# WARD COVE CRUISE SHIP DOCK PROJECT

# BENTHIC MONITORING SAMPLING AND ANALYSIS PLAN

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOC | area of concern |
| aRPD | apparent redox potential discontinuity |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| COC | chemical of concern |
| DGPS | differential global positioning system |
| EcoAnalysts | EcoAnalysts, Inc. |
| EcoChem | EcoChem, Inc. |
| EDD | electronic data deliverable |
| Eh | oxidation/reduction potential |
| ENR | enhanced natural recovery |
| EPA | U.S. Environmental Protection Agency |
| GPS | global positioning system |
| Integral | Integral Consulting Inc. |
| ISO | International Standards Organization |
| iSPI | MATLAB-based image analysis software |
| GC/MS-SIM | gas chromatography/mass spectrometry with selected ion monitoring |
| GUI | graphical use interface |
| KPC | Ketchikan Pulp Company |
| LMRP | Long-term Monitoring and Reporting Plan |
| MDL | method detection limit |
| MLLW | mean lower low water |
| MS/MSD | matrix spike/matrix spike duplicate |
| NEF | Nikon Electronic Format |
| OIS | Ocean Imaging Systems |
| QA/QC | quality assurance and quality control |
| RAO | remedial action objective |
| SPI | sediment profile imaging |
| SPI/PV | sediment profile imaging and plan view |

| | |
|---|---|
| SQL | sample quantitation limit |
| SVOC | semivolatile organic compound |
| SWI | sediment–water interface |
| TLP | thin layer sand cap placement |
| TOC | total organic carbon |
| USB | universal serial bus |
| WGS84 | World Geodetic System 1984 |

# 1 INTRODUCTION

The objective of this monitoring plan is to establish the current (i.e., baseline) physical, chemical, and biological characteristics of sediments in the vicinity of the proposed Ward Cove cruise dock, as well as at Ward Cove reference areas established during Ketchikan Pulp Company's (KPC) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sediment cleanup concluded in 2009 (Keeley 2009). This plan will be implemented prior to the construction and operation of the cruise ship dock. As directed in the U.S. Environmental Protection Agency's (EPA) 2019 letter to the U.S. Army Corps of Engineers (Opalski 2019), the approach detailed here addresses and is consistent with the Long-term Monitoring and Reporting Plan (LMRP) for Sediment Remediation in Ward Cove (Exponent 2001).

## 1.1 BACKGROUND

In 2009, EPA approved the 2007 Monitoring Report for Sediment Remediation in Ward Cove (Integral 2009; Keeley 2009) and with the acceptance of this report, EPA concurred that the remedial action objectives (RAOs) for the sediment remedy had been achieved and that monitoring pursuant to the LMRP was no longer necessary (Keeley 2009). In EPA's 2019 comment letter to the U.S. Army Corps of Engineer on the permit application to construct the cruise ship dock in Ward Cove, EPA recommends that "the permit require monitoring during construction to confirm that authorized activities are not contributing to the release of hazardous substances and/or material damage the remedy." EPA also states that a "pre-construction benthic seafloor survey and sampling/analysis plan is needed to document baseline conditions within the Marine operable unit (OU) where construction activities are proposed to occur."

The remedy implemented in the 80-acre Ward Cove sediment area of concern (AOC) in 2000 and 2001 consisted of the placement of a thin sand cap (6-12 inches) across 28 acres of the site and monitored natural recovery across the remaining areas. Figure 1-1 shows the boundary of the sediment AOC, the thin layer sand cap placement (TLP) areas, and the location of the proposed cruise ship dock.

As summarized in the LMRP, the remedial studies concluded that the risk/toxicity to the benthic community was due to organic loading to the sediments offshore of the mill due to wood waste and pulp mill effluent by-products (i.e., ammonia, 4-methyphenol, and sulfide) accumulated during the mill's operation. With the cessation of the pulp mill operations in May 1997, and due to the nature of the chemicals of concern (COCs) (i.e., organic loading degradation products that are nonpersistent, do not bioaccumulate, and are readily oxidized in the environment), the combined monitored natural recovery and TLP (in areas more severely impacted) remedy was selected.

The 2007 sediment monitoring event showed that Ward Cove sediments in both the capped and uncapped areas had achieved the RAO of eliminating or minimizing the ecological risks associated with toxicity of sediments to benthic organisms, based on the chemical, toxicity testing, and benthic community composition results obtained that year. Finally, it is important to note that the TLP sand cap remedy used in this project was not predicted nor intended to isolate or bury the sediment of concern from exposure to biota over time. This approach, often referred to enhanced natural recovery (ENR) is designed to hasten the recovery of surface sediments by adding clean sediment to the bottom to enhance the recolonization of infauna in those areas. The recolonizing benthic communities, through biogenic sediment reworking, accelerate the degradation of organic matter and its by-products and so expedite the return of the system to a healthy benthic community.

## 1.2 MONITORING PLAN OVERVIEW

The monitoring program will consist of two major elements: sediment "triad" sampling (i.e., sediment chemistry, toxicity, and benthic infauna) as prescribed in the LMRP, and a sediment-profile imaging (SPI) survey, which will complement the triad data and provide for broader spatial coverage in and around the cruise dock area. These elements are designed to achieve both overlapping and separate objectives as described below. A third minor element of the sampling program will be the collection of surface sediment cores for geotechnical analyses, (e.g., bulk sediment density and particle size distribution by laser diffraction). These data will be collected opportunistically during this sampling effort to support a prop wash evaluation being conducted by another contractor for Turnagain Marine.

**Objective 1**: Establish current sediment chemistry, toxicity, and benthic community composition in Ward Cove.

**Approach:** Using the same sediment sampling and analysis methods used in the 2007 monitoring effort (Integral 2009), collect single, surface sediment (0–10 cm) samples at four of the historical stations from each of five of the benthic strata established in the LMRP, as well as four replicate samples from each of the two Ward Cove reference stations (Figure 1-1). The samples from each of these locations will be analyzed for chemistry, toxicity, and benthos. The chemical analytes will include the COCs (ammonia and 4-methyphenol) and the conventional parameters (total solids, total organic carbon [TOC], and grain size) analyzed in prior monitoring events. The toxicity test will be the 10-day amphipod test using *Eohaustorius estuarius*. The benthic taxonomic analysis will be conducted on organisms retained on a 1.0-mm screen to the lowest practical taxonomic level.

In addition to this sediment triad data (chemistry, toxicity, and benthos), SPI images will be collected at each station sampled for sediments. SPI data will complement the sediment chemical and biology results by providing *in situ* measurements of grain size and strata (e.g.,

the presence and mixing of thin layer sand cap); relative sediment bearing strength/consolidation based on prism penetration; apparent redox potential discontinuity (aRPD) depths (i.e., the depth of the oxidized surface layer); evidence of organic loading (i.e., sedimentary methane, sulfur-oxidizing bacterial mats); the depth of biological mixing; and the spatial distribution of infaunal successional stages (Rhoads and Germano 1982).

The sediment triad data will allow determination of whether the sediment RAOs are still being met in Ward Cove and can be compared with the 2007 results.[1] The combined triad and SPI data sets from all the stations shown in Figure 1-1, including the reference locations, will document the current benthic habitat conditions in Ward Cove, particularly in the vicinity of the proposed cruise ship dock immediately prior to any in-water construction and dock operations.

**Objective 2:** Generate a detailed map of the existing physical and biological benthic habitat conditions using SPI technology throughout in the cruise ship dock project area.

**Approach:** In addition to the SPI images collocated with the 28 sediment triad sampling locations, SPI images will be collected at an additional approximately 31 locations oriented in an orthogonal grid such that an area approximately 1,5000 by 1,000 ft skewed right from the center of the floating dock is surveyed (Figure 1-1).

The results of this SPI survey will define surface sediment (0–20 cm) conditions, including the presence of TLP cap material, wood debris, biogenic mixing depths, and infaunal successional stage throughout this broader area potentially affected by the cruise ship dock construction and long-term operations. This SPI survey will provide a baseline "view" of the bottom at and immediately surrounding the planned cruise ship dock. Potential changes in surface sediment conditions, such as cap disturbance, depositional, or erosional layers, or a degradation in benthic community conditions (as inferred from SPI) can then be evaluated and documented over time by follow-on surveys. The LMPR notes that once RAOs are achieved "no further monitoring or possibly surrogate monitoring parameters (e.g., monitoring of grain size or *sediment profile imaging*) may be recommended to EPA." Depending on the findings of this 2020 survey, future (post-construction/post-operational) surveys of Ward Cove may need only consist of SPI surveys to verify stable bottom conditions over time. SPI is often used as a monitoring tool for long-term remedial sediment monitoring, particularly for capped sediment sites due to its ability to document cap material extent, thickness, and mixing with ambient sediments (Germano et al. 2011).

[1] The LMRP called for sampling benthos in July whenever monitoring is done so that seasonality in benthic community structure is accounted for. This sampling is likely to take place in the winter so direct comparison with historical data many not be useful. Nonetheless, information on current macroinfauna community structure will be obtained.

# 2 PROJECT TEAM

The responsibilities and roles of personnel contributing to the Ward Cove benthic monitoring project are described below. Integral Consulting Inc. (Integral) will lead the project planning and subcontractor coordination. Contact information for key personnel is listed in Table 2-1.

## 2.1 INTEGRAL TEAM

Mr. Gene Revelas is the Project Manager. The project manager has overall responsibility for the activities and progress of the project. Mr. Revelas is the main point of contact with Turnagain Marine. The project manager is responsible for developing and implementing this sampling and analysis plan (SAP). He is responsible for ensuring that the tasks associated with this SAP are completed and for monitoring the quality of the work. He is responsible for the project schedule and for ensuring that deliverables are completed in a timely manner and on budget absent unanticipated scope changes.

Ms. Shannon Ashurst is the Technical Lead. She will assist the Project Manager in managing the tasks associated with the project completion, and will serve as a secondary point of contact with the ability to direct and assign project resources should the project manager not be available. In addition, she will support the development of the SAP, coordinate and assist the field collection team, and ensure that laboratory data from the project meets the QA/QC requirements. As project technical lead, she will oversee the interpretation and reporting of the project results.

Mr. Stefan Wodzicki is the Field Team Lead. He will oversee execution of the field program, including mobilization/demobilization, field activities, sample processing, and shipment of samples to project laboratories. Mr. Wodzicki will also serve as the Site Safety Officer, responsible for ensuring that the field teams operate safely.

The project will have two primary laboratory liaisons. Ms. Manon Tanner-Dave is the Lead Chemist, and will be responsible for analytical laboratory coordination and oversight, as well as for coordination of analytical data validation. Ms. Ashurst will be responsible for biological laboratory coordination and oversight, and will conduct validation of the final biological data.

Mr. Revelas and Mr. Wodzicki will lead the SPI and plan view (SPI/PV) image analysis and interpretation. Mr. Wodzicki will conduct the image analysis and Mr. Revelas will conduct a quality assurance review of all image analysis results.

Mr. Samuel McWilliams will lead the geotechnical analyses. He will oversee the analysis and reporting of sediment testing conducted at the Integral laboratory located in Santa Cruz,

California, which will consist of bulk density measurements and particle size distribution via laser diffraction.

## 2.2 SUBCONTRACTOR TEAM

Integral will be supported by several subcontractors.

The SPI/PV camera equipment will be leased from NewFields Sediment Management and Marine Sciences LLC. In addition, NewFields will provide an experienced SPI field scientist, Mr. John Nakayama, to operate the SPI camera system with assistance from an Integral SPI scientist, Stefan Wodzicki, for the survey. Mr. Wodzicki will be responsible for completion of the SPI/PV survey as detailed in this SAP.

Analytical laboratory services will be provided by ALS. Mr. Mark Harris of ALS Kelso will be the Analytical Laboratory Project Manager responsible for the analytical testing. Analytical laboratory reports of results and quality assurance and quality control (QA/QC) procedures will be included as appendices in the final data report. Chemical analyses methods are discussed in Section 4.3.

Analytical result validation services will be provided by EcoChem. Ms. Christina Mott Frans of EcoChem will be responsible for the data validation. The final validation report will be included as an appendix in the final data report. Validation is discussed further in Section 4.3.1.5.

Toxicity and benthic evaluations will be conducted by EcoAnalysts, Inc. (EcoAnalysts). Mr. Brian Hester of EcoAnalysts will be responsible for overseeing and coordinating the sediment toxicity and benthic taxonomy analyses. Laboratory reports of results and QA/QC procedures will be included as appendices to the final report. Toxicity and benthic evaluation methods are further detailed in Section 4.3.

# 3 SPI CAMERA SURVEY

The SPI/PV image survey will obtain an *in situ* view of bottom conditions in Ward Cove in and around the planned cruise ship dock location. The SPI/PV system will be deployed on the vessel provided by Turnagain Marine. A total of 54 stations will be targeted for the collection of SPI/PV images, three replicate drops per station. This includes the 26 locations that will be also sampled for sediments (circles on Figure 1-1) as well as 28 stations that will be samples with the SPI/PV camera system only (triangles on Figure 1-1) to provide broader spatial coverage of the area. It is anticipated that two or three field days will be needed to collect the images. The SPI/PV camera system setup and deployment are summarized below.

## 3.1 SPI/PV DEPLOYMENT

The SPI/PV system to be used for this survey consists of an Ocean Imaging Systems (OIS; Pocasset, Massachusetts) full ocean depth (4,000-m depth rating) Model 3731-D Sediment Profiling System camera system to which an OIS DSC 24,000 digital still camera (with wide angle dome) and OIS remote head strobe Model 3831 is attached (Figure 3-1). The SPI camera obtains a cross-sectional image of surface sediments in profile (to a maximum depth of 21 cm below the sediment–water interface [SWI]). The plan view camera obtains an image of the seabed from above immediately in front of where the SPI image is taken. Integral's SPI and plan view camera systems were manufactured by OIS in 2015 and feature Nikon D7100, 24-megapixel digital cameras within their respective watertight housings.

In air, the total weight of the assembled SPI/PV camera system is approximately 360 kg (762 lb). Another 119 kg (262 lb) of lead weight can be added to the frame to increase penetration depth into the bottom in firm substrates (Figure 3-1). The SPI camera housing sits on top of a wedge-shaped prism. This prism assembly is a stainless steel structure that slides between two stainless steel rods contained within a stainless steel frame. The prism assembly is locked in the "up" position by two pins before deployment. These pins are removed when the frame is lifted by the winch wire while on deck and the entire frame is then moved outboard. The tension on the wire keeps the prism from sliding down.

Figure 3-2 shows a schematic of the SPI/PV image collection sequence once the camera is hanging outboard on the winch wire. Once on station, the frame is lowered to the seafloor on a winch wire. A 2-lb lead weight attached to a bounce switch is used to trigger the plan view camera. The weight hangs below the base of the SPI frame on descent. As the SPI system nears the bottom, the lead ball hits the seafloor and releases the tension on the trigger switch, which then activates the flash and plan view camera image acquisition. The plan view image field of view is a function of the length of bounce switch tether. This length is adjusted based on site-specific bottom turbidity to both optimize image clarity and maximize the field of view.

Soon after the plan view image is taken, the base of the SPI frame makes contact with the bottom, and slack on the winch wire allows the prism assembly to drop and vertically cut into the seafloor. A trigger for the SPI camera is tripped by the descending prism activating an adjustable time delay on the SPI camera shutter release and strobe discharge. This delay is typically set for 10–15 seconds, which allows time for the prism to obtain maximum penetration into the bottom before a photograph of the sediment column is taken. After 20–30 seconds on the bottom, the entire camera system is lifted 2–3 m up off the bottom; after a 1–2 minute delay to allow the strobes to recharge and any near-bottom turbidity generated by the first drop to clear, the camera can be lowered to the seafloor for a second replicate image, towed at depth to the next station, or brought back up to the vessel to download images and assess their quality and camera system performance.

Several mechanical adjustments to the SPI/PV camera frame system can be made in the field. A primary goal is to obtain SPI images with optimal prism penetration, typically about 15 cm deep, so that approximately 75 percent of the image is below the mudline. Following review of images obtained, lead weights can be added or subtracted to the chassis to optimize control penetration depth. In addition, the distance that the prism can descend can be controlled by adjusting the location of penetration stops on the vertical lifting bars (Figure 3-1). For the plan view camera, the length of the bounce switch tether is adjusted to optimize image clarity and field of view. Also, whenever the tether length is modified, the strobe light angle is checked/adjusted to ensure even lighting across the plan view image. These adjustments are made at the beginning of the survey, and as needed during the survey whenever bottom conditions (e.g., sediment texture, ambient turbidity) change.

## 3.2 CAMERA SETTINGS AND IMAGE FILE MANAGEMENT

Camera settings (i.e., f-stop, shutter speed, International Standards Organization [ISO] equivalents, digital file format, color balance) can be selected through a watertight universal serial bus (USB) port on the camera housing connected to a laptop computer and Nikon® Control Pro software. At the beginning of the survey, the time on the SPI camera's internal data logger is synchronized with the internal clock of the laptop computer, which will store the downloadable images. In turn, the laptop computer will synchronize its clock with the research vessel's onboard navigation system on local time. Details of the camera settings for each digital image are available in the metadata parameters embedded in the electronic image file. For this survey, the SPI camera will be set with the following parameters: ISO-equivalent 400, shutter speed 1/60, aperture f10, white balance to flash, color mode sRGB, Active D-lighting off, and High ISO Noise Ratio normal. Images will be stored in two separate memory SD cards on the camera as lossless compressed raw (14 bit) Nikon Electronic Format (NEF; 6,000 x 4,000 pixels) files and optimal quality JPEG (fine, 6,000 x 4,000 pixels) files. Recording modes for the two 32 MB memory SD cards are set as NEF in slot 1 and JPEG in slot 2. When images are relabeled with actual station identification numbers, a copy of the JPEG files will be relabeled using the

Nikon® Capture NX2 software (Version 2.10.3, 64 bit). These images will be reviewed onboard as soon as they are downloaded to the field laptop computer to ascertain that all images have been captured.

Image color calibration on SPI images will be determined by photographing a Kodak® Color Separation Guide card against the SPI prism before the first deployment of each day. The card also contains a ruler, which will be used to determine the number of pixels per centimeter. The calibration information will be applied to all SPI images and stored in the image analysis database.

Three replicate images will be taken at each station during the survey. When reviewing image quality during the field effort, the unique time stamp on each digital image will be cross-checked with the time stamp of the onboard navigational system. The coordinates for each image will be added to the database by cross-referencing with time stamps of each drop. The field crew will keep a redundant written sample log of image acquisition time and sampling stations along with other specific notes. Images will be downloaded after the first drop of each day to verify successful sample acquisition and good functioning of the camera equipment, and to assess acceptable prism penetration depth. Thereafter, the camera system and image quality will be monitored periodically or when bottom conditions change. If images are missed or are of suboptimal quality (e.g., strobe misfire or the penetration depth was insufficient or excessive [over penetration]), additional images will be taken at those locations with the goal of obtaining three analyzable replicate images at all stations.

The downloaded JPEG and RAW image files will be renamed with the appropriate station name during or at the end of each survey day using Nikon® Capture NX2 software. The image labeling convention will be as follows (station numbers are shown on Figure 1-1):

WC2020-71-A-SPI

where:

| | | |
|---|---|---|
| WC2020 | = | the 2020 Ward Cove survey. |
| 71 or 001 | = | station number: a two-digit station number refers to a location sampled in 2007; a three-digit station is a station added in 2020 |
| A | = | replicate (A, B, C, D) |
| SPI | = | image type (SPI or PV), so the collocated plan view image taken during the same drop is: |

WC2020-71-A-PV

The plan view system consists of Nikon D7100 digital single lens reflex camera encased in a 17-4PH stainless steel housing with a domed glass port, a 24 VDC autonomous power pack, a

500 W strobe, and a bounce trigger. Two OIS Model 400-37 Deep Sea Scaling lasers are mounted to the DSC240000 housing that project two red laser dots separated by a constant distance of 26 cm regardless of the field of view of the plan view image, which is a function of the length of the trigger wire. As the SPI/PV camera frame is lowered to the seafloor, the weight attached to the bounce trigger contacts the seafloor prior to the SPI/PV camera frame, hitting the bottom and triggering the plan view camera to fire (Figure 3-2). Details of the plan view camera settings for each digital image are available in the metadata embedded in each electronic image file; for this survey, the ISO-equivalent will be set at 400. The additional camera settings will be used as follows: shutter speed set to 1/30, aperture at f16, white balance to flash, color mode to sRGB, Active D-lighting to off, and High ISO Noise Ratio to normal. Images will be stored as lossless compressed raw (14 bit) NEF files (6,000 x 4,000 pixels) and optimal quality JPEG (fine, 6,000 x 4,000 pixels).

As for the SPI camera, recording modes for two 32 MB memory SD cards are set as NEF in slot 1 and JPEG in slot 2. When relabeling images with actual station identification numbers, a copy of the JPEG files will be relabeled using the Nikon® Capture NX2 software (version 2.10.3, 64 bit). Also, the internal clock in the digital plan view camera will be synchronized with the field laptop, which will have been synchronized with the onboard navigational system during field operations. Throughout the survey, plan view images will be downloaded at the same time as the SPI images at a frequency of approximately every 5 to 10 sampling stations.

The ability of the plan view camera to collect usable images is dependent on the clarity of the near-bottom water column. If near-bottom turbidity is high as expected in Ward Cove, the bounce trigger cable, typically set at 3 ft below the camera frame base to start, can be shortened to decrease the distance between the camera focal plane and the seafloor. A drawback to the shortening of the trigger cable length is that the areal field of view of the plan view image will be decreased. In very turbid environments, it can be impossible to collect useful plan view images. Finally, it may not be possible to analyze the second and third plan view image replicates if the bottom is disturbed by the SPI camera frame during the first replicate drop. Therefore, the objective of the survey will be to obtain at least one high-quality plan view image at each sampled location.

## 3.3 SEDIMENT PROFILE IMAGE ANALYSIS

Integral will use its integrated, MATLAB-based image analysis software (iSPI v1.3a) to analyze SPI/PV images. The image files along with the metadata-containing Microsoft® Excel files generated during the field survey are imported directly into iSPI for analysis. A menu-structured graphical use interface (GUI) in iSPI allows the image analyst to either manually or semi-automatically measure key imaged features (Figure 3-3) and also add descriptive comments. The draft data are stored in the system for review by a senior SPI scientist. All SPI and plan view data are independently reviewed and revised as needed before being identified

as having undergone a quality assurance check or final data within iSPI. Following the QA check of all measured and descriptive parameters, the final SPI/PV data set is compiled and can be evaluated and exported as desired.

The sections below describe the methodology used for identifying and manually measuring key features observed in SPI images, as well as the underlying interpretive rationale and paradigms.

### 3.3.1 Sediment Type and Composition

The sediment grain-size major mode and range are estimated by visually comparing the textures in each image with a photograph set (grain-size comparator) that was generated by imaging a series of sieved Udden-Wentworth sediment size classes samples (equal to or less than coarse silt up to granules) placed against the SPI camera prism in the laboratory. Seven grain-size classes (phi units) are on this comparator: >4 (silt-clay), 4–3 (very fine sand), 3–2 (fine sand), 2–1 (medium sand), 1–0 (coarse sand), 0– (–1) (very coarse sand), and < –1 (granule and larger). The lower limit of optical resolution of the photographic system is about 62 μm, allowing recognition of grain sizes equal to or greater than coarse silt (>4). The image analyst documents the major mode (predominant grain size across the entire image) and total grain size range (minimum to maximum particle size) observed in each image. If distinct sediment type strata are evident in an image (e.g., sand over mud), the major mode will be noted for each stratum; for example, 3–2 phi/>4 phi (i.e., fine sand over silt/clay).

A mix of ambient silt, thin-layer placed sands, and wood fiber/debris from the former pulp operation is expected in the Ward Cove images. As warranted, the analyst will note the relative abundance and distribution of these different fractions in each SPI image.

### 3.3.2 Prism Penetration Depth

The SWI is traced in each SPI image by the analyst. The prism penetration depth is the average depth in centimeters from the SWI to the bottom of the image. iSPI automatically calculates the average penetration depth on the SWI is delineated.

The penetration depth is a function of the bearing capacity of the surface sediment column. If the number of weights added to the camera is kept the same during a survey (0 to 250 lb can be added to the camera prism frame in 50-lb increments), then the penetration values obtained across the site is a function of sediment consolidation/bearing strength. Highly bioturbated or methanogenic muds are typically the most deeply penetrated. Seasonal changes in camera prism penetration have been observed at the same station in some studies and are related to the control of sediment geotechnical properties by bioturbation (Rhoads and Boyer 1982). Consolidated or relic clayey sediments and well-sorted sands can be difficult to penetrate even with a fully weighted camera system. The presence of the thin sand layers placed in Ward Cove

as part of the remediation as well as historical wood debris may be visually evident in the SPI images and/or their presence may be revealed by reduced prism penetration depth.

### 3.3.3 Small-Scale Surface Boundary Roughness

The iSPI determines surface boundary roughness automatically by calculating the vertical distance between the highest and lowest points of the SWI, regardless of whether the SWI was drawn manually or by the computer. The surface boundary roughness may be related to either physical structures (e.g., ripples) or biogenic features (e.g., burrow openings, fecal mounds, foraging depressions).

### 3.3.4 Apparent Redox Potential Discontinuity Depth

Near-surface marine sediments are typically aerobic and have higher optical reflectance than the underlying reduced or anaerobic sediments. Surface sands washed free of mud also have higher optical reflectance than underlying muddy sands. These differences in reflectance with depth in the sediment column are readily apparent in SPI images. The oxidized surface sediment particles are coated with ferric hydroxide, which has a brownish or olive color, while reduced sediments below this oxygenated layer are darker, generally gray to black (Fenchel 1969; Lyle 1983). The boundary between the colored ferric hydroxide surface sediment and underlying gray to black sediment is called the apparent redox potential discontinuity (aRPD).

The average aRPD depth is measured in each image by the analyst by tracing the transition from surface brown/olive to subsurface gray/black sediments across the image. This boundary is often undulated or wavy as a function of the distribution of individual macrofauna and their localized biogenic mixing activities. The average depth of the aRPD is then calculated in iSPI by subtracting the aRPD boundary depth from the SWI horizon.

This measure is referred to as the *apparent* RPD as the actual RPD is the horizon that separates the positive oxidation/reduction potential (Eh) (oxidizing) region of the sediment column from the underlying negative Eh (reducing) region, which can only be determined with microelectrodes.

The aRPD is a key SPI parameter for documenting changes (or gradients) that develop over time in response to benthic disturbance factors (e.g., sediment erosion or depositional events), demersal fish foraging, and temporal (seasonal or yearly cycles) changes in environmental factors, such as water temperature and organic loading. Overall, time-series RPD measurements following a disturbance are a diagnostic element in assessing the rate and degree of recovery in an area following a perturbation (Rhoads and Germano 1982, 1986) (Figure 3-4).

Finally, in well-sorted sands with little to no silt or organic matter in them, the depth of the aRPD can be controlled by the physical factors that force surface water into the substrate. These

aRPD depths are noted as physical aRPDs in the image analyst comments and are not fully a function of infaunal biogenic mixing. This bottom type is not expected in Ward Cove.

### 3.3.5 Organic Loading, Sedimentary Methane, and Thiophilic Bacterial Colonies

If organic loading is high in marine sediments, porewater sulfate is depleted and methanogenesis occurs. In SPI images, methanogenesis can be revealed by the appearance of methane bubbles in the sediment column. These gas-filled voids are readily discernible in SPI images because of their irregular shape and glassy texture (due to the reflection of the strobe off the gas). The image analyst notes the presence of these methane voids, and the number and area of the voids can be measured.

A related feature that indicates if an area is suffering severe sediment oxygen demand due to organic enrichment and/or depleted water column dissolved oxygen levels (i.e., hypoxia or anoxia) is the presence of the sulfur-oxidizing bacterial colonies at or just below the SWI. These bacterial colonies have diagnostic bright white or orange filamentous morphology that has been documented in numerous SPI surveys (Germano et al. 2011). The presence of sulfur-oxidizing bacterial colonies appear when boundary-layer dissolved oxygen concentrations drop into the "hypoxic" range between 0–1 mL/L (Rosenberg and Diaz 1993).

If observed in any of the Ward Cove images, the relative abundance of sedimentary methane and bacterial colonies will be noted by the analyst.

### 3.3.6 Infaunal Successional Stage

After a disturbance in soft-bottom marine sediments, macrobenthic infaunal communities generally follow a succession pattern. Figure 3-4 illustrates this progression from an initial community of densely populated, small, tubiculous, surface-dwelling polychaetes (Stage 1) to an equilibrium community of deep-dwelling, head-down deposit feeders (Stage 3). The identification of benthic infaunal successional stages in SPI images is based on empirical evidence that organism-sediment interactions in fine-grained sediments follow this predictable sequence after a seafloor disturbance (Pearson and Rosenberg 1978; Rhoads and Germano 1982; Rhoads and Boyer 1982). This interpretive paradigm is based on observations that primary benthic succession results in:

> "…the predictable appearance of macrobenthic invertebrates belonging to specific functional types following a benthic disturbance. These invertebrates interact with sediment in specific ways. Because functional types are the biological units of interest..., our definition does not demand a sequential appearance of particular invertebrate species or genera" (Rhoads and Boyer 1982).

This continuum of change in animal communities after a disturbance (primary succession) has been divided into four primary stages:

- Stage 0, indicative of a sediment column that is largely devoid of macrofauna, occurs immediately following a major physical disturbance or in close proximity to an organic enrichment source.
- Stage 1 is the initial community of tiny, densely populated, tubicolous, surface-dwelling polychaete assemblages.
- Stage 2 is the start of the transition to head-down deposit feeders and can also consist of shallow-dwelling bivalves and tube-dwelling amphipods.
- Stage 3 is the mature, equilibrium community of deep-dwelling, head-down deposit feeders that create distinctive feeding voids and aerated burrows that are visible in SPI images (Figure 3-2).

However, in temporal and spatially dynamic marine environments, benthic communities are unlikely to progress completely and sequentially through all four stages in accordance with the idealized conceptual model depicted in Figure 3-4. Various and transitional combinations of these basic successional stages are possible (e.g., Stage 1 going to Stage 2). More frequently, secondary succession can occur in response to additional labile carbon input to surface sediments, with surface-dwelling Stage 1 or 2 organisms co-existing at the same time and place with Stage 3, resulting in the assignment of a "Stage 1 on 3" or "Stage 2 on 3" designation. The image analyst will assign an infaunal successional stage for each SPI image analyzed based on this interpretive paradigm.

As a final note, the successional dynamics of benthic invertebrate communities noted above are based on well-documented studies of fine-grained benthic environments; the successional dynamics of invertebrate communities in sand and coarser sediments are less well-known and biogenic structures are less-well preserved or discernable in sands. As a result, the interpretation of successional patterns from SPI images in sandy and coarse-grained bottoms is relatively limited and the successional stage is often indeterminate.

### 3.3.7 Biological Features

In addition to the infaunal successional stage designation, specific biological features can be observed, counted, and measured in the images. These features typically include 1) the infaunal organisms themselves (bivalves, polychaetes, crustacea); 2) the feeding pockets or voids that subsurface, deposit-feeding polychaetes produce; and 3) the burrows that polychaetes, bivalves, and crustacea can produce. For this survey, the maximum biogenic feature observed in each image will be identified and traced so the maximum observed evidence of biological activity is recorded.

### 3.3.8 Plan View Image Analysis

The plan view images can provide a larger view of surface sediment conditions than the SPI images and therefore may provide complimentary information about the landscape ecology and sediment topography in the area where the smaller-scale sediment profile is taken. Unusual surface sediment layers/textures or structures detected in the SPI images can also be interpreted in light of the context of surface sediment features (e.g., is the surface burrow evident in a SPI image regularly occurring or is it an isolated feature?). In addition, the scale information provided by the underwater lasers allows accurate density counts (number per square meter) of attached epifaunal colonies, sediment burrow openings, or larger macrofauna that may be missed or very limited in the SPI cross section. Presence of *Beggiatoa* bacterial colonies along with information on sediment transport dynamics and bedform wavelengths are also available from plan view image analysis. The key features noted in plan view images, and as warranted, counted, or measured, are listed below:

- Sediment type (e.g., sand and silt, silt, sand)
- Surface debris, such as wood or algal detritus
- Bedforms (presence: Yes/No)
- Burrows, mounds (presence: Yes/No; count/density)
- Tubes (presence: Yes/No; count/density)
- Tracks (presence: Yes/No; count/density)
- *Lebenspurren* (i.e., biologically formed, sedimentary structures found in sediments, including tracks, trails, burrows, borings, fecal casts, and coprolites)

# 4 SEDIMENT SAMPLING PROGRAM

This section details the sediment sample collection methods for analytical, toxicity, and benthos evaluation. The approach is based on details presented in the LMRP (Exponent 2001) and the 2007 Ward Cove monitoring event (Integral 2009).

## 4.1 FIELD METHODS

Surface sediment (0–10 cm) samples will be collected using a 0.1-$m^2$ stainless steel van Veen grab sampler following field procedures consistent with Puget Sound Estuary Protocols (PSEP) protocols (PSEP 1986a,b, 1989a,b). Samples will be collected from 28 locations within the Ward Cove AOC, as well as from 2 reference areas within Ward Cove but outside the AOC (Figure 1-1).

### 4.1.1 Sampling Strategy

Samples will be collected in five of the benthic strata originally identified in the LMRP (Exponent 2001). The strata were established on water depth, organic deposit thickness, and the remedial action implemented (i.e., either natural recovery or thin layer cap placement) as shown in Table 4-1. Stratum 1 and Stratum 2c, are outside the area of potential impact by the cruise ship dock construction and operation and will not be sampled. (what about sampling these for data for future possible future development since the equipment is there anyways? Just a suggestion though.)

Five, unreplicated locations will be sampled within Strata 2a, 2b, 3a, 3b, and 4 to document stratum-wide conditions as well as to provide a measure of within-stratum variability. Reference station No. 96 from the LMRP will also be sampled (three replicates) to provide information on potential temporal changes in Ward Cove since the previous sampling in 2007 that are unrelated to the remedial action activities (Figure 1-1 and Table 4-1) and well away from the cruise ship dock area.

### 4.1.2 Sampling Vessel, Navigation, and Positioning

Surface sediments will be collected from the vessel *Alaskan Salvor*, operated by Alaska Commercial Divers. The vessel operator is familiar and experienced with accurate deployment and retrieval of the sampling gear.

Station positioning will be accomplished using the sampling vessel's differential global positioning system (DGPS) and computer navigation software. Differential corrections will be obtained from the U.S. Coast Guard beacon on Annette Island. The GPS receiver will be situated as close as is possible over the sampling gear to achieve the most accurate position for

each station. A positional fix will be recorded when the sampler impacts the seafloor. Accuracy of the GPS will be verified at a horizontal control or navigation checkpoint before sampling activities begin. The navigation check is expected to have a positional accuracy of ± 2 m. Horizontal coordinates will be recorded as latitude and longitude, World Geodetic System 1984 (WGS84) in degrees and decimal minutes to four decimal places (e.g., 55° 24.2185' N, 131 43.7664' W) or in decimal degrees (e.g., 55.403641, –131.72944). Station locations will be digitally recorded and written in the field logs at the time of collection of each sample. Planned station location coordinates are provided in Table 4-2.

Once on station, observed water depths will be recorded in the field notebook using the shipboard fathometer. If needed following the survey, the observed water depths can be corrected to mean lower low water (MLLW) based on tide gage readings from the National Oceanic and Atmospheric Administration (NOAA) water elevation station located at Ketchikan, AK (Station ID 9450460).[2]

### 4.1.3 Sample Equipment Cleaning

All sampling equipment that contacts sediment samples (i.e., stainless-steel bowls, utensils) will be decontaminated prior to use. The decontamination procedure will consist of the following sequential rinses:

- Rinse with tap water or water supplied by the sampling vessel
- Scrub with phosphate-free laboratory-grade detergent (i.e., Liquinox®, as opposed to Alconox®, which is not phosphate-free) solution
- Rinse with tap water
- Rinse with distilled water.

All decontaminated equipment will be wrapped in aluminum foil to prevent contamination when not in use. Any excess water or sediment remaining after processing will be returned to the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site.

The sampling crew will wear disposable nitrile gloves during sample processing (i.e., classification, subsampling, compositing, and filling sample containers).

### 4.1.4 Surface Sediment Collection: Chemistry and Bioassay Testing

Sample collection procedures are as follows:

[2] https://tidesandcurrents.noaa.gov/stationhome.html?id=9450460

- Prior to sampling at a specific location, the double van Veen grab sampler is washed with a phosphate-free cleaning detergent (e.g., Liquinox®) and rinsed with site water. Within that same location, the grab sampler will be rinsed with site water between individual grab samples. Multiple drops at each target location are needed to obtain the sediment volumes needed for all analyses.
- Once the boat is in the general proximity of the planned sampling location, the van Veen grab sampler is lowered vertically through the water column until just above the sediment surface. The position of the boat is verified as on station, and the van Veen grab sampler is dropped into the sediment surface. The actual coordinates when the sampler hits the bottom are recorded for each drop.
- The station name, latitude/longitude, time of collection, and observed depth to mudline are noted in the field log.
- When the grab sampler approaches the water surface, the winch is slowed or stopped, and any handling lines in use should be attached to the winch cable if necessary to reduce swinging of the grab sampler.
- The winch then slowly brings the grab sampler onto the boat with minimal swinging. The grab sampler is secured as soon as possible once it has been retrieved onto the boat.

Once the sampler is retrieved, overlying water will be siphoned off and sample acceptability assessed. A sample will be determined to be acceptable if the following conditions (PSEP 1986b) are met:

- Sediment does not extrude from the upper surface of the sampler.
- No water is leaking from the sampler (overlying water is present, indicating minimal leakage).
- The overlying water is clear or not excessively turbid.
- The SWI is intact and relatively flat, with no sign of channeling or sample washout.
- Penetration is sufficient to collect a sample from the 0–10 cm interval.
- There is no evidence of sediment loss (incomplete closure of sampler, penetration at an angle, or tilting upon retrieval).

If the grab sample is unacceptable, the sediment grab will be rejected and the sediment discarded away from the station; depending on the reason for the unacceptable grab, the target location may be slightly shifted and another attempt will be made to collect a grab sample. After multiple attempts without success, the field lead will have the discretion to abandon the target location and move it to a new location within the stratum to obtain an acceptable grab sample.

If the sample is acceptable, the penetration depth and physical characteristics of the sediment sample (e.g., color, texture, odor) will be recorded on field log forms (Appendix B). After these observations have been recorded, the sediment can be removed from the sampler (0–10 cm). Overlying water will be siphoned off. Stainless-steel spatulas and spoons will be used to collect the sediment. A stainless-steel ruler will be used to ensure that the sampling criterion for adequate penetration depth is met and that the correct amount (i.e., 10 cm) of sediment has been removed. Sediment touching the sides of the grab sampler will not be collected.

At each sampling station, one or more grab samples will be collected for chemical analyses and toxicity testing. The surface (top 10 cm) sediment will be collected from each grab sample, and the sediment will be composited. The sediment sample at each station will be composited in a stainless-steel bowl and covered with aluminum foil until a sufficient volume of sediment (4 L) is collected for both chemical and toxicity testing. Sediment in the bowl will then be mixed using a large stainless-steel spoon to achieve a uniform texture and color before subsamples are taken and transferred to pre-cleaned glass containers with Teflon®-lined lids.

Each sample container will be clearly labeled with the project name, sample/composite identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Sample nomenclature will be as follows:

- SD####: where "SD" represents sediment and #### corresponds with the station ID (e.g., Station ID 9 would have a sample ID of SD0009). For reference locations, which will have four replicates each (Table 4-1), each replicate will be represented sequentially by a letter following the station ID (i.e., SD0096a, SD0096b, etc.).
- Field duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples will be assigned a sample ID starting with SD0100, and increasing sequentially.

Samples will be stored on ice at approximately 4°C onboard the sampling vessel. Table 4-3 outlines the storage and holding time requirements for each type of analysis. Sample handling and custody procedures are described in Section 4.2.

### 4.1.5 Surface Sediment Collection: Geotechnical Testing

Up to 20 sampling locations will be identified in the field for the collection of a subsample for geotechnical testing. These data are being collected opportunistically during this sampling effort to support a prop wash evaluation being conducted by another contractor for Turnagain Marine. The geotechnical analyses with be conducted subsamples collected from a single grab by inserting a 6 in. by 2 in. (diameter) acrylic tube into the undisturbed sample. The intent of this approach is to preserve the bulk sediments characteristics of the substrate prior to the mixing/homogenization that occurs for the samples processes for chemistry and toxicity testing as described above. The cores will be capped on both ends, carefully removed from the grab,

secured with tape, and labeled with sample ID. Collected samples will be stored upright and packed to minimize disturbance during travel.

### 4.1.6 Benthic Infauna Sample Collection

Sediment for benthic infauna community analysis will be collected using a 0.1-$m^2$ stainless-steel van Veen grab sampler in accordance with standard methods used by PSEP (1986a,b; 1989a,b). The sediment in the grab sampler will be evaluated for acceptability according to the requirements described in the previous section. All of the sediment and overlying water collected in each grab sample will be sieved. A single grab sample (i.e., replicate) will be collected at each station.

Sediments collected for benthic community analysis will be sieved using a mesh size of 1.0 mm. Retained material will be transferred to appropriate containers and fixed with formalin. To fix the benthic samples, 10% formalin will be used. The residual material that is left on the 1.0 mm screen will be transferred to a sample container. It is important that the sample container not be more than two-thirds full with this material. Following the transfer, half of the jar will be filled with site water, and then the remainder will be filled with 10% formalin, creating a 5% formalin solution. The lid will be replaced on the sample jar and sealed using electrical tape. Once the jar is sealed, it will be rolled to ensure even distribution of the formalin throughout the chamber. The sample containers will be shipped to the laboratory for taxonomic analysis. The laboratory will stain the samples with rose bengal (125 mg/L) after receipt, as needed.

### 4.1.7 Field Quality Control Samples

Field quality control samples will consist of field duplicate samples, equipment rinsate blanks, MS/MSD samples, and sample temperature blanks. These sample types are described in this section. Field duplicates and MS/MSD samples for analytical testing will be collected from different locations. Quality control sample requirements are presented in Table 4-4.

#### 4.1.7.1 Field Duplicate Samples

A field duplicate will be collected to evaluate sampling reproducibility. Field duplicates provide a measure of the total analytical bias (field and laboratory variance) including bias resulting from the heterogeneity of the replicate sample set itself. The duplicate samples will be collected in conjunction with and analyzed by the same methods as the primary sample, but will be submitted blind to the analytical laboratory with sample numbers that are indistinguishable from the primary samples. Duplicate samples will be collected at a frequency of one sample for up to every 20 collected. A minimum of one field duplicate will be collected from each type of remedial action area in the AOC (i.e., thin capped area and natural recovery area). Field duplicates will be analyzed for chemical and conventional parameters only, not for toxicity or taxonomic evaluations.

#### 4.1.7.2 Rinsate Blanks

An equipment rinsate blank is a sample of distilled/deionized water poured over or through decontaminated field sampling equipment prior to environmental sample collection. These samples are used to determine the adequacy of the decontamination process. An equipment rinsate blank will be collected once during the sampling event from the grab sampler.

#### 4.1.7.3 Matrix Spike/Matrix Spike Duplicates

MS/MSD samples are used to assess sample matrix interferences and to measure the accuracy and precision of the laboratory analyses. Known concentrations of target analytes are added to sediment samples. The spiked samples are then processed through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known spiked amount (and the relative percent difference for MS/MSD pairs). The MS/MSD samples will be collected and analyzed at a rate of 5 percent of the total field samples for each analytical method, or at least one for each analytical batch, whichever frequency is greater. If possible, MS/MSD samples will not be collected from locations with potentially high concentrations of target analytes that may mask the added MS/MSD compounds.

#### 4.1.7.4 Temperature Blanks

One temperature blank will be prepared and submitted to the laboratory with each sample cooler. The temperature blank will consist of a sample jar containing water, which will be packed in the cooler on ice in the same manner as that for the rest of the samples. The temperature blank is to be used to measure the cooler temperature upon receipt of the cooler at the laboratory.

### 4.1.8 Field Documentation

Proper record-keeping and chain-of-custody procedures will be conducted to allow samples to be traced from collection to final disposition. Field documentation will include:

- Field logbook: The field logbook will be a bound, waterproof field notebook with consecutively numbered pages. All daily field activities will be documented in indelible ink. All entries will be signed and dated. No erasures will be made. Incorrect entries will be crossed out with a single strike and initialed and dated. The field logbook will include the following:
  - Project name, project location, and project number
  - Date and time of entry
  - Time and duration of daily sampling activities

  - Weather conditions
  - Name of person making entries and other field personnel
  - Onsite visitors, if any
  - The sample identifier and analysis code for each sample to be submitted for laboratory analysis
  - Specific information on each type of sampling activity
  - Variations, if any, from specified sampling protocols and reasons for deviation
- Sample logs: A sample log will be completed for each station sampled (Appendix B). The station name, date, gear, cast number, depth, and location coordinates will be recorded on each log sheet. The sample logs will also include a description of the sample (source and appearance, such as sediment type, color, and odor) and a description and number of photographs taken at the sampling location, if any
- Sample labels: A sample label will be affixed to the outside of each sample container. An internal label on waterproof paper will also be placed inside each benthic community sample container. All sample label entries will be made with indelible ink, except for the internal label used with the benthic community samples, which will be made with pencil. Sample containers will be labeled at the time of sampling with the following information: sample number, site name, sampling date and time, sampling personnel, preservative (if appropriate), and tag number.

## 4.2 SAMPLE HANDLING AND DOCUMENTATION

All sample containers will be provided by the chemical and toxicity testing laboratories and prepared in accordance with PSEP guidelines (PSEP 1986a) prior to field operations. Sample containers for chemical analyses and toxicity testing will be kept closed and in a cooler until use. As they are collected, samples will be fully labeled, recorded in the field logbook along with other pertinent collection data, and returned to coolers as soon as possible. Immediately after they are filled, all sample containers containing sediment for chemical analyses and toxicity testing will be placed on ice in a cooler at 4°C. Samples collected for benthic infauna community analysis will be stored in an upright position at a cool temperature and away from direct sunlight. All samples will be stored in a secure place, where containers are not susceptible to breakage.

Sediment samples for all chemical analyses and toxicity testing will be shipped on ice (4°C) to the testing laboratories and will be stored at 4°C until analysis and final disposition of the samples. All field samples will be analyzed as soon as possible after receipt at the laboratory.

Sediment samples for geotechnical testing will be packaged such as to minimize sample movement within the cooler during travel. Sediments should not be frozen so as not to alter the ratio of sediment to water per volume. Samples will be shipped to the Integral laboratory in Santa Cruz, California, and will be refrigerated upon arrival. Each sample will be checked in referenced to the accompanying chain of custody.

Samples in glass containers will be packed in bubble-wrap plastic to prevent breakage, and chain-of-custody seals will be placed across the cooler lids. Chain-of-custody forms (Appendix B) will be enclosed in the coolers with the samples and will be signed at the laboratory upon receipt. Samples will be shipped or sent by courier to arrive at the participating laboratories within 3 to 5 days of sample collection. A copy of the signed chain-of-custody form will be returned by the testing laboratory to Integral and filed in the project file. The laboratories will maintain chain-of-custody internally to track handling and final disposition of all samples.

## 4.3 LABORATORY METHODS

This section describes the project requirements for the analytical laboratory for analysis, QA/QC, and data reporting.

### 4.3.1 Analytical Laboratory

Chemical and physical analyses of sediments will be performed at ALS Environmental (Kelso, Washington). Geotechnical analyses will be conducted at Integral's sediment testing laboratory (Santa Cruz, California).

#### 4.3.1.1 Chemicals of Concern

Sediments will be analyzed for ammonia, 4-methylphenol, grain size distribution, TOC, and total solids consistent with methods specified in the LMRP and Integral (2009). The analyses will be completed as follows:

- **Ammonia:** Plumb (1981), a potentiometric procedure for ammonia in water, modified to include sediment extraction with 2M potassium chloride
- **4-Methylphenol:** EPA Method 8270C (USEPA 2016), gas chromatography/mass spectrometry with selected ion monitoring (GC/MS-SIM)
- **Grain size distribution:** PSEP (1986b), wet sieving and pipette analysis for gravel, sand, silt, and clay
- **TOC:** PSEP (1986b)/SM 5310B (2017) , sample combustion and infrared detection, with modifications to accommodate the sediment matrix

- **Total solids:** PSEP (1986b)/EPA Method 160.3M (USEPA 1983), gravimetric analysis.

#### 4.3.1.2 Limits of Detection

The samples identified in Table 4-1 will be analyzed for the analytes listed in Table 4-5, as discussed above. The preparation procedures, test methods, and sample quantitation limits (SQLs) to be achieved by the analytical laboratory are identified in Table 4-5. SQLs, also known as reporting limits, are established by the low standard of the initial calibration curve or low-level calibration check. SQLs are typically 3 to 5 times the method detection limits (MDLs). The MDL is a minimum concentration that can be measured and reported with 99 percent confidence that the chemical concentration is greater than zero. Detected analyte concentrations will be reported to the MDL, and both the MDL and the sample SQL will be reported for nondetects. MDLs of all COCs must be below screening level values. Failure to achieve detection limits may result in a requirement to reanalyze the samples.

#### 4.3.1.3 Quality Assurance / Quality Control

Laboratory quality control procedures, where applicable, include instrument performance checks, initial and continuing instrument calibrations, retention time windows, chromatographic resolution checks, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table 4-6 lists the type and frequency for laboratory QA/QC samples, and Table 4-7 summarizes the data quality objectives for precision, bias, and completeness for all analyses.

Instrument performance checks for GC/MS are performed every 12 hours.

For the analysis of semivolatile organic compounds (SVOCs) (4-methylphenol), and most conventional parameters, initial instrument calibrations are required before any samples are analyzed after each major disruption of equipment, and when ongoing calibration fails the acceptance criteria. Ongoing calibration is required before and after every 10 samples for inorganics or every 12 hours for organics methods.

Surrogates are required for all organic analyses, for every sample, including matrix spike samples, blanks, and laboratory control samples. Matrix spike and matrix spike duplicates are required for SVOCs for every 20 samples received. Laboratory duplicates are required for selected conventional parameters.

A method blank is prepared with each sample batch.

All samples are diluted and reanalyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Reanalyses are performed if surrogate or spike recoveries are outside of control limits to demonstrate matrix effects.

To reduce interferences, the laboratory should first perform additional cleanup techniques identified in the methods before attempting diluting samples. If reanalysis is required, the laboratory shall report both initial and reanalysis results.

#### 4.3.1.4 Laboratory Data Quality Review and Reporting

The quality and usability of data collected in this investigation will be determined, based on the outcomes of data verification and validation, and expressed as data quality indicators. Precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity will be evaluated. Accuracy and precision control criteria for the project COCs in sediment is given in Table 4-7.

The analytical methods selected in this SAP are consistent with previous investigation at the site. However, there may be cases where individual analyses or detection limits are affected by sample matrices or analytical method limitations. Should this occur, those outliers will be identified in the data review and brought to the attention of the project team and client for discussion and resolution.

To ensure that investigation chemical data are sufficient to meet both qualitative and quantitative objectives, laboratory data deliverables that will permit a data quality assessment consistent with the requirements of this SAP are required.

The chemistry laboratory will provide a data package for each sample delivery group or analysis batch that is comparable in content to a full Contract Laboratory Program package. It will contain all information required for a complete quality assurance review, including the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered
- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from referenced methods and this SAP
- Chain-of-custody and cooler receipt forms
- A summary of analyte concentrations (to two significant figures, unless otherwise justified), method reporting limits, and method detection limits
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Sample preparation, extraction, dilution, and cleanup logs
- Instrument tuning data
- Initial and continuing calibration data, including instrument printouts and quantification summaries, for all analytes

- Results for method and calibration blanks
- Results for all QA/QC checks, including surrogate spikes, laboratory control samples, matrix spike samples, matrix spike duplicate samples, and laboratory duplicate or triplicate samples
- Original data quantification reports for all analyses and samples
- All laboratory worksheets and standards preparation logs
- An electronic data deliverable (EDD) in the Integral IDB format.

#### 4.3.1.5 Data Verification and Validation

All sediment chemistry, grain-size, and conventional data generated during this investigation will undergo data validation by EcoChem, Inc. (EcoChem). One hundred percent of all data generated will be subjected to Stage 3 data validation.

Data validation will be performed using the following guidance:

- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA 2017a)
- USEPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Methods Data Review (USEPA 2017b).

The data validation will examine and verify the following parameters against criteria set forth in this SAP:

- Sample management and holding times
- Instrument tuning, calibration, and calibration verification
- Retention time windows
- Chromatographic resolution checks
- Laboratory and field blank results
- Detection and reporting limits
- Laboratory replicate results
- Matrix spike/matrix spike duplicate results
- Laboratory control sample results
- Field quality control sample results
- Surrogate spike recovery (organic analyses only)
- Internal standard recovery (internal calibration methods only).

Final data qualifiers will be assigned based on applicable laboratory qualifiers and outcome of the data validation.

In cases of multiple analyses (such as an undiluted and a diluted analysis) performed on one sample, the optimal result will be determined and only the determined result is to be reported for the sample.

### 4.3.2 Geotechnical Testing

The intact core samples collected for physical/geotechnical characterization will be tested for water content, loss on ignition, wet and dry bulk density, and particle size distribution via laser diffraction. The Beckman Coulter LS 13-320 particle size analyzer determines particle size distributions across 93 bins between 0.375 and 2,000 μm. Particles larger than 2,000 μm will be sieved and separated prior to laser diffraction analysis. Sediment will also be analyzed for water content, loss on ignition, and bulk density through a series of comparisons of wet and dry weights. Particle size results can also be used to support SPI analysis of grainsize distribution.

### 4.3.3 Toxicity Testing

The laboratory will conduct a standardized 10-day amphipod test using *Eohaustorius estuarius*, consistent with site monitoring events conducted since 2004 (Integral 2009). Protocols and QA/QC performance standards for this test are described in PSEP (1995).

Adult amphipods will be collected in the field and acclimated to the test water temperature and salinity for 3–4 days prior to testing. For each toxicity test replicate, 20 amphipods will be exposed to a 2-cm layer of bedded test sediment in a 1-L chamber filled with clean seawater. After the 10-day exposure period, the surviving amphipods in each test chamber will be sieved from the sediment and counted. Percent mortality will be determined relative to the total of 20 individuals added to each chamber at the beginning of the test.

All toxicity tests will be conducted using positive and negative controls; blind testing of samples; and measurements of salinity, pH, temperature, dissolved oxygen, and ammonia. For this study, ammonia will be used as the reference toxicant, and a sediment sample from Yaquina Bay, Oregon, will be used as the negative control.

#### 4.3.3.1 Quality Assurance / Quality Control

Laboratory QA/QC procedures for the amphipod mortality test include the use of positive and negative controls and daily measurement of water quality conditions (i.e., temperature, salinity, pH, and dissolved oxygen) in each test chamber. Appropriate ranges of water quality variables are as follows:

- Temperature: 15 ± 1°C

- pH: 8 ± 1 pH units (desirable)
- Salinity: 28 ± 1 ppt
- Dissolved oxygen: >5 mg/L (desirable).

All procedures will be carried out according to PSEP (1995) guidance. Only healthy organisms will be used for testing. Positive and negative controls will be tested concurrently with each toxicity test series. Reference toxicants (i.e., positive controls) will be used to provide insight into mortalities or increased sensitivity that may have occurred as a result of disease or the potential stresses related to handling, acclimation, and testing (e.g., loading density). Negative controls will be used to confirm the viability of the test organisms in the absence of stressors introduced with the test sediment. Results from a series will not be accepted if mean mortality in the negative controls exceeds 10 percent.

Integral will conduct a quality assurance review of toxicity test laboratory procedures and results to ensure that the toxicity tests are consistent with the specifications of the test protocols and that the data are acceptable for use in future stages of the monitoring program. The complete quality assurance report will be included as an appendix to the final report.

#### 4.3.3.2 Laboratory Data Reporting

The following information will be reported by the toxicity testing laboratory to allow a complete quality assurance review of the sediment toxicity data:

- Results for all water quality measurements made during testing (i.e., ammonia, dissolved oxygen, pH, temperature, and salinity)
- The 10-day survival value for each exposure chamber and the mean and standard deviation for each treatment
- The 10-day survival value for each exposure chamber and the mean and standard deviation for the negative control (i.e., laboratory reference sediment)
- The 96-hour $LC_{50}$ values for the positive control tests
- Information on the source of test organisms (i.e., must be from the same source)
- Information on the type of test chambers used (must be identical), and information on the amount of sediment and overlying water in each test chamber (must also be identical)
- PDF copies of all laboratory data sheets and bench sheets
- Descriptions of any problems that may have influenced data quality and any corrective actions taken by the laboratory (may only be taken with the project QA/QC officer's concurrence).

### 4.3.4 Benthic Taxonomy

Sediment samples for benthic macroinvertebrate enumeration and identification will be sieved using a mesh size of 1.0 mm and preserved in the field prior to shipment. At the laboratory, detritus will be removed from the samples by technicians. Benthic taxonomists will sort the invertebrates in each sample. After sorting has been completed, organisms will be identified to the lowest taxonomic level possible; the target being species level. All taxa will be identified in their entirety. All taxonomic identifications will be made by qualified taxonomists and will be based on published keys. For incomplete specimens, only the anterior or posterior ends will be enumerated, depending upon the taxon. All identifications will be made using binocular-dissecting or compound microscopes. If possible, at least two pieces of literature will be used for each species identification. Moreover, each species identification will be verified by a taxonomic expert or checked against a reference specimen from a verified reference collection.

After completing taxonomic identifications, all organisms will be placed in vials containing 70 percent ethyl alcohol, 25 percent water, and 5 percent glycerine. These vials will be sealed. A label will be affixed to each vial with the following information: survey name, sample number, and date of collection.

Each taxonomist will record initial identifications and counts on sample data sheets. Any pertinent notes and comments on the organisms in each sample will also be recorded. The taxonomist will then sign and date the sample data sheet. All data sheets will be kept in the laboratory at all times so the laboratory supervisor can check questionable identifications and follow the progress of each sample.

#### 4.3.4.1 Quality Assurance/Quality Control

At least 25 percent of one replicate from each sample will be re-sorted for QA/QC purposes. Re-sorting is the examination of a sample or subsample that has been sorted once and is considered free of organisms. It is critical that the re-sorted sediment aliquot be a representative subsample of the total sediment sample. Care should be taken to examine the preservative in each sample for any organisms that may be floating in the preservative. Re-sorting should be conducted using a dissection microscope capable of magnification to 25X. A partial re-sorting of every sample ensures that any gross sorting errors are detected. Re-sorting will be conducted by an individual other than the one who sorted the original sample.

Each sample aliquot that is selected for re-sorting will be checked for removal of ≥95 percent of total organisms. Thus, each sample elicits a decision concerning a possible re-sort. If a sample is found that does not meet the recommended 95 percent removal criterion, the entire sample will be re-sorted.

When taxonomic error or inconsistency is found, all previous results generated by the taxonomist responsible for the error or inconsistency should be evaluated to identify those

samples that may be affected. This process, which should be carefully documented by the laboratory, can be very time-consuming. However, upon completion of all taxonomic work, few (if any) taxonomic errors or inconsistencies should remain in the data set. Avoiding errors and inconsistencies through the constant interchange of information and ideas among taxonomists is the best way to minimize time lost from faulty identifications.

When all identification and QA/QC procedures are completed, the jars containing the vials of identified species will be topped off with a solution of 5 percent glycerine/70 percent ethyl alcohol. The lids will then be sealed tightly with black electrical tape to prevent evaporation. Each container will be labeled clearly with the survey name, date of collection, and number and type of samples within.

#### 4.3.4.2 Laboratory Data Reporting

The following information will be reported by the taxonomic laboratory to allow a complete quality assurance review of the benthic invertebrate enumeration data:

- The number of individuals of each taxon found in each replicate sample. Data for each replicate sample will be reported as numbers of individuals per sample for each species (or lowest identifiable taxon).
- Information on standard invertebrate metrics such as taxonomic richness, community evenness, Shannon-Wiener diversity, and percent composition in functional feeding groups.
- Information on the sample-sorting efficiency (a minimum of 95 percent of the total number of individuals in each sample is required [i.e., no more than 5 percent of the organisms in a given sample can be missed by the original sorter]).
- Information on accuracy of the taxonomic identifications by each taxonomist (i.e., accurate for at least 95 percent of the total number of species).
- Project reference collection of all taxa and a list of all literature used for taxonomic identifications of each taxon.
- PDF copies of all laboratory data sheets.

# 5 RECORDS MANAGEMENT AND REPORTING

The flow of data from the field team to the laboratories and from the laboratories to the data users will be fully documented to ensure that the data are properly tracked, reviewed, and validated for use. During the course of the project, all electronic and hard copy data deliverables will be maintained as part of the project file. Following completion of the project, all records, including field notebooks, chain-of-custody records, field data sheets, disks, laboratory reports, and project reports will be filed and/or provided to the client as requested.

## 5.1 DATA MANAGEMENT

During field, laboratory, and data evaluation operations, effective data management is critical to providing consistent, accurate, and defensible data and data products.

### 5.1.1 Field Data

Daily field records (a combination of field logbooks, field forms, photograph logs, equipment log/calibration books, GPS records, and chain-of-custody forms) will make up the primary documentation for field activities. Upon completion of sampling, hard copy notes and forms will be scanned to create an electronic record. Information on sampling locations, dates, depths, equipment, relevant field conditions, and sample identifiers will be entered into the project database. One hundred percent of hand-entered data will be verified based on hard copy records. Electronic quality assurance checks to identify anomalous values will also be conducted following entry. Hard copies of field data will be transferred to archive after completion of the project.

### 5.1.2 SPI Data

NewFields' field logs and full-resolution copies of all images collected (both JPEG and NEF file formats), as well as quality assurance images (e.g., Kodak color/gray card shots), will be provided to Integral no later than 1 week following the SPI survey completion. Image file transfer in the field is preferred. These will be stored in digital project files for analysis with Integral's integrated, MATLAB-based iSPI software.

### 5.1.3 Laboratory Data

The analytical laboratory will submit EDDs in conjunction with PDF analytical report(s). The project database administrator or the designated data manager will specify the appropriate format for EDDs to the laboratory, and the project data manager and laboratory coordinator will discuss these specifications with laboratory quality assurance managers prior to data delivery and tailor them as necessary to specific laboratory capabilities. The data manager will

perform quality assurance checks of format and consistency to EDDs received from the laboratory. After any issues have been resolved, the data will be loaded into the project database. Each data set loaded will be linked to the electronic document of the relevant laboratory data package. Data summaries will be produced from the database for use by data validators. Validators will return edited versions of these summaries, and the revisions will then be incorporated into the database. An automated change log will be maintained by the database so that the history of all such revisions is maintained, and the provenance of each data record can be determined.

Geotechnical data will be summarized in a data report. PDF summaries of particle size data including relevant statistics will be provided for each sample. Each sample summary will be based on the three analyses the Beckman Coulter Laser Diffraction particle size analyzer performs on each sample. Raw data of volume percentage for each of the three tests per sample will also be included in the data package. PDF summaries of water content, wet and dry bulk density, and loss on ignition for each sample will also be provided. Data tables and calculations will undergo standard QA procedures prior to delivery.

The biological laboratory will provide PDF copies of the final data reports and supporting materials (e.g., toxicity test bench sheets) for both the toxicity tests and taxonomic evaluations. In addition, the laboratory will provide Excel files containing results. Toxicity data will be validated as discussed in Section 4.3.2.1. Taxonomic data will undergo quality assurance review as discussed in Section 4.3.3.1. Data will be loaded into the project database. Each data set loaded will be linked to the electronic document of the relevant laboratory data package.

### 5.1.4 Database

Project data will be compiled and maintained in a relational database that accurately represents the natural structure of information, including locations, dates, sample types, personnel, and all the identifiers and attributes of the different chemical, biological, and physical measurements. The database is tailored to environmental investigations and accommodates a wide variety of data types, including chemical measurements in any type of medium. The database explicitly represents geographic features and therefore allows spatial operations to be conducted within the database itself (e.g., to find all sampling locations within a specified area of interest). The database supports the storage of chain-of-custody information and laboratory quality control information, and further extends the rigor of chain-of-custody documentation into the database itself by maintaining a complete audit trail of all changes made to the data. The database will incorporate rules to guarantee basic data integrity, and all data management activities (data loading, updating, summarization, and reporting) will be carried out using scripts, and those scripts will be kept under version control to establish a detailed functional history of data operations. The database itself will also maintain an automatic log of all data additions and changes. These and other procedures and standards will ensure that the data management goals will be fully met and will ensure data of the highest quality.

## 5.2 REPORTING

Data will be presented and evaluated in a technical report. The sediment triad data (chemistry, toxicity, benthos) and SPI data will be used to document current benthic habitat conditions. If requested, results can be compared to the 2007 data[3] (Integral 2009) to assess whether the sediment RAOs are still being met in sediments located in the vicinity of the proposed cruise ship dock prior to any construction and operations.

In addition to helping define current surface sediment conditions, the SPI survey data should provide information on the presence and mixing of TLP cap material into the bottom, the distribution of wood debris in surface sediments, and the extent of ambient sediment deposits on the TLP cap material since its placement. The SPI survey will provide a baseline "*in situ* view" of the bottom at and surrounding the planned cruise ship dock.

## 5.3 PROJECT SCHEDULE

The anticipated project schedule is as follows:

- SAP
  - Client review draft January 10, 2020
  - Final report January 17, 2020
- Field Event
  - Mobilization week of January 6, 2020; equipment departs Seattle on barge to Ketchikan on January 10, 2020
  - Field days (including travel, on-site mobilization/demobilization, and on-water days) January 17–25, 2020
- Laboratory and Image Analysis
  - Final validated data sets available for use by April 30, 2020
- Data Evaluation and Technical Reporting
  - Client technical report review draft June 1, 2020
  - Final report July 1, 2020.

[3] As noted previously, routine monitoring of the site called for sampling to be conducted in July. As this sampling is being done in the winter, direct comparison with historical data many not be useful. Nonetheless, information on current macroinfauna community structure will be obtained.

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# Figures

N:\GIS\Projects\ Projects 2000 to 2999\C2174 DockMonitoring_TMC\Production MXDs\SAP\Figure 1_1 Planned SPI Locs.mxd 1/9/2020 1:44:25 PM

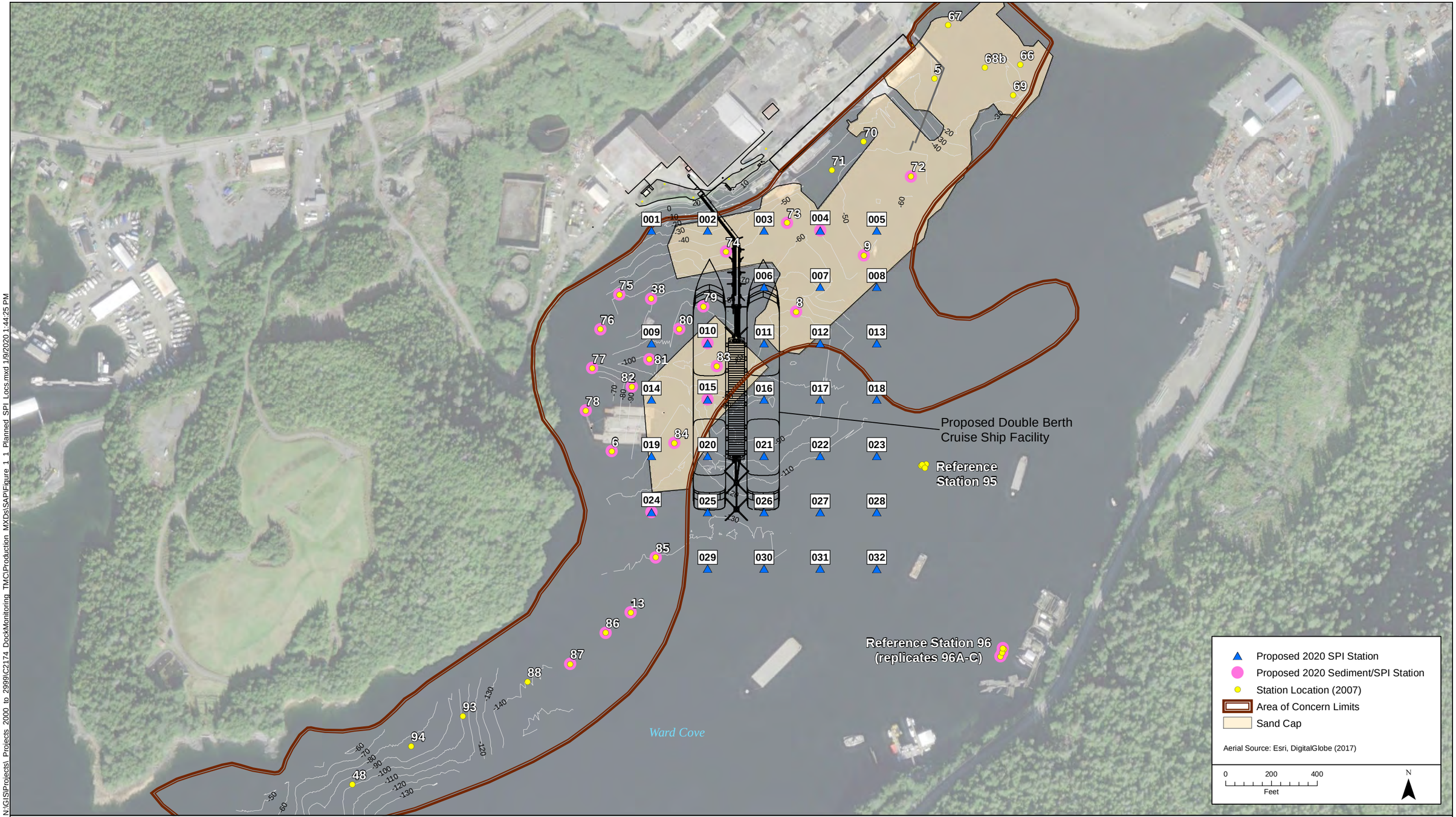


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**Figure 1-1.**
Planned SPI and Sediment Sampling Locations


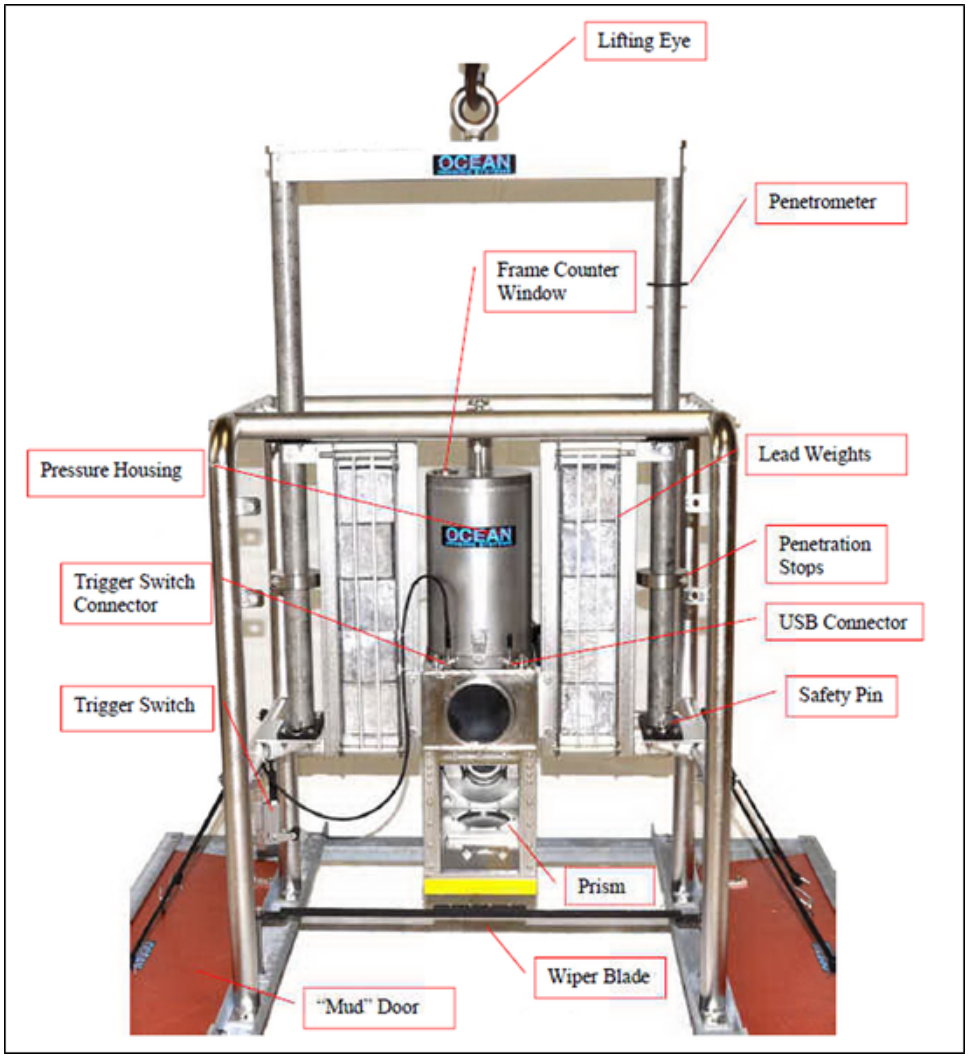


**Figure 3-1.**
Sediment Profile and Plan View Camera System

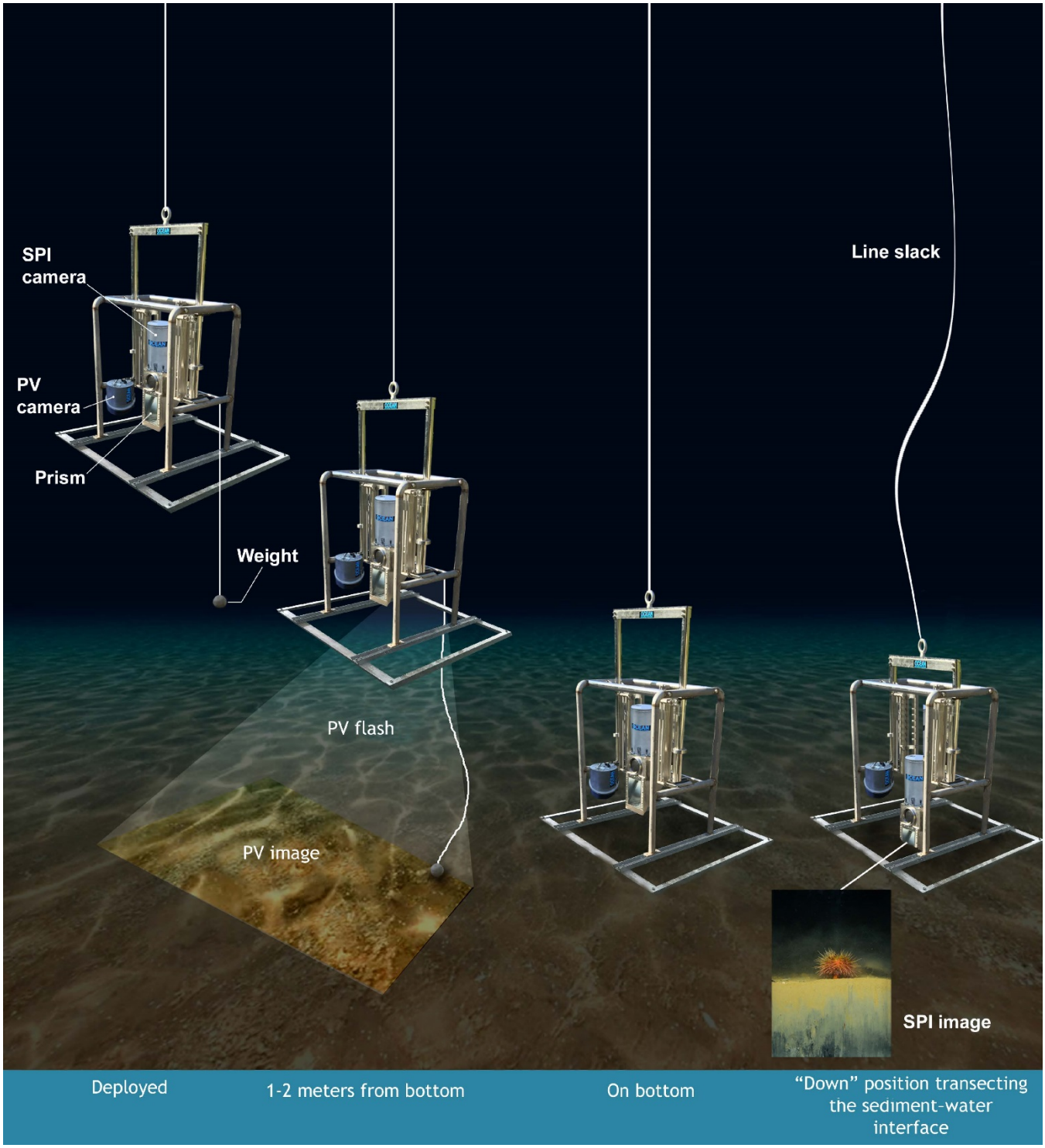


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**Figure 3-2.**
Sediment Profile and Plan View Camera System Deployment

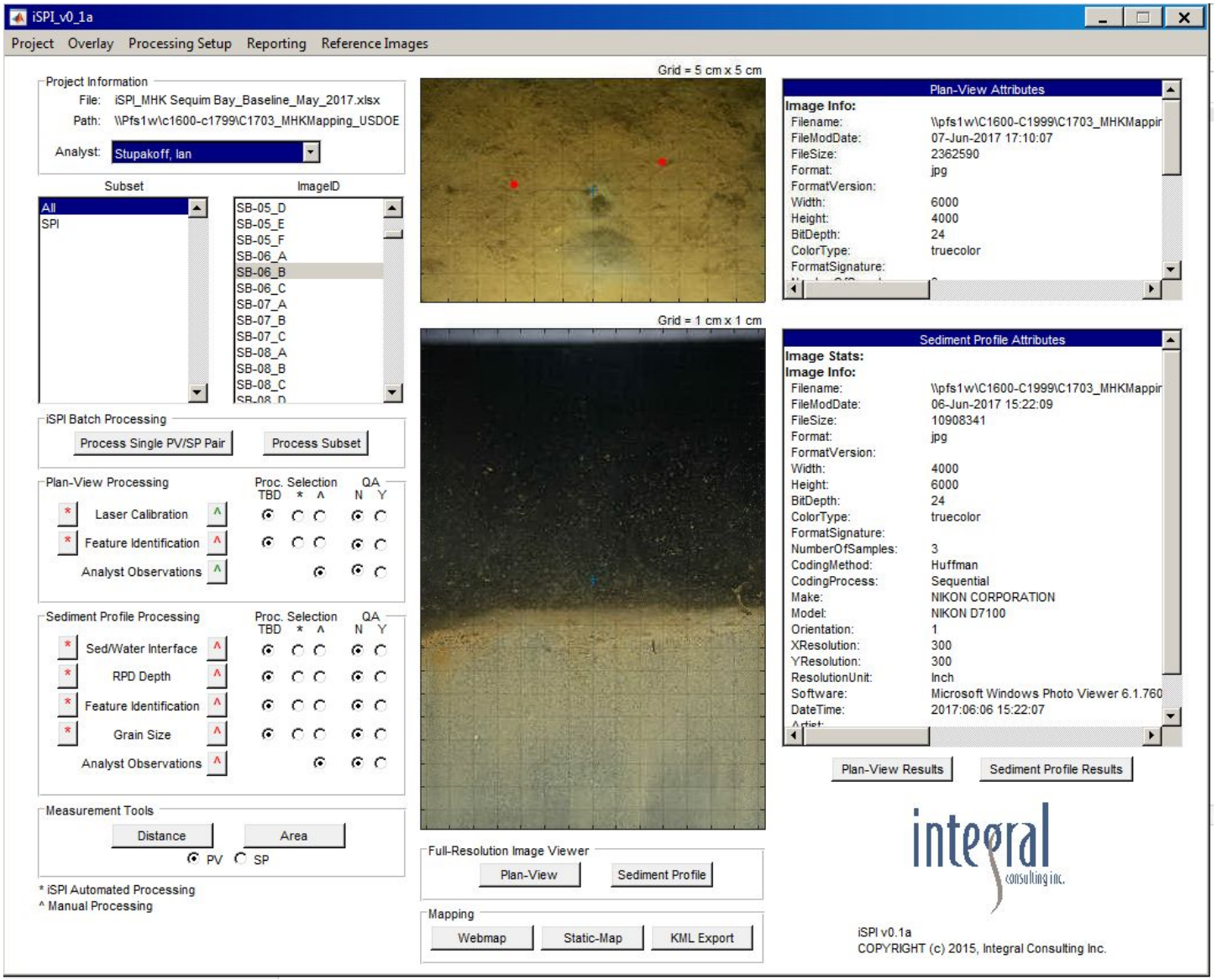


**Figure 3-3.**
iSPI Display

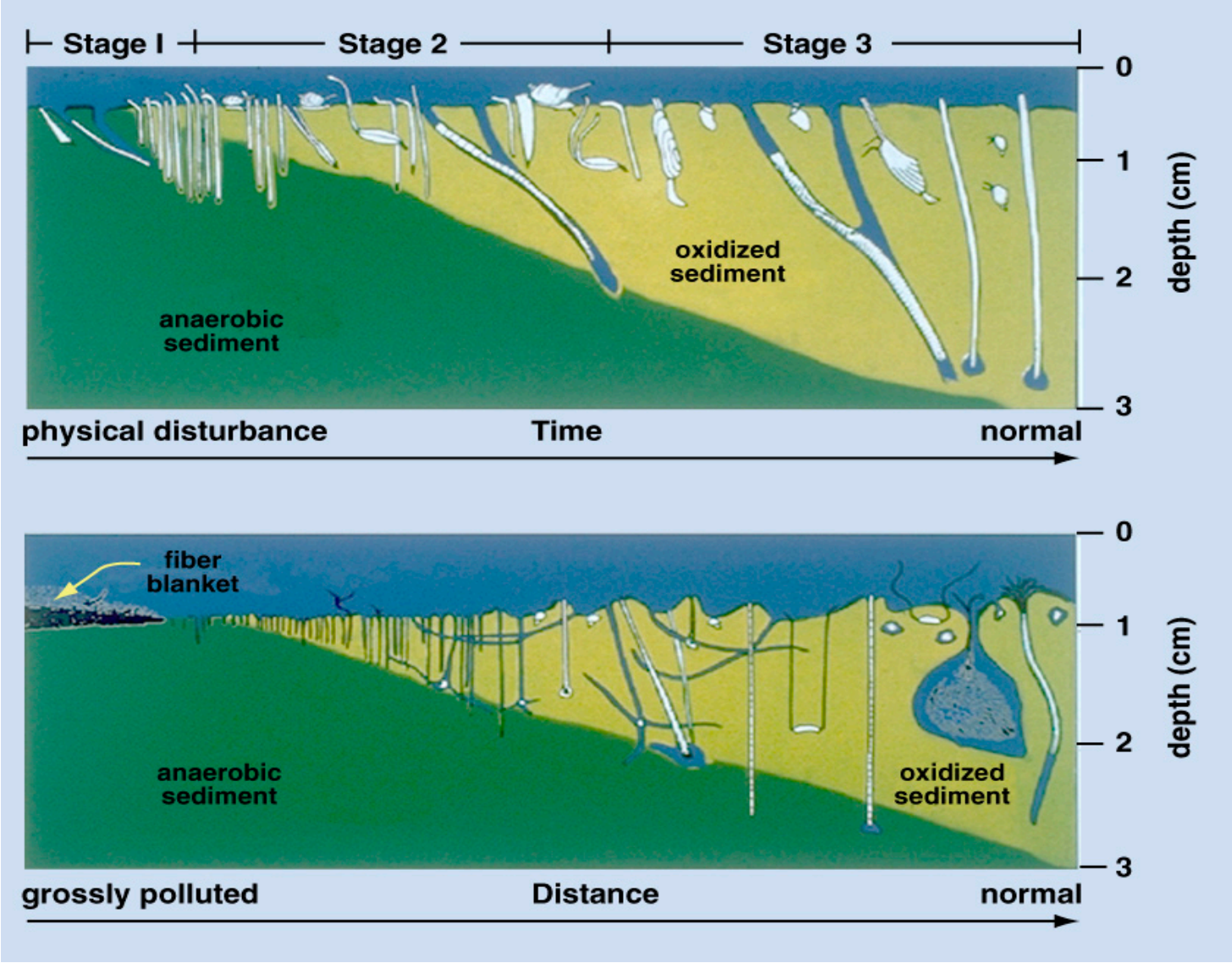


**Figure 3-4.**
Benthic Infaunal Successional Patterns and Stages That Develop Over Time Following a Disturbance (from Rhoads and Germano 1982)

# Tables

Table 2-1. Project Contact Information

| Company | Contact | Title | Email Address | Phone Number |
|---|---|---|---|---|
| Turnagain Marine Construction | Jason Davis | President | jdavis@turnagain.build | 907 261 8960 |
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| Integral Consulting Inc. | Manon Tanner-Dave | Senior Chemist | mtanner@integral-corp.com | 503-943-3616 |
| Integral Consulting Inc. | Tom Schulz | Data Management | tschulz@integral-corp.com | 360-705-3534, ext. 414 |
| NewFields Sediment Management and Marine Sciences LLC | John Nakayama | SPI Camera Operator | jnakayama@newfields.com | 206-276-0257 |
| ALS Kelso | Mark Harris | Project Manager | mark.harris@ALSGlobal.com | 360-501-3376 |
| EcoChem, Inc. | Christina Mott Frans | Project Manager | cmfrans@ecochem.net | 206-233-9332 |
| EcoAnalysts, Inc. | Brian Hester | Project Manager | bhester@ecoanalysts.com | 360-297-6040, ext. 6045 |

Table 4.1 Overview of Sampling Strata and Target Sediment Sampling Locations

| Stratum ID | Depth Category (ft MLLW) | Remediation Category | Station IDs [a] |
|---|---|---|---|
| 1 | Very shallow (<20) | Thin capping | 5, 66, 67, 68, 69 |
| 2a | Shallow (20–70) | Thin capping | **9**, **72**, **73**, **74,** **004** [b] |
| 2b | Shallow (20–70) | Natural recovery (thick organic deposits) | **38**, 70, 71, **75,** **76**, **77**, **78** |
| 2c | Shallow (20–70) | Natural recovery (thin organic deposits) | 47, 89, 90, 91, 92 |
| 3a | Moderate (70–120) | Thin capping | **8**, 48, **83**, **84**, 93, 94, **010** [b]**, 015** [b] |
| 3b | Moderate (70–120) | Natural recovery | **6**, **79**, **80**, **81**, **82** |
| 4 | Deep (>120) | Natural recovery | **13**, **85**, **86**, **87**, 88, **024** [b] |
| 5a | Shallow (20–70) | Reference | **96** [c] |
| 5b | Moderate (70–120) | Reference | 95 |

Notes:
MLLW = mean lower low water
SPI = sediment profile imaging

[a] Target sample locations in **bold**.
[b] Proposed 2020 SPI location; not a previously sampled location.
[c] Three replicates will be collected.

Table 4-2. Target Sampling Location Coordinates

| Station | Location | Latitude (Dec. Degrees) | Longitude (Dec. Degrees) | Latitude | Longitude |
|---|---|---|---|---|---|
| **Target Sediment and SPI Sample Locations** | | | | | |
| 6 | Site | 55.402658 | -131.731693 | 55° 24.1595' N | 131° 43.9016' W |
| 8 | Site | 55.404265 | -131.727738 | 55° 24.2559' N | 131° 43.6643' W |
| 9 | Site | 55.404911 | -131.726280 | 55° 24.2947' N | 131° 43.5768' W |
| 13 | Site | 55.400725 | -131.731393 | 55° 24.0435' N | 131° 43.8836' W |
| 38 | Site | 55.404471 | -131.730776 | 55° 24.2683' N | 131° 43.8466' W |
| 72 | Site | 55.405845 | -131.725241 | 55° 24.3507' N | 131° 43.5145' W |
| 73 | Site | 55.405330 | -131.727880 | 55° 24.3198' N | 131° 43.6728' W |
| 74 | Site | 55.405006 | -131.729178 | 55° 24.3004' N | 131° 43.7507' W |
| 75 | Site | 55.404528 | -131.731443 | 55° 24.2717' N | 131° 43.8866' W |
| 76 | Site | 55.404121 | -131.731858 | 55° 24.2473' N | 131° 43.9115' W |
| 77 | Site | 55.403658 | -131.732056 | 55° 24.2195' N | 131° 43.9234' W |
| 78 | Site | 55.403153 | -131.732218 | 55° 24.1892' N | 131° 43.9331' W |
| 79 | Site | 55.404358 | -131.729683 | 55° 24.2615' N | 131° 43.781' W |
| 80 | Site | 55.404096 | -131.730206 | 55° 24.2458' N | 131° 43.8124' W |
| 81 | Site | 55.403746 | -131.730850 | 55° 24.2248' N | 131° 43.8510' W |
| 82 | Site | 55.403421 | -131.731235 | 55° 24.2053' N | 131° 43.8741' W |
| 83 | Site | 55.403641 | -131.729440 | 55° 24.2185' N | 131° 43.7664' W |
| 84 | Site | 55.402735 | -131.730376 | 55° 24.1641' N | 131° 43.8226' W |
| 85 | Site | 55.401376 | -131.730835 | 55° 24.0826' N | 131° 43.8501' W |
| 86 | Site | 55.400495 | -131.731926 | 55° 24.0297' N | 131° 43.9156' W |
| 87 | Site | 55.400133 | -131.732693 | 55° 24.008' N | 131° 43.9616' W |
| 004 [a] | Site | 55.405228 | -131.727180 | 55° 24.3137' N | 131° 43.6308' W |
| 010 [a] | Site | 55.403920 | -131.729613 | 55° 24.2352' N | 131° 43.7768' W |
| 015 [a] | Site | 55.403245 | -131.729646 | 55° 24.1947' N | 131° 43.7788' W |
| 024 [a] | Site | 55.401916 | -131.730896 | 55° 24.115' N | 131° 43.8538' W |
| 96A | Reference Area | 55.400078 | -131.723648 | 55° 24.0047' N | 131° 43.4189' W |
| 96B | Reference Area | 55.400116 | -131.723610 | 55° 24.007' N | 131° 43.4166' W |
| 96C | Reference Area | 55.400171 | -131.723591 | 55° 24.0103' N | 131° 43.4155' W |
| **Target SPI-Only Sample Locations** | | | | | |
| 001 | Site | 55.405285 | -131.730730 | 55° 24.3171' N | 131° 43.8438' W |
| 002 | Site | 55.405266 | -131.729546 | 55° 24.316' N | 131° 43.7728' W |
| 003 | Site | 55.405246 | -131.728363 | 55° 24.3148' N | 131° 43.7018' W |
| 005 | Site | 55.405208 | -131.725996 | 55° 24.3125' N | 131° 43.5598' W |
| 006 | Site | 55.404573 | -131.728396 | 55° 24.2744' N | 131° 43.7038' W |
| 007 | Site | 55.404555 | -131.727213 | 55° 24.2733' N | 131° 43.6328' W |
| 008 | Site | 55.404535 | -131.726030 | 55° 24.2721' N | 131° 43.5618' W |
| 009 | Site | 55.403938 | -131.730796 | 55° 24.2363' N | 131° 43.8478' W |

Table 4-2. Target Sampling Location Coordinates

| Station | Location | Latitude (Dec. Degrees) | Longitude (Dec. Degrees) | Latitude | Longitude |
|---|---|---|---|---|---|
| 011 | Site | 55.403900 | -131.728430 | 55° 24.234' N | 131° 43.7058' W |
| 012 | Site | 55.403881 | -131.727246 | 55° 24.2329' N | 131° 43.6348' W |
| 013 | Site | 55.403861 | -131.726061 | 55° 24.2317' N | 131° 43.5637' W |
| 014 | Site | 55.403263 | -131.730830 | 55° 24.1958' N | 131° 43.8498' W |
| 016 | Site | 55.403226 | -131.728463 | 55° 24.1936' N | 131° 43.7078' W |
| 017 | Site | 55.403206 | -131.727280 | 55° 24.1924' N | 131° 43.6368' W |
| 018 | Site | 55.403188 | -131.726096 | 55° 24.1913' N | 131° 43.5658' W |
| 019 | Site | 55.402591 | -131.730863 | 55° 24.1555' N | 131° 43.8518' W |
| 020 | Site | 55.402571 | -131.729680 | 55° 24.1543' N | 131° 43.7808' W |
| 021 | Site | 55.402553 | -131.728496 | 55° 24.1532' N | 131° 43.7098' W |
| 022 | Site | 55.402535 | -131.727313 | 55° 24.1521' N | 131° 43.6388' W |
| 023 | Site | 55.402515 | -131.726130 | 55° 24.1509' N | 131° 43.5678' W |
| 025 | Site | 55.401898 | -131.729713 | 55° 24.1139' N | 131° 43.7828' W |
| 026 | Site | 55.401878 | -131.728530 | 55° 24.1127' N | 131° 43.7118' W |
| 027 | Site | 55.401860 | -131.727346 | 55° 24.1116' N | 131° 43.6408' W |
| 028 | Site | 55.401841 | -131.726161 | 55° 24.1105' N | 131° 43.5697' W |
| 029 | Site | 55.401225 | -131.729746 | 55° 24.0735' N | 131° 43.7848' W |
| 030 | Site | 55.401206 | -131.728563 | 55° 24.0724' N | 131° 43.7138' W |
| 031 | Site | 55.401186 | -131.727380 | 55° 24.0712' N | 131° 43.6428' W |
| 032 | Site | 55.401168 | -131.726196 | 55° 24.0701' N | 131° 43.5718' W |

Notes:
Coordinates are provided in World Geodetic System 1984 (WGS84).

[a] Proposed 2020 SPI location; not a previously sampled location.

Table 4-3. Sample Storage Requirements

| Analyte | Holding Time | Sample Size[a] | Preservation | Container |
|---|---|---|---|---|
| **Sediment Chemistry and Conventionals** | | | | |
| Grain size | 6 months | 100–200 g | 4±2ºC | (1) 16 oz. WMG or HDPE |
| Total solids | 10 days | 100 g | 4±2ºC | (1) 8 oz. WMG |
| Ammonia | 28 days | 100 g | | |
| Total organic carbon | 28 days | 100 g | | |
| 4-Methylphenol | 14 days[b] | 100 g | | |
| **Biological Testing / Evaluation** | | | | |
| 10-day Amphipod | 8 weeks | 3 L | 4±2ºC | poly bags (doubled) |
| Taxonomy | <long-term; preserved> | <variable> | 10% formalin, site water[c] | (2-3) 500 mL HDPE |

Notes:

HDPE = high density polyethylene

NA = not applicable

WMG = wide mouth glass

[a] Recommended minimum field sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retests.

[b] Holding time is 14 days to extraction and extracts must be analyzed within 40 days from extraction.

[c] Sample should not fill more than two-thirds of the container. Half the jar will contain site water, and the remainder will contain 10% formalin, creating a 5% formalin solution.

Table 4-4. Analyses and QA/QC Samples

| Analysis | No. of Samples[a] | Field Duplicates[b] | Equipment Rinsate Blank[b] | MS/MSD | Lab Replicates |
|---|---|---|---|---|---|
| Grain size | 28 | 5 | 0 | 0 | 1 |
| Total solids | 28 | 5 | 0 | 0 | 1 |
| Ammonia | 28 | 5 | 1 | 0 | 1 |
| Total organic carbon | 28 | 5 | 1 | 0 | 1 |
| 4-Methylphenol | 28 | 5 | 1 | 1 | 0 |

Notes:
MS/MSD = matrix spike/matrix spike duplicate

[a] Collect surface sediments (0-10 cm) at four historical stations from each of five of the benthic strata established in the Long-Term Monitoring and Reporting Plan as well as the two Ward Cove reference stations: N - 7 strata (5 sites + 2 ref) × 4 = 28 samples.

[b] A minimum of one field duplicate will be collected from each type of remedial action area in the AOC. Assume 1 field duplicate from each sampling station location plus 1 equipment rinsate blank.

Table 4-5. Chemical Parameters, Analytical Methods, and Reporting Limits

| Parameter | Prep/Cleanup Method | Analysis Method | Sediment RAOs | ALS SQLs MDL | ALS SQLs MRL |
|---|---|---|---|---|---|
| **Conventionals** | | | | | |
| Ammonia (mg/kg) | Plumb (1981) | Plumb (1981) | 1 | 0.08 | 0.5 |
| Grain size (%) | --- | PSEP (1986) | 0.1 | --- | 0.01 |
| Total organic carbon (%) | PSEP (1986)/SM 5310B | PSEP (1986)/SM 5310B | 0.5 | 0.02 | 0.05 |
| Total solids (%) | PSEP (1986)/EPA 160.3M | PSEP (1986)/EPA 160.3M | 0.1 | --- | 0.1 |
| **Semivolatile Organic Compounds (µg/kg dw)** | | | | | |
| 4-Methylphenol | EPA 3546/3640A | EPA 8270C-SIM | 10 | 4.5 | 10 |

Notes:
EPA = U.S. Environmental Protection Agency
MDL = method detection limit
MRL = method reporting limit
PSEP = Puget Sound Estuary Protocols
RAO = remedial action objective
SIM = selective ion monitoring
SM = Standard Method for the Examination of Water and Wastewater
SQL = sample quantitation limit

Table 4-6. Laboratory QA/QC Requirements

| Analysis Type | Method Blanks [a] | Field Splits [a] | LCS [a] | MS/MSD [a] | Surrogates [b] |
|---|---|---|---|---|---|
| Ammonia | X | X | X | X | --- |
| Grain size | --- | X | --- | --- | --- |
| Total organic carbon | X | X | X | X | --- |
| Total solids | --- | X | --- | --- | --- |
| 4-Methylphenol [c] | X | X [d] | X | X | X |

Notes:

LCS = laboratory control sample

MS/MSD = matrix spike/matrix spike duplicate

QA/QC = quality assurance and quality control

[a] Frequency of analysis is 5 percent or one per batch, whichever is more frequent.

[b] Surrogate spikes required for every sample, including matrix spiked samples, and blanks.

[c] Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10–12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.

[d] Matrix spike duplicate will be run.

Table 4-7. Project Data Quality Objectives—Sediment

| | Duplicate | Matrix Spike | | Blank Spike/LCS | | |
|---|---|---|---|---|---|---|
| Analysis Type | RPD | %R | RPD | %R | RPD | Completeness |
| **Conventionals** | | | | | | |
| Ammonia | 20% | 75-120 | 20 | 90-110 | 20% | 95% |
| Grain size | 20% | NA | NA | NA | NA | 95% |
| Total organic carbon | 20% | 75-120 | 20 | 90-110 | 20% | 95% |
| Total solids | 20% | NA | NA | NA | NA | 95% |
| **SVOCs** | | | | | | |
| 4-Methylphenol | 30% | 29-120 | 30% | 29-120 | 30% | 95% |

Notes:

%R = percent recovery

LCS = laboratory control sample

NA = not applicable

RPD = relative percent difference

SVOC - semivolatile organic compound

# Appendix A

Health and Safety Plan

# SITE-SPECIFIC HEALTH AND SAFETY PLAN

## Ward Cove Cruise Ship Dock Project

## Ward Cove, Alaska

*Prepared for*
**Turnagain Marine Construction**
8241 Dimond Hook Drive, Unit A
Anchorage, AK 99507

*Prepared by*

1205 West Bay Drive NW
Olympia, WA 98502

January 10, 2020

# KEY PROJECT AND SAFETY INFORMATION

## Site and Location

Site/Project Location:
Ward Cove Cruise Ship Dock
Ketchikan, AK 99928
*Township 74S, Range 90E, Sections 33 and 34, Copper River Meridian, USGS Quadrangle Juneau A5 NE; latitude 55.4037 and longitude -131.7316*

Project Client Contact:
Jason Davis
Turnagain Marine Construction
8241 Dimond Hook Drive, Unit A
Anchorage, AK 99507
Phone: (907) 261-8960
jdavis@turnagain.build

WorkCare Medical Contact Information
Tony Vo
300 S. Harbor Blvd., Suite 600
Anaheim, CA 92805
Phone: (714) 978-7488 ext. 2403
Tony.Vo@workcare.com

Incident Intervention Hotline
1-888-449-7787

## Project Manager

**Gene Revelas**
Work: (360) 705-3634, ext. 418
Cell: (360) 870-4950

## Corporate Health and Safety Manager

**Matthew Behum**
Work: (410) 573-1982, ext. 512
Cell: (443) 454-1615

## Nearest Hospital

**PeaceHealth Ketchikan Medical Center**
3100 Tongass Ave.
Ketchikan, AK 99901
(907) 225-5171
*See next page for hospital map and directions from the project site.*
*Site and hospital maps are also included in Attachment 1.*


**Directions from the site to the nearest hospital from downtown Ward Cove:**

1. Head south on N Tongass Hwy. for 5 mi.
2. Turn left onto Carlanna Lake Rd.
3. Turn right at first cross street onto Dale St.

# CONTENTS

# LIST OF ATTACHMENTS

# ACRONYMS AND ABBREVIATIONS

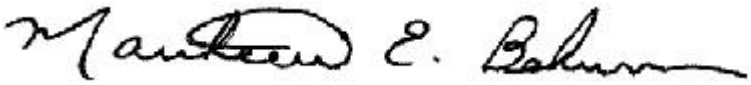
| | |
|---|---|
| AKOSH | Alaska Occupational Safety and Health |
| CFR | Code of Federal Regulations |
| CHSM | corporate health and safety manager |
| CPR | cardiopulmonary resuscitation |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| Integral | Integral Consulting Inc. |
| JHA | Job Hazard Analysis |
| OSHA | Occupational Safety and Health Administration |
| PFD | personal flotation device |
| PPE | personal protective equipment |
| R/V | research vessel |
| SHSP | site health and safety plan |
| SPI/PV | sediment profile imaging and plan view |
| SSO | site safety officer |
| Turnagain | Turnagain Marine Construction |
| USCG | U.S. Coast Guard |

# SITE HEALTH AND SAFETY PLAN APPROVAL

This site health and safety plan has been reviewed and approved for benthic habitat mapping and sediment sampling in Ward Cove, Alaska, using a sediment profile imaging and plan view (SPI/PV) system and surface sediment sampler.

January 9, 2020

Project Manager Date



January 8, 2020

Corporate Health and Safety Manager Date

# SITE HEALTH AND SAFETY PLAN ACKNOWLEDGMENT

In the absence of an appropriate subcontractor or consultant health and safety plan, and with the written approval of Integral Consulting Inc. (Integral) corporate health and safety manager, the subcontractor or consultant may utilize the Integral site health and safety plan (SHSP), provided there is written concurrence from the subcontractor or consultant that they will directly administer the plan for their employees and assume all risks associated with any possible errors or omissions in the plan. This SHSP does not cover any construction activities. The Integral SHSP is a minimum standard for the site and will be strictly enforced for all Integral personnel, or its subcontractors or consultants where applicable.

I have reviewed the SHSP prepared by Integral, dated January 10, 2020, for the fieldwork involved with the SPI/PV and surface sediment survey in Ward Cove, Alaska. I understand the purpose of the plan, and I consent to adhere to its policies, procedures, and guidelines while an employee of Integral, or its subcontractors or consultants. I have had an opportunity to ask questions regarding this plan, which have been answered satisfactorily by Integral.

| | | |
|---|---|---|
| Employee signature | Company | Date |
| Employee signature | Company | Date |
| Employee signature | Company | Date |
| Employee signature | Company | Date |
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| Employee signature | Company | Date |
| Employee signature | Company | Date |

# 1 INTRODUCTION

It is the policy of Integral Consulting Inc. (Integral) to provide a safe and healthful work environment that is compliant with applicable regulations. No aspect of the work is more important than protecting the health and safety of all workers.

This site health and safety plan (SHSP) provides general health and safety provisions to protect workers from potential hazards during field activities Ward Cove, Alaska, at the Cruise Ship Dock. This SHSP has been prepared in accordance with Alaska and federal Occupational Safety and Health Administration (OSHA) safety regulations. Workplace health and safety regulations within the state of Alaska, with a few exceptions, are covered by the Alaska Occupational Safety and Health (AKOSH) Section, which is administered by the Division of Labor Standards and Safety of the Alaska Department of Labor and Workforce Development. AKOSH is the state equivalent of the federal government's Occupational Safety and Health Act, which is administered by OSHA. This SHSP follows both AKOSH and federal OSHA Hazardous Waste Operations Emergency Response (HAZWOPER) and applicable regulations in 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926.

Attachments to the SHSP provide a site-specific map and specific routes to the hospital from the site (Attachment 1), regulatory notices (Attachment 2), safety procedures (Attachment 3), near-miss/near-loss incident report (Attachment 4), employee exposure/incident report (Attachment 5), Job Hazard Analysis (JHA) Assessment form (Attachment 6), and a field safety tailgate briefing form (Attachment 7).

This SHSP has been prepared to identify potential site hazards to the extent possible based on information available to Integral. Integral cannot guarantee the health or safety of any person entering this site. Because of the potentially hazardous nature of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury and illness at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior evaluation by trained health and safety personnel.

A copy of this SHSP must be in the custody of the field crew during field activities. All individuals performing fieldwork must read, understand, and comply with this plan before undertaking field activities. Once the information has been read and understood, the individual must sign the Site Health and Safety Plan Acknowledgment form provided as part of this plan. The signed form will become part of the project file.

This plan may be modified at any time based on the judgment of the Integral site safety officer (SSO) in consultation with the project manager and Integral corporate health and safety

manager (CHSM) or designee. Any modification will be presented to the onsite team during a safety briefing and will be recorded in the field logbook.

## 1.1 OBJECTIVES AND METHODS

Integral is under a subcontract to Turnagain Marine Construction (Turnagain) to perform a baseline survey in support of construction activities at a cruise ship docking facility in Ward Cove, Alaska.

The primary objective of this field effort is to establish the current (baseline) physical, chemical, and biological characteristics of sediment in the vicinity of the proposed Ward Cove cruise dock, as well as at Ward Cove reference areas established during Ketchikan Pulp Company's Comprehensive Environmental Response, Compensation and Liability Act sediment cleanup concluded in 2009 (Keeley 2009, pers. comm.).

To meet these objectives, field activities will include surface sediment sampling and sediment profile imaging and plan view (SPI/PV) image collection. Aboard a sampling vessel, a single van Veen grab sampler will be used to collect the in-water surface sediment samples (0–10 cm). An SPI/PV camera system will be used to collect images of the sediment profile and an overview snapshot of the seafloor. Additional details on the objectives and methods are presented in the sampling and analysis plan to which this SHSP is appended.

## 1.2 ORGANIZATION

This SHSP covers the benthic habitat mapping and surface sediment collection in Ward Cove, Alaska, with the deployment of the SPI/PV system and single van Veen grab sampler. Chemical and physical hazard evaluations are presented in Sections 3 and 4, respectively. Specific health and safety guidelines associated with each task, including a brief description of the work, are discussed in Section 12 (Task-Specific Safety Procedures).

## 1.3 ROLES AND RESPONSIBILITIES

All Integral personnel, subcontractors, or consultants and visitors on this site must comply with the requirements of this SHSP. Other health and safety orientations will be given by the captain of the sampling vessel. The specific responsibilities and authority of management, safety and health, and other personnel on this site are detailed in the following paragraphs.

### 1.3.1 Site Safety Officer

The SSO has full responsibility and authority to implement this SHSP and to verify compliance. The SSO reports to the project manager and is onsite or readily accessible to the site during all

work operations. The SSO is responsible for assessing site conditions and directing and controlling emergency response activities. The specific responsibilities of the SSO include:

- Managing the safety and health functions on this site
- Serving as the onsite point of contact for safety and health concerns
- Assessing site conditions for unsafe acts and conditions and ensuring corrective action
- Ensuring that all Integral employees and subcontractors understand and follow the SHSP
- Ensuring that daily work schedules and tasks are reasonable for the required levels of effort and weather conditions
- Confirming local emergency response phone numbers and locations
- Conducting and documenting the initial and daily or periodic health and safety briefings
- Evaluating and modifying the level of protective apparel and safety equipment, based on site conditions
- Ensuring that the field team observes all necessary decontamination procedures.

If the SSO determines that site conditions are unsafe, he or she has the authority to suspend field operations until the problem is corrected. The SSO can modify SHSP procedures in the field. Any changes must be documented in the field logbook, and field staff must be immediately informed of the change. The project manager and Integral's CHSM must be notified by phone or email within 24 hours of any major changes to the SHSP.

### 1.3.2 Project Manager

The project manager has overall responsibility to ensure that personnel working onsite are safe. The specific responsibilities of the project manager include:

- Ensuring that the SHSP is developed prior to the fieldwork or site visit
- Reviewing and approving the SHSP prior to the fieldwork or site visit
- Ensuring employee understanding of and compliance with the SHSP.

### 1.3.3 Corporate Health and Safety Manager

The CHSM provides guidance to the project manager and SSO on SHSP preparation, and reviews and approves the SHSP. The CHSM also serves as an arbitrator if there is a conflict

between the project manager, SSO, and field personnel. In addition, the CHSM[1] conducts periodic unannounced audits of Integral field operations to ensure compliance with the SHSP.

### 1.3.4 Field Personnel

All Integral personnel and subcontractors on this site are responsible for reading and complying with this SHSP, using the proper personal protective equipment (PPE), reporting unsafe acts and conditions, and following the work and safety and health instructions of the project manager and SSO. All Integral personnel, subcontractors, or consultants can and are encouraged to suspend field operations if they believe conditions have become unsafe.

## 1.4 SITE DESCRIPTION

**Site history:** Ward Cove, Alaska, is located approximately 10 km north of Ketchikan, Alaska. Pulp mill operations on Ward Cove ended in 1997. In 2000 and 2001, the remedy implemented in the 80-acre Ward Cove sediment area of concern consisted of the placement of a thin sand cap across 28 acres of the site and monitored natural recovery across the remaining areas. In 2007, the sediment monitoring event showed that Ward Cove sediments in both the capped and uncapped areas had achieved the remedial action objectives of eliminating or minimizing the ecological risks associated with toxicity of sediments to benthic organisms, based on the chemical, toxicity testing, and benthic community composition results obtained that year.

The dock area adjacent to Ward Cove will be used to stage and set up the SPI/PV and sediment sampling equipment. A sampling vessel provided by Turnagain will be used to perform the SPI/PV and surface sediment survey. Attachment 1 shows the emergency route from Ward Cove to Peace Health Ketchikan Medical Center.

- **Current site uses:** Light industry and recreational area
- **Hazardous waste site:** No
- **Industrial waste site:** No
- **Topography (if applicable):** Ward Cove, open water
- **Site access:** Dock at Ward Cove
- **Nearest drinking water/sanitary facilities:** Bottled water will be provided on the sampling vessel
- **Nearest telephone:** Cell phone will be used by the field crew
- **Size of site:** Approximately 80 acres

[1] The audit task may be delegated to an office health and safety representative by the CHSM.

- **Pathways for hazardous substance dispersion:** Skin absorption, skin contact, eye contact, and inhalation.

## 1.5 PROJECT MANAGER AND OTHER KEY CONTACTS

| | Name (Affiliation) | Work Telephone | Cell Phone |
|---|---|---|---|
| Project Manager | Gene Revelas (Integral) | (360) 705-3534 ext. 418 | (360) 870-4950 |
| Site Safety Officer | Stefan Wodzicki (Integral) | | (360) 303-2708 |
| Corporate Health and Safety Manager | Matthew Behum (Integral) | (410) 573-1982 ext. 512 | (443) 454-1615 |
| Senior Project Manager | Jason Davis (Turnagain) | (907) 261-8960 | (907) 602-7412 |
| Project / Field Manager | Chris Nielsen (Turnagain) | (907) 261-8967 | (907) 891-5499 |
| Facility Contact | Mark Keller (Ward Cove Dock Group Representative) | (206) 419-4080 | |

# 2 HAZARD ANALYSIS

The primary hazards for this project are associated with working overwater and include falling overboard and suffering injury, exposure effect, and potentially death by drowning.

These hazards as well as additional project hazards have been ranked in the JHA Assessment Form, provided in Attachment 6 of this SHSP, using minor, moderate, serious, and most severe health and safety hazards based on current site knowledge. Hazards that are not applicable are left blank in the form. The results of this analysis are used to verify that controls in the JHA form or other supporting documents are adequate to mitigate the identified task hazards. When staff are in the field, they should use the Field Safety Tailgate Briefing Form for task-specific evaluation of task hazards (Attachment 7).

## 2.1 JOB HAZARD ANALYSIS

A JHA form has been completed for the Ward Cove SPI/PV and sediment sampling survey. The deployment of the SPI/PV camera system has been identified as a safety critical task. The JHA form is in Attachment 6. The hazards identified in Section 4 are addressed specifically in the JHA form, as are control methods to protect personnel and property from hazards. The JHA form also lists the type of personal protective equipment (PPE) required for the completion of the project. A detailed summary of PPE for the project is provided in Section 5. The following JHA form is included in this SHSP:

- JHA ID 001 – Ward Cove Cruise Ship Dock—SPI Survey
- JHA ID 002 – Ward Cove Cruise Ship Dock—Sediment Surface Sampling.

# 3 CHEMICAL HAZARD EVALUATION

Sediments to be analyzed for chemistry, toxicity, and benthos will be collected with a van Veen sediment sampler by Integral staff. During sediment sampling efforts, the field crew will be wearing nitrile disposable gloves and eye protection in addition to standard PPE described in Section 5. Sediments that may also adhere to the SPI/PV frame will be washed off the frame before landing on the sampling vessel.

Possible chemical exposure routes at the site include skin contact, skin absorption, and eye contact. Skin and eye exposures are minimized by the PPE specified for field personnel (Section 5). As discussed in Section 6 (Air Monitoring), additional respiratory protection is not expected to be needed, and air monitoring will not be conducted during sampling activities.

| Chemical of Concern | Concentration (site maximum or range expected) | Medium | OSHA PEL (ppm) | OSHA STEL (ppm) | OSHA IDLH (ppm) | IP(eV) | Carcinogen or Other Hazard |
|---|---|---|---|---|---|---|---|
| Formalin | 10% | Preservative | 0.75 | -- | 20 | -- | Suspected carcinogen; eye, skin, respiratory irritant |
| Sulfuric Acid | 25% | Preservative | 0.001 | -- | 0.015 | -- | Known/Suspected carcinogen |
| 4-Methylphenol | 25,000 µg/kg [a] | Site Sediment | 5 | -- | 250 | -- | Eye, skin, internal organ irritant (burns, illness) |
| Ammonia | 230 mg/kg [a] | Site sediment | 35 | -- | -- | -- | Eye, skin burns; respiratory irritant |
| Liquinox™ | Product | Decon | -- | -- | -- | -- | Eye and skin irritant |

**Notes:** -- = none established
IDLH = immediately dangerous to life and health
IP(eV) = ionization potential (electron volts)
NA = not available
PEL = permissible exposure limit
ppm = parts per million
STEL = short-term exposure limit

[a] Maximum sediment concentration in 2007 sampling (Integral 2009).

The table below summarizes the chemical characteristics and potential chemical exposure routes at the site.

| | Likely | Possible | Unlikely |
|---|---|---|---|
| **Potential Chemical Exposure Routes at the Site:** | | | |
| Inhalation | | X[a] | X[a] |
| Ingestion | | | X[b] |
| Skin absorption | | X | |
| Skin contact | | X | |
| Eye contact | | X | |
| **Chemical Characteristics:** | | | |
| Corrosive | | | X[b] |
| Flammable | | X[a] | X[b] |
| Ignitable | | X[a] | X[b] |
| Reactive | | | X[,b] |
| Volatile | | X[a] | X[b] |
| Radioactive | | | X[b] |
| Explosive | | | X[b] |
| Biological agent | | | X[b] |
| Particulates or fibers | | | X[b] |

Notes:
[a] Boat fuel or exhaust fumes
[b] Sediment

# 4 PHYSICAL HAZARD EVALUATION AND GUIDELINES

The following sections present general physical hazards and overwater work guidelines.

## 4.1 GENERAL PHYSICAL HAZARDS

The following table presents possible physical hazards that are expected to be present during field activities.

| Possible Hazard | Yes | No | Proposed Safety Procedure |
|---|---|---|---|
| Heavy equipment | X | | Stay back from operating equipment; wear safety vests and hard hats; coordinate and maintain eye contact with equipment operator. |
| Material handling | X | | Lift properly; seek assistance if necessary; do not overfill coolers or boxes. |
| Adverse weather | X | | Seek shelter during electrical storms; work in adverse weather conditions only with proper training and equipment. |
| Plant/animal hazards | | X | Know local hazards and take appropriate precautions. Use insect repellent if mosquitoes are persistent. |
| Uneven terrain/tripping | X | | Use caution, wear properly fitting shoes or boots, and keep work area orderly. |
| Noise | X | | Wear ear protection when working around heavy equipment and other noise sources. |
| Cold/hypothermia | X | | Keep warm and dry; bring changes of clothes; do not work in extreme conditions without proper equipment and training. Follow cold stress information (Attachment 3). *Note:* Potential for cold/hypothermia will depend on season and location of the site. |
| Falling objects | X | | Wear hard hats near overhead hazards (i.e., winch). |
| Laceration | X | | Wear hard hats and appropriate work gloves when working with and near winch line. |

A summary of potential physical hazards posed by proposed site activities:

| Activity | Potential Hazard |
|---|---|
| SPI/PV and Sediment Collection | Uneven terrain/tripping, cold/hypothermia, drowning, falling objects, heavy equipment, pinch and crushing points, material handling, adverse weather, vessel operations |

## 4.2 OVERWATER WORK GUIDELINES

### 4.2.1 General Overwater Safety Guidelines

The overwater safety program requires the following:

- STOP WORK Authority—All site personnel are empowered to stop work if site conditions or behaviors are considered unsafe and/or they feel their safety or the safety of the other personnel or the public is compromised.
- Personnel will wear U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs) at all times when working over water greater than 6 in. deep. They will inspect the PFDs prior to use and will not use defective PFDs.
- The boat operator must have training in the safe operation of the boat (Section 7.1.1).
- No smoking is allowed on boats or near refueling activities.
- Sampling equipment on boats will be kept organized at all times.
- Boats are required to be equipped with a throwable life ring, fire extinguisher, first aid kit, eyewash bottle and water (if acids are taken on the boat), drinking water (for long trips), alternate propulsion mechanism (e.g., paddles), rope, and warning horn; each field member will be briefed on the storage location of this equipment on the first day of the field event.
- All equipment will be used in accordance with the manufacturers' recommendations.

The following table summarizes possible physical hazards that are expected to be present during overwater work field activities.

| Possible Hazard | Yes | No | Proposed Safety Procedure |
|---|---|---|---|
| Water hazards | X | | Wear a USCG-approved PFD at all times when working over water greater than 6 in. deep. Inspect the PFDs prior to use and do not use defective PFDs. Keep sampling equipment on boats organized at all times. Boats are required to be equipped with a throwable life ring, fire extinguisher, and warning horn, and each field member will be briefed on the storage location of these safety items on the first day of the field event. |
| Vessel operations | X | | Exercise prudent overwater safety. Watch for tripping and falling hazards on deck; wear hard hats when winch is in operation; work gloves to protect from lacerations and pinching points; ear protection in noisy environment; steel-toed boots when carrying heavy equipment; rain gear under inclement weather; and safety glasses when retrieving SPI/PV camera system on deck. |

### 4.2.2 Sampling Vessel Operations

The physical hazards associated with the deployment and retrieval of sampling equipment from a sampling vessel result from the equipment's weight and the method of deployment. Only trained personnel will deploy and retrieve sampling gear. Under circumstances of potentially dangerous waves or winds and freezing temperatures, the vessel pilot and field team leader will employ best professional judgment to ensure safe field operations.

To avoid injuries from heavy equipment, personnel will wear steel-toed boots when working on the work deck or loading/unloading heavy equipment from the vessel. Hard hats will be worn by personnel when present on the work deck due to the proximity of overhead gear. Sample handling equipment, containers, deck lines, hydraulic cables, and water hoses not in immediate use will be kept clear of walkways and work areas until needed. Each time sampling operations at a given location have been completed, excess sediment will be washed off from equipment before it is placed on deck, and any sediment left on the deck will be washed from the deck over the sampled location or, if specified in the field sampling plan (depending the anticipated level of contamination), will be containerized in U.S. Department of Transportation–approved 55-gallon drums to 1) prevent personnel from slipping, 2) minimize personnel exposure to potentially contaminated sediment, and 3) limit cross-contamination between sample locations.

In the event that snow and ice have built up on the work deck, extra caution will be employed by field staff to ensure that the work deck is safe enough to work on. Vessel personnel and field staff will clear the deck of accumulated snow and ice.

USCG-approved PFDs will be provided for and worn by all personnel working on the deck, or as directed by the Integral SSO or vessel operator. As mentioned above, the vessel must also be equipped with throwable life rings, fire extinguishers, and warning horns, and each crewmember will be briefed on the location of this equipment prior to initiation of the sampling event.

### 4.2.3 Small Craft Operation

A small craft will not be used in this project.

### 4.2.4 U.S. Coast Guard Notification

The USCG will be notified of the schedule and scope of the overwater sampling work. If the USCG deems a notice to other mariners to be necessary, then information will be provided by the vessel's captain to the USCG to make shipping and other ocean traffic aware of the sampling activities.

### 4.2.5 SPI/PV and Sediment Sampling Equipment Handling

It must be emphasized that the SPI/PV equipment is very heavy and that no field staff members should attempt to carry, lift, or transport any of this equipment by themselves. Lifting heavy items is one of the leading causes of injury in the workplace involving missed workdays because of shoulder and back injuries. Overexertion and cumulative trauma are the biggest factors in these injuries. Always seek the assistance of a second person to handle this equipment. Proper body posture for lifting heavy equipment must be followed.

#### 4.2.5.1 Lifting

Lifting properly is important. While there are some general lifting guidelines, a different approach may be needed for each load to be lifted. Sometimes it is appropriate to lift with the legs, and other times the back should be used to lift. These techniques depend on the size and shape of the load, and the frequency of lifting that is required.

#### 4.2.5.2 Planning

Planning should be done with ergonomics in mind. Items to be planned include determining routes between staging areas and workspaces, scheduling for members of other trades, and knowing what services and utilities will be provided.

#### 4.2.5.3 Staging

Proper staging includes placing materials as close as possible to workspaces, and storing materials at ideal heights so employees can utilize the power zone to take materials from storage.

# 5 PERSONAL PROTECTIVE EQUIPMENT AND SAFETY EQUIPMENT

The following sections address PPE and safety equipment required for completing the field activities.

## 5.1 PERSONAL PROTECTIVE EQUIPMENT

Based on the hazards identified in Sections 3 and 4, the following table identifies the PPE required for site activities.

| | Level of Protection | |
|---|---|---|
| Site Activity | Initial[a] | Contingency |
| SPI/PV sampling | MD | Leave site |
| Sediment sampling | MD | Leave site |

Notes:
[a] See protection level definitions, below.

Each level of protection will incorporate the following PPE:

| | |
|---|---|
| Level D | Long pants and work coveralls, hard hat, latex or nitrile gloves under work gloves, eye protection, and steel-toe boots are required. Hearing protection is required as needed |
| Level MD | Is a modified Level D with addition of rain gear and PFD |

Level D = A work uniform affording minimal protection; used for nuisance contamination only.

**Respirator and Respirator Cartridge Information**

Is there potential for a respirator to be donned during fieldwork? Yes _____ No X

## 5.2 SAFETY EQUIPMENT

The following safety equipment will be onsite during the proposed field activities.

**First Aid Kit** Mandatory, including absorbent compress, adhesive bandages, adhesive tape, antiseptic, burn treatment, medical exam gloves, sterile pad, cardiopulmonary resuscitation (CPR) shield, triangle bandage, and scissors—for cutting off the PPE from an injured person (check additional items required for the site)

- [X] Emergency blanket
- [ ] Insect repellent
- [ ] Sunscreen
- [ ] Other: _____

**Other** (check the items required for this project)

- [X] Eyewash
- [X] Drinking water
- [ ] Stopwatch for monitoring heart rate for heat stress monitoring[2]
- [ ] Thermoscan® thermometer for heat stress monitoring
- [ ] Survival kit[3]
- [X] Personal flotation device
- [ ] Cool vests
- [ ] Fit test supplies
- [X] Fire extinguisher (drill rigs and onboard larger sampling vessels)
- [ ] Windsock
- [X] Cellular phone
- [ ] Radio sets
- [X] Global positioning system
- [X] Other: Pocket warmers

[2] Heart rate monitoring requires special training.
[3] Consult CHSM for guidance on site-specific survival kits.

# 6 AIR MONITORING

The sediments will be wet, so no dust will be generated. Air monitoring will not be conducted during sampling activities. Respiratory protection is not expected to be needed, and Level MD PPE will be donned by the field crew.

In the event of noxious or perceivably hazardous odors within the vicinity, work will be suspended and workers will vacate the area. Site conditions will be reevaluated to determine if sampling work may commence at a later time.

Air monitoring must be reinstated for fieldwork in different areas of the site or when sampling new media.

# 7 HEALTH AND SAFETY TRAINING AND MEDICAL MONITORING

The following sections present requirements for health and safety training and medical monitoring.

## 7.1 HEALTH AND SAFETY TRAINING AND MEDICAL MONITORING

State and federal laws establish training requirements for workers at uncontrolled hazardous waste sites (including areas where accumulations of hazardous waste create a threat to the health and safety of an individual, the environment, or both). Integral and subcontractor personnel are required to complete the following training requirements prior to working at the site.

### 7.1.1 Training Requirements

| Task | No Training | 24-hour | 40-hour[a] | Supervisor[b] | First Aid/CPR[c] | Medical Monitoring |
|---|---|---|---|---|---|---|
| **Integral Field Personnel[d]** | | | | | | |
| Stefan Wodzicki | | | X | X | X | X |
| Frank Spada | | | X | X | X | X |
| Conner Schultz | | | X | | X | X |
| Vessel operator / deckhands[e] | | | X | | | |

Notes:

[a] Must have current OSHA 8-hour refresher if it has been more than a year since the OSHA 40-hour training.

[b] At least one person onsite must be OSHA HAZWOPER supervisor trained if this is a hazardous waste site.

[c] At least one member of each team of two or more people onsite must be first aid/CPR trained.

[d] Integral subcontractors and consultants may have requirements that are more stringent than those listed above. These are minimum training and monitoring requirements required to work on this site.

[e] The vessel operator and deckhand will not be required to have 40-hour training. The vessel operator and deckhands are required to have USCG training.

### 7.1.2 Site Safety Meetings

Site safety meetings must be held before beginning new tasks or when new staff enter the site. Site safety meetings should be held at a minimum of once a week and should be held daily on complex or high hazard projects. Tailgate safety meetings must occur every morning during review of the day's work plan, covering specific hazards that may be encountered (Attachment 3). Additional meetings will be held at any time health and safety concerns are

raised by any of the personnel. Attendance and topics covered are to be documented in the field logbook.

## 7.2 MEDICAL MONITORING

OSHA requires medical monitoring for personnel potentially exposed to chemical hazards in concentrations in excess of the permissible exposure limit for more than 30 days per year and for personnel who must use respiratory protection for more than 30 days per year. Integral requires medical monitoring for all employees potentially exposed to chemical hazards.

| | | |
|---|---|---|
| Will personnel working at this site be enrolled in a medical monitoring program? | Yes | X |
| | No | |

# 8 EMERGENCY RESPONSE PLAN

The following sections discuss emergency recognition and prevention, emergency response and notification, emergency decontamination, site communications, and use of the buddy system.

## 8.1 EMERGENCY RECOGNITION AND PREVENTION

It is the responsibility of all personnel to monitor work at the site for potential safety hazards. All personnel are required to immediately report any unsafe conditions to the SSO. The SSO is responsible for immediately taking steps to remedy any unsafe conditions observed at the work site.

The following are examples of some emergency situations that could occur during field activities for the Ward Cove cruise ship dock benthic habitat mapping:

- Slips, trips, and falls (on sloped areas, steel stairs, etc.)
- Lacerations from winch line (sampling vessel)
- Entrainment of clothes or objects in moving equipment or parts
- A person falls overboard
- Serious injury or illness (e.g., physical injury, heart attack).

Immediate actions will be taken by the field team under the leadership of the SSO in response to these emergencies.

## 8.2 EMERGENCY RESPONSE AND NOTIFICATION

If an emergency at the site warrants it, all personnel must immediately evacuate the affected work area and report to the SSO at the predetermined emergency assembly location onboard the R/V *Alaskan Salvor*.

In case of injury, field personnel should take precautions to protect the victim from further harm and notify local or facility emergency services. In remote areas, it will be necessary to have first aid–trained personnel on the field team. The victim may require decontamination prior to treatment if practicable—requirements will vary based on site conditions.

Emergency medical care will be provided by:

- [X] Local emergency medical provider (i.e., fire department)
- [ ] Facility emergency medical provider
- [ ] First aid-trained field staff (for remote areas only)

Emergency Response Resources

| Local Resources | Name | Telephone | Notified Prior to Work (Yes/No)? |
|---|---|---|---|
| Fire | | 911 | No |
| Police | | 911 | No |
| Ambulance | | 911 | No |
| 24-hour Coast Guard Rescue Coordination Center, | | (907) 228-0340 | |
| Coast Guard from cell phone: | | *CG or #CG | |
| USCG VHF | | Channel 16 | |
| Hospital | PeaceHealth Ketchikan Medical Center<br>3100 Tongass Ave.<br>Ketchikan, AK 99901 | 911 | No |
| Site phone | Stefan Wodzicki | (360) 303-2708 | |
| Directions to the hospital: | Consult map (Attachment 1) | | |

The SSO must confirm that the hospital listed is still in operation and that it has an emergency room. **It is required that the SSO drive to the hospital so that the directions are practiced and understood prior to initiating fieldwork.**

Corporate Emergency Contacts

| Corporate Resource | Name | Work Telephone | Cell Phone |
|---|---|---|---|
| Integral CHSM [a] | Matthew Behum | Office: (410) 573-1982 | (443) 454-1615 |
| Integral President | William Locke | Office: (720) 465-3315 | (303) 548-1111 |
| Integral Human Resources Manager | Joseph Drew | Office: (206) 957-0330 | (206) 379-1289 |
| Medical consultant | Dr. Peter Greaney, MD (WorkCare) | Office: (800) 455-6155, ext. 2219 | NA |

Notes:

[a] If the CHSM cannot be reached, call Eron Dodak: office: (503) 943-3614; cell: (503) 407-2933.
If Matt Behum cannot be reached, call David Livermore: office: (503) 943-3613; cell: (503) 806-4665.

In case of serious injuries, death, or other emergency, the Integral CHSM must be notified immediately at the phone numbers listed above. The Integral CHSM will notify the project manager and Integral's President. The project manager will notify the client.

## 8.3 EMERGENCY DECONTAMINATION PROCEDURES

In case of an emergency, if possible, gross decontamination procedures will be promptly implemented. If a life-threatening injury occurs and the injured person cannot undergo decontamination procedures onsite, then the medical facility will be informed that the injured person has not been decontaminated and given information regarding the most probable chemicals of concern.

Decontamination procedures will only be used if practical and if they will not further injure the person or delay treatment. Decontamination procedures should not be implemented if there is not a reasonable possibility that the injured party requires such intervention. The SSO will make the determination whether or not to decontaminate the injured person. The following steps will be followed for decontaminating injured personnel while onsite:

- If it will not injure the person further, cut off PPE using scissors or scrub the gross contamination from the injured person's PPE (e.g., Tyvek® coveralls, work boots) with a Liquinox® or detergent solution followed by a rinse with tap or deionized/distilled water
- Remove PPE if feasible without further injuring the person.

## 8.4 SITE COMMUNICATIONS

Each field team will carry a cell phone or satellite phone that is in good working order. If there is any type of emergency that requires the site to be evacuated (e.g., severe thunderstorm with lightening, chemical release), the boat captain will sound an alarm and will give instructions on how to proceed. When the alarm sounds, all personnel will meet at the predetermined emergency assembly location, provided the muster point is in safe territory. All other emergency notifications that do not require evacuation (e.g., a person falling overboard) will be conducted using a cell or satellite phone. Emergency phone numbers are listed above in Section 8.2.

## 8.5 BUDDY SYSTEM

The buddy system will be used at the site at all times. The buddy system is a system of organizing employees into field teams in such a manner that each employee of the field team is designated to be observed by at least one other employee in the field team. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

# 9 WORK ZONES

Work zones are defined as follows:

| | |
|---|---|
| **Exclusion zone** | Any area of the site where hazardous substances or activities are present, or are reasonably suspected to be present, and pose an exposure hazard to personnel |
| **Contamination reduction zone** | Area between the exclusion and support zones that provides a transition between contaminated and clean zones |
| **Support zone** | Any area of the site, so designated, that is outside the exclusion and contamination reduction zones |

Site control measures in work zones are described below for each type of field activity.

## 9.1 SPI/PV IMAGE COLLECTION

**Exclusion zone:** The aft deck of the sampling vessel will be considered to be the exclusion zone. The deployment and retrieval of the SPI/PV camera system will occur in this area. Only properly equipped and trained personnel (i.e., wearing modified D protective clothing) will be allowed in this area. The area will be washed with water between sample stations.

**Contamination reduction zone**: Personnel will be required to wash any residual sediment from the base of the SPI/PV camera system before bringing it back on deck.

**Support zone:** The pilot house will be the support zone. No chemical or sample handling activities will occur in this area. Personnel will be required to wash raingear or Tyvek® coveralls before entering this area.

## 9.2 SEDIMENT SAMPLE COLLECTION

**Exclusion zone:** The aft deck of the sampling vessel will be considered to be the exclusion zone. The deployment and retrieval of the van Veen grab will occur in this area. Only properly equipped and trained personnel (i.e., wearing modified D protective clothing) will be allowed in this area. The area will be washed with water between sample stations.

**Contamination reduction zone**: Personnel will be required to wash any residual sediment from the van Veen after sub-sampling from within the grab.

**Support zone:** The pilot house will be the support zone. No chemical or sample handling activities will occur in this area. Personnel will be required to wash raingear or Tyvek® coveralls before entering this area.

# 10 EQUIPMENT DECONTAMINATION AND PERSONAL HYGIENE

## 10.1 EQUIPMENT DECONTAMINATION PROCEDURES

After sampling is completed, the exclusion zone will be used as the contaminant reduction zone for decontamination activities, provided there is no contamination remaining after the sampling is completed. To minimize or prevent personal exposure to hazardous materials, all personnel working in the exclusion zone and contaminant reduction zone will comply with the following decontamination procedures:

- All personnel will wash sediment and chemicals from their raingear or Tyvek® coveralls before leaving the exclusion zone.
- All gloves, Tyvek®, rain gear, and rubber boots will be removed prior to entering the field vehicle.

Decontamination equipment required at the site includes the following:

- Buckets or tubs
- Laboratory grade distilled/deionized water
- Site water
- Scrub brushes (long-handled)
- Liquinox® detergent
- Plastic bags
- Foil
- Paper towels
- Garbage bags
- Clean garden sprayer.

All non-disposable components of the sampling equipment (e.g., stainless steel spoons and bowls used for sample compositing) that contact the sediment will be decontaminated using the following steps:

1. Rinse with site water/tap water.
2. Wash with Alconox® or Liquinox® detergent.
3. Rinse with site water/tap water.

4. Rinse with site water (van Veen grab sampler) or distilled/deionized water using a garden sprayer (compositing equipment only).
5. Allow to air dry.
6. Wrap up compositing equipment in aluminum foil.

Decontamination wastewater containing Alconox® will be collected in plastic tubs and discarded overboard. The base of the SPI/PV camera frame that contacts the sediment will be decontaminated at the end of each day using the following steps:

1. Rinse with freshwater.

## 10.2 PERSONAL HYGIENE

The following personal hygiene practices will be used at the site to reduce exposure to chemicals.

- Long hair will be secured away from the face so it does not interfere with any activities.
- All personnel leaving potentially contaminated areas will wash their hands, forearms, and faces in the contaminant reduction zone prior to entering any clean areas or eating areas.
- Personnel leaving potentially contaminated areas will shower (including washing hair) and change to clean clothing as soon as possible after leaving the site.
- No person will eat, drink, or chew gum or tobacco in potentially contaminated areas. Single portion drink containers and drinking of replacement fluids for heat stress control will be permitted only in support areas.
- Smoking is prohibited by Integral personnel and subcontractors in all areas of the site because of the potential for contaminating samples and for the health of the field team.

# 11 VEHICLE SAFETY, SPILL CONTAINMENT, AND SHIPPING INSTRUCTIONS

## 11.1 VEHICLE SAFETY

Integral's vehicle safety program requires the following:

- Cell phone usage while driving is not allowed, including the use of hands-free devices. If it not feasible to wait to use the cell phone until arriving at the destination, pull off the road and park in a safe location to use the cell phone. Do not pull to the side of the road to use a cell phone because this significantly increases the risk of a rear-end collision.
- All vehicles are to be operated in a safe manner and in compliance with local traffic regulations and ordinances.
- Drivers are to practice defensive driving and drive in a courteous manner.
- Drivers are required to have a valid driver's license and liability insurance (per local state laws).
- Seat belts are to be worn by the driver and all passengers.
- No persons are allowed to ride in the back of any trucks or vans, unless equipped with seatbelts.
- Vehicles are to be driven in conformance with local speed limits.
- Personnel who are impaired by fatigue, illness, alcohol, illegal or prescription drugs, or who are otherwise physically unfit, are not allowed to drive or work on Integral field sites.
- Personnel are to avoid engaging in other distractions such as changing radio stations while driving.
- Motor vehicle accidents are to be reported to the responsible law enforcement agency, the Integral human resources manager, and the Integral CHSM on the same day of occurrence. Documentation of damage should be photographed.
- Personnel who have experienced work-related vehicle accidents or citations may be required to complete a defensive driving program.

## 11.2 SPILL CONTAINMENT

All decontamination chemicals will be dispensed from the manufacturers' capped containers directly into laboratory safety squirt bottles that have been permanently marked with the name of the chemical and that have screw caps. Decontamination chemicals will be poured into the prelabeled squirt bottles while they are over shallow Rubbermaid® tubs to capture any possible overflow or spills. Any spills will be cleaned up and disposed of in accordance with applicable regulations

## 11.3 SHIPPING INFORMATION

Federal laws and international guidelines place restrictions on what materials may be shipped by passenger and cargo aircraft. In addition, 49 CFR regulates labeling, manifesting, and shipment of all packages containing potentially hazardous materials. In the course of this field investigation, the following items will be shipped to and from the site as shown below:

| Item | Hazardous Constituent | Quantity | Packaging | How Shipped |
|---|---|---|---|---|
| Samples | None | 34 solid matrix samples | Coolers | Field vehicle |
| Preservative | Sulfuric Acid | 125 mL plastic bottle (ammonia rinsate blank) | Inside sample jars | Field vehicle |
| Preservative | Sulfuric Acid | 40 mL VOA vial (TOC rinse blank) | Inside sample jars | Field vehicle |

A 24-hour emergency response number (on any shipping documents such as a Uniform Hazardous Waste Manifest, Shipper's Declaration of Dangerous Goods, etc.) is required for shipments of all dangerous or hazardous goods. Integral does not have a 24-hour emergency contact number for dangerous or hazardous goods shipment. No dangerous or hazardous goods may be shipped by Integral until an account is set up with a 24-hour emergency response service such as CHEM-TEL (1-813-248-0573). If any hazardous or dangerous goods need to be shipped for a project, they must be shipped directly to the site by the supplier. Any hazardous or dangerous goods that are not used in the course of the field effort must remain at the site.

The samples will be prepared and labeled for shipment in accordance with the sampling and analysis plan developed for the site.

# 12 TASK-SPECIFIC SAFETY PROCEDURE SUMMARY

## 12.1 SPI/PV IMAGE COLLECTION

Always wear a USCG-approved PFD when doing any work on the sampling vessel or dock. A hard hat, safety glasses, steel-toe boots, and nitrile gloves are required at all times without exception. Use hearing protection as needed.

Exercise caution when working on a boat deck. Always be aware of the surroundings and channel wave action that can rock the sampling vessel without notice. Keep sampling equipment on boats organized at all times. Boats are required to be equipped with a throwable life ring, fire extinguisher, and warning horn, and each field member will be briefed on the storage location for this equipment.

Avoid getting sediment on clothes or skin. Exercise care when lifting and assembling the SPI/PV camera system. Always stay clear of the winch line and be aware of its location. Exercise care and communicate the position of the SPI/PV system with the winch operator when deploying and retrieving the SPI/PV camera system.

## 12.2 SEDIMENT SAMPLING

Always wear a USCG-approved PFD when doing any work on the sampling vessel or dock. A hard hat, safety glasses, steel-toe boots, and nitrile gloves are required at all times without exception. Use hearing protection as needed.

Exercise caution when working on a boat deck. Always be aware of the surroundings and channel wave action that can rock the sampling vessel without notice. Keep sampling equipment on boats organized at all times. Boats are required to be equipped with a throwable life ring, fire extinguisher, and warning horn, and each field member will be briefed on the storage location for this equipment.

Avoid getting sediment and decontamination chemicals on clothes or skin. Exercise care when lifting, assembling, and decontaminating van Veen grab samplers. Always stay clear of the winch line and be aware of its location.

If it is necessary for personnel to enter restricted areas of the upland facility during the sampling event, then they will comply with the client's safety requirements for the site (e.g., wear hard hats and safety glasses).

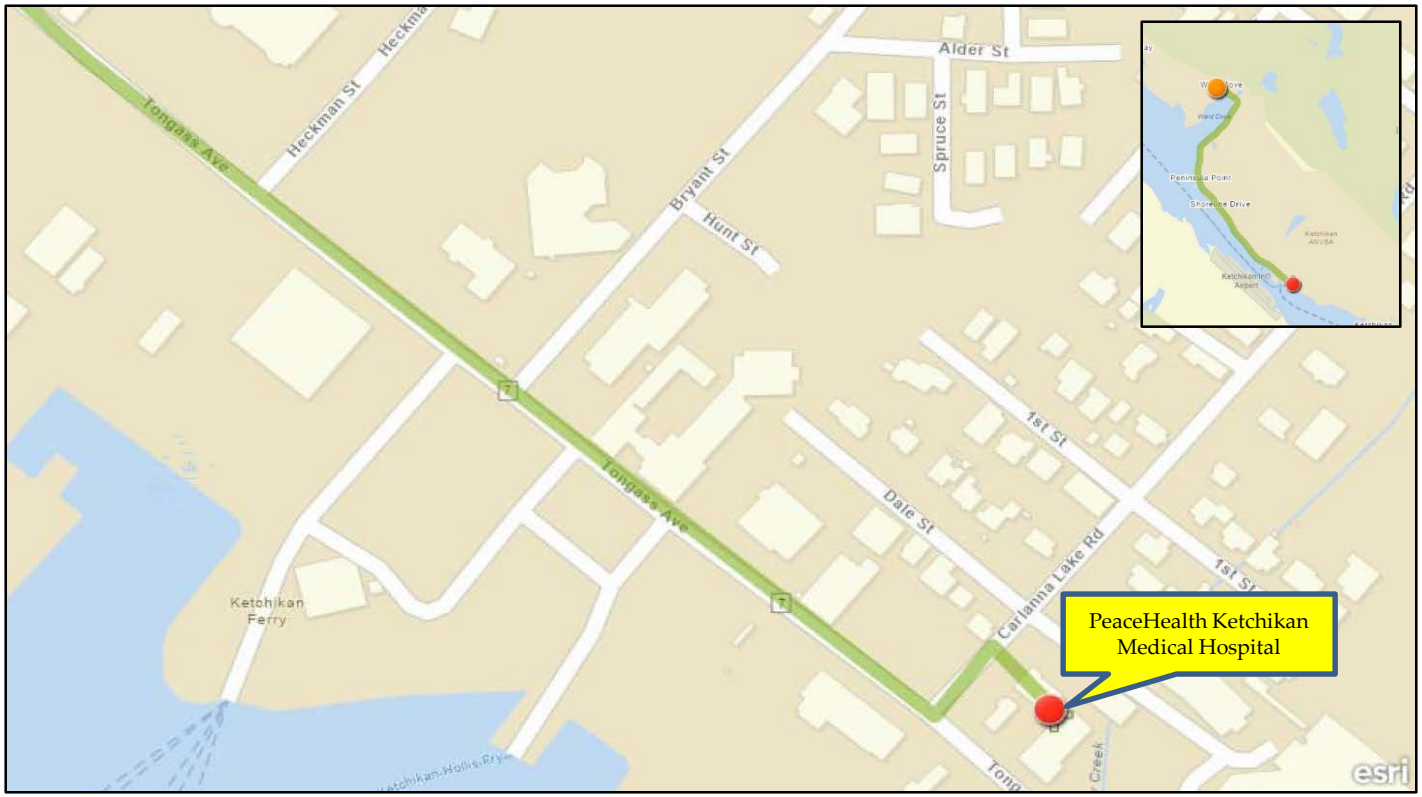
# 13 REFERENCES

Integral. 2009. 2007 Monitoring Report for Sediment Remediation in Ward Cove, Alaska. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Integral Consulting Inc., Seattle, WA.

Keeley, K. 2009. Personal communication (letter to P. Benning, Ketchikan Pulp Company, and B. Hogarty, TECS-AK, Ketchikan, AK, dated May 7, 2009, regarding EPA Approval of 2007 Monitoring Report for Sediment Remediation in Ward Cove, Alaska [April 2009], Marine Operable Unit, Ketchikan Pulp Company [KPC] Site Consent Decree No. A00-225 CV [JKS]). U.S. Environmental Protection Agency, Region 10, Seattle, WA.

# ATTACHMENT 1

## SITE MAP AND HOSPITAL ROUTE




**From: Ward Cove (downtown)**

**To: PeaceHealth Ketchikan Medical Center**
3100 Tongass Ave.
Ketchikan, AK 99901
(907) 225-5171

**Directions:**
1. Head south on N Tongass Hwy. for 5 mi.
2. Turn left onto Carlanna Lake Rd.
3. Turn right at 1st cross street onto Dale St.

# ATTACHMENT 2

## REGULATORY NOTICES

# You Have a Right to a Safe and Healthful Workplace.

# IT'S THE LAW!

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act)*, P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act*. The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at **www.osha.gov**. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

## 1-800-321-OSHA
## www.osha.gov

**U.S. Department of Labor • Occupational Safety and Health Administration • OSHA 3165**

# ATTACHMENT 3

## SAFETY PROCEDURES

## FROSTBITE

### What happens to the body:

Freezing in deep layers of skin and tissue; pale, waxy-white skin color; skin becomes hard and numb; usually affects fingers, hands, toes, feet, ears, and nose.

### What to do: (land temperatures)

- Move the person to a warm, dry area. Don't leave the person alone.
- Remove wet or tight clothing that may cut off blood flow to the affected area.
- **Do not** rub the affected area because rubbing damaged the skin and tissue.
- Gently place the affected area in a warm water bath (105°) and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast, causing tissue damage. Warming takes 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm. **Note:** If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

## How to Protect Workers

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train workers about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene.)
- Take frequent short breaks in warm, dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs.)
- Drink warm, sweet beverages (sugar water, sports-type drinks.) **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) **or alcohol**.
- Eat warm, high-calorie foods like hot pasta dishes.

### Workers are at increased risk when…

- They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
- They take certain medications. Check with your doctor, nurse, or pharmacy and ask if medicines you take affect you while working in cold environments.
- They are in poor physical condition, have a poor diet, or are older.

## HYPOTHERMIA - (Medical Emergency)

### What happens to the body:

Normal body temperature (98.6°F/37°C) drops to or below 95°F/35°C; fatigue or drowsiness; uncontrolled shivering; cool, bluish skin; slurred speech; clumsy movements; irritable, irrational, or confused behavior.

### What to do: (land temperatures)

- Call for emergency help (i.e., ambulance or 911).
- Move the person to a warm, dry area. Don't leave the person alone.
- Remove wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if he is alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) **or alcohol**.
- Have the person move his arms and legs to create muscle heat. If he is unable to do this, place warm bottles or hot packs in the armpits, groin, neck, and head areas. **Do not** rub the person's body or place him in a warm water bath. This may stop his heart.

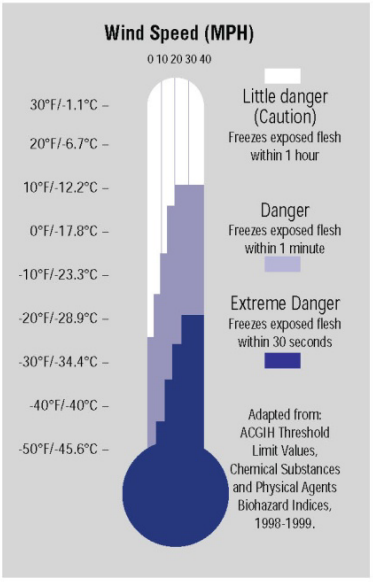
### What to do: (water temperatures)

- Call for emergency help (i.e., ambulance or 911). Body heat is lost up to 25 times faster in water.
- **Do not** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **Do not** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses body heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

## THE COLD STRESS EQUATION

**LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS**

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result. **Hypothermia** can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.




Oregon Occupational Safety & Health Division
440-3336E S (9/03)

## HEAT EXHAUSTION

### What happens to the body:

Headaches, dizziness, or light-headedness, weakness, mood changes, irritability or confusion, feeling sick to your stomach, vomiting, fainting, decreased and dark-colored urine, and pale, clammy skin.

### What should be done:

- Move the person to a cool shaded area. Don't leave the person alone. If the person is dizzy or light-headed, lay him on his back and raise his legs about 6-8 inches. If the person is sick to his stomach, lay him on his side.
- Loosen and remove heavy clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if he is not feeling sick to his stomach.
- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (ambulance or call 911.)

*(If heat exhaustion is not treated, the illness may advance to heat stroke.)*

## HEAT STROKE - A Medical Emergency

### What happens to the body:

Dry, pale skin (no sweating); hot red skin (looks like a sunburn); mood changes; irritability, confusion, and not making any sense; seizures or fits, and collapse (will not respond).

### What should be done:

- Call for emergency help (i.e., ambulance or 911.)
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures, remove objects close to him so he won't hit them. If the person is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

## How to Protect Workers

- Learn the signs and symptoms of heat-induced illnesses and what to do to help the worker.
- Train workers about heat-induced illnesses.
- Perform the heaviest work during the coolest part of the day.
- Slowly build up tolerance to the heat and the work activity (usually takes up to 2 weeks.)
- Use the buddy system (work in pairs.)
- Drink plenty of cool water (one small cup every 15-20 minutes.)
- Wear light, loose-fitting, breathable (like cotton) clothing.
- Take frequent short breaks in cool, shaded areas (allow your body to cool down.)
- Avoid eating large meals before working in hot environments.
- Avoid caffeine and alcoholic beverages (these beverages make the body lose water and increase the risk of heat illnesses.)

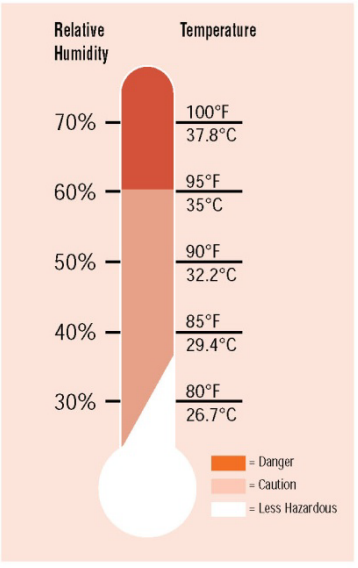
### Workers are at increased risk when...

- They take certain medications. Check with your doctor, nurse, or pharmacy to see if medicines you take affect you when working in hot environments.
- They have had a heat-induced illness in the past.
- They wear personal protective equipment.

## THE HEAT EQUATION

**HIGH TEMPERATURE + HIGH HUMIDITY + PHYSICAL WORK = HEAT ILLNESS**

When the body is unable to cool itself through sweating, **serious** heat illnesses may occur. The most severe heat-induced illnesses are **heat exhaustion** and **heat stroke**. If actions are not taken to treat heat exhaustion, the illness could progress to heat stroke and **death**.




Oregon Occupational Safety & Health Division
440-3333E S(9/03)

# ATTACHMENT 4

## NEAR-MISS/NEAR-LOSS INCIDENT REPORT

# NEAR-MISS/NEAR-LOSS INCIDENT REPORT

This form is to be completed by field staff.

Employee: _____

Office or site location: _____

Near-miss incident (check one or more): Exposure ☐ Physical injury ☐ Property damage ☐

Location (city and state): _____ Project no.: _____

Date of incident: _____ Time of incident: _____

Fully describe the incident, including how it happened, persons involved, if chemicals were involved in the incident, etc.:

_____

_____

_____

_____

_____

_____

Was the operation being conducted under an established safety plan? ☐ Yes ☐ No

If yes, attach a copy. If no, explain: _____

_____

_____ _____

Employee signature Date

_____ _____

Site safety officer signature (field incidents only) Date

_____ _____

Project manager or office health and safety representative signature Date

## CORPORATE HEALTH AND SAFETY MANAGER (CHSM) REVIEW AND COMMENTS

Corrective action/procedure changes carried out on this project or office:

Corrective actions to be taken to prevent similar incidents at other project sites or offices:

CHSM signature

Date

# ATTACHMENT 5

## EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT

# Employee Exposure/Injury Incident Report

(completed by the CHSM or designee)

Employee: _____

Office or field location: _____

Incident: _____

Potential or known exposure (describe): _____

Physical injury or illness (describe):

_____

Location (city and state): _____ Project and Contract No. _____

Date of incident: _____ Time of incident: _____

Date incident reported: _____ Person to whom incident was reported: _____

Weather condition during incident: Temperature: Precipitation: _____

Wind speed and direction: _____ Cloud cover: _____

Name of materials potentially encountered (chemical exposure):

Chemical and phase (i.e., liquid, solid, gas, vapor, fume, mist), radiological, etc.: _____

_____

Describe the exposure/injury in detail and the parts of the body affected (attach extra sheets if necessary):

_____

_____

Describe exact onsite or offsite location where the incident occurred:

_____

What was the employee doing when the exposure/injury occurred? (Describe briefly as site reconnaissance, soil sampling, etc.):

_____

How did the incident occur? Describe fully the factors that led to or contributed to the incident:

_____

_____

Was medical treatment given? ☐ Yes ☐ No If yes, when? _____

By whom? Name of paramedic: _____

Name of physician: _____

Other: _____

Where? Onsite _____ Offsite _____

If offsite, name of hospital or clinic: _____

Length of inpatient stay (dates): _____

Was Integral Consulting management notified? ☐ Yes ☐ No If yes, when? _____

Name and title of manager(s) notified: _____

Did the exposure/injury result in permanent disability or death? ☐ Yes ☐ No

If yes, explain: _____

Number of days away from work _____ Number of days of restricted work activity: _____

Has the employee returned to work? (Yes / No) If yes, date: _____

Names of other persons affected during the incident:

_____ _____

Names of persons who witnessed the incident:

_____ _____

Name and title of field team leader or immediate supervisor at the site:

_____

Was the operation being conducted under an established safety plan? ☐ Yes ☐ No

If yes, attach a copy. If no, explain: _____

_____

Was personal protective equipment (PPE) used by the employee? ☐ Yes ☐ No

If yes, list items: _____

Did any limitations in safety equipment or PPE affect or contribute to exposure? ☐ Yes ☐ No

If yes, explain: _____

_____

Attachments to this report: ____ Medical report(s) (if not confidential) ____ Site safety plan

____ Other relevant information

_____ _____

Employee's signature Date

_____ _____

Site safety officer's signature Date

_____ _____

Project manager's signature Date

## Corporate health and safety manager review and comments

Corrective action/procedure changes carried out on the project:

_____

_____

_____

Corrective actions to be taken to prevent similar incidents at other sites:

_____

_____

_____

_____ _____

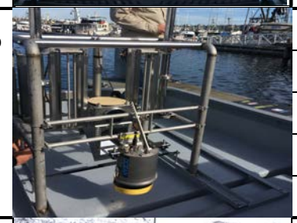
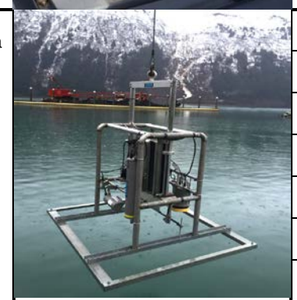
Corporate Health and Safety Manager's signature Date

# ATTACHMENT 6

## JOB HAZARD ANALYSIS ASSESSMENT FORM

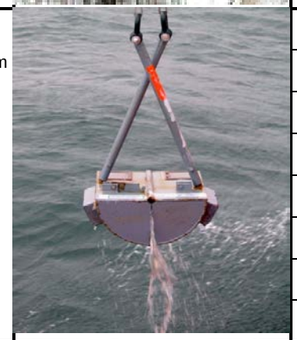
## Job Hazard Analysis (JHA) Assessment Form

| | | |
|---|---|---|
| **JHA Title: Ward Cove** - Sediment Profile Imaging (SPI) Survey | **JHA Number:** 001 | **Date:** 1/8/2020 |
| **Job Description:** SPI camera survey | **Project Number:** C2174-0101 | |
| **General Personal Protective Equipment (PPE) Required:** Steel toe boots, hard hat, personal floatation device, sunscreen and work gloves | **JHA Team Names:** Gene Revelas, Stefan Wodzicki and To be determined | **Approved by:** |
| **Additional PPE Required:** Rain gear | | |

| Job Steps | Photographs | Hazard Type | Potential Hazards | Control Type | Existing Controls | SEV | OCC | EFF | HPN | Control Type | Recommended Controls | SEV | OCC | EFF | HPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shipment of SPI camera system, packing components into cases, transport of cases to shipping center |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Traffic | Adm | Administrative control—Other (defensive driving) | | | | | | | | | | |
| Assembly of SPI camera system prior to deployment |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes (electrical rated) | | | | | | | | | | |
| | | Phys | Sharp or rough surfaces (laceration/puncture) | Eng | Crush/pinch/abrasion protection—"Body out of line of fire" | | | | | | | | | | |
| Deployment and retrieval of SPI camera system from boat |  | Phys | Impact with or strike by moving, flying, or falling object | PPE | Head/face—Hard hat | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Eng | Ergonomics—Mechanical lifting devices (SPI camera deployed with cable and winch) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | Adm | Crush/pinch/abrasion protection—"Body out of line of fire" | | | | | | | | | | |
| | | Env | Environmental—Adverse weather | Adm | Atmospheric monitoring (monitoring of weather forecasts) | | | | | | | | | | |
| | | Phys | Unexpected start-up | Adm | Alarms—Audible or visible | | | | | | | | | | |
| | | Phys | Overboard | Adm | Buddy system (If man overboard, keep sight of person until rescued) | | | | | | | | | | |
| | | Phys | Overboard | PPE | PPE—Other (PFD) | | | | | | | | | | |
| Disassembly and shipment of SPI camera system, packing components into cases, transport of cases to shipping center |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Traffic | Adm | Administrative control—Other (defensive driving) | | | | | | | | | | |

## Job Hazard Analysis (JHA) Assessment Form

| | | |
|---|---|---|
| **JHA Title: Ward Cove** - Sediment Surface Sampling | **JHA Number:** 002 | **Date:** 1/8/2020 |
| **Job Description:** Sediment Surface Sampling | **Project Number:** C2174-0101 | |
| **General Personal Protective Equipment (PPE) Required:** Steel toe boots, hard hat, personal floatation device, sunscreen and work gloves | **JHA Team Names:** Gene Revelas, Stefan Wodzicki and Frank Spada | **Approved by:** |
| **Additional PPE Required:** Rain gear | | |

| Job Steps | Photographs | Hazard Type | Potential Hazards | Control Type | Existing Controls | SEV | OCC | EFF | HPN | Control Type | Recommended Controls | SEV | OCC | EFF | HPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shipment of Van Veen Sediment Sampler, packing components into cases, transport of cases to shipping center |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Traffic | Adm | Administrative control—Other (defensive driving) | | | | | | | | | | |
| Setting of Van Veen Sediment Sampler prior to deployment |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes (electrical rated) | | | | | | | | | | |
| | | Phys | Mechanical pinch points | Eng | Crush/pinch/abrasion protection—"Body out of line of fire" | | | | | | | | | | |
| Deployment and retrieval of Van Veen Sediment Sampler from boat |  | Phys | Impact with or strike by moving, flying, or falling object | PPE | Head/face—Hard hat | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Eng | Ergonomics—Mechanical lifting devices (SPI camera deployed with cable and winch) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | Adm | Crush/pinch/abrasion protection—"Body out of line of fire" | | | | | | | | | | |
| | | Env | Environmental—Adverse weather | Adm | Atmospheric monitoring (monitoring of weather forecasts) | | | | | | | | | | |
| | | Phys | Unexpected start-up | Adm | Alarms—Audible or visible | | | | | | | | | | |
| | | Phys | Overboard | Adm | Buddy system (If man overboard, keep sight of person until rescued) | | | | | | | | | | |
| | | Phys | Overboard | PPE | PPE—Other (PFD) | | | | | | | | | | |
| Disassembly and shipment of Van Veen Sediment Sampler, packing components into cases, transport of cases to shipping center |  | Phys | Ergonomics—Heavy lifting (material handling) | Adm | Sprain/strain protection—Proper lifting techniques / body posture | 3 | 2 | 0.50 | 3 | | Not applicable (NA) - No substantial recommendations, hazard already low | | | | 0 |
| | | Phys | Manual movement of heavy items (>40 lb) | Adm | Ergonomics—Assisted lifts (>40 lb) | | | | | | | | | | |
| | | Phys | Slip/trip/fall—Same level | PPE | Foot—Safety shoes | | | | | | | | | | |
| | | Phys | Object or machine that may crush or pinch a body or body part | PPE | Foot—Safety shoes with metatarsal protection | | | | | | | | | | |
| | | Phys | Traffic | Adm | Administrative control—Other (defensive driving) | | | | | | | | | | |

# ATTACHMENT 7

## FIELD SAFETY TAILGATE BRIEFING FORM

SAFETY BRIEFING

CHSM: Matthew Behum (410) 573-1982 ext.512

Date/Time: _____ Project Name: _____ Project Number: _____

Meeting Conductor: _____ Site Safety Officer: _____ Project Manager: _____

- □ HASP Review & Location
- □ Lines of Authority
- □ Chemical Hazards & Exposure Routes
- □ Flammable Hazards
- □ Lifting Techniques
- □ Buddy System
- □ Self & Coworker Monitoring
- □ Biological/Plant/ Animal Hazards
- □ Slips, Trips, & Falls
- □ Heat & Cold Stress
- □ Overhead Hazards
- □ Vessel Safety Protocols
- □ Proper Use of PPE
- □ Safety Equipment Location
- □ Proper Safety Equipment Use
- □ Fire Extinguisher Location
- □ Eye Wash Station Location
- □ Emergency Procedures & Evacuation Route
- □ Directions to Hospital
- □ Emergency Decontamination Procedures
- □ Site Communication
- □ Work Zones
- □ Site Security
- □ Vehicle Safety & Driving/Road Conditions
- □ Equipment Safety & Operation
- □ Other _____

Field Staff H&S Concerns: _____

Weather Conditions: _____

Daily Work Scope: _____

Site-Specific Hazards: _____

ATTENDEES

| Printed Name | Signature |
|---|---|
| | |
| | |
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| | |

# ATTACHMENT 8

## SAFETY DATA SHEETS

ALDRICH CHEMICAL CO INC. -- LIQUI-NOX PHOSPHATE-FREE DETERGENT, 24302-7 -- 6810-00N016648

========== Product Identification ==========

Product ID:LIQUI-NOX PHOSPHATE-FREE DETERGENT, 24302-7
MSDS Date:01/09/1990
FSC:6810
NIIN:00N016648
MSDS Number: BQTFQ
=== Responsible Party ===
Company Name:ALDRICH CHEMICAL CO INC.
Address:1001 W. ST. PAUL AVE
Box:355
City:MILWAUKEE
State:WI
ZIP:53201
Country:US
Info Phone Num:414-273-3850/FAX -4979
Emergency Phone Num:414-273-3850
CAGE:60928
=== Contractor Identification ===
Company Name:ALDRICH CHEMICAL CO INC
Address:1001 WEST ST PAUL AVE
Box:355
City:MILWAUKEE
State:WI
ZIP:53233
Country:US
Phone:414-273-3850
CAGE:60928

========== Composition/Information on Ingredients ==========

Ingred Name:LIQUI-NOX, PHOSPHATE-FREE DETERGENT

========== Hazards Identification ==========

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:ACUTE: MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION. MAY CAUSE EYE IRRITATION. MAY CAUSE SKIN IRRITATION. TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERT IES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:SEE HEALTH HAZARDS.
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

========== First Aid Measures ==========

First Aid:EYE: IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MIN. SKIN: IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS AMOUNTS OF WATER. INHAL: REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ART F RESP. IF BREATHING IS DIFFICULT, GIVEOXYGEN. CALL A PHYSICIAN. WASH CONTAMINATED CLOTHING BEFORE REUSE. INGEST: GET MD IMMEDIATELY .

========== Fire Fighting Measures ==========

Extinguishing Media:WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT TO PREVENT CONTACT WITH SKIN AND EYES.
Unusual Fire/Explosion Hazard:NONE SPECIFIED BY MANUFACTURER.

========== Accidental Release Measures ==========

Spill Release Procedures:WEAR NIOSH/MSHA APPROVED RESP, CHEMICAL SAFETY GOGGLES, RUBBER BOOTS AND HEAVY RUBBER GLOVES. ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR DISPOSAL. VENTILATE AREA AND WASH SPILL S ITE AFTER MATERIAL PICKUP IS COMPLETE.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

========== Handling and Storage ==========

Handling and Storage Precautions:KEEP TIGHTLY CLOSED. STORE IN A COOL DRY PLACE. AVOID INHALATION. AVOID CONTACT WITH EYES, SKIN AND CLOTHING. AVOID PROLONGED OR REPEATED EXPOSURE.
Other Precautions:NONE SPECIFIED BY MANUFACTURER.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation:MECHANICAL EXHAUST REQUIRED.
Protective Gloves:COMPATIBLE CHEMICAL-RESISTANT GLOVES.
Eye Protection:CHEMICAL SAFETY GOGGLES.
Other Protective Equipment:SAFETY SHOWER AND EYE BATH.
Work Hygienic Practices:WASH THOROUGHLY AFTER HANDLING.
Supplemental Safety and Health
WASTE DISP: AND NEUTRALIZATION REACTIONS MAY GENRATE HEAT & FUMES WHICH CAN BE CONTROLLED BY THE RATE OF ADDITION. OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.

========== Physical/Chemical Properties ==========

HCC:N1
Spec Gravity:1.051
Appearance and Odor:NONE SPECIFIED BY MANUFACTURER.

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:NATURE OF DECOMPOSITION PRODUCTS NOT KNOWN.

========== Disposal Considerations ==========

Waste Disposal Methods:SML QTYS: CAUTIOUSLY ADD TO A LRG STIRRED EXCESS OF WATER. ADJUST THE PH TO NEUTRAL, SEPARATE ANY INSOLUBLE SOLIDS OR LIQUIDS & PACKAGE THEM FOR HAZARDOUS-WASTE DISP. FLUSH THE AQUEOUS SOLN DOWN THE D RAIN W/PLENTY OF WATER. THE HYDROLYSIS (SUPP DATA)

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# Material Safety Data Sheet

## Section 1. Chemical Product and Company Identification

| | |
|---|---|
| Product Name<br>Formalin Solution 10% Neutral Buff. pH 7.0 | Product Code<br>28600 |
| Manufacturer's Name<br>StatLab Medical Products, Inc. | Emergency Telephone Numbe<br>800-424-9300 |
| Address (Number, Street, City, State, and ZIP Code)<br>407 Interchange st. | Telephone Number for Informatior<br>800-442-3573 x 2 |
| McKinney Tx 75071 | Date Preparec<br>10/14/2003 (rev 10/20/05)<br>Signature of Preparer (optional |

## Section 2. Composition/Information on Ingredients

| Component | CAS # | OSHA PEL | ACGIH TLV | Other Limits Recommended | Percent |
|---|---|---|---|---|---|
| Formaldehyde | 50-00-0 | 0.75 ppm | C 0.3 mg/m$^3$ | | 3-4 |
| Methyl Alcohol | 67-56-1 | 200 ppm | 250 ppm | | 1-1.5 |
| Sodium Phosphate Monobasic Monohydrate | 10049-21-5 | N/A | N/A | | <1 |
| Sodium Phosphate Dibasic | 7558-79-4 | N/A | N/A | | <1 |
| Water, Deionized | 7732-18-5 | N/A | N/A | | Balance |

## Section 3. Hazards Identification

**Emergency Overview**

Contains Formaldehyde, a suspected carcinogen. Irritating to the eyes, respiratory system and skin. May cause sensitization by inhalation or skin contact. May be fatal if swallowed. If ingested, dilute with water, induce vomiting then call a physician. Wash areas of contact with water. If inhaled, remove to fresh air.

**Potential Health Effects**

Target Organs: Eyes, skin, respiratory system.

Eye: Causes irritation, redness and pain.

Skin: May cause irritation, redness and pain. Frequent or prolonged exposure may cause hypersensitivity leading to contact dermatitis.

Ingestion: May cause severe abdominal pain, vomiting, headache and diarrhea.

Inhalation: Causes irritation of respiratory tract. Symptoms may include sore throat, coughing and shortness of breath.

Chronic/Carcinogenicity: IARC-Formaldehyde is probably carcinogenic. NTP-Formaldehyde is reasonably anticipated to be a carcinogen. OSHA-Yes (Formaldehyde)

Teratology: Mutation data cited in "Registry of Toxic Effects of Chemical Substances" on Formaldehyde.

Reproduction: Reproductive effects cited in "Registry of Toxic Effects of Chemical Substances" on Formaldehyde.

Mutagenicity:

## Section 4. First Aid Measures

| | |
|---|---|
| Eye | Irrigate immediately with large quantity of water for at least 15 minutes. |
| Skin | Flush with water for at least 15 minutes. |
| Ingestion | Dilute immediately with water or milk. Induce vomiting. Call a physician. |
| Inhalation | Remove to fresh air. Give artificial respiration if necessary. |
| All Other Means of Exposure | CONTACT POISON CONTROL CENTER IMMEDIATELY. Be prepared to provide hazardous ingredient information from Section 2. |

## Section 5. Fire Fighting Measures

| | | | | |
|---|---|---|---|---|
| Flammable Properties | Flash Point | N/A | Method | N/A |
| Flammable Limits | Lower | N/A | Upper | N/A |
| Autoignition Temperature | | | | |

| | |
|---|---|
| Hazardous Combustion Products | |
| Extinguishing Media | Use any means suitable for extinguishing the surrounding fire. (Water spray, dry chemical, alcohol foam, or carbon dioxide.) |
| Fire & Explosion Hazards | Not considered to be a fire or explosion hazard. |
| Fire Fighting Instructions | Use normal procedures/instructions. |
| Fire Fighting Equipment | Use protective clothing and breathing equipment appropriate for the surrounding fire. |

## Section 6. Accidental Release Measures

Ventilate area of leak or spill. Cover spill with 1:1:1 mixture of Sodium Carbonate, clay cat litter and sand. Scoop into container and transport to fume hood. Add the mixture to cold water (about 10 mL water for each 1 mL of Formaldehyde solution). Slowly add household bleach (2.5 mL bleach for each 1 mL of Formaldehyde solution). Allow to stand for 20 minutes. Decant liquid to drain. Flush with water. Treat solid residue as normal refuse.

## Section 7. Handling and Storage

| | |
|---|---|
| Handling/Storage | As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes. Protect from freezing and physical damage. Use with adequate ventilation. Store at controlled room temperature, 15-30°C. |

SAFETY STORAGE CODE: HEALTH

## Section 8. Exposure Controls, Personal Protection

Engineering Controls: Use of a fume hood is recommended.

Respiratory Protection: If the exposure level is exceeded, wear a full facepiece respirator equipped with a formaldehyde cartridge.

Skin Protection: Gloves

Eye Protection: Safety glasses or goggles.

**Permissible Exposure Levels (see also Section 2)**

| Component | CAS # | OSHA PEL | ACGIH TLV | Other Limits Recommended | Percent |
|---|---|---|---|---|---|
| Formaldehyde | 50-00-0 | 0.75 ppm | C 0.3 mg/m$^3$ | | 3-4 |
| Methyl Alcohol | 67-56-1 | 200 ppm | 250 ppm | | 1-1.5 |
| Sodium Phosphate Monobasic Monohydrate | 10049-21-5 | N/A | N/A | | <1 |
| Sodium Phosphate Dibasic | 7558-79-4 | N/A | N/A | | <1 |
| Water, Deionized | 7732-18-5 | N/A | N/A | | Balance |

## Section 9. Physical and Chemical Properties

| | | | |
|---|---|---|---|
| Boiling Point | approx. 100°C | Specific Gravity (H2O = 1) | approx. 1.02 |
| Vapor Pressure (mm Hg) | N/A | Melting Point | approx. 0°C |
| Vapor Density (AIR = 1) | | Evaporation rate (Butyl Acetate = 1) | |
| Solubility in Water | Infinite | Physical State | |
| Appearance and Odor | Clear, colorless/pungent odor | Other | pH: 7.0 |

## Section 10. Stability and Reactivity

Chemical Stability: Stable under normal conditions of use and storage.

Incompatibility: Strong oxidizers, strong alkalies, acids, phenol, urea.

Hazardous Decomposition Products: May form Carbon Dioxide, Carbon Monoxide and Formaldehyde when heated to decomposition.

Hazardous Polymerization: Nonhazardous polymerization may occur, forming paraformaldehyde, a white solid.

## Section 11. Toxological Information

$LD_{50}$, Oral, Rat: (Formaldehyde) 100 mg/kg; $LD_{50}$, Oral, Rat: (Sodium Phosphate Diabasic) 17,000 mg/kg; Details of toxic effects not reported other than lethal dose value.

## Section 12. Ecological Information

Ecotoxicological Information: Formaldehyde is expected to be slightly toxic to aquatic life.

Chemical Fate Information: Formaldehyde is expected to readily biodegrade when released into water.

## Section 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be disposed of in a RCRA approved waste disposal facility. Dispose of in accordance with local, state, and federal regulations.

## Section 14. Transport Information

GROUND SHIPMENTS: Not regulated

AIR SHIPMENTS: Aviation Regulated Liquid n.o.s. (formaldehyde), 9, UN3334

*NOTE: It is ultimately the shippers responsibility to make hazard class determination based on their best information available.*

## Section 15. Regulatory Information

OSHA Status: This item meets the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA Status: All components of this solution are listed on the TSCA Inventory.

CERCLA Reportable Quantity: Formaldehyde, RQ 100 pounds.

SARA TITLE III:

Section 302 Extremely Hazardous Substances: Formaldehyde TPQ 500 pounds

Section 311/312 Hazardous Categories: No

Section 313 Toxic Chemicals: Formaldehyde, 0.1% De Minimus concentration

RCRA Status: No

California Proposition 65: No listed (Formaldehyde gas is listed)

Florida: Formaldehyde is listed on the state Toxic Substances List.

Pennsylvania: Formaldehyde is listed as an environmental and special hazard on the Hazardous Substances List.

## Section 16. Other Information

NFPA Ratings: Health: 2 Flammability: 2 Reactivity: 0 Special Notice Key: None

HMIS® Ratings: Health: 4 Flammability: 2 Reactivity: 0 Protective Equipment: C (protective eyewear and gloves)

# SAFETY DATA SHEET

**Creation Date** 12-Nov-2010 **Revision Date** 06-Jul-2018 **Revision Number** 7

## 1. Identification

**Product Name** **Sulfuric Acid (Certified ACS Plus)**

**Cat No. :** **A300-212; A300-225LB; A300-500; A300-612GAL; A300-700LB; A300C212; A300C212EA; A300P500; A300S212; A300S212EA; A300S500; A300SI212;**

**Synonyms** Hydrogen sulfate; Vitriol brown oil; Oil of vitriol

**Recommended Use** Laboratory chemicals.
**Uses advised against** Food, drug, pesticide or biocidal product use

**Details of the supplier of the safety data sheet**

**Company**
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

**Emergency Telephone Number**
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

## 2. Hazard(s) identification

**Classification**
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

| | |
|---|---|
| Corrosive to metals | Category 1 |
| Skin Corrosion/irritation | Category 1 A |
| Serious Eye Damage/Eye Irritation | Category 1 |
| Specific target organ toxicity (single exposure) | Category 3 |
| Target Organs - Respiratory system. | |

**Label Elements**

**Signal Word**
Danger

**Hazard Statements**
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation

**Precautionary Statements**
**Prevention**
Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Wash face, hands and any exposed skin thoroughly after handling
Use only outdoors or in a well-ventilated area
Keep only in original container
**Response**
Immediately call a POISON CENTER or doctor/physician
**Inhalation**
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
**Skin**
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
**Eyes**
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
**Ingestion**
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
**Storage**
Store locked up
Store in a well-ventilated place. Keep container tightly closed
**Disposal**
Dispose of contents/container to an approved waste disposal plant
**Hazards not otherwise classified (HNOC)**
None identified
WARNING. Cancer - https://www.p65warnings.ca.gov/.

## 3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|---|---|---|
| Sulfuric acid | 7664-93-9 | 90 - 98 |
| Water | 7732-18-5 | 2 - 10 |

## 4. First-aid measures

**General Advice** Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

**Eye Contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

**Skin Contact** Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before re-use. Immediate medical attention is required.

**Inhalation** Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

**Ingestion** Do not induce vomiting. Never give anything by mouth to an unconscious person. Call a

physician or Poison Control Center immediately.

**Most important symptoms and effects** Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

**Notes to Physician** Treat symptomatically

## 5. Fire-fighting measures

**Suitable Extinguishing Media** $CO_2$, dry chemical, dry sand, alcohol-resistant foam.

**Unsuitable Extinguishing Media** DO NOT USE WATER

**Flash Point** Not applicable
**Method -** No information available

**Autoignition Temperature** No information available

**Explosion Limits**
**Upper** No data available
**Lower** No data available
**Sensitivity to Mechanical Impact** No information available
**Sensitivity to Static Discharge** No information available

**Specific Hazards Arising from the Chemical**
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes.

**Hazardous Combustion Products**
Sulfur oxides Hydrogen
**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

**NFPA**

| Health | Flammability | Instability | Physical hazards |
|---|---|---|---|
| 3 | 0 | 2 | W |

## 6. Accidental release measures

**Personal Precautions** Ensure adequate ventilation. Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

**Environmental Precautions** Should not be released into the environment.

**Methods for Containment and Clean Up** Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

## 7. Handling and storage

**Handling** Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.

**Storage** Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from water. Corrosives area.

## 8. Exposure controls / personal protection

**Exposure Guidelines**

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH | Mexico OEL (TWA) |
|---|---|---|---|---|
| Sulfuric acid | TWA: 0.2 mg/m³ | (Vacated) TWA: 1 mg/m³<br>TWA: 1 mg/m³ | IDLH: 15 mg/m³<br>TWA: 1 mg/m³ | TWA: 1 mg/m³ |

*Legend*

*ACGIH - American Conference of Governmental Industrial Hygienists*
*OSHA - Occupational Safety and Health Administration*
*NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

**Engineering Measures** Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

**Personal Protective Equipment**

**Eye/face Protection** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection** Wear appropriate protective gloves and clothing to prevent skin exposure.

**Respiratory Protection** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

**Hygiene Measures** Handle in accordance with good industrial hygiene and safety practice.

## 9. Physical and chemical properties

| | |
|---|---|
| **Physical State** | Liquid |
| **Appearance** | Clear, Colorless to brown |
| **Odor** | Odorless |
| **Odor Threshold** | No information available |
| **pH** | 0.3 (1N) |
| **Melting Point/Range** | 10 °C / 50 °F |
| **Boiling Point/Range** | 290 - 338 °C / 554 - 640.4 °F |
| **Flash Point** | Not applicable |
| **Evaporation Rate** | Slower than ether |
| **Flammability (solid,gas)** | Not applicable |
| **Flammability or explosive limits** | |
| **Upper** | No data available |
| **Lower** | No data available |
| **Vapor Pressure** | < 0.001 mmHg @ 20 °C |
| **Vapor Density** | 3.38 (Air = 1.0) |
| **Specific Gravity** | 1.84 |
| **Solubility** | Soluble in water |
| **Partition coefficient; n-octanol/water** | No data available |
| **Autoignition Temperature** | No information available |
| **Decomposition Temperature** | 340°C |
| **Viscosity** | No information available |
| **Molecular Formula** | H2SO4 |
| **Molecular Weight** | 98.08 |

## 10. Stability and reactivity

**Reactive Hazard** Yes

**Stability** Reacts violently with water. Hygroscopic.

**Conditions to Avoid** Incompatible products. Excess heat. Exposure to moist air or water.

**Incompatible Materials** Water, Organic materials, Strong acids, Strong bases, Metals, Alcohols, Cyanides, Sulfides

**Hazardous Decomposition Products** Sulfur oxides, Hydrogen

**Hazardous Polymerization** Hazardous polymerization does not occur.

**Hazardous Reactions** None under normal processing.

## 11. Toxicological information

**Acute Toxicity**

**Product Information**

**Oral LD50** Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

**Dermal LD50** Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

**Vapor LC50** Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

**Component Information**

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|---|---|---|---|
| Sulfuric acid | 2140 mg/kg ( Rat ) | Not listed | LC50 85 - 103 mg/m³ ( Rat ) 1 h |
| Water | - | Not listed | Not listed |

**Toxicologically Synergistic Products** No information available

**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

**Irritation** Causes severe burns by all exposure routes

**Sensitization** No information available

**Carcinogenicity** The table below indicates whether each agency has listed any ingredient as a carcinogen. Exposure to strong inorganic mists containing sulfuric acid may cause cancer by inhalation.

| Component | CAS-No | IARC | NTP | ACGIH | OSHA | Mexico |
|---|---|---|---|---|---|---|
| Sulfuric acid | 7664-93-9 | Group 1 | Known | A2 | X | A2 |
| Water | 7732-18-5 | Not listed | Not listed | Not listed | Not listed | Not listed |

*IARC: (International Agency for Research on Cancer)*

*NTP: (National Toxicity Program)*

*ACGIH: (American Conference of Governmental Industrial Hygienists)*

*Mexico - Occupational Exposure Limits - Carcinogens*

*IARC: (International Agency for Research on Cancer)*
*Group 1 - Carcinogenic to Humans*
*Group 2A - Probably Carcinogenic to Humans*
*Group 2B - Possibly Carcinogenic to Humans*

*NTP: (National Toxicity Program)*
*Known - Known Carcinogen*
*Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen*

*A1 - Known Human Carcinogen*
*A2 - Suspected Human Carcinogen*
*A3 - Animal Carcinogen*
*ACGIH: (American Conference of Governmental Industrial Hygienists)*

*Mexico - Occupational Exposure Limits - Carcinogens*
*A1 - Confirmed Human Carcinogen*
*A2 - Suspected Human Carcinogen*
*A3 - Confirmed Animal Carcinogen*
*A4 - Not Classifiable as a Human Carcinogen*
*A5 - Not Suspected as a Human Carcinogen*

**Mutagenic Effects** No information available

**Reproductive Effects** No information available.

**Developmental Effects** No information available.

**Teratogenicity** No information available.

# Appendix A

Health and Safety Plan

**STOT - single exposure** Respiratory system
**STOT - repeated exposure** None known

**Aspiration hazard** No information available

**Symptoms / effects,both acute and delayed** Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

**Endocrine Disruptor Information** No information available

**Other Adverse Effects** The toxicological properties have not been fully investigated.

## 12. Ecological information

**Ecotoxicity**
This product contains the following substance(s) which are hazardous for the environment. .

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|---|---|---|---|---|
| Sulfuric acid | - | LC50: > 500 mg/L, 96h static (Brachydanio rerio) | - | EC50: 29 mg/L/24h |

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available.

**Mobility** No information available.

## 13. Disposal considerations

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

## 14. Transport information

**DOT**
**UN-No** UN1830
**Proper Shipping Name** Sulfuric acid
**Hazard Class** 8
**Packing Group** II

**TDG**
**UN-No** UN1830
**Proper Shipping Name** SULFURIC ACID
**Hazard Class** 8
**Packing Group** II

**IATA**
**UN-No** UN1830
**Proper Shipping Name** SULFURIC ACID
**Hazard Class** 8
**Packing Group** II

**IMDG/IMO**
**UN-No** UN1830
**Proper Shipping Name** SULFURIC ACID
**Hazard Class** 8
**Packing Group** II

## 15. Regulatory information

**All of the components in the product are on the following Inventory lists:** X = listed

**International Inventories**

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfuric acid | X | X | - | 231-639-5 | - | | X | X | X | X | X |
| Water | X | X | - | 231-791-2 | - | | X | - | X | X | X |

**Legend:**
**X - Listed**
**E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.**
**F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.**
**N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.**
**P - Indicates a commenced PMN substance**
**R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.**
**S - Indicates a substance that is identified in a proposed or final Significant New Use Rule**
**T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.**
**XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).**
**Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.**
**Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.**

**U.S. Federal Regulations**

**TSCA 12(b)** Not applicable

**SARA 313**

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|---|---|---|---|
| Sulfuric acid | 7664-93-9 | 90 - 98 | 1.0 |

**SARA 311/312 Hazard Categories** See section 2 for more information

**CWA (Clean Water Act)**

| Component | CWA - Hazardous Substances | CWA - Reportable Quantities | CWA - Toxic Pollutants | CWA - Priority Pollutants |
|---|---|---|---|---|
| Sulfuric acid | X | 1000 lb | - | - |

**Clean Air Act** Not applicable

**OSHA** Occupational Safety and Health Administration
Not applicable

**CERCLA** This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|---|---|---|
| Sulfuric acid | 1000 lb | 1000 lb |

**California Proposition 65** This product contains the following proposition 65 chemicals

| Component | CAS-No | California Prop. 65 | Prop 65 NSRL | Category |
|---|---|---|---|---|
| Sulfuric acid | 7664-93-9 | Carcinogen | - | Carcinogen |

**U.S. State Right-to-Know Regulations**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---|---|---|---|---|---|
| Sulfuric acid | X | X | X | X | X |
| Water | - | - | X | - | - |

**U.S. Department of Transportation**

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**
This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade** No information available

## 16. Other information

**Prepared By**
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

**Creation Date** 12-Nov-2010
**Revision Date** 06-Jul-2018
**Print Date** 06-Jul-2018
**Revision Summary** SDS sections updated. 2.

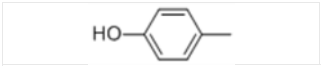
**Disclaimer**
**The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text**

**End of SDS**

# 4-Methylphenol(106-44-5)

## Contents






## Product Identification

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**【Product Name】**

4-Methylphenol

**【Synonyms】**

4-Hydroxy-1-methylbenzene
4-Methylphenol
p-Hydroxytoluene

**【CAS】**

**106-44-5**

**【Formula】**

C7H8O

**【Molecular Weight】**

108.14

**【EINECS】**

203-398-6

**【RTECS】**

GO6475000

**【RTECS Class】**

Tumorigen; Drug; Mutagen; Natural Product; Primary Irritant

**【Merck】**

13,2604

**【Beilstein/Gmelin】**

1305151

**【Beilstein Reference】**

4-06-00-02093

**【EC Index Number】**

604-004-00-9

**【EC Class】**

Toxic; Corrosive

## Physical and Chemical Properties

Back to Contents

**【Appearance】**

Colorless crystals or yellowish liquid, with a phenolic or sweet, tarry odor.

**【Solubility in water】**

19 g/L

**【Melting Point】**

32 - 34

**【Boiling Point】**

201.8

**【Vapor Pressure】**

.1

**【Density】**

1.034 g/cm3 (20 C)

**【pKa/pKb】**

10.26 (pKa)

**【Partition Coefficient】**

1.94

**【Heat Of Vaporization】**

47.45 kJ/mol

**【Heat Of Combustion】**

-3773 kJ/mol

**【Usage】**

Chemical intermediate for tricresyl phosphate & cresyl diphenyl phosphate, agent in prodn of disinfectants, explosives, & synthetic perfumery materials, metal cleaning agent, solvent for wire enamels, agent in ore flotation, monomer for phenolic resins.

**【Saturation Concentration】**

145 ppm (0.015%) at 25 C (calculated)

**【Odor threshold】**

0.46 ppb

**【Refractive Index】**

1.5312 (20 C)

## First Aid Measures

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**【Ingestion】**

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**【Inhalation】**

Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear. DO NOT use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.

**【Skin】**

Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.

**【Eyes】**

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation is required (at least 30 minutes).

## Handling and Storage

Back to Contents

**【Storage】**

Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**【Handling】**

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Minimize dust generation and accumulation. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not ingest or inhale. Discard contaminated shoes. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

## Hazards Identification

Back to Contents

**【Inhalation】**

Irritation may lead to chemical pneumonitis and pulmonary edema. May cause liver and kidney damage. May cause severe irritation of the upper respiratory tract with pain, burns, and inflammation. Causes chemical burns to the respiratory tract.

**【Skin】**

Causes skin burns. May be absorbed through the skin in harmful amounts.

**【Eyes】**

Causes eye burns. May result in corneal injury. Contact with liquid is corrosive to the eyes and causes severe b urns.

**【Ingestion】**

May cause severe and permanent damage to the digestive tract. Causes gastrointestinal tract burns. Causes s evere digestive tract burns with abdominal pain, vomiting, and possible death. Aspiration of material into the lun gs may cause chemical pneumonitis, which may be fatal.

**【Hazards】**

When heated, vapors may form explosive mixtures with air: indoors, outdoors, and sewers explosion hazards.

**【EC Risk Phrase】**

R 24/25 34

**【EC Safety Phrase】**

S 36/37/39 45

**【UN (DOT)】**

2076

## Exposure Controls/Personal Protection

Back to Contents

**【Personal Protection】**

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and fac e protection regulations in 29 CFR 1910.133 or European Standard EN166. Skin: Wear appropriate protective g loves to prevent skin exposure. Clothing: Wear appropriate protective clothing to minimize contact with skin. We ar appropriate protective clothing to prevent skin exposure.

**【Respirators】**

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or Europ ean Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use. Follow the O SHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or E uropean Standard EN 149 approved respirator when necessary.

**【Exposure Effects】**

Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion.

**【Exposure limit(s)】**

OSHA PEL: TWA 5 ppm (22 mg/m3) skin NIOSH REL: TWA 2.3 ppm (10 mg/m3) NIOSH IDLH: 250 ppm

**【Poison Class】**

3

## Fire Fighting Measures

Back to Contents

**【Flash Point】**

86

**【Autoignition】**

555

**【Fire Fighting】**

Wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and f ull protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Duri ng a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. May poly merize explosively when involved in a fire. Extinguishing media: For small fires, use water spray, dry chemical, carbon dioxide or chemical foam.

**【Upper exp. limit】**

7.6

**【Lower exp. limit】**

1.1

**【Fire Potential】**

Slightly flammable. With flame. If handled at elevated temperatures, flammable toxic vapors may be given off.

## Accidental Release Measures

Back to Contents

**【Small spills/leaks】**

Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Avoid runof f into storm sewers and ditches which lead to waterways. Clean up spills immediately, using the appropriate pro tective equipment. Wear a self contained breathing apparatus and appropriate Personal protection. (See Expos ure Controls, Personal Protection section). Remove all sources of ignition. Provide ventilation.

## Stability and Reactivity

Back to Contents

**【Disposal Code】**

9

**【Incompatibilities】**

Oxidizing agents, strong acids, coatings, plastics, rubber, alliphatic amines, amides (e.g. butyramide, diethyltolu amide, dimethyl formamide), chlorosulfonic acid, oleum, alkalies.

**【Stability】**

Stable at room temperature in closed containers under normal storage and handling conditions.

**【Decomposition】**

Carbon monoxide, carbon dioxide, cresol.

**【Combustion Products】**

Emits highly toxic fumes.

## Transport Information

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**【UN Number】**

2076

**【Hazard Class】**

6.1

**【Packing Group】**

II

**【HS Code】**

2907 12 00

# Ammonia

## SECTION 1 : Identification of the substance/mixture and of the supplier

**Product name** : **Ammonia**

**Manufacturer/Supplier Trade name**:

**Manufacturer/Supplier Article number**: **S25164**

**Recommended uses of the product and uses restrictions on use**:

**Manufacturer Details**:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

**Supplier Details**:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

**Emergency telephone number**:

Fisher Science Education Emergency Telephone No.: 800-535-5053

## SECTION 2 : Hazards identification

**Classification of the substance or mixture**:

**Corrosive**
Skin corrosion, category 1B

**Environmentally Damaging**
Acute hazards to the aquatic environment, category 1

**Irritant**
Specific target organ toxicity following single exposure, category 3

STOT SE 3
AcAq Tox 1
Skin Corr. 1B

**Signal word** :Danger

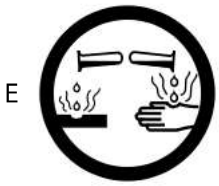
**Hazard statements**:
Causes severe skin burns and eye damage
May cause respiratory irritation
Very toxic to aquatic life
**Precautionary statements**:
If medical advice is needed, have product container or label at hand
Keep out of reach of children
Read label before use
Do not breathe dust/fume/gas/mist/vapours/spray
Avoid release to the environment
Wear protective gloves/protective clothing/eye protection/face protection
Use personal protective equipment as required

Do not eat, drink or smoke when using this product
Wash skin thoroughly after handling
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting
Collect spillage
Specific treatment (see supplemental first aid instructions on this label)
Wash contaminated clothing before reuse
Store locked up
Store in a dry place
Store in a well ventilated place. Keep container tightly closed
Dispose of contents/container to ...

**Combustible Dust Hazard: :**
May form combustible dust concentrations in air (during processing).

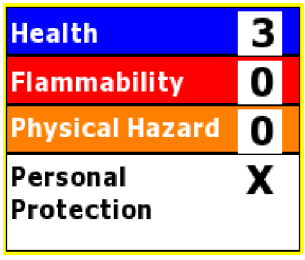
**Other Non-GHS Classification**:

**WHMIS**




**NFPA/HMIS**


NFPA SCALE (0-4)




HMIS RATINGS (0-4)

## SECTION 3 : Composition/information on ingredients

| **Ingredients:** | | |
|---|---|---|
| CAS 1336-21-6 | Ammonium Hydroxide, ACS | 12.32 % |
| CAS 7732-18-5 | Deionized Water | 87 % |
| | | Percentages are by weight |

## SECTION 4 : First aid measures

**Description of first aid measures**

**After inhalation:** Move exposed individual to fresh air. Loosen clothing as necessary and position individual in

a comfortable position.Seek medical advice if discomfort or irritation persists.If breathing difficult, give oxygen.

**After skin contact:** Wash affected area with soap and water. Rinse/flush exposed skin gently using water for 15-20 minutes. Seek medical advice if discomfort or irritation persists.

**After eye contact:** Protect unexposed eye. Rinse/flush exposed eye(s) gently using water for 15-20 minutes. Remove contact lens(es) if able to do so during rinsing. Seek medical attention if irritation persists or if concerned.

**After swallowing:** Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Seek medical attention if irritation, discomfort or vomiting persists.

**Most important symptoms and effects, both acute and delayed:**

Irritation, Nausea,Headache, Shortness of breath.;

**Indication of any immediate medical attention and special treatment needed:**

If seeking medical attention, provide SDS document to physician.

## SECTION 5 : Firefighting measures

**Extinguishing media**

**Suitable extinguishing agents:** If in laboratory setting, follow laboratory fire suppression procedures. Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition

**For safety reasons unsuitable extinguishing agents:**

**Special hazards arising from the substance or mixture:**

Combustion products may include carbon oxides or other toxic vapors.Thermal decomposition can lead to release of irritating gases and vapors.Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

**Advice for firefighters:**

**Protective equipment:** Use NIOSH-approved respiratory protection/breathing apparatus.

**Additional information (precautions):** Move product containers away from fire or keep cool with water spray as a protective measure, where feasible.Use spark-proof tools and explosion-proof equipment.

## SECTION 6 : Accidental release measures

**Personal precautions, protective equipment and emergency procedures:**

Wear protective equipment. Transfer to a disposal or recovery container.Use spark-proof tools and explosion-proof equipment.Use respiratory protective device against the effects of fumes/dust/aerosol. Keep unprotected persons away. Ensure adequate ventilation.Keep away from ignition sources. Protect from heat.Stop the spill, if possible. Contain spilled material by diking or using inert absorbent.

**Environmental precautions:**

Prevent from reaching drains, sewer or waterway. Collect contaminated soil for characterization per Section 13

**Methods and material for containment and cleaning up:**

If in a laboratory setting, follow Chemical Hygiene Plan procedures.Place into properly labeled containers for recovery or disposal. If necessary, use trained response staff/contractor.Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Collect solids in powder form using vacuum with (HEPA filter)

**Reference to other sections:**

## SECTION 7 : Handling and storage

**Precautions for safe handling:**

Wash hands after handling. Follow good hygiene procedures when handling chemical materials. Do not eat, drink, smoke, or use personal products when handling chemical substances. If in a laboratory setting, follow Chemical Hygiene Plan.Use only in well ventilated areas.Avoid contact with eyes, skin, and clothing.

**Conditions for safe storage, including any incompatibilities:**

Provide ventilation for containers. Avoid storage near extreme heat, ignition sources or open flame. Store away from foodstuffs. Store away from oxidizing agents.Store in cool, dry conditions in well sealed containers. Store with like hazards

## SECTION 8 : Exposure controls/personal protection



**Control Parameters:**
1336-21-6, Ammonium Hydroxide, ACGIH TLV: 17 mg/m3
1336-21-6 , Ammonium Hydroxide , OSHA PEL: 35 mg/m3
1336-21-6, Ammonium Hydroxide, OSHA TWA 25 ppm (18 mg/m3) ST 35 ppm (27 mg/m3)
1336-21-6, Ammonium Hydroxide, ACGIH TWA 25 ppm (18 mg/m3) ST 35 ppm (27 mg/m3)

**Appropriate Engineering controls:**
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use/handling.Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or dusts (total/respirable) below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.Use under a fume hood. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment.Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment).

**Respiratory protection:**
Use suitable respiratory protective device when high concentrations are present. Use suitable respiratory protective device when aerosol or mist is formed. For spills, respiratory protection may be advisable.

**Protection of skin:**
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation being used/handled.Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.

**Eye protection:**
Safety glasses with side shields or goggles.

**General hygienic measures:**
The usual precautionary measures are to be adhered to when handling chemicals. Keep away from food, beverages and feed sources. Immediately remove all soiled and contaminated clothing. Wash hands before breaks and at the end of work. Do not inhale gases/fumes/dust/mist/vapor/aerosols. Avoid contact with the eyes and skin.

## SECTION 9 : Physical and chemical properties

| | | | |
|---|---|---|---|
| **Appearance (physical state,color)**: | Clear, colorless liquid. | **Explosion limit lower**:<br>**Explosion limit upper**: | Not Determined<br>Not Determined |

**Ammonia**

| | | | |
|---|---|---|---|
| **Odor**: | Ammonia-like | **Vapor pressure**: | 115 at 20 C |
| **Odor threshold**: | Not Determined | **Vapor density**: | 3.38 |
| **pH-value**: | 9 | **Relative density**: | 0.9 |
| **Melting/Freezing point**: | - 72 C | **Solubilities**: | Infinite solubility in water. |
| **Boiling point/Boiling range**: | 36 C | **Partition coefficient (n-octanol/water)**: | Not Determined |
| **Flash point (closed cup)**: | Not Determined | **Auto/Self-ignition temperature**: | Not Determined |
| **Evaporation rate**: | Not Determined | **Decomposition temperature**: | Not Determined |
| **Flammability (solid,gaseous)**: | Not Determined | **Viscosity**: | a. Kinematic:Not Determined<br>b. Dynamic: Not Determined |
| **Density**: 0.9 g/cm3 at 20 °C | | | |

## SECTION 10 : Stability and reactivity

**Reactivity:**
**Chemical stability:**No decomposition if used and stored according to specifications.
**Possible hazardous reactions:**
**Conditions to avoid:**Store away from oxidizing agents, strong acids or bases.
**Incompatible materials:**Strong oxidizers, acids, gold, mercury, halogens, silv er, calcium hypochlorite bleaches.
**Hazardous decomposition products:**Ammonia and nitrogen oxides.

## SECTION 11 : Toxicological information

| | | |
|---|---|---|
| **Acute Toxicity**: | | |
| **Oral**: | LD50: 350 mg/kg (rat) | Ammonium Hydroxide (1336-21-6) |
| **Chronic Toxicity**: No additional information. | | |
| **Corrosion Irritation**: No additional information. | | |
| **Sensitization**: | | No additional information. |
| **Single Target Organ (STOT)**: | | No additional information. |
| **Numerical Measures**: | | No additional information. |
| **Carcinogenicity**: | | No additional information. |
| **Mutagenicity**: | | No additional information. |
| **Reproductive Toxicity**: | | No additional information. |

## SECTION 12 : Ecological information

**Ecotoxicity**

**Fish (acute 1336-21-6)**: 96 Hr LC50 Pimephales promelas: 8.2 mg/L

**Crustacea (acute 1336-21-6)**: 48 Hr EC50 water flea: 0.66 mg/L; 48 Hr EC50 Daphnia pulex: 0.66 mg/L

**Persistence and degradability**: Readily degradable in the environment.
**Bioaccumulative potential**:
**Mobility in soil**:
**Other adverse effects**:

## SECTION 13 : Disposal considerations

**Waste disposal recommendations**:

Product/containers must not be disposed together with household garbage. Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Consult federal state/ provincial and local regulations regarding the proper disposal of waste material that may incorporate some amount of this product.

## SECTION 14 : Transport information

**UN-Number**

2672

**UN proper shipping name**

Ammonia Solution

**Transport hazard class(es)**

**Class:**
8 Corrosive substances

**Packing group**:III
**Environmental hazard**:
**Transport in bulk**:
**Special precautions for user**:

## SECTION 15 : Regulatory information

**United States (USA)**

**SARA Section 311/312 (Specific toxic chemical listings)**:

Acute, Chronic

**SARA Section 313 (Specific toxic chemical listings)**:

1336-21-6 Ammonium Hydroxide

**RCRA (hazardous waste code)**:

None of the ingredients is listed

**TSCA (Toxic Substances Control Act)**:

All ingredients are listed.

**CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act)**:

1336-21-6 Ammonium Hydroxide, ACS 1000

**Proposition 65 (California)**:

**Chemicals known to cause cancer**:

None of the ingredients is listed

**Chemicals known to cause reproductive toxicity for females**:

None of the ingredients is listed

**Chemicals known to cause reproductive toxicity for males**:

None of the ingredients is listed

**Chemicals known to cause developmental toxicity**:

None of the ingredients is listed

**Canada**

**Canadian Domestic Substances List (DSL)**:

All ingredients are listed.

**Canadian NPRI Ingredient Disclosure list (limit 0.1%)**:

None of the ingredients is listed

**Canadian NPRI Ingredient Disclosure list (limit 1%)**:

1336-21-6 Ammonium hydroxide

## SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material.It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

**GHS Full Text Phrases**:

**Abbreviations and acronyms**:
IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)
CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Control Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)

**Effective date** : 12.31.2014
**Last updated** : 03.19.2015

# Appendix B

Field Forms

# SPI and PV IMAGING COLLECTION FORM

**Project Name:** **Project No.:**

**Date:** _____ **Boat:** **Crew:**

| Station ID | Replicate (A,B,C) | Time (hh:mm) | Water Depth (m) | Frame Count (#) | Stop Height (in.) | Lead Weight (each side) | Comments |
|---|---|---|---|---|---|---|---|
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Note: Number of lead weights on each side x 53 lb = total weight on both racks

# SURFACE SEDIMENT COLLECTION FORM

**Project Name:** _____ **Project #:** _____ pg ___of____

**Date:** _____ **Weather:** _____

**Crew:** _____

**Sampling Method:** _____

**Station Positioning Tolerance:**

**Station:** _____ **Time:** _____ **Attempt #:** _____ **Acceptable Grab:** □ Yes □ No

**"On Bottom" Coordinates:** _____

**Estimated Distance from Target Station:** _____ **Acceptable Distance:** □ Yes □ No

**Bottom Depth:** _____ **Penetration Depth:** _____ **Photo ID:** _____

**Sample ID:** _____ □ **discrete** □ **composite**

**Type:** □ cobble □ gravel □ sand [coarse / medium / fine] □ silt clay □ organic matter □ wood/shell fragments

**Color:** □ drab olive □ gray □ black □ brown **Apparent Redox Discontinuity Depth:** _____

**Odor:** □ none □ slight □ moderate □ strong □ sulfidic □ petroleum □ other

**Comments/Description:**

**Station:** _____ **Time:** _____ **Attempt #:** _____ **Acceptable Grab:** □ Yes □ No

**"On Bottom" Coordinates:** _____

**Estimated Distance from Target Station:** _____ **Acceptable Distance:** □ Yes □ No

**Bottom Depth:** _____ **Penetration Depth:** _____ **Photo ID:** _____

**Sample ID:** _____ □ **discrete** □ **composite**

**Type:** □ cobble □ gravel □ sand [coarse / medium / fine] □ silt clay □ organic matter □ wood/shell fragments

**Color:** □ drab olive □ gray □ black □ brown **Apparent Redox Discontinuity Depth:** _____

**Odor:** □ none □ slight □ moderate □ strong □ sulfidic □ petroleum □ other

**Comments/Description:**