moon		
RE:	Shannon Pt Seafoods Sample Locations		

TO

Golder Associates Inc.
4104 148th Ave. NE
Redmond, Wa. 98052

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

- ☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
2	11-22-93	93270	8 1/2" x 11" Exhibit with Lat/Long Positions Samples 1-7

THESE ARE TRANSMITTED as checked below:

- ☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Thank you!

COPY TO _____



40% Pre-Consumer Content • 10% Post-Consumer Content

SIGNED:

Thomas E. Barry, P.L.S.

SA

GEOG

GOLDER ASSOCIATES INC.
OFFSHORE SAMPLE LOCATIONS
FOR
SHANNON POINT SEAFOODS INC.
IN THE
CITY OF ANACORTES, WA.



THETA ANGLE = -1°20'28.5"

GUEMES CHANNEL

⊙ SAMPLE #3 ⊙ SAMPLE #5 ⊙ SAMPLE #7

⊙ SAMPLE #2 ⊙ SAMPLE #4

⊙ SAMPLE #1

⊙ SAMPLE #6

FOUND HUB&TACK

SAMPLE #	LATITUDE	LONGITUDE
1	48°30'45.196"	122°38'31.571"
2	48°30'45.597"	122°38'31.923"
3	48°30'46.328"	122°38'32.065"
4	48°30'45.687"	122°38'30.965"
5	48°30'46.391"	122°38'31.324"
6	48°30'45.564"	122°38'29.355"
7	48°30'46.402"	122°38'30.073"

GEOGRAPHIC POSITIONS COMPUTED FROM WASHINGTON NORTH ZONE S.P.C. SYSTEM NAD29 DATUM

LEONARD BOUDINOT AND SKODJE INC.
CIVIL ENGINEERS AND LAND SURVEYORS
603 SOUTH FIRST ST., MOUNT VERNON, WA 98273

DWN BY: TEB DATE: 11-22-93

SCALE: 1" = 50'

JOB NO: 93270

NAIL

SURVEY CONTROL
 N 16°49'20"W 184.54'

APPENDIX C
ARI LABORATORY REPORTS FOR SEDIMENT SAMPLES



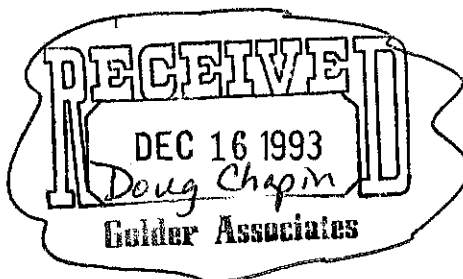
**ANALYTICAL
RESOURCES
INCORPORATED**

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

December 16, 1993

Mr. Doug Chapin
Golder Associates
4104 148th Avenue NE
Redmond, WA 98052



RE: Project No. 933 - 1341.003 / ARI Job No. F579

Dear Mr. Chapin:

Please find enclosed original reports for the above-referenced project. Analytical Resources, Incorporated (ARI) accepted the following eight sediment samples on November 18, 1993:

SP-1	SP-2	SP-3	SP-4
SP-5	SP-6	SP-7	SP-8

We received the samples intact with no discrepancies on the chain of custody documentation (COC). As requested, the laboratory completed the sample analyses according to the Shannon Point sediment sampling and testing plan (STP), dated November 15, 1993, and I provided you with a partial copy of the results on December 9, 1993.

As specified in the STP, the laboratory has reported select organic compounds normalized to total organic carbon (TOC). ARI completed the sample analysis according to the STP and Table 1 of the Sediment Management Standards.

The laboratory selected sample **SP-1** as the matrix spike/matrix spike duplicate set (MS/MSD) and sample **SP-3** was analyzed in triplicate. As agreed, the laboratory has also included a standard reference material (SRM), when appropriate. For the general chemistry and inorganic sample parameters ARI selected SRM 2704 (Buffalo River Sediment) and for the organic constituents ARI selected Harbour Sediment Reference Materials HS-4. These samples were analyzed as requested, to provide you with laboratory quality assurance and quality control (QA/QC) information.

As we discussed by telephone on December 6, 1993, the laboratory experienced some reporting delays. The delays may be attributed to the sample matrix. The laboratory performed a reanalysis for select total volatile solid in order to verify sample variability. The sample reanalysis was comparable to the initial data results and both analysis sets have been included.

Mr. Doug Chapin (12/16/93)

-2-

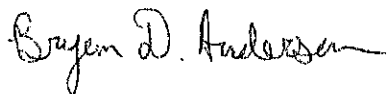
Analytical Resources, Inc.

Due to sample matrix interferences and individual PAH compounds that exceeded the calibrated linear range of the GC/MS instrumentation, sample dilutions with reanalysis were required. When possible we have included both the initial PAH analysis and the sample reanalysis have been included. Due to the extreme GC/MS system overload the laboratory was only able to provide you with the dilution results for samples **SP-5**, **SP-6** and **SP-7**.

As always, a copy of this report and all associated raw data will remain on file with ARI. If you have any questions, or require additional information please feel free to contact me at your convenience. If I am unavailable, you can leave a message on my voice mail and I will return your call as soon as possible.

Sincerely,

ANALYTICAL RESOURCES, INC.



Bryan D. Anderson
Project Manager
(206)340-2866, ext. 116

enclosures
cc: file F579

cooler Temp = $2^{\circ}, 5^{\circ}$

[illegible]

Golden Associates

PROJ. NO.	SITE/LOCATION		NO. OF CONTAINERS		REMARKS (with initials)									
STA. NO.	DATE	TIME	SAMPLE TYPE	MEDIA	SAMPLE IDENTIFICATION	AMOUNT/PRESERVATIVE	TVS/TS	Ammonia	TOC	PAH/Phenols	Metals/Mercury	PCB-Accelers	SEAL NO.	SEAL INTACT? (Y/N)
933-1341.003	BWT Shannon/Anacortes													
SAMPLERS: (Signature) <i>Shannon C. Wynn</i>														
SP-1	11/17/13	10:15	Co-0	Soil	SP-1-11/17	X	X	X	X	X	X	X		
SP-2	"	10:55	"	"	SP-2-11/17	X	X	X	X	X	X	X		
SP-3	"	11:20	"	"	SP-3-11/17	X	X	X	X	X	X	X		
SP-4	"	11:45	"	"	SP-4-11/17	X	X	X	X	X	X	X		
SP-5	"	12:30	"	"	SP-5-11/17	X	X	X	X	X	X	X		
SP-6	"	1:30	"	"	SP-6-11/17	X	X	X	X	X	X	X		
SP-7	"	2:00	"	"	SP-7-11/17	X	X	X	X	X	X	X		
SP-8	"	2:40	"	"	SP-8-11/17	X	X	X	X	X	X	X		
Relinquished by: (Signature/Firm) <i>Shannon C. Wynn/GFI</i> Date/Time <i>11/18/13 9:00</i> Received by: (Signature/Firm) <i>[Signature]</i>														
Relinquished by: (Signature/Firm) Date/Time Received by: (Signature/Firm)														
Relinquished by: (Signature/Firm) Date/Time Received by: (Signature/Firm)														
Relinquished by: (Signature/Firm) Date/Time Received by: (Signature/Firm)														

**ANALYTICAL
RESOURCES
INCORPORATED**Analytical
Chemists &
Consultants333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)**Final Report
Laboratory Analysis of Selected Parameters**

Matrix: SOIL/SEDIMENT

Project: 933-1341.003

Point Shannon/Anacortes

Data Release Authorized: *[Signature]*
Report Prepared 12/06/93 DWN 12-6-93QC Report No: F579 - Golder
Date Received: 11/18/93**Sample Data:**

Method Number		DATE OF ANALYSIS									
		11/19/93	11/22/93	11/22/93	-	-	11/22/93	11/23/93	11/23/93	11/22/93	
		SEE COMMENTS			Calculated	Calculated	EPA 160.4 SM 2540 E	EPA 350.1 SM 4500 NH3-H	EPA 160.3 SM 2540 B	EPA 376.2 SM 4500-S2	
		SOLIDS		TOC (Dry Wt)		TOC Dry Wt 104C (% C)	TOTAL VOLATILE SOLIDS (mg /kg)	NH3-N (mg-N/kg)	SULFIDE TOTAL SOLIDS (%)	SULFIDE (mg /kg)	
Lab ID	Sample Number	PURGED (% @ 70C)	TOTAL (% @ 104C)	TOC (70C) (ppm C)	TOC (104C) (ppm C)						
F579 A	SP-1-11/17	71.64%	70.03%	7,500	7,700	0.77	27,500	9.20	58.71%	479	
F579 B	SP-2-11/17	67.20%	62.08%	7,110	7,700	0.77	27,300	20.7	64.46%	257	
F579 C	SP-3-11/17	64.23%	58.97%	8,490	9,200	0.92	33,500	8.11	64.56%	67.1	
F579 D	SP-4-11/17	65.37%	63.77%	15,000	15,400	1.54	27,800	11.3	59.71%	173	
F579 E	SP-5-11/17	61.81%	57.87%	58,300 *	62,300	6.23	39,000	13.8	60.68%	1,100	
F579 F	SP-6-11/17	84.45%	72.40%	5,090 *	5,900	0.59	21,400	3.63	76.64%	88.8	
F579 G	SP-7-11/17	76.59%	65.06%	30,300	35,700	3.57	27,100	7.37	65.11%	580	
F579 H	SP-8-11/17	60.91%	58.88%	15,100	15,600	1.56	30,600	17.0	62.50% +	702	

*Analysis 11/23

+Analysis 12/1

•Analysis 11/29

Method Blank Analysis:

	PURGED (mg residue)	TOTAL (mg residue)	TOC (70C) (ppm C)	TOC (104C) (ppm C)	Dry Wt 104C (% C)	SOLIDS (mg residue)	NH3-N (mg-N/L)	SOLIDS (mg residue)	SULFIDE (mg /L)
Method Blank	-	<1.0	<293	-	-	<1.0	0.016	<1.0	<0.059
Detection Limit :	-	1.0	293	-	-	1.0	0.010	1.0	0.059

Standard Reference Material

	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)	(mg /kg)	(mg-N/L)	(%)	(mg /L)
Measured Value	-	-	33,000	-	-	-	2.19	-	0.705
"True" Value	-	-	33,480	-	-	-	2.00	-	0.740
% Recovery	-	-	98.6%	-	-	-	110%	-	95.3%

Replicate Analysis:

	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)	(mg /kg)	(mg-N/kg)	(%)	(mg /kg)
Sample ID	F579 A	F579 H	F579 A	F579 A	F579 A	F579 H	F579 A	F579 G	F579 E
Original	71.64%	58.88%	7,500	7700	0.77	30,600	9.20	65.11%	1,100
Duplicate	72.83%	55.26%	11,600	12100	1.21	49,700	9.69	64.69%	950
Triplicate	71.18%	59.68%	7,650	7800	0.78	28,800	9.93	65.72%	1,000
RSD	1.18%	4.06%	26.1%	27.3%	27.3%	31.8%	3.87%	0.79%	7.51%

Spike Analysis:

	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)	(mg /kg)	(mg-N/kg)	(%)	(mg /kg)
Sample ID	-	-	F579 A	-	-	-	F579 A	-	F579 E
Original	-	-	7,500	-	-	-	9.20	-	1,100
Spike	-	-	19,300	-	-	-	296	-	1750.0
Spike Amount	-	-	11,800	-	-	-	283	-	571.0
% Recovery	-	-	100%	-	-	-	101%	-	114%

Comments: Sediment TOC analysis conducted on dried (70 C), ground and sieved samples (120 mesh) using a Dohrmann DC-180 Carbon Analyzer. Calibration, standardization and spiking are conducted following manufacturers directions using potassium hydrogen phthalate (KHP). Samples are purged of inorganic carbon and dried at 70C before analysis. Values are expressed on a sediment dry weight basis (104C) by multiplying the ppm C of the 70C dried sample by the ratio of % Solids 70C to % Solids 104C. The procedure is modified after PSEP, 1986. NBS 2704 was used as the Standard Reference Material (SRM) for TOC. WP QC Lot # 1188 was used as the SRM for Ammonia. Ammonia performed on 2N KCl extracts.



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Final Report

Laboratory Analysis of Selected Parameters

Matrix: SOIL/SEDIMENT

Project: 933-1341.003

Data Release Authorized: *M. P. [Signature]*
Report Prepared 12/13/93 DWN 12-13-93

QC Report No: F579 - Golder
Date Received: 11/18/93

Sample Data:		Method Number	DATE OF ANALYSIS	
			12/09/93	12/09/93
Lab ID	Sample Number		EPA 160.3 SM 2540 B	EPA 160.4 SM 2540 E
			TOTAL SOLIDS (%)	TOTAL VOLATILE SOLIDS (mg /kg)
F579 D	SP-4-11/17		69.76%	28,700
F579 E	SP-5-11/17		63.34%	32,900
F579 G	SP-7-11/17		69.55%	28,300
F579 H	SP-8-11/17		64.25%	33,200

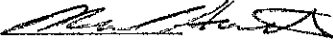
Method Blank Analysis:		SOLIDS (mg residue)	SOLIDS (mg residue)
	Method Blank	<1.0	<1.0
	Detection Limit :	1.0	1.0

Duplicate Analysis:		(%)	(mg /kg)
	Sample ID	F579 H	F579 H
	Original	64.25%	33,200
	Duplicate	64.43%	31,600
	Triplicate	64.96%	29,400
	RSD	0.57%	6.08%

Comments:

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Chemists &
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(206) 621-6490
(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579A
Matrix: Soil/Sediment

Sample No: SP-1-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93Data Release Authorized: 
Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 101 g
Final Extract Volume: 1.0 mL
Percent TOC: 0.77% (Dry Wt.)
Percent Moisture: 35.0%
pH: 7.9
Dilution: 1:5

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	6.4U
95-50-1	1,2-Dichlorobenzene	6.4U
120-82-1	1,2,4-Trichlorobenzene	6.4U
91-20-3	Naphthalene	40
87-68-3	Hexachlorobutadiene	6.4U
91-57-6	2-Methylnaphthalene	17
131-11-3	Dimethyl Phthalate	6.4U
208-96-8	Acenaphthylene	6.4 U
83-32-9	Acenaphthene	48
132-64-9	Dibenzofuran	39
84-66-2	Diethylphthalate	6.4 U
86-73-7	Fluorene	69
86-30-6	N-Nitrosodiphenylamine(1)	6.4U
118-74-1	Hexachlorobenzene	6.4U
85-01-8	Phenanthrene	280

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	110
84-74-2	Di-n-Butylphthalate	6.4U
206-44-0	Fluoranthene	300
129-00-0	Pyrene	200
85-68-7	Butylbenzylphthalate	6.4U
56-55-3	Benzo(a)Anthracene	88
117-81-7	bis(2-Ethylhexyl)Phthalate	22
218-01-9	Chrysene	98
117-84-0	Di-n-Octyl Phthalate	6.4U
205-99-2	Benzo(b)Fluoranthene	55
207-08-9	Benzo(k)Fluoranthene	51
50-32-8	Benzo(a)Pyrene	35
193-39-5	Indeno(1,2,3-cd)Pyrene	14
53-70-3	Dibenz(a,h)Anthracene	8.7
191-24-2	Benzo(ghi)Perylene	10

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	63.4%
2-Fluorobiphenyl	85.0%
d14-p-Terphenyl	78.2%
d4-1,2-Dichlorobenzene	56.6%

Acid surrogate recoveries

d5-Phenol	77.8%
2-Fluorophenol	67.5%
2,4,6-Tribromophenol	68.5%
d4-2-Chlorophenol	79.5%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579A
Matrix: Soil/Sediment

Data Release Authorized: [Signature]
Report: 12/09/93 MAC:ctr

Sample No: SP-1-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 65.6 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 35.0%
pH: 7.9
Dilution: 1:5

CAS Number		µg/Kg
108-95-2	Phenol	76 U
100-51-6	Benzyl Alcohol	76 U
95-48-7	2-Methylphenol	76 U
106-44-5	4-Methylphenol	76 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	76 U
65-85-0	Benzole Acid	760 U
87-86-5	Pentachlorophenol	380 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	63.4%
2-Fluorobiphenyl	85.0%
d14-p-Terphenyl	78.2%
d4-1,2-Dichlorobenzene	56.6%

Acid surrogate recoveries

d5-Phenol	77.8%
2-Fluorophenol	67.5%
2,4,6-Tribromophenol	68.5%
d4-2-Chlorophenol	79.5%



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SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ARI Sample ID: F579A
Client Sample ID: SP-1-11/17
Instrument ID: FINN 2

Client: Golder
Project: 933-1341.003
Pt. Shannon/Anacortes

Date Extracted: 11/23/93

Date Analyzed: 12/03/93

Report: 12/14/93 MAC:ctr *mt*

COMPOUND	SPIKE ADDED (mg/Kg)	SAMPLE CONC (mg/Kg)	MS CONC (mg/Kg)	MS REC
1,4-Dichlorobenzene	32.5	0	22.4	68.9%
1,2,4-Trichlorobenzene	32.5	0	24.4	75.1%
Acenaphthene	32.5	47.5	87.3	122%
Pyrene	32.5	198	200	6.2%

COMPOUND	SPIKE ADDED (mg/Kg)	MSD CONC (mg/Kg)	MSD REC	RPD
1,4-Dichlorobenzene	32.1	23.6	73.5%	6.5
1,2,4-Trichlorobenzene	32.1	21.2	66.0%	12.9
Acenaphthene	32.1	377	-	-
Pyrene	32.1	357	-	-

Comments: Spike values normalized on a %TOC of 0.77%.
Values not reported due to high spike recovery.

FORM III - SV



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SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ARI Sample ID: F579A
Client Sample ID: SP-1-11/17
Instrument ID: FINN 2

Client: Golder
Project: 933-1341.003
Pt. Shannon/Anacortes

Date Extracted: 11/23/93

Date Analyzed: 12/03/93

Report: 12/14/93 MAC:ctr *MA*

COMPOUND	SPIKE ADDED ($\mu\text{g/Kg}$)	SAMPLE CONC ($\mu\text{g/Kg}$)	MS CONC ($\mu\text{g/Kg}$)	MS REC
Phenol	577	0	515	89.3%
Pentachlorophenol	577	0	287	49.7%

COMPOUND	SPIKE ADDED ($\mu\text{g/Kg}$)	MSD CONC ($\mu\text{g/Kg}$)	MSD REC	RPD
Phenol	571	520	91.1%	2.0
Pentachlorophenol	571	283	49.6%	0.2

Comments:

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RESOURCES
INCORPORATED**Analytical
Chemists &
Consultants333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579AMS
Matrix: Soil/Sediment

Sample No: SP-1-11/17

Matrix Spike

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Data Release Authorized:

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 100 g

Final Extract Volume: 1.0 mL

Percent TOC: 0.77% (Dry Wt.)

Percent Moisture: 35.0%

pH: 7.9

Dilution: 1:5

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	-
95-50-1	1,2-Dichlorobenzene	6.5U
120-82-1	1,2,4-Trichlorobenzene	-
91-20-3	Naphthalene	45
87-68-3	Hexachlorobutadiene	6.5U
91-57-6	2-Methylnaphthalene	23
131-11-3	Dimethyl Phthalate	6.5U
208-96-8	Acenaphthylene	6.5U
83-32-9	Acenaphthene	-
132-64-9	Dibenzofuran	47
84-66-2	Diethylphthalate	6.5U
86-73-7	Fluorene	83
86-30-6	N-Nitrosodiphenylamine(1)	6.5U
118-74-1	Hexachlorobenzene	6.5U
85-01-8	Phenanthrene	330

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	120
84-74-2	Di-n-Butylphthalate	6.5U
206-44-0	Fluoranthene	290
129-00-0	Pyrene	-
85-68-7	Butylbenzylphthalate	6.5U
56-55-3	Benzo(a)Anthracene	85
117-81-7	bis(2-Ethylhexyl)Phthalate	630 K
218-01-9	Chrysene	88
117-84-0	Di-n-Octyl Phthalate	6.5U
205-99-2	Benzo(b)Fluoranthene	57
207-08-9	Benzo(k)Fluoranthene	34
50-32-8	Benzo(a)Pyrene	34
193-39-5	Indeno(1,2,3-cd)Pyrene	19
53-70-3	Dibenz(a,h)Anthracene	9.4
191-24-2	Benzo(ghi)Perylene	14

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	68.1%
2-Fluorobiphenyl	99.6%
d14-p-Terphenyl	79.6%
d4-1,2-Dichlorobenzene	67.5%

Acid surrogate recoveries

d5-Phenol	94.8%
2-Fluorophenol	83.7%
2,4,6-Tribromophenol	73.4%
d4-2-Chlorophenol	90.4%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579AMS
Matrix: Soil/Sediment

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Sample No: SP-1-11/17

Matrix Spike

QC Report No: F579 -Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 65.0 g (Dry Wt.)

Final Extract Volume: 1.0 mL

Percent Moisture: 35.0%

pH: 7.9

Dilution: 1:5

CAS Number		µg/Kg
108-95-2	Phenol	-
100-51-6	Benzyl Alcohol	77 U
95-48-7	2-Methylphenol	77 U
106-44-5	4-Methylphenol	77 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	77 U
65-85-0	Benzoic Acid	770 U
87-86-5	Pentachlorophenol	-

Base/neutral surrogate recoveries

d5-Nitrobenzene	68.1%
2-Fluorobiphenyl	99.6%
d14-p-Terphenyl	79.6%
d4-1,2-Dichlorobenzene	67.5%

Acid surrogate recoveries

d5-Phenol	94.8%
2-Fluorophenol	83.7%
2,4,6-Tribromophenol	73.4%
d4-2-Chlorophenol	90.4%



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579AMSD
Matrix: Soil/Sediment

Sample No: SP-1-11/17

Matrix Spike Dup.

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Analytical
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Consultants

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Data Release Authorized:

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 101 g
Final Extract Volume: 1.0 mL

Percent TOC: 0.77% (Dry Wt.)

Percent Moisture: 35.0%

pH: 7.9

Dilution: 1:5

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	-
95-50-1	1,2-Dichlorobenzene	6.4U
120-82-1	1,2,4-Trichlorobenzene	-
91-20-3	Naphthalene	260
87-68-3	Hexachlorobutadiene	6.4U
91-57-6	2-Methylnaphthalene	250
131-11-3	Dimethyl Phthalate	6.4U
208-96-8	Acenaphthylene	13
83-32-9	Acenaphthene	-
132-64-9	Dibenzofuran	260
84-66-2	Diethylphthalate	6.4U
86-73-7	Fluorene	380
86-30-6	N-Nitrosodiphenylamine(1)	6.4U
118-74-1	Hexachlorobenzene	6.4U
85-01-8	Phenanthrene	790 K

CAS Number		mg/Kg
120-12-7	Anthracene	200
84-74-2	Di-n-Butylphthalate	6.5
206-44-0	Fluoranthene	620 K
129-00-0	Pyrene	-
85-68-7	Butylbenzylphthalate	6.4U
56-55-3	Benzo(a)Anthracene	170
117-81-7	bis(2-Ethylhexyl)Phthalate	16
218-01-9	Chrysene	160
117-84-0	Di-n-Octyl Phthalate	6.4U
205-99-2	Benzo(b)Fluoranthene	88
207-08-9	Benzo(k)Fluoranthene	65
50-32-8	Benzo(a)Pyrene	61
193-39-5	Indeno(1,2,3-cd)Pyrene	28
53-70-3	Dibenz(a,h)Anthracene	14
191-24-2	Benzo(ghi)Perylene	21

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	69.0%
2-Fluorobiphenyl	97.6%
d14-p-Terphenyl	78.4%
d4-1,2-Dichlorobenzene	75.1%

Acid surrogate recoveries

d5-Phenol	97.6%
2-Fluorophenol	85.4%
2,4,6-Tribromophenol	73.0%
d4-2-Chlorophenol	90.3%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579AMSD
Matrix: Soil/Sediment

Data Release Authorized: [Signature]
Report: 12/09/93 MAC:ctr

Sample No: SP-1-11/17
Matrix Spike Dup.

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 65.7 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 35.0%
pH: 7.9
Dilution: 1:5

CAS Number		µg/Kg
108-95-2	Phenol	-
100-51-6	Benzyl Alcohol	76 U
95-48-7	2-Methylphenol	76 U
106-44-5	4-Methylphenol	76 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	76 U
65-85-0	Benzolic Acid	760 U
87-86-5	Pentachlorophenol	-

Base/neutral surrogate recoveries

d5-Nitrobenzene	69.0%
2-Fluorobiphenyl	97.6%
d14-p-Terphenyl	78.4%
d4-1,2-Dichlorobenzene	75.1%

Acid surrogate recoveries

d5-Phenol	97.6%
2-Fluorophenol	85.4%
2,4,6-Trifluorophenol	73.0%
d4-2-Chlorophenol	90.3%

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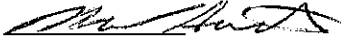
Sample ID: F579B
Matrix: Soil/Sediment

Sample No: SP-2-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes

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Data Release Authorized: 
Report: 12/14/93 MAC:ctr

VTSR: 11/18/93

Date extracted: 11/23/93

Sample Wt: 103 g
Final Extract Volume: 4.0 mL

Date Analyzed: 12/02/93

Percent TOC: 0.77% (Dry Wt.)

Instrument: FINN 2

Percent Moisture: 41.0%

GPC Clean-up: Yes

pH: 7.8

Dilution: 1:1

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	5.0U
95-50-1	1,2-Dichlorobenzene	5.0U
120-82-1	1,2,4-Trichlorobenzene	5.0U
91-20-3	Naphthalene	40
87-68-3	Hexachlorobutadiene	5.0U
91-57-6	2-Methylnaphthalene	31
131-11-3	Dimethyl Phthalate	5.0U
208-96-8	Acenaphthylene	8.1
83-32-9	Acenaphthene	73
132-64-9	Dibenzofuran	74
84-66-2	Diethylphthalate	7.4
86-73-7	Fluorene	110
86-30-6	N-Nitrosodiphenylamine(1)	5.0U
118-74-1	Hexachlorobenzene	5.0U
85-01-8	Phenanthrene	380 K

CAS Number		mg/Kg
120-12-7	Anthracene	120
84-74-2	Di-n-Butylphthalate	5.0U
206-44-0	Fluoranthene	340 K
129-00-0	Pyrene	190
85-68-7	Butylbenzylphthalate	5.0U
56-55-3	Benzo(a)Anthracene	100
117-81-7	bis(2-Ethylhexyl)Phthalate	130
218-01-9	Chrysene	120
117-84-0	Di-n-Octyl Phthalate	5.0U
205-99-2	Benzo(b)Fluoranthene	57
207-08-9	Benzo(k)Fluoranthene	62
50-32-8	Benzo(a)Pyrene	41
193-39-5	Indeno(1,2,3-cd)Pyrene	14
53-70-3	Dibenz(a,h)Anthracene	7.7
191-24-2	Benzo(ghi)Perylene	10

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	74.7%
2-Fluorobiphenyl	96.6%
d14-p-Terphenyl	90.3%
d4-1,2-Dichlorobenzene	72.2%

Acid surrogate recoveries

d5-Phenol	84.4%
2-Fluorophenol	87.8%
2,4,6-Tribromophenol	79.8%
d4-2-Chlorophenol	87.2%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		


**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579BDL
Matrix: Soil/Sediment

Sample No: SP-2-11/17

Dilution

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Data Release Authorized: *[Signature]*

Report: 12/14/93 MAC:ctr

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Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 103 g
Final Extract Volume: 4.0 mL

Percent TOC: 0.77% (Dry Wt.)

Percent Moisture: 41.0%

pH: 7.8

Dilution: 1:5

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	25U
95-50-1	1,2-Dichlorobenzene	25U
120-82-1	1,2,4-Trichlorobenzene	25U
91-20-3	Naphthalene	36
87-68-3	Hexachlorobutadiene	25U
91-57-6	2-Methylnaphthalene	27
131-11-3	Dimethyl Phthalate	25U
208-96-8	Acenaphthylene	25 U
83-32-9	Acenaphthene	61
132-64-9	Dibenzofuran	56
84-66-2	Diethylphthalate	25 U
86-73-7	Fluorene	120
86-30-6	N-Nitrosodiphenylamine(1)	25U
118-74-1	Hexachlorobenzene	25U
85-01-8	Phenanthrene	600

CAS Number		mg/Kg
120-12-7	Anthracene	230
84-74-2	Di-n-Butylphthalate	25U
206-44-0	Fluoranthene	520
129-00-0	Pyrene	330
85-68-7	Butylbenzylphthalate	25U
56-55-3	Benzo(a)Anthracene	110
117-81-7	bis(2-Ethylhexyl)Phthalate	190
218-01-9	Chrysene	140
117-84-0	Di-n-Octyl Phthalate	25U
205-99-2	Benzo(b)Fluoranthene	74
207-08-9	Benzo(k)Fluoranthene	55
50-32-8	Benzo(a)Pyrene	44
193-39-5	Indeno(1,2,3-cd)Pyrene	25 U
53-70-3	Dibenz(a,h)Anthracene	25 U
191-24-2	Benzo(ghi)Perylene	25 U

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	74.7%
2-Fluorobiphenyl	83.5%
d14-p-Terphenyl	86.6%
d4-1,2-Dichlorobenzene	78.6%

Acid surrogate recoveries

d5-Phenol	82.0%
2-Fluorophenol	99.5%
2,4,6-Tribromophenol	55.5%
d4-2-Chlorophenol	80.6%

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

NR Analysis not required.

B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

K This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.

M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579B
Matrix: Soil/Sediment

Sample No: SP-2-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 60.7 g (Dry Wt.)
Final Extract Volume: 4.0 mL
Percent Moisture: 41.0%
pH: 7.8
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	250
100-51-6	Benzyl Alcohol	66 U
95-48-7	2-Methylphenol	66 U
106-44-5	4-Methylphenol	390

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	66 U
65-85-0	Benzoic Acid	660 U
87-86-5	Pentachlorophenol	330 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	74.7%
2-Fluorobiphenyl	96.6%
d14-p-Terphenyl	90.3%
d4-1,2-Dichlorobenzene	72.2%

Acid surrogate recoveries

d5-Phenol	84.4%
2-Fluorophenol	87.8%
2,4,6-Tribromophenol	79.8%
d4-2-Chlorophenol	87.2%

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(206) 621-6490
(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579CDL
Matrix: Soil/Sediment

Sample No: SP-3-11/17

Dilution

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Data Release Authorized:

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 102 g

Final Extract Volume: 1.0 mL

Percent TOC: 0.92% (Dry Wt.)

Percent Moisture: 43.9%

pH: 7.7

Dilution: 1:5

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	5.3 U
95-50-1	1,2-Dichlorobenzene	5.3 U
120-82-1	1,2,4-Trichlorobenzene	5.3 U
91-20-3	Naphthalene	11
87-68-3	Hexachlorobutadiene	5.3 U
91-57-6	2-Methylnaphthalene	5.3 U
131-11-3	Dimethyl Phthalate	5.3 U
208-96-8	Acenaphthylene	5.3 U
83-32-9	Acenaphthene	11
132-64-9	Dibenzofuran	6.9
84-66-2	Diethylphthalate	5.3 U
86-73-7	Fluorene	13
86-30-6	N-Nitrosodiphenylamine(1)	5.3 U
118-74-1	Hexachlorobenzene	5.3 U
85-01-8	Phenanthrene	87

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	24
84-74-2	Di-n-Butylphthalate	5.3 U
206-44-0	Fluoranthene	130
129-00-0	Pyrene	97
85-68-7	Butylbenzylphthalate	5.3 U
56-55-3	Benzo(a)Anthracene	41
117-81-7	bis(2-Ethylhexyl)Phthalate	130
218-01-9	Chrysene	55
117-84-0	Di-n-Octyl Phthalate	16
205-99-2	Benzo(b)Fluoranthene	41
207-08-9	Benzo(k)Fluoranthene	31
50-32-8	Benzo(a)Pyrene	34
193-39-5	Indeno(1,2,3-cd)Pyrene	18
53-70-3	Dibenz(a,h)Anthracene	7.1
191-24-2	Benzo(ghi)Perylene	15

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	64.9%
2-Fluorobiphenyl	93.3%
d14-p-Terphenyl	81.2%
d4-1,2-Dichlorobenzene	67.0%

Acid surrogate recoveries

d5-Phenol	84.5%
2-Fluorophenol	87.3%
2,4,6-Tribromophenol	76.5%
d4-2-Chlorophenol	80.3%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		

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(206) 621-6490
(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579FDL
Matrix: Soil/Sediment

Sample No: SP-6-11/17

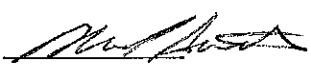
Dilution

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

Data Release Authorized: 

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 105 g
Final Extract Volume: 1.0 mL

Percent TOC: 0.59% (Dry Wt.)

Percent Moisture: 26.3%

pH: 8.5

Dilution: 1:20

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	32 U
95-50-1	1,2-Dichlorobenzene	32 U
120-82-1	1,2,4-Trichlorobenzene	32 U
91-20-3	Naphthalene	32 U
87-68-3	Hexachlorobutadiene	32 U
91-57-6	2-Methylnaphthalene	32 U
131-11-3	Dimethyl Phthalate	32 U
208-96-8	Acenaphthylene	32 U
83-32-9	Acenaphthene	32 U
132-64-9	Dibenzofuran	32 U
84-66-2	Diethylphthalate	32 U
86-73-7	Fluorene	32 U
86-30-6	N-Nitrosodiphenylamine(1)	32 U
118-74-1	Hexachlorobenzene	32 U
85-01-8	Phenanthrene	220

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	49
84-74-2	Di-n-Butylphthalate	32 U
206-44-0	Fluoranthene	340
129-00-0	Pyrene	200
85-68-7	Butylbenzylphthalate	32 U
56-55-3	Benzo(a)Anthracene	68
117-81-7	bis(2-Ethylhexyl)Phthalate	32 U
218-01-9	Chrysene	92
117-84-0	Di-n-Octyl Phthalate	32 U
205-99-2	Benzo(b)Fluoranthene	43
207-08-9	Benzo(k)Fluoranthene	55
50-32-8	Benzo(a)Pyrene	39
193-39-5	Indeno(1,2,3-cd)Pyrene	32 U
53-70-3	Dibenz(a,h)Anthracene	32 U
191-24-2	Benzo(ghi)Perylene	32 U

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	53.2%
2-Fluorobiphenyl	76.4%
d14-p-Terphenyl	67.2%
d4-1,2-Dichlorobenzene	68.6%

Acid surrogate recoveries

d5-Phenol	75.3%
2-Fluorophenol	84.2%
2,4,6-Tribromophenol	53.1%
d4-2-Chlorophenol	75.7%

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

NR Analysis not required.

B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

K This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.

M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579F
Matrix: Soil/Sediment

Sample No: SP-6-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

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(206) 621-6490
(206) 621-7523 (FAX)

Data Release Authorized:
Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 105 g
Final Extract Volume: 1.0 mL
Percent TOC: 0.59% (Dry Wt.)
Percent Moisture: 26.3%
pH: 8.5
Dilution: 1:1

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	1.6 U
95-50-1	1,2-Dichlorobenzene	1.6 U
120-82-1	1,2,4-Trichlorobenzene	1.6 U
91-20-3	Naphthalene	8.6
87-68-3	Hexachlorobutadiene	1.6 U
91-57-6	2-Methylnaphthalene	3.8
131-11-3	Dimethyl Phthalate	1.6 U
208-96-8	Acenaphthylene	4.8
83-32-9	Acenaphthene	19
132-64-9	Dibenzofuran	17
84-66-2	Diethylphthalate	1.6 U
86-73-7	Fluorene	27
86-30-6	N-Nitrosodiphenylamine(1)	1.6 U
118-74-1	Hexachlorobenzene	1.6 U
85-01-8	Phenanthrene	130 K

CAS Number		mg/Kg
120-12-7	Anthracene	36
84-74-2	Di-n-Butylphthalate	3.2
206-44-0	Fluoranthene	140 K
129-00-0	Pyrene	96
85-68-7	Butylbenzylphthalate	1.6 U
56-55-3	Benzo(a)Anthracene	61
117-81-7	bis(2-Ethylhexyl)Phthalate	16
218-01-9	Chrysene	70
117-84-0	Di-n-Octyl Phthalate	1.6 U
205-99-2	Benzo(b)Fluoranthene	49
207-08-9	Benzo(k)Fluoranthene	41
50-32-8	Benzo(a)Pyrene	33
193-39-5	Indeno(1,2,3-cd)Pyrene	12
53-70-3	Dibenz(a,h)Anthracene	6.6
191-24-2	Benzo(ghi)Perylene	9.3

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	76.8%
2-Fluorobiphenyl	93.6%
d14-p-Terphenyl	81.2%
d4-1,2-Dichlorobenzene	69.4%

Acid surrogate recoveries

d5-Phenol	77.2%
2-Fluorophenol	75.9%
2,4,6-Tribromophenol	86.7%
d4-2-Chlorophenol	76.3%

Data Reporting Qualifiers

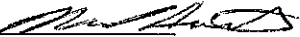
Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579F
Matrix: Soil/Sediment

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Sample No: SP-6-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

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(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 77.2 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 26.3%
pH: 8.5
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	16
100-51-6	Benzyl Alcohol	13 U
95-48-7	2-Methylphenol	13 U
106-44-5	4-Methylphenol	21

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	13 U
65-85-0	Benzoic Acid	130 U
87-86-5	Pentachlorophenol	65 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	76.8%
2-Fluorobiphenyl	93.6%
d14-p-Terphenyl	81.2%
d4-1,2-Dichlorobenzene	69.4%

Acid surrogate recoveries

d5-Phenol	77.2%
2-Fluorophenol	75.9%
2,4,6-Tribromophenol	86.7%
d4-2-Chlorophenol	76.3%



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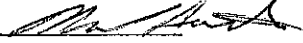
ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579GDL
Matrix: Soil/Sediment

Sample No: SP-7-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 
Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 107 g
Final Extract Volume: 1.0 mL
Percent TOC: 3.57% (Dry Wt.)
Percent Moisture: 34.9%
pH: 8.1
Dilution: 1:20

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	5.2 U
95-50-1	1,2-Dichlorobenzene	5.2 U
120-82-1	1,2,4-Trichlorobenzene	5.2 U
91-20-3	Naphthalene	5.2 U
87-68-3	Hexachlorobutadiene	5.2 U
91-57-6	2-Methylnaphthalene	5.2 U
131-11-3	Dimethyl Phthalate	5.2 U
208-96-8	Acenaphthylene	5.2 U
83-32-9	Acenaphthene	5.2 U
132-64-9	Dibenzofuran	5.2 U
84-66-2	Diethylphthalate	5.2 U
86-73-7	Fluorene	5.4
86-30-6	N-Nitrosodiphenylamine(1)	5.2 U
118-74-1	Hexachlorobenzene	5.2 U
85-01-8	Phenanthrene	41

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	14
84-74-2	Di-n-Butylphthalate	5.2 U
206-44-0	Fluoranthene	160
129-00-0	Pyrene	110
85-68-7	Butylbenzylphthalate	5.2 U
56-55-3	Benzo(a)Anthracene	26
117-81-7	bis(2-Ethylhexyl)Phthalate	220
218-01-9	Chrysene	50
117-84-0	Di-n-Octyl Phthalate	18
205-99-2	Benzo(b)Fluoranthene	32
207-08-9	Benzo(k)Fluoranthene	25
50-32-8	Benzo(a)Pyrene	18
193-39-5	Indeno(1,2,3-cd)Pyrene	9.5
53-70-3	Dibenz(a,h)Anthracene	5.2 U
191-24-2	Benzo(ghi)Perylene	6.5

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	54.6%
2-Fluorobiphenyl	72.9%
d14-p-Terphenyl	64.7%
d4-1,2-Dichlorobenzene	67.3%

Acid surrogate recoveries

d5-Phenol	70.4%
2-Fluorophenol	84.8%
2,4,6-Tribromophenol	45.7%
d4-2-Chlorophenol	73.5%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579GDL
Matrix: Soil/Sediment

Sample No: SP-7-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 69.6 g (Dry Wt.)

Final Extract Volume: 1.0 mL

Percent Moisture: 34.9%

pH: 8.1

Dilution: 1:20

CAS Number		µg/Kg
108-95-2	Phenol	290 U
100-51-6	Benzyl Alcohol	290 U
95-48-7	2-Methylphenol	290 U
106-44-5	4-Methylphenol	290 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	290 U
65-85-0	Benzolc Acid	2,900 U
87-86-5	Pentachlorophenol	1,400 U

Base/neutral surrogate recoveries

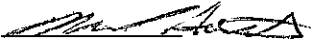
d5-Nitrobenzene	54.6%
2-Fluorobiphenyl	72.9%
d14-p-Terphenyl	64.7%
d4-1,2-Dichlorobenzene	67.3%

Acid surrogate recoveries

d5-Phenol	70.4%
2-Fluorophenol	84.8%
2,4,6-Tribromophenol	45.7%
d4-2-Chlorophenol	73.5%

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(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579H
Matrix: Soil/Sediment

Sample No: SP-8-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93Data Release Authorized: 
Report: 12/14/93 MAC:ctrDate extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: YesSample Wt: 103 g
Final Extract Volume: 1.0 mL
Percent TOC: 1.56% (Dry Wt.)
Percent Moisture: 47.3%
pH: 8.0
Dilution: 1:1

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	0.6 U
95-50-1	1,2-Dichlorobenzene	0.6 U
120-82-1	1,2,4-Trichlorobenzene	0.6 U
91-20-3	Naphthalene	7.1
87-68-3	Hexachlorobutadiene	0.6 U
91-57-6	2-Methylnaphthalene	4.0
131-11-3	Dimethyl Phthalate	1.2
208-96-8	Acenaphthylene	2.9
83-32-9	Acenaphthene	12
132-64-9	Dibenzofuran	8.4
84-66-2	Diethylphthalate	0.6 U
86-73-7	Fluorene	21
86-30-6	N-Nitrosodiphenylamine(1)	0.6 U
118-74-1	Hexachlorobenzene	0.6 U
85-01-8	Phenanthrene	94 K

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	30
84-74-2	Di-n-Butylphthalate	1.1
206-44-0	Fluoranthene	81 K
129-00-0	Pyrene	49 K
85-68-7	Butylbenzylphthalate	0.6 U
56-55-3	Benzo(a)Anthracene	29
117-81-7	bis(2-Ethylhexyl)Phthalate	130 K
218-01-9	Chrysene	35
117-84-0	Di-n-Octyl Phthalate	0.6 U
205-99-2	Benzo(b)Fluoranthene	26
207-08-9	Benzo(k)Fluoranthene	17
50-32-8	Benzo(a)Pyrene	16
193-39-5	Indeno(1,2,3-cd)Pyrene	6.0
53-70-3	Dibenz(a,h)Anthracene	3.2
191-24-2	Benzo(ghi)Perylene	4.7

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	76.7%
2-Fluorobiphenyl	91.1%
d14-p-Terphenyl	84.6%
d4-1,2-Dichlorobenzene	69.8%

Acid surrogate recoveries

d5-Phenol	81.2%
2-Fluorophenol	78.5%
2,4,6-Tribromophenol	84.8%
d4-2-Chlorophenol	80.2%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		

**ANALYTICAL
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INCORPORATED****ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**

Sample ID: F579HDL
Matrix: Soil/Sediment

Sample No: SP-8-11/17

Dilution

QC Report No: F579 - Golder

Project: 933-1341.003

Pt. Shannon/Anacortes

VTSR: 11/18/93

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Data Release Authorized:

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93

Date Analyzed: 12/03/93

Instrument: FINN 2

GPC Clean-up: Yes

Sample Wt: 103 g
Final Extract Volume: 1.0 mL

Percent TOC: 1.56% (Dry Wt.)

Percent Moisture: 47.3%

pH: 8.0

Dilution: 1:20

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	12 U
95-50-1	1,2-Dichlorobenzene	12 U
120-82-1	1,2,4-Trichlorobenzene	12 U
91-20-3	Naphthalene	12 U
87-68-3	Hexachlorobutadiene	12 U
91-57-6	2-Methylnaphthalene	12 U
131-11-3	Dimethyl Phthalate	12 U
208-96-8	Acenaphthylene	12 U
83-32-9	Acenaphthene	12 U
132-64-9	Dibenzofuran	12 U
84-66-2	Diethylphthalate	12 U
86-73-7	Fluorene	25
86-30-6	N-Nitrosodiphenylamine(1)	12 U
118-74-1	Hexachlorobenzene	12 U
85-01-8	Phenanthrene	130

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	47
84-74-2	Di-n-Butylphthalate	12 U
206-44-0	Fluoranthene	160
129-00-0	Pyrene	110
85-68-7	Butylbenzylphthalate	12 U
56-55-3	Benzo(a)Anthracene	34
117-81-7	bis(2-Ethylhexyl)Phthalate	410
218-01-9	Chrysene	55
117-84-0	Di-n-Octyl Phthalate	12 U
205-99-2	Benzo(b)Fluoranthene	23
207-08-9	Benzo(k)Fluoranthene	28
50-32-8	Benzo(a)Pyrene	20
193-39-5	Indeno(1,2,3-cd)Pyrene	12 U
53-70-3	Dibenz(a,h)Anthracene	12 U
191-24-2	Benzo(ghi)Perylene	12 U

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	55.3%
2-Fluorobiphenyl	80.9%
d14-p-Terphenyl	71.9%
d4-1,2-Dichlorobenzene	73.3%

Acid surrogate recoveries

d5-Phenol	71.8%
2-Fluorophenol	86.9%
2,4,6-Tribromophenol	57.9%
d4-2-Chlorophenol	72.5%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579H
Matrix: Soil/Sediment

Sample No: SP-8-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 

Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 54.5 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 47.3%
pH: 8.0
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	79
100-51-6	Benzyl Alcohol	18 U
95-48-7	2-Methylphenol	18 U
106-44-5	4-Methylphenol	87

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	18 U
65-85-0	Benzoic Acid	180 U
87-86-5	Pentachlorophenol	92 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	76.7%
2-Fluorobiphenyl	91.1%
d14-p-Terphenyl	84.6%
d4-1,2-Dichlorobenzene	69.8%

Acid surrogate recoveries

d5-Phenol	81.2%
2-Fluorophenol	78.5%
2,4,6-Tribromophenol	84.8%
d4-2-Chlorophenol	80.2%

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(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579SRM
Matrix: Soil/Sediment

Sample No: HS-4

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93Data Release Authorized:
Report: 12/14/93 MAC:ctrDate extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: YesSample Wt: 50.1 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 0%
pH: NA
Dilution: 1:1

CAS Number		µg/Kg
106-46-7	1,4-Dichlorobenzene	20 U
95-50-1	1,2-Dichlorobenzene	20 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	Naphthalene	42
87-68-3	Hexachlorobutadiene	20 U
91-57-6	2-Methylnaphthalene	43
131-11-3	Dimethyl Phthalate	20 U
208-96-8	Acenaphthylene	96
83-32-9	Acenaphthene	20 U
132-64-9	Dibenzofuran	38
84-66-2	Diethylphthalate	20 U
86-73-7	Fluorene	35
86-30-6	N-Nitrosodiphenylamine(1)	20 U
118-74-1	Hexachlorobenzene	20 U
85-01-8	Phenanthrene	530

(1) Cannot be separated from diphenylamine

CAS Number		µg/Kg
120-12-7	Anthracene	84
84-74-2	Di-n-Butylphthalate	95
206-44-0	Fluoranthene	680
129-00-0	Pyrene	640
85-68-7	Butylbenzylphthalate	20 U
56-55-3	Benzo(a)Anthracene	390
117-81-7	bis(2-Ethylhexyl)Phthalate	520
218-01-9	Chrysene	490
117-84-0	Di-n-Octyl Phthalate	43
205-99-2	Benzo(b)Fluoranthene	570
207-08-9	Benzo(k)Fluoranthene	470
50-32-8	Benzo(a)Pyrene	370
193-39-5	Indeno(1,2,3-cd)Pyrene	230
53-70-3	Dibenz(a,h)Anthracene	120
191-24-2	Benzo(ghi)Perylene	170

Base/neutral surrogate recoveries

d5-Nitrobenzene	70.3%
2-Fluorobiphenyl	82.4%
d14-p-Terphenyl	78.6%
d4-1,2-Dichlorobenzene	59.4%

Acid surrogate recoveries

d5-Phenol	92.1%
2-Fluorophenol	69.1%
2,4,6-Tribromophenol	82.9%
d4-2-Chlorophenol	70.0%

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

NR Analysis not required.

B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

K This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.

M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.

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PCB Analysis by GC/ECD**

QC Report: F579 - Golder
Project: Pt. Shannon/Ancortes
933-1341.003
VTSR: 11/18/93

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Matrix: Soils/Sediments

Data Release Authorized: *Cathy M. Newman*

Report: 12/14/93 MAC:ctr

GPC Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: Yes

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Reported in Total ppm (mg/kg) Dry Weight normalized on a TOC basis.

Sample #:	Method Blank	SP-1-11/17	SP-1-11/17 MS	SP-1-11/17 MSD	SP-2-11/17	SP-3-11/17
ARI Lab ID:	MB1123	F579A	F579AMS	F579AMSD	F579B	F579C
Date Extracted:	11/23/93	11/23/93	11/23/93	11/23/93	11/23/93	11/23/93
Date Analyzed:	12/03/93	12/03/93	12/03/93	12/03/93	12/03/93	12/03/93
Sample Amount:	100 g	101 g	100 g	101 g	103 g	102 g
Percent TOC:	1.00%	0.77%	0.77%	0.77%	0.77%	0.92%
Final Volume:	10 mL	10 mL	10 mL	10 mL	10 mL	10 mL
Dilution:	1:1	1:1	1:1	1:1	1:1	1:1
1016/1242	2.0 U	1.7 U	-	-	1.5 U	1.2 U
1248	2.0 U	1.7 U	1.7 U	1.7 U	1.5 U	1.2 U
1254	2.0 U	2.5 Y	3.4 Y	4.4 Y	4.4	2.1 Y
1260	2.0 U	1.7 U	1.7 U	1.7 U	1.5 U	2.8 Y
TCMX Surrogate	87.6%	91.6%	91.2%	81.7%	93.8%	89.9%
DCBP Surrogate	76.1%	71.4%	82.3%	74.7%	79.1%	71.5%

Sample #:	SP-4-11/17	SP-5-11/17	SP-6-11/17	SP-7-11/17	SP-8-11/17
ARI Lab ID:	F579D	F579E	F579F	F579G	F579H
Date Extracted:	11/23/93	11/23/93	11/23/93	11/23/93	11/23/93
Date Analyzed:	12/03/93	12/03/93	12/03/93	12/03/93	12/03/93
Sample Amount:	104 g	104 g	105 g	107 g	103 g
Percent TOC:	1.54%	6.23%	0.59%	3.57%	1.56%
Final Volume:	10 mL	10 mL	10 mL	10 mL	10 mL
Dilution:	1:1	1:1	1:1	1:1	1:1
1016/1242	0.7 U	0.2 Y	2.5 U	0.4 U	0.7 U
1248	0.7 U	0.2 U	2.5 U	0.4 U	0.7 U
1254	1.1 Y	0.2	2.5 U	0.6 Y	0.8
1260	0.7 U	0.2 U	2.5 U	0.4 U	0.7 U
TCMX Surrogate	82.7%	96.4%	83.1%	71.3%	94.5%
DCBP Surrogate	70.3%	81.9%	71.7%	60.8%	82.1%

Data Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.
B	Found in associated method blank.
J	Indicates an estimated value when that value is less than the calculated detection limit.
U	Indicates compound was analyzed for, but not detected at the given detection limit.
X	Indicates value above the linear range of the detector. Dilution required.
D	Indicates surrogate was diluted out of the sample
NA	Indicates compound was not analyzed.
NR	Indicates no recovery due to matrix interference and/or dilution.
S	Indicates saturation of the detector. Dilution required.
Y	Indicates a raised detection limit due to interference.



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579C
Matrix: Soil/Sediment

Sample No: SP-3-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

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Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 57.4 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 43.9%
pH: 7.7
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	34
100-51-6	Benzyl Alcohol	17 U
95-48-7	2-Methylphenol	17 U
106-44-5	4-Methylphenol	36

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	17 U
65-85-0	Benzole Acid	170 U
87-86-5	Pentachlorophenol	87 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	74.3%
2-Fluorobiphenyl	87.3%
d14-p-Terphenyl	68.9%
d4-1,2-Dichlorobenzene	64.5%

Acid surrogate recoveries

d5-Phenol	72.8%
2-Fluorophenol	72.1%
2,4,6-Tribromophenol	84.7%
d4-2-Chlorophenol	71.1%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579DDL
Matrix: Soil/Sediment

Sample No: SP-4-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

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(206) 621-7523 (FAX)

Data Release Authorized:

Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 104 g
Final Extract Volume: 1.0 mL
Percent TOC: 1.54% (Dry Wt.)
Percent Moisture: 42.1%
pH: 7.9
Dilution: 1:20

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	12 U
95-50-1	1,2-Dichlorobenzene	12 U
120-82-1	1,2,4-Trichlorobenzene	12 U
91-20-3	Naphthalene	12 U
87-68-3	Hexachlorobutadiene	12 U
91-57-6	2-Methylnaphthalene	16
131-11-3	Dimethyl Phthalate	12 U
208-96-8	Acenaphthylene	12 U
83-32-9	Acenaphthene	28
132-64-9	Dibenzofuran	22
84-66-2	Diethylphthalate	12 U
86-73-7	Fluorene	37
86-30-6	N-Nitrosodiphenylamine(1)	12 U
118-74-1	Hexachlorobenzene	12 U
85-01-8	Phenanthrene	180

CAS Number		mg/Kg
120-12-7	Anthracene	71
84-74-2	Di-n-Butylphthalate	12 U
206-44-0	Fluoranthene	160
129-00-0	Pyrene	110
85-68-7	Butylbenzylphthalate	12 U
56-55-3	Benzo(a)Anthracene	32
117-81-7	bis(2-Ethylhexyl)Phthalate	120
218-01-9	Chrysene	38
117-84-0	Di-n-Octyl Phthalate	12 U
205-99-2	Benzo(b)Fluoranthene	17
207-08-9	Benzo(k)Fluoranthene	17
50-32-8	Benzo(a)Pyrene	14
193-39-5	Indeno(1,2,3-cd)Pyrene	12 U
53-70-3	Dibenz(a,h)Anthracene	12 U
191-24-2	Benzo(ghi)Perylene	12 U

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	57.0%
2-Fluorobiphenyl	75.4%
d14-p-Terphenyl	71.8%
d4-1,2-Dichlorobenzene	63.6%

Acid surrogate recoveries

d5-Phenol	74.8%
2-Fluorophenol	85.0%
2,4,6-Tribromophenol	49.9%
d4-2-Chlorophenol	72.8%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample ID: F579DDL
Matrix: Soil/Sediment

Sample No: SP-4-11/17

QC Report No: F579-Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 60.0 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 42.1%
pH: 7.9
Dilution: 1:20

CAS Number		µg/Kg
108-95-2	Phenol	330 U
100-51-6	Benzyl Alcohol	330 U
95-48-7	2-Methylphenol	330 U
106-44-5	4-Methylphenol	610

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	330 U
65-85-0	Benzolic Acid	3,300 U
87-86-5	Pentachlorophenol	1,700 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	57.0%
2-Fluorobiphenyl	75.4%
d14-p-Terphenyl	71.8%
d4-1,2-Dichlorobenzene	63.6%

Acid surrogate recoveries

d5-Phenol	74.8%
2-Fluorophenol	85.0%
2,4,6-Tribromophenol	49.9%
d4-2-Chlorophenol	72.8%

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INCORPORATED****ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**

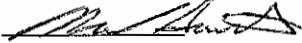
Sample ID: F579EDL
Matrix: Soil/Sediment

Sample No: SP-5-11/17

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

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Data Release Authorized: 
Report: 12/14/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 104 g
Final Extract Volume: 1.0 mL
Percent TOC: 6.23% (Dry Wt.)
Percent Moisture: 45.4%
pH: 7.7
Dilution: 1:20

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	3.1 U
95-50-1	1,2-Dichlorobenzene	3.1 U
120-82-1	1,2,4-Trichlorobenzene	3.1 U
91-20-3	Naphthalene	3.1 U
87-68-3	Hexachlorobutadiene	3.1 U
91-57-6	2-Methylnaphthalene	3.1 U
131-11-3	Dimethyl Phthalate	3.1 U
208-96-8	Acenaphthylene	3.1 U
83-32-9	Acenaphthene	3.1 U
132-64-9	Dibenzofuran	3.1 U
84-66-2	Diethylphthalate	3.1 U
86-73-7	Fluorene	3.1
86-30-6	N-Nitrosodiphenylamine(1)	3.1 U
118-74-1	Hexachlorobenzene	3.1 U
85-01-8	Phenanthrene	23

CAS Number		mg/Kg
120-12-7	Anthracene	6.2
84-74-2	Di-n-Butylphthalate	3.1 U
206-44-0	Fluoranthene	31
129-00-0	Pyrene	23
85-68-7	Butylbenzylphthalate	3.1 U
56-55-3	Benzo(a)Anthracene	7.8
117-81-7	bis(2-Ethylhexyl)Phthalate	41
218-01-9	Chrysene	12
117-84-0	Di-n-Octyl Phthalate	3.1 U
205-99-2	Benzo(b)Fluoranthene	5.7
207-08-9	Benzo(k)Fluoranthene	10
50-32-8	Benzo(a)Pyrene	5.2
193-39-5	Indeno(1,2,3-cd)Pyrene	3.1 U
53-70-3	Dibenz(a,h)Anthracene	3.1 U
191-24-2	Benzo(ghi)Perylene	3.1 U

(1) Cannot be separated from diphenylamine

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	55.0%
2-Fluorobiphenyl	76.3%
d14-p-Terphenyl	72.0%
d4-1,2-Dichlorobenzene	67.1%

Acid surrogate recoveries

d5-Phenol	69.9%
2-Fluorophenol	84.7%
2,4,6-Tribromophenol	51.6%
d4-2-Chlorophenol	70.5%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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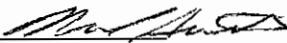
ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579EDL
Matrix: Soil/Sediment

Sample No: SP-5-11/17

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 56.5 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 45.4%
pH: 7.7
Dilution: 1:20

CAS Number		µg/Kg
108-95-2	Phenol	350 U
100-51-6	Benzyl Alcohol	350 U
95-48-7	2-Methylphenol	350 U
106-44-5	4-Methylphenol	350 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	350 U
65-85-0	Benzoic Acid	3,500 U
87-86-5	Pentachlorophenol	1,800 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	55.0%
2-Fluorobiphenyl	76.3%
d14-p-Terphenyl	72.0%
d4-1,2-Dichlorobenzene	67.1%

Acid surrogate recoveries

d5-Phenol	69.9%
2-Fluorophenol	84.7%
2,4,6-Tribromophenol	51.6%
d4-2-Chlorophenol	70.5%



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PCB MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Sample No: SP-1-11/17

ARI Job No: F579A

QC Report No: F579 - Golder

Matrix: Soils/Sediments

Project: Pt. Shannon/Anacortes

933-1341.003

Data Release Authorized: 

Report: 12/14/93 MAC:ctr

COMPOUND	SPIKE ADDED (mg/kg)	SAMPLE CONC. (mg/kg)	MS CONC. (mg/kg)	MS REC
Aroclor-1242	13.0	0	12.4	95.4%

COMPOUND	SPIKE ADDED (mg/kg)	MSD CONC. (mg/kg)	MSD REC	RPD
Aroclor-1242	12.8	12.3	96.1%	0.7%

Comments: Values normalized on a Total Organic Carbon basis.



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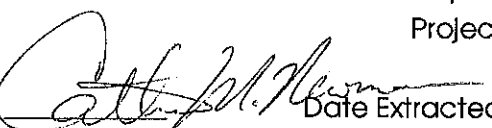
PCB BLANK SPIKE RECOVERY

Matrix: Soils/Sediments

QC Report: F579 - Golder

Project: Pt. Shannon/Anacortes

933-1341.003

Data Release Authorized: 

Date Extracted: 11/23/93

Report: 12/14/93 MAC:ctr

Date Analyzed: 12/03/93

COMPOUND	SPIKE ADDED (mg/Kg)	SPIKE CONC (mg/Kg)	SPIKE REC	QC LIMITS
Aroclor 1242	10.0	8.63	86.3%	57-122

	Surrogate rec.	QC Limits
TCMX	84.4%	46-131
DCBP	95.6%	54-138

Spike Recovery: 0 out of 1 outside limits

Surrogate Recovery: 0 out of 2 outside limits

Asterisked values outside QC Limits

Comments: Values normalized on a %TOC of 1.00%.



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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579SRM
Matrix: Soil/Sediment

Sample No: HS-4

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: 11/18/93

Data Release Authorized: 
Report: 12/09/93 MAC:ctr

Date extracted: 11/23/93
Date Analyzed: 12/03/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 50.1 g (Dry Wt.)
Final Extract Volume: 1.0 mL
Percent Moisture: 0%
pH: NA
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	20 U
100-51-6	Benzyl Alcohol	20 U
95-48-7	2-Methylphenol	20 U
106-44-5	4-Methylphenol	20 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	20 U
65-85-0	Benzoic Acid	260
87-86-5	Pentachlorophenol	100 U

Base/neutral surrogate recoveries

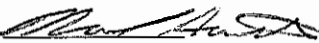
d5-Nitrobenzene	70.3%
2-Fluorobiphenyl	82.4%
d14-p-Terphenyl	78.6%
d4-1,2-Dichlorobenzene	59.4%

Acid surrogate recoveries

d5-Phenol	92.1%
2-Fluorophenol	69.1%
2,4,6-Tribromophenol	82.9%
d4-2-Chlorophenol	70.0%

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(206) 621-6490
(206) 621-7523 (FAX)**ORGANICS ANALYSIS DATA SHEET****Semivolatiles by GC/MS**Sample ID: F579MB
Matrix: Soil/Sediment

Sample No: Method Blank

QC Report No: F579 - Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: NAData Release Authorized: 
Report: 12/14/93 MAC:ctrDate extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: YesSample Wt: 100 g
Final Extract Volume: 1.0 mL
Percent TOC: 1.00% (Dry Wt. Equiv.)
Percent Moisture: NA
pH: NA
Dilution: 1:1

CAS Number		mg/Kg
106-46-7	1,4-Dichlorobenzene	1.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
87-68-3	Hexachlorobutadiene	1.0 U
91-57-6	2-Methylnaphthalene	1.0 U
131-11-3	Dimethyl Phthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
83-32-9	Acenaphthene	1.0 U
132-64-9	Dibenzofuran	1.0 U
84-66-2	Diethylphthalate	1.0 U
86-73-7	Fluorene	1.0 U
86-30-6	N-Nitrosodiphenylamine(1)	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
85-01-8	Phenanthrene	1.0 U

(1) Cannot be separated from diphenylamine

CAS Number		mg/Kg
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	Butylbenzylphthalate	1.0 U
56-55-3	Benzo(a)Anthracene	1.0 U
117-81-7	bis(2-Ethylhexyl)Phthalate	1.0 U
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl Phthalate	1.0 U
205-99-2	Benzo(b)Fluoranthene	1.0 U
207-08-9	Benzo(k)Fluoranthene	1.0 U
50-32-8	Benzo(a)Pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)Pyrene	1.0 U
53-70-3	Dibenz(a,h)Anthracene	1.0 U
191-24-2	Benzo(ghi)Perylene	1.0 U

Values are Normalized on a Total Organic Carbon basis.

Base/neutral surrogate recoveries

d5-Nitrobenzene	65.7%
2-Fluorobiphenyl	73.8%
d14-p-Terphenyl	63.4%
d4-1,2-Dichlorobenzene	64.7%

Acid surrogate recoveries

d5-Phenol	66.5%
2-Fluorophenol	66.0%
2,4,6-Tribromophenol	60.7%
d4-2-Chlorophenol	64.2%

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.	B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
U	Indicates compound was analyzed for but not detected at the given detection limit.	K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
J	Indicates an estimated value when result is less than specified detection limit.	M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.
NR	Analysis not required.		



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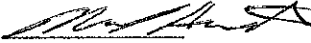
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample ID: F579MB
Matrix: Soil/Sediment

Data Release Authorized: 

Report: 12/09/93 MAC:ctr

Sample No: Method Blank

QC Report No: F579 -Golder
Project: 933-1341.003
Pt. Shannon/Anacortes
VTSR: NA

Date extracted: 11/23/93
Date Analyzed: 12/02/93
Instrument: FINN 2
GPC Clean-up: Yes

Sample Wt: 60.0 g (Dry Wt. Equiv.)
Final Extract Volume: 1.0 mL
Percent Moisture: NA
pH: NA
Dilution: 1:1

CAS Number		µg/Kg
108-95-2	Phenol	17 U
100-51-6	Benzyl Alcohol	17 U
95-48-7	2-Methylphenol	17 U
106-44-5	4-Methylphenol	17 U

CAS Number		µg/Kg
105-67-9	2,4-Dimethylphenol	17 U
65-85-0	Benzole Acid	170 U
87-86-5	Pentachlorophenol	83 U

Base/neutral surrogate recoveries

d5-Nitrobenzene	65.7%
2-Fluorobiphenyl	73.8%
d14-p-Terphenyl	63.4%
d4-1,2-Dichlorobenzene	64.7%

Acid surrogate recoveries

d5-Phenol	66.5%
2-Fluorophenol	66.0%
2,4,6-Tribromophenol	60.7%
d4-2-Chlorophenol	64.2%



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SOIL SEMIVOLATILE BLANK SPIKE RECOVERY

ARI Job No.: F579
Sample ID: F2F579SB
Instrument: FINN 2

Client: Golder
Project: 933-1341.003
Pt. Shannon/Anacortes

Date Extracted: 11/23/93
Date Analyzed: 12/03/93

Report: 12/14/93 MAC:ctr *mt*

COMPOUND	SPIKE ADDED (mg/Kg)	SB CONC (mg/Kg)	SB RECOVERY
1,4-Dichlorobenzene	25.0	15.7	62.8%
1,2,4-Trichlorobenzene	25.0	17.2	68.8%
Acenaphthene	25.0	21.4	85.6%
Pyrene	25.0	21.4	85.6%

Base/neutral surrogate recoveries

d5-Nitrobenzene	66.9%
2-Fluorobiphenyl	86.2%
d14-p-Terphenyl	74.5%
d4-1,2-Dichlorobenzene	66.3%

Acid surrogate recoveries

d5-Phenol	72.3%
2-Fluorophenol	72.9%
2,4,6-Tribromophenol	90.6%
d4-2-Chlorophenol	73.0%

Comments: Spike values normalized on an equivalent %TOC of 1.00%.



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SOIL SEMIVOLATILE BLANK SPIKE RECOVERY

ARI Job No.: F579
Sample ID: F2F579SB
Instrument: FINN 2

Client: Golder
Project: 933-1341.003
Pt. Shannon/Anacortes

Date Extracted: 11/23/93
Date Analyzed: 12/03/93

Report: 12/14/93 MAC:ctr *mt*

COMPOUND	SPIKE ADDED ($\mu\text{g/Kg}$)	SB CONC ($\mu\text{g/Kg}$)	SB RECOVERY
Phenol	625	372	59.5%
Pentachlorophenol	625	231	37.0%

Base/neutral surrogate recoveries

d5-Nitrobenzene	66.9%
2-Fluorobiphenyl	86.2%
d14-p-Terphenyl	74.5%
d4-1,2-Dichlorobenzene	66.3%

Acid surrogate recoveries

d5-Phenol	72.3%
2-Fluorophenol	72.9%
2,4,6-Tribromophenol	90.6%
d4-2-Chlorophenol	73.0%

Comments:

EXPLANATION OF INORGANIC DATA REPORT CODES

The columns labeled 'PREP', 'C', and 'M' contain important information about your analyses. The codes are defined below.

PREPARATION CODES

These 3-letter codes describe methods used to prepare samples for analysis:

AEN	USEPA, Metals in air filters	RWC	USEPA SW-846 3005
AHM	ARI, Mercury in air filters	SCC	USEPA CLP, Soil digestion, HCl matrix
AHN	ARI, Metals in air filters	SCM	USEPA CLP, Mercury in soil
ANN	NIOSH 7300, Metals in air filters	SCN	USEPA CLP, Soil digestion, HNO ₃ matrix
CAN	AOAC (1984) 25.024, Metals in earthenware	SEM	EPA 600/4-79-020 245.5, Mercury in soil
DE6	EPA 600/4-79-020 218.5, Cr(VI) in water	SHF	ARI, Metals in soil, HF digestion
DMM	DMN followed by TMM, Dissolved mercury	SMN	Agronomy, Metals in soil, Water extract
DMN	Filtered through .45u filter, Dissolved metals	SMM	SMN followed by DMM, Dissolved mercury
EW6	EWN followed by DE6	SSC	Standard Methods 302C, Sb/Sn in soil
EWM	EWN followed by TMM	SSN	Standard Methods 302C, Soil digestion
EWN	USEPA SW-846 1310, EP Toxicity	SSS	Standard Methods 302C, Ti in soil
FHP	ARI, Metals in tissue (HNO ₃ /HClO ₄)	SW6	USEPA SW-846 3060, Cr(VI) in soil
FPP	PSEP, Metals in tissue (HNO ₃ /HClO ₄)	SWC	USEPA SW-846 3050, HCl matrix
FRM	Journal, Mercury in tissue	SWN	USEPA SW-846 3050, HNO ₃ matrix
FRN	Journal, Metals in tissue (HNO ₃ /H ₂ O ₂)	SZF	PSEP/PSDDA, Microwave, Total acid digestion
KRN	ARI, Concentration by coprecipitation	TEC	EPA 600/4-79-020 4.1.3, HCl matrix
LEM	USEPA, TCLP followed by TMM	TEG	EPA 600/4-79-020 272.1, Silver in water
LEN	USEPA, TCLP Extraction	TEI	EPA 600/4-79-020 200.7 and 9.3
MHM	ARI, Mercury in miscellaneous materials	TEN	EPA 600/4-79-020 4.1.3, HNO ₃ matrix
MHN	ARI, Metals in miscellaneous materials	THG	ARI, Silver in photographic solutions
OAM	ARI, Mercury in oil, grease or tar	TMM	EPA 600/4-79-020 245.1, Mercury in water
OAN	ARI, Metals in oil, grease or tar	TSC	Standard Methods 302C, Sb/Sn in water
PHM	ARI, Mercury in wipes	TSN	Standard Methods 302D
PHN	ARI, Metals in wipes	TSS	Standard Methods 302E, Ti in water
RCC	USEPA CLP, Water digestion, HCl matrix	TWC	USEPA SW-846 3010, HCl matrix
RCN	USEPA CLP, Water digestion, HNO ₃ matrix	TWG	USEPA SW-846 7760, Silver in water
REC	EPA 600/4-79-020 4.1.4, HCl matrix	TWN	USEPA SW-846 3020, HNO ₃ matrix
REI	EPA 600/4-79-020 200.7 and 9.4	WMN	EPA 600/4-79-020, Preserved, undigested water
REN	EPA 600/4-79-020 4.1.4, HNO ₃ matrix	XSC	Standard Methods 302B
RMA	EPA 600/4-79-020 206.2		

CONCENTRATION CODES

These codes are used to qualify reported concentrations:

U	No analyte was detected. The reported value is the lower limit of detection.
----------	--

METHOD CODES

These codes signify the instrumental technique used for analysis:

CVA	Cold Vapor Atomic Absorption Spectrophotometry
FLA	Flame Atomic Absorption Spectrophotometry
GFA	Graphite Furnace Atomic Absorption Spectrophotometry
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry



**ANALYTICAL
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ARI job number: F579
ARI Sample number: A
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-1-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 74.83

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.8 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	47 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	64.7 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	46 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.06 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	146 mg/kg-dry		0.8	SZF	ICP	12/03/93



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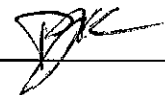
ARI job number: F579
ARI Sample number: ADUP
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-1-11/17
Project: 933-1341.003
Description: Laboratory Duplicate
Sampled: / /
Received: 11/18/93

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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 74.83

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.6 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	47 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	66.7 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	48 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.06 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	158 mg/kg-dry		0.8	SZF	ICP	12/03/93



**ANALYTICAL
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Matrix Duplicate Quality Control Report

Client: Golder
Client's sample ID: SP-1-11/17
ARI sample ID: F579 ADUP
Units: mg/kg-dry

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
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Analyte	Meth	Original Sample	Matrix Duplicate	RPD	Control Limit	Q
Arsenic	ICP	U 10	U 10	0.0	± 10	L
Cadmium	ICP	0.8	0.6	28.6	± 0.4	L
Chromium	ICP	47	47	0.0	± 20 %	
Copper	ICP	64.7	66.7	3.0	± 20 %	
Lead	ICP	46	48	4.3	± 20 %	
Mercury	CVA	0.06	0.06	0.0	± 0.06	L
Silver	ICP	U 0.6	U 0.6	0.0	± 0.6	L
Zinc	ICP	146	158	7.9	± 20 %	

RPD = Relative Percent Difference

'Q' codes: '*' = control limit not met
 'L' = RPD not valid, alternate limit = ± detection limit



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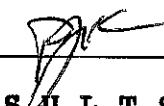
ARI job number: F579
ARI Sample number: ASPK
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-1-11/17
Project: 933-1341.003
Description: Matrix Spike
Sampled: / /
Received: 11/18/93

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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 74.83

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	480 mg/kg-dry		10	SZF	ICP	12/03/93
7440-43-9	Cadmium	19.1 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	96 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	82.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	230 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.53 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	47.8 mg/kg-dry		0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	241 mg/kg-dry		0.8	SZF	ICP	12/03/93



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Matrix Spike Quality Control Report

Client: Golder
Client's sample ID: SP-1-11/17
ARI sample ID: F579 ASPK
Units: mg/kg-dry

Analyte	Meth	Sample	Matrix Spike	Spike Added	%R	Control Limit	Q
Arsenic	ICP	0	480	500	96.0	75-125%	
Cadmium	ICP	0.8	19.1	20.2	90.6	75-125%	
Chromium	ICP	47	96	50	98.0	75-125%	
Copper	ICP	64.7	82.4	20.2	87.6	75-125%	
Lead	ICP	46	230	202	91.1	75-125%	
Mercury	CVA	0.06	0.53	0.58	81.0	75-125%	
Silver	ICP	0	47.8	50.4	94.8	75-125%	
Zinc	ICP	146	241	101	94.1	75-125%	

%R = Percent Recovery

'Q' codes: 'N' = control limit not met
'H' = %R not applicable, sample concentration too high



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ARI job number: F579
ARI Sample number: B
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-2-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

% Solids: 64.46

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.7 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	47 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	45.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	38 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.07 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	124 mg/kg-dry		0.8	SZF	ICP	12/03/93



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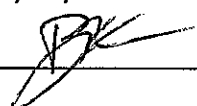
Analytical
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Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ARI job number: F579
ARI Sample number: C
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-3-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

% Solids: 63.66

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.7 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	47 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	45.1 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	37 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.07 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	124 mg/kg-dry		0.8	SZF	ICP	12/03/93



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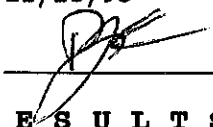
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ARI job number: F579
ARI Sample number: D
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-4-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

% Solids: 66.10

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	50 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	32.5 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	36 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.07 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	76.6 mg/kg-dry		0.8	SZF	ICP	12/03/93



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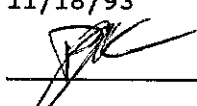
ARI job number: F579
ARI Sample number: E
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-5-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 61.34

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.8 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	42 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	39.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	52 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.08 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	97.5 mg/kg-dry		0.8	SZF	ICP	12/03/93



**ANALYTICAL
RESOURCES
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ARI job number: F579
ARI Sample number: F
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-6-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 73.84

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.7 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	46 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	135 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	106 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.06 mg/kg-dry	U	0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	985 mg/kg-dry		0.8	SZF	ICP	12/03/93



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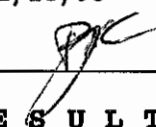
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ARI job number: F579
ARI Sample number: G
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-7-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

% Solids: 68.46

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.6 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	45 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	26.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	49 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.11 mg/kg-dry		0.06	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	95.4 mg/kg-dry		0.8	SZF	ICP	12/03/93



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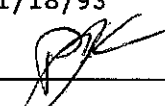
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ARI job number: F579
ARI Sample number: H
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: SP-8-11/17
Project: 933-1341.003
Description:
Sampled: / /
Received: 11/18/93

% Solids: 61.56

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.5 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	48 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	43.3 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	51 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.09 mg/kg-dry		0.07	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	104 mg/kg-dry		0.8	SZF	ICP	12/03/93



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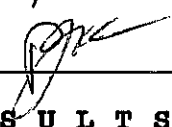
ARI job number: F579
ARI Sample number: MB
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number:
Project: 933-1341.003
Description: Method Blank
Sampled: / /
Received: / /

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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 100.0

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	10 mg/kg-dry	U	10	SZF	ICP	12/03/93
7440-43-9	Cadmium	0.4 mg/kg-dry	U	0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	1 mg/kg-dry	U	1	SZF	ICP	12/03/93
7440-50-8	Copper	0.4 mg/kg-dry	U	0.4	SZF	ICP	12/03/93
7439-92-1	Lead	4 mg/kg-dry	U	4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.05 mg/kg-dry	U	0.05	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry	U	0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	0.8 mg/kg-dry	U	0.8	SZF	ICP	12/03/93



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(206) 621-6490
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ARI job number: F579
ARI Sample number: MBSPK
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number:
Project: 933-1341.003
Description: Method Blank Spike
Sampled: / /
Received: / /

% Solids: 100.0

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	510 mg/kg-dry		10	SZF	ICP	12/03/93
7440-43-9	Cadmium	20.0 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	50 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	20.4 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	202 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	0.39 mg/kg-dry		0.05	SCM	CVA	12/01/93
7440-22-4	Silver	50.7 mg/kg-dry		0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	101 mg/kg-dry		0.8	SZF	ICP	12/03/93



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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Matrix Spike Quality Control Report

Client: Golder
Client's sample ID:
ARI sample ID: F579 MBSPK
Units: mg/kg-dry

Analyte	Meth	Sample	Matrix Spike	Spike Added	%R	Control Limit	Q
Arsenic	ICP	0	510	500	102.0	75-125%	
Cadmium	ICP	0	20.0	20.0	100.0	75-125%	
Chromium	ICP	0	50	50	100.0	75-125%	
Copper	ICP	0	20.4	20.0	102.0	75-125%	
Lead	ICP	0	202	200	101.0	75-125%	
Mercury	CVA	0	0.39	0.50	78.0	75-125%	
Silver	ICP	0	50.7	50.0	101.4	75-125%	
Zinc	ICP	0	101	100	101.0	75-125%	

%R = Percent Recovery

'Q' codes: 'N' = control limit not met
'H' = %R not applicable, sample concentration too high



**ANALYTICAL
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INCORPORATED**

ARI job number: F579
ARI Sample number: REF
Client: Golder
Contact: Doug Chapin
Matrix: Sediment

ID number: Reference NBS 2704
Project: 933-1341.003
Description:
Sampled: / /
Received: / /

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

% Solids: 100.0

Released by: 

A N A L Y T I C A L R E S U L T S

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	22 mg/kg-dry		1	SZF	GFA	12/07/93
7440-43-9	Cadmium	3.1 mg/kg-dry		0.4	SZF	ICP	12/03/93
7440-47-3	Chromium	119 mg/kg-dry		1	SZF	ICP	12/03/93
7440-50-8	Copper	91.6 mg/kg-dry		0.4	SZF	ICP	12/03/93
7439-92-1	Lead	167 mg/kg-dry		4	SZF	ICP	12/03/93
7439-97-6	Mercury	1.44 mg/kg-dry		0.05	SCM	CVA	12/01/93
7440-22-4	Silver	0.6 mg/kg-dry		0.6	SZF	ICP	12/03/93
7440-66-6	Zinc	396 mg/kg-dry		0.8	SZF	ICP	12/03/93



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Results of NBS 2704 Buffalo River Sediment Analysis

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Client: Golder
ARI Sample number: F579 REF
Units: mg/kg-dry

ANALYTE	FOUND	CERTIFIED	VALUE	RECOVERY
Arsenic	22	23.4 ±	0.8	94.0
Cadmium	3.1	3.45 ±	0.22	89.9
Chromium	119	135 ±	5	88.1
Copper	91.6	98.6 ±	5	92.9
Lead	167	161 ±	17	103.7
Mercury	1.44	1.44 ±	0.07	100.0
Zinc	396	438 ±	12	90.4

RECOVERY = Percent Recovery

NOTE: Silver is not a certified element for NBS 2704.

Sample ID: F579-C Triplicate 3		64 % SOLIDS															
SP-3-11/17		No. 4:	No. 10:	No. 20:	No. 40:	No. 60:	No. 140:	No. 200:	No. 230:								
Sieve Size -->										4	5	6	7	8	9	10	Balance
Finer than Phi Size -->																	
Grain Size -->																	
		> 4750	4750-2000	2000-850	850-425	425-250	250-106	106-75	75-62.5	62.5-31.2	31.2-15.6	15.6-7.8	7.8-3.9	3.9-1.9	1.9-0.9	<0.9	
		microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	
Percent Passing (%) -->		100	97	95	93	89	55	37	29	18	13	11	9	7	6	1	
Fractional Percent (%) -->		0	3	2	2	4	34	18	8	11	5	2	2	2	1	5	1

Sieve Size -->	No. 4:	No. 10:	No. 20:	No. 40:	No. 60:	No. 140:	No. 200:	No. 230:	4	5	6	7	8	9	10	Balance
Finer than Phi Size -->																
Grain Size -->																
	> 4750	4750-2000	2000-850	850-425	425-250	250-106	106-75	75-62.5	62.5-31.2	31.2-15.6	15.6-7.8	7.8-3.9	3.9-1.9	1.9-0.9	0.9	
	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	microns	
Percent Passing (%) -->	93	89	86	84	82	35	18	14	9	6	5	4	3	3	0	
Fractional Percent (%) -->	7	4	3	2	2	47	17	4	5	3	1	1	1	0	3	0

[illegible]

	No. 4:	No. 10:	No. 20:	No. 40:	No. 60:	No. 140:	No. 200:	No. 230:	4	5	6	7	8	9	10	Balance
Sieve Size →																
Finer than Phi Size →																
Grain Size →																
Percent Passing (%) →	92	74	47	31	23	4	3	3	2	2	2	2	2	2	1	1
Fractional Percent (%) →	8	18	27	16	8	19	1	0	1	0	0	0	0	0	1	1

Shannon Point 933-1341.003
*Apparent Sediment Grain Size Distribution

69 % SOLIDS

Sample ID: F579-G
SP-7-11/17

Sieve Size -->	No. 4:	No. 10:	No. 20:	No. 40:	No. 60:	No. 140:	No. 200:	No. 230:	4	5	6	7	8	9	10	Balance
Finer than Phi Size -->																
Grain Size -->																
	> 4750 microns	4750-2000 microns	2000-850 microns	850-425 microns	425-250 microns	250-106 microns	106-75 microns	75-62.5 microns	62.5-31.2 microns	31.2-15.6 microns	15.6-7.8 microns	7.8-3.9 microns	3.9-1.9 microns	1.9-0.9 microns	<0.9 microns	
Percent Passing (%) -->	94	82	75	71	67	29	18	14	11	9	8	7	6	6	3	
Fractional Percent (%) -->	6	12	7	4	4	38	11	4	3	2	1	1	1	0	3	3

58 % SOLIDS

Sample ID: F579-H
SP-8-11/17

Sieve Size -->	No. 4:	No. 10:	No. 20:	No. 40:	No. 60:	No. 140:	No. 200:	No. 230:	4	5	6	7	8	9	10	Balance
Finer than Phi Size -->																
Grain Size -->																
	> 4750 microns	4750-2000 microns	2000-850 microns	850-425 microns	425-250 microns	250-106 microns	106-75 microns	75-62.5 microns	62.5-31.2 microns	31.2-15.6 microns	15.6-7.8 microns	7.8-3.9 microns	3.9-1.9 microns	1.9-0.9 microns	<0.9 microns	
Percent Passing (%) -->	92	84	77	72	68	36	22	17	10	7	6	4	3	3	0	
Fractional Percent (%) -->	8	8	7	5	4	32	14	5	7	3	1	2	1	0	3	0

* Organics included



Analytical Resources, Incorporated Facsimile Transmittal

333 Ninth Avenue N.

Seattle, Wa 98109

Phone: (206) 621-6490

Fax: (206) 621-7523

From: Bryan D. AndersonDate of Transmittal: 12-17-93Number of Pages: 3Addressee: Mike HigginsTime: 8:15Company: GolderFax Number: 882-5498Project Reference: Shannon PointPhone Number: 823-0777Comments: Mike,

Here is a copy of the Harbour Sediment
SRM.

As you requested, we will perform a
reanalysis on the TOC's for both
sample FS79 E & FS79 H. I believe
the discrepancy may be associated to
sample homogeneity & the fact that the
samples were analyzed at different times.
I will provide the reanalysis results ASAP.

If you do not receive the number of pages indicated, please contact sender at ARI
immediately.



National Research
Council Canada

Conseil national
de recherches Canada

Marine Analytical Chemistry Standards Program

HS-3, HS-4, HS-5, HS-6

Harbour Sediment Reference Materials for Polycyclic Aromatic Hydrocarbons

CCRC-22

HS-3, HS-4, HS-5 and HS-6 are four natural marine sediment reference materials for determination of polycyclic aromatic hydrocarbons (PAHs).

The samples were collected from four harbours in Nova Scotia. Environments at these sites reflect varying degrees of commercial and industrial activity.

The suite of samples covers a range of values of concentrations of 16 PAHs designated as priority pollutants by the United States Environmental Protection Agency (EPA). Reliable values for the concentrations of these PAHs are shown in the table overleaf. The uncertainties represent 90% confidence intervals for the pools of from 22 to 40 determinations of each compound. Homogeneity test and determinations of PAHs in these materials were carried out using 35 gram subsamples.

The materials have been freeze-dried, passed through a No. 120 (125µm) sieve, homogenized in a modified cement mixer, then subsampled into 200g lots and placed in solvent-rinsed, pint-sized steel cans.

Determinations were carried out using:

- capillary column gas chromatography with flame ionization detection (GC-FID)
- capillary column gas chromatography with mass spectrometric detection (GC-MS)
- high performance liquid chromatography with ultraviolet absorption detection (HPLC-UV)
- high performance liquid chromatography with fluorescence detection (HPLC-FLD)
- high performance liquid chromatography with mass spectrometric detection (HPLC-MS)

(See table overleaf for results).

To order this material, or for further technical information, contact:

National Research Council
Institute for Marine Biosciences
Marine Analytical Chemistry Standards Program
1411 Oxford Street
Halifax, Nova Scotia, Canada B3H 3Z1

Telephone (902) 426-8280
Facsimile (902) 426-8413

January 1992

HS-3, HS-4, HS-5, HS-6

Polycyclic Aromatic Hydrocarbons in Harbour Sediment
(mg/kg (ppm) of dry sediment)

	HS-3	HS-4	HS-5	HS-6
Naphthalene	9.0 ± 0.7	0.15 ^a	0.25 ± 0.07	4.1 ± 1.1
Acenaphthylene	0.3 ± 0.1	0.15 ^a	0.15 ^a	0.19 ± 0.05
Acenaphthene	4.6 ± 1.5	0.15 ^a	0.23 ± 0.10	0.23 ± 0.07
Fluorene	13.3 ± 3.1	0.15 ^a	0.4 ± 0.1	0.47 ± 0.12
Phenanthrene	85 ± 20	0.68 ± 0.08	5.2 ± 1.0	3.0 ± 0.6
Anthracene	13.4 ± 0.5	0.14 ± 0.07	0.38 ± 0.15	1.1 ± 0.4
Fluoranthene	60 ± 9	1.25 ± 0.10	8.4 ± 2.6	3.54 ± 0.65
Pyrene	39 ± 9	0.94 ± 0.12	5.8 ± 1.8	3.0 ± 0.6
Benz[a]anthracene	14.6 ± 2.0	0.53 ± 0.05	2.9 ± 1.2	1.8 ± 0.3
Chrysene	14.1 ± 2.0	0.65 ± 0.08	2.8 ± 0.9	2.0 ± 0.3
Benzo[a]pyrene	7.4 ± 3.6	0.65 ± 0.08	1.7 ± 0.8	2.2 ± 0.4
Benzo[b]fluoranthene	7.7 ± 1.2	0.70 ± 0.15	2.0 ± 1.0	2.8 ± 0.6
Benzo[k]fluoranthene	2.8 ± 2.0	0.36 ± 0.05	1.0 ± 0.4	1.43 ± 0.15
Benzo[ghi]perylene	5.0 ± 2.0	0.58 ± 0.22	1.3 ± 0.3	1.78 ± 0.72
Dibenz[a,h]anthracene	1.3 ± 0.5	0.12 ± 0.05	0.2 ± 0.1	0.49 ± 0.16
Indeno[1,2,3-cd]pyrene	5.4 ± 1.3	0.51 ± 0.15	1.3 ± 0.7	1.96 ± 0.58

^a Upper limit - amount present is not greater than 0.15 mg/kg.

Post-It™ brand fax transmittal memo 7671 # of pages 1

To: Doug Chapin/Mike Higgins	From: Bryan D. Anderson
Co: Golder	Co: ARJ
Dept: Shannon Pt.	Phone #: 621-6490
Fax #: 882-5498	Fax #: 621-7523

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Chemists &
Consultants

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(206) 621-7523 (FAX)

Laboratory Re-analysis of TOC

 Matrix: SOIL/SEDIMENT

Project: Shannon Point

QC Report No: F579 - Golder

 Data Release Authorized: *M. Anderson*

Date Received: 11/18/93

Report Prepared 12/30/93 DWN 12-3-93

Change Order Date: 12/17/93

Sample Data:		DATE OF ANALYSIS				
		12/22/93	12/20/93	12/30/93	-	-
Method Number		SEE COMMENTS			Calculated	Calculated
		SOLIDS		TOC (Dry Wt)		TOC
Lab ID	Sample Number	PURGED (% @ 70C)	TOTAL (% @ 104C)	TOC (70C) (ppm C)	TOC (104C) (ppm C)	Dry Wt 104C (% C)
F579 E	SP-5	70.98%	61.16%	16,300	18,900	1.890
F579 H	SP-8	74.60%	64.46%	17,300	20,000	2.000

Method Blank Analysis:		PURGED (mg residue)	TOTAL (mg residue)	TOC (70C) (ppm C)	TOC (104C) (ppm C)	Dry Wt 104C (% C)
Method Blank		-	<1.0	<98.6	-	-
Detection Limit:		-	1.0	98.6	-	-

Check Standard		(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Measured Value		-	-	30,700	-	-
"True" Value		-	-	33,480	-	-
% Recovery		-	-	91.7%	-	-

Duplicate Analysis:		(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Sample ID		F579 E	F579 H	F579 E	F579 L	F579 E
Original		70.98%	64.46%	16,300	18,900	1.89
Duplicate		71.77%	63.59%	14,900	17,500	1.75
Triplicate		72.09%	63.23%	12,400	14,600	1.46
RSD		0.80%	0.99%	13.6%	12.9%	12.9%

Spike Analysis:		(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Sample ID		-	-	F579 E	-	-
Original		-	-	16,300	-	-
Matrix Spike		-	-	25,800	-	-
Spike Amount		-	-	9,520	-	-
MS % Recovery		-	-	99.8%	-	-
Matrix Spike Dup.		-	-	24,400	-	-
Spike Amount		-	-	10,000	-	-
MSD % Recovery		-	-	81.0%	-	-

Comments: Sediment TOC analysis conducted on dried (70 C), ground and sieved samples (120 mesh) using a Dohrmann DC-180 Carbon Analyzer. Calibration, standardization and spiking are conducted following manufacturers directions using potassium hydrogen phthalate (KHP). Samples are purged of inorganic carbon and dried at 70C before analysis. Values are expressed on a sediment dry weight basis (104C) by multiplying the ppm C of the 70C dried sample by the ratio of % Solids 70C to % Solids 104C. The procedure is modified after PSEP, 1985. NBS 2704 was used as the Standard Reference material for TOC.



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January 3, 1994



Mr. Doug Chapin
Golder Associates
4104 148th Avenue NE
Redmond, WA 98052

RE: Project No. 933 - 1341.003 TOC Reanalysis / ARI Job No. F579

Dear Mr. Chapin:

Please find enclosed reanalysis results for the above-referenced project.

As Mike Higgins requested on December 17, 1993, the laboratory performed a TOC reanalysis on sample **SP-5** and **SP-8**. The reanalysis was requested due to a discrepancy between the field duplicate results. The sample discrepancy may be associated to the limited sample size, variation in run dates and sample homogeneity. The reanalysis results were completed without incident and a copy of these results were supplied to you by facsimile on January 3, 1994.

As always, a copy of this report and all associated raw data will remain on file with ARI. If you have any questions, or require additional information please feel free to contact me at your convenience. If I am unavailable, you can leave a message on my voice mail and I will return your call as soon as possible.

Sincerely,

ANALYTICAL RESOURCES, INC.

Bryan D. Anderson
Project Manager
(206)340-2866, ext. 116

enclosures
cc: file F579

**ANALYTICAL
RESOURCES
INCORPORATED**Analytical
Chemists &
Consultants333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)**Final Report
Laboratory Re-analysis of TOC**Matrix: SOIL/SEDIMENT

Project: Shannon Point

Data Release Authorized: *McAnis*

QC Report No: F579 - Golder

Date Received: 11/18/93

Report Prepared 12/30/93 DWN *12-30-93*

Change Order Date: 12/17/93

Sample Data:		DATE OF ANALYSIS				
		12/22/93	12/20/93	12/30/93	-	-
		SEE COMMENTS			Calculated	Calculated
		SOLIDS		TOC (Dry Wt)		TOC
Lab ID	Sample Number	PURGED (% @ 70C)	TOTAL (% @ 104C)	TOC (70C) (ppm C)	TOC (104C) (ppm C)	Dry Wt 104C (% C)
F579 E	SP-5	70.98%	61.16%	16,300	18,900	1.890
F579 H	SP-8	74.60%	64.46%	17,300	20,000	2.000

Method Blank Analysis:		PURGED (mg residue)	TOTAL (mg residue)	TOC (70C) (ppm C)	TOC (104C) (ppm C)	Dry Wt 104C (% C)
	Method Blank	-	<1.0	<98.6	-	-
	Detection Limit :	-	1.0	98.6	-	-

Check Standard	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Measured Value	-	-	30,700	-	-
"True" Value	-	-	33,480	-	-
% Recovery	-	-	91.7%	-	-

Duplicate Analysis:	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Sample ID	F579 E	F579 H	F579 E	F579 E	F579 E
Original	70.98%	64.46%	16,300	18,900	1.89
Duplicate	71.77%	63.59%	14,900	17,500	1.75
Triplicate	72.09%	63.23%	12,400	14,600	1.46
RSD	0.80%	0.99%	13.6%	12.9%	12.9%

Spike Analysis:	(% @ 70C)	(% @ 104C)	(ppm C)	(ppm C)	(% C)
Sample ID	-	-	F579 E	-	-
Original	-	-	16,300	-	-
Matrix Spike	-	-	25,800	-	-
Spike Amount	-	-	9,520	-	-
MS % Recovery	-	-	99.8%	-	-
Matrix Spike Dup.	-	-	24,400	-	-
Spike Amount	-	-	10,000	-	-
MSD % Recovery	-	-	81.0%	-	-

Comments: Sediment TOC analysis conducted on dried (70 C), ground and sieved samples (120 mesh) using a Dohrmann DC-180 Carbon Analyzer. Calibration, standardization and spiking are conducted following manufacturers directions using potassium hydrogen phthalate (KHP). Samples are purged of inorganic carbon and dried at 70C before analysis. Values are expressed on a sediment dry weight basis (104C) by multiplying the ppm C of the 70C dried sample by the ratio of % Solids 70C to % Solids 104C. The procedure is modified after PSEP, 1986. NBS 2704 was used as the Standard Reference material for TOC.

*Results of Phase II
Sampling and Analysis
Shannon Point Seafoods
Anacortes, Washington*

*Prepared for
Shannon Point Seafoods*

*June 14, 1995
J-4096-05*

RECEIVED

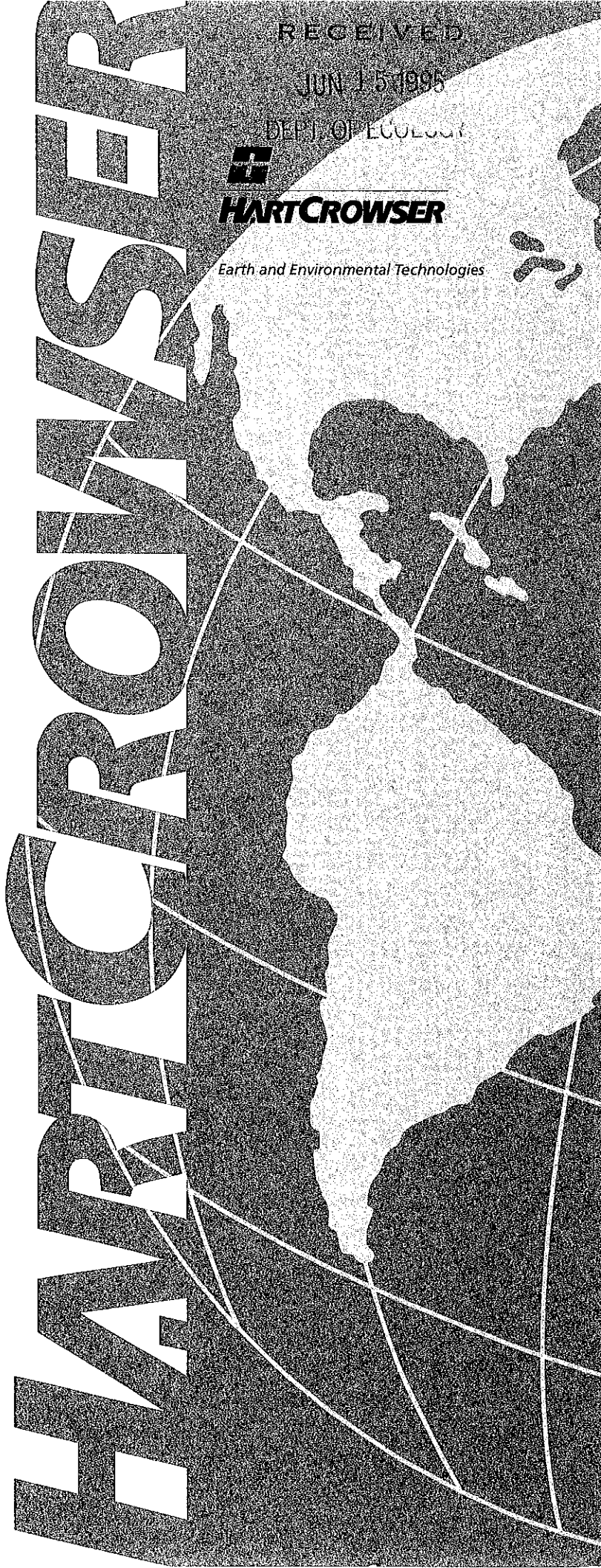
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**RESULTS OF PHASE II SAMPLING AND ANALYSIS
SHANNON POINT SEAFOODS
ANACORTES, WASHINGTON**

INTRODUCTION

This report presents the results of sediment sampling and analysis conducted as part of the approved Phase II Sediment Sampling and Analysis Plan (SAP) dated January 4, 1995 (Hart Crowser, 1995a). This sediment sampling program was designed to further evaluate the status of sediments within the tideland and harbor area associated with the site of the demolished Shannon Point Seafoods fish-processing facility located in Anacortes, Washington (Figure 1). The work was conducted and sediment quality was assessed under the Washington State Department of Ecology (Ecology) Sediment Management Standards (SMS) Chapter 173-204 WAC sediment cleanup decision process.

This report, presenting these Phase II results, is divided into the following sections:

- ▶ Background;
- ▶ Approach;
- ▶ Phase II Sediment Sampling Locations;
- ▶ Sediment Sampling, Handling, and Analysis;
- ▶ Chemical and Physical Testing Results;
- ▶ Results of Confirmatory Biological Testing; and
- ▶ Conclusions.

These sections are supported by tables and figures which are presented at the end of the text. Table 1 presents a summary of the Phase I and Phase II chemical and physical results, Table 2 presents a summary of the biological results, and Table 3 presents a summary of the field observations.

In addition, three appendices present supporting information concerning the following:

- ▶ Appendix A - Analytical Chemistry Testing Data;
- ▶ Appendix B - Physical Testing Data;
- ▶ Appendix C - Biological Testing Data; and
- ▶ Appendix D - Chemical Data Quality Evaluation.

BACKGROUND

Initial Phase I sediment sampling at the site was performed by Golder Associates (1994). Sampling occurred shortly after the completion of demolition activities at the site. The prior Phase I efforts included chemical analysis of seven surficial sediment samples (0 to 2 cm) collected in the vicinity of the demolished facility (Figure 2). All chemicals with numeric concentration standards as established under the SMS were analyzed in these sediment samples.

The concentrations of several chemicals detected in the Phase I sediment samples exceeded SMS Puget Sound Marine Sediment Quality Standards (SQS). Phase I chemical analysis results are summarized in Table 1. The identified chemicals of potential concern included zinc (sample SP-6 only), seven polynuclear aromatic hydrocarbons (PAHs), bis(2-ethylhexyl) phthalate (BEHP), and dibenzofuran. However, only BEHP was detected at high enough concentrations to identify a station cluster of potential concern, as defined under WAC 173-204-510 (2). A station cluster of potential concern is identified when average chemical concentrations measured over three contiguous stations exceed SMS Cleanup Screening Levels (CSL).

Sources of chemical constituents associated with the Shannon Point Seafoods facility are likely to have been eliminated at the completion of demolition activities. Local accumulations of metal debris in the intertidal beach area were also removed at that time. This included the removal of a damaged fork lift battery (a likely source of zinc) directly adjacent to SP-6. Verification sampling and analysis performed on June 22, 1994, verified that the source of zinc had been removed. The results of this verification sampling are presented in a July 7, 1994, letter to the Department of Natural Resources (DNR; Hart Crowser, 1994) and presented in Table 1.

As discussed above, Phase I investigation efforts were limited to chemical determinations of sediment samples. However, the SMS include a provision for (optional) confirmatory biological testing to identify station clusters of low concern. Given the relatively marginal exceedence of the SMS chemical criteria observed during Phase I (see Table 1), confirmatory biological testing may be utilized to determine if station clusters exceed the CSL.

SUMMARY OF APPROACH

Based on the evaluation of the Phase I chemical data summarized above, the purpose of Phase II sampling and analyses was as follows:

- ▶ Collect surficial sediment (0 to 2 centimeters) samples at five Phase I locations with CSL exceedences of BEHP;
- ▶ Collect surficial sediment (0 to 2 centimeters) samples at four locations outside the location of the former contaminant boom;
- ▶ Perform chemical and physical testing of the nine surficial sediment samples; and
- ▶ Perform confirmatory biological testing at five Phase I sediment sampling locations, as set forth in the SMS (WAC 173-204-315[1] and WAC 173-204-520[3]);

If the Phase II chemical and/or biological data do not identify a station cluster which exceeds the CSL, a no further cleanup action determination would be requested from Ecology. A summary of cleanup action activities is presented on Figure 3.

PHASE II SEDIMENT SAMPLING LOCATIONS

The nine Phase II surface sediment (0 to 2 centimeters) sampling locations include:

- ▶ Five Phase I sample locations (co-located with SP-2, SP-3, SP-4, SP-5, and SP-7, and identified with an HC-prefix) which exceed the CSL for BEHP; and
- ▶ Four locations (HC-8 through HC-11) outside the location of the former containment boom (Figure 1).

No additional surface sediment sampling were performed at SP-1 or SP-6.

Sufficient surface sediment sample for (simultaneous) confirmatory biological testing were also collected at the five Phase I locations. An additional surface sediment sample was collected from Carr Inlet as the biological testing reference sample.

Sampling location positioning was achieved by site-related methods. Latitude and longitude for each sediment sample location are provided in Table 3.

SEDIMENT SAMPLING, HANDLING, AND ANALYSIS

Sediment sampling, handling, and analysis were conducted in accordance with the approved Phase II Sediment SAP. All sampling equipment was cleaned prior to and between collection activities. Sediment samples were collected by modified van Veen methods outlined in Puget Sound Estuary Program (PSEP) Protocols (Tetra Tech, 1986). Immediately after retrieval, the acceptability of each grab sample was assessed against criteria outlined in the PSEP Protocols Sample Acceptability Criteria. To collect sufficient sample volume at each of the nine sampling locations, numerous grabs were obtained from each location. After the standing water was decanted, the top 2 cm of each acceptable grab at a given location were then homogenized in a stainless steel bowl prior to transfer to the specific sample container. Sample containers were immediately placed in a cooled ice chest. One sample (HC-12) was submitted as a field duplicate of HC-11. A summary of field observations is provided in Table 3.

To prevent sample contamination, all sampling equipment (sampler and stainless steel spoons and bowls) were cleaned (Alconox, tap water, deionized water) prior to and between collection activities. Guidance provided in the PSEP Protocols for preventing organic sample contamination were followed.

Proper custody documentation procedures were followed at all times. All sample containers were clearly labeled with the project name and number, sampling location, sample identification, date and time, and the field representative's initials. Chain of custody forms were completed for all samples and the forms were accompanied with the sealed coolers to laboratories for analyses.

Following transport to the appropriate laboratories, the nine composite sediment samples were analyzed for the following parameters at Analytical Resources, Inc.:

- ▶ Selected Semivolatile Compounds (bis(2-ethylhexyl)phthalate, PAHs, and dibenzofuran); and
- ▶ Total Organic Carbon (TOC).

Grain Size analyses was performed at Hart Crowser. The field duplicate (HC-12) was only submitted for semivolatile compounds, and TOC analyses. Sediment physical and chemical testing results are discussed in the following section. Data packages were reviewed for completeness upon receipt from the laboratories and data quality assessed in accordance with the approved Phase II Sediment SAP.

In addition to the chemical and physical testing discussed above, five sediment samples (co-located with SP-2, SP-3, SP-4, SP-5, and SP-7, and identified with an HC-prefix) were submitted to Beak Consultants, Inc., on January 27, 1995 and February 22, 1995 (the objective of the two sample dates is discussed below) for the following confirmatory marine sediment biological tests:

- ▶ Acute 10-Day Amphipod Mortality (*Rhepoxynius abronius*);
- ▶ Acute Larval Mortality/Abnormality (*Dendraster excentricus*); and
- ▶ Chronic 20-Day Juvenile Polychaete (*Neanthes arenocodentata*).

This biological testing was performed under an Ecology-certified laboratory program in accordance with Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms (EPA/600-4-85/013) and Quality Assurance Guidelines for Biological Testing (EPA/600-4-78-043). Water quality parameters of the overlying seawater included salinity, temperature, pH, dissolved oxygen, and ammonia.

The approved Phase II Sediment SAP identified the Acute Larval Mortality/Abnormality test as *Crassostrea gigas*. However, based on problems meeting appropriate control performance standards of WAC 173-204-315 (2) and subsequent holding time exceedences, it was necessary to resample each of the five surface sediment locations (Hart Crowser, 1995b). Ultimately, these resampled sediments were tested with *Dendraster excentricus*.

The response of test organisms to the test sediment samples were statistically compared to the response of these organisms to control sediments (statistical significance is defined with a *t* test, where *p* less than or equal to 0.05). Both Amphipod and Juvenile Polychaete test controls were acceptable.

Carr Inlet was utilized as the biological testing reference site and was the basis for assessing compliance with the biological criteria. West Beach sediment was collected from Whidbey Island for use as the negative control. Comparison of samples with reference sediments was based on individual sediment sample percent fines that were closest matches with the reference sediments. Four samples (HC-02, HC-04, HC-07, and HC-11) had percent fines that ranged from 26 to 60 percent. Therefore, these four samples were compared with Reference Sediment 0102B35/0225B35 (22.72 and 21.78 percent). Sample HC-08 had percent fines of 18 percent and was therefore, compared with Reference Sediment 0102A43/0225A43 (12.11 and 14.01 percent).

Bioassay tests were also performed on a control sediment sample from Carr Inlet by Beak Consultants, Inc. The response of the test organisms to the sediment samples was statistically compared to the response of these organisms to control sediments. The results of sediment chemical, physical, and biological testing are provided in the following sections.

CHEMICAL AND PHYSICAL TESTING RESULTS

Surface sediment locations which exceed the SQS are identified (boxed) in Table 1. A total of six SQS exceedences were identified for the PAHs and one SQS exceedence for bis(2-ethylhexyl)phthalate. Surface sediment locations which exceed the SQS or CSL are identified (shaded) in Table 1. Four CSL exceedences were identified for the PAHs and one CSL for dibenzofuran. A total of three CSL exceedences were found for bis(2-ethylhexyl)phthalate. Appendix A contains analytical chemistry testing data. Appendix B contains physical testing results. These chemical and physical results are discussed in more detail below.

Total Organic Carbon

Total organic carbon (in percent) ranged from 0.40 percent in sample HC-8 to 2.9 percent in sample HC-7.

Semivolatile Compounds

For the low molecular weight PAHs; phenanthrene exceeded the SQS for sample HC-4. Acenaphthene, fluorene, phenanthrene, and total LPAH exceeded both the SQS and CSL for sample HC-5.

For the high molecular weight PAHs, fluoranthene and chrysene exceeded the SQS for sample HC-2. Fluoranthene and total HPAHs exceeded the SQS for sample HC-5; fluoranthene exceeded the SQS for sample HC-10.

Bis(2-ethylhexyl)phthalate exceeded the CSL criteria for samples HC-2, HC-4, and HC-7. Bis(2-ethylhexyl)phthalate exceeded the SQS for Sample HC-10. Dibenzofuran exceeded the CSL for Sample HC-5.

There were no other chemical criteria exceedences for other SMS compounds of concern at the Phase II sample locations. A summary of all chemical data is presented in Table 1.

Grain Size

Grain size distribution tests were performed on nine sediment samples by wet-sieving and pipet methods outlined in PSEP Protocols at the Hart Crowser sediment testing laboratory in Seattle. After analysis, these samples were classified in accordance with the Unified Soil Classification (USC) System. Table 1 presents grain size distributions for each sediment sample. These grain size distribution results are presented as percent gravel, percent sands ($>62\ \mu\text{m}$), silts (4 to $62\ \mu\text{m}$), and clays ($<4\ \mu\text{m}$). Samples HC-2, HC-3, and HC-5 are comprised of sandy, clayey silt. Samples HC-4 and HC-8 are comprised of silty sand. Samples HC-7 and HC-10 are clayey, gravelly, silty sand. Samples HC-11 and HC-12 are clayey silty sand. Sample HC-9 is comprised of silty, very gravelly sand. Grain size analysis data sheets are provided in Appendix B. Total solids ranged from 42.1 to 79.6 percent for all samples.

RESULTS OF CONFIRMATORY BIOLOGICAL TESTING

Confirmatory biological testing results were evaluated against appropriate control and reference performance standards of WAC 173-204-315 (2), and SQS and CSL criteria of WAC 173-204-320 (3) and WAC 173-204-520 (3). The results of the confirmatory biological testing are presented in Table 2 and discussed below. Complete results are presented in Appendix C.

- **Acute 10-Day Amphipod Mortality (*Rhepoxynius abronius*).** The negative control sediment (West Beach Sand) had less than ten percent mortality over the test period. The reference sediments (0102A43 and 0102B35) had 5 and 13 percent mortality, respectively, and are below the 25 percent criteria.

Samples HC-02, HC-04, HC-07, and HC-11 were compared against reference sediment 0102B35. Based on this reference sediment none of the samples exceeded the SQS biological effects criteria. Sample HC-08 was compared with reference sediment 0102A43 and also did not exceed SQS biological effects criteria.

- **Acute Larval Mortality/Abnormality (*Dendraster excentricus*).** The seawater control sample had less than fifty percent combined abnormality and mortality (i.e., a fifty percent normal survivorship at time final).

Samples HC-02, HC-04, HC-07, and HC-11 were compared against reference sediment 0225B35. Based on this reference sediment, Sample

HC-07 exceeded the SQS but met the CSL biological effects criteria. Samples HC-02, HC-04, and HC-11 did not exceed the SQS biological effects criteria. Sample HC-08 was compared with reference sediment 0225A43 and did not exceed the SQS biological effects criteria.

- **Chronic 20-Day-Juvenile Polychaete (*Neanthes arenocodentata*).**
The negative control sediment (West Beach Sand) had a survivorship of 100 percent and the reference sediments (0102A43 and 0102B35) had 88 and 92 percent, respectively, of the mean biomass found in the control.

Samples HC-02, HC-04, HC-07 and HC-11 were compared against reference sediment 0102B35. Based on this reference sediment, sample HC-02 exceeded the SQS biological effects criteria but did not exceed the CSL biological criteria. Samples HC-04, HC-07, and HC-11 did not exceed the SQS biological effects criteria. Sample HC-08 was compared with reference sediment 0102A43 and did not exceed the SQS biological effects criteria.

The SQS biological effects criteria was exceeded for Acute Larval Mortality/Abnormality at location HC-07 and Chronic 20-Day-Juvenile Polychaete at location HC-02. No exceedences of the CSL biological effects criteria was observed at the other five sediment sampling locations.

CONCLUSIONS

Based on the Phase II chemical and physical testing and the results of the confirmatory biological testing, we can conclude the following:

- Elevated SMS chemical concentrations are limited to sediments within the site of the demolished Shannon Point Seafoods fish processing facility. Of the four locations (HC-8 through HC-11) sampled outside the location of the former containment boom (Figure 1), only two minor SQS chemical exceedences were noted (fluoranthene and BEHP, both at location HC-10).
- BEHP sediment concentrations within the site of the demolished Shannon Point Seafoods fish processing facility are highly variable and do not indicate that BEHP concentrations have been naturally attenuated since demolition was completed. These concentrations are not associated with CSL biological effects (discussed below), and we assume the BEHP may be bound within small debris (plastic particles).

- ▶ Minor SQS and CSL exceedences of PAHs and dibenzofuran were noted within the site of the demolished Shannon Point Seafoods fish processing facility. These chemical concentrations do not represent a station cluster of concern and are not associated with biological effects.
- ▶ The Phase II confirmatory biological testing results do not identify a station cluster which exceed the CSL biological effects criteria (WAC 173-204-520 (3)). Consequently, a no further cleanup action determination is requested from Ecology.

LIMITATIONS

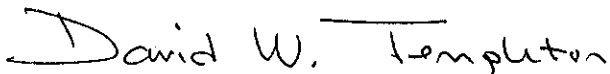
Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Shannon Point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

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to David W. Templeton at (206) 324-9530.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.


DAVID W. TEMPLETON
Senior Sediment Quality Specialist
Project Manager


ALBERT SHEN
Environmental Chemist

RESULTS.fr

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- Hart Crowser, Inc., 1995b. Letter to Ecology, Re: Shannon Point Seafoods Sediment Sampling, February 17, 1995.
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Table 1 - Shannon Point Seafoods Sediment Sampling Chemistry Results

Sheet 1 of 5

Sampling Date: Sample Depth in Centimeters:	Ecology Sediment Quality Standards (SQS) Table I (a)	Ecology Cleanup Screening Levels (CSL) Table II (a)	Golder SP-1 1994 0 to 2	Golder SP-2 1994 0 to 2	HC HC-2 1/25/95 0 to 2	Golder SP-3 1994 0 to 2	HC HC-3 1/26/95 0 to 2	Golder SP-4 1994 0 to 2	HC HC-4 1/25/95 0 to 2	Golder SP-5 (f) 1994 0 to 2	HC HC-5 1/25/95 0 to 2
Conventionals in Percent											
Total Organic Carbon	—	—			2.3		1.6		1.6		1.6
Percent Solids	—	—			42.1		50.1		67.9		49.7
Pipet Analysis											
Percent Gravel					3		2		3		3
Percent Sand					37		40		70		33
Percent Silt					46		41		23		54
Percent Clay					14		17		4		10
Metals in mg/kg dry (ppm)											
Arsenic	57	93	10 U	10 U	—	10 U	—	10 U	—	10 U	—
Cadmium	5.1	6.7	0.8	0.7	—	0.7	—	0.4	—	0.5	—
Chromium	260	270	47	47	—	47	—	50	—	48	—
Copper	390	390	64.7	45.4	—	45.1	—	32.5	—	43.3	—
Lead	450	530	46	38	—	37	—	36	—	51	—
Mercury	0.41	0.59	0.06	0.07	—	0.07	—	0.07	—	0.09	—
Silver	6.1	6.1	0.6 U	0.6 U	—	0.6 U	—	0.6 U	—	0.6 U	—
Zinc	410	960	146	124	—	124	—	76.6	—	104	—
Low Molecular Weight PAHs in mg/kg TOC (b) (ppm)											
Total LPAHs	370 (c)	780 (c)	570	762	286.1	127	67.2	356	193.6	171	971
Naphthalene	99	170	40	40	10	11	4.3 U	12 U	16	7.1	18
Acenaphthylene	66	66	6.4 U	8.1	2.1	5.8	4.3 U	12 U	2.6	2.9	11
Acenaphthene	16	57	48	7.3	13	12	4.3 U	28	12	12	66
Fluorene	23	79	69	110	22	13	4.3 U	37	17	21	100
Phenanthrene	100	480	280	600	200	87	35	180	110	130	740
Anthracene	220	1200	110	120	39	20	15	71	36	30	36
2-Methylnaphthalene	38	64	17	31	5.6	3.5	4.3 U	16	4.8	4	30

Table 1 – Shannon Point Seafoods Sediment Sampling Chemistry Results

Sheet 2 of 5

Sampling Date: Sample Depth in Centimeters:	Ecology Sediment Quality Standards (SQS) Table I (a)	Ecology Cleanup Screening Levels (CSL) Table II (a)	Golder SP-1	Golder SP-2	HC HC-2	Golder SP-3	HC HC-3	Golder SP-4	HC HC-4	Golder SP-5 (f)	HC HC-5
			1994 0 to 2	1994 0 to 2	1/25/95 0 to 2	1994 0 to 2	1/26/95 0 to 2	1994 0 to 2	1/25/95 0 to 2	1994 0 to 2	1/25/95 0 to 2
High Molecular Weight PAHs in mg/kg TOC (b) (ppm)											
Total HPAHs	960 (d)	5300 (d)	806	1122	744.1	418	400.3	424	419.8	407	1104.9
Fluoranthene	160	1200	300	520	250	130	140	160	160	160	450
Pyrene	1000	1400	200	190	220	97	92	110	100	110	400
Benzo(a)anthracene	110	270	88	100	44	35	35	32	35	29	49
Chrysene	110	460	98	120	120	48	52	38	50	35	110
Total Benzo(a)fluoranthenes	230 (e)	450 (e)	106	119	60	57	46	34	41	43	61
Benzo(a)pyrene	99	210	35	41	27	26	20	14	18	16	20
Indeno(1,2,3-c,d)pyrene	34	88	14	14	17	11	11	12 U	12	6	11
Dibenzo(a,h)anthracene	12	33	8.7	7.7	6.1	5.5	4.3 U	12 U	3.8	3.2	3.9
Benzo(g,h,i)perylene	31	78	10	10	—	8.3	—	12 U	—	4.7	—
Chemicals in mg/kg TOC (b) (ppm)											
1,2-Dichlorobenzene	2.3	2.3	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
1,4-Dichlorobenzene	3.1	9	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
1,2,4-Trichlorobenzene	0.81	1.8	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
Hexachlorobenzene	0.38	2.3	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
Dimethyl Phthalate	53	53	6.4 U	5 U	—	1.1 U	—	12 U	—	1.2	—
Diethyl Phthalate	61	110	6.4 U	7.4	—	1.1 U	—	12 U	—	0.6 U	—
Di-n-butyl Phthalate	22	1700	6.4 U	5 U	—	1.1 U	—	12 U	—	1.1	—
Butyl Benzyl Phthalate	4.9	64	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
Bis(2-ethylhexyl)Phthalate	47	78	22	130	140	130	4.3 U	120	450	288	7.6
Di-n-octyl Phthalate	58	4500	6.4 U	5 U	—	18	—	12 U	—	0.6 U	—
Dibenzofuran	15	58	39	74	15	9.1	4.3 U	22 U	13	8.4	95
Hexachlorobutadiene	3.9	6.2	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
N-Nitroso-Diphenylamine	11	11	6.4 U	5 U	—	1.1 U	—	12 U	—	0.6 U	—
Total PCBs	12	65	7.6 U	8.9	—	7.3	—	3.2 U	—	2.9	—
Chemicals in µg/kg DW (ppb)											
Phenol	420	1200	76 U	250	—	34	—	330 U	—	79	—
2-Methylphenol	63	63	76 U	66 U	—	17 U	—	330 U	—	18 U	—
4-Methylphenol	670	670	76 U	390	—	36	—	610	—	87	—
2,4-Dimethylphenol	29	29	76 U	66 U	—	17 U	—	330 U	—	18 U	—
Pentachlorophenol	360	690	380 U	330 U	—	87 U	—	1700 U	—	92 U	—
Benzyl Alcohol	57	73	76 U	66 U	—	17 U	—	330 U	—	18 U	—
Benzoic Acid	650	650	760 U	660 U	—	170 U	—	3300 U	—	180 U	—

Table 1 - Shannon Point Seafoods Sediment Sampling Chemistry Results

Sheet 3 of 5

	Golder SP-6	HC SP-6-1 (g) 6/22/94 0 to 2	HC SP-6-2 (g) 6/22/94 0 to 2	HC SP-6-3 (g) 6/22/94 0 to 2	Golder SP-7	HC HC-7 1/25/95 0 to 2	HC HC-8 1/25/95 0 to 2	HC HC-9 1/26/95 0 to 2	HC HC-10 1/26/95 0 to 2	HC HC-11 1/25/95 0 to 2	HC HC-12 1/25/95 0 to 2
Sampling Date:	1994	6/22/94	6/22/94	6/22/94	1994	1/25/95	1/25/95	1/26/95	1/26/95	1/25/95	1/25/95
Sample Depth in Centimeters:	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2
Conventional in Percent											
Total Organic Carbon		81.56	81.34	80.36		2.9	0.40	0.97	1.5	1.9	1.3
Percent Solids						61.5	73.9	79.6	61.6	60.5	61.9
Pipet Analysis											
Percent Gravel						7	0	41	23	1	1
Percent Sand						67	82	46	49	59	57
Percent Silt						21	15	10	21	35	36
Percent Clay						5	3	3	7	5	6
Metals in mg/kg dry (ppm)											
Arsenic	10 U	—	—	—	10 U	—	—	—	—	—	—
Cadmium	0.7	—	—	—	0.6	—	—	—	—	—	—
Chromium	46	—	—	—	45	—	—	—	—	—	—
Copper	135	—	—	—	26.4	—	—	—	—	—	—
Lead	106	—	—	—	49	—	—	—	—	—	—
Mercury	0.06 U	—	—	—	0.11	—	—	—	—	—	—
Silver	0.6 U	—	—	—	0.6 U	—	—	—	—	—	—
Zinc	985	325	281	212	95.4	—	—	—	—	—	—
Low Molecular Weight PAHs in mg/kg TOC (b) (ppm)											
Total LPAHs	229	—	—	—	81	78.6	34.6	12.9	91.2	70.4	114.2
Naphthalene	8.6	—	—	—	5.2 U	14	3.4 U	1.3 U	1.4	3.6	6.4
Acenaphthylene	4.8	—	—	—	5.2 U	2.6	3.4 U	1.3 U	1.1 U	0.9	1.4
Acenaphthene	19	—	—	—	5.2 U	6.5	3.4 U	1.3 U	4.0	4.8	7.4
Fluorene	27	—	—	—	5.4	7.5	3.4 U	1.3 U	8.7	7.1	11
Phenanthrene	220	—	—	—	41	31	16	6.3	46	37	50
Anthracene	36	—	—	—	14	17	5.0	1.4	30	17	38
2-Methylnaphthalene	3.8	—	—	—	5.2 U	2.9	3.4 U	1.3 U	2.1	1.6	2.9

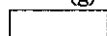
Table 1 - Shannon Point Seafoods Sediment Sampling Chemistry Results

Sheet 4 of 5

	Golder SP-6	HC SP-6-1 (g)	HC SP-6-2 (g)	HC SP-6-3 (g)	Golder SP-7	HC HC-7	HC HC-8	HC HC-9	HC HC-10	HC HC-11	HC HC-12
Sampling Date:	1994	6/22/94	6/22/94	6/22/94	1994	1/25/95	1/25/95	1/26/95	1/26/95	1/25/95	1/25/95
Sample Depth in Centimeters:	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2
High Molecular Weight PAHs											
in mg/kg TOC (b) (ppm)											
Total HPAHs	702	—	—	—	442	442.2	122	40.8	559.6	256.2	366
Fluoranthene	340	—	—	—	160	100	34	11	190	76	120
Pyrene	96	—	—	—	110	140	26	8.4	120	49	64
Benzo(a)anthracene	61	—	—	—	26	37	10	3.3	53	25	38
Chrysene	70	—	—	—	50	61	18	7.1	75	45	55
Total Benzofluoranthenes	74	—	—	—	57	55	20	5.9	78	39	59
Benzo(a)pyrene	33	—	—	—	18	30	6.8	2.5	27	14	20
Indeno(1,2,3-c,d)pyrene	12	—	—	—	9.5	15	3.8	1.3 U	11	5.6	6.7
Dibenzo(a,h)anthracene	6.6	—	—	—	5.2 U	4.2	3.4 U	1.3 U	5.6	2.6	3.3
Benzo(g,h,i)perylene	9.3	—	—	—	6.5	—	—	—	—	—	—
Chemicals in mg/kg TOC (b) (ppm)											
1,2-Dichlorobenzene	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
1,4-Dichlorobenzene	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
1,2,4-Trichlorobenzene	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Hexachlorobenzene	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Dimethyl Phthalate	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Diethyl Phthalate	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Di-n-butyl Phthalate	3.2	—	—	—	5.2 U	—	—	—	—	—	—
Butyl Benzyl Phthalate	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Bis(2-ethylhexyl)Phthalate	16	—	—	—	220	470	11	1.3 U	64	26	15
Di-n-octyl Phthalate	1.6 U	—	—	—	18	—	—	—	—	—	—
Dibenzofuran	17	—	—	—	5.2 U	6.4	3.4 U	1.3 U	4.4	4.8	7.5
Hexachlorobutadiene	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
N-Nitroso-Diphenylamine	1.6 U	—	—	—	5.2 U	—	—	—	—	—	—
Total PCBs	10 U	—	—	—	1.8 U	—	—	—	—	—	—
Chemicals in µg/kg DW (ppb)											
Phenol	16	—	—	—	290 U	—	—	—	—	—	—
2-Methylphenol	13 U	—	—	—	290 U	—	—	—	—	—	—
4-Methylphenol	21	—	—	—	290 U	—	—	—	—	—	—
2,4-Dimethylphenol	13 U	—	—	—	290 U	—	—	—	—	—	—
Pentachlorophenol	65 U	—	—	—	1400 U	—	—	—	—	—	—
Benzyl Alcohol	13 U	—	—	—	290 U	—	—	—	—	—	—
Benzoic Acid	130 U	—	—	—	2900 U	—	—	—	—	—	—

Notes:

- (a) Where laboratory analysis indicates a chemical is not detected in a sediment sample, the detection limit shall be reported and shall be at or below the criteria value shown in this table. Where chemical criteria in this table represent the sum of individual compounds or isomers, and a chemical analysis identifies an undetected value for one or more individual compounds or isomers, the detection limit shall be used for calculating the sum of the respective compounds or isomers.
- (b) The listed chemical parameter criteria represent concentrations in parts per million, "normalized", or expressed, on a total organic carbon basis. To normalize total organic carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.
- (c) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
- (d) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzo(a)fluoranthenes, Benzo(a)pyrene, Ideno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene, and Benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds listed.
- (e) The Total Benzo(a)fluoranthenes criterion represents the sum of the concentrations of the B, J, and K isomers.
- (f) Bis(2-ethylhexyl)phthalate duplicate analysis results (based on 1.56 percent TOC) were 410 and 166 mg/kg TOC. The reported value of 288 mg/kg TOC is the average of these two values.
- (g) Verification samples collected after removal of damaged fork-lift battery. See Figure 2.

	Exceeds SQS.
	Exceeds CSL.
	Not analyzed.

409605\RESU-1.WK1

Table 2 – Confirmatory Biological Testing Results

Location:	HC-02	HC-04	HC-07	HC-08	HC-11
Sampling Date:	1/25/95	1/25/95	1/25/95	1/25/95	1/25/95
Amphipod Mortality (Rhepoxynius abronius)	P	P	P	P	P
Larval Mortality/Abnormality (1) (Dendraster excentricus)	P	P	SQS	P	P
Juvenile Polychaete (Neanthes arenocodentata)	SQS	P	P	P	P
SQS Failure	Yes	No	Yes	No	No
CSL Failure	No	No	No	No	No

Notes:

(1) Sediments resampled on February 22, 1995.

SQS – SQS Failure

CSL – CSL Failure

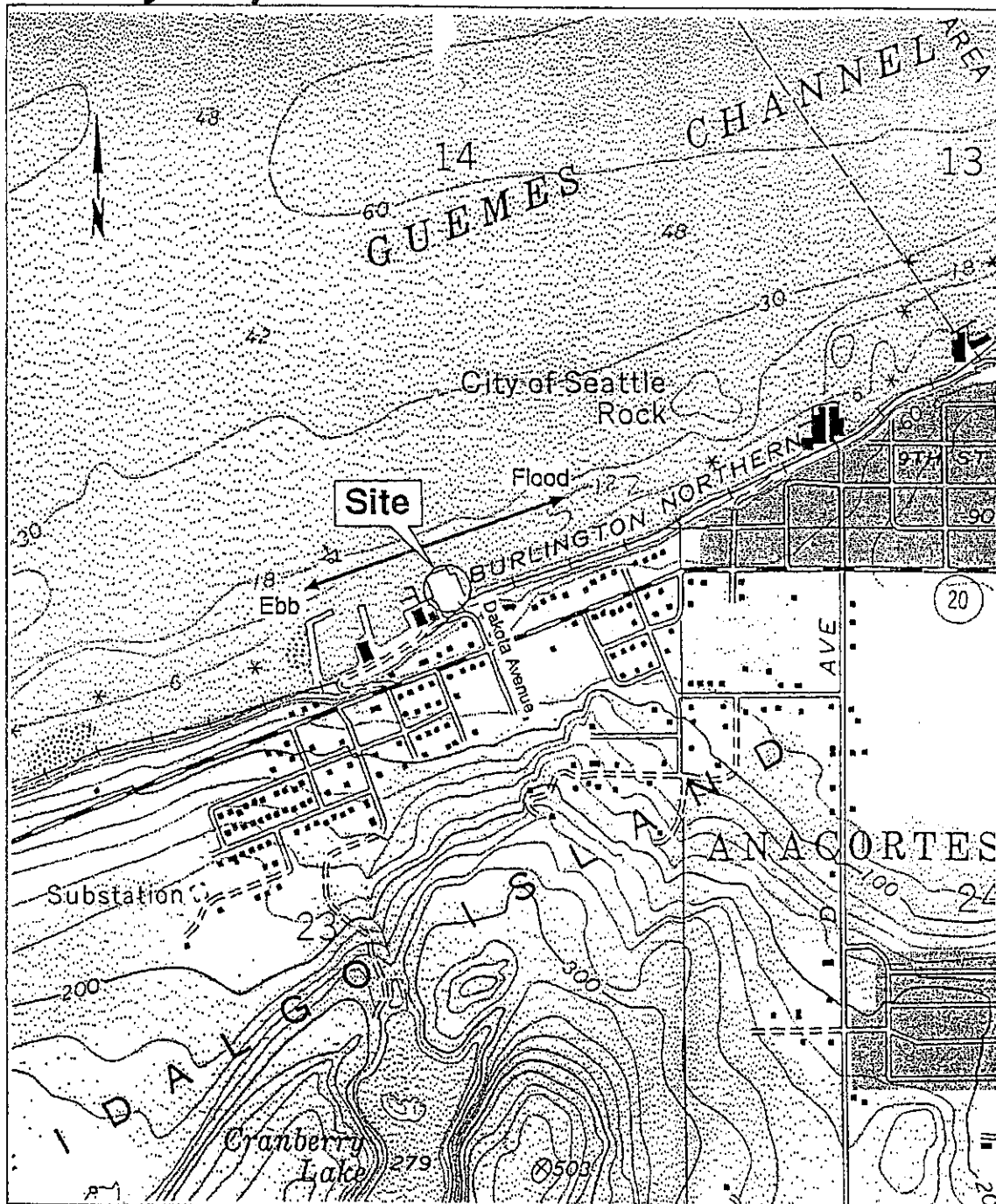
P – Passed SQS and CSL criteria.

409603\RESU-2.WK1

Table 3 - Shannon Point Seafoods Sediment Sampling Field Observations

Sample Number	Date	Location (Latitude/ Longitude)	Comments
HC-2	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.56	Clayey, very sandy SILT with spotty oily sheen observed. Abundant wood chunks and shell fragments. Seaweed, worms, and strong sulfur odor.
HC-3	1/26/95	Lat: 48.30.96 Long: 122.38.55	Clayey, very sandy SILT with various live shrimp and crabs observed.
HC-4	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.55	Silty SAND with abundant shell fragments, rocks, nails, and wood chips. Occasional pebbles/cobbles, worms, seaweed, and a piece of concrete. Strong sulfur odor.
HC-5	1/25/95	Lat: 48.30.86 Long: 122.38.54	Slightly clayey, very sandy SILT with occasional shrimp, concrete, rocks, worms, and a fishing line.
HC-7	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.52	Slightly clayey, slightly gravelly, silty SAND with occasional wood chunks, fish bones, wire, tar paper, shrimp, crab, and shell fragments. Spotty oily sheen and sulfur odor detected.
HC-8	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.50	Silty SAND with trace of shell fragments and slight sulfur odor.
HC-9	1/26/95 and 2/22/95	Lat: 48.30.87 Long: 122.38.57	Silty very gravelly SAND. No debris noted.
HC-10	1/26/95	Lat: 48.30.86 Long: 122.38.57	Slightly clayey, silty, gravelly SAND with occasional shells, cobble, and worms.
HC-11	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.55	Slightly clayey, very silty SAND with abundant worms observed. Occasional shell fragments, wood debris, pieces of steel, and wood chunks found. Slight sulfur odor.
HC-12	1/25/95 and 2/22/95	Lat: 48.30.84 Long: 122.38.55	Slightly clayey, very silty SAND with abundant worms observed. Occasional shell fragments, wood debris, pieces of steel, and wood chunks found. Slight sulfur odor.

Vicinity Map



Note: Base map prepared from figure provided by Golder Associates entitled Site Location Map dated October 27, 1993.

0 600 1200
Scale in Feet



HARTCROWSER

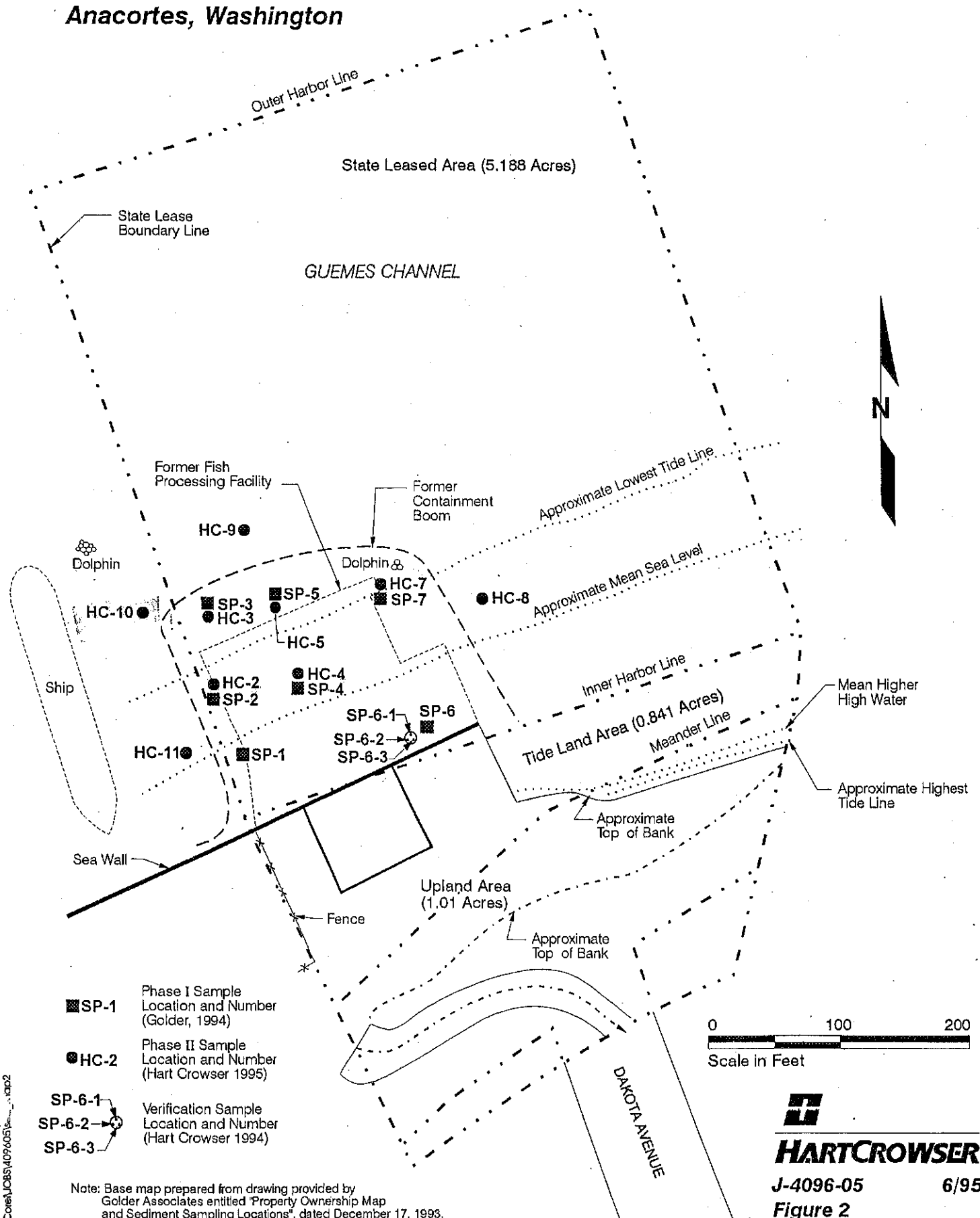
J-4096-05 6/95

Figure 1

Sediment Sampling Location Plan

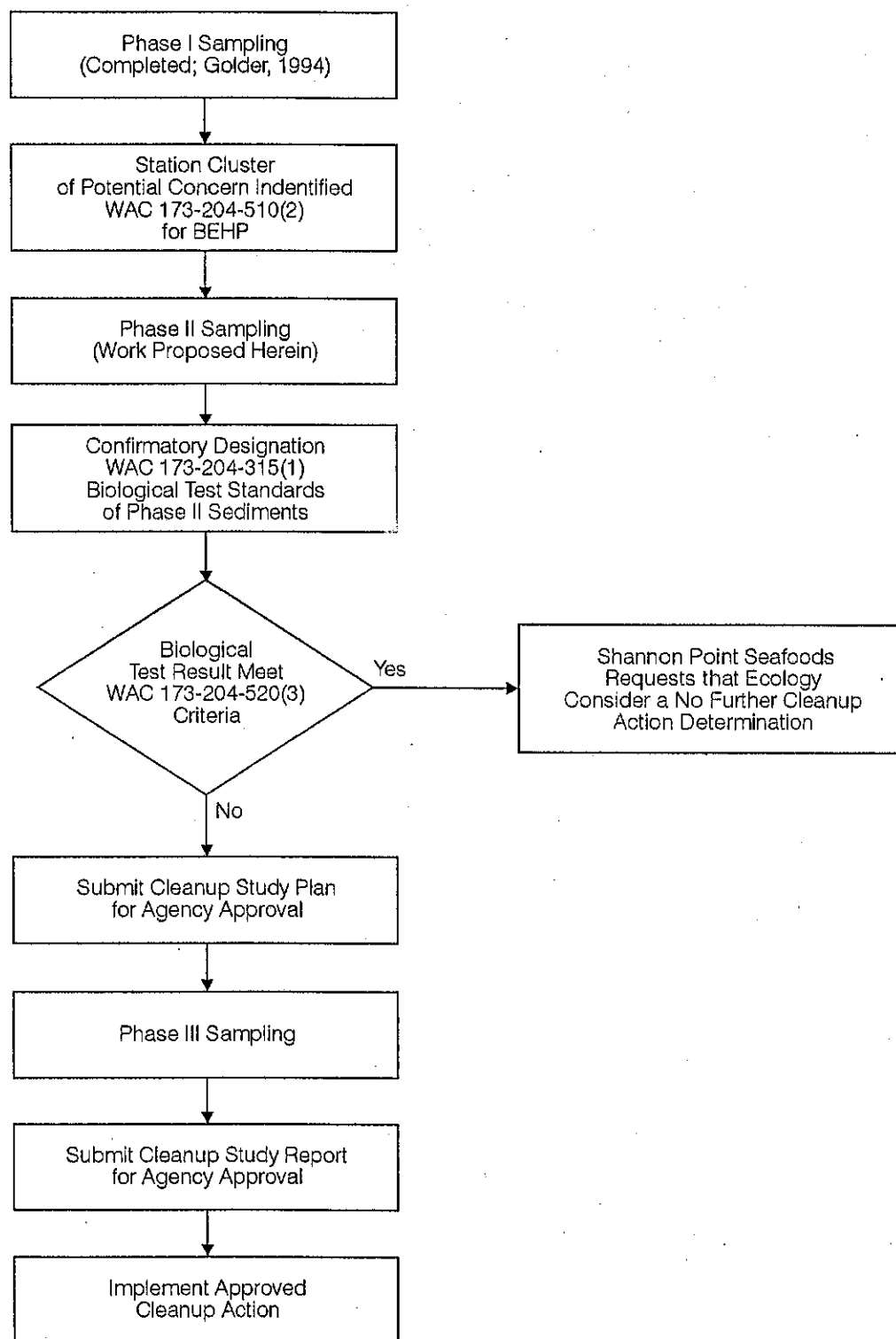
Shannon Point Seafoods

Anacortes, Washington



Summary of Cleanup Process

Shannon Point Seafoods, Anacortes, Washington



APPENDIX A
ANALYTICAL CHEMISTRY TESTING DATA
ANALYTICAL RESOURCES, INC.



Analytical Resources, Incorporated
Analytical Chemists and Consultants

14 February 1995

Albert Shen
Hart Crowser, Inc.
1910 Fairview Ave. East
Seattle, WA 98102

**RE: Client Project: 4096-05, Shannon Pt. Seafoods;
ARI Job #J574**

Dear Mr. Shen,

Please find enclosed the original chain-of-custody (COC) record and results for the above-referenced project. Ten sediment samples were received in good condition on 1/26/95. There were no discrepancies between the COC and sample container labels, and the analyses were initiated without incident of note. Preliminary results were faxed to you on 2/6 and 2/7.

The analysis for TOC was routine. A duplicate and matrix spike were analyzed using sample HC-2; RPD and recovery reports are included as QC documentation for the project.

Semivolatiles samples **HC-2** and **HC-3** became bi-phasic during the concentration phase of the extractions. The latter, when initially analyzed, had extremely low surrogate recoveries, and was therefore re-extracted, using a smaller sample amount to avoid matrix interference. While both sets of results are included, only the concentrations reported for the re-extract are considered valid. Samples **HC-2**, **HC-4**, **HC-5**, **HC-7**, **HC-10**, **HC-11**, and **HC-12** all required reanalysis at dilution due to analyte levels above the linear range of instrument calibration. Both sets of results for these samples are included. Note that in some of the dilutions the surrogate recoveries are outside QC limits; as the recoveries in the initial runs are acceptable, no corrective action is required.

Sample **HC-9** was used as the matrix spike/matrix spike duplicate (MS/MSD) sample for semivolatiles; a Laboratory Control Sample (LCS) was also extracted and analyzed with these samples as additional QC. RPD and recovery reports are included as documentation. Recoveries of 4-nitrophenol are outside advisory limits in the MS/MSD, but are acceptable in the LCS, indicating matrix effect. No corrective action is required.

A copy of this package will be kept on file by ARI should you required further information or copies of any documentation. Also, if you have questions please feel free to call any time.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kate Stegemoeller
Project Manager
206-340-2866, ext. 117

Enclosures
cc: file #J574



574

Sample Custody Record

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

HART CROWSER

PAGE 1 OF 1

DATE: 1/26/95

JOB NUMBER <u>4096-05</u> LAB NUMBER <u> </u>				TESTING										OBSERVATIONS / COMMENTS / COMPOSITING INSTRUCTIONS							
PROJECT MANAGER <u>Dave Templeton / Albert Shen</u>				NO. OF CONTAINERS																	
PROJECT NAME <u>Shannon Pt Seafoods</u>														METHOD OF SHIPMENT							
SAMPLED BY: <u>AKS / MAH</u>																					
LAB NO.	SAMPLE	TIME	STATION	MATRIX											TOTAL NUMBER OF CONTAINERS	SPECIAL SHIPMENT / HANDLING OR STORAGE REQUIREMENTS	DISTRIBUTION:				
	HC-2		Shannon Pt	Sediments															10	Hand	**= see lab work order.
	HC-3																				
	HC-4																				
	HC-5																				
	HC-7																				
	HC-8																				
	HC-9																				
	HC-10																				
	HC-11																				
	HC-12																				
RELINQUISHED BY				DATE	RECEIVED BY	DATE															
SIGNATURE <u>Albert Shen</u>				<u>1/26/95</u>	<u>Dave Templeton</u>	<u>1/26/95</u>															
PRINTED NAME <u>Albert Shen</u>				TIME <u>4:00 PM</u>	PRINTED NAME <u>Dave Templeton</u>	TIME <u>4:05 PM</u>															
COMPANY <u>Hart Crowser</u>					COMPANY <u>Hart Crowser</u>																
RELINQUISHED BY				DATE	RECEIVED BY	DATE															
SIGNATURE <u> </u>					<u> </u>																
PRINTED NAME <u> </u>				TIME <u> </u>	PRINTED NAME <u> </u>	TIME <u> </u>															
COMPANY <u> </u>					COMPANY <u> </u>																



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**Final Report
Laboratory Analysis of Conventional Parameters**

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Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Sample No: HC-2

Lab Sample ID: J574A

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-970

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MCY*

Date Sampled: 01/25/95

Reported: 02/10/95

2-10

Date Received: 01/26/95

<u>Analyte</u>	<u>Analysis Date</u>	<u>Method</u>	<u>Dilution Factor</u>	<u>RL</u>	<u>Units</u>	<u>Result</u>
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	42.1
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	2.3

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-3

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574B

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-971

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MOP*

Date Sampled: 01/25/95

Reported: 02/10/95

2-10

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	50.1
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	1.6

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-4

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574C

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-972

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *mop*

Date Sampled: 01/25/95

Reported: 02/10/95 *2-16*

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	67.9
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	1.6

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-5

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574D

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-973

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MAR*

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	49.7
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	1.6

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-7

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574E

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-974

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MOP*

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	61.5
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	2.9

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-8

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574F

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-975

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *map*
2-10

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	73.9
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	0.40

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-9

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574G

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-976

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MAP*
2-10

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	79.6
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	0.97

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-10

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574H

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-977

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MOP*
2-10

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	61.6
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	1.5

RL Analytical reporting limit

U Undetected at reported detection limit

Report for J574 received 01/26/95



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Sample No: HC-11

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574I

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-978

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *May 2-10*

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis		Dilution		Units	Result
	Date	Method	Factor	RL		
Total Solids	01/28/95	EPA 160.3 SM 2540 B		0.01	Percent	60.5
Total Organic Carbon @104C	01/31/95	Plumb, 1981		0.02	Percent	1.9

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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Laboratory Analysis of Conventional Parameters**

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Sample No: HC-12

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574J

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-979

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *map*
2-10

Date Sampled: 01/25/95

Reported: 02/10/95

Date Received: 01/26/95

Analyte	Analysis		Dilution		RL	Units	Result
	Date	Method	Factor				
Total Solids	01/28/95	EPA 160.3 SM 2540 B			0.01	Percent	61.9
Total Organic Carbon @104C	01/31/95	Plumb, 1981			0.02	Percent	1.3

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J574 received 01/26/95



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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

QA Report - Replicate Analysis

Matrix: Sediment

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Received: 01/26/95

Data Release Authorized: *map*
2-10

**REPLICATE ANALYSIS RESULTS
CONVENTIONALS**

Constituent	Units	Sample Value	Replicate Value(s)	RPD/RSD
ARI ID: 95-970, J574 A Client Sample ID: HC-2				
Total Solids	Percent	42.1	43.8 41.5	RSD: 2.8%
Total Organic Carbon @104C	Percent	2.3	2.2 1.8	RSD: 12.6%



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333 Ninth Ave. North
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(206) 621-6490
(206) 621-7523 (FAX)

QA Report - Matrix Spike Analysis

Matrix: Sediment

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Received: 01/26/95

Data Release Authorized: *msp*
2-10

**MATRIX SPIKE QA/QC REPORT
CONVENTIONALS**

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 95-970, J574 A Client Sample ID: HC-2					
Total Organic Carbon @104C	Percent	2.28	2.99	0.612	116%



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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

QA Report - Method Blank Analysis

Matrix: Sediment

QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05

Date Received: 01/26/95

Data Release Authorized: *MOP*
2-10

**METHOD BLANK RESULTS
CONVENTIONALS**

<u>Analysis Date</u>	<u>Constituent</u>	<u>Units</u>	<u>Result</u>
Method Blank			
01/28/95	Total Solids	mg residue	< 1 U
System Blank			
01/31/95	Total Organic Carbon @70C	mg/kg	6.0



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QA Report - Check Standard Analysis

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05

Date Received: 01/26/95

Data Release Authorized: *maf*
2-10

**CHECK STANDARD ANALYSIS
CONVENTIONALS**

<u>Constituent</u>	<u>Units</u>	<u>Measured Value</u>	<u>True Value</u>	<u>Recovery</u>
Check Standard				
Total Organic Carbon @70C	mg/kg	5,100	5,000	102%
Date analyzed: 01/31/95				



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Chemists &
Consultants

QA Report - Standard Reference Material Analysis

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05

Data Release Authorized: *MOF*
2-10

Date Received: 01/26/95

**STANDARD REFERENCE MATERIAL ANALYSIS
CONVENTIONALS**

<u>Constituent</u>	<u>Units</u>	<u>Value</u>	<u>True Value</u>	<u>Recovery</u>
NBS #2704				
Total Organic Carbon @70C	mg/kg	36,500	33,500	109%
Date analyzed: 01/31/95				



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: Method Blank

Analytical
Chemists &
Consultants

Lab Sample ID: J574MB

LIMS ID: 95-970

Matrix: Sediment

Data Release Authorized: *001*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: NA

Date Received: NA

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 2.00 Average Equiv

Sample Amount: 100 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: NA

pH: NA

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	0.5 U
91-57-6	2-Methylnaphthalene	0.5 U
208-96-8	Acenaphthylene	0.5 U
83-32-9	Acenaphthene	0.5 U
132-64-9	Dibenzofuran	0.5 U
86-73-7	Fluorene	0.5 U
85-01-8	Phenanthrene	0.5 U
120-12-7	Anthracene	0.5 U
206-44-0	Fluoranthene	0.5 U
129-00-0	Pyrene	0.5 U
56-55-3	Benzo(a)anthracene	0.5 U
117-81-7	bis(2-Ethylhexyl)phthalate	0.5 U
218-01-9	Chrysene	0.5 U
205-99-2	Benzo(b)fluoranthene	0.5 U
207-08-9	Benzo(k)fluoranthene	0.5 U
50-32-8	Benzo(a)pyrene	0.5 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.5 U
53-70-3	Dibenz(a,h)anthracene	0.5 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	63.7%	d5-Phenol	60.0%
2-Fluorobiphenyl	70.1%	2-Fluorophenol	59.0%
dl4-p-Terphenyl	89.5%	2,4,6-Tribromophenol	51.7%
d4-1,2-Dichlorobenzene	70.6%	d4-2-Chlorophenol	61.2%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574MB

LIMS ID: 95-970

Matrix: Sediment

Data Release Authorized: *MM*

Reported: 02/14/95

Sample No: Method Blank

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods
4096-05

Date Sampled: NA

Date Received: NA

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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 100 g-dry-wt Equiv

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: NA

pH: NA

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	10 U
91-57-6	2-Methylnaphthalene	10 U
208-96-8	Acenaphthylene	10 U
83-32-9	Acenaphthene	10 U
132-64-9	Dibenzofuran	10 U
86-73-7	Fluorene	10 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U
206-44-0	Fluoranthene	10 U
129-00-0	Pyrene	10 U
56-55-3	Benzo(a)anthracene	10 U
117-81-7	bis(2-Ethylhexyl)phthalate	10 U
218-01-9	Chrysene	10 U
205-99-2	Benzo(b)fluoranthene	10 U
207-08-9	Benzo(k)fluoranthene	10 U
50-32-8	Benzo(a)pyrene	10 U
193-39-5	Indeno(1,2,3-cd)pyrene	10 U
53-70-3	Dibenz(a,h)anthracene	10 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	63.7%	d5-Phenol	60.0%
2-Fluorobiphenyl	70.1%	2-Fluorophenol	59.0%
d14-p-Terphenyl	89.5%	2,4,6-Tribromophenol	51.7%
d4-1,2-Dichlorobenzene	70.6%	d4-2-Chlorophenol	61.2%



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: Method Blank

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Lab Sample ID: J574MB

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *DA*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: NA

Date Received: NA

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 02/06/95

Date analyzed: 02/09/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 2.00 Average Equiv

Sample Amount: 100 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: NA

pH: NA

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	0.5 U
91-57-6	2-Methylnaphthalene	0.5 U
208-96-8	Acenaphthylene	0.5 U
83-32-9	Acenaphthene	0.5 U
132-64-9	Dibenzofuran	0.5 U
86-73-7	Fluorene	0.5 U
85-01-8	Phenanthrene	0.5 U
120-12-7	Anthracene	0.5 U
206-44-0	Fluoranthene	0.5 U
129-00-0	Pyrene	0.5 U
56-55-3	Benzo(a)anthracene	0.5 U
117-81-7	bis(2-Ethylhexyl)phthalate	0.5 U
218-01-9	Chrysene	0.5 U
205-99-2	Benzo(b)fluoranthene	0.5 U
207-08-9	Benzo(k)fluoranthene	0.5 U
50-32-8	Benzo(a)pyrene	0.5 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.5 U
53-70-3	Dibenz(a,h)anthracene	0.5 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	56.7%	d5-Phenol	61.5%
2-Fluorobiphenyl	73.2%	2-Fluorophenol	72.1%
d14-p-Terphenyl	74.0%	2,4,6-Tribromophenol	56.8%
d4-1,2-Dichlorobenzene	63.9%	d4-2-Chlorophenol	68.7%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574MB

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *AAA*

Reported: 02/14/95

Sample No: Method Blank

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: NA

Date Received: NA

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 02/06/95

Date analyzed: 02/09/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 100 g-dry-wt Equiv

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: NA

pH: NA

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	10 U
91-57-6	2-Methylnaphthalene	10 U
208-96-8	Acenaphthylene	10 U
83-32-9	Acenaphthene	10 U
132-64-9	Dibenzofuran	10 U
86-73-7	Fluorene	10 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U
206-44-0	Fluoranthene	10 U
129-00-0	Pyrene	10 U
56-55-3	Benzo(a)anthracene	10 U
117-81-7	bis(2-Ethylhexyl)phthalate	10 U
218-01-9	Chrysene	10 U
205-99-2	Benzo(b)fluoranthene	10 U
207-08-9	Benzo(k)fluoranthene	10 U
50-32-8	Benzo(a)pyrene	10 U
193-39-5	Indeno(1,2,3-cd)pyrene	10 U
53-70-3	Dibenz(a,h)anthracene	10 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	56.7%	d5-Phenol	61.5%
2-Fluorobiphenyl	73.2%	2-Fluorophenol	72.1%
d14-p-Terphenyl	74.0%	2,4,6-Tribromophenol	56.8%
d4-1,2-Dichlorobenzene	63.9%	d4-2-Chlorophenol	68.7%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-2

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Lab Sample ID: J574A

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-970

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *DM*

Date Sampled: 01/25/95

Reported: 02/14/95

Date Received: 01/26/95

Date extracted: 01/31/95

Sample Amount: 51.0 g-dry-wt

Date analyzed: 02/03/95

Final Extract Volume: 1.0 mL

Instrument: FINN8

Dilution Factor: 1:1

GPC Cleanup: YES

Percent Moisture: 66.0%

Percent TOC: 2.28

pH: 7.8

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	10
91-57-6	2-Methylnaphthalene	5.6
208-96-8	Acenaphthylene	2.1
83-32-9	Acenaphthene	13
132-64-9	Dibenzofuran	15
86-73-7	Fluorene	22
85-01-8	Phenanthrene	100 E
120-12-7	Anthracene	39
206-44-0	Fluoranthene	140 E
129-00-0	Pyrene	110 E
56-55-3	Benzo(a)anthracene	44
117-81-7	bis(2-Ethylhexyl)phthalate	85 E
218-01-9	Chrysene	68 E
205-99-2	Benzo(b)fluoranthene	41
207-08-9	Benzo(k)fluoranthene	19
50-32-8	Benzo(a)pyrene	27
193-39-5	Indeno(1,2,3-cd)pyrene	17
53-70-3	Dibenz(a,h)anthracene	6.1

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	75.5%	d5-Phenol	84.7%
2-Fluorobiphenyl	84.0%	2-Fluorophenol	78.0%
d14-p-Terphenyl	103%	2,4,6-Tribromophenol	96.8%
d4-1,2-Dichlorobenzene	63.6%	d4-2-Chlorophenol	87.4%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574A

LIMS ID: 95-970

Matrix: Sediment

Data Release Authorized: *06/*

Reported: 02/14/95

Sample No: HC-2

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 51.0 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 66.0%

pH: 7.8

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	240
91-57-6	2-Methylnaphthalene	130
208-96-8	Acenaphthylene	48
83-32-9	Acenaphthene	300
132-64-9	Dibenzofuran	350
86-73-7	Fluorene	490
85-01-8	Phenanthrene	2,300 E
120-12-7	Anthracene	890
206-44-0	Fluoranthene	3,100 E
129-00-0	Pyrene	2,400 E
56-55-3	Benzo(a)anthracene	1,000
117-81-7	bis(2-Ethylhexyl)phthalate	1,900 E
218-01-9	Chrysene	1,600 E
205-99-2	Benzo(b)fluoranthene	920
207-08-9	Benzo(k)fluoranthene	440
50-32-8	Benzo(a)pyrene	610
193-39-5	Indeno(1,2,3-cd)pyrene	390
53-70-3	Dibenz(a,h)anthracene	140

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	75.5%	d5-Phenol	84.7%
2-Fluorobiphenyl	84.0%	2-Fluorophenol	78.0%
d14-p-Terphenyl	103%	2,4,6-Tribromophenol	96.8%
d4-1,2-Dichlorobenzene	63.6%	d4-2-Chlorophenol	87.4%



ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-2
Dilution

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Lab Sample ID: J574A

LIMS ID: 95-970

Matrix: Sediment

Data Release Authorized: *AM*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 2.28

Sample Amount: 51.0 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 66.0%

pH: 7.8

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	15
91-57-6	2-Methylnaphthalene	13 U
208-96-8	Acenaphthylene	13 U
83-32-9	Acenaphthene	19
132-64-9	Dibenzofuran	20
86-73-7	Fluorene	31
85-01-8	Phenanthrene	200
120-12-7	Anthracene	61
206-44-0	Fluoranthene	250
129-00-0	Pyrene	220
56-55-3	Benzo(a)anthracene	65
117-81-7	bis(2-Ethylhexyl)phthalate	140
218-01-9	Chrysene	120
205-99-2	Benzo(b)fluoranthene	51
207-08-9	Benzo(k)fluoranthene	54
50-32-8	Benzo(a)pyrene	41
193-39-5	Indeno(1,2,3-cd)pyrene	26
53-70-3	Dibenz(a,h)anthracene	13 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	94.4%	d5-Phenol	97.3%
2-Fluorobiphenyl	123%	2-Fluorophenol	91.5%
d14-p-Terphenyl	157%	2,4,6-Tribromophenol	98.4%
d4-1,2-Dichlorobenzene	94.1%	d4-2-Chlorophenol	102%



**ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574A

LIMS ID: 95-970

Matrix: Sediment

Data Release Authorized: *008*

Reported: 02/14/95

Sample No: HC-2

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 51.0 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 66.0%

pH: 7.8

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	350
91-57-6	2-Methylnaphthalene	290 U
208-96-8	Acenaphthylene	290 U
83-32-9	Acenaphthene	430
132-64-9	Dibenzofuran	460
86-73-7	Fluorene	710
85-01-8	Phenanthrene	4,500
120-12-7	Anthracene	1,400
206-44-0	Fluoranthene	5,600
129-00-0	Pyrene	5,100
56-55-3	Benzo (a) anthracene	1,500
117-81-7	bis (2-Ethylhexyl) phthalate	3,100
218-01-9	Chrysene	2,700
205-99-2	Benzo (b) fluoranthene	1,200
207-08-9	Benzo (k) fluoranthene	1,200
50-32-8	Benzo (a) pyrene	940
193-39-5	Indeno (1,2,3-cd) pyrene	600
53-70-3	Dibenz (a, h) anthracene	290 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	94.4%	d5-Phenol	97.3%
2-Fluorobiphenyl	123%	2-Fluorophenol	91.5%
d14-p-Terphenyl	157%	2,4,6-Tribromophenol	98.4%
d4-1,2-Dichlorobenzene	94.1%	d4-2-Chlorophenol	102%



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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-3

Lab Sample ID: J574B

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *PA*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated.

Project: Shannon Point Seafoods
4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.64

Sample Amount: 52.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 59.7%

pH: 8.1

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	1.2 U
91-57-6	2-Methylnaphthalene	1.2 U
208-96-8	Acenaphthylene	1.2 U
83-32-9	Acenaphthene	1.2 U
132-64-9	Dibenzofuran	1.2 U
86-73-7	Fluorene	1.2 U
85-01-8	Phenanthrene	4.7
120-12-7	Anthracene	2.5
206-44-0	Fluoranthene	18
129-00-0	Pyrene	13
56-55-3	Benzo (a) anthracene	3.6
117-81-7	bis (2-Ethylhexyl) phthalate	2.7
218-01-9	Chrysene	5.8
205-99-2	Benzo (b) fluoranthene	2.3
207-08-9	Benzo (k) fluoranthene	2.6
50-32-8	Benzo (a) pyrene	2.0
193-39-5	Indeno (1,2,3-cd) pyrene	1.2 U
53-70-3	Dibenz (a,h) anthracene	1.2 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	10.9%	d5-Phenol	22.2%
2-Fluorobiphenyl	6.2%	2-Fluorophenol	17.5%
d14-p-Terphenyl	6.3%	2,4,6-Tribromophenol	12.8%
d4-1,2-Dichlorobenzene	4.5%	d4-2-Chlorophenol	16.2%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574B

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *AM*

Reported: 02/14/95

Sample No: HC-3

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 52.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 59.7%

pH: 8.1

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	19 U
91-57-6	2-Methylnaphthalene	19 U
208-96-8	Acenaphthylene	19 U
83-32-9	Acenaphthene	19 U
132-64-9	Dibenzofuran	19 U
86-73-7	Fluorene	19 U
85-01-8	Phenanthrene	77
120-12-7	Anthracene	41
206-44-0	Fluoranthene	290
129-00-0	Pyrene	210
56-55-3	Benzo(a)anthracene	58
117-81-7	bis(2-Ethylhexyl)phthalate	44
218-01-9	Chrysene	95
205-99-2	Benzo(b)fluoranthene	38
207-08-9	Benzo(k)fluoranthene	42
50-32-8	Benzo(a)pyrene	32
193-39-5	Indeno(1,2,3-cd)pyrene	19 U
53-70-3	Dibenz(a,h)anthracene	19 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	10.9%	d5-Phenol	22.2%
2-Fluorobiphenyl	6.2%	2-Fluorophenol	17.5%
d14-p-Terphenyl	6.3%	2,4,6-Tribromophenol	12.8%
d4-1,2-Dichlorobenzene	4.5%	d4-2-Chlorophenol	16.2%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-3
Reextraction

Analytical
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Lab Sample ID: J574BRE

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *asf*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave, North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 02/06/95

Date analyzed: 02/09/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.64

Sample Amount: 14.1 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 59.7%

pH: 8.1

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	4.3 U
91-57-6	2-Methylnaphthalene	4.3 U
208-96-8	Acenaphthylene	4.3 U
83-32-9	Acenaphthene	4.3 U
132-64-9	Dibenzofuran	4.3 U
86-73-7	Fluorene	4.3 U
85-01-8	Phenanthrene	35
120-12-7	Anthracene	15
206-44-0	Fluoranthene	140
129-00-0	Pyrene	92
56-55-3	Benzo(a)anthracene	35
117-81-7	bis(2-Ethylhexyl)phthalate	4.3 U
218-01-9	Chrysene	52
205-99-2	Benzo(b)fluoranthene	24
207-08-9	Benzo(k)fluoranthene	22
50-32-8	Benzo(a)pyrene	20
193-39-5	Indeno(1,2,3-cd)pyrene	11
53-70-3	Dibenz(a,h)anthracene	4.3 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	53.0%	d5-Phenol	62.5%
2-Fluorobiphenyl	71.4%	2-Fluorophenol	52.6%
d14-p-Terphenyl	81.3%	2,4,6-Tribromophenol	71.0%
d4-1,2-Dichlorobenzene	52.2%	d4-2-Chlorophenol	55.2%



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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574B

LIMS ID: 95-971

Matrix: Sediment

Data Release Authorized: *MA*

Reported: 02/14/95

Sample No: HC-3

REEXTRACTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Date extracted: 02/06/95

Date analyzed: 02/09/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 14.1 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 59.7%

pH: 8.1

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	71 U
91-57-6	2-Methylnaphthalene	71 U
208-96-8	Acenaphthylene	71 U
83-32-9	Acenaphthene	71 U
132-64-9	Dibenzofuran	71 U
86-73-7	Fluorene	71 U
85-01-8	Phenanthrene	570
120-12-7	Anthracene	240
206-44-0	Fluoranthene	2,400
129-00-0	Pyrene	1,500
56-55-3	Benzo(a)anthracene	570
117-81-7	bis(2-Ethylhexyl)phthalate	71 U
218-01-9	Chrysene	850
205-99-2	Benzo(b)fluoranthene	400
207-08-9	Benzo(k)fluoranthene	360
50-32-8	Benzo(a)pyrene	330
193-39-5	Indeno(1,2,3-cd)pyrene	180
53-70-3	Dibenz(a,h)anthracene	71 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	53.0%	d5-Phenol	62.5%
2-Fluorobiphenyl	71.4%	2-Fluorophenol	52.6%
d14-p-Terphenyl	81.3%	2,4,6-Tribromophenol	71.0%
d4-1,2-Dichlorobenzene	52.2%	d4-2-Chlorophenol	55.2%



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Semivolatiles by GC/MS
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Sample No: HC-4

Lab Sample ID: J574C

LIMS ID: 95-972

Matrix: Sediment

Data Release Authorized: *MS*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187

(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.64

Sample Amount: 65.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 34.1%

pH: 8.0

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	16
91-57-6	2-Methylnaphthalene	4.8
208-96-8	Acenaphthylene	2.6
83-32-9	Acenaphthene	12
132-64-9	Dibenzofuran	13
86-73-7	Fluorene	17
85-01-8	Phenanthrene	80 E
120-12-7	Anthracene	36
206-44-0	Fluoranthene	100 E
129-00-0	Pyrene	76 E
56-55-3	Benzo(a)anthracene	35
117-81-7	bis(2-Ethylhexyl)phthalate	260 E
218-01-9	Chrysene	50
205-99-2	Benzo(b)fluoranthene	27
207-08-9	Benzo(k)fluoranthene	14
50-32-8	Benzo(a)pyrene	18
193-39-5	Indeno(1,2,3-cd)pyrene	12
53-70-3	Dibenz(a,h)anthracene	3.8

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	74.1%	d5-Phenol	69.8%
2-Fluorobiphenyl	83.8%	2-Fluorophenol	62.1%
d14-p-Terphenyl	79.3%	2,4,6-Tribromophenol	70.4%
d4-1,2-Dichlorobenzene	68.6%	d4-2-Chlorophenol	69.1%



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Semivolatiles by GC/MS

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Lab Sample ID: J574C

LIMS ID: 95-972

Matrix: Sediment

Data Release Authorized: *DM*

Reported: 02/14/95

Sample No: HC-4

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 65.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 34.1%

pH: 8.0

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	260
91-57-6	2-Methylnaphthalene	79
208-96-8	Acenaphthylene	43
83-32-9	Acenaphthene	200
132-64-9	Dibenzofuran	210
86-73-7	Fluorene	280
85-01-8	Phenanthrene	1,300 E
120-12-7	Anthracene	590
206-44-0	Fluoranthene	1,700 E
129-00-0	Pyrene	1,200 E
56-55-3	Benzo (a) anthracene	580
117-81-7	bis (2-Ethylhexyl) phthalate	4,300 E
218-01-9	Chrysene	810
205-99-2	Benzo (b) fluoranthene	440
207-08-9	Benzo (k) fluoranthene	220
50-32-8	Benzo (a) pyrene	300
193-39-5	Indeno (1,2,3-cd) pyrene	190
53-70-3	Dibenz (a,h) anthracene	62

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	74.1%	d5-Phenol	69.8%
2-Fluorobiphenyl	83.8%	2-Fluorophenol	62.1%
d14-p-Terphenyl	79.3%	2,4,6-Tribromophenol	70.4%
d4-1,2-Dichlorobenzene	68.6%	d4-2-Chlorophenol	69.1%



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Semivolatiles by GC/MS
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Sample No: HC-4
Dilution

Analytical
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Consultants

Lab Sample ID: J574C

LIMS ID: 95-972

Matrix: Sediment

Data Release Authorized: *NA*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.64

Sample Amount: 65.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:12

Percent Moisture: 34.1%

pH: 8.0

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	18
91-57-6	2-Methylnaphthalene	11 U
208-96-8	Acenaphthylene	11 U
83-32-9	Acenaphthene	12
132-64-9	Dibenzofuran	11
86-73-7	Fluorene	17
85-01-8	Phenanthrene	110
120-12-7	Anthracene	40
206-44-0	Fluoranthene	160
129-00-0	Pyrene	100
56-55-3	Benzo(a)anthracene	37
117-81-7	bis(2-Ethylhexyl)phthalate	450
218-01-9	Chrysene	59
205-99-2	Benzo(b)fluoranthene	22
207-08-9	Benzo(k)fluoranthene	27
50-32-8	Benzo(a)pyrene	22
193-39-5	Indeno(1,2,3-cd)pyrene	16
53-70-3	Dibenz(a,h)anthracene	11 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.8%	d5-Phenol	46.9%
2-Fluorobiphenyl	71.4%	2-Fluorophenol	55.1%
d14-p-Terphenyl	81.4%	2,4,6-Tribromophenol	55.0%
d4-1,2-Dichlorobenzene	64.6%	d4-2-Chlorophenol	54.7%



**ANALYTICAL
RESOURCES
INCORPORATED**

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Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574C

LIMS ID: 95-972

Matrix: Sediment

Data Release Authorized: *MM*

Reported: 02/14/95

Sample No: HC-4

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 65.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:12

Percent Moisture: 34.1%

pH: 8.0

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	290
91-57-6	2-Methylnaphthalene	180 U
208-96-8	Acenaphthylene	180 U
83-32-9	Acenaphthene	190
132-64-9	Dibenzofuran	180
86-73-7	Fluorene	280
85-01-8	Phenanthrene	1,800
120-12-7	Anthracene	660
206-44-0	Fluoranthene	2,600
129-00-0	Pyrene	1,700
56-55-3	Benzo(a)anthracene	600
117-81-7	bis(2-Ethylhexyl)phthalate	7,400
218-01-9	Chrysene	970
205-99-2	Benzo(b)fluoranthene	360
207-08-9	Benzo(k)fluoranthene	440
50-32-8	Benzo(a)pyrene	360
193-39-5	Indeno(1,2,3-cd)pyrene	260
53-70-3	Dibenz(a,h)anthracene	180 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.8%	d5-Phenol	46.9%
2-Fluorobiphenyl	71.4%	2-Fluorophenol	55.1%
d14-p-Terphenyl	81.4%	2,4,6-Tribromophenol	55.0%
d4-1,2-Dichlorobenzene	64.6%	d4-2-Chlorophenol	54.7%



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Sample No: HC-5

Analytical
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Lab Sample ID: J574D

LIMS ID: 95-973

Matrix: Sediment

Data Release Authorized: *OK*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.56

Sample Amount: 52.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 51.9%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	18
91-57-6	2-Methylnaphthalene	30
208-96-8	Acenaphthylene	11
83-32-9	Acenaphthene	66
132-64-9	Dibenzofuran	90 E
86-73-7	Fluorene	90 E
85-01-8	Phenanthrene	400 E
120-12-7	Anthracene	36
206-44-0	Fluoranthene	320 E
129-00-0	Pyrene	200 E
56-55-3	Benzo(a)anthracene	49
117-81-7	bis(2-Ethylhexyl)phthalate	7.6
218-01-9	Chrysene	100 E
205-99-2	Benzo(b)fluoranthene	30
207-08-9	Benzo(k)fluoranthene	31
50-32-8	Benzo(a)pyrene	20
193-39-5	Indeno(1,2,3-cd)pyrene	11
53-70-3	Dibenz(a,h)anthracene	3.9

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	61.9%	d5-Phenol	63.5%
2-Fluorobiphenyl	71.5%	2-Fluorophenol	57.0%
d14-p-Terphenyl	70.6%	2,4,6-Tribromophenol	68.8%
d4-1,2-Dichlorobenzene	57.5%	d4-2-Chlorophenol	62.7%



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Semivolatiles by GC/MS

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Lab Sample ID: J574D

LIMS ID: 95-973

Matrix: Sediment

Data Release Authorized: *DA*

Reported: 02/14/95

Sample No: HC-5

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 52.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 51.9%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	280
91-57-6	2-Methylnaphthalene	460
208-96-8	Acenaphthylene	180
83-32-9	Acenaphthene	1,000
132-64-9	Dibenzofuran	1,400 E
86-73-7	Fluorene	1,400 E
85-01-8	Phenanthrene	6,200 E
120-12-7	Anthracene	560
206-44-0	Fluoranthene	5,000 E
129-00-0	Pyrene	3,200 E
56-55-3	Benzo (a) anthracene	760
117-81-7	bis (2-Ethylhexyl) phthalate	120
218-01-9	Chrysene	1,600 E
205-99-2	Benzo (b) fluoranthene	470
207-08-9	Benzo (k) fluoranthene	480
50-32-8	Benzo (a) pyrene	320
193-39-5	Indeno (1,2,3-cd) pyrene	180
53-70-3	Dibenz (a,h) anthracene	60

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	61.9%	d5-Phenol	63.5%
2-Fluorobiphenyl	71.5%	2-Fluorophenol	57.0%
d14-p-Terphenyl	70.6%	2,4,6-Tribromophenol	68.8%
d4-1,2-Dichlorobenzene	57.5%	d4-2-Chlorophenol	62.7%



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Semivolatiles by GC/MS
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Sample No: HC-5
Dilution

Analytical
Chemists &
Consultants

Lab Sample ID: J574D

LIMS ID: 95-973

Matrix: Sediment

Data Release Authorized: *MA*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 1.56

Sample Amount: 52.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 51.9%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	18 U
91-57-6	2-Methylnaphthalene	31
208-96-8	Acenaphthylene	18 U
83-32-9	Acenaphthene	71
132-64-9	Dibenzofuran	95
86-73-7	Fluorene	100
85-01-8	Phenanthrene	740
120-12-7	Anthracene	37
206-44-0	Fluoranthene	450
129-00-0	Pyrene	400
56-55-3	Benzo(a)anthracene	42
117-81-7	bis(2-Ethylhexyl)phthalate	18 U
218-01-9	Chrysene	110
205-99-2	Benzo(b)fluoranthene	30
207-08-9	Benzo(k)fluoranthene	44
50-32-8	Benzo(a)pyrene	24
193-39-5	Indeno(1,2,3-cd)pyrene	18 U
53-70-3	Dibenz(a,h)anthracene	18 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	40.4%	d5-Phenol	37.1%
2-Fluorobiphenyl	58.7%	2-Fluorophenol	43.3%
d14-p-Terphenyl	76.3%	2,4,6-Tribromophenol	50.4%
d4-1,2-Dichlorobenzene	54.0%	d4-2-Chlorophenol	41.1%



**ANALYTICAL
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Semivolatiles by GC/MS

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Lab Sample ID: J574D

LIMS ID: 95-973

Matrix: Sediment

Data Release Authorized: *AM*

Reported: 02/14/95

Sample No: HC-5

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 52.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 51.9%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	280 U
91-57-6	2-Methylnaphthalene	480
208-96-8	Acenaphthylene	280 U
83-32-9	Acenaphthene	1,100
132-64-9	Dibenzofuran	1,500
86-73-7	Fluorene	1,600
85-01-8	Phenanthrene	12,000
120-12-7	Anthracene	580
206-44-0	Fluoranthene	7,000
129-00-0	Pyrene	6,200
56-55-3	Benzo(a)anthracene	650
117-81-7	bis(2-Ethylhexyl)phthalate	280 U
218-01-9	Chrysene	1,700
205-99-2	Benzo(b)fluoranthene	460
207-08-9	Benzo(k)fluoranthene	690
50-32-8	Benzo(a)pyrene	370
193-39-5	Indeno(1,2,3-cd)pyrene	280 U
53-70-3	Dibenz(a,h)anthracene	280 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	40.4%	d5-Phenol	37.1%
2-Fluorobiphenyl	58.7%	2-Fluorophenol	43.3%
d14-p-Terphenyl	76.3%	2,4,6-Tribromophenol	50.4%
d4-1,2-Dichlorobenzene	54.0%	d4-2-Chlorophenol	41.1%



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Semivolatiles by GC/MS

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Sample No: HC-7

Lab Sample ID: J574E

LIMS ID: 95-974

Matrix: Sediment

Data Release Authorized: *004*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINNS

GPC Cleanup: YES

Percent TOC: 2.89

Sample Amount: 59.2 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 40.8%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	14
91-57-6	2-Methylnaphthalene	2.9
208-96-8	Acenaphthylene	2.6
83-32-9	Acenaphthene	6.5
132-64-9	Dibenzofuran	6.4
86-73-7	Fluorene	7.5
85-01-8	Phenanthrene	31
120-12-7	Anthracene	17
206-44-0	Fluoranthene	88 E
129-00-0	Pyrene	80 E
56-55-3	Benzo(a)anthracene	37 E
117-81-7	bis(2-Ethylhexyl)phthalate	180 E
218-01-9	Chrysene	52 E
205-99-2	Benzo(b)fluoranthene	28
207-08-9	Benzo(k)fluoranthene	27
50-32-8	Benzo(a)pyrene	30
193-39-5	Indeno(1,2,3-cd)pyrene	15
53-70-3	Dibenz(a,h)anthracene	4.2

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	66.3%	d5-Phenol	66.9%
2-Fluorobiphenyl	81.4%	2-Fluorophenol	60.1%
d14-p-Terphenyl	80.0%	2,4,6-Tribromophenol	77.2%
d4-1,2-Dichlorobenzene	68.2%	d4-2-Chlorophenol	69.1%



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RESOURCES
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Semivolatiles by GC/MS

Sample No: HC-7

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Lab Sample ID: J574E

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-974

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *MM*

Date Sampled: 01/25/95

Reported: 02/14/95

Date Received: 01/26/95

Analytical
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Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Sample Amount: 59.2 g-dry-wt

Date analyzed: 02/03/95

Final Extract Volume: 1.0 mL

Instrument: FINN8

Dilution Factor: 1:1

GPC Cleanup: YES

Percent Moisture: 40.8%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	400
91-57-6	2-Methylnaphthalene	84
208-96-8	Acenaphthylene	75
83-32-9	Acenaphthene	190
132-64-9	Dibenzofuran	180
86-73-7	Fluorene	220
85-01-8	Phenanthrene	900
120-12-7	Anthracene	480
206-44-0	Fluoranthene	2,600 E
129-00-0	Pyrene	2,300 E
56-55-3	Benzo(a)anthracene	1,100 E
117-81-7	bis(2-Ethylhexyl)phthalate	5,300 E
218-01-9	Chrysene	1,500 E
205-99-2	Benzo(b)fluoranthene	810
207-08-9	Benzo(k)fluoranthene	770
50-32-8	Benzo(a)pyrene	860
193-39-5	Indeno(1,2,3-cd)pyrene	420
53-70-3	Dibenz(a,h)anthracene	120

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	66.3%	d5-Phenol	66.9%
2-Fluorobiphenyl	81.4%	2-Fluorophenol	60.1%
d14-p-Terphenyl	80.0%	2,4,6-Tribromophenol	77.2%
d4-1,2-Dichlorobenzene	68.2%	d4-2-Chlorophenol	69.1%



**ANALYTICAL
RESOURCES
INCORPORATED**

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Semivolatiles by GC/MS
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Sample No: HC-7
Dilution

Analytical
Chemists &
Consultants

Lab Sample ID: J574E

LIMS ID: 95-974

Matrix: Sediment

Data Release Authorized: *MM*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Percent TOC: 2.89

Sample Amount: 59.2 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 40.8%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	15
91-57-6	2-Methylnaphthalene	8.8 U
208-96-8	Acenaphthylene	8.8 U
83-32-9	Acenaphthene	8.8 U
132-64-9	Dibenzofuran	8.8 U
86-73-7	Fluorene	8.8 U
85-01-8	Phenanthrene	35
120-12-7	Anthracene	18
206-44-0	Fluoranthene	100
129-00-0	Pyrene	140
56-55-3	Benzo(a)anthracene	37
117-81-7	bis(2-Ethylhexyl)phthalate	470
218-01-9	Chrysene	61
205-99-2	Benzo(b)fluoranthene	28
207-08-9	Benzo(k)fluoranthene	36
50-32-8	Benzo(a)pyrene	34
193-39-5	Indeno(1,2,3-cd)pyrene	22
53-70-3	Dibenz(a,h)anthracene	8.8 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	46.7%	d5-Phenol	46.0%
2-Fluorobiphenyl	68.9%	2-Fluorophenol	54.2%
d14-p-Terphenyl	94.3%	2,4,6-Tribromophenol	45.1%
d4-1,2-Dichlorobenzene	63.1%	d4-2-Chlorophenol	51.6%



**ANALYTICAL
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Analytical
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Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574E

LIMS ID: 95-974

Matrix: Sediment

Data Release Authorized: *MP*

Reported: 02/14/95

Sample No: HC-7

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN8

GPC Cleanup: YES

Sample Amount: 59.2 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:15

Percent Moisture: 40.8%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	430
91-57-6	2-Methylnaphthalene	250 U
208-96-8	Acenaphthylene	250 U
83-32-9	Acenaphthene	250 U
132-64-9	Dibenzofuran	250 U
86-73-7	Fluorene	250 U
85-01-8	Phenanthrene	1,000
120-12-7	Anthracene	530
206-44-0	Fluoranthene	3,000
129-00-0	Pyrene	4,000
56-55-3	Benzo(a)anthracene	1,100
117-81-7	bis(2-Ethylhexyl)phthalate	14,000
218-01-9	Chrysene	1,800
205-99-2	Benzo(b)fluoranthene	800
207-08-9	Benzo(k)fluoranthene	1,000
50-32-8	Benzo(a)pyrene	990
193-39-5	Indeno(1,2,3-cd)pyrene	640
53-70-3	Dibenz(a,h)anthracene	250 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	46.7%	d5-Phenol	46.0%
2-Fluorobiphenyl	68.9%	2-Fluorophenol	54.2%
d14-p-Terphenyl	94.3%	2,4,6-Tribromophenol	45.1%
d4-1,2-Dichlorobenzene	63.1%	d4-2-Chlorophenol	51.6%



**ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-8

Lab Sample ID: J574F

LIMS ID: 95-975

Matrix: Sediment

Data Release Authorized: *mm*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 0.40

Sample Amount: 73.2 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 26.9%

pH: 7.8

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	3.4 U
91-57-6	2-Methylnaphthalene	3.4 U
208-96-8	Acenaphthylene	3.4 U
83-32-9	Acenaphthene	3.4 U
132-64-9	Dibenzofuran	3.4 U
86-73-7	Fluorene	3.4 U
85-01-8	Phenanthrene	16
120-12-7	Anthracene	5.0
206-44-0	Fluoranthene	34
129-00-0	Pyrene	26
56-55-3	Benzo(a)anthracene	10
117-81-7	bis(2-Ethylhexyl)phthalate	11
218-01-9	Chrysene	18
205-99-2	Benzo(b)fluoranthene	10
207-08-9	Benzo(k)fluoranthene	10
50-32-8	Benzo(a)pyrene	6.8
193-39-5	Indeno(1,2,3-cd)pyrene	3.8
53-70-3	Dibenz(a,h)anthracene	3.4 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	52.6%	d5-Phenol	56.5%
2-Fluorobiphenyl	69.9%	2-Fluorophenol	63.0%
d14-p-Terphenyl	76.8%	2,4,6-Tribromophenol	78.3%
d4-1,2-Dichlorobenzene	51.9%	d4-2-Chlorophenol	60.6%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574F

LIMS ID: 95-975

Matrix: Sediment

Data Release Authorized: *DBA*

Reported: 02/14/95

Sample No: HC-8

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 73.2 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 26.9%

pH: 7.8

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	14 U
91-57-6	2-Methylnaphthalene	14 U
208-96-8	Acenaphthylene	14 U
83-32-9	Acenaphthene	14 U
132-64-9	Dibenzofuran	14 U
86-73-7	Fluorene	14 U
85-01-8	Phenanthrene	64
120-12-7	Anthracene	20
206-44-0	Fluoranthene	140
129-00-0	Pyrene	110
56-55-3	Benzo(a)anthracene	41
117-81-7	bis(2-Ethylhexyl)phthalate	43
218-01-9	Chrysene	73
205-99-2	Benzo(b)fluoranthene	40
207-08-9	Benzo(k)fluoranthene	42
50-32-8	Benzo(a)pyrene	28
193-39-5	Indeno(1,2,3-cd)pyrene	16
53-70-3	Dibenz(a,h)anthracene	14 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	52.6%	d5-Phenol	56.5%
2-Fluorobiphenyl	69.9%	2-Fluorophenol	63.0%
d14-p-Terphenyl	76.8%	2,4,6-Tribromophenol	78.3%
d4-1,2-Dichlorobenzene	51.9%	d4-2-Chlorophenol	60.6%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-9

Analytical
Chemists &
Consultants

Lab Sample ID: J574G

LIMS ID: 95-976

Matrix: Sediment

Data Release Authorized: *[Signature]*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 0.97

Sample Amount: 76.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 23.7%

pH: 8.3

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	1.3 U
91-57-6	2-Methylnaphthalene	1.3 U
208-96-8	Acenaphthylene	1.3 U
83-32-9	Acenaphthene	1.3 U
132-64-9	Dibenzofuran	1.3 U
86-73-7	Fluorene	1.3 U
85-01-8	Phenanthrene	6.3
120-12-7	Anthracene	1.4
206-44-0	Fluoranthene	11
129-00-0	Pyrene	8.4
56-55-3	Benzo(a)anthracene	3.3
117-81-7	bis(2-Ethylhexyl)phthalate	1.3 U
218-01-9	Chrysene	7.1
205-99-2	Benzo(b)fluoranthene	3.2
207-08-9	Benzo(k)fluoranthene	2.7
50-32-8	Benzo(a)pyrene	2.5
193-39-5	Indeno(1,2,3-cd)pyrene	1.3 U
53-70-3	Dibenz(a,h)anthracene	1.3 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	43.9%	d5-Phenol	49.2%
2-Fluorobiphenyl	61.1%	2-Fluorophenol	50.2%
d14-p-Terphenyl	79.6%	2,4,6-Tribromophenol	82.7%
d4-1,2-Dichlorobenzene	42.1%	d4-2-Chlorophenol	48.4%



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574G

LIMS ID: 95-976

Matrix: Sediment

Data Release Authorized: *UMA*

Reported: 02/14/95

Sample No: HC-9

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 76.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 23.7%

pH: 8.3

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	13 U
91-57-6	2-Methylnaphthalene	13 U
208-96-8	Acenaphthylene	13 U
83-32-9	Acenaphthene	13 U
132-64-9	Dibenzofuran	13 U
86-73-7	Fluorene	13 U
85-01-8	Phenanthrene	61
120-12-7	Anthracene	14
206-44-0	Fluoranthene	110
129-00-0	Pyrene	82
56-55-3	Benzo(a)anthracene	32
117-81-7	bis(2-Ethylhexyl)phthalate	13 U
218-01-9	Chrysene	69
205-99-2	Benzo(b)fluoranthene	31
207-08-9	Benzo(k)fluoranthene	26
50-32-8	Benzo(a)pyrene	24
193-39-5	Indeno(1,2,3-cd)pyrene	13 U
53-70-3	Dibenz(a,h)anthracene	13 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	43.9%	d5-Phenol	49.2%
2-Fluorobiphenyl	61.1%	2-Fluorophenol	50.2%
d14-p-Terphenyl	79.6%	2,4,6-Tribromophenol	82.7%
d4-1,2-Dichlorobenzene	42.1%	d4-2-Chlorophenol	48.4%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-9
Matrix Spike

Analytical
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Consultants

Lab Sample ID: J574GMS

LIMS ID: 95-976

Matrix: Sediment

Data Release Authorized: ~~Yes~~

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 0.97

Sample Amount: 76.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 23.7%

pH: 8.3

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	1.3 U
91-57-6	2-Methylnaphthalene	1.3 U
208-96-8	Acenaphthylene	1.3 U
83-32-9	Acenaphthene	---
132-64-9	Dibenzofuran	1.3 U
86-73-7	Fluorene	1.3 U
85-01-8	Phenanthrene	3.8
120-12-7	Anthracene	1.3 U
206-44-0	Fluoranthene	13
129-00-0	Pyrene	---
56-55-3	Benzo(a)anthracene	3.0
117-81-7	bis(2-Ethylhexyl)phthalate	1.4
218-01-9	Chrysene	6.1
205-99-2	Benzo(b)fluoranthene	2.9
207-08-9	Benzo(k)fluoranthene	2.9
50-32-8	Benzo(a)pyrene	1.6
193-39-5	Indeno(1,2,3-cd)pyrene	1.3 U
53-70-3	Dibenz(a,h)anthracene	1.3 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	40.8%	d5-Phenol	48.1%
2-Fluorobiphenyl	61.7%	2-Fluorophenol	45.2%
d14-p-Terphenyl	74.4%	2,4,6-Tribromophenol	75.1%
d4-1,2-Dichlorobenzene	40.2%	d4-2-Chlorophenol	43.7%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574G-MS

LIMS ID: 95-976

Matrix: Sediment

Data Release Authorized: *RAH*

Reported: 02/14/95

Sample No: HC-9

MATRIX SPIKE

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
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333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 76.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 23.7%

pH: 8.3

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	13 U
91-57-6	2-Methylnaphthalene	13 U
208-96-8	Acenaphthylene	13 U
83-32-9	Acenaphthene	---
132-64-9	Dibenzofuran	13 U
86-73-7	Fluorene	13 U
85-01-8	Phenanthrene	37
120-12-7	Anthracene	13 U
206-44-0	Fluoranthene	120
129-00-0	Pyrene	---
56-55-3	Benzo(a)anthracene	29
117-81-7	bis(2-Ethylhexyl)phthalate	14
218-01-9	Chrysene	59
205-99-2	Benzo(b)fluoranthene	28
207-08-9	Benzo(k)fluoranthene	28
50-32-8	Benzo(a)pyrene	15
193-39-5	Indeno(1,2,3-cd)pyrene	13 U
53-70-3	Dibenz(a,h)anthracene	13 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	40.8%	d5-Phenol	48.1%
2-Fluorobiphenyl	61.7%	2-Fluorophenol	45.2%
d14-p-Terphenyl	74.4%	2,4,6-Tribromophenol	75.1%
d4-1,2-Dichlorobenzene	40.2%	d4-2-Chlorophenol	43.7%



**ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-9
Spike Duplicate

Lab Sample ID: J574GMSD
LIMS ID: 95-976
Matrix: Sediment
Data Release Authorized: *OM*
Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05
Date Sampled: 01/25/95
Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95
Date analyzed: 02/03/95
Instrument: FINN2
GPC Cleanup: YES
Percent TOC: 0.97

Sample Amount: 76.4 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 23.7%
pH: 8.3

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	1.3 U
91-57-6	2-Methylnaphthalene	1.3 U
208-96-8	Acenaphthylene	1.3 U
83-32-9	Acenaphthene	---
132-64-9	Dibenzofuran	1.3 U
86-73-7	Fluorene	1.3 U
85-01-8	Phenanthrene	2.4
120-12-7	Anthracene	1.3 U
206-44-0	Fluoranthene	7.7
129-00-0	Pyrene	---
56-55-3	Benzo (a) anthracene	1.9
117-81-7	bis (2-Ethylhexyl) phthalate	1.3 U
218-01-9	Chrysene	4.1
205-99-2	Benzo (b) fluoranthene	1.6
207-08-9	Benzo (k) fluoranthene	1.9
50-32-8	Benzo (a) pyrene	1.3 U
193-39-5	Indeno (1,2,3-cd) pyrene	1.3 U
53-70-3	Dibenz (a,h) anthracene	1.3 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.7%	d5-Phenol	60.8%
2-Fluorobiphenyl	71.1%	2-Fluorophenol	68.7%
d14-p-Terphenyl	76.0%	2,4,6-Tribromophenol	76.9%
d4-1,2-Dichlorobenzene	58.3%	d4-2-Chlorophenol	59.6%



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574G-MSD

LIMS ID: 95-976

Matrix: Sediment

Data Release Authorized: *AK*

Reported: 02/14/95

Sample No: HC-9

SPIKE DUPLICATE

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 76.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 23.7%

pH: 8.3

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	13 U
91-57-6	2-Methylnaphthalene	13 U
208-96-8	Acenaphthylene	13 U
83-32-9	Acenaphthene	---
132-64-9	Dibenzofuran	13 U
86-73-7	Fluorene	13 U
85-01-8	Phenanthrene	23
120-12-7	Anthracene	13 U
206-44-0	Fluoranthene	75
129-00-0	Pyrene	---
56-55-3	Benzo(a)anthracene	19
117-81-7	bis(2-Ethylhexyl)phthalate	13 U
218-01-9	Chrysene	39
205-99-2	Benzo(b)fluoranthene	16
207-08-9	Benzo(k)fluoranthene	19
50-32-8	Benzo(a)pyrene	13 U
193-39-5	Indeno(1,2,3-cd)pyrene	13 U
53-70-3	Dibenz(a,h)anthracene	13 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.7%	d5-Phenol	60.8%
2-Fluorobiphenyl	71.1%	2-Fluorophenol	68.7%
d14-p-Terphenyl	76.0%	2,4,6-Tribromophenol	76.9%
d4-1,2-Dichlorobenzene	58.3%	d4-2-Chlorophenol	59.6%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-10

Analytical
Chemists &
Consultants

Lab Sample ID: J574H

LIMS ID: 95-977

Matrix: Sediment

Data Release Authorized: *AM*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.50

Sample Amount: 59.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 40.2%

pH: 8.2

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	1.4
91-57-6	2-Methylnaphthalene	2.1
208-96-8	Acenaphthylene	1.1 U
83-32-9	Acenaphthene	4.0
132-64-9	Dibenzofuran	4.4
86-73-7	Fluorene	8.7
85-01-8	Phenanthrene	46
120-12-7	Anthracene	30
206-44-0	Fluoranthene	130 E
129-00-0	Pyrene	97 E
56-55-3	Benzo(a)anthracene	53
117-81-7	bis(2-Ethylhexyl)phthalate	64
218-01-9	Chrysene	69 E
205-99-2	Benzo(b)fluoranthene	42
207-08-9	Benzo(k)fluoranthene	36
50-32-8	Benzo(a)pyrene	27
193-39-5	Indeno(1,2,3-cd)pyrene	11
53-70-3	Dibenz(a,h)anthracene	5.6

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	55.7%	d5-Phenol	58.8%
2-Fluorobiphenyl	71.7%	2-Fluorophenol	65.8%
d14-p-Terphenyl	72.3%	2,4,6-Tribromophenol	77.9%
d4-1,2-Dichlorobenzene	53.0%	d4-2-Chlorophenol	62.9%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample No: HC-10

Analytical
Chemists &
Consultants

Page 1 of 1

Lab Sample ID: J574H

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-977

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *AM*

Date Sampled: 01/25/95

Reported: 02/14/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Sample Amount: 59.9 g-dry-wt

Date analyzed: 02/03/95

Final Extract Volume: 1.0 mL

Instrument: FINN2

Dilution Factor: 1:1

GPC Cleanup: YES

Percent Moisture: 40.2%

pH: 8.2

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	21
91-57-6	2-Methylnaphthalene	32
208-96-8	Acenaphthylene	17 U
83-32-9	Acenaphthene	59
132-64-9	Dibenzofuran	66
86-73-7	Fluorene	130
85-01-8	Phenanthrene	680
120-12-7	Anthracene	450
206-44-0	Fluoranthene	2,000 E
129-00-0	Pyrene	1,400 E
56-55-3	Benzo(a)anthracene	800
117-81-7	bis(2-Ethylhexyl)phthalate	960
218-01-9	Chrysene	1,000 E
205-99-2	Benzo(b)fluoranthene	620
207-08-9	Benzo(k)fluoranthene	530
50-32-8	Benzo(a)pyrene	400
193-39-5	Indeno(1,2,3-cd)pyrene	160
53-70-3	Dibenz(a,h)anthracene	84

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	55.7%	d5-Phenol	58.8%
2-Fluorobiphenyl	71.7%	2-Fluorophenol	65.8%
d14-p-Terphenyl	72.3%	2,4,6-Tribromophenol	77.9%
d4-1,2-Dichlorobenzene	53.0%	d4-2-Chlorophenol	62.9%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-10
Dilution

Analytical
Chemists &
Consultants

Lab Sample ID: J574H

LIMS ID: 95-977

Matrix: Sediment

Data Release Authorized: *DAF*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.50

Sample Amount: 59.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 40.2%

pH: 8.2

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	5.6 U
91-57-6	2-Methylnaphthalene	5.6 U
208-96-8	Acenaphthylene	5.6 U
83-32-9	Acenaphthene	5.6 U
132-64-9	Dibenzofuran	5.6 U
86-73-7	Fluorene	7.3
85-01-8	Phenanthrene	44
120-12-7	Anthracene	29
206-44-0	Fluoranthene	190
129-00-0	Pyrene	120
56-55-3	Benzo(a)anthracene	46
117-81-7	bis(2-Ethylhexyl)phthalate	61
218-01-9	Chrysene	75
205-99-2	Benzo(b)fluoranthene	38
207-08-9	Benzo(k)fluoranthene	40
50-32-8	Benzo(a)pyrene	27
193-39-5	Indeno(1,2,3-cd)pyrene	11
53-70-3	Dibenz(a,h)anthracene	5.6 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	33.7%	d5-Phenol	39.3%
2-Fluorobiphenyl	67.6%	2-Fluorophenol	45.8%
d14-p-Terphenyl	64.7%	2,4,6-Tribromophenol	54.4%
d4-1,2-Dichlorobenzene	50.8%	d4-2-Chlorophenol	53.3%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574H

LIMS ID: 95-977

Matrix: Sediment

Data Release Authorized: *MA*

Reported: 02/14/95

Sample No: HC-10

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 59.9 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 40.2%

pH: 8.2

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	84 U
91-57-6	2-Methylnaphthalene	84 U
208-96-8	Acenaphthylene	84 U
83-32-9	Acenaphthene	84 U
132-64-9	Dibenzofuran	84 U
86-73-7	Fluorene	110
85-01-8	Phenanthrene	660
120-12-7	Anthracene	430
206-44-0	Fluoranthene	2,900
129-00-0	Pyrene	1,900
56-55-3	Benzo(a)anthracene	700
117-81-7	bis(2-Ethylhexyl)phthalate	920
218-01-9	Chrysene	1,100
205-99-2	Benzo(b)fluoranthene	570
207-08-9	Benzo(k)fluoranthene	600
50-32-8	Benzo(a)pyrene	400
193-39-5	Indeno(1,2,3-cd)pyrene	160
53-70-3	Dibenz(a,h)anthracene	84 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	33.7%	d5-Phenol	39.3%
2-Fluorobiphenyl	67.6%	2-Fluorophenol	45.8%
d14-p-Terphenyl	64.7%	2,4,6-Tribromophenol	54.4%
d4-1,2-Dichlorobenzene	50.8%	d4-2-Chlorophenol	53.3%



ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-11

Analytical
Chemists &
Consultants

Lab Sample ID: J574I

LIMS ID: 95-978

Matrix: Sediment

Data Release Authorized: *DM*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.90

Sample Amount: 59.7 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 40.3%

pH: 7.8

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	3.6
91-57-6	2-Methylnaphthalene	1.6
208-96-8	Acenaphthylene	0.9
83-32-9	Acenaphthene	4.8
132-64-9	Dibenzofuran	4.8
86-73-7	Fluorene	7.1
85-01-8	Phenanthrene	37
120-12-7	Anthracene	17
206-44-0	Fluoranthene	61 E
129-00-0	Pyrene	49
56-55-3	Benzo(a)anthracene	25
117-81-7	bis(2-Ethylhexyl)phthalate	26
218-01-9	Chrysene	45
205-99-2	Benzo(b)fluoranthene	24
207-08-9	Benzo(k)fluoranthene	15
50-32-8	Benzo(a)pyrene	14
193-39-5	Indeno(1,2,3-cd)pyrene	5.6
53-70-3	Dibenz(a,h)anthracene	2.6

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.8%	d5-Phenol	57.2%
2-Fluorobiphenyl	73.0%	2-Fluorophenol	65.6%
d14-p-Terphenyl	72.9%	2,4,6-Tribromophenol	79.4%
d4-1,2-Dichlorobenzene	56.4%	d4-2-Chlorophenol	61.5%



ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample No: HC-11

Page 1 of 1

Lab Sample ID: J574I

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-978

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: *OK*

Date Sampled: 01/25/95

Reported: 02/14/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Sample Amount: 59.7 g-dry-wt

Date analyzed: 02/03/95

Final Extract Volume: 1.0 mL

Instrument: FINN2

Dilution Factor: 1:1

GPC Cleanup: YES

Percent Moisture: 40.3%

pH: 7.8

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	68
91-57-6	2-Methylnaphthalene	31
208-96-8	Acenaphthylene	17
83-32-9	Acenaphthene	91
132-64-9	Dibenzofuran	90
86-73-7	Fluorene	140
85-01-8	Phenanthrene	700
120-12-7	Anthracene	330
206-44-0	Fluoranthene	1,200 E
129-00-0	Pyrene	920
56-55-3	Benzo(a)anthracene	470
117-81-7	bis(2-Ethylhexyl)phthalate	500
218-01-9	Chrysene	850
205-99-2	Benzo(b)fluoranthene	460
207-08-9	Benzo(k)fluoranthene	290
50-32-8	Benzo(a)pyrene	270
193-39-5	Indeno(1,2,3-cd)pyrene	110
53-70-3	Dibenz(a,h)anthracene	50

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	57.8%	d5-Phenol	57.2%
2-Fluorobiphenyl	73.0%	2-Fluorophenol	65.6%
d14-p-Terphenyl	72.9%	2,4,6-Tribromophenol	79.4%
d4-1,2-Dichlorobenzene	56.4%	d4-2-Chlorophenol	61.5%



**ANALYTICAL
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INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-11
Dilution

Analytical
Chemists &
Consultants

Lab Sample ID: J574I

LIMS ID: 95-978

Matrix: Sediment

Data Release Authorized: *AW*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.90

Sample Amount: 59.7 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 40.3%

pH: 7.8

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	4.4 U
91-57-6	2-Methylnaphthalene	4.4 U
208-96-8	Acenaphthylene	4.4 U
83-32-9	Acenaphthene	4.4 U
132-64-9	Dibenzofuran	4.4 U
86-73-7	Fluorene	6.3
85-01-8	Phenanthrene	35
120-12-7	Anthracene	17
206-44-0	Fluoranthene	76
129-00-0	Pyrene	51
56-55-3	Benzo(a)anthracene	23
117-81-7	bis(2-Ethylhexyl)phthalate	25
218-01-9	Chrysene	49
205-99-2	Benzo(b)fluoranthene	17
207-08-9	Benzo(k)fluoranthene	22
50-32-8	Benzo(a)pyrene	15
193-39-5	Indeno(1,2,3-cd)pyrene	5.6
53-70-3	Dibenz(a,h)anthracene	4.4 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	38.9%	d5-Phenol	36.4%
2-Fluorobiphenyl	68.1%	2-Fluorophenol	45.0%
d14-p-Terphenyl	68.6%	2,4,6-Tribromophenol	56.4%
d4-1,2-Dichlorobenzene	55.1%	d4-2-Chlorophenol	54.3%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574I

LIMS ID: 95-978

Matrix: Sediment

Data Release Authorized: *DM*

Reported: 02/14/95

Sample No: HC-11

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 59.7 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 40.3%

pH: 7.8

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	84 U
91-57-6	2-Methylnaphthalene	84 U
208-96-8	Acenaphthylene	84 U
83-32-9	Acenaphthene	84 U
132-64-9	Dibenzofuran	84 U
86-73-7	Fluorene	120
85-01-8	Phenanthrene	670
120-12-7	Anthracene	320
206-44-0	Fluoranthene	1,400
129-00-0	Pyrene	970
56-55-3	Benzo (a) anthracene	440
117-81-7	bis (2-Ethylhexyl) phthalate	480
218-01-9	Chrysene	940
205-99-2	Benzo (b) fluoranthene	330
207-08-9	Benzo (k) fluoranthene	420
50-32-8	Benzo (a) pyrene	280
193-39-5	Indeno (1,2,3-cd) pyrene	110
53-70-3	Dibenz (a,h) anthracene	84 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	38.9%	d5-Phenol	36.4%
2-Fluorobiphenyl	68.1%	2-Fluorophenol	45.0%
d14-p-Terphenyl	68.6%	2,4,6-Tribromophenol	56.4%
d4-1,2-Dichlorobenzene	55.1%	d4-2-Chlorophenol	54.3%



ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-12

Analytical
Chemists &
Consultants

Lab Sample ID: J574J

LIMS ID: 95-979

Matrix: Sediment

Data Release Authorized: *DAI*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.30

Sample Amount: 62.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:1

Percent Moisture: 37.6%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	6.4
91-57-6	2-Methylnaphthalene	2.9
208-96-8	Acenaphthylene	1.4
83-32-9	Acenaphthene	7.4
132-64-9	Dibenzofuran	7.5
86-73-7	Fluorene	11
85-01-8	Phenanthrene	50
120-12-7	Anthracene	38
206-44-0	Fluoranthene	93 E
129-00-0	Pyrene	64
56-55-3	Benzo(a)anthracene	38
117-81-7	bis(2-Ethylhexyl)phthalate	15
218-01-9	Chrysene	55
205-99-2	Benzo(b)fluoranthene	35
207-08-9	Benzo(k)fluoranthene	24
50-32-8	Benzo(a)pyrene	20
193-39-5	Indeno(1,2,3-cd)pyrene	6.7
53-70-3	Dibenz(a,h)anthracene	3.3

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	61.5%	d5-Phenol	60.1%
2-Fluorobiphenyl	74.4%	2-Fluorophenol	70.0%
d14-p-Terphenyl	71.3%	2,4,6-Tribromophenol	82.9%
d4-1,2-Dichlorobenzene	61.4%	d4-2-Chlorophenol	65.0%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Sample No: HC-12

Page 1 of 1

Lab Sample ID: J574J

QC Report No: J574-Hart Crowser, Incorporated

LIMS ID: 95-979

Project: Shannon Point Seafoods

Matrix: Sediment

4096-05

Data Release Authorized: ~~000~~

Date Sampled: 01/25/95

Reported: 02/14/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Sample Amount: 62.4 g-dry-wt

Date analyzed: 02/03/95

Final Extract Volume: 1.0 mL

Instrument: FINN2

Dilution Factor: 1:1

GPC Cleanup: YES

Percent Moisture: 37.6%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	83
91-57-6	2-Methylnaphthalene	38
208-96-8	Acenaphthylene	19
83-32-9	Acenaphthene	96
132-64-9	Dibenzofuran	97
86-73-7	Fluorene	140
85-01-8	Phenanthrene	660
120-12-7	Anthracene	500
206-44-0	Fluoranthene	1,200 E
129-00-0	Pyrene	840
56-55-3	Benzo(a)anthracene	490
117-81-7	bis(2-Ethylhexyl)phthalate	200
218-01-9	Chrysene	710
205-99-2	Benzo(b)fluoranthene	450
207-08-9	Benzo(k)fluoranthene	320
50-32-8	Benzo(a)pyrene	260
193-39-5	Indeno(1,2,3-cd)pyrene	86
53-70-3	Dibenz(a,h)anthracene	43

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	61.5%	d5-Phenol	60.1%
2-Fluorobiphenyl	74.4%	2-Fluorophenol	70.0%
d14-p-Terphenyl	71.3%	2,4,6-Tribromophenol	82.9%
d4-1,2-Dichlorobenzene	61.4%	d4-2-Chlorophenol	65.0%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Sample No: HC-12
Dilution

Analytical
Chemists &
Consultants

Lab Sample ID: J574J

LIMS ID: 95-979

Matrix: Sediment

Data Release Authorized: *AKA*

Reported: 02/14/95

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Percent TOC: 1.30

Sample Amount: 62.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 37.6%

pH: 7.9

CAS Number	Analyte	mg/kg OC
91-20-3	Naphthalene	6.2 U
91-57-6	2-Methylnaphthalene	6.2 U
208-96-8	Acenaphthylene	6.2 U
83-32-9	Acenaphthene	6.2
132-64-9	Dibenzofuran	6.2 U
86-73-7	Fluorene	9.3
85-01-8	Phenanthrene	47
120-12-7	Anthracene	36
206-44-0	Fluoranthene	120
129-00-0	Pyrene	75
56-55-3	Benzo(a)anthracene	35
117-81-7	bis(2-Ethylhexyl)phthalate	14
218-01-9	Chrysene	60
205-99-2	Benzo(b)fluoranthene	29
207-08-9	Benzo(k)fluoranthene	29
50-32-8	Benzo(a)pyrene	20
193-39-5	Indeno(1,2,3-cd)pyrene	8.1
53-70-3	Dibenz(a,h)anthracene	6.2 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	38.3%	d5-Phenol	37.2%
2-Fluorobiphenyl	67.8%	2-Fluorophenol	44.5%
d14-p-Terphenyl	66.7%	2,4,6-Tribromophenol	56.2%
d4-1,2-Dichlorobenzene	53.8%	d4-2-Chlorophenol	51.5%



**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET

Semivolatiles by GC/MS

Page 1 of 1

Lab Sample ID: J574J

LIMS ID: 95-979

Matrix: Sediment

Data Release Authorized: *06/1*

Reported: 02/14/95

Sample No: HC-12

DILUTION

QC Report No: J574-Hart Crowser, Incorporated

Project: Shannon Point Seafoods

4096-05

Date Sampled: 01/25/95

Date Received: 01/26/95

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Date extracted: 01/31/95

Date analyzed: 02/03/95

Instrument: FINN2

GPC Cleanup: YES

Sample Amount: 62.4 g-dry-wt

Final Extract Volume: 1.0 mL

Dilution Factor: 1:5

Percent Moisture: 37.6%

pH: 7.9

CAS Number	Analyte	ug/kg
91-20-3	Naphthalene	80 U
91-57-6	2-Methylnaphthalene	80 U
208-96-8	Acenaphthylene	80 U
83-32-9	Acenaphthene	81
132-64-9	Dibenzofuran	80 U
86-73-7	Fluorene	120
85-01-8	Phenanthrene	620
120-12-7	Anthracene	470
206-44-0	Fluoranthene	1,600
129-00-0	Pyrene	970
56-55-3	Benzo(a)anthracene	460
117-81-7	bis(2-Ethylhexyl)phthalate	180
218-01-9	Chrysene	780
205-99-2	Benzo(b)fluoranthene	380
207-08-9	Benzo(k)fluoranthene	380
50-32-8	Benzo(a)pyrene	270
193-39-5	Indeno(1,2,3-cd)pyrene	100
53-70-3	Dibenz(a,h)anthracene	80 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	38.3%	d5-Phenol	37.2%
2-Fluorobiphenyl	67.8%	2-Fluorophenol	44.5%
d14-p-Terphenyl	66.7%	2,4,6-Tribromophenol	56.2%
d4-1,2-Dichlorobenzene	53.8%	d4-2-Chlorophenol	51.5%



**ANALYTICAL
RESOURCES
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Analytical
Chemists &
Consultants

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Lab Sample ID: J574G
LIMS ID: 95-976
Matrix: Sediment

Sample No: HC-9
QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05
Date Received: 01/26/95

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Data Release Authorized: *NA*
Reported: 02/14/95

MATRIX SPIKE/SPIKE DUPLICATE RECOVERY

CONSTITUENT	SAMPLE VALUE	SPIKE VALUE	SPIKE ADDED	% RECOVERY	RPD
MATRIX SPIKE					
Phenol	61.9	339.	491	56.4%	
2-Chlorophenol	< 13.1	221.	491	45.0%	
1,4-Dichlorobenzene	< 13.1	133.	327	40.6%	
N-Nitroso-Di-N-Propylamine	< 26.2	171.	327	52.2%	
1,2,4-Trichlorobenzene	< 13.1	152.	327	46.4%	
4-Chloro-3-methylphenol	< 26.2	431.	491	87.8%	
Acenaphthene	< 13.1	243.	327	74.2%	
4-Nitrophenol	< 65.5	718.	491	146%	
2,4-Dinitrotoluene	< 65.5	331.	327	101%	
Pentachlorophenol	< 65.5	307.	491	62.5%	
Pyrene	81.7	349.	327	81.7%	
MATRIX SPIKE DUPLICATE					
Phenol	61.9	425.	491	74.0%	27%
2-Chlorophenol	< 13.1	308.	491	62.7%	33%
1,4-Dichlorobenzene	< 13.1	195.	327	59.6%	38%
N-Nitroso-Di-N-Propylamine	< 26.2	237.	327	72.4%	32%
1,2,4-Trichlorobenzene	< 13.1	215.	327	65.7%	34%
4-Chloro-3-methylphenol	< 26.2	408.	491	83.1%	5.5%
Acenaphthene	< 13.1	251.	327	76.7%	3.3%
4-Nitrophenol	< 65.5	788.	491	160%	9.0%
2,4-Dinitrotoluene	< 65.5	333.	327	102%	0.9%
Pentachlorophenol	< 65.5	304.	491	61.9%	1.0%
Pyrene	81.7	323.	327	73.7%	10%

Values reported in ug/kg-dry-weight



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Consultants

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Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Lab Sample ID: J574SB
LIMS ID: 95-970
Matrix: Sediment

QC Report No: J574-Hart Crowser, Incorporated
Project: Shannon Point Seafoods
4096-05

Data Release Authorized: *OK*
Reported: 02/14/95

LABORATORY CONTROL SAMPLE CONSTITUENT	SPIKE VALUE	SPIKE ADDED	% RECOVERY
Phenol	312.	375	83.2%
2-Chlorophenol	272.	375	72.5%
1,4-Dichlorobenzene	185.	250	74.0%
N-Nitroso-Di-N-Propylamine	191.	250	76.4%
1,2,4-Trichlorobenzene	185.	250	74.0%
4-Chloro-3-methylphenol	280.	375	74.7%
Acenaphthene	172.	250	68.8%
4-Nitrophenol	326.	375	86.9%
2,4-Dinitrotoluene	194.	250	77.6%
Pentachlorophenol	182.	375	48.5%
Pyrene	210.	250	84.0%

Spike Blank Surrogate Recovery

d5-Nitrobenzene	67.7%	d5-Phenol	68.5%
2-Fluorobiphenyl	69.7%	2-Fluorophenol	64.9%
d14-p-Terphenyl	75.7%	2,4,6-Tribromophenol	48.9%
d4-1,2-Dichlorobenzene	71.3%	d4-2-Chlorophenol	66.0%

Values reported in ug/kg

APPENDIX B
PHYSICAL TESTING DATA

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-2
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Clayey, very sandy SILT	Moisture	Tare ID:	DB-1
			Wt. Tare:	1.45
			Wt. Wet + Tare:	73.30
			Wt. Dry + Tare:	30.05
			Moisture Content:	151.29%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 10.9290 g
 Total Dry Weight: 27.5384 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.7896		-	-	0.7896	97
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	10.9290		-	-	10.9290	60
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	30.1804	30.0769	0.1022	5.1100		19
0.004	122m	39.9297	39.8495	0.0789	3.9450		14
0.002	8h 6m	29.4644	29.3985	0.0646	3.2300		12
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
3	37	46	14

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-3
 Sample Number:

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number:

Classification	Desc: Clayey, very sandy SILT	Moisture	Tare ID:	DB-3
			Wt. Tare:	1.46
			Wt. Wet + Tare:	53.26
			Wt. Dry + Tare:	26.48
			Moisture Content:	107.00%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 11.0006 g
 Total Dry Weight: 26.1008 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Allquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.4098		-	-	0.4098	98
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	11.0006		-	-	11.0006	58
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	37.2977	37.1813	0.1151	5.7550		22
0.004	122m	39.0995	39.0094	0.0888	4.4400		17
0.002	8h 6m	30.1592	30.0928	0.0651	3.2550		12
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
2	40	41	17

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-4
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Silty SAND	Moisture	Tare ID:	DB-5
			Wt. Tare:	1.50
			Wt. Wet + Tare:	75.27
			Wt. Dry + Tare:	51.08
			Moisture Content:	48.79%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 41.4236 g
 Total Dry Weight: 56.4980 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	1.9052		-	-	1.9052	97
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#80			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	41.4236		-	-	41.4236	27
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	29.3202	29.2454	0.0735	3.6750		7
0.004	122m	30.1601	30.1168	0.0420	2.1000		4
0.002	8h 6m	35.7819	35.7551	0.0255	1.2750		2
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
3	70	23	4

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-5
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Slightly clayey, very sandy SILT	Moisture	Tare ID:	DB-7
			Wt. Tare:	1.50
			Wt. Wet + Tare:	68.99
			Wt. Dry + Tare:	34.03
			Moisture Content:	107.47%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 9.7633 g
 Total Dry Weight: 26.8904 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.8306		-	-	0.8306	97
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	9.7633		-	-	9.7633	64
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	36.8181	36.7534	0.0634	3.1700		12
0.004	122m	37.4705	37.4143	0.0549	2.7450		10
0.002	8h 6m	38.7911	38.7470	0.0428	2.1400		8
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
3	33	54	10

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-7
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Sl. clayey, sl. gravelly, silty SAND	Moisture	Tare ID:	DB-7
			Wt. Tare:	1.50
			Wt. Wet + Tare:	80.87
			Wt. Dry + Tare:	47.11
			Moisture Content:	74.00%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 32.7995 g
 Total Dry Weight: 44.2027 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	3.0336		-	-	3.0336	93
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	32.7995		-	-	32.7995	26
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	37.4688	37.4165	0.0510	2.5500		6
0.004	122m	28.8286	28.7875	0.0398	1.9900		5
0.002	8h 6m	28.8203	28.7897	0.0293	1.4650		3
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
7	67	21	5

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-8
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Silty SAND	Moisture	Tare ID:	DB-11
			Wt. Tare:	1.51
			Wt. Wet + Tare:	84.45
			Wt. Dry + Tare:	58.95
			Moisture Content:	44.38%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 49.8705 g
 Total Dry Weight: 61.0718 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.0705		-	-	0.0705	100
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	49.8705		-	-	49.8705	18
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	38.2726	38.2233	0.0480	2.4000		4
0.004	122m	29.4690	29.4327	0.0350	1.7500		3
0.002	8h 6m	31.0329	31.0061	0.0255	1.2750		2
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
0	82	15	3

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-9
 Sample Number:

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number:

Classification	Desc: Silty, very gravelly SAND	Moisture	Tare ID:	DB-13
			Wt. Tare:	1.49
			Wt. Wet + Tare:	159.60
			Wt. Dry + Tare:	125.75
			Moisture Content:	27.24%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 101.6496 g
 Total Dry Weight: 116.2990 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	48.2600		-	-	48.2600	59
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	101.6496		-	-	101.6496	13
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	28.8913	28.7810	0.1090	5.4500		5
0.004	122m	37.1573	37.0825	0.0735	3.6750		3
0.002	8h 6m	30.2894	30.2347	0.0534	2.6700		2
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
41	46	10	3

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-10
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Slightly clayey, silty, gravelly SAND	Moisture	Tare ID:	DB-15
			Wt. Tare:	1.49
			Wt. Wet + Tare:	105.35
			Wt. Dry + Tare:	65.93
			Moisture Content:	61.17%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 47.0635 g
 Total Dry Weight: 65.2275 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	14.9670		-	-	14.9670	77
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	47.0635		-	-	47.0635	28
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	37.1373	37.0109	0.1251	6.2550		10
0.004	122m	29.9466	29.8535	0.0918	4.5900		7
0.002	8h 6m	29.5156	29.4577	0.0566	2.8300		4
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
23	49	21	7

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-11
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Slightly clayey, very silty SAND	Moisture	Tare ID:	DB-17
			Wt. Tare:	1.51
			Wt. Wet + Tare:	87.61
			Wt. Dry + Tare:	50.25
			Moisture Content:	76.66%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 26.1650 g
 Total Dry Weight: 43.3659 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.3985		-	-	0.3985	99
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	26.1650		-	-	26.1650	40
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	29.8728	29.8159	0.0556	2.7800		6
0.004	122m	34.4189	34.3701	0.0475	2.3750		5
0.002	8h 6m	38.0471	38.0102	0.0356	1.7800		4
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
1	59	35	5

PIPET ANALYSIS

Job Name: Shannon Point
 Job Number: J-4096-05
 Exploration Number: HC-12
 Sample Number: _____

Date: 2/3/95
 Tested By: DKS, DAB
 Checked By: D.Berta
 Figure Number: _____

Classification	Desc: Slightly clayey, very silty SAND	Moisture	Tare ID:	DB-19
			Wt. Tare:	1.48
			Wt. Wet + Tare:	91.40
			Wt. Dry + Tare:	51.70
			Moisture Content:	79.07%

Weight of Dispersant: 0.00013 g/ml
 Amount of Dispersant: 10 ml

Amount Retained on #230: 27.9843 g
 Total Dry Weight: 48.0703 g

"Sieve Size" (mm)	Reading (Sieve/Time)	Sample & Tare	Tare Weight	Dry Wt of Aliquot	Phi Weight	Accume Weight	Percent Passing
19	3/4"			-	-		
12.5	1/2"			-	-		
9.5	3/8"			-	-		
4.75	#4			-	-		
2	#10	0.5118		-	-	0.5118	99
0.85	#20			-	-		
0.425	#40			-	-		
0.25	#60			-	-		
0.15	#100			-	-		
0.075	#200			-	-		
0.0625	#230	27.9843		-	-	27.9843	42
0.062	20s						
0.031	1m 54s						
0.016	7m 36s						
0.008	30m 26s	34.7438	34.6793	0.0632	3.1600		7
0.004	122m	29.1379	29.0812	0.0554	2.7700		6
0.002	8h 6m	30.0594	30.0140	0.0441	2.2050		5
-	32h 28m				-		

% Gravel	% Sand	% Silt	% Clay
1	57	36	6

APPENDIX C
BIOLOGICAL TESTING DATA
BEAK CONSULTANTS

BIOASSAY ANALYSES OF
SHANNON POINT FISH PIER
SEDIMENTS FOR
HART CROWSER, INC.

Prepared for:

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

Prepared by:

Beak Consultants Incorporated
12931 NE 126th Place
Kirkland, WA 98034

April 21, 1995

SIGNATURE PAGE

PREPARED BY:

Charles S. Wisdom, Ph.D.
Bioassay Laboratory Director

QUALITY ASSURANCE REVIEW PERFORMED BY:

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Bioassay Laboratory Manager

Aquatic Bioassay Services
Washington Laboratory Accreditation #C117
BEAK CONSULTANTS INCORPORATED

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1.0 INTRODUCTION

Five sediments from Shannon Point Fish Pier were examined for potential toxicity using three marine sediment bioassays - the Amphipod Sediment Bioassay (with *Rhepoxynius abronius* as the test organism), the Echinoderm Larval Sediment Bioassay (with *Dendraster excentricus* as the test organism) and the Juvenile Polychaete Sediment Bioassay. Each of these bioassays was performed using protocols identified in PTI, 1991. This report details the specific conditions of each test, quality assurance measures, the original data and the results of appropriate statistical analyses conducted for each test.

2.0 SEDIMENT INFORMATION

Five different sediments were evaluated in the course of these tests. The experimental material, sediments from Shannon Point Fish Pier were received from Hart Crowser, Inc. personnel. West Beach sediment was collected by Beak Consultants personnel from Whidbey Island for use as the negative control using a 0.1 m² Van Veen sampler. Two additional reference sediments were collected by Beak Consultants personnel from Carr Inlet using the same methodology. The following table details the collection dates of the negative control and reference sediments. All sediments were stored under nitrogen at 4°C with physical security when not in use.

Reference Sediments	Collection Dates		
	January 30, 1995	February 1, 1994	February 25, 1995
West Beach	✓		
0102A43		✓	
0102B35		✓	
0225A43			✓
0225B35			✓

Reference Sediments	Collection Locality Information		
	Site Description	Latitude	Longitude
West Beach	West Beach, Whidbey Island, WA	48° 23' 15"	122° 39' 49"
0102A43	Carr Inlet, WA	47° 20' 01"	122° 40' 27"
0102B35	Carr Inlet, WA	47° 20' 01"	122° 40' 27"
0225A43	Carr Inlet, WA	47° 20' 01"	122° 40' 27"
0225B35	Carr Inlet, WA	47° 20' 01"	122° 40' 27"

2.1 Sediment Testing Information

Bioassay Testing Periods			
Sample ID Number	Juvenile Polychaete Sediment Bioassay	Amphipod (<i>Rhepoxynius</i>) Sediment Bioassay	Echinoderm Larval Sediment Bioassay
	3 Feb 95 to 13 Feb 95	2 Feb 95 to 22 Feb 95	12 Apr 95 to 14 Apr 95
HC-2	✓	✓	✓
HC-4	✓	✓	✓
HC-7	✓	✓	✓
HC-8	✓	✓	✓
HC-11	✓	✓	✓

AMPHIPOD SEDIMENT BIOASSAY

3.0 AMPHIPOD SEDIMENT BIOASSAY

3.1 Introduction

Sediments from Shannon Point Fish Pier were examined for potential toxicity using the Amphipod Sediment Bioassay as the test methodology with *Rhepoxynius abronius* as the test organism (PTI, 1991; ASTM 1990). The test sediments were introduced separately to replicate test vessels along with filtered natural seawater. Amphipod individuals were introduced to the sediment test vessels and to positive control test vessels containing cadmium chloride solutions with no sediment.

3.2 Test Procedure Overview

Sediments from Shannon Point Fish Pier were provided by Hart Crowser, Inc. personnel for the purpose of determining acute toxicity to amphipod individuals. West Beach sediment was collected by Beak Consultants personnel for use as the negative control. A reference sediment was collected from the vicinity of Raft Island, Carr Inlet for use in these experiments. These sediments were introduced into test vessels with filtered and sterilized natural seawater. Amphipods were exposed to these sediments for 10 days. Absolute and percent survivorship and mortality were determined at the end of this time period. Water quality parameters for the seawater were collected daily. This report details the conditions under which these sediments were tested, quality assurance measures and test results.

3.3 Toxicity Test

3.3.1 Test Parameters

Toxicity Test Methodology: Amphipod Sediment Bioassay (PTI, 1991; ASTM 1990)	
Method Modifications (if applicable): 0.9 L of natural seawater used per test vessel	
Test Chambers: PSEP level Pre-cleaned glass jars, Total Volume 0.950 L Overlying Seawater Volume/Chamber: 0.9 L/Test Vessel	
Test Organism:	<i>Rhepoxynius abronius</i>
Test Endpoint: Survival of individuals after 10 day exposure to sediments	
Test Acceptability:	≥ 90% survivorship in negative control sediment. ≥ 80% survivorship in reference sediment.
Aeration:	Continuous Aeration of overlying seawater throughout test
Replicate Chambers/Treatment: 5 Test Vessels/Sediment	
Test temperature:	<i>Rhepoxynius</i> - 15.0 °C ± 1.0 °C
Organism Loading Rates: 20 neonates/test vessel	

3.3.2 Test Organisms

Scientific Name:	<i>Rhepoxynius abronius</i>
Life Stage:	Juveniles
Locality:	West Beach, Whidbey Island, WA.
Collection Date:	30 January 1995
Collection Personnel:	Beak Consultants Incorporated

3.3.3 Seawater Information

Source:	National Marine Fisheries Laboratory, Mukilteo, WA
Pretreatment:	Filtration to 10 microns with UV sterilization

3.3.4 Quality Assurance

3.3.5 Positive Control Use

A positive control bioassay (using CdCl_2 as the reference toxicant) was conducted alongside each Amphipod Sediment Bioassay test using *Rhepoxynius* or *Ampelisca* neonates as appropriate from the same stock population. A 63.1 mg/L stock solution of Cd^{2+} (as cadmium chloride) (Integra #RC-0060, Lot #36073) was prepared as the initial concentration for the *Rhepoxynius* test. Material was then serially diluted 1:10 for each subsequent concentration to produce the five positive control concentrations. Percent neonate survivorship was determined at the end of the 96 hour test period. Salinity, pH, and dissolved oxygen were recorded over the 96 hour testing period.

Positive Control Dilution Information - <i>Rhepoxynius</i>	
Starting Solution Concentration:	100 mg/L CdCl_2 (63.1 mg/L as Cd^{2+})
Dilution to Initial Concentration:	None
Subsequent Dilution:	1:10

3.3.5.1 Positive Control Test Results

Amphipod (<i>Rhepoxynius</i>) Sediment Bioassay Positive Control			
CdCl ₂ Conc.	Absolute Mortality		
	AVG	STD ¹	COV ²
0.000 mg/L	1.5	2.1	141.4%
0.01 mg/L	3.0	2.8	94.3%
0.10 mg/L	0.0	0.0	-
1.00 mg/L	5.0	2.8	56.6%
10.00 mg/L	17.5	0.7	4.0%
100.00 mg/L	20.0	0.00	0.0%
LC ₅₀ = 2.16 mg/L			

¹STD = Standard Deviation

²COV = Coefficient of Variation

3.3.6 Physical and Chemical Methods Used

Various water quality parameters of the overlying seawater were measured during the course of each test. Temperature was determined by mercury thermometer. The pH of each replicate was measured by Hanna Instruments Model HI 9024, using a Hanna Instruments probe Model HI 1230. The pH meter was calibrated daily against external standards at the test temperature. Dissolved oxygen was determined using a YSI model 51B oxygen meter with an associated YSI model 5739 probe. The dissolved oxygen meter was air calibrated daily. Salinity was measured with a Spartan A366ATC refractometer. Ammonia levels were determined by AMTest Inc. using method EPA 350.1 (NH₃-N). Sulfide levels were determined by AMTest Inc. using EPA 376.1 (Sulfides).

3.4 Results

Survivorship, positive control, and water quality results of the Amphipod Sediment Bioassay are presented in Appendix 2. The survivorship data were analyzed via t-Tests between each sediment and the control sediment from Carr Inlet as specified in the PSDDA protocol.

ECHINODERM LARVAL SEDIMENT BIOASSAY

4.0 ECHINODERM LARVAL SEDIMENT BIOASSAY

4.1 Introduction

Sediments from Shannon Point Fish Pier were examined for potential toxicity using the Echinoderm Larval Sediment Bioassay as the test methodology with the Common Sand Dollar (*Dendraster excentricus*) as the test organism (PTI, 1991). The test sediments were introduced separately to replicate test vessels along with filtered natural seawater, shaken, and allowed to settle for four hours. Gametes (sperm and eggs) were obtained from male and female common sand dollars and combined in appropriate ratios to produce larvae. Larvae were introduced into sediment loaded test vessels and seawater control vessels without sediment.

4.2 Test Procedure Overview

Sediments from Shannon Point Fish Pier were received from Hart Crowser, Inc. for the purpose of determining toxicity of these sediments to echinoderm larvae. These sediments were introduced into test vessels with natural seawater, mixed thoroughly and then allowed to settle for four hours. Echinoderm larvae formed from common sand dollar gametes (*Dendraster excentricus*) were exposed to the seawater in contact with these sediments and control seawater vessels. Larval numbers and any abnormalities were determined microscopically at the end of this time period. Water quality parameters of the overlying seawater were collected daily. This report details the conditions under which these sediments were tested, quality assurance measures and test results.

4.3 Toxicity Test

4.3.1 Test Parameters

Toxicity Test Methodology: Echinoderm Larval Sediment Bioassay (PTI, 1991)
Method Modifications (if applicable): 0.9 L of natural seawater used per test vessel with 18 g of Sediment
Test Chambers: PSEP level Pre-cleaned glass jars, Total Volume 0.950 L Seawater Volume/Chamber: 0.9 L/Test Vessel
Test Endpoint: Larval mortality and larval developmental abnormality. Test terminated when 90% of seawater control larvae reach the 4-armed pluteus stage of development.
Test Acceptability: $\geq 50\%$ larvae survivorship in control seawater
Aeration: Continuous aeration of overlying seawater throughout test
Replicate Chambers/Treatment: 5 Test Vessels/Sediment or Seawater Control
Test temperature: $15.0\text{ }^{\circ}\text{C} \pm 1.0\text{ }^{\circ}\text{C}$

5.3.1 Test Parameters (Continued)

Initiation Day/Time:	4/12/95 14:00
Termination Day/Time:	4/14/95 11:00
Test Duration:	45 Hrs
Stocking Beaker Density:	6,000 embryos/mL
Loading Aliquot Size:	7.5 mL

4.3.2 Test Organisms

Scientific Name:	<i>Dendraster excentricus</i> , Common Sand Dollars
Life Stage:	Larvae created from egg and sperm produced by injection of adults with 0.5 M KCl through the oral opening
Source:	Common sand dollar individuals were collected from Semiahmoo Point, Washington by Beak personnel
Diseases and Treatment (where applicable):	None

4.3.2.1 Description of Test Organism Condition

Dendraster individuals were spawned immediately after reaching the laboratory. In general, fecundity was high, with large quantities of sperm and eggs produced by spawning individuals.

4.3.3 Control and Test Seawater Information

Source:	National Marine Fisheries Laboratory, Mukilteo, WA
Pretreatment:	Filtration to 10 microns with UV sterilization

4.3.4 Quality Assurance

4.3.4.1 Positive Control Use

A positive control bioassay (using CdCl_2 as the reference toxicant) was conducted alongside each Echinoderm Larval Sediment Bioassay test using larvae from the same stock. A 100 mg/L stock solution of cadmium chloride (Integra #RC-0060, Lot #36073) was used as the initial concentration. Material was then diluted 1:10 for each subsequent concentration to produce the five positive control concentrations. Percent larvae mortality and percent larvae abnormality were determined at the end of the test period. Salinity, pH, and dissolved oxygen were recorded over the testing period. The combined percentage of mortality and abnormality are reported as corrected to the seawater control.

4.3.4.1 Positive Control Use (Continued)

Positive Control Dilution Information	
Starting Solution Concentration:	100.0 mg/L CdCl ₂
Dilution to Initial Concentration:	None
Subsequent Dilution:	1:10

4.3.4.2 Positive Control Test Results

Echinoderm Larval Sediment Bioassay Positive Control			
CdCl ₂ Conc.	Percent Mortality		
	Avg	STD ¹	COV ²
0.0 mg/L	1.7%	12.4%	739%
0.01 mg/L	16.8%	7.9%	47%
0.1 mg/L	-0.6%	5.5%	-990%
1.0 mg/L	0.2%	29.8%	15981%
10 mg/L	30.6%	7.9%	26%
100 mg/L	0.0%	1.6%	-
LC ₅₀ = Unable to Determine			

¹STD = Standard Deviation

²COV = Coefficient of Variation

4.3.5 Physical and Chemical Methods Used

Various water quality parameters of the overlying seawater were measured throughout the test. Temperature was determined by mercury thermometer. The pH of each water quality vessel was measured by Hanna Instruments Model HI 9024, using a Hanna Instruments probe Model HI 1230. The pH meter was calibrated daily against external standards at the test temperature. Dissolved oxygen was determined using a YSI model 51B oxygen meter with an associated YSI model 5739 probe. The dissolved oxygen meter was air calibrated daily. Salinity was measured with a Spartan A366ATC refractometer. Ammonia levels were determined by AmTest Inc. using method EPA 350.1 (NH₃-N). Sulfide levels were determined by AmTest Inc. using EPA 376.1 (Sulfides).

4.4 Results

Summary results of each Echinoderm Larval Sediment Bioassay are found in Appendix 3. These data were analyzed via a t-Test as required in the PSDDA protocols.

JUVENILE POLYCHAETE SEDIMENT BIOASSAY

5.0 JUVENILE POLYCHAETE SEDIMENT BIOASSAY

4.1 Introduction

Sediments from Shannon Point Fish Pier were to be examined for potential toxicity using the Juvenile Polychaete Sediment Bioassay as the test methodology with *Neanthes arenocodentata* as the test organism (PTI, 1991). Test sediments, along with appropriate reference sediments were introduced into replicate test vessels along with filtered and sterilized natural seawater. Juvenile *Neanthes* were introduced to each test vessel and allowed to feed and grow for twenty days. At the end of this time period, individual *Neanthes* were removed from the test sediment, counted and dried to a constant weight.

5.2 Test Procedure Overview

Sediments from Shannon Point Fish Pier were received from Hart Crowser Inc. for the purpose of determining toxicity to juvenile polychaetes. These sediments were introduced into replicate test vessels with overlying natural seawater with *Neanthes* exposed to each sediment type for 20 days. Each replicate test vessel was fed TetraMarin® flake food every second day and one third of the seawater was renewed every third day. Water quality parameters of the seawater were collected at each renewal period. This report details sediment test conditions, quality assurance measures and test results.

5.3 Toxicity Test

5.3.1 Test Parameters

Toxicity Test Methodology: Juvenile Polychaete Sediment Bioassay (PTI 1991)	
Method Modifications (if applicable): 0.9 L of natural seawater used per test vessel	
Test Chambers: PSEP level Pre-cleaned glass jars, Total Volume 0.950 L Overlying Seawater Volume/Chamber: 0.9 L/Test Vessel	
Test Organism: Juvenile <i>Neanthes</i> Individuals	
Test Endpoint Criteria: Individual <i>Neanthes</i> survivorship, and Average Individual Biomass	
Test Acceptability: $\geq 90\%$ individual survivorship in negative control sediment Reference Sediment Acceptability: $\geq 80\%$ of negative control sediment growth	
Aeration: Continuous Aeration of overlying seawater throughout test	
Replicate Chambers/Treatment: 5 Test Vessels/Sediment	
Test Organisms/Replicate Chamber: 5 Juvenile <i>Neanthes</i>	
Feeding Regime: Each test vessel fed 40 mg TetraMarin® Flake Food every two days starting on Day 0	
Test temperature: $20.0\text{ }^{\circ}\text{C} \pm 0.0\text{ }^{\circ}\text{C}$	

5.3.2 Test Organisms

Scientific Name:	<i>Neanthes arenocodentata</i>
Source:	Dr. Don Reisch, California State University, Long Beach
Age:	36-45 Days old
Post Emergence:	2-3 Weeks

5.3.3 Seawater Information

Source:	National Marine Fisheries Laboratory, Mukilteo, WA
Pretreatment:	Filtration to 10 microns with UV Sterilization

5.3.4 Quality Assurance

5.3.5 Positive Control Use

A positive control bioassay (without sediment using CdCl_2 as the reference toxicant) was conducted alongside the Juvenile Polychaete Sediment Bioassay test using juvenile *Neanthes* from the same stock. A 100 mg/L stock solution of cadmium chloride (Integra #RC-0060, Lot #36073) was used as the initial concentration. Material was then diluted 1:10 for each subsequent concentration to produce the positive control concentrations. Percent juvenile survivorship was determined at the end of the test period. Salinity, pH, and dissolved oxygen were recorded over the 96 hour testing period.

Positive Control Dilution Information	
Starting Solution Concentration:	100.0 mg/L CdCl_2
Dilution to Initial Concentration:	None
Subsequent Dilution:	1:10

5.3.5.1 Positive Control Test Results

Juvenile Polychaete Sediment Bioassay Positive Control			
CdCl ₂ Conc.	Absolute Mortality		
	Avg	STD	COV
0.0 mg/L	0.5	0.7	141 %
0.01 mg/L	1.0	1.4	-
0.1 mg/L	0.0	0.0	-
1.0 mg/L	0.5	0.7	141 %
10.0 mg/L	1.0	1.4	141 %
100.0 mg/L	10.0	0.0	0 %
LC ₅₀ = 26.2 mg/L 95% Upper Confidence = 37.7 mg/L 95% Lower Confidence = 18.2 mg/L			

5.3.6 Physical and Chemical Methods Used

Various water quality parameters of the overlying seawater were measured during the course of the test. Temperature was determined by mercury thermometer. The pH of the water quality vessel was measured by Hanna Instruments Model HI 9024, using a Hanna Instruments probe Model HI 1230. The pH meter was calibrated daily against external standards at the test temperature. Dissolved oxygen was determined using a YSI model 51B oxygen meter with an associated YSI model 5739 probe. The dissolved oxygen meter was air calibrated daily. Salinity was measured with a Spartan A366ATC refractometer. Ammonia levels were determined by AMTest Inc. using method EPA 350.1 (NH₃-N). Sulfide levels were determined by AMTest Inc. using method EPA 376.1 (Sulfides).

5.4 Results

Summary results of each Juvenile Polychaete Sediment Bioassay are found in Appendix 3. Data from each test were analyzed for heterogeneity of variances using Bartlett's Test prior to statistical analysis. The variances of these tests were found to be homogeneous and the data normally distributed in both tests. These data were analyzed via t-Test (Sokal and Rohlf 1991).

LITERATURE CITED

5.0 LITERATURE CITED

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Appendix 1: QA/QC Summary on Shannon Point Fish Pier Sediment Bioassays

QA/QC Commentary on Shannon Point Fish Pier Sediment Bioassays

The following quality assurance issues were noted during the conduct and analysis of these sediment bioassays:

Amphipod (*Rhepoxynius*) Sediment Bioassays

- Survivorship in the negative control sediment (*Rhepoxynius* Native sediment) was within the acceptable range for this bioassay.
- Survivorship in reference sediment #0102A43 was within the acceptable range for this bioassay. This reference sediment was used in the evaluation of test sediments.
- Survivorship in reference sediment #0102B35 was within the acceptable range for this bioassay. This reference sediment was used in the evaluation of test sediments.
- The LC_{50} value calculated from the positive control test was within the normal range for these organisms.
- Temperature values recorded through the duration of these bioassays were within the acceptable range for this parameter.
- Dissolved oxygen concentrations recorded were within the normal range for this parameter.
- pH values recorded through the duration of these bioassays were within the acceptable range for this parameter.
- Salinity values were within the acceptable range for this parameter.
- Ammonia levels were collected only at termination and not at initiation. Ammonia levels were high on Day 10 for sediments HC-11, HC-02, Reference Sediment 0102A43, HC-08, HC-04 and HC-07. All sulfide levels were within acceptable levels.
- Sulfide levels were collected only at termination and not at initiation. All sulfide levels were within acceptable levels.
- All water quality values recorded for the positive control concentrations were within the normal range for each parameter.
- Interstitial salinities were not collected at the initiation of the Amphipod (*Rhepoxynius*) Sediment Bioassay. However, interstitial salinities at termination were in the appropriate range for this organism.

Echinoderm Larval Sediment Bioassays

- The average initial loading density in the negative control (Seawater Control) was within the acceptable range for this bioassay.

Echinoderm Larval Sediment Bioassays (Continued)

- Survivorships in the negative control test vessels (Seawater Control) were within the acceptable range for this bioassay.
- The LC_{50} value calculated from the positive control test could not be calculated due to high levels of survivorship at each concentration.
- Temperature ranges recorded throughout the duration of these bioassays were within the normal range for this parameter.
- Dissolved oxygen values recorded through the duration of these bioassays were within the normal range for this parameter.
- All sediment pH values were within the normal range for this parameter.
- Salinity values recorded through the duration of these bioassays were within the normal range for this parameter.
- Ammonia levels recorded for this bioassay were within the normal range for this parameter.
- Sulfide levels were within the normal range for this parameter.
- All water quality values recorded for the positive control concentrations were within the normal range for each parameter.

Juvenile Polychaete Sediment Bioassays

- Survivorship in the negative control sediment (West Beach sediment) was within the acceptable range for this bioassay.
- Survivorship and growth in reference sediment #0102A43 were within the acceptable range for this bioassay. This reference sediment was used in the evaluation of test sediments.
- Survivorship and growth in reference sediment #0102B35 were within the acceptable range for this bioassay. This reference sediment was used in the evaluation of test sediments.
- The LC_{50} value calculated from the positive control test was within the normal range for these organisms.
- Temperature values recorded through the duration of these bioassays were within the acceptable range for this parameter.
- Dissolved oxygen concentrations recorded were within the normal range for this parameter.
- All sediment pH values were within the normal range for this parameter.

Juvenile Polychaete Sediment Bioassays (Continued)

- Salinity values were within the acceptable range for this parameter.
- Ammonia levels were collected only at termination and not at initiation. Ammonia levels were high on Day 10 for sediment HC-02. All other ammonia levels were within acceptable levels.
- Sulfide levels were collected only at termination and not at initiation. Sulfide levels were high on Day 10 for sediments HC-11, West Beach, HC-04, HC-07. All other sulfide levels were within acceptable levels.
- All water quality values recorded for the positive control concentrations were within the normal range for each parameter.

Appendix 2: Results of Amphipod (*Rhepoxynius abronius*) Sediment Bioassays

02/22/95

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**BEAK CONSULTANTS - Hart Crowser/Shannon Point Fish Pier
Rhepoxynius Test Results & Analysis, 2/3/95 to 2/13/95**

Field ID	Lab ID	Rep	Number of Emerged Individuals										Abs. Surv. Day 10	Prop. Surv. Day 10	Absolute Survivorship Statistics				Proportional Survivorship Statistics			
			Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day										
			1	2	3	4	5	6	7	8	9	Day										
HC-04	SH-06	A	1	0	0	1	0	0	0	0	0	1	20	1.00	19.00	1.41	2.00	7%	0.95	0.07	0.00	7%
HC-04	SH-06	B	0	0	0	0	0	0	0	0	0	1	20	1.00								
HC-04	SH-06	C	0	0	1	2	0	0	0	0	0	0	17	0.85								
HC-04	SH-06	D	0	0	1	2	0	0	0	0	0	1	20	1.00								
HC-04	SH-06	E	0	0	0	0	0	0	0	0	0	0	18	0.90								
Ref. 0102B35	SH-07	A	0	0	0	0	0	0	0	0	0	0	20	1.00	17.40	1.95	3.80	11%	0.87	0.10	0.01	11%
Ref. 0102B35	SH-07	B	0	0	2	2	0	0	0	0	0	0	15	0.75								
Ref. 0102B35	SH-07	C	0	0	1	0	0	0	0	0	0	0	16	0.80								
Ref. 0102B35	SH-07	D	0	0	0	1	0	0	0	0	0	0	18	0.90								
Ref. 0102B35	SH-07	E	1	0	0	0	0	0	0	0	0	0	18	0.90								
HC-07	SH-08	A	0	2	0	1	0	0	0	0	0	0	17	0.85	17.40	1.14	1.30	7%	0.87	0.06	0.00	7%
HC-07	SH-08	B	0	1	0	1	0	0	0	0	0	1	16	0.80								
HC-07	SH-08	C	0	0	2	2	0	0	0	0	0	2	18	0.90								
HC-07	SH-08	D	0	0	0	0	0	0	0	0	0	0	17	0.85								
HC-07	SH-08	E	0	0	0	0	0	0	0	2	0	0	19	0.95								

BEAK CONSULTANTS - Hart Crowser/Shannon Point Fish Pier

Rhepoxynius Test Results & Analysis, 2/3/95 to 2/13/95

Field ID	Lab ID	Rep	Absolute Mortality		Absolute Mortality Statistics			Prop. Mortality		Proportional Mortality Statistics			Number Not Rebury.	No. Not Reburying In Sediment Statistics			Asin-Sqrt Mortality		Arcsin Sqrt (Prop) Mortality Statistics		
			Day 10	AVG	STD	VAR	COV	Day 10	AVG	STD	VAR	COV		Day 10	AVG	STD	VAR	COV	Day 10	AVG	STD
HC-11	SH-01	A	3	3.2	1.5	2.2	46%	0.15	0.2	0.1	0.0	46%	0	0.2	0.4	0	0.40	0.4	0.1	0.0	28%
HC-11	SH-01	B	5				0.25						1				0.52				
HC-11	SH-01	C	1				0.05						0				0.23				
HC-11	SH-01	D	4				0.20						0				0.46				
HC-11	SH-01	E	3				0.15						0				0.40				
West Beach	SH-02	A	0	0.4	0.9	0.8	224%	0.00	0.0	0.0	0.0	224%	0	0.4	0.9	0.8	0.00	0.1	0.1	0.0	224%
West Beach	SH-02	B	0				0.00						2				0.00				
West Beach	SH-02	C	0				0.00						0				0.00				
West Beach	SH-02	D	0				0.00						0				0.00				
West Beach	SH-02	E	2					0.10					0				0.32				
HC-02	SH-03	A	4	3.8	2.5	6.2	66%	0.20	0.2	0.1	0.0	66%	0	1.0	1.4	2.0	0.46	0.4	0.2	0.1	59%
HC-02	SH-03	B	4				0.20						2				0.46				
HC-02	SH-03	C	0				0.00						0				0.00				
HC-02	SH-03	D	7				0.35						3				0.63				
HC-02	SH-03	E	4				0.20						0				0.46				
Ref. 0102A43	SH-04	A	0	1.0	1.0	1.0	100%	0.00	0.1	0.1	0.0	100%	0	0.6	0.5	0.3	0.00	0.2	0.2	0.0	94%
Ref. 0102A43	SH-04	B	1				0.05						1				0.23				
Ref. 0102A43	SH-04	C	0				0.00						1				0.00				
Ref. 0102A43	SH-04	D	2				0.10						1				0.32				
Ref. 0102A43	SH-04	E	2				0.10						0				0.32				
HC-08	SH-05	A	3	1.4	1.5	2.3	108%	0.15	0.1	0.1	0.0	108%	0	0.0	0.0	0.0	0.40	0.2	0.2	0.0	98%
HC-08	SH-05	B	3				0.15						0				0.40				
HC-08	SH-05	C	1				0.05						0				0.23				
HC-08	SH-05	D	0				0.00						0				0.00				
HC-08	SH-05	E	0				0.00						0				0.00				

BEAK CONSULTANTS - Hart Crowser/Shannon Point Fish Pier

Rhepoxynius Test Results & Analysis, 2/3/95 to 2/13/95

Field ID	Lab ID	Rep	Absolute Mortality		Absolute Mortality Statistics			Prop. Mortality		Proportional Mortality Statistics			Number Not Rebury.	No. Not Reburying In Sediment Statistics				Asin-Sqrt Mortality		Arcsin Sqrt (Prop) Mortality Statistics			
			Day 10	AVG	STD	VAR	COV	Day 10	AVG	STD	VAR	COV		AVG	STD	VAR	COV	Day 10	AVG	STD	VAR	COV	
HC-04	SH-06	A	0	1.0	1.4	2.0	141%	0.00	0.1	0.1	0.0	141%	1	0.2	0.4	0	224%	0.00	0.1	0.2	0.0	138%	
HC-04	SH-06	B	0				0.00					0					0.00						
HC-04	SH-06	C	3				0.15					0					0.40						
HC-04	SH-06	D	0				0.00					0					0.00						
HC-04	SH-06	E	2				0.10					0					0.32						
Ref. 0102B35	SH-07	A	0	2.6	1.9	3.8	75%	0.00	0.1	0.1	0.0	75%	0	0.6	0.9	0.8	149%	0.00	0.3	0.2	0.0	62%	
Ref. 0102B35	SH-07	B	5				0.25					0					0.52						
Ref. 0102B35	SH-07	C	4				0.20					0					0.46						
Ref. 0102B35	SH-07	D	2				0.10					2					0.32						
Ref. 0102B35	SH-07	E	2				0.10					1					0.32						
HC-07	SH-08	A	3	2.6	1.1	1.3	44%	0.15	0.1	0.1	0.0	44%	0	0.6	0.9	0.8	149%	0.40	0.4	0.1	0.0	25%	
HC-07	SH-08	B	4				0.20					0					0.46						
HC-07	SH-08	C	2				0.10					1					0.32						
HC-07	SH-08	D	3				0.15					2					0.40						
HC-07	SH-08	E	1				0.05					0					0.23						

**BEAK CONSULTANTS - Hart Crowser/Shannon Point Fish Pier
Rhepoxynius Test Results & Analysis, 2/3/95 to 2/13/95**

Field ID	Lab ID	Rep	t-Test Value Against 0102A43	Is t-Test Sig?	Is Sed. > 30% of 0102A43 Mortality?	t-Test Value Against 0102B35	Is t-Test Sig?	Is Sed. > 30% of 0102B35 Mortality?	Is Sed. Mortality > 25% Absolute?	Exceeds Biological Effects Criteria?	Exceeds Minimum Cleanup Level?
HC-11	SH-01	A	2.57	Yes	No	0.73	No	No	No	No	No
HC-11	SH-01	B									
HC-11	SH-01	C									
HC-11	SH-01	D									
HC-11	SH-01	E									
West Beach	SH-02	A	-1.12	No	No	-2.36	No	No	No	No	No
West Beach	SH-02	B									
West Beach	SH-02	C									
West Beach	SH-02	D									
West Beach	SH-02	E									
HC-02	SH-03	A	1.79	No	No	0.56	No	No	No	No	No
HC-02	SH-03	B									
HC-02	SH-03	C									
HC-02	SH-03	D									
HC-02	SH-03	E									
Ref. 0102A43	SH-04	A	0.00	No	No	-1.31	No	No	No	No	No
Ref. 0102A43	SH-04	B									
Ref. 0102A43	SH-04	C									
Ref. 0102A43	SH-04	D									
Ref. 0102A43	SH-04	E									
HC-08	SH-05	A	0.26	No	No	-0.96	No	No	No	No	No
HC-08	SH-05	B									
HC-08	SH-05	C									
HC-08	SH-05	D									
HC-08	SH-05	E									

**BEAK CONSULTANTS - Hart Crowser/Shannon Point Fish Pier
Rhepoxynius Test Results & Analysis, 2/3/95 to 2/13/95**

Field ID	Lab ID	Rep	t-Test Value Against 0102A43	Is t-Test Sig?	Is Sed. > 30% of 0102A43 Mortality?	t-Test Value Against 0102B35	Is t-Test Sig?	Is Sed. > 30% of 0102B35 Mortality?	Is Sed. Mortality > 25% Absolute?	Exceeds Biological Effects Criteria?	Exceeds Minimum Cleanup Level?
HC-04	SH-06	A	-0.26	No	No	-1.44	No	No	No	No	No
HC-04	SH-06	B									
HC-04	SH-06	C									
HC-04	SH-06	D									
HC-04	SH-06	E									
Ref. 0102B35	SH-07	A	1.31	No	No	0.00	No	No	No	No	No
Ref. 0102B35	SH-07	B									
Ref. 0102B35	SH-07	C									
Ref. 0102B35	SH-07	D									
Ref. 0102B35	SH-07	E									
HC-07	SH-08	A	2.24	Yes	No	0.35	No	No	No	No	No
HC-07	SH-08	B									
HC-07	SH-08	C									
HC-07	SH-08	D									
HC-07	SH-08	E									

Replicate Data

CdCl ₂ Conc.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 4 Mortality	% Srvshp.	% Mort.
0.0 mg/L	20	20	20		17	3	85%	15%
0.0 mg/L	20	20	20		20	0	100%	0%
0.01 mg/L	20	20	20		19	1	95%	5%
0.01 mg/L	20	20	20		15	5	75%	25%
0.1 mg/L	20	20	20		20	0	100%	0%
0.1 mg/L	20	20	20		20	0	100%	0%
1.0 mg/L	20	20	20		17	3	85%	15%
1.0 mg/L	20	20	20		13	7	65%	35%
10.0 mg/L	20	20	20		3	17	15%	85%
10.0 mg/L	20	20	20		2	18	10%	90%
100.0 mg/L	20	18	18		0	20	0%	100%
100.0 mg/L	20	18	18		0	20	0%	100%

Combined Concentration Data

CdCl ₂ Conc.	Day 0	Day 1	Day 2	Day 3	Day 4	% Srvshp.	% Mort.
0.0 mg/L	40	40	40		37	93%	7%
0.01 mg/L	40	40	40		34	85%	15%
0.1 mg/L	40	40	40		40	100%	0%
1.0 mg/L	40	40	40		30	75%	25%
10.0 mg/L	40	40	40		5	13%	88%
100.0 mg/L	40	36	36		0	0%	100%

Final Survivorship Statistics

CdCl ₂ Conc.	AVG	STD	VAR	COV	+95% C.I.	-95% C.I.
0.0 mg/L	18.5	2.1	4.5	11.5%	22.7	14.3
0.01 mg/L	17.0	2.8	8.0	16.6%	22.5	11.5
0.1 mg/L	20.0	0.0	0.0	0.0%	20.0	20.0
1.0 mg/L	15.0	2.8	8.0	18.9%	20.5	9.5
10.0 mg/L	2.5	0.7	0.5	28.3%	3.9	1.1
100.0 mg/L	0.0	0.0	0.0	-	0.0	0.0

Final Mortality Statistics

CdCl ₂ Conc.	AVG	STD	VAR	COV	+95% C.I.	-95% C.I.
0.0 mg/L	1.5	2.1	4.5	141.4%	5.7	-2.7
0.01 mg/L	3.0	2.8	8.0	94.3%	8.5	-2.5
0.1 mg/L	0.0	0.0	0.0	-	0.0	0.0
1.0 mg/L	5.0	2.8	8.0	56.6%	10.5	-0.5
10.0 mg/L	17.5	0.7	0.5	4.0%	18.9	16.1
100.0 mg/L	20.0	0.0	0.0	0.0%	20.0	20.0

+-----+
| TRIMMED SPEARMAN-KARBER ANALYSIS |
+-----+

FILE:

TEST: Positive Control DATE: 2/3/95
SPECIES: Rhepoxynius abronius DURATION: 96-Hr
CHEMICAL: Cadmium Chloride
CARRIER: CARRIER CONC:

CONC(mg/L)	#EXPOSED	MORTALITY
0.010	40	6
0.100	40	0
1.000	40	10
10.000	40	35
100.000	40	40

Spearman-Karber trim: 7.500

Spearman-Karber est LC50: 2.164

95% Lower confidence: 1.377

95% Upper Confidence: 3.401

<Mortality proportions were adjusted>

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Amphipod/Rhepoxynius Test Results and Analysis, 2/3/95 to 2/13/95

Field ID		Lab ID	Temperature										
			Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
HC-11		SH-01	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
West Beach		SH-02	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
HC-02		SH-03	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Ref. 0102A43		SH-04	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
HC-08		SH-05	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
HC-04		SH-06	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Ref. 0102B35		SH-07	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
HC-07		SH-08	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0

Field ID	Lab ID	Dissolved Oxygen										
		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
HC-11	SH-01	7.7	9.2	7.5	7.7	7.7	7.8	8.0	8.2	7.9	8.1	7.7
West Beach	SH-02	8.1	8.2	7.6	7.7	7.5	7.7	8.2	8.3	8.1	8.3	7.8
	SH-03	8.0	8.8	7.9	7.8	7.6	7.7	8.2	8.4	8.0	8.0	7.6
Ref. 0102A43	SH-04	7.7	8.9	7.4	7.3	6.0	7.7	8.0	8.4	8.2	8.1	7.7
HC-08	SH-05	7.6	9.2	6.3	6.0	7.5	6.2	8.0	8.1	7.9	8.0	7.6
HC-04	SH-06	7.6	7.8	7.1	7.8	7.8	7.8	8.1	8.2	6.8	8.0	7.8
Ref. 0102B35	SH-07	7.7	9.2	7.3	7.8	7.5	7.9	8.0	8.1	7.8	8.1	7.7
HC-07	SH-08	7.8	9.2	7.2	7.8	7.7	8.0	8.2	8.2	7.9	8.2	7.6

Field ID	Lab ID	pH										
		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
HC-11	SH-01	7.88	7.81	7.55	7.92	7.97	8.05	7.95	7.85	7.88	7.77	8.24
West Beach	SH-02	7.81	7.75	7.59	7.78	7.87	7.96	7.98	7.84	7.81	7.81	8.10
HC-02	SH-03	7.86	7.77	7.63	7.97	7.91	8.08	8.12	8.00	8.07	8.22	8.36
Ref. 0102A43	SH-04	7.86	7.79	7.66	7.69	7.71	8.01	8.02	7.98	7.98	8.07	8.24
HC-08	SH-05	7.84	7.91	7.68	7.76	7.98	7.96	8.07	8.04	8.01	8.11	8.27
HC-04	SH-06	7.86	7.81	7.71	7.83	7.95	8.01	7.96	8.03	7.80	8.08	8.24
Ref. 0102B35	SH-07	7.87	7.87	7.70	7.81	7.87	7.96	7.78	7.94	7.88	8.01	8.13
HC-07	SH-08	7.78	7.94	7.70	7.74	7.88	8.00	7.93	8.01	8.00	8.09	8.22

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Amphipod/Rhepoxynius Test Results and Analysis, 2/3/95 to 2/13/95

Field ID	Lab ID	Salinity										
		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
HC-11	SH-01	30.0	30.0	29.0	29.0	31.0	30.5	29.0	29.0	28.0	30.0	
West Beach	SH-02	30.0	30.0	30.0	29.0	30.0	30.0	28.0	28.0	27.0	29.0	
	SH-03	30.0	30.0	30.0	29.0	30.0	30.5	27.0	30.0	28.0	30.0	
Ref. 0102A43	SH-04	30.0	30.0	30.0	29.0	31.0	30.0	28.0	30.0	29.0	30.0	
HC-08	SH-05	30.0	30.0	30.0	29.0	30.0	30.0	28.0	30.0	30.0	28.0	
HC-04	SH-06	30.0	30.0	30.0	30.0	31.0	30.0	28.0	30.0	29.0	30.0	
Ref. 0102B35	SH-07	30.0	30.0	30.0	28.0	31.0	30.0	28.0	30.0	30.0	30.0	
HC-07	SH-08	30.0	30.0	30.0	30.0	31.0	30.0	28.0	30.0	30.0	30.0	

Units Legend:

- Temperature - Degrees C;
- Dissolved oxygen - mg/L;
- pH - pH Units;
- Salinity - parts per thousand;
- Ammonia - mg/L;
- Sulfides - mg/L

Field ID	Lab ID	Ammonia		Sulfides	
		Day 0	Day 10	Day 0	Day 10
HC-11	SH-01		5.400		<1
West Beach	SH-02		0.490		<1
HC-02	SH-03		9.400		<1
Ref. 0102A43	SH-04		4.000		<1
HC-08	SH-05		6.500		<1
HC-04	SH-06		3.000		<1
Ref. 0102B35	SH-07		1.400		<1
HC-07	SH-08		6.200		<1

Field ID	Lab ID	Temp.			D.O.			pH		
		AVG	STD	COV	AVG	STD	COV	AVG	STD	COV
HC-11	SH-01	15.0	0.0	0%	7.9	0.2	3%	7.9	0.2	2%
West Beach	SH-02	15.0	0.0	0%	8.0	0.3	4%	7.9	0.1	2%
HC-02	SH-03	15.0	0.0	0%	8.0	0.4	5%	8.0	0.2	3%
Ref. 0102A43	SH-04	15.0	0.0	0%	7.8	0.7	10%	7.9	0.2	2%
HC-08	SH-05	15.0	0.0	0%	7.5	1.0	13%	8.0	0.2	2%
HC-04	SH-06	15.0	0.0	0%	7.7	0.4	5%	7.9	0.2	2%
Ref. 0102B35	SH-07	15.0	0.0	0%	7.9	0.5	6%	7.9	0.1	1%
HC-07	SH-08	15.0	0.0	0%	8.0	0.5	6%	7.9	0.2	2%

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Amphipod/Rhepoxynius Test Results and Analysis, 2/3/95 to 2/13/95

Field ID	Lab ID	Salinity			Sulfides			Ammonia		
		AVG	STD	COV	AVG	STD	COV	AVG	STD	COV
HC-11	SH-01	29.5	0.9	3%	0.0			5.4		
West Beach	SH-02	29.0	1.1	4%	0.0			0.5		
HC-02	SH-03	29.3	1.1	4%	0.0			9.4		
Ref. 0102A43	SH-04	29.5	0.9	3%	0.0			4.0		
HC-08	SH-05	29.4	0.9	3%	0.0			6.5		
HC-04	SH-06	29.6	0.9	3%	0.0			3.0		
Ref. 0102B35	SH-07	29.6	0.9	3%	0.0			1.4		
HC-07	SH-08	29.8	0.8	3%	0.0			6.2		

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Amphipod/Rhepoxynius Test Results and Analysis, 2/3/95 to 2/13/95

Lab ID	Temperature, Degree C				
	Day 0	Day 1	Day 2	Day 3	Day 4
0 mg/L	15.0	15.0	15.0	15.0	15.0
0.01 mg/L	15.0	15.0	15.0	15.0	15.0
0.1 mg/L	15.0	15.0	15.0	15.0	15.0
1 mg/L	15.0	15.0	15.0	15.0	15.0
10 mg/L	15.0	15.0	15.0	15.0	15.0
100 mg/L	15.0	15.0	15.0	15.0	15.0

Lab ID	pH				
	Day 0	Day 1	Day 2	Day 3	Day 4
0 mg/L	7.90	7.31	7.59	7.85	7.94
0.01 mg/L	7.90	7.47	7.68	7.86	7.93
0.1 mg/L	7.90	7.57	7.74	7.81	7.96
1 mg/L	7.90	7.62	7.76	7.82	7.89
10 mg/L	7.90	7.67	7.72	7.84	7.87
100 mg/L	7.84	7.64	7.75	7.84	7.90

Lab ID	Dissolved Oxygen				
	Day 0	Day 1	Day 2	Day 3	Day 4
0 mg/L	8.0	9.7	7.2	7.9	7.6
0.01 mg/L	7.7	9.8	7.9	8.0	7.7
0.1 mg/L	7.7	9.6	6.9	7.9	7.6
1 mg/L	7.7	9.7	6.9	7.8	7.5
10 mg/L	7.7	9.8	7.4	7.9	7.8
100 mg/L	7.7	9.8	7.5	8.0	7.6

Lab ID	Salinity				
	Day 0	Day 1	Day 2	Day 3	Day 4
0 mg/L	30.0	30.0	30.0	30.0	30.0
0.01 mg/L	30.0	30.0	30.0	30.0	30.0
0.1 mg/L	30.0	30.0	30.0	30.0	30.0
1 mg/L	30.0	30.0	30.0	28.0	31.0
10 mg/L	30.0	30.0	30.0	30.0	31.0
100 mg/L	30.0	30.0	30.0	30.0	31.0

Lab ID	Temp.			D.O.			pH			Salinity		
	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV
0 mg/L	15.0	0.0	0%	8.1	1.0	12%	7.7	0.3	3%	30.0	0.0	0%
0.01 mg/L	15.0	0.0	0%	8.2	0.9	11%	7.8	0.2	2%	30.0	0.0	0%
0.1 mg/L	15.0	0.0	0%	7.9	1.0	13%	7.8	0.2	2%	30.0	0.0	0%
1 mg/L	15.0	0.0	0%	7.9	1.1	13%	7.8	0.1	1%	29.8	1.1	4%
10 mg/L	15.0	0.0	0%	8.1	1.0	12%	7.8	0.1	1%	30.2	0.4	1%
100 mg/L	15.0	0.0	0%	8.1	1.0	12%	7.8	0.1	1%	30.2	0.4	1%

Appendix 3: Results of Echinoderm Larval (*Dendraster excentricus*) Sediment Bioassays

Test Acceptability Criteria:

Initial Loading Density (Embryos/mL)	Target Loading Densities (Embryos/mL)	Is Initial Loading Density Acceptable
26.96	20-40	Yes

Final Density (Embryos/mL)	Average Percent Mortality	Maximum Acceptable Mortality	Is Seawater Control Mortality Acceptable?
31.2	1.7	50.0	Yes

Ref.	Sediment Average Percent Survivor	Ref.	Sediment Average Percent Mortality
Ref. 0225A43	75.4		24.6
Ref. 0225B35	102.7		0.6

Hart Crowser/Shannon Point Fish Pier - Job No. 31084
Echinoderm Larval Sediment Bioassay

Test Date: 4/12/95

Sediment Field ID	Lab ID	Replicate A		Replicate B		Replicate C		Replicate D		Replicate E	
		Total Larvae	Abnormal Larvae	Total Larvae	Abnormal Larvae	Total Larvae	Abnormal Larvae	Total Larvae	Abnormal Larvae	Total Larvae	Abnormal Larvae
Seawater t-Zero	-	274	-	214	-	279	-	320	-	261	-
Seawater t-Final	-	299	26	266	19	335	46	311	19	351	17
HC-11	SH-01	247	12	311	22	278	11	264	4	257	24
HC-02	SH-03	313	17	142	18	288	11	263	36	267	20
Ref. 0225A43	SH-04	220	5	287	19	198	14	240	24	138	5
HC-08	SH-05	356	27	149	9	298	26	324	15	278	61
HC-04	SH-06	230	14	223	64	341	58	302	13	263	11
Ref. 0225B35	SH-07	306	23	269	8	297	26	331	59	313	15
HC-07	SH-08	274	41	233	8	172	34	238	19	221	22

Sediment Field ID	Lab ID	Total Larvae					Normal Larvae					Abnormal Larvae				
		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Seawater t-Zero	-	274	214	279	320	261	-	-	-	-	-	-	-	-	-	-
Seawater t-Final	-	299	266	335	311	351	273	247	289	292	334	26	19	46	19	17
HC-11	SH-01	247	311	278	264	257	235	289	267	260	233	12	22	11	4	24
HC-02	SH-03	313	142	288	263	267	296	124	277	227	247	17	18	11	36	20
Ref. 0225A43	SH-04	220	287	198	240	138	215	268	184	216	133	5	19	14	24	5
HC-08	SH-05	356	149	298	324	278	329	140	272	309	217	27	9	26	15	61
HC-04	SH-06	230	223	341	302	263	217	159	283	289	252	14	64	58	13	11
Ref. 0225B35	SH-07	306	269	297	331	313	283	261	271	272	298	23	8	26	59	15
HC-07	SH-08	274	233	172	238	221	233	225	138	219	199	41	8	34	19	22

Sediment Field ID	Lab ID	Total Larvae				Normal Larvae				Abnormal Larvae			
		Avg	STD	VAR	COV	Avg	STD	VAR	COV	Avg	STD	VAR	COV
Seawater t-Zero	-	269.6	38.1	1453.3	14.1%	-	-	-	-	-	-	-	-
Seawater t-Final	-	312.4	32.9	1083.8	10.5%	287.0	31.8	1008.5	11.1%	25.4	12.0	144.3	47.3%
HC-11	SH-01	271.4	24.8	617.3	9.2%	256.8	23.4	548.2	9.1%	14.6	8.3	68.8	56.8%
HC-02	SH-03	254.6	66.0	4357.3	25.9%	234.2	67.1	4502.7	28.7%	20.4	9.3	87.3	45.8%
Ref. 0225A43	SH-04	216.6	54.9	3009.8	25.3%	203.2	49.5	2449.7	24.4%	13.4	8.4	71.3	63.0%
HC-08	SH-05	281.0	79.4	6299.0	28.2%	253.4	76.4	5834.3	30.1%	27.6	20.1	405.8	73.0%
HC-04	SH-06	271.8	49.8	2476.7	18.3%	240.0	53.6	2871.0	22.3%	32.0	26.6	706.5	83.1%
Ref. 0225B35	SH-07	303.2	22.8	521.2	7.5%	277.0	14.1	198.5	5.1%	26.2	19.6	385.7	75.0%
HC-07	SH-08	227.6	36.8	1356.3	16.2%	202.8	38.3	1470.2	18.9%	24.8	12.9	167.7	52.2%

Hart Crowser/Shannon Point Fish Pier - Job No. 31084
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Test Date: 4/12/95

Sediment Field ID	Lab ID	Percent Survivorship					Percent Mortality				
		A	B	C	D	E	A	B	C	D	E
Seawater t-Final	-	101.3	91.6	107.2	108.3	123.9	0.0	8.4	0.0	0.0	0.0
HC-11	SH-01	87.2	107.2	99.0	96.4	86.4	12.8	0.0	1.0	3.6	13.6
HC-02	SH-03	109.8	46.0	102.7	84.2	91.6	0.0	54.0	0.0	15.8	8.4
Ref. 0225A43	SH-04	79.7	99.4	68.2	80.1	49.3	20.3	0.6	31.8	19.9	50.7
HC-08	SH-05	122.0	51.9	100.9	114.6	80.5	0.0	48.1	0.0	0.0	19.5
HC-04	SH-06	80.5	59.0	105.0	107.2	93.5	19.5	41.0	0.0	0.0	6.5
Ref. 0225B35	SH-07	105.0	96.8	100.5	100.9	110.5	0.0	3.2	0.0	0.0	0.0
HC-07	SH-08	86.4	83.5	51.2	81.2	73.8	13.6	16.5	48.8	18.8	0.0

Sediment Field ID	Lab ID	Percent Survivorship					Percent Mortality				
		Avg	STD	VAR	COV		Avg	STD	VAR	COV	
Seawater t-Final	-	106.5	11.8	138.8	11.1%		1.7	3.7	14.1	223.6%	
HC-11	SH-01	95.3	8.7	75.4	9.1%		6.2	6.5	42.8	105.7%	
HC-02	SH-03	86.9	24.9	619.5	28.7%		15.6	22.4	503.5	143.5%	
Ref. 0225A43	SH-04	75.4	18.4	337.0	24.4%		24.6	18.4	337.0	74.5%	
HC-08	SH-05	94.0	28.3	802.7	30.1%		13.5	21.1	444.5	156.0%	
HC-04	SH-06	89.0	19.9	395.0	22.3%		13.4	17.4	301.7	129.5%	
Ref. 0225B35	SH-07	102.7	5.2	27.3	5.1%		0.6	1.4	2.0	223.6%	
HC-07	SH-08	75.2	14.2	202.3	18.9%		19.5	17.9	321.0	91.7%	

Sediment Field ID	Lab ID	Compared to Ref. 0225A43			Compared to Ref. 0225B35		
		t-Value	df	Sig?	t-Value	df	Sig?
HC-11	SH-01	-2.12	8	No	1.85	8	No
HC-02	SH-03	-0.69	8	No	1.49	8	No
HC-08	SH-05	-0.89	8	No	1.36	8	No
HC-04	SH-06	-0.99	8	No	1.64	8	No
HC-07	SH-08	-0.44	8	No	2.35	8	Yes

Sediment		Percent Mortality	Mort. 15% Over 0225A43?	Mort. 15% Over 0225B35?	Mort. 30% Over 0225A43?	Mort. 30% Over 0225B35?
Field ID	Lab ID					
HC-11	SH-01	6.19	No	No	No	No
HC-02	SH-03	15.64	No	Yes	No	No
HC-08	SH-05	13.52	No	No	No	No
HC-04	SH-06	13.41	No	No	No	No
HC-07	SH-08	19.54	No	Yes	No	No

Test Date: 4/12/95

Lab ID	Replicate A				Replicate B			Total Larvae		Normal Larvae		Abnormal Larvae	
	Total Larvae	Normal Larvae	Abnormal Larvae	Total Larvae	Replicate B		A	B	A	B	A	B	
					Normal	Abnormal							
0 ug/L	261	240	21	302	287	15	261	302	240	287	21	15	
0.01 mg/L	245	208	37	271	238	33	245	271	208	238	37	33	
0.1 mg/L	327	259	68	297	280	17	327	297	259	280	68	17	
1 mg/L	366	324	42	258	211	47	366	258	324	211	42	47	
10 mg/L	244	201	43	196	171	25	244	196	201	171	43	25	
100 mg/L	303	265	38	299	271	28	303	299	265	271	38	28	

Lab ID	Total Larvae				Normal Larvae				Abnormal Larvae			
	Avg	STD	VAR	COV	Avg	STD	VAR	COV	Avg	STD	VAR	COV
0 ug/L	281.5	29.0	840.5	10.3%	263.5	33.2	1104.5	12.6%	18.0	4.2	18.0	23.6%
0.01 mg/L	258.0	18.4	338.0	7.1%	223.0	21.2	450.0	9.5%	35.0	2.8	8.0	8.1%
0.1 mg/L	312.0	21.2	450.0	6.8%	269.5	14.8	220.5	5.5%	42.5	36.1	1300.5	84.9%
1 mg/L	312.0	76.4	5832.0	24.5%	267.5	79.9	6384.5	29.9%	44.5	3.5	12.5	7.9%
10 mg/L	220.0	33.9	1152.0	15.4%	186.0	21.2	450.0	11.4%	34.0	12.7	162.0	37.4%
100 mg/L	301.0	2.8	8.0	0.9%	268.0	4.2	18.0	1.6%	33.0	7.1	50.0	21.4%

Lab ID	Percent Survivorship		Percent Mortality		Percent Survivorship				Percent Mortality			
	A	B	A	B	Avg	STD	VAR	COV	Avg	STD	VAR	COV
0 ug/L	89.6	107.1	10.4	-7.1	98.3	12.4	153.8	12.6%	1.7	12.4	153.8	739%
0.01 mg/L	77.6	88.8	22.4	11.2	83.2	7.9	62.7	9.5%	16.8	7.9	62.7	47%
0.1 mg/L	96.6	104.5	3.4	-4.5	100.6	5.5	30.7	5.5%	-0.6	5.5	30.7	-990%
1 mg/L	120.9	78.7	-20.9	21.3	99.8	29.8	888.9	29.9%	0.2	29.8	888.9	15981%
10 mg/L	75.0	63.8	25.0	36.2	69.4	7.9	62.7	11.4%	30.6	7.9	62.7	26%
100 mg/L	98.9	101.1	1.1	-1.1	100.0	1.6	2.5	1.6%	0.0	1.6	2.5	-

Hart Crowser/Shannon Point Fish Pier - Job No. 31084
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Field ID	Lab ID	Temperature		
		Day 0	Day 1	Day 2
HC-11	SH-01	15.0	15.0	15.0
HC-02	SH-03	15.0	15.0	15.0
Ref. 0102A43	SH-04	15.0	15.0	15.0
HC-08	SH-05	15.0	15.0	15.0
HC-04	SH-06	15.0	15.0	15.0
Ref. 0102B35	SH-07	15.0	15.0	15.0
HC-07	SH-08	15.0	15.0	15.0
SeaH2O B	SeaH2O B	15.0	15.0	15.0

Lab ID	Dissolved Oxygen		
	Day 0	Day 1	Day 2
SH-01	8.5	7.8	7.6
SH-03	8.4	7.9	7.8
SH-04	8.4	7.9	7.8
SH-05	8.8	7.9	7.8
SH-06	8.8	8.0	7.9
SH-07	8.9	8.0	8.0
SH-08	9.0	7.8	7.9
SeaH2O B	9.2	8.0	7.9

Units Legend: Temperature - Degrees C; D.O. Dissolved Oxygen - mg/L; pH - pH Units;
Salinity - parts per thousand; Ammonia - mg/L; Sulfides - mg/L

Field ID	Lab ID	pH		
		Day 0	Day 1	Day 2
HC-11	SH-01	7.89	7.78	7.82
HC-02	SH-03	7.86	7.89	7.86
Ref. 0102A43	SH-04	7.92	7.82	7.88
HC-08	SH-05	7.92	7.92	7.88
HC-04	SH-06	7.90	7.93	7.91
Ref. 0102B35	SH-07	7.93	7.94	7.90
HC-07	SH-08	7.91	7.95	7.91
SeaH2O B	SeaH2O B	7.94	7.96	7.91

Lab ID	Salinity		
	Day 0	Day 1	Day 2
SH-01	28.0	27.0	27.0
SH-03	27.0	27.0	27.0
SH-04	27.0	28.0	28.0
SH-05	28.0	28.0	28.0
SH-06	28.0	28.0	28.0
SH-07	27.0	28.0	28.0
SH-08	27.0	28.0	28.0
SeaH2O B	27.0	28.0	28.0

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Field ID	Lab ID	Total Ammonia		Total Sulfides	
		Day 0	Day 2	Day 0	Day 2
HC-11	SH-01	0.270	0.410	0.0	0.0
HC-02	SH-03	0.290	0.370	0.0	0.0
Ref. 0102A43	SH-04	0.380	0.390	0.0	0.0
HC-08	SH-05	0.740	0.700	0.0	0.0
HC-04	SH-06	0.390	0.570	0.0	0.0
Ref. 0102B35	SH-07	0.360	0.300	0.0	0.0
HC-07	SH-08	0.670	0.780	0.0	0.0

Field ID	Lab ID	Temp			DO			pH		
		Avg	STD	COV	Avg	STD	COV	Avg	STD	COV
HC-11	SH-01	15.0	0.0	0.0%	8.0	0.5	5.9%	7.8	0.1	0.7%
HC-02	SH-03	15.0	0.0	0.0%	8.0	0.3	4.0%	7.9	0.0	0.2%
Ref. 0102A43	SH-04	15.0	0.0	0.0%	8.0	0.3	4.0%	7.9	0.1	0.6%
HC-08	SH-05	15.0	0.0	0.0%	8.2	0.6	6.7%	7.9	0.0	0.3%
HC-04	SH-06	15.0	0.0	0.0%	8.2	0.5	6.0%	7.9	0.0	0.2%
Ref. 0102B35	SH-07	15.0	0.0	0.0%	8.3	0.5	6.3%	7.9	0.0	0.3%
HC-07	SH-08	15.0	0.0	0.0%	8.2	0.7	8.1%	7.9	0.0	0.3%
SeaH2O B	SeaH2O B	15.0	0.0	0.0%	8.4	0.7	8.6%	7.9	0.0	0.3%

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Echinoderm Larval Sediment Bioassay

Test Date: 4/12/95

Field ID	Lab ID	Salinity			Total Ammonia			Total Sulfide		
		Avg	STD	COV	Avg	STD	COV	Avg	STD	COV
HC-11	SH-01	27.3	0.6	2.1%	0.3	0.1	29%	0.0	0.0	-
HC-02	SH-03	27.0	0.0	0.0%	0.3	0.1	17%	0.0	0.0	-
Ref. 0102A43	SH-04	27.7	0.6	2.1%	0.4	0.0	2%	0.0	0.0	-
HC-08	SH-05	28.0	0.0	0.0%	0.7	0.0	4%	0.0	0.0	-
HC-04	SH-06	28.0	0.0	0.0%	0.5	0.1	27%	0.0	0.0	-
Ref. 0102B35	SH-07	27.7	0.6	2.1%	0.3	0.0	13%	0.0	0.0	-
HC-07	SH-08	27.7	0.6	2.1%	0.7	0.1	11%	0.0	0.0	-
SeaH2O B	SeaH2O B	27.7	0.6	2.1%						

Hart Crowser/Shannon Point Fish Pier - Job No. 31084
Echinoderm Larval Sediment Bioassay

Test Date: 4/12/95

Lab ID	Temperature, Degree C		
	Day 0	Day 1	Day 2
0 mg/L	15.0	15.0	15.0
0.01 mg/L	15.0	15.0	15.0
0.1 mg/L	15.0	15.0	15.0
1.0 mg/L	15.0	15.0	15.0
10 mg/L	15.0	15.0	15.0
100 mg/L	15.0	15.0	15.0

Lab ID	pH		
	Day 0	Day 1	Day 2
0 mg/L	7.96	7.96	7.95
0.01 mg/L	7.96	7.96	7.91
0.1 mg/L	7.96	7.97	7.91
1.0 mg/L	7.96	7.97	7.91
10 mg/L	7.97	7.97	7.92
100 mg/L	7.97	7.94	7.92

Lab ID	Dissolved Oxygen		
	Day 0	Day 1	Day 2
0 mg/L	9.0	8.0	8.0
0.01 mg/L	8.6	8.2	8.0
0.1 mg/L	9.0	8.0	8.0
1.0 mg/L	9.2	8.0	7.8
10 mg/L	9.2	8.0	7.8
100 mg/L	9.0	8.0	8.0

Lab ID	Salinity		
	Day 0	Day 1	Day 2
0 mg/L	28.0	28.0	28.0
0.01 mg/L	28.0	28.0	28.0
0.1 mg/L	27.0	28.0	28.0
1.0 mg/L	27.0	28.0	28.0
10 mg/L	27.0	28.0	28.0
100 mg/L	27.0	28.0	28.0

Lab ID	Temp.			D.O.			pH			Salinity		
	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV
0 mg/L	15.0	0.0	0%	8.3	0.6	7%	8.0	0.0	0%	28.0	0.0	0%
0.01 mg/L	15.0	0.0	0%	8.3	0.3	4%	7.9	0.0	0%	28.0	0.0	0%
0.1 mg/L	15.0	0.0	0%	8.3	0.6	7%	7.9	0.0	0%	27.7	0.6	2%
1.0 mg/L	15.0	0.0	0%	8.3	0.8	9%	7.9	0.0	0%	27.7	0.6	2%
10 mg/L	15.0	0.0	0%	8.3	0.8	9%	8.0	0.0	0%	27.7	0.6	2%
100 mg/L	15.0	0.0	0%	8.3	0.6	7%	7.9	0.0	0%	27.7	0.6	2%

Appendix 4: Results of Juvenile Polychaete (*Neanthes arenoceodentata*) Sediment Bioassays

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	AVG of Mean Individual Larval Weight	STD of Mean Individual Larval Weight	VAR of Mean Individual Larval Weight	COV of Mean Individual Larval Weight	Individual Weight		Is Sed. Weight < 70% of West Beach?	Is Sed. Weight < 50% of West Beach?
						t-Test Value West Beach	Sig?		
HC-11	SH-01	13.89	2.59	6.7	18.7%	1.50	No	No	No
West Beach	SH-02	16.24	2.38	5.7	14.6%	0.00	No	No	No
HC-02	SH-03	10.20	1.31	1.7	12.8%	4.98	Yes	Yes	No
Ref. 0102A43	SH-04	14.25	1.86	3.4	13.0%	1.48	No	No	No
HC-08	SH-05	14.49	2.72	7.4	18.7%	1.09	No	No	No
HC-04	SH-06	16.67	2.30	5.3	13.8%	-0.29	No	No	No
Ref. 0102B35	SH-07	14.86	2.15	4.6	14.5%	0.96	No	No	No
HC-07	SH-08	14.33	3.97	15.7	27.7%	0.92	No	No	No

Sed. Lab. No.	Sed. Lab. No.	Percent Surv.	Acceptable Survivorship	Acceptable for use?
W. Beach	SH-02	100	90	Yes

Sediment Field ID No.	Sediment Lab ID No.	AVG of Mean Individual Larval Weight	STD of Mean Individual Larval Weight	VAR of Mean Individual Larval Weight	COV of Mean Individual Larval Weight	Percent of West Beach Growth	Acceptability Criteria for Reference Sediment Use?	Reference Sediment Acceptable for Use?
West Beach	SH-02	16.24	2.38	5.7	14.6%			
Ref. 0102A43	SH-04	14.25	1.86	3.4	13.0%	87.7	80.0	Yes
Ref. 0102B35	SH-07	14.86	2.15	4.6	14.5%	91.5	80.0	Yes

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	AVG of Mean Individual Growth Rate	STD of Mean Individual Growth Rate	VAR of Mean Individual Growth Rate	COV of Mean Individual Growth Rate	Growth Rate		Growth Rate	
						t-Test Value West Beach	Sig?	t-Test Value 0102A43	Sig?
HC-11	SH-01	0.66	0.13	0.0	19.6%	1.50	No	0.25	No
West Beach	SH-02	0.78	0.12	0.0	15.2%	0.00	No	-1.48	No
HC-02	SH-03	0.48	0.07	0.0	13.7%	4.98	Yes	3.99	Yes
Ref. 0102A43	SH-04	0.68	0.09	0.0	13.6%	1.48	No	0.00	No
HC-08	SH-05	0.69	0.14	0.0	19.6%	1.09	No	-0.16	No
HC-04	SH-06	0.80	0.11	0.0	14.3%	-0.29	No	-1.83	No
Ref. 0102B35	SH-07	0.71	0.11	0.0	15.1%	0.96	No	-0.48	No
HC-07	SH-08	0.68	0.20	0.0	29.0%	0.92	No	-0.04	No

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Individual Weight		Is Sed. Weight < 70% of 0102A43 ?	Is Sed. Weight < 50% of 0102A43 ?	Individual Weight		Is Sed. Weight < 70% of 0102B35 ?	Is Sed. Weight < 50% of 0102B35 ?
		t-Test Value 0102A43	Sig? 0102A43			t-Test Value 0102B35	Sig? 0102B35		
HC-11	SH-01	0.25	No	No	No	0.25	No	No	No
West Beach	SH-02	-1.48	No	No	No	-1.48	No	No	No
HC-02	SH-03	3.99	Yes	No	No	3.99	Yes	Yes	No
Ref. 0102A43	SH-04	0.00	No	No	No	0.00	No	No	No
HC-08	SH-05	-0.16	No	No	No	-0.16	No	No	No
HC-04	SH-06	-1.83	No	No	No	-1.83	No	No	No
Ref. 0102B35	SH-07	-0.48	No	No	No	-0.48	No	No	No
HC-07	SH-08	-0.04	No	No	No	-0.04	No	No	No

Sediment Field ID No.	Sediment Lab ID No.
West Beach	SH-02
Ref. 0102A43	SH-04
Ref. 0102B35	SH-07

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
 Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Growth Rate	
		t-Test Value 0102B35	Sig?
HC-11	SH-01	0.65	No
West Beach	SH-02	-0.96	No
HC-02	SH-03	4.14	Yes
Ref. 0102A43	SH-04	0.48	No
HC-08	SH-05	0.24	No
HC-04	SH-06	-1.29	No
Ref. 0102B35	SH-07	0.00	No
HC-07	SH-08	0.26	No

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	No. t-0 Indiv.	No. t-final Indiv.	% Survshp	AVG Larval Survshp	STD Larval Survshp	VAR Larval Survshp	COV Larval Survshp	Initial Weigh Boat (g)	2/24/95 Boat+ Larvae (g)	2/28/95 Boat+ Larvae (g)	3/1/95 Boat+ Larvae (g)
Day 0	Day 0	A		5						1.00205	1.00562	1.00572	
Day 0	Day 0	B		5						1.00382	1.00600	1.00595	
Day 0	Day 0	C		5						1.00809	1.01059	1.01070	1.01066
Day 0	Day 0	D		5						1.00080	1.00473	1.00477	
Day 0	Day 0	E		5						1.00264	1.00624	1.00631	
HC-11	SH-01	A				90.00	20.00	400.00	22.2%	1.01731	1.05571	1.05526	1.05529
HC-11	SH-01	B	5	3	60.0					1.02016	1.10906	1.10775	1.10750
HC-11	SH-01	C	5	5	100.0					1.01636	1.08767	1.08591	1.08556
HC-11	SH-01	D	5	5	100.0					1.01271	1.07174	1.07078	1.07045
HC-11	SH-01	E	5	5	100.0					1.01831	1.09808	1.09617	1.09588
West Beach	SH-02	A	5	5	100.0	100.00	0.00	0.00	0.0%	1.01575	1.12072	1.11830	1.11805
West Beach	SH-02	B	5	5	100.0					1.01186	1.09334	1.09112	1.09132
West Beach	SH-02	C	5	5	100.0					1.01518	1.08748	1.08586	1.08591
West Beach	SH-02	D	5	5	100.0					1.01192	1.09150	1.09002	1.08977
West Beach	SH-02	E	5	5	100.0					1.01277	1.06021	1.05893	1.05876
HC-02	SH-03	A	5	5	100.0	100.00	0.00	0.00	0.0%	1.01458	1.06634	1.06473	1.06490
HC-02	SH-03	B	5	5	100.0					1.01343	1.07546	1.07392	1.07394
HC-02	SH-03	C	5	5	100.0					1.01471	1.06421	1.06252	1.06250
HC-02	SH-03	D	5	5	100.0								
HC-02	SH-03	E											

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	No. t-0 Indiv.	No. t-final Indiv.	% Srvshp	AVG Larval Srvshp	STD Larval Srvshp	VAR Larval Srvshp	COV Larval Srvshp	Initial Weigh Boat (g)	2/24/95 Boat+ Larvae (g)	2/28/95 Boat+ Larvae (g)	3/1/95 Boat+ Larvae (g)
Ref. 0102A43	SH-04	A	5	3	60.0	88.00	17.89	320.00	20.3%	1.01888	1.07148	1.07030	1.07006
Ref. 0102A43	SH-04	B	5	5	100.0					1.01792	1.09111	1.09057	1.09016
Ref. 0102A43	SH-04	C	5	5	100.0					1.01874	1.09525	1.09470	1.09427
Ref. 0102A43	SH-04	D	5	4	80.0					1.01213	1.06271	1.06227	1.06213
Ref. 0102A43	SH-04	E	5	5	100.0					1.01108	1.08858	1.08756	1.08737
HC-08	SH-05	A	5	5	100.0	100.00	0.00	0.00	0.0%	1.01538	1.10945	1.10822	1.10850
HC-08	SH-05	B	5	5	100.0					1.01682	1.08040	1.07953	1.07913
HC-08	SH-05	C	5	5	100.0					1.01726	1.08912	1.08734	1.08716
HC-08	SH-05	D	6	6	100.0					1.00700	1.07925	1.07816	1.07785
HC-08	SH-05	E	5	5	100.0					1.00690	1.08844	1.08760	1.08668
HC-04	SH-06	A	5	5	100.0	88.00	17.89	320.00	20.3%	1.00939	1.08762	1.08730	1.08711
HC-04	SH-06	B	5	5	100.0					1.00750	1.07450	1.07414	1.07414
HC-04	SH-06	C	5	3	60.0					1.00714	1.06865	1.06421	1.06428
HC-04	SH-06	D	5	5	100.0					1.01688	1.10847	1.10767	1.10782
HC-04	SH-06	E	5	4	80.0					1.01777	1.08907	1.08764	1.08727
Ref. 0102B35	SH-07	A	5	5	100.0	100.00	0.00	0.00	0.0%	1.01210	1.10231	1.09938	1.09877
Ref. 0102B35	SH-07	B	5	5	100.0					1.01640	1.09787	1.09692	1.09684
Ref. 0102B35	SH-07	C	5	5	100.0					1.01825	1.09945	1.09823	1.09824
Ref. 0102B35	SH-07	D	5	5	100.0					1.01591	1.08303	1.08204	1.08162
Ref. 0102B35	SH-07	E	5	5	100.0					1.00936	1.07099	1.06993	1.06966

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	No. t-0 Indiv.	No. t-final Indiv.	% Surv	AVG Larval Surv	STD Larval Surv	VAR Larval Surv	COV Larval Surv	Initial Weight Boat (g)	2/24/95 Boat+ Larvae (g)	2/28/95 Boat+ Larvae (g)	3/1/95 Boat+ Larvae (g)
HC-07	SH-08	A	5	5	100.0	96.00	8.94	80.00	9.3%	1.01217	1.09692	1.09657	1.09664
HC-07	SH-08	B	5	5	100.0					1.01216	1.06999	1.06872	1.06791
HC-07	SH-08	C	5	5	100.0					1.01128	1.08131	1.08267	1.08239
HC-07	SH-08	D	5	5	100.0					1.01228	1.11167	1.11071	1.11059
HC-07	SH-08	E	5	4	80.0					1.00920	1.04898	1.04878	1.04866

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Hart Crowser/Job No. 31084
Testing Dates: 2/2/95 to 2/22/95

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/2/95 Boat+ Larvae (g)	3/3/95 Boat+ Larvae (g)	3/5/95 Boat+ Larvae (g)	3/6/95 Boat+ Larvae (g)	3/7/95 Boat+ Larvae (g)	3/8/95 Boat+ Larvae (g)	3/10/95 Boat+ Larvae (g)	3/13/95 Boat+ Larvae (g)	3/14/95 Boat+ Larvae (g)
Day 0	Day 0	A									
Day 0	Day 0	B									
Day 0	Day 0	C									
Day 0	Day 0	D									
Day 0	Day 0	E									
HC-11	SH-01	A									
HC-11	SH-01	B									
HC-11	SH-01	C	1.10713	1.10690	1.10724	1.10893	1.10913	1.10946	1.10908	1.10958	1.10775
HC-11	SH-01	D	1.08504	1.08540	1.08567	1.08563					
HC-11	SH-01	E	1.07038								
West Beach	SH-02	A	1.09540	1.09546							
West Beach	SH-02	B	1.11755	1.11746							
West Beach	SH-02	C	1.09082	1.09088							
West Beach	SH-02	D									
West Beach	SH-02	E	1.08938	1.08940							
HC-02	SH-03	A	1.05860	1.05860							
HC-02	SH-03	B	1.06475	1.06448	1.06476	1.06459	1.06498	1.06532	1.06508	1.06536	1.06511
HC-02	SH-03	C									
HC-02	SH-03	D									
HC-02	SH-03	E									

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Hart Crowser/Job No. 31084
Testing Dates: 2/2/95 to 2/22/95

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/2/95 Larvae (g) Boat+	3/3/95 Larvae (g) Boat+	3/5/95 Larvae (g) Boat+	3/6/95 Larvae (g) Boat+	3/7/95 Larvae (g) Boat+	3/8/95 Larvae (g) Boat+	3/10/95 Larvae (g) Boat+	3/13/95 Larvae (g) Boat+	3/14/95 Larvae (g) Boat+
Ref. 0102A43	SH-04	A	1.06951	1.06991	1.07035	1.07014	1.07019				
Ref. 0102A43	SH-04	B	1.08982	1.08959	1.08962						
Ref. 0102A43	SH-04	C	1.09377	1.09410	1.09479	1.09466	1.09448	1.09481	1.09312	1.08253	1.08245
Ref. 0102A43	SH-04	D	1.06185	1.06194							
Ref. 0102A43	SH-04	E	1.08726	1.08702	1.08775	1.08757	1.08789	1.08770	1.08470	1.08428	1.08422
HC-08	SH-05	A	1.10771	1.10707	1.10742	1.10709	1.10775	1.10831	1.10731	1.10740	
HC-08	SH-05	B	1.07893	1.07934	1.07918	1.07910					
HC-08	SH-05	C	1.08661	1.08668							
HC-08	SH-05	D	1.07746	1.07751							
HC-08	SH-05	E	1.08672								
HC-04	SH-06	A	1.08675	1.08667							
HC-04	SH-06	B									
HC-04	SH-06	C									
HC-04	SH-06	D	1.10737	1.10716	1.10781	1.10754	1.10841	1.10860	1.10825	1.10870	1.10899
HC-04	SH-06	E	1.08688	1.08696							
Ref. 0102B35	SH-07	A	1.09854	1.09873	1.09787	1.09733	1.09816	1.09844	1.09750	1.09793	1.09779
Ref. 0102B35	SH-07	B									
Ref. 0102B35	SH-07	C									
Ref. 0102B35	SH-07	D	1.08173	1.08169							
Ref. 0102B35	SH-07	E	1.06943	1.06950							

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95
Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/2/95 Boat+ Larvae (g)	3/3/95 Boat+ Larvae (g)	3/5/95 Boat+ Larvae (g)	3/6/95 Boat+ Larvae (g)	3/7/95 Boat+ Larvae (g)	3/8/95 Boat+ Larvae (g)	3/10/95 Boat+ Larvae (g)	3/13/95 Boat+ Larvae (g)	3/14/95 Boat+ Larvae (g)
HC-07	SH-08	A									
HC-07	SH-08	B	1.06836	1.06849	1.06843						
HC-07	SH-08	C	1.08210	1.08212							
HC-07	SH-08	D	1.10987	1.10977							
HC-07	SH-08	E	1.04854	1.04856							

**Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 Hart Crowser/Job No. 31084**

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/16/95 Boat+ Larvae (g)	3/17/95 Boat+ Larvae (g)	3/18/95 Boat+ Larvae (g)	3/20/95 Boat+ Larvae (g)	Difference Between Subsequent Weighings < / = 0.0001 g?	Final Boat+ Larvae (g)	Total Larval Weight (g)	Mean Individual Larval Weight (mg)
Day 0	Day 0	A					Yes	1.00572	0.00367	0.73
Day 0	Day 0	B					Yes	1.00595	0.00213	0.43
Day 0	Day 0	C					Yes	1.01066	0.00257	0.51
Day 0	Day 0	D					Yes	1.00477	0.00397	0.79
Day 0	Day 0	E					Yes	1.00631	0.00367	0.73
HC-11	SH-01	A								
HC-11	SH-01	B					Yes	1.05529	0.03798	12.66
HC-11	SH-01	C	1.10761	1.10771			Yes	1.10771	0.08755	17.51
HC-11	SH-01	D					Yes	1.08563	0.06927	13.85
HC-11	SH-01	E					Yes	1.07038	0.05767	11.53
West Beach	SH-02	A					Yes	1.09546	0.07715	15.43
West Beach	SH-02	B					Yes	1.11746	0.10171	20.34
West Beach	SH-02	C					Yes	1.09088	0.07902	15.80
West Beach	SH-02	D					Yes	1.08591	0.07073	14.15
West Beach	SH-02	E					Yes	1.08940	0.07748	15.50
HC-02	SH-03	A					Yes	1.05860	0.04583	9.17
HC-02	SH-03	B	1.06452	1.06484	1.06442	1.06449	Yes	1.06449	0.04991	9.98
HC-02	SH-03	C					Yes	1.07394	0.06051	12.10
HC-02	SH-03	D					Yes	1.06250	0.04779	9.56
HC-02	SH-03	E								

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/16/95 Boat+ Larvae (g)	3/17/95 Boat+ Larvae (g)	3/18/95 Boat+ Larvae (g)	3/20/95 Boat+ Larvae (g)	Difference Between Subsequent Weighings < / = 0.0001 g?	Final Boat+ Larvae (g)	Total Larval Weight (g)	Mean Individual Larval Weight (mg)
Ref. 0102A43	SH-04	A					Yes	1.07019	0.05131	17.10
Ref. 0102A43	SH-04	B					Yes	1.08962	0.07170	14.34
Ref. 0102A43	SH-04	C					Yes	1.08245	0.06371	12.74
Ref. 0102A43	SH-04	D					Yes	1.06194	0.04981	12.45
Ref. 0102A43	SH-04	E					Yes	1.08422	0.07314	14.63
HC-08	SH-05	A					Yes	1.10740	0.09202	18.40
HC-08	SH-05	B					Yes	1.07910	0.06228	12.46
HC-08	SH-05	C					Yes	1.08668	0.06942	13.88
HC-08	SH-05	D					Yes	1.07751	0.07051	11.75
HC-08	SH-05	E					Yes	1.08672	0.07982	15.96
HC-04	SH-06	A					Yes	1.08667	0.07728	15.46
HC-04	SH-06	B					Yes	1.07414	0.06664	13.33
HC-04	SH-06	C					Yes	1.06428	0.05714	19.05
HC-04	SH-06	D	1.10805	1.10796			Yes	1.10796	0.09108	18.22
HC-04	SH-06	E					Yes	1.08696	0.06919	17.30
Ref. 0102B35	SH-07	A	1.09730	1.09729			Yes	1.09729	0.08519	17.04
Ref. 0102B35	SH-07	B					Yes	1.09684	0.08044	16.09
Ref. 0102B35	SH-07	C					Yes	1.09824	0.07999	16.00
Ref. 0102B35	SH-07	D					Yes	1.08169	0.06578	13.16
Ref. 0102B35	SH-07	E					Yes	1.06950	0.06014	12.03

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	3/16/95 Boat+ Larvae (g)	3/17/95 Boat+ Larvae (g)	3/18/95 Boat+ Larvae (g)	3/20/95 Boat+ Larvae (g)	Difference Between Subsequent Weighings < / = 0.0001 g?	Final Boat+ Larvae (g)	Total Larval Weight (g)	Mean Individual Larval Weight (mg)
HC-07	SH-08	A					Yes	1.09664	0.08447	16.89
HC-07	SH-08	B					Yes	1.06843	0.05627	11.25
HC-07	SH-08	C					Yes	1.08212	0.07084	14.17
HC-07	SH-08	D					Yes	1.10977	0.09749	19.50
HC-07	SH-08	E					Yes	1.04856	0.03936	9.84

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Hart Crowser/Job No. 31084
Testing Dates: 2/2/95 to 2/22/95

Sediment Field ID No.	Sediment Lab ID No.	Rep	AVG of Mean Individual Larval Weight (mg)	STD of Mean Individual Larval Weight (mg)	VAR of Mean Individual Larval Weight (mg)	COV of Mean Individual Larval Weight (mg)	Individual Growth Rate (mg/Day)	AVG of Individual Growth Rate (mg/Day)	STD of Individual Growth Rate (mg/Day)	VAR of Individual Growth Rate (mg/Day)	COV of Individual Growth Rate (mg/Day)
Day 0	Day 0	A	0.64	0.16	0.03	25.1%					
Day 0	Day 0	B									
Day 0	Day 0	C									
Day 0	Day 0	D									
Day 0	Day 0	E									
HC-11	SH-01	A	13.89	2.59	6.72	18.7%		0.66	0.13	0.02	19.6%
HC-11	SH-01	B					0.60				
HC-11	SH-01	C					0.84				
HC-11	SH-01	D					0.66				
HC-11	SH-01	E					0.54				
West Beach	SH-02	A	16.24	2.38	5.65	14.6%		0.78	0.12	0.01	15.2%
West Beach	SH-02	B					0.99				
West Beach	SH-02	C					0.76				
West Beach	SH-02	D					0.68				
West Beach	SH-02	E					0.74				
HC-02	SH-03	A	10.20	1.31	1.72	12.8%		0.48	0.07	0.00	13.7%
HC-02	SH-03	B					0.43				
HC-02	SH-03	C					0.47				
HC-02	SH-03	D					0.57				
HC-02	SH-03	E					0.45				

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Hart Crowser/Job No. 31084

Testing Dates: 2/2/95 to 2/22/95

Sediment Field ID No.	Sediment Lab ID No.	Rep	AVG of Mean Individual Larval Weight (mg)	STD of Mean Individual Larval Weight (mg)	VAR of Mean Individual Larval Weight (mg)	COV of Mean Individual Larval Weight (mg)	Individual Growth Rate (mg/Day)	AVG of Individual Growth Rate (mg/Day)	STD of Individual Growth Rate (mg/Day)	VAR of Individual Growth Rate (mg/Day)	COV of Individual Growth Rate (mg/Day)
Ref. 0102A43	SH-04	A	14.25	1.86	3.45	13.0%	0.82	0.68	0.09	0.01	13.6%
Ref. 0102A43	SH-04	B					0.68				
Ref. 0102A43	SH-04	C					0.61				
Ref. 0102A43	SH-04	D					0.59				
Ref. 0102A43	SH-04	E					0.70				
HC-08	SH-05	A	14.49	2.72	7.37	18.7%	0.89	0.69	0.14	0.02	19.6%
HC-08	SH-05	B					0.59				
HC-08	SH-05	C					0.66				
HC-08	SH-05	D					0.56				
HC-08	SH-05	E					0.77				
HC-04	SH-06	A	16.67	2.30	5.27	13.8%	0.74	0.80	0.11	0.01	14.3%
HC-04	SH-06	B					0.63				
HC-04	SH-06	C					0.92				
HC-04	SH-06	D					0.88				
HC-04	SH-06	E					0.83				
Ref. 0102B35	SH-07	A	14.86	2.15	4.62	14.5%	0.82	0.71	0.11	0.01	15.1%
Ref. 0102B35	SH-07	B					0.77				
Ref. 0102B35	SH-07	C					0.77				
Ref. 0102B35	SH-07	D					0.63				
Ref. 0102B35	SH-07	E					0.57				

Juvenile Polychaete Sediment Bioassay Results - Shannon Point Fish Pier
Testing Dates: 2/2/95 to 2/22/95
Hart Crowser/Job No. 31084

Sediment Field ID No.	Sediment Lab ID No.	Rep	AVG of Mean Individual Larval Weight (mg)	STD of Mean Individual Larval Weight (mg)	VAR of Mean Individual Larval Weight (mg)	COV of Mean Individual Larval Weight (mg)	Individual Growth Rate (mg/Day)	AVG of Individual Growth Rate (mg/Day)	STD of Individual Growth Rate (mg/Day)	VAR of Individual Growth Rate (mg/Day)	COV of Individual Growth Rate (mg/Day)
HC-07	SH-08	A	14.33	3.97	15.73	27.7%	0.81	0.68	0.20	0.04	29.0%
HC-07	SH-08	B					0.53				
HC-07	SH-08	C					0.68				
HC-07	SH-08	D					0.94				
HC-07	SH-08	E					0.46				

Hart Crowser/Shannon Point Fish Pier - 2/2/95 - 2/22/95
Juvenile Polychaete Sediment Bioassay Results
Positive Control Survivorship
Replicate Data

Cd2+ Conc.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 4 Mortality	% Srvshp.	% Mort.
0.0 mg/L	10	10	10	10	10	0	100%	0%
0.0 mg/L	10	10	10	10	9	1	90%	10%
0.01 mg/L	10	10	9	9	10	0	100%	0%
0.01 mg/L	10	10	9	9	8	2	80%	20%
0.1 mg/L	10	10	10	10	8	0	80%	20%
0.1 mg/L	10	10	10	10	10	0	100%	0%
1.0 mg/L	10	10	10	10	9	1	90%	10%
1.0 mg/L	10	10	10	10	10	0	100%	0%
10.0 mg/L	10	10	10	10	8	2	80%	20%
10.0 mg/L	10	10	10	10	10	0	100%	0%
100.0 mg/L	10	0	0	0	0	10	0%	100%
100.0 mg/L	10	0	0	0	0	10	0%	100%

Combined Concentration Data

Cd2+ Conc.	Day 0	Day 1	Day 2	Day 3	Day 4	% Srvshp.	% Mort.
0.0 mg/L	20	20	20	20	19	95%	5%
0.01 mg/L	20	20	18	18	18	90%	10%
0.1 mg/L	20	20	20	20	18	90%	10%
1.0 mg/L	20	20	20	20	19	95%	5%
10.0 mg/L	20	20	20	20	18	90%	10%
100.0 mg/L	20	0	0	0	0	0%	100%

Final Survivorship Statistics

Cd2+ Conc.	AVG	STD	VAR	COV	+95% C.I.	-95% C.I.
0.0 mg/L	9.5	0.7	0.5	7.4%	10.9	8.1
0.01 mg/L	9.0	1.4	2.0	15.7%	11.8	6.2
0.1 mg/L	9.0	1.4	2.0	15.7%	11.8	6.2
1.0 mg/L	9.5	0.7	0.5	7.4%	10.9	8.1
10.0 mg/L	9.0	1.4	2.0	15.7%	11.8	6.2
100.0 mg/L	0.0	0.0	0.0	-	0.0	0.0

Final Mortality Statistics

Cd2+ Conc.	AVG	STD	VAR	COV	+95% C.I.	-95% C.I.
0.0 mg/L	0.5	0.7	0.5	141.4%	1.9	-0.9
0.01 mg/L	1.0	1.4	2.0	-	3.8	-1.8
0.1 mg/L	0.0	0.0	0.0	-	0.0	0.0
1.0 mg/L	0.5	0.7	0.5	141.4%	1.9	-0.9
10.0 mg/L	1.0	1.4	2.0	141.4%	3.8	-1.8
100.0 mg/L	10.0	0.0	0.0	0.0%	10.0	10.0

+-----+
| TRIMMED SPEARMAN-KARBER ANALYSIS |
+-----+

FILE:

TEST: Positive Control DATE: 2/2/95
SPECIES: Neanthes arenocodentata DURATION: 96-Hr
CHEMICAL: Cadmium Chloride
CARRIER: CARRIER CONC:

CONC(mg/L)	#EXPOSED	MORTALITY
0.010	20	2
0.100	20	0
1.000	20	1
10.000	20	2
100.000	20	20

Spearman-Kärber trim: 5.000
Spearman-Kärber est LC50: 26.194

95% Lower confidence: 18.190

95% Upper Confidence: 37.722

<Mortality proportions were adjusted>

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Juvenile Polychaete Test Results and Analysis, 2/2/95 to 2/22/95

Field ID	Lab ID	Temperature								
		Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	
HC-11	SH-01	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
West Beach	SH-02	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
	SH-03	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
Ref. 0102A43	SH-04	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
HC-08	SH-05	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
HC-04	SH-06	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
Ref. 0102B35	SH-07	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
HC-07	SH-08	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	

Field ID	Lab ID	Dissolved Oxygen								
		Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	
HC-11	SH-01	7.4	6.6	6.8	6.8	6.6	6.8	7.4	6.8	
West Beach	SH-02	7.3	6.9	6.8	6.9	6.9	6.9	7.1	6.8	
	SH-03	7.2	6.8	6.7	7.0	7.2	6.9	6.4	6.6	
Ref. 0102A43	SH-04	7.6	6.8	6.6	6.9	6.7	6.6	6.8	6.6	
HC-08	SH-05	7.5	6.3	6.7	6.8	6.6	6.4	6.8	6.5	
HC-04	SH-06	7.2	6.9	6.7	6.7	7.0	6.8	6.6	6.2	
Ref. 0102B35	SH-07	7.6	7.3	6.6	6.7	7.2	6.8	6.7	6.5	
HC-07	SH-08	7.1	7.1	6.6	6.8	6.8	6.4	6.6	6.5	

Units Legend: Temperature - Degrees C; D.O. Dissolved Oxygen - mg/L; pH - pH Units;

Salinity - parts per thousand; Ammonia - mg/L; Sulfides - mg/L

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Juvenile Polychaete Test Results and Analysis, 2/2/95 to 2/22/95

Field ID	Lab ID	pH								
		Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	
HC-11	SH-01	7.89	7.55	6.67	7.91	7.45	7.30	8.15	8.30	
West Beach	SH-02	7.83	7.55	7.22	7.82	7.69	7.47	8.05	7.90	
	SH-03	7.89	7.78	8.04	8.26	8.38	7.92	7.82	8.34	
Ref. 0102A43	SH-04	7.86	7.75	7.83	7.73	8.13	7.74	8.01	7.90	
HC-08	SH-05	7.78	7.81	7.85	7.93	8.21	7.59	8.08	8.01	
HC-04	SH-06	7.88	7.88	7.91	8.02	8.32	7.99	7.94	8.04	
Ref. 0102B35	SH-07	7.88	7.81	7.81	7.85	8.17	7.73	7.95	7.93	
HC-07	SH-08	7.83	7.84	7.99	8.16	8.37	8.02	7.78	8.21	

Field ID	Lab ID	Salinity								
		Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	
HC-11	SH-01	28.0	29.0	30.0	28.0	28.0	28.0	28.0	29.0	
West Beach	SH-02	29.0	29.0	30.0	28.0	28.0	28.0	28.0	28.0	
	SH-03	29.0	29.0	30.0	29.0	29.0	28.0	28.0	28.0	
Ref. 0102A43	SH-04	29.0	29.0	25.0	27.0	28.0		27.0	28.0	
HC-08	SH-05	28.0	29.0	30.0	28.0	28.0	28.0	29.0	28.0	
HC-04	SH-06	29.0	29.0	30.0	28.0	28.0	28.0	28.0	28.0	
Ref. 0102B35	SH-07	29.0	29.0	29.0	28.0	30.0	28.0	28.0	27.0	
HC-07	SH-08	29.0	29.0	29.0	28.0	29.0	28.0	28.0	28.0	

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
Juvenile Polychaete Test Results and Analysis, 2/2/95 to 2/22/95

Field ID	Lab ID	Total Ammonia		Total Sulfides	
		Day 0	Day 20	Day 0	Day 20
HC-11	SH-01		0.140		5.3
West Beach	SH-02		0.190		6.9
HC-02	SH-03		4.100		< 4
Ref. 0102A43	SH-04		0.210		< 4
HC-08	SH-05		0.380		< 4
HC-04	SH-06		0.230		4.5
Ref. 0102B35	SH-07		0.540		< 4
HC-07	SH-08		1.700		6.9

Field ID	Lab ID	Temp			DO			pH		
		Avg	STD	COV	Avg	STD	COV	Avg	STD	COV
HC-11	SH-01	20.0	0.0	0.0%	6.9	0.3	4.6%	7.7	0.5	6.9%
West Beach	SH-02	20.0	0.0	0.0%	7.0	0.2	2.4%	7.7	0.3	3.5%
HC-02	SH-03	20.0	0.0	0.0%	6.9	0.3	4.1%	8.1	0.2	3.0%
Ref. 0102A43	SH-04	20.0	0.0	0.0%	6.8	0.3	4.9%	7.9	0.1	1.8%
HC-08	SH-05	20.0	0.0	0.0%	6.7	0.4	5.5%	7.9	0.2	2.4%
HC-04	SH-06	20.0	0.0	0.0%	6.8	0.3	4.4%	8.0	0.1	1.8%
Ref. 0102B35	SH-07	20.0	0.0	0.0%	6.9	0.4	5.7%	7.9	0.1	1.7%
HC-07	SH-08	20.0	0.0	0.0%	6.7	0.3	4.0%	8.0	0.2	2.6%

Hart Crowser/Shannon Point Fish Pier Sediment Bioassays
 Juvenile Polychaete Test Results and Analysis, 2/2/95 to 2/22/95

Field ID	Lab ID	Salinity			Total Ammonia			Total Sulfides		
		Avg	STD	COV	Avg	STD	COV	Avg	STD	COV
HC-11	SH-01	28.5	0.8	2.7%	0.1			5.3		
West Beach	SH-02	28.5	0.8	2.7%	0.2			6.9		
HC-02	SH-03	28.8	0.7	2.5%	4.1			0.0		
Ref. 0102A43	SH-04	27.6	1.4	5.1%	0.2			0.0		
HC-08	SH-05	28.5	0.8	2.7%	0.4			0.0		
HC-04	SH-06	28.5	0.8	2.7%	0.2			4.5		
Ref. 0102B35	SH-07	28.5	0.9	3.2%	0.5			0.0		
HC-07	SH-08	28.5	0.5	1.9%	1.7			6.9		

Hart Crowser/Shannon Point Fish Pier - Sediment Bioassays
Juvenile Polychaete Test Results and Analysis, 2/2/95 to 2/22/95

Lab ID	Temperature, Degree C			
	Day 0	Day 3	Day 4	
0 mg/L	20.0	20.0	20.0	
0.01 mg/L	20.0	20.0	20.0	
0.1 mg/L	20.0	20.0	20.0	
1.0 mg/L	20.0	20.0	20.0	
10 mg/L	20.0	20.0	20.0	
100 mg/L	20.0	20.0	20.0	

Lab ID	pH		
	Day 0	Day 3	Day 4
0 mg/L	7.91	7.12	7.36
0.01 mg/L	7.91	7.34	7.50
0.1 mg/L	7.91	7.45	7.56
1.0 mg/L	7.91	7.54	7.62
10 mg/L	7.90	7.55	7.69
100 mg/L	7.87	7.54	7.65

Lab ID	Dissolved Oxygen			
	Day 0	Day 3	Day 4	
0 mg/L	7.5	6.3	6.4	
0.01 mg/L	7.4	6.4	6.8	
0.1 mg/L	7.2	6.3	6.6	
1.0 mg/L	7.5	6.2	6.8	
10 mg/L	7.6	6.3	6.6	
100 mg/L	7.8	6.2	6.7	

Lab ID	Salinity		
	Day 0	Day 3	Day 4
0 mg/L	28.0	28.0	28.0
0.01 mg/L	28.0	28.0	28.0
0.1 mg/L	28.0	28.0	28.0
1.0 mg/L	28.0	29.0	28.0
10 mg/L	28.0	28.0	28.0
100 mg/L	28.0	28.0	28.0

Lab ID	Temp.			D.O.			pH			Salinity		
	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV	AVG	STD	COV
0 mg/L	20.0	0.0	0%	6.7	0.7	10%	7.5	0.4	5%	28.0	0.0	0%
0.01 mg/L	20.0	0.0	0%	6.9	0.5	7%	7.6	0.3	4%	28.0	0.0	0%
0.1 mg/L	20.0	0.0	0%	6.7	0.5	7%	7.6	0.2	3%	28.0	0.0	0%
1.0 mg/L	20.0	0.0	0%	6.8	0.7	10%	7.7	0.2	3%	28.3	0.6	2%
10 mg/L	20.0	0.0	0%	6.8	0.7	10%	7.7	0.2	2%	28.0	0.0	0%
100 mg/L	20.0	0.0	0%	6.9	0.8	12%	7.7	0.2	2%	28.0	0.0	0%

Appendix 5: Results of Grain Size Analysis of Reference Sediments



AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

Beak Consultants
12931 NE 126th Place
Kirkland, WA 98034
Attention: Bob Suggs

Date Received: 3/15/95
Date Reported: 3/28/95

Project Name: Shannon Point
Project #: 31084
PO Number: 2269

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A005055
CLIENT ID 0225A43
DATE SAMPLED 2/25/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	73.3			
Total Volatile Solids (%)	1.40			
Total Organic Carbon (%)	0.44			
Ammonia (mg/kg)	12.			
Total Sulfides (mg/kg)	< 14			
GRAIN SIZE DISTRIBUTION				
PHI	OPENING (MM)	% RETENTION		
	4.75	< 0.1		
-2,	4.00	0.40		
-1,	2.00	0.30		
0,	1.00	0.10		
+1,	0.50	0.80		
+2,	0.25	10.1		
+3,	0.125	60.6		
+4,	0.063	13.6		
+5,	0.032	5.00		
+6,	0.016	1.90		
+7,	0.008	0.70		
+8,	0.004	1.40		
+9,	0.002	1.20		
+10,	0.001	0.70		
>+10,	<0.001	3.10		

AMTEST

Beak Consultants
12931 NE 126th Place
Kirkland, WA 98034
Attention: Bob Suggs

Date Received: 3/15/95
Date Reported: 3/28/95

Project Name: Shannon Point
Project #: 31084
PO Number: 2269

PSDDA CHEMICALS OF CONCERN

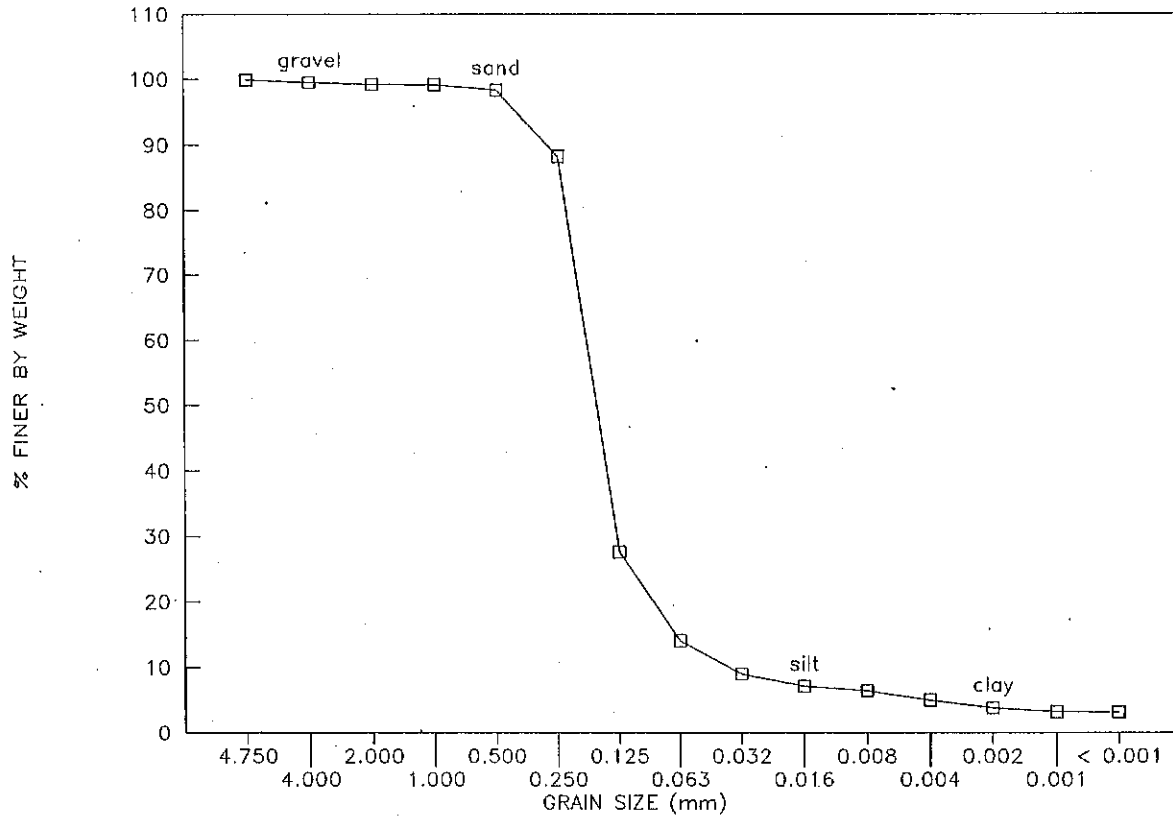
AM TEST ID 95-A005056
CLIENT ID 0225B35
DATE SAMPLED 2/25/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	68.6			
Total Volatile Solids (%)	1.90			
Total Organic Carbon (%)	0.66			
Ammonia (mg/kg)	16.			
Total Sulfides (mg/kg)	< 15			
GRAIN SIZE DISTRIBUTION				
PHI	OPENING (MM)	% RETENTION		
	4.75	< 0.1		
-2,	4.00	< 0.1		
-1,	2.00	0.60		
0,	1.00	0.90		
+1,	0.50	5.20		
+2,	0.25	14.7		
+3,	0.125	36.9		
+4,	0.063	20.0		
+5,	0.032	8.20		
+6,	0.016	4.10		
+7,	0.008	2.10		
+8,	0.004	1.90		
+9,	0.002	0.90		
+10,	0.001	0.40		
>+10,	<0.001	4.20		

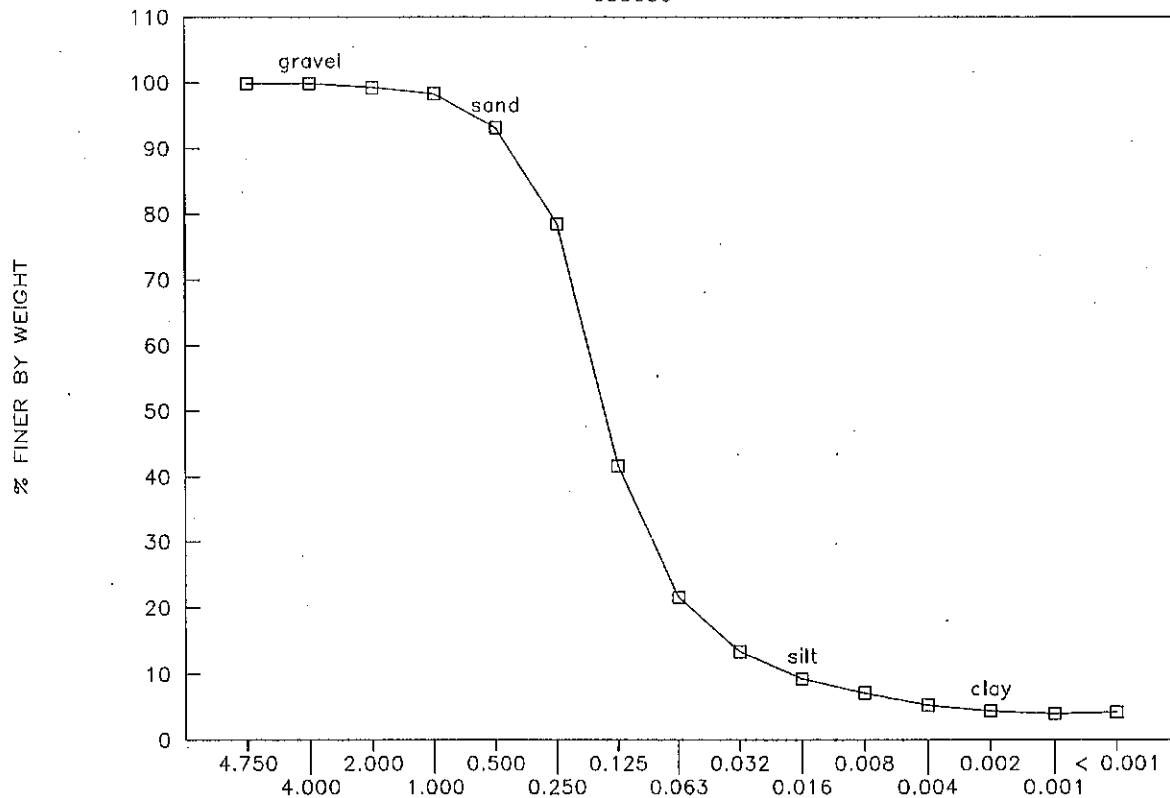
AMTEST

GRAIN SIZE DISTRIBUTION

005055



005056



ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - ANALYSIS DATES
CONVENTIONALS

AM TEST
SAMPLE NOS.

ANALYSIS
DATES

CONVENTIONALS

Total Solids	03/17/95
Total Volatile Solids	03/17/95
Total Organic Carbon	03/16/95
Ammonia	03/16/95
Total Sulfides	03/20/95
Grain Size	03/17/95

ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - METHOD REFERENCES
CONVENTIONALS

AM TEST
SAMPLE NOS.

METHOD
REFERENCES

CONVENTIONALS

Total Solids	PSEP p. 17
Total Volatile Solids	PSEP p. 20
Total Organic Carbon	PSEP p. 23 mod.
Ammonia	Plumb 1981
Total Sulfides	PSEP p. 32
Grain Size	PSEP p. 29

ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - TRIPLICATES
CONVENTIONALS

AM TEST Sample Number
Client Identification

95-A005055
0225A43

PARAMETERS

TRIPLICATES

	#1	#2	#3
Total Solids (%)	73.3	73.3	73.0
Total Volatile Solids (%)	1.4	1.4	1.3
Total Organic Carbon (%)	0.45	0.46	0.44
Ammonia (mg/kg)	12.	12.	12.
Total Sulfides (mg/kg)	<14.	<14.	<14.

< = less than

ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - STANDARD REFERENCE MATERIALS
TOTAL ORGANIC CARBON - BCSS-1

COMPOUNDS	MEASURED VALUE (%)	TRUE VALUE (%)	RECOVERY (%)
Total Organic Carbon	2.37	2.19	108.

ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - CONVENTIONALS - BLANK

AM TEST Sample Number
Client Identification

BLANK

ANALYTES

RESULTS

Total Organic Carbon (%)	<0.05
Ammonia (mg/kg)	<1.
Total Sulfides (mg/kg)	<10.

< = less than

ANALYSIS REPORT

AMTEST

Beak Consultants
Bob Suggs

Date Received: 03/15/95
Date Reported: 03/28/95
Project: Shannon Point
Project No.: 31084
P.O. No.: 2269

QUALITY CONTROL - GRAIN SIZE ANALYSIS - TRIPLICATES

AM TEST Sample Number
Client Identification

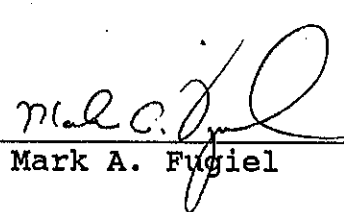
94-A005055
0225A43

PHI	OPENING (mm)	RETENTION (%)		
		#1	#2	#3
	4.75	<0.1	<0.1	0.1
-2	4.00	0.4	<0.1	<0.1
-1	2.00	0.3	0.3	0.1
0	1.00	0.1	0.1	0.1
+1	0.50	0.8	0.7	0.8
+2	0.25	10.1	10.8	13.3
+3	0.125	60.6	57.2	60.4
+4	0.063	13.6	16.0	14.0
+5	0.032	5.0	6.0	2.1
+6	0.016	1.9	1.9	1.9
+7	0.008	0.7	0.7	0.7
+8	0.004	1.4	1.4	1.4
+9	0.002	1.2	1.2	1.2
+10	0.001	0.7	0.7	0.7
PASS	<0.001	3.1	3.1	3.1
Total Solids (%)		73.3	73.3	73.0
Total Volatile Solids (%)		1.4	1.4	1.3

< = less than

MAF/pb

REPORTED BY


Mark A. Fugiel

Appendix 6: Priority Pollutant Analysis of Seawater Source Used in Bioassay Testing

ANALYSIS REPORT

AMTEST

AmTest Inc.

Professional
Analytical
Services14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

Beak Consultants
12931 NE 126th Place
Kirkland, WA 98034
Attention: Charlie WisdomDate Received: 2/22/95
Date Reported: 3/ 9/95Project Name: Seawater P.P. Scan
PO Number: 2227RECEIVED
MAR 14 1995
BEAK

WATER SAMPLES

AM TEST Identification Number 95-A003830
Client Identification Seawater
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
Conventionals			
Total Cyanide (mg/l)	< 0.005		0.005
Total Phenol (mg/l)	< 0.5		0.005
Total Metals			
Antimony (mg/l)	< 0.02		0.02
Arsenic (mg/l)	< 0.001		0.001
Beryllium (mg/l)	< 0.005		0.005
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Copper (mg/l)	< 0.002		0.002
Mercury (mg/l)	< 0.0002		0.0002
Nickel (mg/l)	< 0.01		0.01
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silver (mg/l)	< 0.01		0.01
Thallium (mg/l)	< 0.001		0.001
Zinc (mg/l)	0.048		0.002

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 2/22/95

Date Reported: 3/ 9/95

WATER SAMPLES

AM TEST Identification Number 95-A003830
Client Identification Seawater
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
-----------	--------	---	------

Pesticides and PCB's (EPA 608)

Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1
Chlordane	< 0.5		0.5

PCB's

Aroclor 1016	< 0.1		0.10
Aroclor 1221	< 0.4		0.40
Aroclor 1232	< 0.1		0.10
Aroclor 1242	< 0.1		0.10
Aroclor 1248	< 0.1		0.10
Aroclor 1254	< 0.1		0.10
Aroclor 1260	< 0.1		0.10

SURROGATE (% Recovery)

Hexabromobenzene	92.0
------------------	------

All values are in ug/l (ppb).

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 2/22/95

Date Reported: 3/ 9/95

WATER SAMPLES

AM TEST Identification Number 95-A003830
Client Identification Seawater
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
-----------	--------	---	------

Volatile Organic Compounds (EPA 624)	(ug/l)	(ug/l)
--------------------------------------	--------	--------

Chloromethane	< 5	5.0
Vinyl Chloride	< 5	5.0
Bromomethane	< 5	5.0
Chloroethane	< 5	5.0
Trichlorofluoromethane	< 1	1.0
1,1-Dichloroethylene	< 1	1.0
Acetone	< 20	20.
Carbon Disulfide	< 1	1.0
Methylene Chloride	1.1	1.0
1,2-Dichloroethylene	< 1	1.0
1,1-Dichloroethane	< 1	1.0
Vinyl Acetate	< 10	10.
2-Butanone (MEK)	< 10	10.
Chloroform	< 1	1.0
1,1,1-Trichloroethane	< 1	1.0
Carbon Tetrachloride	< 1	1.0
Benzene	< 1	1.0
1,2-Dichloroethane	< 1	1.0
1,1,2-Trichloroethene	< 1	1.0
Bromodichloromethane	< 1	1.0
1,2-Dichloropropane	< 1	1.0
4-Methyl-2-Pentanone	< 10	10.
Toluene	< 1	1.0
Cis-1,3-Dichloropropene	< 1	1.0
1,1,2-Trichloroethane	< 1	1.0
Tetrachloroethylene	< 1	1.0
2-Hexanone	< 10	10.
Chlorodibromomethane	< 1	1.0
Chlorobenzene	< 1	1.0
Ethyl Benzene	< 1	1.0
Total Xylenes	< 1	1.0
Styrene	< 1	1.0
Bromoform	< 1	1.0
1,1,2,2-Tetrachloroethane	< 1	1.0
Trans-1,3-Dichloropropene	< 1	1.0
p-Dichlorobenzene	< 1	1.0

SURROGATE (% Recovery)

D4-1,2-Dichloroethane	101.
D8-Toluene	96.0
4-Bromofluorobenzene	97.0

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 2/22/95
Date Reported: 3/ 9/95

WATER SAMPLES

AM TEST Identification Number 95-A003830
Client Identification Seawater
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
Semi-Volatile Organic Compounds (EPA METHOD 625)			
N-Nitrosodimethylamine	< 5		5.0
Aniline	< 2		2.0
Phenol	< 2		2.0
bis(2-Chloroethyl)ether	< 2		2.0
2-Chlorophenol	< 2		2.0
1,3-Dichlorobenzene	< 2		2.0
1,4-Dichlorobenzene	< 2		2.0
Benzyl Alcohol	< 2		2.0
1,2-Dichlorobenzene	< 2		2.0
2-Methylphenol	< 2		2.0
bis(2-Chloroisopropyl)ether	< 2		2.0
4-Methylphenol	< 2		2.0
N-Nitroso-di-n-propylamine	< 2		2.0
Hexachloroethane	< 2		2.0
Nitrobenzene	< 2		2.0
Isophorone	< 2		2.0
2-Nitrophenol	< 5		5.0
2,4-Dimethylphenol	< 2		2.0
Benzoic Acid	< 5		5.0
bis(2-Chloroethoxy)methane	< 2		2.0
2,4-Dichlorophenol	< 2		2.0
1,2,4-Trichlorobenzene	< 2		2.0
Naphthalene	< 2		2.0
4-Chloroaniline	< 2		2.0
Hexachlorobutadiene	< 2		2.0
4-Chloro-3-methylphenol	< 2		2.0
2-Methylnaphthalene	< 2		2.0
Hexachlorocyclopentadiene	< 5		5.0
2,4,6-Trichlorophenol	< 2		2.0
2,4,5-Trichlorophenol	< 2		2.0
2-Chloronaphthalene	< 2		2.0
2-Nitroaniline	< 5		5.0
Dimethylphthalate	< 2		2.0
Acenaphthylene	< 2		2.0
2,6-Dinitrotoluene	< 5		5.0
3-Nitroaniline	< 5		5.0
Acenaphthene	< 2		2.0
2,4-Dinitrophenol	< 10		10.

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 2/22/95
Date Reported: 3/ 9/95

WATER SAMPLES

AM TEST Identification Number 95-A003830
Client Identification Seawater
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
4-Nitrophenol	< 10		10.
Dibenzofuran	< 2		2.0
2,4-Dinitrotoluene	< 5		5.0
Diethylphthalate	< 2		2.0
4-Chlorophenyl-phenyl ether	< 2		2.0
Fluorene	< 2		2.0
4-Nitroaniline	< 5		5.0
4,6-Dinitro-2-methylphenol	< 5		5.0
N-nitrosodiphenylamine	< 2		2.0
Azobenzene	< 2		2.0
4-Bromophenyl-phenyl ether	< 2		2.0
Hexachlorobenzene	< 2		2.0
Pentachlorophenol	< 5		5.0
Phenanthrene	< 2		2.0
Anthracene	< 2		2.0
Di-n-butylphthalate	< 2		2.0
Fluoranthene	< 2		2.0
Benzidine	< 50		50.
Pyrene	< 2		2.0
Butylbenzylphthalate	< 2		2.0
3,3-Dichlorobenzidine	< 3		3.0
Benzo(a)anthracene	< 2		2.0
Chrysene	< 2		2.0
bis(2-Ethylhexyl)phthalate	< 2		2.0
Di-n-octylphthalate	< 2		2.0
Benzo(b)fluoranthene	< 2		2.0
Benzo(k)fluoranthene	< 2		2.0
Benzo(a)pyrene	< 2		2.0
Indeno(1,2,3-cd)pyrene	< 4		4.0
Dibenzo(a,h)anthracene	< 4		4.0
Benzo(g,h,i)perylene	< 4		4.0

SURROGATES (% Recovery)

2-Fluorophenol	62.0
D6-Phenol	46.0
D5-Nitrobenzene	77.0
2-Fluorobiphenyl	84.0
2,4,6-Tribromophenol	61.0
D14-Terphenyl	94.0

All values are in ug/l (ppb).

ANALYSIS REPORT

AMTEST

AmTest Inc.

Professional
Analytical
ServicesBeak Consultants
12931 NE 126th Place
Kirkland, WA 98034
Attention: Charlie WisdomDate Received: 2/22/95
Date Reported: 3/ 9/9514603 N.E. 87th St.
Redmond, WA
98052Project Name: Seawater P.P. Scan
PO Number: 2227Fax: 206 883 3495
Tel: 206 885 1664

WATER SAMPLES

AM TEST Identification Number 95-A003837
Client Identification P.P. Scan Trip Blank
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)	(ug/l)		(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	< 1		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0

ANALYSIS REPORT **AMTEST**

Beak Consultants
Charlie Wisdom

Date Received: 2/22/95
Date Reported: 3/ 9/95

WATER SAMPLES

AM TEST Identification Number 95-A003837
Client Identification P.P. Scan Trip Blank
Sampling Date 2/22/95

PARAMETER	RESULT	Q	D.L.
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	103.		
D8-Toluene	99.0		
4-Bromofluorobenzene	99.0		



AmTest Inc.

Professional
Analytical
Services14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

AM TEST ID 95-A003830
CLIENT ID SeawaterMATRIX : Water
SAMPLED: 2/22/95

ANALYTE	UNITS	METHOD NUMBER	METHOD REFERENCE	DETECTION LIMIT *	DATE OF ANALYSIS
Pesticides and PCB's	ug/l	608	EPA	0.03-5.0	3/ 6/95
Volatile Organics	ug/l	624	EPA	1.0-10	2/27/95
Semi-Volatile Organics	ug/l	625	EPA	2-10	2/24/95
Total Cyanide	mg/l	335.3	EPA	0.005	2/27/95
Total Phenol	mg/l	420.2	EPA	0.005	3/ 8/95
Silver	mg/l	200.7	EPA	0.01	2/24/95
Arsenic	mg/l	206.2	EPA	0.001	3/ 2/95
Beryllium	mg/l	200.7	EPA	0.005	2/24/95
Cadmium	mg/l	200.7	EPA	0.002	2/24/95
Chromium	mg/l	200.7	EPA	0.006	2/24/95
Copper	mg/l	200.7	EPA	0.002	2/24/95
Mercury	mg/l	245.1	EPA	0.0002	3/ 3/95
Nickel	mg/l	200.7	EPA	0.01	2/24/95
Lead	mg/l	239.2	EPA	0.001	2/28/95
Antimony	mg/l	200.7	EPA	0.02	2/24/95
Selenium	mg/l	270.2	EPA	0.001	2/27/95
Thallium	mg/l	279.2	EPA	0.001	2/27/95
Zinc	mg/l	200.7	EPA	0.002	2/24/95
Acid Dig. (Tot Metals)		3010	EPA		2/23/95
Sep. Funnel Ext. (608)		3510	SW-846		2/27/95
Sep Funnel Ext. (625)		3510	SW-846		2/24/95

S. = Standard Methods for the Examination of Water and Wastewater 18th ed.

SW-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods

EPA = Methods for Chemical Analysis of Water and Wastes 1983

* Instrument Detection Limit

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 8260

AM TEST Sample Number
Client Identification

VOA BLANK 02/27/95

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethylene	ND	1.0
Acetone	ND	20.
Carbon Disulfide	ND	1.0
Methylene Chloride	ND	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	ND	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0
SURROGATE RECOVERIES (%)		
D4-1,2-Dichloroethane	103.	
D8-Toluene	98.	
4-Bromofluorobenzene	96.	

ND = Not Detected

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - BLANK - SEMI-VOLATILES BY EPA METHOD 625

AM TEST Sample Number
Client Identification

BLANK 02/24/95

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
N-Nitrosodimethylamine	ND	5.0
Aniline	ND	2.0
Phenol	ND	2.0
Bis(2-Chloroethyl) ether	ND	2.0
2-Chlorophenol	ND	2.0
1,3-Dichlorobenzene	ND	2.0
1,4-Dichlorobenzene	ND	2.0
Benzyl Alcohol	ND	2.0
1,2-Dichlorobenzene	ND	2.0
3-Methylphenol	ND	2.0
Bis(2-Chloroisopropyl) ether	ND	2.0
4-Methylphenol	ND	2.0
N-Nitroso-di-n-propylamine	ND	2.0
Hexachloroethane	ND	2.0
Nitrobenzene	ND	2.0
Isophorone	ND	2.0
2-Nitrophenol	ND	5.0
2,4-Dimethylphenol	ND	2.0
Benzoic Acid	ND	5.0
Bis(2-Chloroethoxy) methane	ND	2.0
2,4-Dichlorophenol	ND	2.0
1,2,4-Trichlorobenzene	ND	2.0
Naphthalene	ND	2.0
4-Chloroaniline	ND	2.0
Hexachlorobutadiene	ND	2.0
4-Chloro-3-Methylphenol	ND	2.0
2-Methylnaphthalene	ND	2.0
Hexachlorocyclopentadiene	ND	5.0
2,4,6-Trichlorophenol	ND	2.0
2,4,5-Trichlorophenol	ND	2.0
2-Chloronaphthalene	ND	2.0
2-Nitroaniline	ND	5.0
Dimethylphthalate	ND	2.0
Acenaphthylene	ND	2.0
1,6-Dinitrotoluene	ND	5.0

ND = Not Detected

All values are reported in ug/l.

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - BLANK - SEMI-VOLATILES BY EPA METHOD 625

AM TEST Sample Number
Client Identification

BLANK 02/24/95

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
3-Nitroaniline	ND	5.0
Acenaphthene	ND	2.0
2,4-Dinitrophenol	ND	10.
4-Nitrophenol	ND	10.
Dibenzofuran	ND	2.0
2,4-Dinitrotoluene	ND	5.0
Diethylphthalate	ND	2.0
4-Chlorophenyl-phenylether	ND	2.0
Fluorene	ND	2.0
4-Nitroaniline	ND	5.0
4,6-Dinitro-2-methylphenol	ND	5.0
N-Nitrosodiphenylamine	ND	2.0
Azobenzene	ND	2.0
4-Bromophenyl-phenylether	ND	2.0
Hexachlorobenzene	ND	2.0
Pentachlorophenol	ND	5.0
Phenanthrene	ND	2.0
Anthracene	ND	2.0
Di-n-butylphthalate	ND	2.0
Fluoranthene	ND	2.0
Benzidine	ND	50.
Pyrene	ND	2.0
Benzylbutylphthalate	ND	2.0
3,3'-Dichlorobenzidine	ND	3.0
Benzo(a)anthracene	ND	2.0
Chrysene	ND	2.0
Bis(2-Ethylhexyl)phthalate	ND	2.0
Di-n-octylphthalate	ND	2.0
Benzo(b)fluoranthene	ND	2.0
Benzo(k)fluoranthene	ND	2.0
Benzo(a)pyrene	ND	2.0
Indeno(1,2,3-cd)pyrene	ND	4.0
Dibenzo(a,h)anthracene	ND	4.0
Benzo(g,h,i)perylene	ND	4.0

ND = Not Detected

All values are reported in ug/l.

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - BLANK - SEMI-VOLATILES BY EPA METHOD 625

AM TEST Sample Number
Client Identification

BLANK 02/24/95

SURROGATE COMPOUNDS

RECOVERY
(%)

2-Fluorophenol	51.
D5-Phenol	35.
D5-Nitrobenzene	61.
2-Fluorobiphenyl	58.
2,4,6-Tribromophenol	46.
D14-Terphenyl	92.

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - SPIKE RECOVERIES - SEMI-VOLATILES BY EPA METHOD 625

AM TEST Sample Number

95-A003830

Client Identification

MS + MSD
Seawater

MATRIX SPIKE COMPOUNDS	SPIKE RECOVERY (%)	SPIKE DUPLICATE RECOVERY (%)	RELATIVE PERCENT DIFFERENCE (%)
Phenol	37.	37.	1.
2-Chlorophenol	71.	75.	5.
1,4-Dichlorobenzene	64.	67.	5.
N-Nitrosodipropylamine	72.	73.	2.
1,2,4-Trichlorobenzene	69.	76.	11.
4-Chloro-3-Methylphenol	72.	76.	6.
Acenaphthene	74.	80.	7.
4-Nitrophenol	25.	24.	2.
2,4-Dinitrotoluene	51.	51.	1.
Pentachlorophenol	50.	51.	1.
Pyrene	101.	93.	8.

MS + MSD = Matrix Spike + Matrix Spike Duplicate

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608 - BLANK

AM TEST Sample Number
Client Identification

BLANK 02/27/95

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	6.00
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.00
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50

SURROGATE RECOVERY (%)

Hexabromobenzene 93.

ND = Not Detected

ANALYSIS REPORT

AMTEST

Beak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608
SPIKE RECOVERIES

AM TEST Sample Number
Client Identification

MS 02/27/95

MSD 02/27/95

COMPOUNDS	RECOVERY (%)		AMOUNT SPIKED (ug)
Lindane	88.	92.	0.40
Heptachlor	95.	98.	0.40
Aldrin	90.	93.	0.40
Dieldrin	92.	94.	1.00
Endrin	91.	91.	1.00
p,p'-DDT	85.	85.	1.00

SURROGATE COMPOUND

Hexabromobenzene	98.	98.	1.00
------------------	-----	-----	------

MS = Method Spike

MSD = Method Spike Duplicate

ANALYSIS REPORT

AMTEST

Peak Consultants
Charlie Wisdom

Date Received: 02/22/95
Date Reported: 03/09/95
Project: Seawater PP Scan
P.O. No.: 2227

QUALITY CONTROL - CONVENTIONALS & METALS - BLANK

AM TEST Sample Number
Client Identification

BLANK

ANALYTES

RESULTS (mg/l)

Conventional

Total Cyanide <0.005
Total Phenol <0.005

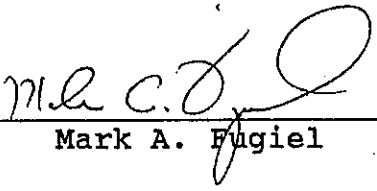
Total Metals

Antimony <0.02
Arsenic <0.001
Beryllium <0.005
Cadmium <0.002
Chromium <0.006
Copper <0.002
Mercury <0.0002
Nickel <0.01
Lead <0.001
Selenium <0.001
Silver <0.01
Thallium <0.001
Zinc <0.002

< = less than

MAF/pb

REPORTED BY


Mark A. Fugiel

Appendix 7: Interstitial Salinity Values for Test Sediments

**Hart Crowser - Shannon Point / Reference Sediment
Interstitial Salinity Measurements**

Field Sediment ID	Laboratory Sediment ID	Initial Sediment Interstitial Salinity (ppt)	Juvenile Polychaete Termination Interstitial Salinity (ppt)
HC-11	SH-01	30.0	29.0
West Beach	SH-02	*	27.0
HC-02	SH-03	30.0	28.0
Ref. 01025A43	SH-04	32.0	26.0
HC-08	SH-05	31.0	27.0
HC-04	SH-06	31.0	28.0
Ref. 0102B35	SH-07	30.0	27.0
HC-07	SH-08	30.0	26.0

* Data was not collected for initial salinity for West Beach Sand, or for Rhepoxynius termination day.

APPENDIX D
SHANNON POINT SEAFOODS
CHEMICAL DATA QUALITY EVALUATION

APPENDIX D CHEMICAL DATA QUALITY EVALUATION

Ten sediment samples were collected on January 25 and 26, 1995. The samples were submitted to Analytical Resources, Inc. of Seattle, WA for total organic carbon (TOC) and selected semivolatile compounds (EPA Method 8270) analysis. Chemical analytical results for these samples and the reported results for quality assurance samples were reviewed. The following criteria were evaluated in the standard validation process for the applicable results;

- ▶ Holding times;
- ▶ Method blanks;
- ▶ Surrogate recoveries;
- ▶ Matrix spike/matrix spike duplicate (MS/MSD) recoveries;
- ▶ Blank spike recoveries;
- ▶ Laboratory duplicates; and
- ▶ Reported detection limits.

Selected Semivolatile Compounds

All samples were analyzed for the required compounds in accordance with the method. All required holding times were met for all analyses. Seven samples required dilutions because of high levels of target analytes in the samples, and therefore some surrogate compounds were diluted out. No data qualifiers were required. One sample required re-extraction and re-analyses based on low surrogate recoveries; however, no data qualifiers were required. The LCS spike recoveries and MS/MSD recoveries were within control limits, with exception to one MS recovery (4-nitrophenol). Since the LCS recoveries were acceptable, no data qualifiers were required. No blank contamination was detected in any of the method blanks for any of the analyses. All duplicate relative percent differences (RPDs) were acceptable. No data qualifiers were required for any of the analyses. The data are acceptable for use, as reported.

Total Organic Carbon

All holding times and QA/QC criteria were acceptable and no data qualifiers were required. The data are acceptable for use, as reported.



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Regional Office, 3190 - 160th Ave S.E. • Bellevue, Washington 98008-5452 • (206) 649-7000

June 26, 1995

Phil Hertzog
DNR Aquatic Lands
Mail Stop 47027

Re: Results of Phase II Sampling and Analysis
Shannon Point Seafoods
Anacortes, Washington

Dear Phil:

I have reviewed the above-referenced report, which has also been submitted to DNR. Based on my review, I generally agree with its conclusions and recommend that DNR send a letter accepting the report and agreeing that additional actions need not be taken.

Overall, it appears that there are still levels of some PAHs and bis(2-ethylhexyl)phthalate present above the cleanup standards. As we expected, there has been little natural recovery of phthalate concentrations, although it does appear that LPAHs have decreased in concentration since the fire. The stations above cleanup standards appear to be restricted to the immediate vicinity of the fire.

Because of the exceedances of chemical concentrations, confirmatory biological testing was conducted in accordance with the PSEP protocols. These tests show that there are little if any impacts to aquatic life from the bis(2-ethylhexyl)phthalate. It is possible, as the report hypothesizes, that the phthalates present are in small pieces of melted plastics from the fire and are not readily bioavailable. In general the field logs indicate relatively healthy sediments, with some debris from the fire though not as much as one might expect.

On this basis, Ecology will remove the site from our draft Contaminated Sediment Site List (which is being finalized and has not yet been published), in accordance with Chapter 173-204-530(4), which provides for an override of site identification based on biological testing. A no further action letter is not necessary, since the site has not yet been publicly listed on the sediment site list or TCP's Site Information System. If you have any questions, please contact me at 649-7257.

Sincerely,

A handwritten signature in cursive script, appearing to read "T. Michelsen".

Teresa Michelsen
Sediment Cleanup Specialist



APPENDIX IV

Sampling & Analysis Plan and Quality Assurance Project Plan (SAP/QAPP)

Inadvertent Discovery Plan (IDP)

Health and Safety Plan (HASP)



**SAMPLING & ANALYSIS PLAN/
QUALITY ASSURANCE
PROJECT PLAN**

Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221
Facility Site ID #21847524

Prepared For:

Guemes Channel Holdings, LLC

By:



PO Box 2546
Bellingham, WA 98227
(360) 714-9409

July 20, 2026

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APPENDICES

APPENDIX SAP-I

Example Surface Sediment Sampling Log
Example Sediment Core Log



July 20, 2026

PO Box 2546, Bellingham, WA 98227

Phone: (360) 714-9409

Kelly Allison
Guemes Channel Holdings, LLC
2629 NW 54th, Suite 201
Seattle, WA 98107

Re: Sediment Sampling & Analysis Plan/Quality Assurance Project Plan

Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221
Facility Site ID #21847524

Dear Ms. Allison:

This document presents a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) developed as part of the Sediment Remedial Investigation Work Plan for the Lovric's Sea-Craft Site (Site) in Anacortes, Washington to investigate and characterize sediment contamination in aquatic portions of the Site per Agreed Order No. DE 22368.

Should you have any questions concerning this SAP/QAPP, please do not hesitate to contact us at (360) 714-9409.

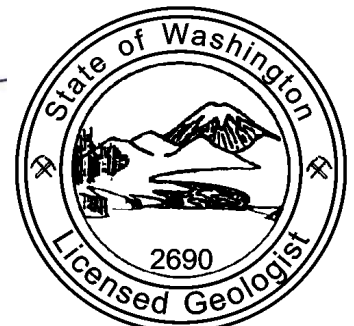
Sincerely,
Stratum Group


Ben Carlson, M.Sc., L.G.
Licensed Geologist



Benjamin Carlson


Kim Ninnemann, B.S.
Licensed Geologist



KIM N NINNEMANN

1.0 INTRODUCTION

This sediment Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) was prepared to present a detailed description of the field and laboratory procedures to be used for sediment sampling and sample analysis at the Lovric's Sea Craft site (Site), currently operated as the Guemes Channel Holdings Anacortes Facility. This work is being completed as part of the Remedial Investigation (RI) under Agreed Order No. DE 22368. This SAP/QAPP was prepared for compliance with Washington Administrative Code (WAC) 173-340-820 and WAC 173-204-600. The goal of this RI is to establish the nature and extent of contaminants of concern (COCs) in Site marine sediments. Project activities described herein are anticipated to commence in 2026 in accordance with the proposed project schedule presented in the Sediment RI Work Plan.

This SAP/QAPP was prepared in accordance with the Guidance for Preparation of Quality Assurance Project Plans, U.S. Environmental Protection Agency (EPA) Region 10, Quality Data Management Program (EPA, 2002), and the Washington State Department of Ecology's Guidelines for preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2016).

2.0 PROJECT BACKGROUND

2.1 Purpose

The purpose of this RI is to define the nature and extent of sediment contamination in aquatic portions of the Site, such that plans for Site remediation and mitigation, if needed, can begin to be designed. The goal of this SAP/QAPP is to describe in detail the procedures for sample collection, sample analysis, and project quality assurance and quality control to demonstrate that data collected in this investigation will be sufficient to meet the project goals and that the data collected can be relied upon.

Previous environmental work on aquatic areas of the Site, as described in the Sediment RI Work Plan, is limited and is not sufficient to define the nature and extent of sediment contamination on the Site. The following data gaps remain:

- Existing sediment data is insufficient to fully characterize the lateral nature and extent of Site sediment contamination.
- Existing sampling data is insufficient to establish Site COCs.
- Minimal subsurface sediment sampling has been completed on the Site, and the vertical nature and extent of Site sediment contamination remains insufficiently characterized.
- No biological testing of sediments has been completed to evaluate toxicity and/or bioaccumulation potential.
- The presence and location of the potential catch basin and stormwater discharge point



beneath the east pier (separate from the City of Anacortes stormwater outfall), which could be a transport mechanism of contaminants from the upland to aquatic areas of the site, has not been confirmed.

- The makeup and extent of the marine railways foundations (e.g., concrete, gravel, pilings, etc.) in the deeper intertidal and subtidal areas of the site are unknown.

2.2 Property Location

The Property, defined as the parcels of real property that make up the Site, is located within the city limits of Anacortes, Washington in Skagit County. The Property is located on the north shore of Fidalgo Island approximately 1.4 miles west-southwest of the historical downtown core of Anacortes, between Dakota Avenue to the east and Hartford Avenue to the west. The Property business utilizes the street address 3100 Oakes Avenue, but the property is also recognized under the addresses 3006 Oakes Avenue, 3022 Oakes Avenue, and 1100 Dakota Avenue. The location of the Property is presented in Figure 1-1 in Appendix I of the Sediment RI Work Plan.

The Property covers approximately 8.7 acres, portions of which are submerged below the high-water mark of Guemes Channel to the north. The upland consists of a steep vegetated hillside and a relatively level shoreline industrial area that is developed with multiple buildings and marine railways. The elevation of the Property along Oakes Avenue is approximately 70 feet above mean lower low water (MLLW), with a 40-to-50-foot elevation drop to the nearshore and shoreline areas where the shipyard infrastructure development is present.

Current and historical use areas of the Site extend into marine waters of Guemes Channel, which consist of aquatic lands leased to the upland property owners from the Washington State Department of Natural Resources (DNR). The lease lands extend approximately 600 feet north-northwest from the Site shoreline bulkheads and cover an area of approximately 13 acres.

2.3 Development and Use History

The Property has been developed since at least the late 1890s, when the Russian Cement plant was constructed. The business produced glue, fertilizer, and fish oil from fish waste gathered from nearby canneries. Robinson Fisheries established a cod cannery on the west side of the Property circa 1912. The entire Property is believed to have operated as a fish processing facility through the mid-1960s.

Lovric's Sea-Craft shipyard was established on the Property circa 1965. Shipyard activities are apparent on the Property by 1969. Fill placement on waterfront areas of the Property, including beaching and backfilling multiple ships and barges, occurred in the 1970s and 1980s to create many of the existing flat areas surrounding the two main warehouses. The fill is reportedly derived from a mix of marine dredge spoils and upland-derived fill of unknown provenance.

The Property has been in continuous operation as a commercial and industrial shipyard since the mid-1960s. Industrial activities have been primarily concentrated in the basin between the east



and west warehouses since that time, currently defined as the industrial basin. The basin between the west warehouse and the west breakwater (currently referred to as the recreational basin) appears to have been used for some industrial shipyard activities in the mid-1970s and early 1980s but it appears to have been converted into the existing recreational vessel moorage by 1989.

Maintenance and repair activities conducted at the shipyard facility have included woodworking, metal fabrication, painting and high pressure washing of hulls, zinc replacement, sandblasting, and electrical and mechanical work. Hull painting and sandblasting activities have predominantly taken place on the marine railways on the Site upland. Other shipyard activities have taken place on the marine railways or onboard vessels moored in the industrial basin. No transport of vessels to other parts of the Site upland has been identified. Process water and sand blast grit from high pressure washing operations on the upland may have previously washed off the marine railways into the environment.

A variety of structures are currently present on the Site which were constructed over a long period of time by prior owners to facilitate site uses including fish processing, a shipyard, and a marina. Key physical elements of the site referenced throughout this SAP/QAPP are discussed in Section 2.2 and are shown in Figure 1-3 in Appendix I of the Sediment RI Work Plan.

3.0 PROJECT ORGANIZATION

Ben Carlson of Stratum Group will be the primary Project Manager responsible for implementation of the Sediment RI Work Plan and this SAP/QAPP, including fieldwork coordination, sample collection and delivery to the laboratory, and assessment and evaluation of the laboratory data. The primary Project Manager will also be responsible for the implementation of the project Health and Safety Plan. Kim Ninnemann of Stratum Group will be the assistant Project Manager in support of these efforts.

Friedman & Bruya Laboratory (F&B) will be the primary analytical laboratory responsible for sample analysis. Analytical Resources LLC (ARL) will be the secondary analytical laboratory responsible for completion of sample analysis that F&B is unable or uncertified to complete. Friedman & Bruya will be responsible for forwarding potentially contaminated media and data to ARL as needed.

Additional key project personnel and entities are outlined in Table 1, below.



Table 1. Project Personnel & Contact Information

Name	Organization	Contact	Responsibilities
Ben Carlson	Stratum Group	978-857-0728 ben@stratumgroup.net	Primary Project Manager including coordination & oversight of subcontractors, HASP implementation, sample collection, evaluation of analytical results, reporting, & general QA/QC compliance
Kim Ninnemann	Stratum Group	360-920-0468 kim@stratumgroup.net	Assistant Project Manager
David Horne	WA Department of Ecology	360-742-1091 hoda461@ecy.wa.gov	Ecology Site Manager
Corey King		360-280-5684 ckin461@ecy.wa.gov	Ecology Sediment Specialist
Kelly Allison	Guemes Channel Holdings, LLC	425-736-9819 kellya@stabbertmaritime.com	Project Manager for GCH (property owner)
Eric Young	Friedman & Bruya Laboratory	206-683-1731 eyoung@friedmanandbruya.com	Laboratory Director responsible for management and execution of analytical laboratory work and QA/QC
Gravity Marine Consulting		425-281-1471	Sampling vessel, Vibracore and power-grab sampling equipment operation, and sediment sample recovery
Regina Edwards	Spheros Environmental	360-297-6040 Regina.Edwards@spherosenv.com	Bioassay testing (if needed)
Stella Cuenco	Laboratory Data Consultants	760-827-1100 Scuenco@lab-data.com	3 rd party data verification and validation for QA/QC

3.1 Regulatory Framework

Agreed Order No. DE22368 (AO) was issued for the Site in accordance with the Model Toxics Control Act (MTCA), RCW 70A.305.050(1). The AO requires Guemes Channel Holdings, LLC (GCH) to perform a Remedial Investigation and Feasibility Study (RI/FS) and to prepare a draft Cleanup Action Plan (DCAP) to address both upland and in-water contamination at the Lovric's Site. This SAP/QAPP was prepared as part of the Sediment RI Work Plan in compliance with WAC 173-340-820 and WAC 173-204-600 for defining the nature and extent of contamination in the aquatic areas of the Site.

4.0 SEDIMENT SAMPLING PLAN

Sediment samples will be collected using a mix of hand tools and vessel-based sampling equipment to evaluate the nature and extent of sediment contamination in aquatic portions of the Site that exceeds preliminary Site screening levels, established herein. This includes both intertidal and subtidal on the Site. Intertidal areas are defined as sediment areas at or above -4 feet mean lower low water (MLLW). Subtidal areas are defined as those below -4 feet MLLW.



4.1 Sampling Locations

A total of 27 sampling locations are proposed in this investigation. Rationale for each of the sampling locations is provided in Table 2, below. A map indicating the proposed sampling locations is provided as Figure 1-5 in Appendix I of the Sediment RI Work Plan.

Table 2. Boring Location & Rationale

Boring ID	Latitude	Longitude	Location	Potential Contaminant Sources
SED1	48.511243	-122.646326	Center of the inner recreational basin	- Pre-1980 industrial ship maintenance/repair - Post-1980s recreational vessel incidental releases
SED2	48.511498	-122.646414	Center of the outer recreational basin	
SED3	48.511737	-122.646233	Center of the recreational basin entrance	
SED4	48.511812	-122.645875	Near the terminus of the finger pier between the west and central peninsulas	- Small vessel maintenance by the finger pier between the peninsulas - Potential leaching from derelict creosote piles to the east. - Evaluates outer extent of potential contamination in recreational basin (above).
SED5	48.512126	-122.645891	Near the middle of the channel between the central peninsula and the west breakwater	
SED6	48.511704	-122.645556	West of the southern end of the central peninsula	- Leaching from derelict creosote piles - Small vessel maintenance by the finger pier between the peninsulas - Decaying wood from buried peninsula barges
SED7	48.511978	-122.645681	Near the northwest tip of the central peninsula	



Table 2. Boring Location & Rationale (continued)

Boring ID	Latitude	Longitude	Location	Potential Contaminant Sources
SED8	48.511617	-122.644876	Nearshore area between east and west railways	<u>Area of greatest current and historical shipyard activity:</u> - Direct releases during vessel maintenance activities on the marine railways (e.g., sand blasting, painting, metal fabrication) - Upland stormwater & process water discharge from marine railways. Evaluate changes from proximal to distal portions of intertidal zone. - Direct releases from historical marine railway operations - Leaching from potential treated piles used to support the marine railways - Upland stormwater discharge through the bulkhead by the east pier (SED14 & 18) - Leaching from derelict creosote piles (SED 15 & 18) - Decaying wood from buried peninsula barges (SED9 & 15)
SED9	48.511638	-122.645093	Nearshore area of the west railways	
SED10	48.511750	-122.644678	Nearshore area of the east railways	
SED11	48.511874	-122.644342	Nearshore area by the east warehouse bulkhead	
SED12	48.511865	-122.644948	~90 ft northeast of the shoreline bulkhead between the east and west railways	
SED13	48.511993	-122.644522	~75 ft north-northwest of the bulkhead west of the east warehouse	
SED14	48.512116	-122.644128	~30 ft north-northwest of the east warehouse bulkhead	
SED15	48.511953	-122.645179	Along the west railways by the south end of the east central peninsula derelict piles	
SED16	48.512029	-122.644833	Along the east railways ~120 ft north of the east warehouse bulkhead	
SED17	48.512145	-122.644494	~120 ft north of the middle of the east warehouse bulkhead	
SED18	48.512251	-122.644129	Within east pier derelict pile area	- Direct releases during vessel maintenance/maneuvering - Transport of nearshore contaminants farther from shore (natural or via prop wash) - Leaching from derelict creosote piles & decaying wood from peninsula barges (SED19)
SED19	48.512193	-122.645350	Near the northeast corner of the central peninsula	
SED20	48.512413	-122.644824	~260 ft north of the east warehouse bulkhead in the middle of the industrial basin	
SED21	48.512638	-122.644239	Adjacent to the east pier ~130 ft north of the derelict pile area	
SED22	48.512396	-122.645630	North tip of the central peninsula pier	- Direct releases during vessel maintenance on central peninsula pier - Decaying wood from buried peninsula barge
SED23	48.512269	-122.646420	In the middle of the entrance to the protected basins	- Direct releases during vessel maintenance on pontoon dock (including former use of dry dock) - Transport of contaminants (natural or via prop wash) - Anticipate establishing northern edge of contamination
SED24	48.512755	-122.645300	Near the central inner edge of the pontoon dock	
SED25	48.513000	-122.644473	Near the interior meeting point of the pontoon dock and the east pier	



Table 2. Boring Location & Rationale (continued)

Boring ID	Latitude	Longitude	Location	Potential Contaminant Sources
SED26	48.512544	-122.643578	~120 feet north of the shoreline bulkhead east of the crane barge	- Direct releases during vessel maintenance on east pier - Transport of contaminants (natural or via prop wash) - Potential residual impacts from Shannon Point Seafoods site - Anticipate establishing eastern edge of contamination
SED27	48.513068	-122.643919	~300 feet north of the shoreline bulkhead east of the crane barge	

Horizontal positioning of each sampling location will be accomplished from the ground or the sampling vessel using either a hand-held or sampling vessel-mounted GPS unit based on target coordinates. The horizontal datum will be NAD83. Identifiable landmarks on the ground may also be used to identify the desired location. In the case of vessel-based sampling locations, once the vessel has navigated to the desired location, the vessel will be anchored in such a way as to maintain the position and mitigate the potential effects of tidal currents and/or wind. The actual latitude and longitude of the final sampling location will be recorded on the GPS unit in the field.

Vertical positioning for samples collected by hand in intertidal areas of the Site will be determined by measuring how deep hand tools penetrate below the mudline. For samples collected from a vessel, vertical positioning will be measured through two metrics: depth to the mudline below the water surface and the water elevation at the time of measurement. Tidal elevations will be estimated using tide prediction models produced by the National Oceanic and Atmospheric Administration for Anacortes, Fidalgo Island (Station ID # 9448794).

The depth to mudline at each sampling location will be measured using a lead line hand-lowered to the seafloor. Once the drilling equipment has been lowered to the mudline, markings will be placed on the core barrel or sampling equipment so that the total advancement depth of the sampling equipment can be measured. These metrics will be recorded on the sampling logs.

If necessary, operators of the vessel-based sampling equipment (Gravity Marine Consulting) may establish a temporary tide gauge onsite from which absolute elevations of sample collection and sampling equipment advancement may be determined.

4.2 Sample Collection & Processing Methodologies

Sediment samples will be collected at each sampling location from both the seafloor surface as grab samples and at depth below the seafloor surface as core samples. The majority of samples will be collected using vessel-based sampling techniques, including a power-grab clamshell sampler for surface samples and a vibracore sampler for subsurface samples.

Several of the sampling stations are located in intertidal portions of the Site that may be accessible via land during sufficiently low tides. If the substrate is firm enough for personnel to



walk, samples may be collected using hand tools including a shovel or trowel for surface samples and a hand auger for subsurface samples as discussed below.

Samples will be preserved, if needed, and placed in the appropriate laboratory supplied containers in accordance with the sample QA/QC parameters outlined in Table 4, below. Sampling practices are generally consistent with SCUM-IV and PSEP guidelines (PSEP, 1997).

4.2.1 Vessel-Based Surface Sediment Grab Sampling

Surface grab samples will be primarily collected using a stainless-steel pneumatic power grab clamshell-style sampler, which will be deployed from a winch mounted on a shallow draft sampling vessel. Grab samples will be collected from the upper 10 cm of the seafloor. Once the vessel has maneuvered into position, the following general procedure will be followed:

- Open the clamshell sampler and lower it to the seafloor.
- While on the bottom, initiate closure of the clamshell.
- Record the actual location of sample collection.
- Retrieve the sampler and carefully place it on a clean processing table.
- Siphon off standing water on top of the sediment taking care not to disturb the surface of the sediment.
- Photograph the sample.
- Examine the sample for debris and field evidence of contamination (e.g., discoloration, sheens, odors).
- Evaluate the collected sample for acceptance criteria:
 - Overlying water is present with low turbidity.
 - Penetration depth of 10 cm was achieved.
 - Sampler is not overfilled.
 - Sediment surface is undisturbed.
 - No signs of winnowing or leaking from the sampling device.

If observations of the collected sample indicate that the acceptance criteria were not met, up to two additional sampling attempts may be made as close to the original cast location as practicable. If subsequent attempts continue to fail the acceptance criteria, Stratum Group field personnel will use professional judgement to move the location to obtain a representative sample. Ideally, samples will be collected from material recovered from a single retrieval. If insufficient sediment volume is recovered for the required analyses, additional retrievals may be collected from the same location until sufficient sample volume has been recovered.

If sample analysis for volatile chemicals is planned for a given location or sampling interval, sample material will be collected from the first viable retrieval and place into appropriate, laboratory supplied containers. If volatiles analysis is not required or after sampling for volatiles has been completed, the following general procedure will be followed:



- Remove the upper 10 cm of sediment from the sampler with a decontaminated stainless-steel spoon and place it into a decontaminated stainless-steel bowl.
- No sediment that has been in direct contact with the edges of the sampler will be collected.
- Unrepresentative material such as woody debris, shells, rocks, and materials greater than ½-inch in diameter may be removed from the sample mass.
- Repeat the above procedures from subsequent retrievals until sufficient sample material has been recovered.
- Homogenize the sediment in the bowl by mixing.
- Collect samples from the homogenized material into appropriate, labeled, laboratory supplied containers.
- Place samples into an ice-filled cooler (~4°C).
- Record observations on a sampling log including a description of the recovered sediment and the presence of field indications of contamination consistent with Section 4.4 below, as well as notes on the success of sample recovery and number of retrievals.
- Thoroughly decontaminate sample recovery and homogenizing equipment using the procedures in Section 4.5.

4.2.2 Vessel-Based Subsurface Sediment Vibracore Sampling

Subsurface sampling activities will be primarily completed using vibracore sampling equipment mounted to the sampling vessel. Vibracore sampling equipment will be advanced to a depth of 12 feet below mudline (bml) or until refusal is encountered. The 12-foot recommended termination depth is expected to reach at least 4 feet into native glacial material based on the current understanding of the Site subsurface geology. Once the vessel has maneuvered into position, the following general procedure will be followed:

- Attach a minimum 13-foot-long, 3" or 4" diameter, decontaminated core barrel with a new, clean liner to the vibracorer head.
- Lower the coring assembly until the core barrel nose rests on the mudline, taking care to keep the coring assembly vertical.
- Mark a reference point on the coring assembly or haul cable so that the final penetration or refusal depth can be measured.
- The core tube will be vibrated into the sediment so that a continuous core sample is collected to a depth of 12 feet bml or until refusal.
- Record the actual sampling location.
- Measure the final depth of core penetration on the coring equipment and record.
- Retrieve the core barrel and extract the liner, keeping the core in a vertical orientation as much as possible until processing.
- Inspect core and measure recovery to determine whether compaction or sample loss has occurred.
- Remove or siphon off water on top of the core.
- If the full core is too long to store intact, the core may be cut in half using a clean,



decontaminated saw or box cutter.

- Cap and tape both ends of each core or core section.
- Label each core or core section with the interval and an up arrow denoting the top of the core.
- Place core within an ice-chilled cooler or refrigerator ($\sim 4^{\circ}\text{C}$) in an upright position for transport to an upland core processing location to be established on the Site.

If the retrieved core length is less than 75% of the core penetration depth, up to two additional attempts will be made as near as possible to the original location to reach that criteria. The longest recovered core will be retained for sample collection.

Previous sampling activities on this Site suggests that there is a clear distinction between soft and loose shallow sediments most likely to be negatively impacted by Site activities and underlying dense, native, glacial deposits. If the corer hits refusal prior to reaching the planned penetration depth of 12 feet bml, drilling action and observations of the retrieved core will be used to determine how far into dense, native material the corer was able to penetrate. If the corer penetrated less than 4 feet into dense native material, up to two additional attempts will be made as near as possible to the original location to reach that criteria.

If after three successive attempts either the recovery or penetration depth criteria remain unmet, the sample location will be relocated as determined by the Stratum Group Project Manager and the new location will be recorded. If a sample location cannot be relocated without encroaching within 25 feet of another sample location, the problematic sampling location will be abandoned.

Sediment cores will be transferred from the vessel to an ice-chilled cooler or refrigerator in a secure area of the Site upland at the end of each sampling day using one of the onsite docks or piers. Sediment core processing will take place in an unused space inside one of the warehouses on the Site upland. Cores will be processed as soon as feasible after vessel-based sample collection activities are completed. The following process will be followed:

- The core liner will be split longitudinally using a clean, decontaminated saw or box cutter.
- Mark either on the processing table or the core liner the sampling intervals.
- Photograph the exposed core showing the planned sampling intervals.
- If sample analysis for volatile chemicals is planned, sample material will be collected from the necessary interval(s) of the intact core and place into appropriate, laboratory supplied containers.
- Record observations on a sampling log including a description of the recovered sediment and the presence of field indications of contamination consistent with Section 4.4 below, as well as notes on sample recovery and the number of core attempts (if more than one).
- Physically divide the core into the following sampling intervals:
 - 0-2 feet
 - 2-4 feet



- 4-6 feet
- 6-8 feet
- 8-10 feet
- 10-12 feet
 - If a clear lithological boundary is encountered within a proposed sample interval, intervals may be adjusted slightly to avoid sampling across the lithological boundary. Particular care will be taken to avoid sampling the boundary between soft, shallow sediment and dense underlying native glacial deposits.
- Place material from one sampling interval into a clean, stainless-steel bowl and homogenize by stirring.
- Collect samples from the homogenized material into appropriate, labeled, laboratory supplied containers.
- Place samples into an ice-filled cooler (~4°C).
- Repeat the homogenization and sample collection steps for each sampling interval, using clean, decontaminated bowls and stirring tools for each sampling interval.
- Thoroughly decontaminate sample recovery and homogenizing equipment using the procedures in Section 4.5.

4.2.3 Land-Based Surface Sediment Grab Sampling

Surface sediment samples from stations located in intertidal portions of the Site where the substrate is firm enough for personnel to walk may be collected during sufficiently low tides using hand tools. Surface samples will be collected from the upper 10 cm of the seafloor. Land-based surface sample collection will be attempted for sample locations SED8 through SED14. Land-based surface sample collection may also be attempted at sample locations SED15 through SED18 if sufficiently low tides are present during sampling activities.

Surface sediment sampling using hand tools will be completed using the following procedures:

- Examine projected tide charts to select an appropriate sampling date, such that the given sampling location will be exposed for the duration of surface and subsurface (if applicable) sampling activities.
- Record the actual location of sample collection.
- Photograph the ground surface at the sampling location.
- If sample analysis for volatile chemicals is planned for a given location, collect sample material directly from the ground and place it into appropriate laboratory supplied containers.
- Dig up the upper 10 cm of sediment from the ground with a clean, decontaminated shovel or stainless-steel spoon and place into a clean stainless-steel bowl until sufficient sample material has been recovered.
- Unrepresentative material such as woody debris, shells, and rocks may be removed from the sample mass at the discretion of the Project Manager.



- Homogenize the sediment in the bowl by stirring.
- Collect samples from the homogenized material into appropriate, labeled, laboratory supplied containers.
- Place samples into an ice-filled cooler (~4°C).
- Record observations on a sampling log including a description of the recovered sediment and the presence of field indications of contamination consistent with Section 4.4 below.
- Thoroughly decontaminate sample collection and homogenizing equipment.

4.2.4 *Land-Based Subsurface Sediment Sampling*

Due to consistently shallow water depths and a high potential for encountering subsurface obstructions (e.g. pile cap for marine railways), subsurface sampling will initially be attempted using a hand auger in locations SED8 through SED11. Ideally, hand auger sampling will be completed prior to vessel-based subsurface sampling so that observations of subsurface conditions and obstructions gained from hand sampling can be used to inform any necessary adjustments to the proposed vessel-based sampling locations.

Hand auger sampling may be completed immediately following collection of hand collection of surface sediment samples at the selected locations. Hand auger sampling equipment will be advanced to a minimum depth of 6 feet below mudline (bml) and at least 2 feet into native soils, or until refusal is encountered. If possible, hand auger holes may be advanced below 6 feet bml to until the 2-foot penetration into native soils is satisfied. Hand auger sampling will be conducted using the following procedures:

- Place a 3¼-inch diameter, clean and decontaminated, stainless steel hand auger with a closed-side bit in the same location where the surface sample was collected.
- Advance the hand auger in 6-inch increments to avoid sediment flowing out the top of the auger bit.
- If sample analysis for volatile chemicals is planned for a given location, collect discrete sample material directly from the head of the bit after the second 6-inch section of the 2-foot sampling interval (at approximately the interval midpoint).
- Place sediment removed from each six-inch run into a clean stainless-steel bowl with a clean stainless-steel spoon. Repeat for four consecutive six-inch runs to compose one two-foot sampling interval.
 - Subsurface sample intervals for hand-auger sample collection will be 0-2 feet bml, 2-4 feet bml, and 4-6 feet bml. If hand augers are advanced below 6 feet bml, samples will be collected in subsequent two-foot intervals.
- Remove unrepresentative material such as woody debris, shells, and rocks from the sample mass.
- Homogenize the sediment in the bowl by stirring.
- Collect samples from the homogenized material into appropriate, labeled, laboratory supplied containers.
- Place samples into an ice-filled cooler (~4°C).



- Repeat the homogenization and sample collection steps for each two-foot sampling interval, using clean, decontaminated bowls and stirring tools for each sampling interval.
 - If a clear lithological boundary is encountered within a proposed sample interval, intervals may be adjusted slightly to avoid sampling across the lithological boundary. Particular care will be taken to avoid sampling the boundary between soft, shallow sediment and dense underlying native glacial deposits.
- Record observations on a sampling log including a description of the recovered sediment and the presence of field indications of contamination consistent with Section 4.4 below, as well as notes on sample recovery and the number of core attempts (if more than one).
- Thoroughly decontaminate sample collection and homogenizing equipment using the procedures in Section 4.5.

If the hand auger hits refusal prior to reaching the minimum penetration depth of 6 feet bml (with at least 2 feet of penetration into native soils), field personnel will attempt to determine the reason for refusal.

If refusal appears to be due to small debris, a local obstruction, or a locally firm layer of sediment, the sampling location may be relocated within ~5 feet of the original proposed location and reattempted.

If refusal is due to the presence of debris or some other discrete physical obstruction, the sampling location may be relocated within ~20 feet of the original proposed location to try to reach the planned completion depth. Samples may be relocated greater than 20 feet from the originally planned location only if field evidence suggests that the edge of an obstruction (e.g., a pile cap or foundation slab) may be reached by moving farther away and the new location does not encroach within 25 feet of another planned sample location.

If after three successive attempts the completion depth remains unmet, the sample location will be abandoned. Observed conditions will be recorded on the sample log. If observed conditions suggest that a greater sampling depth may be achieved using vessel-based sampling equipment (i.e., vibracore), the location may be reoccupied during high tide (if practicable) and sampled in accordance with procedures outlined in Section 4.2.2.

If sediment characteristics are such that the auger hole advancement is prevented by continuous cave in, preventing collection of representative samples at depth, the location will be abandoned, reoccupied during high tide with the vessel-based vibracoring equipment (where practicable), and sampled in accordance with Section 4.2.2.

Shallow water depths during high tides may limit use of vessel-based sampling equipment at some of the intertidal sampling locations. Additionally, exceedingly soft surface materials may limit the use of land-based sampling equipment other than hand tools. Although all reasonable efforts will be made to reach the depth criteria above, sampling at depth may be limited by Site and/or subsurface conditions. If such complications arise during field activities, Stratum Group



will consult with Ecology to determine the most appropriate path forward.

4.3 Sample Labelling

All sample containers will be laboratory supplied and affixed with a sampling label. Each sample label will include the site name (Lovrics) and the date and time of sample collection.

All sediment sample labels will begin with the sampling location identifier (e.g., SED1). Surface sediment sample IDs will be followed by “: S” (e.g., SED1: S). Subsurface sediment sample IDs will be followed by the sampling interval (e.g., SED1: 0-2). Field duplicate sample IDs will have “DUP” appended to the end of the primary ID (e.g., SED1: 0-2 DUP).

4.4 Sampling Logs

As samples are collected, field notes will be recorded describing the sediments being collected and other pertinent details. These written observations will be accompanied by photographs of each sample and core. Sampling logs will contain the following information at a minimum:

- Sample recovery (penetration depth, recovery length)
- Physical description of the sediment using the Unified Soil Classification System, including grain size, color, density, plasticity, moisture content, presence of debris and/or indicators of contamination.
- Presence and description of odors (e.g., hydrogen sulfide, petroleum, etc.)
- Presence of petroleum sheen
- Evidence of biological activity
- Other notable or unusual characteristics
- Any problems encountered during sampling activities or deviations from the SAP/QAPP (e.g., equipment malfunction, relocation, etc.)

Example surface sampling and sediment core logs are attached in Appendix SAP-1.

4.5 Decontamination Procedures

All sediment sampling and homogenizing tools and equipment will be decontaminated prior to sampling, between sampling stations, and between each sampling interval. Decontamination will consist of rinsing equipment with site water and brushing until it is free of sediment. Equipment will then be washed and scrubbed with Alconox, rinsed with site water, and rinsed a final time with distilled water before it can be used again.

4.6 Management of Investigation Derived Waste (IDW)

Excess sediment remaining after sample collection from surface sediment sampling or subsurface sampling using hand tools will be returned to the collection site. Excess sediment and rinse water remaining after sample collection from sediment cores will be stored on site in properly labeled 55-gallon drums to await characterization and proper disposal. This waste will



be stored on-site until cleanup activities commence, at which time the sediment and rinse water will be disposed of along with other contaminated media.

Waste personal protective equipment (e.g., gloves) and field supplies (e.g., sampling syringes, paper towels, etc.) will be bagged and disposed of as general solid waste at the end of each field day.

5.0 LABORATORY SAMPLE ANALYSIS PLAN

5.1 Chemical & Physical Analyses

Sediment samples will be delivered or mailed to a laboratory with Department of Ecology accreditation for the required analysis. Friedman & Bruya Laboratory (F&B) of Seattle, Washington (accreditation C578) will be the primary lab for sample analysis. Analysis for substances that F&B is not accredited for will be forwarded to secondary laboratories accredited for those analyses. Analytical Resources, LLC (ARL) of Tukwila, Washington (C558) is slated to conduct analyses for TBT. Ceres Analytical Laboratory (CAL) of El Dorado Hills, California (C996) is slated to conduct analyses for PCB congeners and dioxins/furans. F&B will be responsible for ensuring that all laboratory analytical work for sediment samples complies with project requirements and will promptly communicate any problems or concerns with the analytical laboratory work with Stratum Group.

At a minimum, the surface sample and the first two core intervals (0-2 feet and 2-4 feet) will be analyzed. All other collected samples will be initially archived at the laboratory. If the 2–4-foot interval sample exceeds the screening levels, samples from deeper intervals will be analyzed until compliance with the screening levels is reached or no additional samples remain to be analyzed.

All samples tested in this sediment RI will be analyzed for the standard marine SMS chemicals, including metals, organic and chlorinated organic chemicals, phthalates, and PAHs.

Sediment samples will also be selectively analyzed for dioxins/furans and PCB aroclors. Initial analysis for total PCB aroclors and dioxins/furans will be completed on all surface sediment samples to allow for effective evaluation of human health exposure risk. PCB aroclor and D/F screening level exceedances in surface samples will trigger analysis for PCB aroclors and/or D/F in the next deeper sample until the respective screening levels are met.

Sediment samples will also be selectively analyzed for total PCB congeners. Analysis for PCB congeners will be completed on surface grab samples and core samples from a minimum of four locations evenly distributed across the industrial basin intertidal area (SED8-SED18), as well as four additional locations to obtain broad spatial coverage across the Site (SED2, SED20, SED22, SED23).



Lastly, sediment porewater will be extracted from surface sediment samples across the Site and from sediment samples collected at depth from the intertidal area near the marine railways (SED8 through SED18) for TBT analysis. No bulk sediment samples are proposed for TBT analysis.

All sediment samples will be analyzed for the standard set of conventional sediment parameters including grain size, total organic carbon (TOC), and total solids. Surface samples will be further analyzed for total volatile solids, ammonia, and total sulfides.

The proposed sample method, type, depth, and analyses for each location are presented in Table 3, below. A list of proposed analytes, the laboratory methods to be used for their preparation and analysis, and the laboratory reporting limits for each analyte as provided by F&B and the secondary laboratories are provided in Table 4, below. Applicable natural background and PQL concentrations that may supersede the screening level are also presented. The shaded cell in each row represents the most restrictive screening level that may apply for a given analyte.

Achieving the reporting limits in Table 4 will generally allow comparison with the SMS screening level criteria. The most restrictive risk-based screening levels from Table 2 of the Sediment RI work plan by dry weight are presented in Table 4 below for direct comparison to the laboratory reporting limits to demonstrate that anticipated reporting limits will be sufficient to appropriately assess site conditions. If analytes with standard SMS screening levels that are TOC-normalized are reported as non-detect with TOC-normalized reporting limits that exceed the SMS SCO, the reporting limit may be compared to the applicable dry-weight screening level to establish whether there is an exceedance.



Table 3. Sampling method, type, interval, and analyses

Sample Location	Sample Method	Sample Interval, Type & Analyses										
		Grab	Core									
		0-10cm	0-2ft	2-4 ft	4-6 ft	6-8 ft	8-10 ft	10-12 ft				
SED1	Vessel (Grab & core)	M SVOC PCB-C (SED2) D/F ^e GS TOC TS	M SVOC	M SVOC	A	A	A	A				
SED2			PCB-C (SED2)	PCB-C (SED2)								
SED3			D/F ^e	D/F ^e								
SED4												
SED5												
SED6												
SED7												
SED8	Hand (Grab & core) ^a	M SVOC TBT PCB-A PCB-C ^d D/F	M SVOC	M SVOC	A ^c	A ^c	A ^c					
SED9			PCB-C ^d	PCB-C ^d								
SED10			TBT D/F ^e	TBT D/F ^e								
SED11	Hand (Grab) ^b & Vessel (Core)	GS TOC TS TVS Am TSf	GS TOC TS	GS TOC TS	A							
SED12												
SED13												
SED14	Hand (Grab) ^b & Vessel (Core)											
SED15												
SED16												
SED17												
SED18	Vessel (Grab & core)	BioassayA	M SVOC PCB-C (SED20/22/23) D/F ^e GS TOC TS	M SVOC PCB-C (SED20/22/23) D/F ^e GS TOC TS					A	A	A	
SED19												
SED20												
SED21												
SED22												
SED23												
SED24												
SED25												
SED26												
SED27												

Vessel = vessel-based sampling (power grab and vibracore); Hand = hand sampling (hand tools and hand auger).

a = Vessel-based core sampling may be attempted if hand sampling is unsuccessful or not practicable.

b = Vessel-based grab sampling may be completed if hand sampling is not practicable.

c = core samples below 6 feet will only be collected if depth below native soil criteria are not met during hand-sampling and/or vessel-based core sampling is completed.

d = PCB congeners analysis to be completed on samples from a minimum of 4 locations.

e = D/F analysis at depth is only to be completed if a corresponding surface sample exceeds the screening level.

M = metals; SVOC = semi-volatile organic compounds (incl. phthalates, PAHs, and chlorinated organics); TBT = tributyltin in porewater; PCB-A = total PCB aroclors; PCB-C = total PCB congeners; D/F = dioxins/furans; GS = grain size; TOC = total organic carbon; TS = total solids; TVS = total volatile solids; Am = ammonia; TSf = total sulfides; BioassayA = additional sample volume archived for potential bioassay testing; A = archive.



Table 4. Laboratory Procedures & Reporting Limits for Proposed Analytes

Analyte		Preparation Method	Analysis Method	Laboratory Reporting Limit (mg/kg dry wt)	Most Restrictive Screening Level (mg/kg dry wt)	Natural Background (mg/kg dry wt)	SCUM PQLs (mg/kg dry wt)
Metals	Arsenic	EPA 3050B/3051A	EPA 6020B	0.2	0.039	11	0.3
	Cadmium			0.2	5.1	0.8	0.07
	Chromium			1	260	62	0.2
	Lead			0.2	450	21	0.1
	Copper			1	390	45	0.1
	Zinc			1	410	93	1
	Silver			0.2	6.1	0.24	0.1
	Mercury	EPA 7471	EPA 7471	0.02	0.41	0.2	0.02
Organic and Chlorinated Organic Chemicals	2,4-Dimethylphenol	EPA 3550-mod ^{a,b}	EPA 8270E/8270E SIM	0.025	0.029	--	--
	2-Methylphenol			0.05	0.063	--	--
	4-Methylphenol ^d			0.05	0.67	--	--
	Benzoic Acid			0.2	0.65	--	--
	Benzyl Alcohol			0.050	0.057	--	--
	Pentachlorophenol			0.05	0.36	--	--
	Phenol			0.025	0.42	--	--
	1,2,4-Trichlorobenzene			0.01	0.031	--	--
	1,2-Dichlorobenzene			0.01	0.035	--	--
	1,4-Dichlorobenzene			0.01	0.11	--	--
	Dibenzofuran			0.0005	0.54	--	--
	Hexachlorobenzene	EPA 3550-mod ^{a,b}	EPA 8270E/8270E SIM	0.01	0.022	--	--
	Hexachlorobutadiene			0.01	0.011	--	--
	N-nitrosodiphenylamine	EPA 3550-mod ^{a,b}	EPA 8270E/8270E SIM	0.01	0.028	--	--



Table 4. Laboratory Procedures & Reporting Limits for Proposed Analytes

Analyte		Preparation Method	Analysis Method	Laboratory Reporting Limit (mg/kg dry wt)	Most Restrictive Screening Level (mg/kg dry wt)	Natural Background (mg/kg dry wt)	SCUM PQLs (mg/kg dry wt)
Phthalates	Bis(2-Ethylhexyl) phthalate	EPA 3550-mod ^{a,b}	EPA 8270E/8270E SIM	0.1	1.3	--	--
	Butyl benzyl phthalate			0.05	0.063	--	--
	Diethyl phthalate			0.05	0.20	--	--
	Dimethyl phthalate			0.025	0.071	--	--
	Di-n-butyl phthalate			0.05	1.4	--	--
	Di-n-octyl phthalate			0.1	6.2	--	--
PAHs	2-Methylnaphthalene			0.0005	0.67	--	--
	Acenaphthene			0.0005	0.50	--	--
	Acenaphthylene			0.0005	1.3	--	--
	Anthracene			0.0005	0.96	--	--
	Fluorene			0.0005	0.54	--	--
	Naphthalene			0.001	2.1	--	--
	Phenanthrene			0.0005	1.5	--	--
	Total LPAH			0.0035 _h	5.2	--	--
	Benz[a]anthracene			0.001	1.3	--	--
	Benzo[a]pyrene			0.0005	1.6	--	--
	Benzo[g,h,i]perylene			0.001	0.67	--	--
	Chrysene			0.0005	1.4	--	--
	Dibenzo[a,h]anthracene			0.001	0.23	--	--
	Fluoranthene			0.0005	1.7	--	--
	Indeno[1,2,3-c,d] pyrene			0.001	0.60	--	--
	Pyrene			0.0005	2.6	--	--
	Total benzofluoranthenes ^c			0.001	3.2	--	--
	Total HPAH			0.006 _h	12	--	--
	Total cPAHs			0.005 _h	0.12	0.021	0.009
Organo-metallics	Tributyltin (in pore water)	Krone 1989 ^f	Krone 1989	0.0052 µg/L	0.05 µg/L	--	0.05 µg/L



Table 4. Laboratory Procedures & Reporting Limits for Proposed Analytes (continued)

Analyte		Preparation Method	Analysis Method	Laboratory Reporting Limit (mg/kg dry wt)	Most Restrictive Screening Level (mg/kg dry wt)	Natural Background (mg/kg dry wt)	SCUM PQLs (mg/kg dry wt)
PCBs & Dioxins/ Furans	Total PCB aroclors	EPA 3550	EPA 8082A	0.002	0.13	--	--
	Total PCB congeners	EPA 1668C	EPA 1668C	332 (ng/kg)	--	3,500 (ng/kg)	--
	Dioxin-like PCB congeners (sum TEQ)			0.26 (ng/kg)	12 (ng/kg)	0.2 (ng/kg)	0.7 (ng/kg)
	Total dioxins/furans (sum TEQ)	EPA 8290A/1613B	EPA 8290A/1613B	5.7 (ng/kg)		4 (ng/kg)	5 (ng/kg)
Conventional Parameters	Ammonia	g	Plumb (1981)	100 mg/L	--	--	--
	Grain size		PSEP (1986)/ ASTM D-422	1%	--	--	--
	Total solids		PSEP (1986)	0.1%	--	--	--
	Total organic carbon		EPA 9060	0.1%	--	--	--
	Total volatile solids		PSEP (1986)	0.1 %	--	--	--
	Total sulfides		Plumb (1981)/EPA 9034/9030B	10 mg/kg	--	--	--

a = EPA Method 3550 is modified to add matrix spikes before the dehydration step.

b = If sulfur is present in the samples (as is common in most marine sediment), cleanup procedures specified by EPA SW-846 Method 3660B should be used.

d = 3-methylphenol and 4-methylphenol may not be able to be separated. In this case 4-methylphenol may be reported as the sum of the 3- and 4-methylphenol isomers.

e = Total benzofluoranthenes represent the sum of the b, j, and k isomers. The "j" isomer is chemically inseparable from the "b" isomer and thus will not be reported as a separate analyte in laboratory reports.

f = For pore water analysis, sediment samples must not be frozen. Sediment samples must be centrifuged within 7 days after collection and analyzed within 7 days after centrifugation (See Appendix B Hoffman 1998 TBT analysis clarification paper).

g = Sample preparation methods for sediment conventional analyses are described in the analytical methods.

h = RL values are not lab provided. Stated RL values are calculated by summing the RLs for the applicable individual analytes that comprise the analyte category (e.g., cPAHs).



5.2 Biological Analyses

Biological testing may be performed if SMS chemical criteria are exceeded. Under the SMS, the biological benthic criteria are the confirmatory criteria. This means that a passing biological test result can override exceedances in chemistry results.

Surface (0-10 cm) sediment samples will be collected from each sampling location noted in Section 4.1 and archived for potential future bioassay testing pending the results of the chemical analysis. A minimum of 6 liters (L) of sediment will be collected for bioassay testing from each sampling location. This volume should be sufficient to allow for re-running any bioassay test if problems are identified with the analysis procedure or QA/QC parameters are not met. Where practicable, up to 12 L of sediment may be collected to allow for future testing flexibility. Samples will be sent to Spheros immediately upon completion of sampling activities where they will be archived until the need for biological analysis is determined.

Stratum Group will communicate to Spheros whether or not biological testing is desired within 5 weeks of the start of sample collection activities. This timing should allow for sufficient time for tests to be re-run if the initial testing fails performance standards and/or QA/QC criteria. If biological testing is warranted, the SMS requires the completion of two acute effects tests and one chronic effects test. The Puget Sound Estuary Protocol (PSEP, 1995) provides guidelines for bioassay testing including two acute effects tests and one chronic effects test to assess the toxicity of Site sediments to benthic organisms.

The first acute effects test is the 10-day amphipod mortality test. Individuals of one species of amphipod are exposed to test, reference, and control sediment during a 10-day period, after which total mortality is measured. The test utilizes one of the following amphipod species: *Rhepoxynius abronius*, *Ampelisca abdita*, or *Eohaustorius estuarius*. The tested species will be selected by the bioassay laboratory based upon interstitial water salinity, sediment fines content, and collection season prior to test initiation per PSEP (1995). If the PSEP-recommended species are unavailable, the *Leptocheirus plumulosus* amphipod species will be used in conformance with guidance presented by Ecology and the DMMP (Hester et al., 2024). This deviation will only be pursued after consultation with and approval from Ecology (see SCUM-IV Section 4.2.3.1).

The second acute effects test is the 48-hour bivalve or echinoderm larval development test. Adult individuals of one species of bivalve or echinoderm are exposed to a seawater control along with test or reference sediment, until formation into the larval stage occurs in 90% of the control organisms (typically 48-60 hours). At the end of the test, larvae from each exposure are examined for both mortality and abnormal growth. The test utilizes one of the following species based on availability: *Mytilus (edulis) galloprovincialis* (Blue mussel), *Dendraster excentricus* (Sand dollar), *Crassostrea gigas* (Pacific oyster), or *Strongylocentrotus purpuratus* (Purple sea urchin), or (PSEP, 1995).

The chronic effects test is the 20-day juvenile polychaete growth test. This test assesses the



mortality and changes in biomass of species of juvenile polychaetes (*Neanthes* sp.) exposed to reference and test and control sediment during a 20-day period. This test is completed using protocols outlined in PSEP (1995) but with the ash-free dry-weight biomass measurement modification described in the *Bioassay endpoint refinements: Bivalve larval and Neanthes growth bioassays* DMMP/SMS clarification paper (2013) to more accurately measure changes in biomass.

If biological testing is required, the SMS requires that test sediments be matched and run with appropriate reference sediment (e.g., similar grain size and TOC concentrations) to factor out confounding factors that may impact bioassay organism health. Reference sediments will be collected by Spheros most likely from Carr Inlet, the preferred reference sediment location noted in the SCUM-IV. The bioassay laboratory will be responsible for recording the location of the reference sediment sample and conducting the necessary physical and chemical testing to verify the selected reference material is suitable to compare against material from the Lovric's Site per PSEP and SMS guidelines. In accordance with PSEP guidelines, five replicate tests of each procedure will be conducted by Spheros for each test, reference, and control sample. A water quality replicate will also be run for each treatment.

As part of their initial sample assessment, Spheros will evaluate the concentrations of ammonia and sulfide in the exposure medium to assist in determining whether high concentrations of ammonia and/or sulfides could contribute to overall toxicity of samples in the bioassay analyses. If pre-test ammonia and sulfide concentrations exceed the purging triggers identified in the DMMP User Manual (DMMP, 2025), and sufficient sample material exists, a portion of the sample material may be purged to reduce ammonia and sulfides concentrations. Spheros will contact the Stratum Group project manager prior to setting up the tests to discuss the need for purging. If purging is recommended, bioassay testing would then be completed side-by-side on purged and non-purged samples to allow for direct comparison. Although per SCUM-IV guidelines the results of purged bioassay samples cannot replace sediment chemistry results, they may provide useful information as to why a sample may be passing or failing the non-purged bioassay test.

The results of the bioassay testing will be compared against the marine biological criteria (SCO and CSL values, and performance standards) in Table 8-2 of the SCUM-IV. If there are issues (e.g., positive or negative control failure) with the bioassay QA/QC tests that result in erroneous findings or failure to meet data quality objectives provided in Table 8-2 (SCUM-IV), then the bioassay samples will be retested. Spheros will be responsible for preparing a laboratory report documenting and interpreting the results of the bioassay testing, which will be incorporated into the final sediment RI report.

6.0 Quality Assurance Project Plan (QAPP)

The purpose of the QAPP is to provide confidence in the analytical results through a system of



quality assurance and quality control (QA/QC) checks with respect to data collection methods, laboratory analysis, data reporting, and corrective actions to achieve compliance with established performance and data quality criteria. This section presents the QA/QC protocols used to ensure that the data obtained during the investigation are defensible and usable for their intended purpose.

6.1 Sampling QA/QC

6.1.1 Sample Collection

All sample containers will be provided by the laboratory. The specific container sizes and types, preservation requirements, and holding times are determined by the laboratory selected for this project, F&B. The sampling equipment needed for the desired analyses based on F&B's collection and preservation guidance is outlined in Table 4.

Field duplicate samples will be collected and analyzed for QA/QC purposes. Field duplicate samples consist of a set of two discrete samples collected at the same sampling location and depth during the same sampling period. Field duplicates are designed to assess actual variability in Site conditions. One field duplicate sample will be collected for every 20 samples planned for chemical analysis. Samples collected for archival purposes noted in Table 3, above, will not be included in the duplicate count. A minimum of half of the field duplicate samples will be collected from either the surface or the first two subsurface sampling intervals (0-2 feet, 2-4 feet) that are certain to be analyzed alongside their matching initial samples. Other duplicate samples may be collected from deeper sampling intervals and may be analyzed only if their corresponding initial sample is also analyzed based on the protocols discussed above.

Since five replicate samples are already analyzed as part of standard bioassay testing procedures, no additional field duplicate sample collection and analysis is proposed for bioassay testing.



Table 5. Sampling Containers, Preservatives, and Holding Times

Analyte	Sample Container(s)	Preservation	Maximum Holding Time
Metals (except mercury)	<u>Sample for analysis:</u> 1x 9 oz glass jar, 1x 4 oz glass jar & 1x 4 oz amber glass jar per sample <u>Sample for archive:</u> 1x 4 oz amber glass jar per sample	Cool @ 4°C Freeze @ -18°C	6 months 2 years
Mercury		Cool @ 4°C Freeze @ -18°C	28 days 1 year
SVOCs (organic and chlorinated organics, phthalates, PAHs, PCB (aroclor & congeners), dioxins/furans)		Cool @ 4°C Freeze @ -18°C Cool @ 4°C (after extraction)	14 days 1 year 40 days
Organometallics (pore water)	1x ½-gallon LDPE bag of sediment	Cool @ 4°C	7 days to centrifuge, 7 days after centrifugation for analysis
Ammonia	1x 4 oz glass jar per sample	Cool @ 4°C	7 days
Total Solids		Cool @ 4°C Freeze @ -18°C	14 days 6 months
Total Organic Carbon		Cool @ 4°C Freeze @ -18°C	28 days 6 months
Total volatile solids		Cool @ 4°C Freeze @ -18°C	28 days 6 months
Grain size	LDPE bag (1 quart)	Cool @ 4°C	6 months
Total sulfides	2 oz glass jar w/ zinc acetate preservative, no headspace	Cool @ 4°C	7 days
Bioassay	LDPE bags, no headspace (6L minimum volume)	Cool @ 4°C in darkness w/ zero headspace or headspace purged w/ nitrogen	8 weeks

6.1.2 Chain of Custody

Sample collection, transport, and analysis will be completed under chain of custody protocols to provide an accurate written record of sample possession from collection through analysis. Samples will be entered into a chain of custody form, provided by the laboratory, at the end of each field day. The field personnel responsible for sample collection will complete the chain of custody, note the shipping company the cooler is being relinquished to (if applicable), and place it within a plastic bag inside each cooler.

The laboratory receiving the samples will note the time and date of sample arrival and document samples in accordance with their respective standard operating procedures.

6.1.3 Sample Storage, Handling, and Shipping

After collection, all samples will be stored in an ice-filled cooler to maintain sample temperature



at or below approximately 4°C. Samples will be packaged carefully to avoid breakage.

Prior to delivery to a shipping company, new ice or ice packs will be placed in the cooler to maintain the desired 4°C temperature. Sample coolers will be taped shut with the chain of custody inside and delivered to the shipping company. Samples will either be delivered to the laboratory within 24 hours of collection or delivered to a shipping company for next-day delivery within 24 hours of collection. Samples will be delivered to the laboratory within the required holding times outlined in Table 5.

6.2 Sample Analysis QA/QC

The analytical methodologies to be used for sediment sample analysis by the laboratory are provided in Table 6. The table includes the measurement quality objectives (MQOs) for each analyte, including method detection limits (MDLs), reporting limits (RLs) achievable by F&B, percent recovery acceptance criteria for laboratory control samples and matrix spike duplicates, and relative percent difference (RPD) acceptance criteria (difference between the percent recovery for laboratory control and matrix spike duplicates) for QA/QC samples. F&B's standard reporting limit concentrations are generally expected to be below the selected screening levels proposed in this work plan.

Table 6. MQOs for Sediment Samples - Analytical Methods and Detection Limits

Analyte	Analytical Method	MDL (mg/kg dry wt)	RL (mg/kg dry wt)	LCS/Matrix Spike % Recovery Acceptance Criteria	RPD (%)
Arsenic	EPA 6020B	0.133	0.2	75-125	≤ 20
Cadmium		0.031	0.2	75-125	
Chromium		0.276	1	75-125	
Lead		0.049	0.2	75-125	
Copper		0.160	1	75-125	
Zinc		0.834	1	75-125	
Silver		0.134	0.2	75-125	
Mercury	EPA 7471	0.0128	0.02	75-125	
Tributyltin (pore water) ^a	Krone 1989	0.0026 (µg/L)	0.0052 (µg/L)	Performance-based intra-laboratory control limits (will be reported by laboratory)	
2,4-Dimethylphenol	EPA 8270E/ 8270E SIM	0.01334	0.025		
2-Methylphenol		0.00814	0.05		
4-Methylphenol ^c		0.01470	0.05		
Benzoic Acid		0.11528	0.2		
Benzyl Alcohol		0.01108	0.050		
Pentachlorophenol		0.01336	0.05		
Phenol		0.01447	0.025		
1,2,4-Trichlorobenzene		0.00303	0.01		
1,2-Dichlorobenzene		0.00257	0.01		
1,4-Dichlorobenzene		0.00200	0.01		
Dibenzofuran		0.00247	0.0005		



Table 6. MQOs for Sediment Samples - Analytical Methods and Detection Limits (continued)

Analyte	Analytical Method	MDL (mg/kg)	RL (mg/kg dry wt)	LCS/Matrix Spike % Recovery Acceptance Criteria	RPD (%)
Hexachlorobenzene	EPA 8270E/ 8270E SIM	0.00253	0.01		
Hexachlorobutadiene		0.00238	0.01		
N-nitrosodiphenylamine	EPA 8270E/ 8270E SIM	0.00143	0.01		
Bis(2-Ethylhexyl) phthalate		0.01576	0.1		
Butyl benzyl phthalate		0.01669	0.05		
Diethyl phthalate		0.01316	0.05		
Dimethyl phthalate		0.00723	0.025		
Di-n-butyl phthalate		0.02027	0.05		
Di-n-octyl phthalate		0.01465	0.1		
2-Methylnaphthalene		0.00045	0.0005		
Acenaphthene		0.00032	0.0005		
Acenaphthylene		0.00040	0.0005		
Anthracene		0.00019	0.0005		
Fluorene		0.00019	0.0005		
Naphthalene		0.00052	0.001		
Phenanthrene		0.00017	0.0005		
Benz(a)anthracene		0.00027	0.001		
Benzo(a)pyrene		0.00021	0.0005		
Benzo[g,h,i]perylene		0.00037	0.001		
Chrysene		0.00023	0.0005		
Dibenzo(a,h)anthracene		0.00029	0.001		
Fluoranthene		0.00018	0.0005		
Indeno(1,2,3-cd)pyrene		0.00040	0.001		
Pyrene		0.00031	0.0005		
Total benzofluoranthenes ^d		0.00024	0.001		
Total cPAH (sum TEQ)		--	0.005 _f		
Total PCB aroclors	EPA 8082A	0.00038	0.002		
Total PCB congeners _e	EPA 1668C	79 (ng/kg)	332 (ng/kg)		
Dioxin-like PCB congeners (sum TEQ) _e		0.095 (ng/kg)	0.26 (ng/kg)		
Total dioxins/furans (sum TEQ) _e	EPA 8290A/1613B	0.97 (ng/kg)	5.7 (ng/kg)		

Method detection limits (MDL) - values represent the highest MDL reported among the various instruments used at Friedman & Bruya Laboratory. Actual MDL may be lower depending upon the actual instrument used for sample analysis.

RL – standard reporting limit (aka practical quantitation limit or PQL)

LCS – Laboratory control sample

RPD – acceptance criteria for relative percent difference between duplicate samples.

a = Tributyltin MQOs are based upon values from Analytical Resources, LLC, the lab that will be responsible for this analysis.

c = 3-methylphenol and 4-methylphenol may not be able to be separated. In this case 4-methylphenol may be reported as the sum of the 3- and 4-methylphenol isomers.

d = Total benzofluoranthenes represent the sum of the b, j, and k isomers. The “j” isomer is chemically inseparable from the “b” isomer and thus will not be reported as a separate analyte in laboratory reports.



e = PCB congeners and dioxins/furans MQOs are based upon values from Ceres Analytical Laboratory, the lab that will be responsible for this analysis.

f = RL values are not lab provided. Stated RL values are calculated by summing the RLs for the applicable individual analytes that comprise the analyte category (e.g., cPAHs).

Laboratories will be responsible for appropriate QA/QC procedures on their analytical equipment including regular instrument calibration and analysis of calibration blanks. Laboratories will also be responsible for analyzing QA/QC samples including method blanks, laboratory duplicates, matrix spikes and matrix spike duplicates, and laboratory control samples. The recommended frequency of specific quality control procedures and associated control limits are summarized in Tables 5-3, 5-4, and 5-5 of the SCUM-IV.

If the results of any of these procedures fall outside of the laboratory-prescribed limits, the results may be “j” flagged, indicating that the reported result is an estimate. Any additional flags attached to reported data in the laboratory will be assessed to determine whether the flag impairs the ability to assess conditions of the site. Definitions of the data qualifier flags will be included in the laboratory reports.

If high levels of contamination are detected in the initial screening by the laboratory, samples may be diluted to keep the solution within the quantitation limits of the laboratory equipment. The final dilution amounts will be included in the laboratory report.

If sediment chemistry results instigate completion of bioassay testing, all bioassays will be conducted using well-established negative (clean) and positive (toxic) control tests. Negative controls will conduct the same testing using clean seawater and sediment taken from outside the study area to evaluate expected organism health and survivorship under non-toxic conditions. Positive controls will conduct the same testing using a reference toxicant such as cadmium chloride, silver chloride, phenol, or sodium lauryl sulfate to evaluate unexpected mortality or toxicant sensitivity due to characteristics of the test organism population (e.g., disease, population tolerance, etc.). Spheros will be responsible for conducting additional QA/QC procedures to ensure the validity and usability of the data produced including water quality monitoring of the test chambers and proper equipment decontamination.

The laboratories are responsible for monitoring the analysis, identifying analytical problems and taking corrective actions prior to the expiration of sample holding times. The laboratory will communicate analytical problems to the project manager during the analysis when the laboratory is having difficulty in meeting any project specific requirements, including detection limits. When reasonable corrective actions do not bring QC sample results into control limit, resulting data may need to be qualified.

6.3 Data Quality Evaluation

The quality of data collected in this investigation will be evaluated for accuracy, precision, representativeness, completeness, and comparability.



Accuracy measures how close a measured value is to the true value in question. Accuracy is calculated as a percent recovery of a known value, which typically takes the form of a manufactured or laboratory-prepared standard. Alternatively, a known surrogate is used that can be spiked into a sample by the laboratory as part of the analysis procedure. Accuracy is calculated by the laboratory using the equation below and compared against the acceptance criteria in Table 6:

$$\text{Percent Recovery} = [(SSR - SR) / SA] \times 100$$

SSR = Spiked sample result
SR = Sample result
SA = Spike added

Precision is how closely a set of replicate measurements match one another. Evaluation of measurement precision takes into account variability in site conditions, sampling activities, sample handling, preservation, storage, and/or analysis. Data precision is assessed using laboratory and field duplicates, which can independently assess analytical equipment precision and overall precision, respectively. Data precision is reported as a relative percent difference (RPD), or the difference of two measurements divided by the average of the two measurements. RPD is calculated by the laboratory using the following equation and compared against the acceptance criteria in Table 6:

$$\text{Relative Percent Difference} = [(ABS (R1 - R2)) / ((R1 + R2) / 2)] \times 100$$

ABS = Absolute difference between values (meaning no negative values)
R1 = Measured concentration for replicate #1
R2 = Measured concentration for replicate #2

Representativeness refers to how well the data accurately reflects a specific characteristic of the environmental matrix being evaluated. Sample representativeness is achieved by following established field sampling procedures, standard laboratory protocols, and collecting a sufficient number of samples.

Comparability addresses whether data collected in the investigation can be compared with another data set. For this program, comparability of data will be established through the use of consistent field personnel and procedures, analytical laboratories, and data assessment techniques throughout the duration of the project. Additionally, data should be generally comparable to other data produced from other similar investigations using similar techniques and analytical procedures.

Completeness refers to how much of the collected data is valid and usable for a project and is defined as the percentage of valid results compared to the total number of samples taken for each parameter. Percent completeness may be calculated using the following equation:

$$\text{Percent Completeness} = [(Number of valid results) / Number of samples analyzed] \times 100$$



Completeness represents a measure of how much valid data is necessary to complete a project's objectives. Completeness is addressed qualitatively in the RI work plan, which has been designed to complete the remedial investigation of contamination at the Site, based on the information available at this time. As new information is gathered, an evaluation of data completeness should be carried out to determine whether the project's objectives have been met.

6.4 Data Verification & Validation

All data generated from sampling activities will be reviewed, verified, and validated in accordance with the EPA's *National Functional Guidelines for Organic Superfund Methods Review* (November 2020) and *National Functional Guidelines for Inorganic Superfund Methods Review* (November 2020).

As part of internal QA/QC procedures, Stratum Group personnel will review project data to verify that key project criteria were met including:

- Verify the correct samples were analyzed for the correct analytes, and data is reported in appropriate units.
- Verify acceptable sample preservation and holding times.
- Verify that no analytes are present in blank samples.
- Verify that at least one of every 20 samples analyzed also has a field duplicate that is analyzed.
- Review the laboratory report narrative for potential problems or deficiencies in the data.
- Apply appropriate data qualifiers to the data, if needed.
- Verify that data abides by the established MQOs.

In addition to internal data verification, formal data validation will be completed by Laboratory Data Consultants. In accordance with Ecology requirements, data for this investigation will undergo Tier 2B validation, which includes validation of both the laboratory analytical data (2A) and the laboratory instrument-related quality control data (2B), as described in the Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009). Upon successful verification and validation of sampling data, an assessment of the usability of the data will be conducted. Stratum Group project managers will evaluate the content and spatial distribution of sample results to determine whether the data collected is sufficient to achieve the project objectives or whether additional data needs to be collected. A discussion of the QA/QC assessment will be presented in the RI report completed for the investigation activities outlined in the Sediment RI work plan.

6.5 Corrective Action

Corrective actions are procedures that may be implemented in the event that samples do not meet the QA/QC objectives outlined in this QAPP. Corrective actions will depend upon the problem(s) encountered and will generally have to be defined if and when problems are



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identified. Corrective actions may be identified and implemented by project managers from Stratum Group and/or the laboratory and will be documented in a QA/QC section of the final report for this investigation.



7.0 REFERENCES

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- PSEP. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. Puget Sound Water Quality Action Team, U.S. Environmental Protection Agency, Region 10. Seattle, WA.
- PSEP. 1997b. Recommended guidelines for measuring organic chemicals in Puget Sound waters and tissue samples. Final Report. Prepared for U.S. Environmental Protection Agency,



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Seattle, WA.

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Ecology, 2025. *Sediment Cleanup User's Manual (SCUM): Fourth Revision*. Toxics Cleanup Program Publication No. 12-09-057. December 2025.



APPENDIX SAP-1

Example Surface Sediment Sampling Log

Example Sediment Core Log

Surface Sediment Sampling Log

Station ID #: _____

Station Latitude: _____ Station Longitude: _____

Project Name: _____

Sampling Method: _____

Project #: _____

Sampling Equipment: _____

Project Location: _____

Sampled By: _____

Weather: _____

Sampling Date: _____

Sample Collection			
	Attempt #1	Attempt #2	Attempt #3
Time			
Measured water depth (ft)			
Estimated Penetration			
Refusal encountered?			
Notes on sampling procedures			

Sample Characteristics			
Sediment type	cobbles, pebbles, sand (C M F), silt, clay, organic matter	cobbles, pebbles, sand (C M F), silt, clay, organic matter	cobbles, pebbles, sand (C M F), silt, clay, organic matter
Color	black, gray, brown, olive	black, gray, brown, olive	black, gray, brown, olive
Odor	none, slight, mod, strong H ₂ S, petroleum, septic	none, slight, mod, strong H ₂ S, petroleum, septic	none, slight, mod, strong H ₂ S, petroleum, septic
Debris			
Structure			
Biological activity			
Comments:			

Samples	
Sample ID: _____	Duplicate? _____
Sample time: _____	Duplicate sample ID: _____
	Duplicate sample time: _____



SEDIMENT CORE LOG Station _____

PROJECT NUMBER		DRILLING COMPANY	COORDINATES
PROJECT NAME		DRILLING METHOD	DEPTH TO MUDLINE
DRILLING DATE		DIAMETER	LOGGED BY
ATTEMPT #		TOTAL DEPTH	
		RECOVERY	
SITE CONDITIONS (e.g., weather)			
COMMENTS (e.g., boring location)			
Depth (ft)	Samples	Material Description (e.g., color, composition, moisture, grain size, roundedness, density - Inferred geologic contact)	Additional Observations (e.g., environmental indicators, well screen depth, etc.)
0.5			
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5			
5			
5.5			
6			
6.5			
7			
7.5			
8			
8.5			
9			
9.5			
10			
10.5			
11			
11.5			

Disclaimer This bore log is intended for environmental not geotechnical purposes.



INADVERTENT DISCOVERY PLAN PLAN AND PROCEDURES FOR THE DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6000 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay Service at 711. People with a speech disability may call TTY at 877-833-6341.

Site Name(s): Location:

Project Lead/Organization: County:

If this Inadvertent Discovery Plan (IDP) is for multiple (batched) projects, ensure the location information covers all project areas.

1. INTRODUCTION

The IDP outlines procedures to perform in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. An IDP is required, as part of Agency Terms and Conditions for all grants and loans, for any project that creates disturbance above or below the ground. An IDP is not a substitute for a formal cultural resource review (Executive 21-02 or Section 106).

Once completed, **the IDP should always be kept at the project site** during all project activities. All staff, contractors, and volunteers should be familiar with its contents and know where to find it.

2. CULTURAL RESOURCE DISCOVERIES

A cultural resource discovery could be prehistoric or historic. Examples include (see images for further examples):

- An accumulation of shell, burned rocks, or other food related materials.
- Bones, intact or in small pieces.
- An area of charcoal or very dark stained soil with artifacts.
- Stone tools or waste flakes (for example, an arrowhead or stone chips).
- Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings.
- Agricultural or logging materials that appear older than 50 years. These could include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, and many other items.
- Clusters of tin cans or bottles, or other debris that appear older than 50 years.
- Old munitions casings. ***Always assume these are live and never touch or move.***
- Buried railroad tracks, decking, foundations, or other industrial materials.
- Remnants of homesteading. These could include bricks, nails, household items, toys, food containers, and other items associated with homes or farming sites.

The above list does not cover every possible cultural resource. When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

If any employee, contractor, or subcontractor believes that they have uncovered cultural resources or human remains at any point in the project, take the following steps to ***Stop-Protect-Notify***. If you suspect that the discovery includes human remains, also follow Sections 5 and 6.

STEP A: Stop Work.

All work must stop immediately in the vicinity of the discovery.

STEP B: Protect the Discovery.

Leave the discovery and the surrounding area untouched and create a clear, identifiable, and wide boundary (30 feet or larger) with temporary fencing, flagging, stakes, or other clear markings. Provide protection and ensure integrity of the discovery until cleared by the Department of Archaeological and Historical Preservation (DAHP) or a licensed, professional archaeologist.

Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site. Do not allow work to resume within the boundary until the requirements of this IDP are met.

STEP C: Notify Project Archaeologist (if applicable).

If the project has an archaeologist, notify that person. If there is a monitoring plan in place, the archaeologist will follow the outlined procedure.

STEP D: Notify Project and Washington Department of Ecology (Ecology) contacts.

Project Lead Contacts

Primary Contact

Name: Ben Carlson
Organization: Stratum Group
Phone: 978-857-0728
Email: ben@stratumgroup.net

Alternate Contact

Name: Kelly Allison
Organization: Stabbert Maritime & Industr
Phone: 425-736-9819
Email: kellya@stabbertmaritime.com

Ecology Contacts (completed by Ecology Project Manager)

Ecology Project Manager

Name: David Horne
Program: Site Manager & Baywide Coordinator
Phone: (360) 742-1091
Email: hoda461@ECY.WA.GOV

Alternate or Cultural Resource Contact

Name: Guy Tasa
Program: State Physical Anthropologist
Phone: (360) 790-1633
Email: Guy.tasa@dahp.wa.gov

STEP E: Ecology will notify DAHP.

Once notified, the Ecology Cultural Resource Contact or the Ecology Project Manager will contact DAHP to report and confirm the discovery. To avoid delay, the Project Lead/Organization will contact DAHP if they are not able to reach Ecology.

DAHP will provide the steps to assist with identification. DAHP, Ecology, and Tribal representatives may coordinate a site visit following any necessary safety protocols. DAHP may also inform the Project Lead/Organization and Ecology of additional steps to further protect the site.

Do not continue work until DAHP has issued an approval for work to proceed in the area of, or near, the discovery.

DAHP Contacts:

Name: Rob Whitlam, PhD
Title: State Archaeologist
Cell: 360-890-2615
Email: Rob.Whitlam@dahp.wa.gov
Main Office: 360-586-3065

Human Remains/Bones:

Name: Guy Tasa, PhD
Title: State Anthropologist
Cell: 360-790-1633 (24/7)
Email: Guy.Tasa@dahp.wa.gov

4. TRIBAL CONTACTS

In the event cultural resources are discovered, the following tribes will be contacted. See Section 10 for Additional Resources.

Tribe:	Samish Indian Nation	Tribe:	Upper Skagit Indian Tribe
Name:	Jackie Ferry	Name:	Scott Schuyler
Title:	Tribal Historic Preservation Officer	Title:	Cultural Resources
Phone:	360-293-6404 x126	Phone:	360-854-7009
Email:	jferry@samishtribe.nsn.us	Email:	sschuyler@upperskagit.com
Tribe:	Tulalip Tribes of Washington	Tribe:	Swinomish Indian Tribal Community
Name:	Richard Young	Name:	Josephine Jefferson
Title:	Cultural Resources	Title:	Tribal Historic Preservation Officer
Phone:	360-716-2652	Phone:	(360) 466-7352
Email:	ryoung@tulaliptribes-nsn.gov	Email:	jjefferson@swinomish.nsn.us

Please provide contact information for additional tribes within your project area, if needed, in Section 11.

5. FURTHER CONTACTS (if applicable)

If the discovery is confirmed by DAHP as a cultural or archaeological resource, or as human remains, and there is a partnering federal or state agency, Ecology or the Project Lead/Organization will ensure the partnering agency is immediately notified.

Federal Agency:

Agency:	
Name:	
Title:	
Phone:	
Email:	

State Agency:

Agency:	
Name:	
Title:	
Phone:	
Email:	

6. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Follow the steps under ***Stop-Protect-Notify***. For specific instructions on how to handle a human remains discovery, see: [RCW 68.50.645: Skeletal human remains—Duty to notify—Ground disturbing activities—Coroner determination—Definitions.](#)

Suggestion: If you are unsure whether the discovery is human bone or not, contact Guy Tasa with DAHP, for identification and next steps. Do not pick up the discovery.

Guy Tasa, PhD State Physical Anthropologist

Guy.Tasa@dahp.wa.gov

(360) 790-1633 (Cell/Office)

For discoveries that are confirmed or suspected human remains, follow these steps:

1. Notify law enforcement and the Medical Examiner/Coroner using the contacts below. **Do not call 911** unless it is the only number available to you.

Enter contact information below (required):

- Local Medical Examiner or Coroner name and phone:

Hayley Thompson: 360-416-1996

- Local Law Enforcement main name and phone:

Skagit County Sheriff - 911

- Local Non-Emergency phone number (911 if without a non-emergency number):

360-416-1911

2. The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human or if the discovery site constitutes a crime scene and will notify DAHP.
3. **DO NOT speak with the media, allow photography or disturbance of the remains, or release any information about the discovery on social media.**
4. If the remains are determined to be non-forensic, Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed by others or disturbed.

Further activities:

- Per [RCW 27.44.055](#), [RCW 68.50](#), and [RCW 68.60](#), DAHP will have jurisdiction over non-forensic human remains. Ecology staff will participate in consultation. Organizations may also participate in consultation.
- Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in [RCW 27.44.055](#), [RCW 68.50](#), and [RCW 68.60](#).
- When consultation and documentation activities are complete, work in the discovery area may resume as described in Section 8.

If the project occurs on federal lands (such as a national forest or park or a military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) apply and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, the Project Lead/Organization will comply with applicable state and federal laws, and the above protocol.

7. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological resources discovered during construction are protected by state law [RCW 27.53](#) and assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

The Project Lead/Organization must ensure that proper documentation and field assessment are made of all discovered cultural resources in cooperation with all parties: the federal agencies (if any), DAHP, Ecology, affected tribes, and the archaeologist.

The archaeologist will record all prehistoric and historic cultural material discovered during project construction on a standard DAHP archaeological site or isolate inventory form. They will photograph site overviews, features, and artifacts and prepare stratigraphic profiles and soil/sediment descriptions for minimal subsurface exposures. They will document discovery locations on scaled site plans and site location maps.

Cultural features, horizons, and artifacts detected in buried sediments may require the archaeologist to conduct further evaluation using hand-dug test units. They will excavate units in a controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. They may also use a test unit or trench excavation to determine if an intact occupation surface is present. They will only use test units when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. They will conduct excavations using standard archaeological techniques to precisely document the location of cultural deposits, artifacts, and features.

The archaeologist will record spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock for each unit on a standard form. They will complete test excavation unit level forms, which will include plan maps for each excavation level and artifact counts and material types, number, and vertical provenience (depth below

surface and stratum association where applicable) for all recovered artifacts. They will draw a stratigraphic profile for at least one wall of each test excavation unit.

The archaeologist will screen sediments excavated for purposes of cultural resources investigation through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

The archaeologist will analyze, catalogue, and temporarily curate all prehistoric and historic artifacts collected from the surface and from probes and excavation units. The ultimate disposition of cultural materials will be determined in consultation with the federal agencies (if any), DAHP, Ecology, and the affected tribe(s).

Within 90 days of concluding fieldwork, the archaeologist will provide a technical report describing any and all monitoring and resultant archaeological excavations to the Project Lead/Organization, who will forward the report to Ecology, the federal agencies (if any), DAHP, and the affected tribe(s) for review and comment.

If assessment activities expose human remains (burials, isolated teeth, or bones), the archaeologist and Project Lead/Organization will follow the process described in **Section 6**.

8. PROCEEDING WITH WORK

The Project Lead/Organization shall work with the archaeologist, DAHP, and affected tribe(s) to determine the appropriate discovery boundary and where work can continue.

Work may continue at the discovery location only after the process outlined in this plan is followed and the Project Lead/Organization, DAHP, any affected tribe(s), Ecology, and the federal agencies (if any) determine that compliance with state and federal laws is complete.

9. ORGANIZATION RESPONSIBILITY

The Project Lead/Organization is responsible for ensuring:

- This IDP has complete and accurate information.
- This IDP is immediately available to all field staff at the sites and available by request to any party.
- This IDP is implemented to address any discovery at the site.
- That all field staff, contractors, and volunteers are instructed on how to implement this IDP.

10. ADDITIONAL RESOURCES

Informative Video

Ecology recommends that all project staff, contractors, and volunteers view this informative video explaining the value of IDP protocol and what to do in the event of a discovery. The target audience is anyone working on the project who could unexpectedly find cultural resources or human remains while excavating or digging. The video is also posted on DAHP's inadvertent discovery language website.

[Ecology's IDP Video](https://www.youtube.com/watch?v=ioX-4cXfbDY) (<https://www.youtube.com/watch?v=ioX-4cXfbDY>)

Informational Resources

[DAHP](https://dahp.wa.gov) (<https://dahp.wa.gov>)

[Washington State Archeology \(DAHP 2003\)](https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf)

(https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf)

[Association of Washington Archaeologists](https://www.archaeologyinwashington.com) (<https://www.archaeologyinwashington.com>)

Potentially Interested Tribes

[Interactive Map of Tribes by Area](https://dahp.wa.gov/archaeology/tribal-consultation-information)

(<https://dahp.wa.gov/archaeology/tribal-consultation-information>)

[WSDOT Tribal Contact Website](https://wsdot.wa.gov/tribal/TribalContacts.htm)

(<https://wsdot.wa.gov/tribal/TribalContacts.htm>)

11. ADDITIONAL INFORMATION

Please add any additional contact information or other information needed within this IDP.

Snoqualmie Indian Tribe
Steven Moses
Director of Archaeology & Historic Preservation
(425) 495-6097
steve@snoqualmietribe.us

Sauk-Suiattle Indian Tribe
Kevin Joseph
Tribal Historic Preservation Officer
(360) 436-0333
kJoseph@sauk-suiattle.com

Lummi Nation
Lena Tso
Tribal Historic Preservation Officer
(360) 312-2257
lenat@lummi-nsn.gov

Confederated Tribes of the Colville Reservation
Guy Moura

Implement the IDP if you see...

Chipped stone artifacts.

Examples are:

- Glass-like material.
- Angular material.
- “Unusual” material or shape for the area.
- Regularity of flaking.
- Variability of size.



Stone artifacts from Oregon.



Stone artifacts from Washington.



Biface-knife, scraper, or pre-form found in NE Washington. Thought to be a well knapped object of great antiquity. Courtesy of Methow Salmon Rec. Foundation.

Implement the IDP if you see...

Ground stone artifacts.

Examples are:

- Unusual or unnatural shapes or unusual stone.
- Striations or scratching.
- Etching, perforations, or pecking.
- Regularity in modifications.
- Variability of size, function, or complexity.



Above: Fishing Weight - credit [CRITFC Treaty Fishing Rights website](#).



Artifacts from unknown locations (left and right images).



Implement the IDP if you see...

Bone or shell artifacts, tools, or beads.

Examples are:

- Smooth or carved materials.
- Unusual shape.
- Pointed as if used as a tool.
- Wedge shaped like a “shoehorn”.
- Variability of size.
- Beads from shell (*dentalium*) or tusk.



Upper Left: Bone Awls from Oregon.

Upper Center: Bone Wedge from California.

Upper Right: Plateau dentalium choker and bracelet, from Nez Perce National Historical Park, 19th century, made using *Antalis pretiosa* shells Credit: Nez Perce - Nez Perce National Historical Park, NEPE 8762, Public Domain.

Above: Tooth Pendants. Right: Bone Pendants. Both from Oregon and Washington.



Implement the IDP if you see...

Culturally modified trees, fiber, or wood artifacts.

Examples are:

- Trees with bark stripped or peeled, carvings, axe cuts, de-limbing, wood removal, and other human modifications.
- Fiber or wood artifacts in a wet environment.
- Variability of size, function, and complexity.



Left and Below: *Culturally modified tree and an old carving on an aspen (Courtesy of DAHP).*

Right, Top to Bottom: *Artifacts from Mud Bay, Olympia: Toy war club, two strand cedar rope, wet basketry.*



Implement the IDP if you see...

Strange, different, or interesting looking dirt, rocks, or shells.

Human activities leave traces in the ground that may or may not have artifacts associated with them. Examples are:

- “Unusual” accumulations of rock (especially fire-cracked rock).
- “Unusual” shaped accumulations of rock (such as a shape similar to a fire ring).
- Charcoal or charcoal-stained soils, burnt-looking soils, or soil that has a “layer cake” appearance.
- Accumulations of shell, bones, or artifacts. Shells may be crushed.
- Look for the “unusual” or out of place (for example, rock piles in areas with otherwise few rocks).



Shell Midden pocket in modern fill discovered in sewer trench.



Underground oven. Courtesy of DAHP.

Shell midden with fire cracked rock.



Hearth excavated near Hamilton, WA.

Implement the IDP if you see...

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Agricultural or logging equipment. May include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, etc.
- Domestic items including square or wire nails, amethyst colored glass, or painted stoneware.



Left: Top to Bottom: Willow pattern serving bowl and slip joint pocket knife discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.



Right: Collections of historic artifacts discovered during excavations in eastern Washington cities.



Implement the IDP if you see...

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Railway tokens, coins, and buttons.
- Spectacles, toys, clothing, and personal items.
- Items helping to understand a culture or identity.
- Food containers and dishware.



Main Image: *Dishes, bottles, workboot found at the North Shore Japanese bath house (ofuro) site, Courtesy Bob Muckle, Archaeologist, Capilano University, B.C. This is an example of an above ground resource.*



Right, from Top to Bottom:
Coins, token, spectacles and Montgomery Ward pitchfork toy discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.



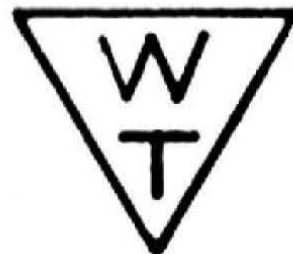
Implement the IDP if you see...

- Old munition casings – if you see ammunition of any type – ***always assume they are live and never touch or move!***
- Tin cans or glass bottles with an older manufacturer's technique – maker's mark, distinct colors such as turquoise, or an older method of opening the container.



Far Left: .303 British cartridge found by a WCC planting crew on Skagit River. Don't ever touch something like this!
Left: Maker's mark on bottom of old bottle.

Right: Old beer can found in Oregon. ACME was owned by Olympia Brewery. Courtesy of Heather Simmons.



Logo employed by Whithall Tatum & Co. between 1924 to 1938 (Lockhart et al. 2016).



Can opening dates, courtesy of W.M. Schroeder.

Implement the IDP if you see...

You see historic foundations or buried structures.

Examples are:

- Foundations.
- Railroad and trolley tracks.
- Remnants of structures.



Counter Clockwise, Left to Right: *Historic structure 45KI924, in WSDOT right of way for SR99 tunnel. Remnants of Smith Cove shantytown (45-KI-1200) discovered during Ecology CSO excavation, City of Spokane historic trolley tracks uncovered during stormwater project, intact foundation of historic home that survived the Great Ellensburg Fire of July 4, 1889, uncovered beneath parking lot in Ellensburg.*

Implement the IDP if you see...

Potential human remains.

Examples are:

- Grave headstones that appear to be older than 50 years.
- Bones or bone tools--intact or in small pieces. It can be difficult to differentiate animal from human so they must be identified by an expert.
- These are all examples of animal bones and are not human.

Center: *Bone wedge tool, courtesy of Smith Cove Shantytown excavation (45K11200).*

Other images (Top Right, Bottom Left, and Bottom) Center: Courtesy of DAHP.



Directly Above: This is a real discovery at an Ecology sewer project site.

What would you do if you found these items at a site? Who would be the first person you would call?

Hint: Read the plan!



HEALTH & SAFETY PLAN

Lovric's Sea-Craft
3100 Oakes Avenue
Anacortes, Washington 98221
Facility Site ID #21847524

Prepared For:

Guemes Channel Holdings, LLC

By:



PO Box 2546
Bellingham, WA 98227
(360) 714-9409

April 17, 2026

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APPENDICES

APPENDIX I

Figure 1 – Site Vicinity Map
Map & Directions to Nearest Hospital

APPENDIX II

Chemical Information Sheets

1.0 INTRODUCTION

This health and safety plan (HASP) was developed specifically for the Remedial Investigation (RI) and Interim Cleanup Action Plan (ICAP) at the Lovric's Sea Craft site (Site) in Anacortes, Washington.

Every employee's personal health and safety is Stratum Group's foremost concern when conducting official company business and work-related activities. Your personal health and safety should be your primary consideration before and while performing any work. You should neither take nor allow anyone else to take any action that you believe jeopardizes your health or safety, or violates any federal, state, or local health or safety regulations. Stratum Group expects its employees to follow the policies and procedures set forth in this HASP. Employees at all level of our organization are covered by this requirement. Changes in this program will only be made with the prior approval of the Project Manager (PM).

The goal on this project, as on all Stratum Group projects, is to experience zero injuries and to remain in compliance with applicable federal, state, and local health and safety requirements. The PM is accountable for employee safety and health on this project. The names and contact numbers for key personnel for this project are provided in Section 2 of this document.

The Department of Labor has published final rules (Part 1910.120 of Title 29 of the Code of Federal Regulations, March 6, 1990) that amend the existing Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations and emergency response. Within the State of Washington, these requirements are addressed in Chapter 296-843 of the Washington Administrative Code, Hazardous Waste Operations. These regulations apply to the activities to be performed at this Site as a site remediation, or cleanup, under the Federal Resource Conservation and Recovery Act of 1976 and/or the Washington State Model Toxics Control Act (MTCA).

Subcontractors to Stratum Group are required to prepare and effectively implement their own HASP based on their unique scope of work and professional expertise. Each subcontractor's HASP must comply with all applicable federal, state, and local regulations. The subcontractor's HASP should employ appropriate best practices to protect all personnel working on the Site, as well as the public, and to prevent negative impacts to the project or site.

A copy of this HASP will be maintained on site during all field activities for this project.



2.0 EMERGENCY CONTACT INFORMATION

For a critical emergency, 911 should be called immediately. An emergency is when an urgent need for assistance or relief is needed with respect to human health.

Contact information for Stratum Group personnel involved in this project is provided below.

Stratum Group Contact Information

Title	Name	Phone	Email
Project Manager	Ben Carlson	978-857-0728	ben@stratumgroup.net
Asst. Project Manager	Kim Ninnemann	360-920-0468	kim@stratumgroup.net
Field Scientist	Kristin Wilmes	360-915-4063	kristin@stratumgroup.net

Contact information for Stabbert Maritime personnel on site in the event of a health and safety concern is provided below.

Stabbert Maritime Contact Information

Title	Name	Phone	Email
Chief Financial Officer – Stabbert Project Manager	Kelly Allison	425-736-9819	kellya@stabbertmaritime.com
Facilities Manager	Scott Statia	360-298-4435	scotts@stabbertmaritime.com
Stabbert Safety Officer	David Summerland	206-900-2032	davids@stabbertmaritime.com

Contact information for other individuals or entities involved in the planned work is provided below.

Remedial Investigation Subcontractor Contact Information

Role	Name	Address	Phone
Vessel-Based Sampling Contractor	Gravity Marine Consulting	32617 SE 44 th St, Fall City, WA	425-281-1471
Private Utility Locate	CNI Locates	450 Alaskan Way, Suite 200, Seattle, WA	253-826-1177

Contact information for local and national emergency services providers is provided below. Directions to the nearest hospital from the work site are provided in Appendix I.



Emergency Service Contact Information

Service	Name	Address	Phone
Hospital	Island Health	1211 24 th Street, Anacortes, WA	360-299-1300
Police	Anacortes Police Department	1218 24 th Street, Anacortes, WA	911 or 360-293-4684
Fire	Anacortes Fire Department	1016 13 th Street, Anacortes, WA	911 or 360-293-1925
Public Works	City of Anacortes Public Works	904 6 th Street, Anacortes, WA	360-293-1921
Poison Control	Washington Poison Center	--	800-222-1222
National Response Center		--	800-422-8802
U.S. Coast Guard		--	206-217-6001

3.0 SITE DESCRIPTION

3.1 Site Location & Description

The Site is located within the city limits of Anacortes, Washington in Skagit County. The Site is located on the north shore of Fidalgo Island approximately 1.4 miles west-southwest of downtown Anacortes. The primary street address for the Site is 3100 Oakes Avenue, but the properties that compose the site are also recognized under the addresses 3006 Oakes Avenue, 3022 Oakes Avenue, and 1100 Dakota Avenue. The location of the Site is presented in Figure 1 in Appendix I.

The Property on which the Site is located covers approximately 8.7 acres, portions of which are submerged below the high-water mark of Guemes Channel. The upland consists of a steep vegetated hillside and a relatively level shoreline commercial area that is developed with multiple buildings and marine railways. The elevation of the Property along Oakes Avenue is approximately 70 feet above mean sea level, with a steep 50-to-60-foot elevation drop to the nearshore and shoreline areas where the shipyard infrastructure development is present.

A variety of structures are located on the Site which were constructed over a period of time by prior owners to facilitate site uses including fish processing, a shipyard, and a marina. An annotated aerial photograph of the Property with key site features labeled is provided in Figure 1-3 in Appendix I of the sediment RI work plan.

3.2 Development and Use History

The Property has been developed since at least the late 1890s, when the Russian Cement plant was constructed. The business produced glue, fertilizer, and fish oil from fish waste gathered



from nearby canneries. Robinson Fisheries established a cod cannery on the west side of the Property circa 1912. The entire Property is believed to have operated as a fish processing facility through the mid-1960s.

Lovric's Sea-Craft shipyard was established on the Property by 1965. Shipyard activities are apparent on the Property through aerial photograph review by 1969. Significant filling of the waterfront areas of the Property occurred in the late 1970s and 1980s to create many of the existing flat areas surrounding the two main warehouses. The fill reportedly consists of a mix of marine dredge spoils and upland-derived fill. The Property has been in continuous operation as a shipyard since the mid-1960s, with activities including engine repair and maintenance, welding, painting, sandblasting, replacement of sacrificial anodes, boat upfitting, hull cleaning and painting, and general boat maintenance services.

4.0 POTENTIAL SITE HAZARDS & HAZARD MANAGEMENT

Environmental investigation and sampling activities are described in detail in the Site's Remedial Investigation Work Plan. The work plan has been designed to investigate and define potential contamination of site soil and groundwater from potentially hazardous substances previously and currently used on site. Planned activities including utilizing drilling equipment and hand tools to collect soil and groundwater samples across the site's upland. Health and safety hazards that may be encountered on site include chemical hazards associated with potential site contaminants, physical hazards associated with shipyard activities on the Site and RI field activities, and natural biological and weather hazards that may be encountered.

4.1 Required Personal Protective Equipment (PPE)

Based on the concentrations of chemicals observed during previous investigations, environmental sampling activities should proceed in LEVEL D PPE consisting of:

- Hard Hat
- Reflective safety vest or jacket
- Noise protection while drilling
- Work boots with safety toe (steel or composite)
- Nitrile Gloves
- Safety Eye Wear (ANSI Z-87 approved)
- If an employee or subcontractor wishes, their work uniform may include a Tychem 9400 Chemically protective suits.

If site conditions are different than those anticipated such that Level C or greater PPE is required (e.g., large volumes of free chemical products are encountered, consistently elevated vapor concentrations are detected by the PID), site work will cease until conditions are suitable to restart work under Level D PPE.



Personnel must remain aware that the use of personal protective equipment (PPE) may reduce an individual's dexterity and visibility and performing some tasks may be more difficult.

4.2 Chemical Hazards

Soil, sediment, surface water, and groundwater at the Site may be contaminated with various chemical contaminants, some of which may be carcinogenic. Drilling personnel will remain alert to staining of drill tools and chemical odors or other signs of subsurface encounters with potentially hazardous materials.

Potential contaminants of concern (COCs) on the Site include petroleum hydrocarbons, volatile and semi-volatile organic compounds (VOCs and sVOCs), polycyclic aromatic hydrocarbons (PAHs), and metals. These contaminants have been shown to be or are suspected to be present in site soil, sediment, and/or groundwater. A list of these COCs is provided in Table 4 in the Remedial Investigation Work Plan.

Chemical information sheets for COCs most likely to be encountered on the Site are included as Appendix II in this document.

4.2.1 Worker Protections for Chemical Hazards

Impermeable gloves will be donned prior to handling drilling tools and/or site media (e.g., soil, groundwater) which are suspected to have encountered contaminants. Field personnel will avoid direct skin and eye contact with impacted soil and groundwater.

Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of site materials is prohibited in the active work zone.

All project work is anticipated to be completed outdoors in an open-air environment. Therefore, significant concentrations of hazardous vapors or air pollutants are not expected. However, if field monitoring equipment (PID) detects consistently elevated concentrations of air pollutants in ambient air in the work area, work may cease, and workers will clear the area until concentrations drop below routine background levels.

4.2.2 Decontamination Procedures

Personnel decontamination may be necessary for personnel coming into contact with contaminated media on the site. Personnel decontamination will consist of washing or brushing off safety footwear, disposal of gloves and other personal protective equipment in plastic garbage bags and washing of exposed areas of skin as needed.

Equipment associated with the drilling work, including drill rods and other downhole equipment, as well as all hand sampling equipment (e.g., shovels, buckets, etc.) will be washed with soap and water between each sampling location. Wash water will be captured and stored in drums along with temporary well purge water until proper off-site disposal can be arranged.



4.2.3 Waste Management

Drilling and soil excavation activities will generate investigation-derived waste (IDW) including soil cuttings and water generated during decontamination of equipment and supplies.

Groundwater sampling will generate purge water. IDW will be stored in labeled drums on site until characterization is complete and the contents can be properly disposed. IDW should not be handled unless proper personal protection equipment (PPE) is used.

Single-use project materials including PPE and sampling supplies will be bagged at the end of each day and disposed of as solid waste.

4.3 Physical Hazards

Fieldwork on an industrial site such as the Lovric's Sea Craft Site may involve a variety of physical hazards, including but not limited to operation of heavy machinery, potential contact with overhead and underground utilities and objects, manual lifting of heavy objects, high levels of noise, incursions into an unsecured work area, and slip/trip/fall hazards.

Activities that may be performed on site involve hydraulic probing operations, powered drilling equipment, and shoveling.

4.3.1 Utility Contact Mitigation

Before drilling, hydraulic soil probing, or excavation work takes place, underground utilities must be located and marked. Stratum Group personnel will submit a ticket to the Washington State One-Call system at least two full business days prior to the start of ground disturbing activities. Review of site utility drawing and a private utility locating company will also be utilized to locate utilities not under the public utility One Call purview and clear all subsurface exploration locations prior to the start of ground disturbing activities.

Any time drill rig equipment is mobilizing around the site or raising the mast to begin drilling, drillers and Stratum Group personnel will act as spotters to observe the area overhead to check for potential utility lines or other overhead obstructions to proper equipment movement and operation. The drill rig should be positioned at least 10 feet from all overhead power lines.

4.3.2 Worker Protections for Physical Hazards

All personnel working around drill rigs and heavy equipment will be familiarized with emergency shut-down procedures and the position of "kill" switches. No loose-fitting clothing, jewelry or unsecured long hair will be permitted near the equipment. Hands and feet should be kept away from all moving parts of the drill rig while drilling is in progress, except for trained and licensed drillers and driller helpers. Daily inspection of all ropes, cables, and moving parts is mandatory.

To avoid impacts from high levels of noise, field personnel should wear hearing protection (e.g.,



earplugs, earmuffs, etc.) whenever the drill rig is operating. Hearing protection may also be warranted when general Site noise (e.g., ship repair activities) becomes too loud for general conversation to continue.

The active work zone will be barricaded as much as is practicable to isolate the work area from pedestrians, site workers, and vehicles. If Stabbert Maritime personnel need to cross through the work area as part of active shipyard operations, and an alternative route is not possible, project work will stop until the work area is again secure.

The project Site is located adjacent to waters of Guemes Channel. This positioning introduces risks associated with water immersion and/or falling from elevated bulkheads or piers. To mitigate these risks, all work activities will take place at least 10 feet away from the water and 10 feet away from the edge of bulkheads or other elevated work areas on the Site. Colorful physical barriers may be erected along the top edge of bulkheads or similar elevated areas to reduce the likelihood of inadvertent falls. No overwater work is planned at this time.

A stocked first aid kit will be kept on site at all times in a Stratum Group field vehicle. If injuries more significant than minor cuts and scrapes are incurred, project work will stop, and personnel should be taken to a medical professional for proper attention.

Other general physical hazards which may be present on this project site and methods of mitigating their risk include:

- Lifting & Ergonomic Stress - Use proper lifting techniques to avoid back injury. Lift with the legs, not the back. Keep loads close to the body and avoid twisting. Loads heavier than 50 pounds (lbs) require a second person or mechanical device for lifting. Use mechanical devices such as drum dollies, hand trucks, and tool hoists (for lifting augers) to lift or move heavy loads whenever possible. When working with a heavy tool or object, keep legs under the load and do not overreach or twist to the side. Reposition body to be more square to the load and work. Push loads, rather than pull, whenever feasible. Do not persist with lifting when the load is too heavy. Use a mechanical lifting aid or have a coworker assist with the lift. Rotate repetitive tasks to avoid soft-tissue fatigue.
- Fire and Explosion - Fire extinguishers will be accessible in the work area. Store flammables in Underwriter's Laboratory and Occupational Safety and Health Administration (OSHA) approved metal safety cans equipped with spark arrestors. Store flammable containers more than 50 ft from possible ignition sources. Keep exhaust equipment powered by internal combustion engines well away from flammables and combustibles. Never refuel equipment (e.g., generators) while it is in operation or hot enough to ignite fuel vapors. Conspicuously mark operations that pose fire hazards "No Smoking" or "Open Flames." Remove trash, weeds, and unnecessary combustibles from the hot equipment.



- Vehicles - Always be aware and stay alert to vehicle and equipment traffic around the work area. If equipment other than the drill rig needs to cross through the work area, project work should stop until the work area is cleared of non-project personnel and equipment. When operating a vehicle to and from the work site, obey all site traffic signs and speed limits. Seat belts must be functional and in use during operation of any site vehicles (including rentals). Operator shall regularly inspect the vehicle for defective parts, such as brakes, controls, motor, chassis and drives.
- Slips, Trips, and Falls - Clear work area of obstructions and debris before setting up. Alter work areas as necessary to provide a safe, reasonably level area. All walking and working surfaces shall continually be inspected and maintained to be free of slip, trip, and fall hazards. Keep platforms, stairs, and immediate work areas clear. Do not allow oil, grease, or excessive mud to accumulate in these areas. Eliminate slip, trip, and fall hazards or identify them clearly with caution tape, barricades, or equivalent means. Store loose or light material and debris in designated areas or containers. Secure tools, materials, and equipment subject to displacement or falling.

4.3.3 Hazards for Overwater Work

Sediment sampling activities to be completed as part of the RI introduces additional potential hazards unique to working in a dynamic marine environment.

Some sediment sample collection is proposed to be completed within intertidal zones of the Site, or areas that are intermittently and routinely inundated by seawater during high tides but become exposed during low tides. To safely work within this area, tide charts specific to the area of the Site will be consulted by field personnel prior to the start of fieldwork. Work in intertidal zones of the site will only be performed when there is a minimum of 1 hour between the start of sampling activities at that location and when the rising tide is expected to inundate the sampling location. If the tide rises unexpectedly in the middle of sampling activities, a sampling location may be abandoned and the location reoccupied at the next low tide.

A significant portion of sediment sampling will be performed on a boat over aquatic areas of the site. When working on a vessel, all personnel will wear a U.S. Coast Guard approved personal flotation device (PFD). Special care will be taken to keep all active work areas clear of obstructions or debris on the deck of the vessel to minimize the potential for slips, trips, and falls. Any and all instructions from the vessel captain will be followed. If excessive wind, rain, snow, or other weather conditions pose an undue hazard to overwater work (see Section 4.4), field activities may be suspended at the discretion of the Project Manager or the vessel operator at any time, with work resuming only once conditions are satisfactory to all field personnel. In the event of a person falling overboard, they should follow all instructions given by vessel personnel still aboard for rescue. If reboarding the vessel is not feasible, a person overboard should swim to the nearest shoreline or pier ladder, whichever is closer. All planned overwater work is near multiple areas of upland and/or piers and docks that can be used for self-rescue.



4.4 Weather Hazards

Weather conditions on the project Site can pose a variety of hazards to personnel and equipment including excessive cold, excessive heat, high winds, precipitation, and electrical storms.

Caution should be taken as weather conditions can change rapidly. Prior to arriving on site, personnel should check the weather forecast and prepare with proper clothing and field equipment. Prior to beginning daily work, the site should be surveyed for any changes due to weather including flooding and slip/fall hazards.

The project may be shut down during the following inclement weather conditions:

- poor visibility
- precipitation severe enough to impair safe movement or travel or posing a high slip/trip/fall hazard
- lightning in the immediate area
- steady winds in excess of 25 mph or at the discretion of the drilling team
- local air quality registering an AQI of 100 or greater (PM2.5)
- other conditions as determined by the Project Manager.

Work will resume when the conditions are deemed safe by the Project Manager and all project personnel are comfortable continuing field activities. If lightning is observed or thunder is heard, work shall immediately cease until the storm has passed.

During portions of the spring, summer, and fall months, site conditions have the potential for heat stress to affect site personnel. Strenuous work in protective clothing may also increase perspiration and the potential for heat stress. At least one gallon of water will be available for each field employee during each day of site activity. The Project Manager or Stratum Group field representative (if different) will observe all project personnel for signs of heat stress (excessive perspiration, flushed skin, nausea, etc.). If such signs are observed, affected workers will be required to leave the work area, loosen protective clothing, drink water, and rest in a shaded area for at least 15 minutes. Fluid replacement will be encouraged during each rest period.

4.5 Biological Hazards

Biological hazards such as snakes and wild animals, although unlikely, could be encountered in areas of the project site. Never try to capture wild or semi-wild animals, as they may bite you or infect you with parasites.

Stinging insects such as wasps, mosquitos and ticks could also be encountered in outdoor environments. Use immediate first aid measures to treat any insect bites. A physician should be consulted regarding removal of ticks that may be detected following site work.



Employees are instructed to watch for the presence of poisonous plants such as poison ivy or poison oak, and to avoid such plants. Project work will not expose workers to infectious agents or wastes; however, responders to first aid incidents could contact bloodborne pathogens. Always treat human blood and bodily fluids as potentially infected with disease and take the proper precautions when coming into contact with these fluids.

4.6 Training/Education Requirements

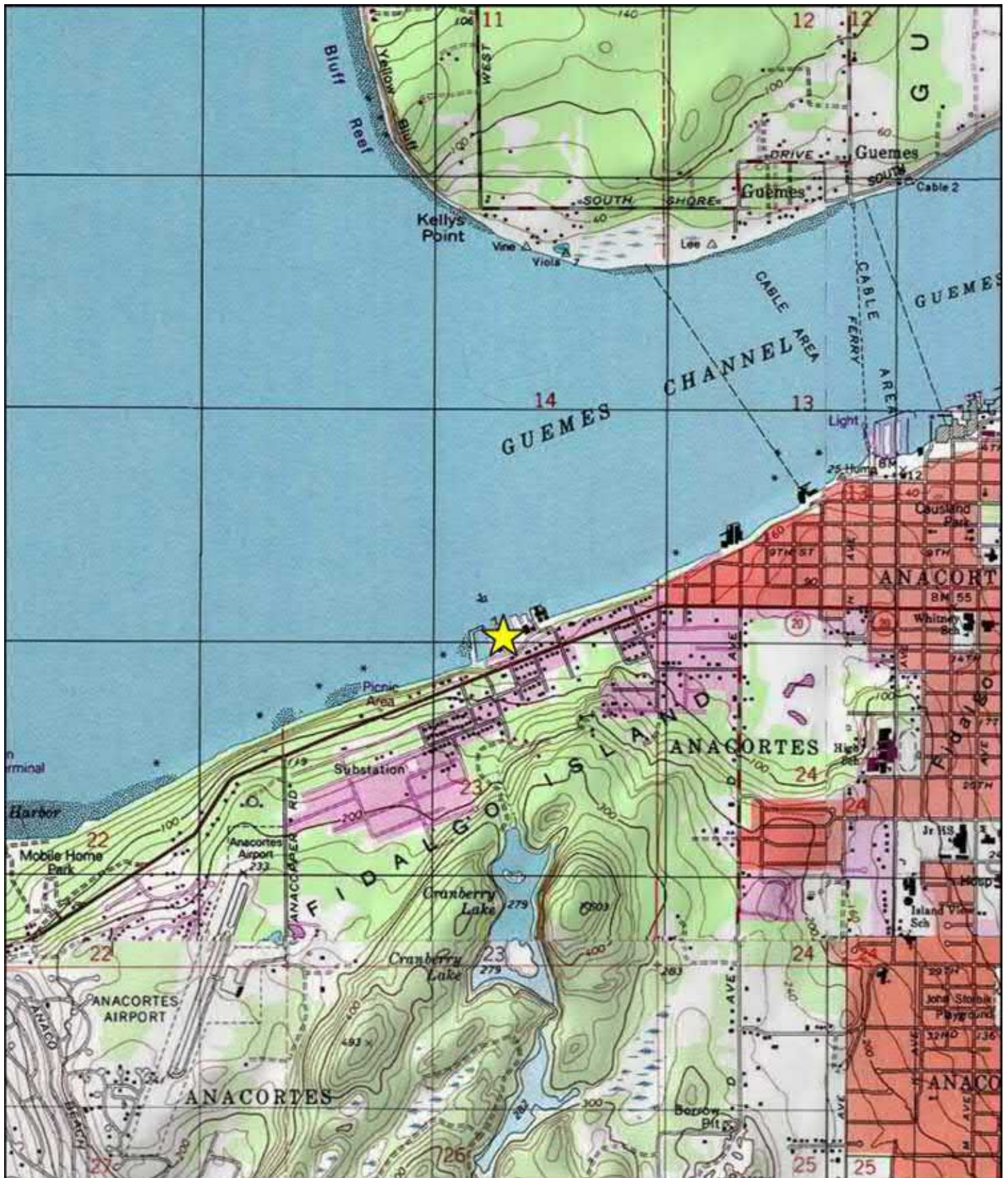
All Stratum Group and subcontractor personnel participating in ground disturbing activities on this Site must have completed 40-hour Hazardous Waste Site Training and at least three days supervised field experience per the requirements of OSHA 29 CFR 1910.120. In addition, a current 8-hour annual refresher training certificate will be required for all Stratum Group field personnel.

Prior to the start of site activities, all Stratum Group project personnel will participate in a pre-project safety and health briefing outlining the contents of this Plan. The personnel responsible for project safety and health will be addressed, as will site history, scope of work, site control measures, emergency procedures and site communications. Daily "tailgate" safety and health briefings will be presented by the Project Manager at the start of each workday. In addition to a general review of the proposed daily activity and safety requirements, findings from the previous day's work that could impact the health and safety of site workers, and any procedural changes will be addressed.



APPENDIX I

Figure 1 – Site Vicinity Map
Map & Directions to Nearest Hospital



Subject Property

Vicinity Map

Lovric's Sea-Craft
3022 Oakes Avenue
Anacortes, WA 98221

Figure 1

0 0.25 0.5 mi

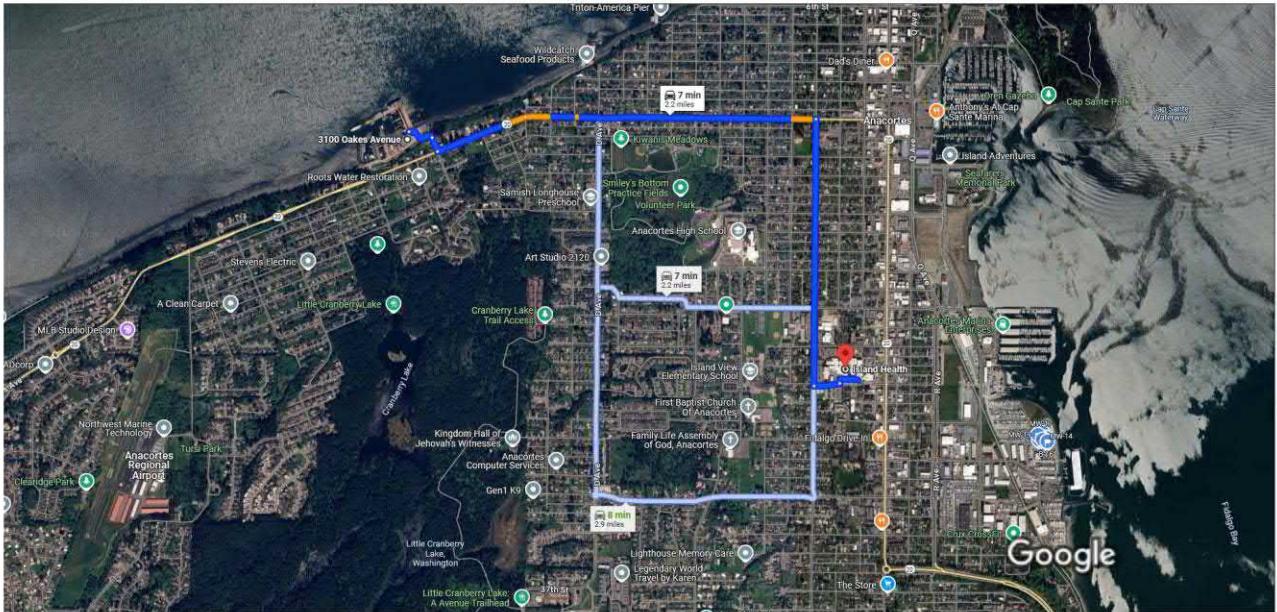


N



 3100 Oakes Ave, Anacortes, WA 98221 to Island Health, 1211 24th St, Anacortes, WA 98221

Drive 2.2 miles, 7 min



Imagery ©2024 Airbus, CNES / Airbus, Maxar Technologies, USDA/FPAC/GEO, Map data ©2024 Google 1000 ft

3100 Oakes Ave

Anacortes, WA 98221

- ↑

1. Head east toward Dakota Ave

440 ft
- ↗

2. Continue onto Dakota Ave

236 ft
- ↶

3. Turn left onto Oakes Ave

0.3 mi
- ↑

4. Continue onto 12th St

0.9 mi
- ↘

5. Turn right onto M Ave

0.8 mi
- ↶

6. Turn left onto 26th St

410 ft
- ↶

7. Turn left

i

 Destination will be on the left

338 ft

Island Health

1211 24th St, Anacortes, WA 98221

APPENDIX II

Chemical Information Sheets

APPENDIX II

Chemical Information Sheets



CAMEO Chemicals



Chemical Datasheet

ACETONE



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
67-64-1 	1090	Flammable Liquid	ACT

NIOSH Pocket Guide
Acetone

International Chem Safety Card
ACETONE

NFPA 704

Diamond	Hazard	Value	Description
3 1 0	 Health	1	Can cause significant irritation.
	 Flammability	3	Can be ignited under almost all ambient temperature conditions.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A clear colorless liquid with a sweetish odor. Flash point 0°F. Less dense than water. Vapors are heavier than air. Used as a solvent in paint and nail polish removers.

Hazards

Reactivity Alerts

Highly Flammable

Air & Water Reactions

Highly flammable. Water soluble.

Fire Hazard

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. **CAUTION:** Ethanol (UN1170) can burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.) Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along the ground and collect in low or confined areas (sewers, basements, tanks, etc.). Vapor explosion hazard indoors, outdoors or in sewers. Those substances designated with a (P) may polymerize explosively when heated or involved in a fire. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids will float on water. (ERG, 2024)

Health Hazard

INHALATION: vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations. **INGESTION:** low order of toxicity but very irritating to mucous membranes. **SKIN:** prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis. (USCG, 1999)

Reactivity Profile

It was reported that a mixture of ACETONE and chloroform, in a residue bottle, exploded. Since addition of acetone to chloroform in the presence of base will result in a highly exothermic reaction, it is thought that a base was in the bottle [MCA Case History 1661. 1970]. Also, Nitrosyl chloride, sealed in a tube with a residue of acetone in the presence of platinum catalyst, gave an explosive reaction [Chem. Eng. News 35(43):60. 1967]. The reaction of nitrosyl perchlorate and acetone ignites and explodes. Explosions occur with mixtures of nitrosyl perchlorate and primary amine [Ann. Chem. 42:2031. 1909]. Reacts violently with nitric acid. Also causes exothermic reaction when in contact with aldehydes.

Belongs to the Following Reactive Group(s)

- Ketones

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient. **CAUTION:** For fire involving UN1170, UN1987 or UN3475, alcohol-resistant foam should be used. **CAUTION:** Ethanol (UN1170) can burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.).

SMALL FIRE: Dry chemical, CO₂, water spray or alcohol-resistant foam.

LARGE FIRE: Water spray, fog or alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Acetone:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Acetone	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Dimethyl ketal	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Dimethyl ketone	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Ketone propane	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Methyl acetyl	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Methyl ketone	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Propan -2-one	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480
Pyroacetic ether	67-64-1	Liquid	imm	imm	13	462	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: C3H6O

Flash Point: 0°F (NTP, 1992)

Lower Explosive Limit (LEL): 2.6 % (NTP, 1992)

Upper Explosive Limit (UEL): 12.8 % (NTP, 1992)

Autoignition Temperature: 869°F (USCG, 1999)

Melting Point: -137°F (NTP, 1992)

Vapor Pressure: 180 mmHg at 68°F ; 270 mmHg at 86°F (NTP, 1992)

Vapor Density (Relative to Air): 2 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 0.791 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 133°F at 760 mmHg (NTP, 1992)

Molecular Weight: 58.08 (NTP, 1992)

Water Solubility: greater than or equal to 100 mg/mL at 72°F (NTP, 1992)

Ionization Energy/Potential: 9.69 eV (NIOSH, 2024)

IDLH: 2500 ppm ; Based on 10% of the lower explosive limit. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Acetone (67-64-1)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	200 ppm	9300 ppm 🔥	16000 ppm 🔥 🔥
30 minutes	200 ppm	4900 ppm 🔥	8600 ppm 🔥
60 minutes	200 ppm	3200 ppm 🔥	5700 ppm 🔥
4 hours	200 ppm	1400 ppm	2500 ppm
8 hours	200 ppm	950 ppm	1700 ppm

Lower Explosive Limit (LEL) = 26000 ppm

🔥 indicates value is 10-49% of LEL. Safety consideration against explosions must be taken into account.

🔥 🔥 indicates value is 50-99% of LEL. Extreme safety consideration against explosions must be taken into account.

Level of Distinct Odor Awareness = 160 ppm

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Acetone (67-64-1)	200 ppm	3200 ppm 🔥	5700 ppm 🔥	LEL = 26000 ppm

🔥 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Acetone	67-64-1			5000 pounds		U002	

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ACETONE
- BETA-KETOPROPANE
- CHEVRON ACETONE
- DIMETHYL KETONE
- DIMETHYLFORMALDEHYDE
- DIMETHYLKETAL
- KETONE PROPANE
- KETONE, DIMETHYL
- METHYL KETONE
- PROPANONE
- 2-PROPANONE
- PYROACETIC ACID
- PYROACETIC ETHER



CAMEO Chemicals



Chemical Datasheet

ARSENIC



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-38-2	1558	Poison	ARX
NIOSH Pocket Guide Arsenic (inorganic compounds, as As)		International Chem Safety Card ARSENIC	

NFPA 704

data unavailable

General Description

A grayish metallic solid that turns black upon exposure to air. Insoluble in water. Toxic by ingestion.

Hazards

Reactivity Alerts

none

Air & Water Reactions

Turns black on exposure to air. Insoluble in water.

Fire Hazard

Special Hazards of Combustion Products: Contain highly toxic arsenic trioxide and other forms of arsenic. Arsenic gas, the most dangerous form of arsenic, is produced upon contact with an acid or acid fumes.

Behavior in Fire: Burns to produce dense white fumes of highly toxic arsenic trioxide. (USCG, 1999)

Health Hazard

Poisonous by inhalation of dust or by ingestion. Regardless of exposure route, symptoms in most cases are characteristic of severe gastritis or gastroenteritis. All chemical forms of arsenic eventually produce similar toxic effects. Symptoms may be delayed. (USCG, 1999)

Reactivity Profile

ARSENIC reacts incandescently with bromine trifluoride, even at 10°C [Mellor 2:113 1946-47]. Causes bromoazide to

explode upon contact. Ignites if ground up together with solid potassium permanganate [Mellor 12:322 1946-47]. Is oxidized by sodium peroxide with incandescence [Mellor 2:490-93 1946-47]. A combination of finely divided arsenic with finely divided bromates (also chlorates and iodates) of barium, calcium, magnesium, potassium, sodium, or zinc can explode by heat, percussion, and friction [Mellor 2:310 1946-47]. Bromine pentafluoride reacts readily in the cold with arsenic. Ignition usually occurs. Reacts vigorously with fluorine at ordinary temperatures [Mellor 9:34 1946-47].

Belongs to the Following Reactive Group(s)

- Metals, Less Reactive

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

SMALL FIRE: Dry chemical, CO₂ or water spray.

LARGE FIRE: Water spray, fog or regular foam. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal. Avoid aiming straight or solid streams directly onto the product.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Cover with plastic sheet to prevent spreading. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINERS. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Arsenic (inorganic compounds, as As):

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin:

- WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.
- DAILY - The worker should wash daily at the end of each work shift, and prior to eating, drinking, smoking, etc.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

Provide:

- EYEWASH - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- QUICK DRENCH - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

Excerpt from NIOSH Pocket Guide for Arsenic (inorganic compounds, as As):

Eye: IRRIGATE IMMEDIATELY - If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin: SOAP WASH IMMEDIATELY - If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breathing: RESPIRATORY SUPPORT - If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: MEDICAL ATTENTION IMMEDIATELY - If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2024)

Physical Properties

Chemical Formula: As

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 1135°F (Sublimes) (NIOSH, 2024)

Vapor Pressure: 0 mmHg (approx) (NIOSH, 2024)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 5.727 at 77°F (USCG, 1999) - Denser than water; will sink

Boiling Point: 1135°F at 760 mmHg (sublimes) (USCG, 1999)

Molecular Weight: 74.9216 (USCG, 1999)

Water Solubility: Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: 5 mg As/m³ ; A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Arsenic (7440-38-2)	1.5 mg/m ³	17 mg/m ³	100 mg/m ³

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Arsenic ††	7440-38-2			1 pound	313		
Arsenic Compounds	N020			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ARSENIC
- ARSENIC BLACK
- ARSENIC METAL: ARSENIA
- ARSENIC, METALLIC
- ARSENIC, SOLID
- ARSENIC, [SOLID]
- ARSENIC-75
- GRAY ARSENIC



CAMEO Chemicals



Chemical Datasheet

BENZENE



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
71-43-2	1114	Flammable Liquid	BNZ

NIOSH Pocket Guide
Benzene

International Chem Safety Card
BENZENE

NFPA 704

Diamond	Hazard	Value	Description
3 2 0	Health	2	Can cause temporary incapacitation or residual injury.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		

(NFPA, 2010)

General Description

A clear colorless liquid with a petroleum-like odor. Flash point less than 0°F. Less dense than water and slightly soluble in water. Hence floats on water. Vapors are heavier than air.

Hazards

Reactivity Alerts

Highly Flammable

Air & Water Reactions

Highly flammable. Slightly soluble in water.

Fire Hazard

Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
(USCG, 1999)

Health Hazard

Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction, nausea, and vomiting. Coma and possible death. (USCG, 1999)

Reactivity Profile

BENZENE reacts vigorously with allyl chloride or other alkyl halides even at -70°C in the presence of ethyl aluminum dichloride or ethyl aluminum sesquichloride. Explosions have been reported [NFPA 491M 1991]. Ignites in contact with powdered chromic anhydride [Mellor 11:235 1946-47]. Incompatible with oxidizing agents such as nitric acid. Mixtures with bromine trifluoride, bromine pentafluoride, iodine pentafluoride, iodine heptafluoride and other interhalogens can ignite upon heating [Bretherick 5th ed. 1995]. Benzene and cyanogen halides yield HCl as a byproduct (Hagedorn, F. H. Gelbke, and Federal Republic of Germany. 2002. Nitriles. In Ullmann's Encyclopedia of Industrial Chemistry. Wiley-VCH Verlag GmbH & Co. KGaA.). The reaction of benzene and trichloroacetonitrile evolves toxic chloroform and HCl gases. (Hagedorn, F., H.-P. Gelbke, and Federal Republic of Germany. 2002. Nitriles. In Ullmann's Encyclopedia of Industrial Chemistry. Wiley-VCH Verlag GmbH & Co. KGaA.).

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Benzene:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Provide:

- EYEWASH - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- QUICK DRENCH - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Benzene	71-43-2	Liquid			imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: C₆H₆

Flash Point: 12°F (NTP, 1992)

Lower Explosive Limit (LEL): 1.4 % (NTP, 1992)

Upper Explosive Limit (UEL): 8 % (NTP, 1992)

Autoignition Temperature: 1097°F (USCG, 1999)

Melting Point: 41.9°F (NTP, 1992)

Vapor Pressure: 60 mmHg at 59°F ; 76 mmHg at 68°F (NTP, 1992)

Vapor Density (Relative to Air): 2.77 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 0.879 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 176.2°F at 760 mmHg (NTP, 1992)

Molecular Weight: 78.11 (NTP, 1992)

Water Solubility: 1 to 5 mg/mL at 64°F (NTP, 1992)

Ionization Energy/Potential: 9.24 eV (NIOSH, 2024)

IDLH: 500 ppm ; A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Benzene (71-43-2)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	130 ppm	2000 ppm 	9700 ppm  
30 minutes	73 ppm	1100 ppm	5600 ppm 
60 minutes	52 ppm	800 ppm	4000 ppm 
4 hours	18 ppm	400 ppm	2000 ppm 
8 hours	9 ppm	200 ppm	990 ppm

Lower Explosive Limit (LEL) = 14000 ppm

 indicates value is 10-49% of LEL. Safety consideration against explosions must be taken into account.

  indicates value is 50-99% of LEL. Extreme safety consideration against explosions must be taken into account.

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Benzene (71-43-2)	50 ppm 	150 ppm	1000 ppm

 indicates that odor should be detectable near ERPG-1.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Benzene (71-43-2)	52 ppm	800 ppm	4000 ppm 	LEL = 14000 ppm

 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information**EPA Consolidated List of Lists**

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Benzene ^a	71-43-2			10 pounds	313	U019	

^a indicates that benzene was already a CERCLA hazardous substance prior to the CAA Amendments of 1990 and received an adjusted 10-pound RQ based on potential carcinogenicity in an August 14, 1989, final rule (54 FR 33418). The CAA Amendments specify that “benzene (including benzene from gasoline)” is a hazardous air pollutant and, thus, a CERCLA hazardous substance.

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- (6)ANNULENE
- [6]ANNULENE
- BENZENE
- BENZIN
- BENZINE
- BENZOL
- BENZOLE
- BENZOLENE
- BICARBURET OF HYDROGEN
- CARBON OIL
- COAL NAPHTHA
- CYCLOHEXATRIENE
- 1,3,5-CYCLOHEXATRIENE
- MINERAL NAPHTHA
- MOTOR BENZOL
- NCI-C55276
- NITRATION BENZENE
- PHENE
- PHENYL HYDRIDE
- PYROBENZOL
- PYROBENZOLE

**CAMEO** *Chemicals***Chemical Datasheet****CADMIUM****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-43-9	2570	Poison	none
NIOSH Pocket Guide Cadmium dust (as Cd)		International Chem Safety Card CADMIUM	

NFPA 704

data unavailable

General Description

PHYSICAL DESCRIPTION: Silver-white blue tinged lustrous metallic solid. (NTP, 1992)

Hazards**Reactivity Alerts**

Pyrophoric

Air & Water Reactions

The finely divided metal is pyrophoric. Slowly oxidized by moist air to form cadmium oxide. Insoluble in water.

Fire Hazard

Flammable in powder form. Combustible. (NTP, 1992)

Health Hazard

Excerpt from NIOSH Pocket Guide for Cadmium dust (as Cd):

Exposure Routes: Inhalation, ingestion

Symptoms: Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]

Target Organs: Respiratory system, kidneys, prostate, blood

Cancer Site: Prostatic & lung cancer (NIOSH, 2024)

Reactivity Profile

A violent explosion occurred 30 minutes after placement of a CADMIUM rod into hydrazoic acid [Mellor 8 Supp. 2:50 1967]. Fused ammonium nitrate with powdered metal often produces a violent explosive reaction. Reactivity similar to zinc. May be incompatible with oxidants.

Belongs to the Following Reactive Group(s)

- Metals, Elemental and Powder, Active

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

To extinguish a fire involving this chemical you may use a dry chemical, carbon dioxide, foam or halon extinguisher; a water spray may also be used. (NTP, 1992)

Non-Fire Response

SMALL SPILLS AND LEAKAGE: If you spill this chemical, you should dampen the solid spill material with water, then transfer the dampened material to a suitable container. Use absorbent paper dampened with water to pick up any remaining material. Seal your contaminated clothing and the absorbent paper in a vapor-tight plastic bag for eventual disposal. Wash all contaminated surfaces with a strong soap and water solution. Do not reenter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

STORAGE PRECAUTIONS: You should keep this material in a tightly-closed container under an inert atmosphere, and store it in a freezer. (NTP, 1992)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Cadmium dust (as Cd):

Skin: No recommendation is made specifying the need for personal protective equipment for the body.

Eyes: No recommendation is made specifying the need for eye protection.

Wash skin: DAILY - The worker should wash daily at the end of each work shift, and prior to eating, drinking,

smoking, etc.

Remove: No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: Some heavy metals are VERY TOXIC POISONS, especially if their salts are very soluble in water (e.g., lead, chromium, mercury, bismuth, osmium, and arsenic). IMMEDIATELY call a hospital or poison control center and locate activated charcoal, egg whites, or milk in case the medical advisor recommends administering one of them. Also locate Ipecac syrup or a glass of salt water in case the medical advisor recommends inducing vomiting. Usually, this is NOT RECOMMENDED outside of a physician's care. If advice from a physician is not readily available and the victim is conscious and not convulsing, give the victim a glass of activated charcoal slurry in water or, if this is not available, a glass of milk, or beaten egg whites and IMMEDIATELY transport victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, assure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: Cd

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 609.6°F (NTP, 1992)

Vapor Pressure: 1 mmHg at 741°F (NTP, 1992)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 8.642 (NTP, 1992) - Denser than water; will sink

Boiling Point: 1409°F at 760 mmHg (NTP, 1992)

Molecular Weight: 112.41 (NTP, 1992)

Water Solubility: Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: 9 mg Cd/m3 ; A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Cadmium (7440-43-9)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	0.13 mg/m3	1.4 mg/m3	8.5 mg/m3
30 minutes	0.13 mg/m3	0.96 mg/m3	5.9 mg/m3
60 minutes	0.1 mg/m3	0.76 mg/m3	4.7 mg/m3
4 hours	0.063 mg/m3	0.4 mg/m3	1.9 mg/m3
8 hours	0.041 mg/m3	0.2 mg/m3	0.93 mg/m3

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Cadmium (7440-43-9)	0.1 mg/m3	0.76 mg/m3	4.7 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Cadmium ††	7440-43-9			10 pounds	313		
Cadmium Compounds	N078			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- C.I. 77180
- CADMIUM
- CADMIUM DUST (AS CD)
- CADMIUM METAL: CADMIUM

**CAMEO** *Chemicals***Chemical Datasheet****CHROMIUM****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-47-3	1759	Corrosive	none
NIOSH Pocket Guide Chromium metal		International Chem Safety Card CHROMIUM	

NFPA 704

data unavailable

General Description

PHYSICAL DESCRIPTION: Very hard gray solid with a metallic luster. (NTP, 1992)

Hazards**Reactivity Alerts**

Pyrophoric

Air & Water Reactions

May be pyrophoric, as dust. Insoluble in water.

Fire Hazard

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.). Corrosives in contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. For electric vehicles or equipment, ERG Guide 147 (lithium ion or sodium ion batteries) or ERG Guide 138 (sodium batteries) should also be consulted. (ERG, 2024)

Health Hazard

Excerpt from NIOSH Pocket Guide for Chromium metal:

Exposure Routes: Inhalation, ingestion, skin and/or eye contact

Symptoms: Irritation eyes, skin; lung fibrosis (histologic)

Target Organs: Eyes, skin, respiratory system (NIOSH, 2024)

Reactivity Profile

CHROMIUM reacts violently with NH_4NO_3 , N_2O_2 , Li, NO, KClO_3 , SO_2 (NTP, 1992). Metal dusts when suspended in atmospheres of carbon dioxide may ignite and explode.

Belongs to the Following Reactive Group(s)

- Metals, Elemental and Powder, Active

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

SMALL FIRE: Dry chemical, CO_2 or water spray.

LARGE FIRE: Dry chemical, CO_2 , alcohol-resistant foam or water spray. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

SMALL SPILLS AND LEAKAGE: If you spill this chemical, dampen the solid spill material with 5% ammonium hydroxide, then transfer the dampened material to a suitable container. Use absorbent paper dampened with 5% ammonium hydroxide to pick up any remaining material. Your contaminated clothing and the absorbent paper should be sealed in a vapor-tight plastic bag for eventual disposal. Wash all contaminated surfaces with 5% ammonium hydroxide followed by washing with a strong soap and water solution. Do not reenter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

STORAGE PRECAUTIONS: You should store this material in a refrigerator. (NTP, 1992)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Chromium metal:

Skin: No recommendation is made specifying the need for personal protective equipment for the body.

Eyes: No recommendation is made specifying the need for eye protection.

Wash skin: No recommendation is made specifying the need for washing the substance from the skin (either immediately or at the end of the work shift).

Remove: No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: Some heavy metals are VERY TOXIC POISONS, especially if their salts are very soluble in water (e.g., lead, chromium, mercury, bismuth, osmium, and arsenic). IMMEDIATELY call a hospital or poison control center and locate activated charcoal, egg whites, or milk in case the medical advisor recommends administering one of them. Also locate Ipecac syrup or a glass of salt water in case the medical advisor recommends inducing vomiting. Usually, this is NOT RECOMMENDED outside of a physician's care. If advice from a physician is not readily available and the victim is conscious and not convulsing, give the victim a glass of activated charcoal slurry in water or, if this is not available, a glass of milk, or beaten egg whites and IMMEDIATELY transport victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, assure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: Cr

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 3452°F (NTP, 1992)**Vapor Pressure:** 1 mmHg at 2941°F (NTP, 1992)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 7.2 (NTP, 1992) - Denser than water; will sink**Boiling Point:** 4788°F at 760 mmHg (NTP, 1992)**Molecular Weight:** 52 (NTP, 1992)**Water Solubility:** Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: 250 mg Cr/m3 (NIOSH, 2024)**AEGLs (Acute Exposure Guideline Levels)**

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Chromium (7440-47-3)	1.5 mg/m3	17 mg/m3	99 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Chromium ††	7440-47-3			5000 pounds	313		
Chromium Compounds	N090			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ALPASTE RRA 030
- ALPASTE RRA 050
- CHROME
- CHROMIUM
- CHROMIUM ELEMENT
- CHROMIUM FULLERIDE (CRC20)
- CHROMIUM METAL



CAMEO Chemicals



Chemical Datasheet

COPPER



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-50-8	3089 (powder)	Flammable Solid	none
NIOSH Pocket Guide Copper (dusts and mists, as Cu)		International Chem Safety Card COPPER	

NFPA 704

data unavailable

General Description

Reddish lustrous malleable odorless metallic solid.

Hazards

Reactivity Alerts

none

Air & Water Reactions

Solid pieces are very slowly oxidized by air to give a green basic carbonate. Solid pieces become covered by a black oxide when heated in air. Insoluble in water.

Fire Hazard

Excerpt from ERG Guide 170 [Metals (Powders, Dusts, Shavings, Borings, Turnings, or Cuttings, etc.)]:

May react violently or explosively on contact with water. Some are transported in flammable liquids. May be ignited by friction, heat, sparks or flames. Some of these materials will burn with intense heat. Dusts or fumes may form explosive mixtures in air. Containers may explode when heated. May re-ignite after fire is extinguished. (ERG, 2024)

Health Hazard

Excerpt from NIOSH Pocket Guide for Copper (dusts and mists, as Cu):

Exposure Routes: Inhalation, ingestion, skin and/or eye contact

Symptoms: Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; In Animals: lung, liver, kidney damage; anemia

Target Organs: Eyes, skin, respiratory system, liver, kidneys (increased risk with Wilson's disease) (NIOSH, 2024)

Reactivity Profile

COPPER combines violently with chlorine trifluoride in the presence of carbon [Mellor 2, Supp. 1, 1956]. Is oxidized by sodium peroxide with incandescence [Mellor 2:490-93, 1946-1947]. Forms an unstable acetylide when acetylene is passed over samples that have been heated enough to form an oxide coating. Reacts more rapidly in powdered or granular form. Subject to explosive reaction then mixed in finely divided form with finely divided bromates chlorates and iodates of barium, calcium, magnesium, potassium, sodium, or zinc; these reactions are initiated by heat, percussion, and occasionally light friction [Mellor 2:310, 1946-1947]. A solution of sodium azide in copper pipe with lead joints formed copper azide and lead azide, both of these compounds can detonate [Klotz, 1973].

Belongs to the Following Reactive Group(s)

- Metals, Less Reactive

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 170 [Metals (Powders, Dusts, Shavings, Borings, Turnings, or Cuttings, etc.)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

LARGE SPILL: Consider initial downwind evacuation for at least 50 meters (160 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 170 [Metals (Powders, Dusts, Shavings, Borings, Turnings, or Cuttings, etc.)]:

DO NOT USE WATER, FOAM OR CO₂. Dousing metallic fires with water will generate hydrogen gas, an extremely dangerous explosion hazard, particularly if fire is in a confined environment (i.e., building, cargo hold, etc.). Use DRY sand, graphite powder, dry sodium chloride-based extinguishers, or class D extinguishers. Confining and smothering metal fires is preferable rather than applying water. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: If impossible to extinguish, protect surroundings and allow fire to burn itself out. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 170 [Metals (Powders, Dusts, Shavings, Borings, Turnings, or Cuttings, etc.)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Do not touch or walk

through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Copper (dusts and mists, as Cu):

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

Excerpt from NIOSH Pocket Guide for Copper (dusts and mists, as Cu):

Eye: IRRIGATE IMMEDIATELY - If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin: SOAP WASH PROMPTLY - If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breathing: RESPIRATORY SUPPORT - If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: MEDICAL ATTENTION IMMEDIATELY - If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2024)

Physical Properties

Chemical Formula: Cu

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 1981°F (NIOSH, 2024)

Vapor Pressure: 0 mmHg (approx) (NIOSH, 2024)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 8.94 (NIOSH, 2024) - Denser than water; will sink

Boiling Point: 4703°F at 760 mmHg (NIOSH, 2024)

Molecular Weight: 63.5 (NIOSH, 2024)

Water Solubility: Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: 100 mg Cu/m³ (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Copper (7440-50-8)	3 mg/m ³	33 mg/m ³	200 mg/m ³

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Copper ††	7440-50-8			5000 pounds	313		
Copper Compounds	N100			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

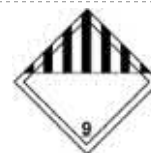
No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- COPPER
- COPPER COMPOUNDS
- COPPER METAL DUSTS
- COPPER METAL FUMES

**CAMEO** *Chemicals***Chemical Datasheet****BENZO[A]PYRENE****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
50-32-8	3077	Class 9	none

NIOSH Pocket Guide
none

International Chem Safety Card
BENZO(a)PYRENE

NFPA 704

data unavailable

General Description

A liquid. Presents a threat to the environment. Immediate steps should be taken to limit its spread to the environment. Easily penetrates the soil and contaminates groundwater or nearby waterways.

Hazards**Reactivity Alerts**

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Literature sources indicate that this chemical is nonflammable. (NTP, 1992)

Health Hazard

SYMPTOMS: Symptoms of exposure to this compound include mucous membrane irritation, dermatitis, bronchitis, cough, dyspnea, conjunctivitis, photosensitization, pulmonary edema, reproductive effects and leukemia. Contact with the skin may result in erythema, pigmentation, desquamation, formation of verrucae and infiltration. It may also cause keratoses which are relatively small, heaped-up, scaling, brown plaques on the skin, some of which may be fissured and may itch. Exposure to this type of compound may cause reddening and squamous eczema of the lid margins with only small erosion of the corneal epithelium and superficial changes in the stroma which disappear a month following exposure. Repeated exposure may cause sunlight to have a more severe effects on a person's skin and also an allergic skin rash. Aplastic anemia may also occur. Chronic exposure to the fumes and dust of this type of compound can cause

discoloration of the cornea and epithelioma of the lid margin.

ACUTE/CHRONIC HAZARDS: This compound may be harmful by ingestion or inhalation. It may cause irritation. When heated to decomposition it emits acrid smoke and toxic fumes of carbon monoxide and carbon dioxide. (NTP, 1992)

Reactivity Profile

BENZO[A]PYRENE undergoes photo-oxidation after irradiation in indoor sunlight or by fluorescent light in organic solvents. Incompatible with strong oxidizing agents including various electrophiles, peroxides, nitrogen oxides and sulfur oxides. Oxidized by ozone, chromic acid and chlorinating agents. Readily undergoes nitration and halogenation. Hydrogenation occurs with platinum oxide (NTP, 1992).

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

CAUTION: Fire involving Safety devices (UN3268) and Fire suppressant dispersing devices (UN3559) may have a delayed activation and a risk of hazardous projectiles. Extinguish the fire at a safe distance.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam.

LARGE FIRE: Water spray, fog or regular foam. Do not scatter spilled material with high-pressure water streams. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS: Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent dust cloud. For Asbestos, avoid inhalation of dust. Cover spill with plastic sheet or tarp to minimize spreading. Do not clean up or dispose of, except under supervision of a specialist.

SMALL DRY SPILL: With clean shovel, place material into clean, dry container and cover loosely; move containers from spill area.

SMALL SPILL: Pick up with sand or other non-combustible absorbent material and place into containers for later disposal.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Cover powder spill with plastic sheet or tarp to minimize spreading. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2024)

Protective Clothing

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing provides thermal protection but only limited chemical protection. (ERG, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: C20H12

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 349.7 to 351.5°F (NTP, 1992)**Vapor Pressure:** 5.49e-09 mmHg at 77°F (NTP, 1992)**Vapor Density (Relative to Air):** 8.7 (NTP, 1992) - Heavier than air; will sink**Specific Gravity:** greater than 1 (NTP, 1992)**Boiling Point:** 887°F at 760 mmHg (NTP, 1992)**Molecular Weight:** 252.32 (NTP, 1992)**Water Solubility:** less than 1 mg/mL at 63°F (NTP, 1992)

Ionization Energy/Potential: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Benzo(a)pyrene; (Coal tar pitch volatiles) (50-32-8)	0.6 mg/m3	120 mg/m3	700 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Benzo[a]pyrene	50-32-8			1 pound	313+	U022	
Polycyclic aromatic compounds (includes only 25 chemicals)	N590				313		

313+ indicates that this is a member of the EPCRA Section 313 PAC (polycyclic aromatic compounds) category.

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- B(A)P
- BAP
- BENZ(A)PYRENE
- 3,4-BENZ(A)PYRENE
- BENZO(D,E,F)CHRYSENE
- BENZOPYRENE
- 1,2-BENZOPYRENE
- 3,4-BENZOPYRENE
- 6,7-BENZOPYRENE
- BENZO[A]PYRENE
- BENZO[D,E,F]CHRYSENE
- 3,4-BENZPYRENE (CARCINOGEN)
- 3,4-BENZPYRENE
- 4,5-BENZPYRENE
- 3,4-BENZYL PYRENE
- 3,4-BENZYPYRENE
- BENZ[A]PYRENE
- 3,4-BENZ[A]PYRENE
- BP
- 3,4-BP

**CAMEO Chemicals****Chemical Datasheet****FUEL OIL, [DIESEL]****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
68334-30-5	1993 (domestic)	Flammable Liquid	ODS
68476-30-2	1202 (international)		
68476-31-3			
68476-34-6			
77650-28-3			

NIOSH Pocket Guide

none

International Chem Safety Card

DIESEL FUEL No. 2

NFPA 704

Diamond	Hazard	Value	Description
2 1 0	 Health	1	Can cause significant irritation.
	 Flammability	2	Must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A straw yellow to dark colored liquid with a petroleum-like odor. Flash point below 141°F. Less dense than water and insoluble in water. Hence floats on water. Vapors heavier than air.

Hazards**Reactivity Alerts**

Highly Flammable

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

Combustible. (USCG, 1999)

Health Hazard

LIQUID: Irritating to skin and eyes. Harmful if swallowed. (USCG, 1999)

Reactivity Profile

Saturated aliphatic hydrocarbons, which are contained in FUEL OIL, [DIESEL], may be incompatible with strong oxidizing agents like nitric acid. Charring of the hydrocarbon may occur followed by ignition of unreacted hydrocarbon and other nearby combustibles. In other settings, aliphatic saturated hydrocarbons are mostly unreactive. They are not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. When heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents, they burn exothermically to produce carbon dioxide and water. May be ignited by strong oxidizers.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient. CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. For petroleum crude oil, do not spray water directly into a breached tank car. This can lead to a dangerous boil over. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing provides thermal protection but only limited chemical protection. (ERG, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Diesel fuel	68334-30-5	Liquid				199	>480	>480	>480	>480	>480
Fuel-oil no 2	68476-30-2	Liquid		imm	>480				>480		

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown

atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and **IMMEDIATELY** call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. **DO NOT INDUCE VOMITING. IMMEDIATELY** transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: data unavailable

Flash Point: 125°F (NTP, 1992)

Lower Explosive Limit (LEL): 1.3 % (NTP, 1992)

Upper Explosive Limit (UEL): 6 % (NTP, 1992)

Autoignition Temperature: 350 to 625°F (USCG, 1999)

Melting Point: 0°F (NTP, 1992)

Vapor Pressure: 2.17 mmHg at 70°F (USCG, 1999)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 0.841 at 60.8°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 540 to 640°F at 760 mmHg (NTP, 1992)

Molecular Weight: data unavailable

Water Solubility: less than 1 mg/mL at 66°F (NTP, 1992)

Ionization Energy/Potential: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Diesel Fuel and Other Middle Distillate Fuels (68334-30-5)	300 mg/m3 	1000 mg/m3	Not Established

 indicates that odor should be detectable near ERPG-1.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Diesel fuels; (includes diesel fuel No. 4 (68476-31-3), fuel oil No.2 (68476-30-2), fuel oil residual (68476-33-5) (68334-30-5)	300 mg/m3	1000 mg/m3	6000 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

No regulatory information available.

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- DFM
- DIESEL FUEL
- DIESEL FUEL OIL
- DIESEL OIL, MEDIUM
- FUEL OIL
- FUEL OIL 1-D
- FUEL OIL 2-D
- FUEL OIL, [DIESEL]
- NCI-C54795
- OILS: DIESEL

**Chemical Datasheet****ETHYLBENZENE****Chemical Identifiers****CAS Number**

100-41-4

UN/NA Number

1175

DOT Hazard Label

Flammable Liquid

USCG CHRIS Code

ETB

NIOSH Pocket Guide

Ethyl benzene

International Chem Safety Card

ETHYLBENZENE

NFPA 704

Diamond	Hazard	Value	Description
3 2 0	Health	2	Can cause temporary incapacitation or residual injury.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		

(NFPA, 2010)

General Description

A clear colorless liquid with an aromatic odor. Flash point 59°F. Less dense than water (at 7.2 lb / gal) and insoluble in water. Hence floats on water. Vapors heavier than air. Used as a solvent and to make other chemicals.

Hazards**Reactivity Alerts**

Highly Flammable

Air & Water Reactions

Highly flammable. Insoluble in water.

Fire Hazard

Special Hazards of Combustion Products: Irritating vapors are generated when heated.

Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back. (USCG, 1999)

Health Hazard

Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters. (USCG, 1999)

Reactivity Profile

ETHYLBENZENE can react vigorously with strong oxidizing materials (NTP, 1992).

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Ethyl benzene:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Ethyl benzene	100-41-4	Liquid			imm	>480	>480	>480	>480	>480	>480
Phenyl ethane	100-41-4	Liquid			imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be

prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and **IMMEDIATELY** call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. **DO NOT INDUCE VOMITING. IMMEDIATELY** transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: C₈H₁₀

Flash Point: 59°F (NTP, 1992)

Lower Explosive Limit (LEL): 1.2 % (NTP, 1992)

Upper Explosive Limit (UEL): 6.8 % (NTP, 1992)

Autoignition Temperature: 860°F (USCG, 1999)

Melting Point: -139°F (NTP, 1992)

Vapor Pressure: 10 mmHg at 85.1°F ; 5 mmHg at 57.0°F; 760 mmHg at 277.2°F (NTP, 1992)

Vapor Density (Relative to Air): 3.66 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 0.867 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 277.2°F at 760 mmHg (NTP, 1992)

Molecular Weight: 106.16 (NTP, 1992)

Water Solubility: less than 1 mg/mL at 73°F (NTP, 1992)

Ionization Energy/Potential: 8.76 eV (NIOSH, 2024)

IDLH: 800 ppm ; Based on 10% of the lower explosive limit. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Ethyl benzene (100-41-4)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	33 ppm	2900 ppm	4700 ppm
30 minutes	33 ppm	1600 ppm	2600 ppm
60 minutes	33 ppm	1100 ppm	1800 ppm
4 hours	33 ppm	660 ppm	1000 ppm
8 hours	33 ppm	580 ppm	910 ppm

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Ethyl benzene (100-41-4)	33 ppm	1100 ppm 🔥	1800 ppm 🔥	LEL = 8000 ppm

 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Ethylbenzene	100-41-4			1000 pounds	313		

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ALPHA-METHYLTOLUENE
- EB
- ETHYL BENZENE
- ETHYLBENZENE
- ETHYLBENZOL
- NCI C56393
- PHENYLETHANE



CAMEO Chemicals



Chemical Datasheet

GASOLINE



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
8006-61-9 86290-81-5	1203	Flammable Liquid	GAT

NIOSH Pocket Guide
Gasoline

International Chem Safety Card
GASOLINE

NFPA 704

Diamond	Hazard	Value	Description
3 1 0	Health	1	Can cause significant irritation.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		

(NFPA, 2010)

General Description

A clear colorless to amber colored, volatile liquid with a petroleum-like odor. Flash point below 0°F. Less dense than water and insoluble in water. Hence floats on water. Vapors heavier than air. Leaked vapors may travel to a source of ignition and then flash back to the source.

Hazards

Reactivity Alerts

Highly Flammable

Air & Water Reactions

Highly flammable.

Fire Hazard

Special Hazards of Combustion Products: None

Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. (USCG, 1999)

Health Hazard

Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat. (USCG, 1999)

Reactivity Profile

GASOLINE may be incompatible with strong oxidizing agents such as nitric acid, peroxides, and perchlorates. Charring may occur followed by ignition of unreacted hydrocarbon and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. When heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents, burns exothermically to produce carbon dioxide and water.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient. CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged

containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. For petroleum crude oil, do not spray water directly into a breached tank car. This can lead to a dangerous boil over. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 128 [Flammable Liquids (Water-Immiscible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Gasoline:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Provide:

- **EYEWASH** - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- **QUICK DRENCH** - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Gasoline, unleaded	86290-81-5	Liquid			imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

Excerpt from NIOSH Pocket Guide for Gasoline:

Eye: IRRIGATE IMMEDIATELY - If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin: SOAP FLUSH IMMEDIATELY - If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.

Breathing: RESPIRATORY SUPPORT - If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: MEDICAL ATTENTION IMMEDIATELY - If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2024)

Physical Properties

Chemical Formula: data unavailable

Flash Point: -36°F (USCG, 1999)

Lower Explosive Limit (LEL): 1.4 % (USCG, 1999)

Upper Explosive Limit (UEL): 7.4 % (USCG, 1999)

Autoignition Temperature: 853°F (USCG, 1999)

Melting Point: data unavailable

Vapor Pressure: 382.58 mmHg (USCG, 1999)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 0.7321 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 140 to 390°F at 760 mmHg (USCG, 1999)

Molecular Weight: 110 (approx) (NIOSH, 2024)

Water Solubility: Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3	
Gasoline (86290-81-5)	200 ppm 🌟	1000 ppm	4000 ppm 🔥	LEL = 14000 ppm

🌟 indicates that odor should be detectable near ERPG-1.

🔥 indicates value is 10-49% of LEL.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Gasoline (86290-81-5)	200 ppm	1000 ppm	4000 ppm 🔥	LEL = 13000 ppm

🔥 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

No regulatory information available.

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- A 76
- A 76 (FUEL)
- AI 3
- AI 93 (FUEL)
- AKVAZIN
- BENZINE (MOTOR FUEL)
- FUELS, GASOLINE
- GASOLINE
- GASOLINE, SYNTHETIC
- GASOLINES: AUTOMOTIVE (<4.23G LEAD/GAL)
- HERBICIDE ES
- INDOLENE
- MOTOR FUEL
- MOTOR SPIRIT
- MOTOR SPIRITS
- NATURAL GAS CONDENSATES, GASOLINE
- NATURAL GASOLINE
- NEFRAS S 150/200
- NEFRAS S 50/170
- PETROL
- PETROL, NATURAL
- PETROL, SYNTHETIC
- SYNFUELS
- SYNTHETIC GASOLINE

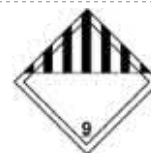


CAMEO Chemicals



Chemical Datasheet

LEAD



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7439-92-1	3077 (powder)	Class 9	none
NIOSH Pocket Guide		International Chem Safety Card	
Lead		LEAD	

NFPA 704

data unavailable

General Description

PHYSICAL DESCRIPTION: Soft silver-bluish white to gray metal. (NTP, 1992)

Hazards

Reactivity Alerts

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Flash point data for this compound are not available, however, it is probably non-combustible. (NTP, 1992)

Health Hazard

Excerpt from NIOSH Pocket Guide for Lead:

Exposure Routes: Inhalation, ingestion, skin and/or eye contact

Symptoms: Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension

Target Organs: Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue (NIOSH, 2024)

Reactivity Profile

In the presence of carbon, the combination of chlorine trifluoride with aluminum, copper, lead, magnesium, silver, tin, or zinc results in a violent reaction [Mellor 2, Supp. 1: 1956]. A solution of sodium azide in copper pipe with lead joints formed copper and lead azide, both are detonating compounds [Klotz 1973]. Sodium acetylide becomes pyrophoric when mixed with metals like lead. Mixtures of trioxane with 60% hydrogen peroxide in contact with metallic lead when heated detonated. Lead containing rubber ignited in a nitric acid atmosphere. Lead is incompatible with strong oxidants such as: ammonium nitrate, chlorine trifluoride, hydrogen peroxide, etc.

Belongs to the Following Reactive Group(s)

- Metals, Less Reactive

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Fires involving this material can be controlled with a dry chemical, carbon dioxide, foam, or Halon extinguisher. (NTP, 1992)

Non-Fire Response

STORAGE PRECAUTIONS: You should store this chemical under refrigerated temperatures, and keep it away from oxidizing materials. (NTP, 1992)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Lead:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: DAILY - The worker should wash daily at the end of each work shift, and prior to eating, drinking, smoking, etc.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated

clothing before leaving the work premises. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. **IMMEDIATELY** transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: **IMMEDIATELY** flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, **IMMEDIATELY** call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: **IMMEDIATELY** leave the contaminated area; take deep breaths of fresh air. **IMMEDIATELY** call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: Some heavy metals are **VERY TOXIC POISONS**, especially if their salts are very soluble in water (e.g., lead, chromium, mercury, bismuth, osmium, and arsenic). **IMMEDIATELY** call a hospital or poison control center and locate activated charcoal, egg whites, or milk in case the medical advisor recommends administering one of them. Also locate Ipecac syrup or a glass of salt water in case the medical advisor recommends inducing vomiting. Usually, this is **NOT RECOMMENDED** outside of a physician's care. If advice from a physician is not readily available and the victim is conscious and not convulsing, give the victim a glass of activated charcoal slurry in water or, if this is not available, a glass of milk, or beaten egg whites and **IMMEDIATELY** transport victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, assure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. **DO NOT INDUCE VOMITING.** **IMMEDIATELY** transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: Pb

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 621.5°F (NTP, 1992)

Vapor Pressure: 1.77 mmHg (NTP, 1992)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 11.3437 at 61°F (NTP, 1992) - Denser than water; will sink

Boiling Point: 3164°F at 760 mmHg (NTP, 1992)

Molecular Weight: 207.19 (NTP, 1992)

Water Solubility: Insoluble (NTP, 1992)

Ionization Energy/Potential: data unavailable

IDLH: 100 mg Pb/m3 (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Lead (7439-92-1)	0.15 mg/m3	120 mg/m3	700 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Lead ††	7439-92-1			10 pounds	313		
Lead Compounds	N420			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- C.I. 77575
- C.I. PIGMENT METAL 4
- KS-4
- LEAD
- LEAD ELEMENT
- LEAD FLAKE
- LEAD METAL
- LEAD S 2
- LEAD SZ

- PB-S 100
- PLUMBUM
- SSO 1

**CAMEO** *Chemicals***Chemical Datasheet****METHYL ETHYL KETONE****Chemical Identifiers****CAS Number**

78-93-3

UN/NA Number

1193

DOT Hazard Label

Flammable Liquid

USCG CHRIS Code

MEK

NIOSH Pocket Guide

2-Butanone

International Chem Safety Card

METHYL ETHYL KETONE

NFPA 704

Diamond	Hazard	Value	Description
3 1 0	Health	1	Can cause significant irritation.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		

(NFPA, 2010)

General Description

Colorless fairly volatile liquid with a pleasant pungent odor. Flash point 20°F. Vapors heavier than air. Does not react with water or many common materials. Stable in normal transportation. Irritates the nose, eyes, and throat. Combustion may produce toxic materials. Density 6.7 lb / gal. Used as a solvent, for making other chemicals, and for production of wax from petroleum.

Hazards**Reactivity Alerts**

Highly Flammable

Air & Water Reactions

Highly flammable. Soluble in water.

Fire Hazard

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. **CAUTION:** Ethanol (UN1170) can burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.) Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along the ground and collect in low or confined areas (sewers, basements, tanks, etc.). Vapor explosion hazard indoors, outdoors or in sewers. Those substances designated with a (P) may polymerize explosively when heated or involved in a fire. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids will float on water. (ERG, 2024)

Health Hazard

Liquid causes eye burn. Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness, and loss of consciousness. (USCG, 1999)

Reactivity Profile

METHYL ETHYL KETONE is explosive in the form of vapor when exposed to heat, flame or sparks. Ignition on contact with potassium tert-butoxide. Reactive with strong oxidizing materials, and will dissolve or soften some plastics. Mixture with 2-propanol will form explosive peroxides during storage. Vigorous reaction with chloroform in the presence of alkali (sodium hydroxide, potassium hydroxide), chlorosulfonic acid, fuming sulfuric acid (oleum) [Lewis, 3rd ed., 1993, p. 855]. Reaction with hydrogen peroxide in the presence of nitric acid forms heat- and shock-sensitive explosive acetone peroxides. [Bjorklund, G. H. et al., Trans. R. Soc. Can, 1950, 44, p. 25].

Belongs to the Following Reactive Group(s)

- Ketones

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient. **CAUTION:** For fire involving UN1170, UN1987 or UN3475, alcohol-resistant foam should be used. **CAUTION:** Ethanol (UN1170) can burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.).

SMALL FIRE: Dry chemical, CO₂, water spray or alcohol-resistant foam.

LARGE FIRE: Water spray, fog or alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 127 [Flammable Liquids (Water-Miscible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for 2-Butanone:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Provide: EYEWASH - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Butanone	78-93-3	Liquid			18	>480	40*/64	40*/64	>480	>480	>480
MEK	78-93-3	Liquid			18	>480	40*/64	40*/64	>480	>480	>480
Methyl ethyl ketone	78-93-3	Liquid			18	>480	40*/64	40*/64	>480	>480	>480

> indicates greater than.

* indicates based on lowest single value.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: C₄H₈O

Flash Point: 26°F (NTP, 1992)

Lower Explosive Limit (LEL): 1.8 % (NTP, 1992)

Upper Explosive Limit (UEL): 10 % (NTP, 1992)

Autoignition Temperature: 961°F (USCG, 1999)

Melting Point: -123.3°F (NTP, 1992)

Vapor Pressure: 77.5 mmHg at 68°F ; 100 mmHg at 77.0°F (NTP, 1992)

Vapor Density (Relative to Air): 2.42 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 0.806 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 175.3°F at 760 mmHg (NTP, 1992)

Molecular Weight: 72.11 (NTP, 1992)

Water Solubility: greater than or equal to 100 mg/mL at 66°F (NTP, 1992)

Ionization Energy/Potential: 9.54 eV (NIOSH, 2024)

IDLH: 3000 ppm (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Final AEGLs for Methyl ethyl ketone (78-93-3)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	200 ppm	4900 ppm 🔥	10000 ppm 🔥🔥
30 minutes	200 ppm	3400 ppm 🔥	10000 ppm 🔥🔥
60 minutes	200 ppm	2700 ppm 🔥	4000 ppm 🔥
4 hours	200 ppm	1700 ppm	2500 ppm 🔥
8 hours	200 ppm	1700 ppm	2500 ppm 🔥

Lower Explosive Limit (LEL) = 18000 ppm

🔥 indicates value is 10-49% of LEL. Safety consideration against explosions must be taken into account.

🔥🔥 indicates value is 50-99% of LEL. Extreme safety consideration against explosions must be taken into account.
(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Butanone, 2-; (Methyl ethyl ketone; MEK) (78-93-3)	200 ppm	2700 ppm 🔥	4000 ppm 🔥	LEL = 18000 ppm

🔥 indicates value is 10-49% of LEL.
(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Methyl ethyl ketone	78-93-3			5000 pounds		U159	

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- BUTANONE
- 2-BUTANONE
- 3-BUTANONE
- ETHYL METHYL KETONE

- KETONE, ETHYL METHYL
- MEETCO
- MEK
- METHYL ACETONE
- METHYL ETHYL KETONE
- METHYL ETHYL KETONE (MEK)



CAMEO Chemicals



Chemical Datasheet

MERCURY



Chemical Identifiers

CAS Number7439-97-6 **UN/NA Number**

2809

DOT Hazard LabelCorrosive
Poison**USCG CHRIS Code**

MCR

NIOSH Pocket Guide

Mercury compounds [except (organo) alkyls] (as Hg)

International Chem Safety Card

MERCURY

NFPA 704

data unavailable

General Description

An odorless, silvery metallic liquid. Insoluble in water. Toxic by ingestion, absorption and inhalation of the fumes. Corrosive to aluminum. Used as a catalyst in instruments, boilers, mirror coatings.

Hazards

Reactivity Alerts

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Behavior in Fire: Not flammable (USCG, 1999)

Health Hazard

No immediate symptoms. As poisoning becomes established, slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Psychic, kidney, and cardiovascular disturbances may occur. (USCG, 1999)

Reactivity Profile

MERCURY forms an explosive acetylide when mixed with acetylene. Can form explosive compounds with ammonia (a residue resulting from such a reaction exploded when an attempt was made to clean it off a steel rod [Chem. Eng. News 25:2138. 1947]). Chlorine dioxide (also other oxidants, such as: chlorine, bromine, nitric acid, performic acid),

and mercury explode when mixed [Mellor 2, Supp. 1:381. 1956]. Methyl azide in the presence of mercury is potentially explosive [Can. J. Chem. 41:1048. 1963]. Ground mixtures of sodium carbide and mercury can react vigorously [Mellor 5:848. 1946-47]. Ammonia forms explosive compounds with gold, mercury, or silver. (Eggeman, Tim. "Ammonia". Kirk-Othmer Encyclopedia of Chemical Technology. John Wiley & Sons, Inc. 2001.).

Belongs to the Following Reactive Group(s)

- Metals, Less Reactive

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 172 [Gallium and Mercury]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 100 meters (330 feet).

FIRE: When any large container is involved in a fire, consider initial evacuation for 500 meters (1/3 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 172 [Gallium and Mercury]:

Use extinguishing agent suitable for type of surrounding fire. Do not direct water at the heated metal. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 172 [Gallium and Mercury]:

Do not touch or walk through spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Do not use steel or aluminum tools or equipment. Cover with earth, sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. For mercury, use a mercury spill kit. Mercury spill areas may be subsequently treated with calcium sulphide/calcium sulfide or with sodium thiosulphate/sodium thiosulfate wash to neutralize any residual mercury. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Mercury compounds [except (organo) alkyls] (as Hg):

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: No recommendation is made specifying the need for eye protection.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Mercury	7439-97-6	Liquid		>480	>480	>480	>480	>480	>480	>480	>480

> indicates greater than.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

Excerpt from NIOSH Pocket Guide for Mercury compounds [except (organo) alkyls] (as Hg):

Eye: IRRIGATE IMMEDIATELY - If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin: SOAP WASH PROMPTLY - If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breathing: RESPIRATORY SUPPORT - If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: MEDICAL ATTENTION IMMEDIATELY - If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2024)

Physical Properties

Chemical Formula: Hg

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: Not flammable (USCG, 1999)

Melting Point: -38°F (USCG, 1999)

Vapor Pressure: 0.0012 mmHg (NIOSH, 2024)

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 13.55 at 68°F (USCG, 1999) - Denser than water; will sink

Boiling Point: 675°F at 760 mmHg (USCG, 1999)

Molecular Weight: 200.59 (USCG, 1999)

Water Solubility: Insoluble (NIOSH, 2024)

Ionization Energy/Potential: data unavailable

IDLH: 10 mg Hg/m3 (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Mercury Vapor (7439-97-6)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	NR	3.1 mg/m3	16 mg/m3
30 minutes	NR	2.1 mg/m3	11 mg/m3
60 minutes	NR	1.7 mg/m3	8.9 mg/m3
4 hours	NR	0.67 mg/m3	2.2 mg/m3
8 hours	NR	0.33 mg/m3	2.2 mg/m3

NR = Not recommended due to insufficient data
(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Mercury Vapor (7439-97-6)	NA	0.25 ppm	0.5 ppm

NA = not appropriate.
(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Mercury vapor (7439-97-6)	0.15 mg/m3	1.7 mg/m3	8.9 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Mercury	7439-97-6			1 pound	313	U151	
Mercury Compounds	N458			&	313		

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- MERCURY
- MERCURY ELEMENT
- MERCURY METAL
- MERCURY METAL: COLLOIDAL MERCURY
- MERCURY, METALLIC
- MERCURY, [METALLIC]
- METALLIC MERCURY
- QUECKSILBER
- QUICKSILVER

**CAMEO Chemicals****Chemical Datasheet****NAPHTHALENE, METHYLNAPHTHALENES****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
91-20-3	1760	Corrosive	none

NIOSH Pocket Guide
Naphthalene

International Chem Safety Card
NAPHTHALENE

NFPA 704

Diamond	Hazard	Value	Description
2 2 0	 Health	2	Can cause temporary incapacitation or residual injury.
	 Flammability	2	Must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A black liquid with the odor of coal tar. Negligibly soluble in water. Slightly denser than water. Vapors, fumes or direct contact may irritate the eyes. Direct skin contact may produce severe burns. Inhalation may produce mucous irritation, dizziness, loss of coordination, cardiovascular collapse and death.

Hazards**Reactivity Alerts**

none

Air & Water Reactions

Negligibly soluble in water.

Fire Hazard

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.). Corrosives in contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. For electric vehicles or equipment, ERG Guide 147 (lithium ion or sodium ion batteries) or ERG Guide 138 (sodium batteries) should also be consulted. (ERG, 2024)

Health Hazard

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

TOXIC and/or CORROSIVE; inhalation, ingestion or skin contact with material may cause severe injury or death. Contact with molten substance may cause severe burns to skin and eyes. Avoid any skin contact. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause environmental contamination. (ERG, 2024)

Reactivity Profile

A mixture containing NAPHTHALENE and METHYLNAPHTHALENES may react vigorously with strong oxidizing agents. Can react exothermically with bases and with diazo compounds. Naphthalene reacts violently with chromic anhydride [Haz. Chem. Data 1967. p 68]. Friedel-Crafts acylation of naphthalene using benzoyl chloride, catalyzed by $AlCl_3$, must be conducted above the melting point of the mixture, or the reaction may be violent [Clar, E. et al., Tetrahedron, 1974, 30, 3296].

Belongs to the Following Reactive Group(s)

- Bases, Strong
- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

Use caution: Liquids with this reactive group classification have been known to react with the absorbents listed below.

- Cellulose-Based Absorbents
- Mineral-Based & Clay-Based Absorbents

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

SMALL FIRE: Dry chemical, CO₂ or water spray.

LARGE FIRE: Dry chemical, CO₂, alcohol-resistant foam or water spray. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINERS. (ERG, 2024)

Protective Clothing

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer when there is NO RISK OF FIRE. Structural firefighters' protective clothing provides thermal protection but only limited chemical protection. (ERG, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Naphthalene	91-20-3	Solid				>480	>480	>480			
Naphthalene (25% in Diethylene glycol dimethylether)	91-20-3	Liquid			79	>480	>480	>480	>480	>480	>480

> indicates greater than.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]:

Refer to the "General First Aid" section. Specific First Aid: For corrosives, in case of contact, immediately flush skin or eyes with running water for at least 30 minutes. Additional flushing may be required. (ERG, 2024)

Physical Properties

Chemical Formula: C₁₀H₈

Flash Point: 174°F (NFPA, 2010)

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: data unavailable

Boiling Point: data unavailable

Molecular Weight: data unavailable

Water Solubility: data unavailable

Ionization Energy/Potential: 8.12 eV [From NPG: Naphthalene] (NIOSH, 2024)

IDLH: 250 ppm [From NPG: Naphthalene] (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Naphthalene (91-20-3)	15 ppm	83 ppm	500 ppm	LEL = 9000 ppm

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Naphthalene	91-20-3			100 pounds	313	U165	

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- NAPHTHALENE, METHYLNAPHTHALENES



CAMEO Chemicals



Chemical Datasheet

OIL, [MOTOR]

Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
none	none	data unavailable	OMT
NIOSH Pocket Guide		International Chem Safety Card	
none		none	

NFPA 704

data unavailable

General Description

Oily yellow-brown liquid. Less dense than water and insoluble in water. Hence floats on water. (USCG, 1999)

Hazards

Reactivity Alerts

none

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

No information available.

Health Hazard

INGESTION: minimal gastrointestinal irritation; increased frequency of bowel passage may occur. ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure. (USCG, 1999)

Reactivity Profile

OIL, [MOTOR] may be incompatible with strong oxidizing agents like nitric acid. Charring may occur followed by ignition of unreacted material and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. Burns exothermically when heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Potentially Incompatible Absorbents

No information available.

Response Recommendations**Isolation and Evacuation**

No information available.

Firefighting

Fire Extinguishing Agents Not to Be Used: Water may be ineffective

Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide (USCG, 1999)

Non-Fire Response

No information available.

Protective Clothing

Protective gloves; goggles or face shield. (USCG, 1999)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

INGESTION: do NOT lavage or induce vomiting.

ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays.

EYES: wash with copious amounts of water.

SKIN: wipe off oil and wash with soap and water. (USCG, 1999)

Physical Properties

Chemical Formula: data unavailable

Flash Point: 275 to 600°F (USCG, 1999)

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: -29.9°F (USCG, 1999)

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 0.84 to 0.96 at 59°F (USCG, 1999)

Boiling Point: Very high (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

Ionization Energy/Potential: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

No PAC information available.

Regulatory Information

EPA Consolidated List of Lists

No regulatory information available.

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

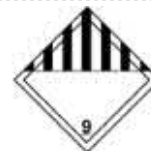
No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- CRANKCASE OIL
- LUBRICATING OIL
- OIL, [MOTOR]
- OILS, MISCELLANEOUS: MOTOR
- TRANSMISSION OIL

**CAMEO Chemicals****Chemical Datasheet****POLYCHLORINATED BIPHENYLS (PCB)****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
11096-82-5	2315 (liquid)	Class 9	PCB
11097-69-1	3432 (solid)		
11104-28-2			
11141-16-5			
12672-29-6			
12674-11-2			
1336-36-3			
53469-21-9			

NIOSH Pocket Guide

Chlorodiphenyl (54% chlorine)

International Chem Safety Card

POLYCHLORINATED BIPHENYL (AROCOR 1254)

NFPA 704

Diamond	Hazard	Value	Description
1 2 0	Health	2	Can cause temporary incapacitation or residual injury.
	Flammability	1	Must be preheated before ignition can occur.
	Instability	0	Normally stable, even under fire conditions.
	Special		

Note: NFPA ratings shown are for polychlorinated biphenyls, CAS number 1336-36-3.

(NFPA, 2010)

General Description

PCBs are colorless oily liquids. Much denser than water and insoluble in water. May burn under exposure to intense heat or flames for prolonged periods of time. Primary hazard is persistence in the environment and potential for long term chronic environmental and health risks. Immediate steps should be taken to limit spread to the environment. As liquids, easily penetrate the soil to contaminate groundwater and nearby waterways.

Hazards**Reactivity Alerts**

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Special Hazards of Combustion Products: Irritating gases are generated in fires. (USCG, 1999)

Health Hazard

Acne from skin contact. (USCG, 1999)

Reactivity Profile

POLYCHLORINATED BIPHENYLS (PCB) are incompatible with the following: Strong oxidizers (NIOSH, 2024).

Belongs to the Following Reactive Group(s)

- Aryl Halides

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

CAUTION: Fire involving Safety devices (UN3268) and Fire suppressant dispersing devices (UN3559) may have a delayed activation and a risk of hazardous projectiles. Extinguish the fire at a safe distance.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam.

LARGE FIRE: Water spray, fog or regular foam. Do not scatter spilled material with high-pressure water streams. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS: Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent dust cloud. For Asbestos, avoid inhalation of dust. Cover spill with plastic sheet or tarp to minimize spreading. Do not clean up or dispose of, except under supervision of a specialist.

SMALL DRY SPILL: With clean shovel, place material into clean, dry container and cover loosely; move containers from spill area.

SMALL SPILL: Pick up with sand or other non-combustible absorbent material and place into containers for later disposal.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Cover powder spill with plastic sheet or tarp to minimize spreading. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Chlorodiphenyl (54% chlorine):

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: DAILY - Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

Provide:

- **EYEWASH** - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- **QUICK DRENCH** - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
PCB 1254 (50% in Mineral Oil)	11097-69-1	Liquid			>480				>480		
PCB 1254 (90%)	11097-69-1	Liquid			>480						

> indicates greater than.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

Excerpt from NIOSH Pocket Guide for Chlorodiphenyl (54% chlorine):

Eye: IRRIGATE IMMEDIATELY - If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin: SOAP WASH IMMEDIATELY - If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breathing: RESPIRATORY SUPPORT - If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: MEDICAL ATTENTION IMMEDIATELY - If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2024)

Physical Properties

Chemical Formula: data unavailable

Flash Point: greater than 286°F (USCG, 1999)

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 1.3 to 1.8 at 68°F (USCG, 1999)

Boiling Point: Very high (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

Ionization Energy/Potential: data unavailable

IDLH: 5 mg/m³ ; A potential occupational carcinogen. [From NPG: Chlorodiphenyl (54% chlorine)] (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Polychlorinated biphenyl (Aroclor 1260); (Chlorodiphenyl (60% Cl)) (11096-82-5)	0.41 mg/m ³	4.5 mg/m ³	260 mg/m ³

Chemical	PAC-1	PAC-2	PAC-3
Polychlorinated biphenyl (Aroclor 1254); (Chlorodiphenyl (54% Cl)) (11097-69-1)	1.5 mg/m3	68 mg/m3	200 mg/m3
Polychlorinated biphenyl (Aroclor 1221); (Chlorodiphenyl (21% Cl)) (11104-28-2)	12 mg/m3	130 mg/m3	790 mg/m3
Polychlorinated biphenyl (Aroclor 1232); (Chlorodiphenyl (32% Cl)) (11141-16-5)	13 mg/m3	150 mg/m3	890 mg/m3
Polychlorinated biphenyl (Aroclor 1248); (Chlorodiphenyl (48% Cl)) (12672-29-6)	6.6 mg/m3	72 mg/m3	2200 mg/m3
Polychlorinated biphenyl (Aroclor 1016); (Chlorodiphenyl (41% Cl)) (12674-11-2)	5.6 mg/m3	62 mg/m3	460 mg/m3
Polychlorinated biphenyl; (Aroclor; PCBs) (1336-36-3)	13 mg/m3	140 mg/m3	840 mg/m3
Polychlorinated biphenyl (Aroclor 1242); (Chlorodiphenyl (42% Cl)) (53469-21-9)	3 mg/m3	140 mg/m3	840 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Aroclor 1016	12674-11-2			1 pound			
Aroclor 1221	11104-28-2			1 pound			
Aroclor 1232	11141-16-5			1 pound			
Aroclor 1242	53469-21-9			1 pound			
Aroclor 1248	12672-29-6			1 pound			
Aroclor 1254	11097-69-1			1 pound			
Aroclor 1260	11096-82-5			1 pound			
PCBs	1336-36-3			1 pound	X		
Polychlorinated biphenyls	1336-36-3			1 pound	313		

"X" indicates that this is a second name for an EPCRA section 313 chemical already included on this consolidated list. May also indicate that the same chemical with the same CAS number appears on another list with a different chemical name.

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- A 1248
- AROCHLOR
- AROCLOR 1016
- AROCLOR 1221
- AROCLOR 1232
- AROCLOR 1242
- AROCLOR 1248
- AROCLOR 1254
- AROCLOR 1260
- AROCLOR® 1254
- CHLORINATED BIPHENYL
- CHLORODIPHENYL (54% CHLORINE)
- HALOGENATED WAXES
- PCB
- PCBS
- POLYCHLORINATED BIPHENYL
- POLYCHLORINATED BIPHENYLS
- POLYCHLORINATED BIPHENYLS (PCB)
- POLYCHLOROPOLYPHENYLS

**CAMEO** *Chemicals***Chemical Datasheet****PERCHLOROETHYLENE****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
127-18-4 	1897	Poison	TTE

NIOSH Pocket Guide
Tetrachloroethylene

International Chem Safety Card
TETRACHLOROETHYLENE

NFPA 704

Diamond	Hazard	Value	Description
0 2 0	 Health	2	Can cause temporary incapacitation or residual injury.
	 Flammability	0	Will not burn under typical fire conditions.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A clear colorless volatile liquid having an ether-like odor. Noncombustible. Insoluble in water. Vapors heavier than air. Density approximately 13.5 lb / gal. Used as dry cleaning solvent, a degreasing solvent, a drying agent for metals, and in the manufacture of other chemicals.

Hazards**Reactivity Alerts**

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Special Hazards of Combustion Products: Toxic, irritating gases may be generated in fires. (USCG, 1999)

Health Hazard

Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury. (USCG, 1999)

Reactivity Profile

PERCHLOROETHYLENE decomposes upon heating and exposure to UV light to give phosgene and HCl. Reacts violently with finely dispersed light metals (aluminum) and zinc. [Handling Chemicals Safely 1980 p. 887]. Mixtures with finely divided barium or lithium metal can detonate [ASESB Pot. Incid. 39. 1968; Chem. Eng. News 46(9):38. 1968]. Decomposes very slowly in water to form trichloroacetic acid and hydrochloric acid

Belongs to the Following Reactive Group(s)

- Halogenated Organic Compounds
- Hydrocarbons, Aliphatic Unsaturated

Potentially Incompatible Absorbents

Use caution: Liquids with this reactive group classification have been known to react with the absorbent listed below.

- Dirt/Earth

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 160 [Halogenated Solvents]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 100 meters (330 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 160 [Halogenated Solvents]:

SMALL FIRE: Dry chemical, CO2 or water spray.

LARGE FIRE: Dry chemical, CO2, alcohol-resistant foam or water spray. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 160 [Halogenated Solvents]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Stop leak if you can do it

without risk.

SMALL LIQUID SPILL: Pick up with sand, earth or other non-combustible absorbent material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Tetrachloroethylene:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Provide:

- **EYEWASH** - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- **QUICK DRENCH** - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Ethylene tetrachloride	127-18-4	Liquid		imm	imm	>480	>480	>480	>480	>480	>480
Tetrachloro ethylene, 1,1,2,2-	127-18-4	Liquid		imm	imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. **IMMEDIATELY** transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: **IMMEDIATELY** flood affected skin with water while removing and isolating all contaminated clothing. Gently

wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Corrosive chemicals will destroy the membranes of the mouth, throat, and esophagus and, in addition, have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. Transport the victim IMMEDIATELY to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: C2Cl4

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: Not flammable (USCG, 1999)

Melting Point: -2°F (NTP, 1992)

Vapor Pressure: 14 mmHg at 68°F ; 15.8 mmHg at 72°F (NTP, 1992)

Vapor Density (Relative to Air): 5.83 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 1.63 at 68°F (USCG, 1999) - Denser than water; will sink

Boiling Point: 250°F at 760 mmHg (NTP, 1992)

Molecular Weight: 165.83 (NTP, 1992)

Water Solubility: less than 0.1 mg/mL at 63°F (NTP, 1992)

Ionization Energy/Potential: 9.32 eV (NIOSH, 2024)

IDLH: 150 ppm ; A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Tetrachloroethylene (127-18-4)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	35 ppm	230 ppm	1600 ppm
30 minutes	35 ppm	230 ppm	1600 ppm

Exposure Period	AEGL-1	AEGL-2	AEGL-3
60 minutes	35 ppm	230 ppm	1200 ppm
4 hours	35 ppm	120 ppm	580 ppm
8 hours	35 ppm	81 ppm	410 ppm

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Perchloroethylene (127-18-4)	100 ppm 	200 ppm	1000 ppm

 indicates that odor should be detectable near ERPG-1.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Perchloroethylene; (Tetrachloroethylene) (127-18-4)	35 ppm	230 ppm	1200 ppm

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Perchloroethylene	127-18-4			100 pounds	X	U210	
Tetrachloroethylene	127-18-4			100 pounds	313	U210	

"X" indicates that this is a second name for an EPCRA section 313 chemical already included on this consolidated list. May also indicate that the same chemical with the same CAS number appears on another list with a different chemical name.

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ANKILOSTIN
- ANTISAL 1
- ANTISOL 1
- CARBON BICHLORIDE
- CARBON DICHLORIDE
- DIDAKENE

- DILATIN PT
- DOW-PER
- ENT 1,860
- ETHENE, TETRACHLORO-
- ETHYLENE TETRACHLORIDE
- ETHYLENE, TETRACHLORO-
- F 1110
- F 1110 (HALOCARBON)
- FEDAL-UN
- FREON 1110
- NCI-C04580
- NEMA
- PCE
- PER
- PERAWIN
- PERC
- PERCHLOR
- PERCHLORETHYLENE
- PERCHLOROETHENE
- PERCHLOROETHYLENE
- PERCLEN
- PERCLEN D
- PERCOSOLVE
- PERK
- PERKLONE
- PERSEC
- R 1110
- TETLEN
- TETRACAP
- TETRACHLORETHYLENE
- TETRACHLOROETHENE
- 1,1,2,2-TETRACHLOROETHENE
- TETRACHLOROETHYLENE
- 1,1,2,2-TETRACHLOROETHYLENE
- TETRAGUER
- TETRALENO
- TETRALEX
- TETRAVEC
- TETROGUER
- TETROPIL

**CAMEO** *Chemicals***Chemical Datasheet****BIS(TRIBUTYLTIN) OXIDE****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
56-35-9	2788	Poison	none

NIOSH Pocket Guide
none

International Chem Safety Card
TRIBUTYLTIN OXIDE

NFPA 704

data unavailable

General Description

PHYSICAL DESCRIPTION: Clear pale yellow liquid. Toxic by skin absorption or inhalation of vapors. Used as a bactericide, fungicide and chemical intermediate.

Hazards**Reactivity Alerts**

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

This chemical is probably combustible. (NTP, 1992)

Health Hazard

ACUTE/CHRONIC HAZARDS: This material is toxic by ingestion and inhalation and is a skin and eye irritant. (NTP, 1992)

Reactivity Profile

BIS(TRIBUTYLTIN) OXIDE may react vigorously with oxidizing agents and with reducing agents.

Belongs to the Following Reactive Group(s)

- Organometallics

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 153 [Substances - Toxic and/or Corrosive (Combustible)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Fires involving this material can be controlled with a dry chemical, carbon dioxide or Halon extinguisher. (NTP, 1992)

Non-Fire Response

SMALL SPILLS AND LEAKAGE: If you should spill this chemical, use absorbent paper to pick up all liquid spill material. Your contaminated clothing and absorbent paper should be sealed in a vapor-tight plastic bag for eventual disposal. Solvent wash all contaminated surfaces with acetone followed by washing with a strong soap and water solution. Do not reenter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

STORAGE PRECAUTIONS: You should store this material in a refrigerator. (NTP, 1992)

Protective Clothing

MINIMUM PROTECTIVE CLOTHING: If Tyvek-type disposable protective clothing is not worn during handling of this chemical, wear disposable Tyvek-type sleeves taped to your gloves.

RECOMMENDED RESPIRATOR: Where the neat test chemical is weighed and diluted, wear a NIOSH-approved half face respirator equipped with an organic vapor/acid gas cartridge (specific for organic vapors, HCl, acid gas and SO₂) with a dust/mist filter. (NTP, 1992)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center

even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: Some heavy metals are VERY TOXIC POISONS, especially if their salts are very soluble in water (e.g., lead, chromium, mercury, bismuth, osmium, and arsenic). IMMEDIATELY call a hospital or poison control center and locate activated charcoal, egg whites, or milk in case the medical advisor recommends administering one of them. Also locate Ipecac syrup or a glass of salt water in case the medical advisor recommends inducing vomiting. Usually, this is NOT RECOMMENDED outside of a physician's care. If advice from a physician is not readily available and the victim is conscious and not convulsing, give the victim a glass of activated charcoal slurry in water or, if this is not available, a glass of milk, or beaten egg whites and IMMEDIATELY transport victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, assure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: C₂₄H₅₄OSn₂

Flash Point: greater than 200°F (NTP, 1992)

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 1.17 at 77°F (NTP, 1992) - Denser than water; will sink

Boiling Point: 356°F at 2 mmHg (NTP, 1992)

Molecular Weight: 596.08 (NTP, 1992)

Water Solubility: less than 1 mg/mL at 70.7°F (NTP, 1992)

Ionization Energy/Potential: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

No PAC information available.

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Bis(tributyltin) oxide	56-35-9				313		

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ACETO TBTO
- BIOMET 66
- BIOMET SRM
- BIOMET TBTO
- BIS(TRIBUTYLOXIDE) OF TIN
- BIS(TRIBUTYLSTANNIC OXIDE)
- BIS(TRIBUTYLSTANNYL) ETHER
- BIS(TRIBUTYLSTANNYL) OXIDE
- BIS(TRIBUTYLTIN) OXIDE
- BTO
- BUTINOX
- C-SN-9
- DI-TRIBUTYL TIN OXIDE
- DIALL
- ENT 24,979
- HEXABUTYLDISTANNOXANE
- HEXABUTYLDITIN
- HEXABUTYLDITIN OXIDE
- INTERCIDE 340A
- L.S. 3394
- LASTANOX F
- LASTANOX Q
- LASTANOX Q1
- LASTANOX SUPER
- LASTANOX T
- LASTANOX T 20
- MT 1E
- MYKOLASTANOX F
- 6-OXA-5,7-DISTANNAUNDECANE, 5,5,7,7-TETRABUTYL-
- OXYBIS(TRIBUTYLSTANNANE)
- OXYBIS(TRIBUTYLTIN)
- OXYBIS[TRIBUTYLTIN]
- STANNICIDE A
- STANNICIDE O
- TBOT

- TBTO
- TRI-N-BUTYLSTANNANE OXIDE
- TRIBUTYLTIN OXIDE
- VIKOL AF 25
- VIKOL LO 25



CAMEO Chemicals



Chemical Datasheet

TRICHLOROETHYLENE



Chemical Identifiers

CAS Number79-01-6 **UN/NA Number**

1710

DOT Hazard Label

Poison

USCG CHRIS Code

TCL

NIOSH Pocket Guide

Trichloroethylene

International Chem Safety Card

TRICHLOROETHYLENE

NFPA 704

Diamond	Hazard	Value	Description
1 2 0	 Health	2	Can cause temporary incapacitation or residual injury.
	 Flammability	1	Must be preheated before ignition can occur.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A clear colorless volatile liquid having a chloroform-like odor. Denser than water and is slightly soluble in water. Noncombustible. Used as a solvent, fumigant, in the manufacture of other chemicals, and for many other uses.

Hazards

Reactivity Alerts

none

Air & Water Reactions

Slightly soluble in water.

Fire Hazard

Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations. (USCG, 1999)

Health Hazard

INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation. (USCG, 1999)

Reactivity Profile

It has been determined experimentally that mixtures of finely divided barium metal and a number of halogenated hydrocarbons possess an explosive capability. Specifically, impact sensitivity tests have shown that granular barium in contact with monofluorotrichloromethane, trichlorotrifluoroethane, carbon tetrachloride, trichloroethylene, or tetrachloroethylene can detonate (ASESB Pot. Incid. 39. 1968; Chem. Eng. News 46(9):38. 1968). It has been determined experimentally that a mixture of beryllium powder with carbon tetrachloride or with trichloroethylene will flash or spark on heavy impact (ASESB Pot. Incid. 39. 1968). A mixture of powdered magnesium with trichloroethylene or with carbon tetrachloride will flash or spark under heavy impact (ASESB Pot. Incid, 39. 1968).

Belongs to the Following Reactive Group(s)

- Halogenated Organic Compounds
- Hydrocarbons, Aliphatic Unsaturated

Potentially Incompatible Absorbents

Use caution: Liquids with this reactive group classification have been known to react with the absorbent listed below.

- Dirt/Earth

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 160 [Halogenated Solvents]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 100 meters (330 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 160 [Halogenated Solvents]:

SMALL FIRE: Dry chemical, CO2 or water spray.

LARGE FIRE: Dry chemical, CO2, alcohol-resistant foam or water spray. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 160 [Halogenated Solvents]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Stop leak if you can do it without risk.

SMALL LIQUID SPILL: Pick up with sand, earth or other non-combustible absorbent material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Trichloroethylene:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET OR CONTAMINATED - Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Provide:

- EYEWASH - Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.
- QUICK DRENCH - Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Ethylene trichloride	79-01-6	Liquid			imm	>480	>480	>480	>480	>480	>480
Trichloro ethylene	79-01-6	Liquid			imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any

ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Chemical Formula: C₂HCl₃

Flash Point: greater than 200°F (NTP, 1992)

Lower Explosive Limit (LEL): 12.5 % (NTP, 1992)

Upper Explosive Limit (UEL): 90 % (NTP, 1992)

Autoignition Temperature: 770°F (USCG, 1999)

Melting Point: -99°F (NTP, 1992)

Vapor Pressure: 60 mmHg at 68°F ; 77 mmHg at 77°F (NTP, 1992)

Vapor Density (Relative to Air): 4.53 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 1.46 at 68°F (USCG, 1999) - Denser than water; will sink

Boiling Point: 189°F at 760 mmHg (NTP, 1992)

Molecular Weight: 131.4 (NTP, 1992)

Water Solubility: less than 1 mg/mL at 70°F (NTP, 1992)

Ionization Energy/Potential: 9.45 eV (NIOSH, 2024)

IDLH: 1000 ppm ; A potential occupational carcinogen. (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Trichloroethylene (79-01-6)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	260 ppm	960 ppm	6100 ppm

Exposure Period	AEGL-1	AEGL-2	AEGL-3
30 minutes	180 ppm	620 ppm	6100 ppm
60 minutes	130 ppm	450 ppm	3800 ppm
4 hours	84 ppm	270 ppm	1500 ppm
8 hours	77 ppm	240 ppm	970 ppm

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Trichloroethylene (79-01-6)	100 ppm 	500 ppm	5000 ppm

 indicates that odor should be detectable near ERPG-1.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Trichloroethylene (79-01-6)	130 ppm	450 ppm	3800 ppm	LEL = 80000 ppm

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Trichloroethylene	79-01-6			100 pounds	313	U228	

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ACETYLENE TRICHLORIDE
- ALGYLEN
- ANAMENTH
- BENZINOL
- BLACOSOLV
- BLANCOSOLV
- CECOLENE
- CHLORILEN
- 1-CHLORO-2,2-DICHLOROETHYLENE
- CHLORYLEA

- CHLORYLEN
- CHORYLEN
- CIRCOSOLV
- CRAWHASPOL
- DENSINFLUAT
- 1,1-DICHLORO-2-CHLOROETHYLENE
- DOW-TRI
- DUKERON
- ETHINYL TRICHLORIDE
- ETHYLENE TRICHLORIDE
- ETHYLENE, TRICHLORO-
- F 1120
- FLECK-FLIP
- FLOCK FLIP
- FLUATE
- GEMALGENE
- GERMALGENE
- LANADIN
- LETHURIN
- NARCOGEN
- NARKOGEN
- NARKOSOID
- NCI-C04546
- NIALK
- PERM-A-CHLOR
- PERM-A-CLOR
- PETZINOL
- PHILEX
- R 1120
- TCE
- THRETHYLEN
- THRETHYLENE
- TRETHYLENE
- TRI
- TRI-CLENE
- TRI-PLUS
- TRI-PLUS M
- TRIAD
- TRIAL
- TRIASOL
- TRICHLORAN
- TRICHLOREN
- TRICHLORETHYLENE
- TRICHLOROETHENE
- TRICHLOROETHYLENE
- 1,1,2-TRICHLOROETHYLENE
- 1,2,2-TRICHLOROETHYLENE
- TRICLENE
- TRIELENE
- TRIELIN
- TRIELINE
- TRIKLONE

- TRIKLONE N
- TRILEN
- TRILENE
- TRILINE
- TRIMAR
- TRIOL
- VESTROL
- VITRAN
- WESTROSOL

**CAMEO Chemicals****Chemical Datasheet****TOLUENE****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
108-88-3 	1294	Flammable Liquid	TOL

NIOSH Pocket Guide
Toluene**International Chem Safety Card**
TOLUENE**NFPA 704**

Diamond	Hazard	Value	Description
3 2 0	 Health	2	Can cause temporary incapacitation or residual injury.
	 Flammability	3	Can be ignited under almost all ambient temperature conditions.
	 Instability	0	Normally stable, even under fire conditions.
	 Special		

(NFPA, 2010)

General Description

A clear colorless liquid with a characteristic aromatic odor. Flash point 40°F. Less dense than water (7.2 lb / gal) and insoluble in water. Hence floats on water. Vapors heavier than air. May be toxic by inhalation, ingestion or skin contact. Used in aviation and automotive fuels, as a solvent, and to make other chemicals.

Hazards**Reactivity Alerts**

Highly Flammable

Air & Water Reactions

Highly flammable. Insoluble in water.

Fire Hazard

Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash

back. (USCG, 1999)

Health Hazard

Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. (USCG, 1999)

Reactivity Profile

TOLUENE reacts vigorously with allyl chloride or other alkyl halides even at -70°C in the presence of ethyl aluminum dichloride or ethyl aluminum sesquichloride. Explosions have been reported [NFPA 491M 1991]. Incompatible with strong oxidizing agents. When added to a tank of sulfur dichloride, the tank over pressurized and ruptured in a reaction thought to be catalyzed by iron or iron(III) chloride [Chem. Eng. News, 1988, 66(32), 2].

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices

or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from NIOSH Pocket Guide for Toluene:

Skin: PREVENT SKIN CONTACT - Wear appropriate personal protective clothing to prevent skin contact.

Eyes: PREVENT EYE CONTACT - Wear appropriate eye protection to prevent eye contact.

Wash skin: WHEN CONTAMINATED - The worker should immediately wash the skin when it becomes contaminated.

Remove: WHEN WET (FLAMMABLE) - Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).

Change: No recommendation is made specifying the need for the worker to change clothing after the workshift. (NIOSH, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Methyl benzol	108-88-3	Liquid		imm	imm	>480	>480	>480	>480	>480	>480
Toluene	108-88-3	Liquid		imm	imm	>480	>480	>480	>480	>480	>480

> indicates greater than.

"imm" indicates immediate; having a normalized breakthrough time of 10 minutes or less.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop,

IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

Physical Properties

Chemical Formula: C7H8

Flash Point: 40°F (NTP, 1992)

Lower Explosive Limit (LEL): 1.27 % (NTP, 1992)

Upper Explosive Limit (UEL): 7.1 % (NTP, 1992)

Autoignition Temperature: 896°F (USCG, 1999)

Melting Point: -139°F (NTP, 1992)

Vapor Pressure: 10 mmHg at 43.5°F ; 20 mmHg at 65.1°F; 40 mmHg at 89.2°F (NTP, 1992)

Vapor Density (Relative to Air): 3.14 (NTP, 1992) - Heavier than air; will sink

Specific Gravity: 0.867 at 68°F (USCG, 1999) - Less dense than water; will float

Boiling Point: 231.1°F at 760 mmHg (NTP, 1992)

Molecular Weight: 92.14 (NTP, 1992)

Water Solubility: less than 1 mg/mL at 64°F (NTP, 1992)

Ionization Energy/Potential: 8.82 eV (NIOSH, 2024)

IDLH: 500 ppm (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Final AEGLs for Toluene (108-88-3)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	67 ppm	1400 ppm 	10000 ppm  
30 minutes	67 ppm	760 ppm	5200 ppm 
60 minutes	67 ppm	560 ppm	3700 ppm 
4 hours	67 ppm	310 ppm	1800 ppm 
8 hours	67 ppm	250 ppm	1400 ppm 

Lower Explosive Limit (LEL) = 14000 ppm

 indicates value is 10-49% of LEL. Safety consideration against explosions must be taken into account.

  indicates value is 50-99% of LEL. Extreme safety consideration against explosions must be taken into account.

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Toluene (108-88-3)	50 ppm 	300 ppm	1000 ppm

 indicates that odor should be detectable near ERPG-1.

(AIHA, 2022)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Toluene (108-88-3)	67 ppm	560 ppm	3700 ppm 	LEL = 14000 ppm

 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Toluene	108-88-3			1000 pounds	313	U220	

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ANTISAL 1A
- BENZENE, METHYL-
- CP 25
- CP 25 (SOLVENT)
- METHACIDE
- METHANE, PHENYL-
- METHYL BENZENE
- METHYL BENZOL
- METHYLBENZENE
- 1-METHYLBENZENE
- METHYLBENZOL
- NCI-C07272
- PHENYL METHANE
- PHENYLMETHANE
- TOLU-SOL
- TOLUENE

- TOLUOL

**Chemical Datasheet****XYLENE, [MIXED ISOMERS]****Chemical Identifiers****CAS Number**

1330-20-7 (mixed isomers)

95-47-6 (o-xylene)

106-42-3 (p-xylene)

108-38-3 (m-xylene)

UN/NA Number

1307

DOT Hazard Label

Flammable Liquid

USCG CHRIS Code

none

NIOSH Pocket Guide

o-Xylene

International Chem Safety Card

m-XYLENE

o-XYLENE

p-XYLENE

NFPA 704

Diamond	Hazard	Value	Description
3 2 0	Health	2	Can cause temporary incapacitation or residual injury.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		

(NFPA, 2010)

General Description

A clear colorless liquid with a characteristic aromatic odor consisting of a mixture of the three isomers (ortho-, meta- and para-). The latter two predominate. Flash point 81-115°F. Less dense (at 7.2 lb / gal) than water and insoluble in water. Hence floats on water. May be toxic by ingestion. Vapors heavier than air and may be narcotic in high concentrations. Used as a solvent for paints and adhesives, and to make other chemicals.

Hazards**Reactivity Alerts**

Highly Flammable

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along the ground and collect in low or confined areas (sewers, basements, tanks, etc.). Vapor explosion hazard indoors, outdoors or in sewers. Those substances designated with a (P) may polymerize explosively when heated or involved in a fire. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids will float on water. (ERG, 2024)

Health Hazard

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

May cause toxic effects if inhaled or absorbed through skin. Inhalation or contact with material may irritate or burn skin and eyes. Fire will produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or asphyxiation, especially when in closed or confined areas. Runoff from fire control or dilution water may cause environmental contamination. (ERG, 2024)

Reactivity Profile

XYLENE reacts exothermically with sulfuric acid, nitric acid, and strong oxidizing agents [Handling Chemicals Safely 1980. p. 962].

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be

inefficient.

SMALL FIRE: Dry chemical, CO₂, water spray or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam.

LARGE FIRE: Water spray, fog or regular foam. If regular foam is ineffective or unavailable, use alcohol-resistant foam. Avoid aiming straight or solid streams directly onto the product. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor, but may not prevent ignition in closed spaces. (ERG, 2024)

Protective Clothing

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing provides thermal protection but only limited chemical protection. (ERG, 2024)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QS	QC	SL	C3	TF	TP	RC	TK	RF
Xylene, mixed isomers	1330-20-7	Liquid				>480	>480	>480	>480	>480	>480
Xylene, o-	95-47-6	Liquid				>480					

> indicates greater than.

Special Warning from DuPont: Tychem® and Tyvek® fabrics should not be used around heat, flames, sparks or in potentially flammable or explosive environments. Only...

(DuPont, 2024)

First Aid

Excerpt from ERG Guide 130 [Flammable Liquids (Water-Immiscible / Noxious)]:

Refer to the "General First Aid" section. Specific First Aid: Wash skin with soap and water. In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin. (ERG, 2024)

Physical Properties

Chemical Formula: C₈H₁₀

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: data unavailable

Boiling Point: data unavailable

Molecular Weight: data unavailable

Water Solubility: data unavailable

Ionization Energy/Potential: 8.56 eV [From NPG: o-Xylene] (NIOSH, 2024)

IDLH: 900 ppm [From NPG: o-Xylene] (NIOSH, 2024)

AEGLs (Acute Exposure Guideline Levels)

Final AEGLs for Xylenes (1330-20-7)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	130 ppm	2500 ppm 	7200 ppm  
30 minutes	130 ppm	1300 ppm 	3600 ppm 
60 minutes	130 ppm	920 ppm 	2500 ppm 
4 hours	130 ppm	500 ppm	1300 ppm 
8 hours	130 ppm	400 ppm	1000 ppm 

Lower Explosive Limit (LEL) = 9000 ppm

 indicates value is 10-49% of LEL. Safety consideration against explosions must be taken into account.

  indicates value is 50-99% of LEL. Extreme safety consideration against explosions must be taken into account.

(NAC/NRC, 2024)

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Xylenes (1330-20-7)	130 ppm	920 ppm 	2500 ppm 	LEL = 9000 ppm
Xylene, m- (includes o- (95-47-6) and p- (106-42-3) isomers) (108-38-3)	130 ppm	920 ppm	2500 ppm 	LEL = 11000 ppm

 indicates value is 10-49% of LEL.

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Benzene, m- dimethyl-	108-38-3			1000 pounds	X	U239	
Benzene, o- dimethyl-	95-47-6			1000 pounds	X	U239	
Benzene, p- dimethyl-	106-42-3			100 pounds	X	U239	
Xylene (mixed isomers)	1330-20-7			100 pounds	313	U239	
m-Xylene	108-38-3			1000 pounds	313	U239	
o-Xylene	95-47-6			1000 pounds	313	U239	
p-Xylene	106-42-3			100 pounds	313	U239	

"X" indicates that this is a second name for an EPCRA section 313 chemical already included on this consolidated list. May also indicate that the same chemical with the same CAS number appears on another list with a different chemical name.

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- BENZENE, M-DIMETHYL-
- BENZENE, O-DIMETHYL-
- BENZENE, P-DIMETHYL-
- DILAN
- 1,4-DIMETHYL BENZENE
- DIMETHYLBENZENE
- 1,2-DIMETHYLBENZENE
- 1,3-DIMETHYLBENZENE
- 1,4-DIMETHYLBENZENE
- DIMETHYLBENZENES
- M-DIMETHYLBENZENE
- M-METHYLTOLUENE
- M-XYLENE
- M-XYLOL
- META-XYLENE
- 2-METHYLTOLUENE
- 4-METHYLTOLUENE

- O-DIMETHYLBENZENE
- O-METHYLTOLUENE
- O-XYLENE
- O-XYLOL
- ORTHO-XYLENE
- ORTHOXYLENE
- P-DIMETHYLBENZENE
- P-METHYLTOLUENE
- P-PHENYLENEBIS(METHYLENE)
- P-XYLENE
- P-XYLOL
- PARA-XYLENE
- XYLENE
- XYLENE (MIXED ISOMERS)
- XYLENE, [MIXED ISOMERS]
- 1,2-XYLENE
- 1,3-XYLENE
- 1,4-XYLENE
- XYLENES
- XYLENES (META-XYLENE)
- XYLENES (ORTHO-XYLENE)
- XYLENES (ORTHO-XYLENE, META-XYLENE, PARA-XYLENE)
- XYLENES (PARA-XYLENE)
- XYLOL



CAMEO Chemicals



Chemical Datasheet

ZINC DUST



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-66-6	1436	Dangerous When Wet Spontaneously Combustible	none

NIOSH Pocket Guide

none

International Chem Safety Card

ZINC POWDER

NFPA 704

data unavailable

General Description

A grayish powder. Insoluble in water. May produce toxic zinc oxide fumes when heated to very high temperatures or when burned. Used in paints, bleaches and to make other chemicals.

Hazards

Reactivity Alerts

Strong Reducing Agent
Known Catalytic Activity
Water-Reactive
Pyrophoric

Air & Water Reactions

Can evolve gaseous hydrogen in contact with water or damp air. The heat of the reaction may be sufficient to ignite the hydrogen produced [Haz. Chem. Data 1966. p. 171]. Flammable. May form an explosive mixture with air [Hawley].

Fire Hazard

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

Produce flammable gases on contact with water. May ignite on contact with water or moist air. Some react vigorously or explosively on contact with water. May be ignited by heat, sparks or flames. May re-ignite after fire is extinguished. Some are transported in highly flammable liquids. Runoff may create fire or explosion hazard. (ERG, 2024)

Health Hazard

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. May produce corrosive solutions on contact with water. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may cause environmental contamination. (ERG, 2024)

Reactivity Profile

ZINC DUST is a reducing agent. Reacts violently with oxidants causing fire and explosion hazards [Handling Chemicals Safely 1980. p. 966]. In the presence of carbon, the combination of chlorine trifluoride with zinc results in a violent reaction [Mellor 2, Supp. 1: 1956]. Sodium peroxide oxidizes zinc with incandescence [Mellor 2:490-93 1946-47]. Zinc powder or dust in contact with acids forms hydrogen. The heat generated by the reaction is sufficient to ignite the hydrogen evolved [Lab. Govt. Chemist 1965]. A mixture of powdered zinc and an oxidizing agent such as potassium chlorate or powdered sulfur can be exploded by percussion. Zinc burns in moist chlorine. A mixture of zinc and carbon disulfide reacts with incandescence. Zinc powder reacts explosively when heated with manganese chloride. The reaction between zinc and selenium or tellurium is accompanied by incandescence [Mellor 4:476-480 1946-47]. When zinc and ammonium nitrate are mixed and wetted with a minimum of water, a violent reaction occurs with evolution of steam and zinc oxide. When hydrazine mononitrate is heated in contact with zinc a flaming decomposition occurs at temperatures a little above its melting point. Hydroxylamine is reduced when heated with zinc dust, unpredictably it may either ignite and burn or explode [Mellor 8 1946-47].

Belongs to the Following Reactive Group(s)

- Metals, Elemental and Powder, Active

Potentially Incompatible Absorbents

No information available.

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet).

FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Firefighting

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

DO NOT USE WATER OR FOAM.

SMALL FIRE: Dry chemical, soda ash, lime or sand.

LARGE FIRE: DRY sand, dry chemical, soda ash or lime or withdraw from area and let fire burn. If it can be done safely, move undamaged containers away from the area around the fire.

FIRE INVOLVING METALS OR POWDERS (ALUMINUM, LITHIUM, MAGNESIUM, ETC.): Use dry chemical, DRY sand, sodium chloride powder, graphite powder or class D extinguishers; in addition, for Lithium you may use Lith-X® powder or copper powder. Also, see ERG Guide 170.

FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. (ERG, 2024)

Non-Fire Response

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. DO NOT GET WATER on spilled substance or inside containers.

SMALL SPILL: Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. Dike for later disposal; do not apply water unless directed to do so.

POWDER SPILL: Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry. DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. (ERG, 2024)

Protective Clothing

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer when there is NO RISK OF FIRE. Structural firefighters' protective clothing provides thermal protection but only limited chemical protection. (ERG, 2024)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

Excerpt from ERG Guide 138 [Substances - Water-Reactive (Emitting Flammable Gases)]:

Refer to the "General First Aid" section. Specific First Aid: In case of contact with substance, wipe from skin immediately; flush skin or eyes with running water for at least 20 minutes. (ERG, 2024)

Physical Properties

Chemical Formula: Zn

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: data unavailable

Boiling Point: data unavailable

Molecular Weight: data unavailable

Water Solubility: data unavailable

Ionization Energy/Potential: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Zinc (7440-66-6)	0.3 mg/m3	40 mg/m3	240 mg/m3

(DOE, 2024)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112(r) RMP TQ
Zinc ††	7440-66-6			1000 pounds			
Zinc (fume or dust)	7440-66-6			1000 pounds	313		
Zinc Compounds	N982			&	313		

†† indicates that no reporting of releases of this CERCLA hazardous substance is required under CERCLA if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches).

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2024)

CISA Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

OSHA Process Safety Management (PSM) Standard List

No regulatory information available.

Alternate Chemical Names

- ASARCO L 15
- BLUE POWDER
- ECKA 4

- F 1000
- F 1000 (METAL)
- F 2000
- F 2000 (METAL)
- LS 2
- LS 2 (ELEMENT)
- LS 4
- LS 5
- RHEINZINK
- UF
- UF (METAL)
- VM 4P16
- ZINC
- ZINC (FUME OR DUST)
- ZINC DUST
- ZINC METAL, [POWDER OR DUST]
- ZINC POWDER

**ALL PERSONNEL HAVE BEEN BRIEFED AND/OR
HAVE READ THE ABOVE PLAN AND ARE FAMILIAR WITH ITS PROVISIONS**

Name

Company

Signature