DRAFT
SAMPLING AND ANALYSIS PLAN

NORTH ENERGY ISLAND BORROW PIT AQUATIC CAPPING DISPOSAL YEAR 5 MONITORING

Prepared for

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cm	centimeter(s)
COC	chain-of-custody
DGPS	Differentially Global Positioning System
DMMP	Dredged Material Management Plan
DOC	dissolved organic carbon
EPA	U.S. Environmental Protection Agency
ft	foot (or feet)
HASP	Health and Safety Plan
HPDE	High Density Polyethylene
in	inch(es)
LARE	Los Angeles River Estuary
LTMP	long-term monitoring program
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mm	millimeter(s)
MS/MSD	matrix spike/matrix spike duplicate
NEIBP	North Energy Island Borrow Pit
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PTFE	poly tetra-fluoroethylene
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SCAMIT	Southern California Association Marine Invertebrate Taxonomists
SCUBA	Self Contained Underwater Breathing Apparatus
SEIBP	South Energy Island Borrow Pit
SEM	Scanning Electron Microscope
SOP	Standard Operating Procedures
SPI	Sediment Profiling Imaging
TOC	total organic carbon
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

1 INTRODUCTION

This document presents the components of a Sampling and Analysis Plan (SAP) for the fifth year of monitoring at the North Energy Island Borrow Pit (NEIBP) aquatic capping site in Long Beach, California. The general scope of work for this project includes collection of physical and chemical data from the surface and subsurface of the cap and surrounding areas to support an evaluation of cap performance. This SAP is intended for use by all personnel collecting and processing the field samples.

1.1 Project History

In early 2001, the Los Angeles District of the U.S. Army Corps of Engineers (USACE) initiated the Los Angeles County Regional Dredged Material Management Plan Pilot Studies (DMMP Pilot Studies) to evaluate the feasibility for treating and/or disposing of contaminated dredge sediments within the Los Angeles County Region. Four alternatives were selected for field and laboratory pilot studies to gather additional information to aid in the evaluation; cement stabilization, sediment washing, sediment blending, and aquatic capping.

For the aquatic capping study, 105,000 cubic meters (m^3) of contaminated sediment were mechanically dredged from the mouth of the Los Angeles River Estuary (LARE) in the City of Long Beach. The dredge material was transported via split hull barge to a large, pre-existing, borrow pit located in Long Beach Harbor where it was deposited into a demonstration cell termed the North Energy Island Borrow Pit (Figure 1). After allowing the approximately 2.5-meter (m) layer of LARE material to consolidate in the disposal pit for 3 months, clean cap material was dredged from a second borrow pit, the South Energy Island Borrow Pit (SEIBP), and used to cover the LARE material with a 1.0- to 1.50-m layer cap.

The DMMP Aquatic Capping Pilot Study was completed in 2001, at which time a long-term monitoring program (LTMP) was immediately initiated to monitor the long-term effectiveness of the procedure for isolating contaminated sediments. The key elements addressed by the monitoring program include:

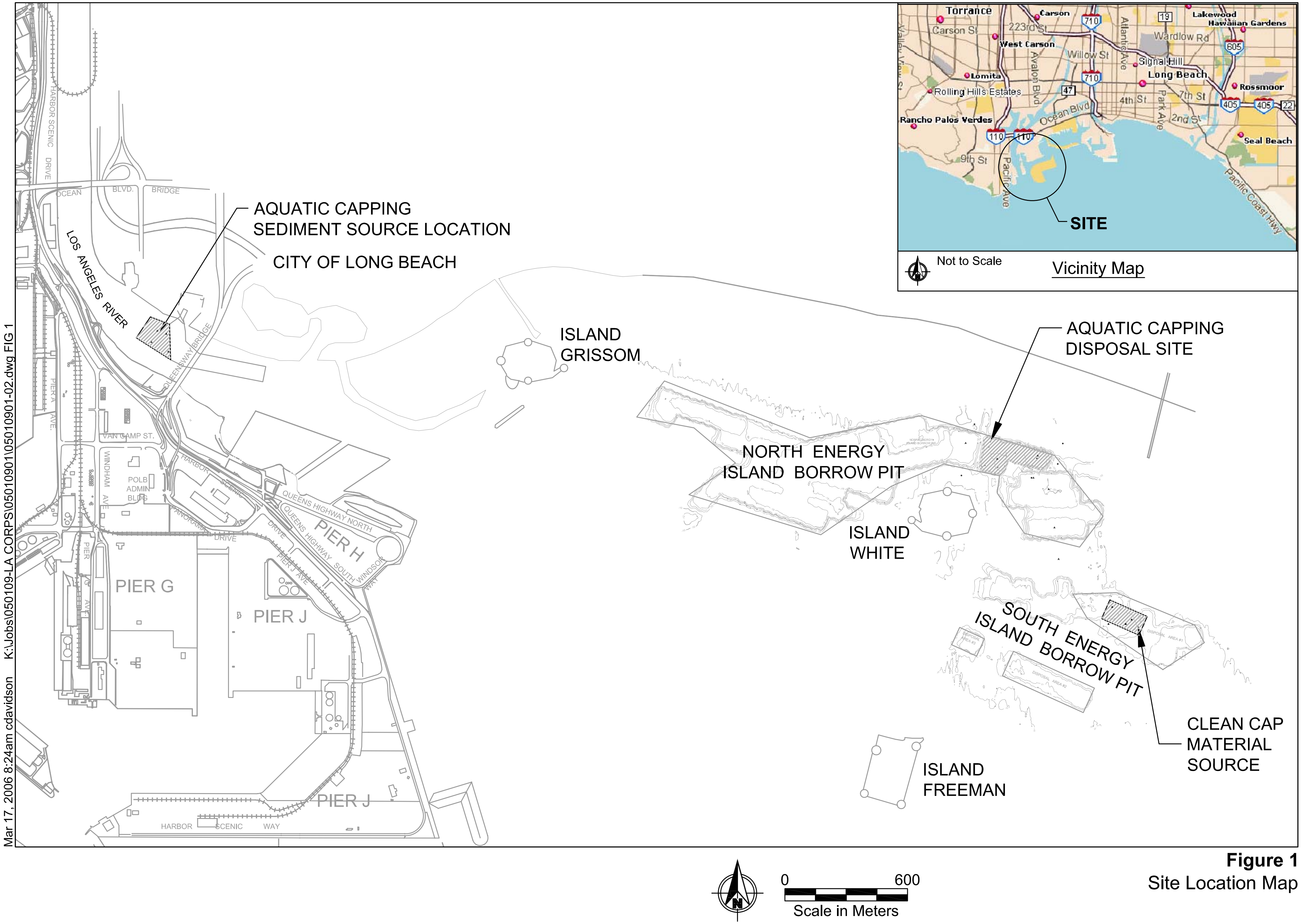


Figure 1
Site Location Map

- Determining if the NEIBP cap site had maintained its physical integrity, ensuring that fractures, erosion or deposition had not compromised the cap's ability to sequester underlying contaminants
- Determining if burrowing organisms (bioturbators) were having a measurable impact on the integrity of the cap
- Determining if, during the 3 years following capping operations, contaminants were migrating through the cap at an unacceptable rate
- Evaluating the rate of re-colonization of the cap site by benthic infauna and comparing this community to the surrounding harbor habitats

Long-term monitoring was first conducted in October 2002 (Year 1), then again in August 2003 (Year 2), and most recently in July 2004 (Year 3). The monitoring plan employed for the first 3 years consisted of the following main categories:

- Bathymetry using a multi beam sonar
- Sediment core sampling at nine locations on the surface of the cap with sub-samples collected at three depths (surface, middle and cap/LARE interface for Year 1, and surface, just above cap/LARE interface and cap/LARE interface for Years 2 and 3) for chemical and physical analyses
- Surface sediment grab sampling at 10 stations within the NEIBP and 10 stations around the edge of the NEIBP for benthic organism abundance and diversity (Years 1 and 2 only)
- Video transects of the NEIBP cap to monitor for the presence of burrowing organisms (Years 1 and 2 only)
- Large benthic grab samples to look for deep burrowing organisms (e.g., ghost shrimp) in areas adjacent to the cap (Year 3 only)
- Pore water from the cap to test for chemical migration from the underlying LARE material (Year 3 only)

2 LONG-TERM MONITORING

2.1 Goals and Objectives

The goals and objectives of the LTMP include intensive (or extensive) monitoring to provide substantial evidence for predicting long-term cap effectiveness by monitoring cap integrity, chemical containment, and biological re-colonization. Monitoring tasks were designed to be sensitive enough to detect "fatal-flaws" in design or site condition factors that were likely to be evident within a few years after cap placement.

To meet these specific study objectives, a series of questions and corresponding data collection methods were developed:

1. Is the surface of the cap eroding or are depositional forces at work?
   a. Conduct bathymetric surveys
   b. Conduct diver video surveys
   c. Collect sediment core samples to evaluate visual evidence of erosion

2. What is the impact of bioturbation on cap integrity?
   a. Conduct diver video surveys
   b. Evaluate cap core chemistry results for evidence of vertical migration
   c. Use cap core visual observations for evidence of mixing
   d. Evaluate benthic community surface samples for the presence of juvenile bioturbators such as Ghost Shrimp

3. Are chemicals migrating through the cap at an unacceptable rate?
   a. Evaluate cap core chemistry results for evidence of vertical migrations
   b. Evaluate cap core sediment grain size samples for evidence of mixing
   c. Use cap core visual observations for evidence of mixing

4. How quickly are biological organisms re-colonizing the surface of the cap?
   a. Collect surface sediment grab samples on the cap and surrounding areas for benthic organism identification and enumeration

5. How do the populations of benthic organisms on the surface of the cap compare to surrounding areas?
   a. Compare surface sediment grab samples (benthic organism identification and enumeration) for the cap to surrounding areas

The ultimate measurement of success or failure of a clean cap placed over contaminated sediments is determined if chemicals do not migrate through the cap layer at a rate that results in significant contamination of the surface sediment or overlying water. To provide the most sensitive measure of potential performance issues for the current project, the bottom layer of the cap (just above the interface with the LARE material) has been the focus of the monitoring program as a way to measure the slightest level of chemical migration. Detecting chemicals in this layer would not indicate a failure of the system; it only provides an early warning that some migration is occurring. Conversely, not detecting chemicals within this layer of the cap can be used as a measure of success for the project.

The LTMP was divided into three monitoring categories: cap integrity, chemical containment, and biological re-colonization. Monitoring for cap integrity and chemical containment are the two primary objectives of the monitoring plan. Biological re-colonization was included to provide information on long-term biological impacts associated with aquatic capping for possible use in future projects.

2.2 Previous Monitoring Results

After 3 years of monitoring the NEIBP cap site, no evidence of contaminant migration into or through the cap from the LARE dredge material has been observed.

Bathymetry results from all three surveys indicated that both the aquatic capping engineering goals of the project had been met and that the integrity of the cap has been maintained. Comparison of surface isopachs between post-construction and the end of the 3-year monitoring effort showed that the surface of the cap has not significantly eroded, fractured or subsided. The video transects across the NEIBP during both the Year 1 and 2 surveys also indicated that there were no visible fractures or large depressions in the cap surface.

No evidence of chemical migration through the cap from the LARE dredge material was measured during the 3 years of monitoring. Visually, the core samples revealed a clear boundary layer between the LARE and cap materials. The LARE material was fine-grained, black in color, and smelled of petroleum, and the cap material was dark grey, odorless and sandy. Of the 15 metals and total polycyclic aromatic hydrocarbons (PAHs) analyzed in the bulk sediment samples from the cap layer, none were detected at concentrations approaching those observed in the LARE material. Total PAH concentrations were considered to be the best marker for the LARE material as they were orders of magnitude lower in the cap material. Further, in Year 2, core layer samples taken from 3 centimeters (cm) above the LARE material showed no evidence of either metals or PAH migration into the cap. Sediment pore water analyzed from the cap layer confirmed the bulk chemistry results because elevated chemical concentrations were not detected in the pore water.

Re-colonization of the NEIBP cap surface by benthic infauna proceeded at a rapid pace during the 10-month period between Year 1 and Year 2. Although total abundances of infauna at the cap site decreased slightly during this time, the numbers of species, diversity, and dominance had each increased dramatically. In Year 3, the results of the macro grab samples suggest that ghost shrimp may be the organisms creating the large burrow mounds on the surface of the cap, but the chemical results do not suggest that they are actually burrowing through the cap layer and into the LARE.

2.3 Proposed Year 5 Monitoring

The proposed monitoring plan for Year 5 is similar to the previous first three monitoring events with the exception of the video transects to monitor for the presence of burrowing organisms. The following bullet points outline the key components for Year 5 monitoring:

- Bathymetry using a multi beam sonar
- Sediment core sampling at nine locations on the surface of the cap with sub-samples collected at three depths (surface, just above cap/LARE interface and cap/LARE interface)
- Sediment core sampling at one location to a depth that penetrates through the cap and LARE material into the underlying sediments
- Pore water and surface water sampling within the cap at two locations (Station 2 and 10) for chemical analysis
- Surface sediment grab sampling at 10 stations within the NEIBP site, and 10 stations around the edge of the NEIBP for benthic organism abundance and diversity
- Particle size analysis of surficial material from the cap compared to similar grain size material collected from the San Gabriel and Los Angeles river estuaries using a Scanning Electron Microscope (SEM) and spectroscopy

3 PROJECT TEAM AND RESPONSIBILITIES

This section presents the organizational structure for sampling and analysis activities associated with the Year 5 monitoring of the NEIBP cap.

3.1 Project Planning and Coordination

Mr. Steve Cappellino of Anchor Environmental will be the overall project manager responsible for coordinating the work of the various contractors and sub contractors. Mr. Chad Richardson of Anchor Environmental will be responsible for implementing the field sampling activities. Mr. Jim Fields of the USACE will be the Corps Study Manager and be responsible for approving the SAP and any subsequent modifications.

3.2 Field Sample Collection

Mr. Cappellino will serve as the Field Team Leader, providing direction on field sampling logistics, personnel assignments, and field operations. Specifically, Mr. Cappellino will supervise all field collection activities and will be responsible for ensuring accurate sample positioning, recording sample locations, depths and identification, ensuring conformity to sampling and handling requirements, including field decontamination procedures; physical evaluation and geological logging of the samples; and a chain-of-custody (COC) through delivery to the analytical laboratory.

Upon collection, samples will be physically evaluated and placed in appropriate sample containers. Appropriate protocols for decontamination, sample composting, sample preservation, and holding times will be observed. Mr. Cappellino and Mr. Richardson will be responsible for documenting sample preparation, observations, and COCs up until the time the samples are delivered to the analytical laboratory for chemical analysis. They will also ensure that collected sediments are stored under proper conditions until delivery, and be responsible for documenting field sampling activities.

3.3 QA/QC Management

Michelle McClelland of Anchor Environmental will serve as the Quality Assurance Representative for this project. Ms. McClelland will provide quality assurance oversight for both the field sampling and laboratory programs. She will be kept fully informed of field program procedures and progress during sample collection and laboratory activities during sample preparation. She will record and correct any activities that vary from the written SAP, and, upon completion of the sampling and analytical program, she will review laboratory Quality Assurance/Quality Control (QA/QC) results and incorporate findings into the final SAP.

3.4 Laboratory Preparation and Analyses

Misty Mercier of CRG Laboratories will be the lab project manager for this project and will be responsible for physical and chemical analyses of the samples. Ms. Mercier will receive and analyze the submitted samples in accordance with the U.S. Environmental Protection Agency's (EPA's) approved protocol, CRG Laboratories' internal QA/QC requirements, and requirements as specified in this or any subsequently revised SAP. A report of analytical results and QA/QC procedures will be prepared by the contract lab upon completion of the analyses.

3.5 Final Sampling and Analysis Report

Mr. Cappellino will be responsible for preparation of the final sampling and analysis results report to support the Year 5 monitoring plan. This report will summarize the sampling effort, analytical methods, QA/QC narrative, and analytical testing results as they relate back to the objectives of the project.

3.6 Contact Information

Table 1
Contact Information

Name	Role	Affiliation	Phone	Mobil Phone
Steve Cappellino	Project Manager	Anchor Environmental	949-833-7150	949-322-8258
Chad Richardson	Assistant	Anchor Environmental	949-833-7153	619-218-6820
Jim Fields	Study Manager	USACE LA District	213-452-3403	213-280-8565
Misty Mercier	Lab Manager	CRG Laboratories	310-533-5190	310-420-4290 Sample pickup number
Scott Johnson	Subcontractor Benthic Sampling	Aquatic Bioassay & Consulting	805-643-5621	
Dr. Joseph Germano	Subcontractor SPI	Germano and Associates	425-865-0199	

4 FIELD SAMPLING PLAN

The sampling and analysis program for the NEIBP Long-Tem Monitoring Plan (Year 5) was designed to provide sufficient surface and subsurface sediment chemical and physical data that would determine if chemicals are migrating through the cap at a rate that resulted in significant contamination of the surface sediment or overlying water. Biological re-colonization was also included to provide information on long-term biological impacts associated with aquatic capping for possible use in future projects.

4.1 Bathymetric Surveys

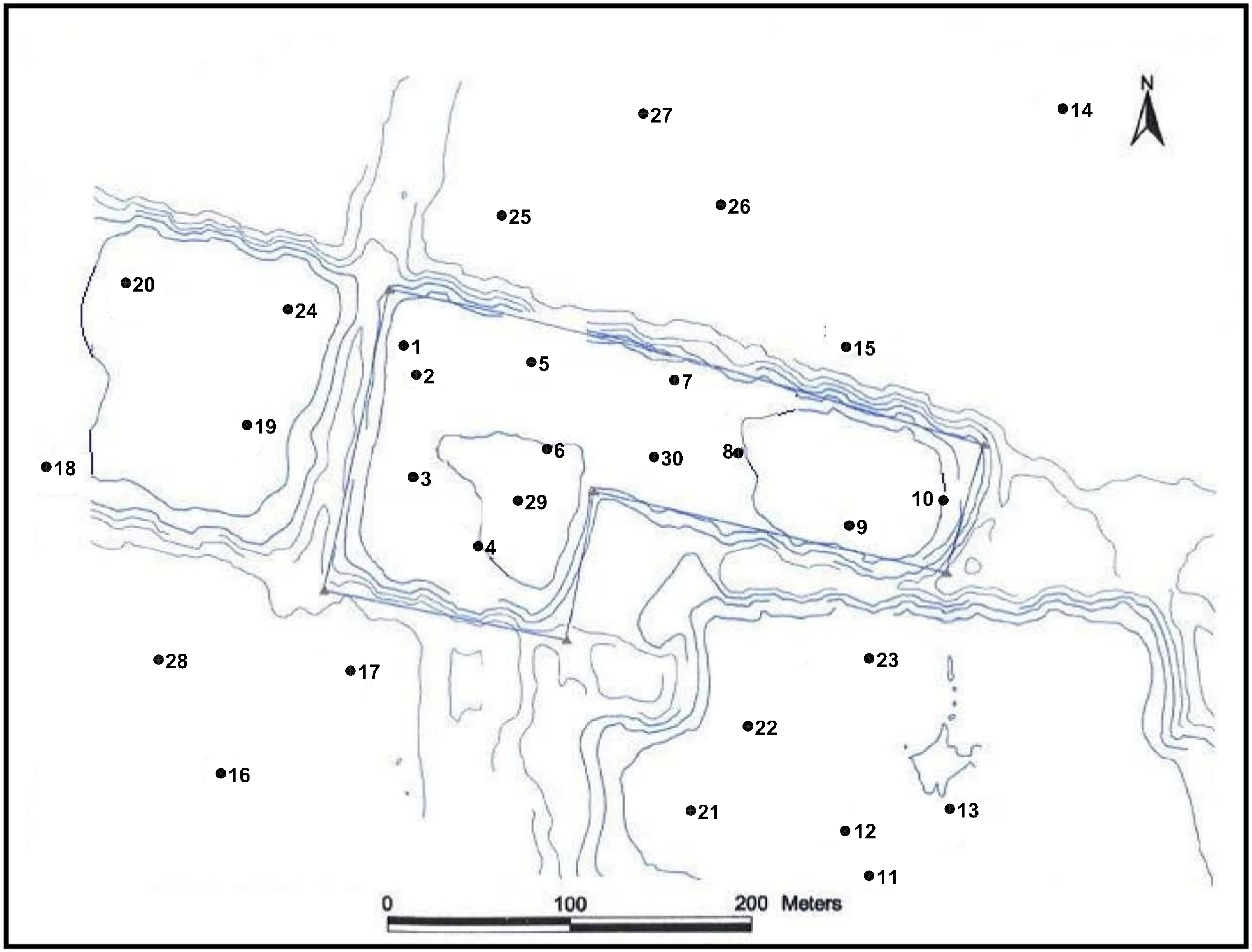
A bathymetric survey will be conducted by Gahagan and Bryant Associates for the entire NEIBP disposal cell and surrounding area (to a minimum of 50 m in all directions) using a multi-beam sonar device such that a maximum 0.1-m vertical resolution will be obtained. These results can then be compared to previous surveys to monitor potential settling or accumulation over the past 5 years.

4.2 Sediment Core Sampling

Sediment coring provides physical and chemical information on the cap profile. This information will be used to determine whether contaminated sediments remain in place underneath the cap. Analysis of core samples will determine whether chemicals might be moving into or through the cap to the water column either through physical/biological movement of contaminated sediment particles or through dissolved chemical migration.

4.2.1 Sample Number and Location

Subsurface sediment core samples will be collected by hand from Self Contained Underwater Breathing Apparatus (SCUBA) trained U.S. Navy divers at nine locations (Figure 2). A total of three sample intervals will be collected for each core sample, resulting in 27 core samples for each constituent to be analyzed. There will also be an additional sample collected for quality assurance purposes. Sediment core samples will be collected at the same nine stations (Stations 2-10) as in past previous monitoring years as depicted in Table 2 and Figure 2. In addition, sediment core sampling using a vibracore will occur at one location (to be determined), to a depth that penetrates through the cap and LARE material into the underlying sediments. These cores will be used for chemical/physical analysis and visual observations.



● Station
Location and Number

Stations 2-10
Core Sample Locations

Stations 1-20
Surface Sediment
Locations for Benthos

Stations 2 and 10
Pore Water and Surface
Water Locations

Stations1-30
SPI Locations

Mar 21, 2006 4:35pm cdavidson K:\Jobs\050109-LA CORPS\05010901\05010901-04.dwg FIG 2

Figure 2
Long-Term Monitoring Locations for Cores, Benthic Infauna, Pore/Surface Water, and SPI

Table 2
Station Location Coordinates

Station Identification	Latitude	Longitude
Station 2	33 45.3518	118 09.4291
Station 3	33 45.3205	118 09.4304
Station 4	33 45.2994	118 09.4077
Station 5	33 45.3286	118 09.3825
Station 6	33 45.3551	118 09.3896
Station 7	33 45.3503	118 09.3378
Station 8	33 45.3282	118 09.3151
Station 9	33 45.3055	118 09.2749
Station 10	33 45.3131	118 09.2426

4.2.2 Sample Depths

The focus of the sediment coring is to monitor for potential chemical migration from the LARE material through the cap. A total of three sample intervals were collected for each core sample in Years 1 through 3. The exact width of the sample interval was determined after completing a project specific Quality Assurance Project Plan (QAPP) and calculating the minimum sample size required to meet the target detection limits. For this project, a 20-cm sample interval was selected. Thus, the three sample intervals will be the top 20-cm layer of the cap, the 10- to 20-cm layer above the cap/LARE interface, and the 0 to 20 cm layer above the cap/LARE interface (Figure 3).

4.2.3 Sample Collection and Processing

Anchor Environmental will provide all necessary field training, including sampling methods, sample collection and processing required to complete the project. Before sampling begins, all personnel will be trained in the safety requirements outlined in the Health and Safety Plan (HASP) attached to this document. Training will be held on EPA approved Standard Operating Procedures (SOP) for core sampling and all equipment will be cleaned prior to use. CRG Laboratories will be notified and ready to receive the samples prior to sample collection.

Nine sediment core samples will be collected by hand using SCUBA diving equipment. At each location, a new, butyrate 3.048-m core liner (1.5-inch [in] diameter) will be used to take a 2-m core by a team of two U.S. Navy divers. These core lengths should be

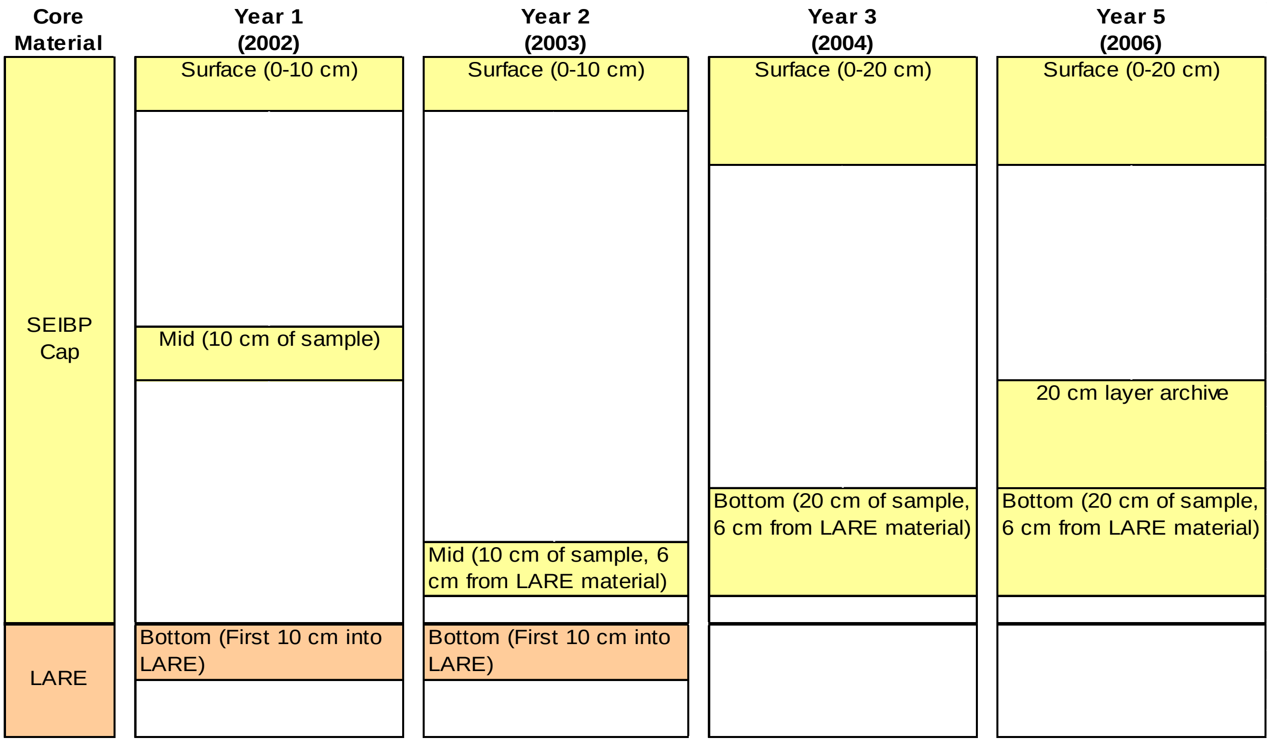


Figure 3
Schematic of Core Samples

sufficient to pass through the cap layer and penetrate at least 15 cm into the LARE material. Once collected, the inner lining of the core tube will be removed, capped, labeled, and placed in a rack on the boat. The cores will then be taken to the dock and the tubes will be split open using a razor blade or electric shears. The core sample will be split in two down the middle and opened for examination. Photographs will first be taken and then the cores will be logged according to the U.S. Geological Survey (USGS) soil classification scale. Once the cores are logged and photographed, sub samples will be removed from the core using decontaminated, stainless-steel spoons, and placed in the appropriate sample containers. After placement of sample material into sample containers, each container will be firmly sealed, clearly labeled with the name of the project, sample number, type of analysis, date, time, and initials of the person preparing the sample. This information will be recorded in the logbook and on the COC forms. Following proper sealing and labeling, all sample containers will be placed on ice in a cooler or container and maintained at 4° C.

4.2.4 Chemical and Physical Analyses

Each core sample interval will be analyzed for total trace metals, PAHs, pesticides and polychlorinated biphenyls (PCBs). A sample will also be collected for QA/QC purposes.

In addition to the chemical analyses, sediment moisture, grain size, bulk density, and organic carbon content will be measured for each sample.

4.2.5 Sample Identification

Each core sample will be assigned a unique identification code based on a sample designation scheme designed to suit the needs of the field personnel, data management, and data users. Sample identifiers will consist of five components separated by dashes. The first component is "NEIBP" to identify the project name. The second component will be the type of sample collected (Core Sample) and third component is the station location number. The fourth component will be the sample interval and the fifth component will the sampling year.

"NEIBP" for North Energy Island Borrow Pit
"CS" for Core Sample
"02" for Station Location Number
"S for Surface, M for Middle, B for Bottom"
"Y5" for Year 5

Example: NEIBP-CS-02-S-Y5

4.3 Surface Water

4.3.1 Sample Number and Locations

Surface water samples will be collected at Stations 2 and 10 within the NEIBP cap study area (Figure 2) to be used for comparison to the pore water samples collected from these same two locations (Section 4.4). Sampling will occur on two events to coincide with pore water sampling.

4.3.2 Sample Collection and Processing

Surface water samples will be collected by hand using the appropriate labeled container. From the boat, the sampling team will insert the sample container just under the water's surface, collect the required volume, and cap the container. The container should be clearly labeled with the name of the project, sample number, type of analysis, date, time, and initials of the person preparing the sample. The container will then be placed into the cooler containing double bagged wet ice for transport to the chemical laboratory for analysis.

4.3.3 Chemical Analysis

Surface water samples will be analyzed for total trace metals, total organic carbon (TOC), dissolved organic carbon (DOC), and total suspended solids (TSS).

4.3.4 Sample Identification

Surface water samples will be assigned a unique identification number. Sample identifiers will consist of four components separated by dashes. The first component is "NEIBP" to identify the project name. The second component will be SW to denote surface water and the third component will be the station location number. The fourth component will be the sampling event number, representing the first and second sampling event for each station.

Example: NEIBP-SW-02-1

4.4 Pore Water

Pore water sampling will be used to determine if dissolved metals can be detected within the cap layer at a point just above the interface with the LARE material.

4.4.1 Sample Number and Locations

Pore water sampling will occur within the cap at Stations 2 and 10. Two sampling events will occur at both stations (Figure 2) to represent potential effects resulting from tidal fluctuations. As such, one sampling event will occur during a flooding tide and one during an ebbing tide.

4.4.2 Sample Collection and Processing

Sediment pore water will be collected by using a well point assembly which consists of a 1-in-diameter by 1-foot (ft)-long pre-cleaned stainless steel, screened tube (well point) covered by a stainless steel driving sheath, and a 4-ft extension rod. The well points were successfully installed and sampled in Year 3 at Stations 2 and 10 (Figure 2) by the U.S. Navy divers, and similar methods are proposed for Year 5. After descending to the bottom along a fixed rope, the divers will drive the well point assembly approximately 1.5 ft into the cap material so that the screened portion of the well would be positioned approximately half way through the cap layer. After purging the line and allowing time to equilibrate (24) hours, pore water will be pumped to the surface using a peristaltic pump and filtered through a 0.45-millimeter (mm) cartridge filter directly into the sample bottles for chemical analyses.

4.4.3 Chemical Analysis

Pore water samples will be analyzed for total trace metals, TOC, DOC, and TSS.

4.4.4 Sample Identification

Pore water samples will be assigned a unique identification number. Sample identifiers will consist of four components separated by dashes. The first component is "NEIBP" to identify the project name. The second component will be PW to denote pore water and the third component will be station location number. The fourth component will be the sampling event number, representing the first and second sampling event for each station.

Example: NEIBP-PW-02-1

4.5 Benthic Invertebrate Sampling

Monitoring benthic re-colonization of the cap surface will be used to track overall long-term biological recovery rates for representative aquatic capping projects in southern California. Previous monitoring provided useful data for the current objectives by monitoring for the presence of juvenile bioturbators that were located in the surface sediments. The presence of bioturbators can be used as indicators for potential biological mixing within the cap. This section describes the procedures for benthic sampling.

4.5.1 Benthic Sampling

Benthic community sampling includes collection, identification, and enumeration of benthic infauna (organisms living in the top 10 cm of bottom sediments) larger than 1,000 microns (often called macrofauna). Typically, the vast majority of benthic macrofauna reside in the top 10 cm of sediment. Thus, surface grabs will be taken in the top 10 cm of the most biologically active zone.

4.5.2 Sample Station Locations

Benthic sampling will occur at a total of 20 stations: 10 stations from within the NEIBP disposal cell and 10 stations from the surrounding areas as shown in Figure 2. Sample stations were randomly located along a 10-m grid laid over the study area. In previous monitoring years, one sample was collected from each of the stations and attempts were made to return to the same sample stations each year using a Differentially Corrected Global Positioning System (DGPS).

4.5.3 Sample Procedures

Aquatic Bioassay & Consulting will collect benthic infauna sediment samples from 20 sites in and near the NEIBP aquatic capping site aboard the research vessel *Hey Jude*. Infauna samples will be collected following the Southern California Bight, Regional Monitoring Field Protocols (SCCWRP 2003). Sampling will be conducted using a 0.1-square meter (m^2) modified van Veen grab, which is capable of retrieving 6 to 10 cm of sediment depth.

4.5.4 Sample Processing

Each sample, including overlying water, will be sieved through a 1,000-micron (1 mm) screen. Organisms and debris will be transferred to sample containers with a label placed on the inside of the container. Benthic organisms will be subjected to a suitable relaxant for a period of 30 minutes and then fixed with 10 to 15 percent borax-buffered formalin. After an appropriate fixing period (minimum 24 hours, maximum 7 days), the samples are rewashed with tap water through a 500-micron or smaller screen. The samples are then rinsed in 70 percent ethanol/water solution and then stored in sample containers in 70 percent ethanol/water solution with internal and external labels.

The identification of all infauna will be conducted by Southern California Association Marine Invertebrate Taxonomists (SCAMIT) certified taxonomists. Samples will be sorted from sediment/debris into major taxonomic groups, which will then be stored in separate vials for each sample.

4.5.5 Benthic Sampling Schedule

As in previous monitoring years, benthic sampling will coincide with the sediment core sampling. It is anticipated that after allowing sufficient time for SAP review/revision/approval, sampling will occur in late June or early July of 2006. The estimated sampling period will be 5 days, at an average of 10 hours per day. The sampling represents a time when peak infaunal abundance is to be expected.

4.6 Sediment Profile Imaging

Sediment Profiling Imaging (SPI) will be used to provide information on any LARE and cap sediment that may have dispersed outside the immediate NEIBP area as well as to measure settlement of fine grained material on the cap, observed during previous monitoring events.

4.6.1 Locations

A post-capping survey was completed by Germano & Associates, Inc. and MEC Analytical Systems in the area surrounding the NEIBP on February 5 and 6, 2001. Two replicate SPI images were collected from 69 survey stations. For the Year 5 monitoring, SPI images will be collected from 30 survey stations in and around the NEIBP capping site (Figure 2).

4.6.2 Methods

Germano & Associates, Inc. will be conducting the SPI survey aboard the research vessel *Hey Jude*. The SPI apparatus is a boat deployed remote camera that enters the top few centimeters (cm) of the sediment and photographs a profile of these upper sediment layers. Expert interpretation of these photographs can provide extensive information on the layering and recent disturbances of surface sediments. Typically, these photographs are examined for changes in color or texture in sediment layers, the depth of any sediment layers, burial of animals or structures (burrows) that indicate recent deposition, oxidation boundary, and other indicators of sediment deposition. The photographs will be analyzed and compared to images taken during the baseline and post disposal surveys.

4.6.3 Reporting

All reporting for the SPI survey will be conducted by Germano & Associates and will include digital photographs of the surface sediment layer as well as their professional interpretation of the results.

4.7 General Sampling Procedures

This section describes the general sampling procedures for Year 5 monitoring including visual observations, station positioning, equipment decontamination procedures, waste management, sample containers and holding times, and COC forms.

4.7.1 Visual Observations

Core samples collected through the cap layer for sediment chemical and physical analysis will be subjected to visual observations to record the thickness of the cap, the depth of bioturbation (if visible), and the depth of the mixed layer between the cap and the LARE material. Sediment core samples will be collected via U.S. Navy SCUBA divers by hand using clear tubes so that visual observations can be made both before and after the tubes are cut.

4.7.2 Station Positioning

Horizontal positioning will be determined using an onboard DGPS based on target coordinates from previous Year 1, Year 2, and Year 3 monitoring events. Measured station positions will be converted to latitudinal and longitudinal coordinates (North American Datum NAD 83) to the nearest 0.1 second. The accuracy of measured and recorded horizontal coordinates will be within three meters. Vertical elevation of each coring station will be measured using a fathometer or lead line. Tidal elevations will be based on direct observations of water level on a surveyed tide gauge located near the NEIBP study site.

4.7.3 Equipment Decontamination Procedures

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment collected for analysis will be made of glass, stainless steel, high density polyethylene (HDPE), or poly tetra-fluoroethylene (PTFE), and will be cleaned prior to each days use and between sampling or composting events. Decontamination of all items will follow EPA protocols. The decontamination procedure follows:

- Pre-wash rinse with site water
- Wash with solution of laboratory grade non-phosphate based soap (brush)
- Rinse with site water
- Rinse three times with laboratory grade distilled water
- Cover (no contact) all decontaminated items with aluminum foil
- Store in clean, closed container for next use

4.7.4 Waste Management

All sediment remaining in the core tubes after processing will be washed overboard or discarded as solid waste after processing. Material from the upper layers of the core is clean sand and can be disposed of back into the water. All material at the bottom of the core (representing the LARE material) will be bagged and disposed of as solid waste. Any sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site. All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy duty garbage bags or other appropriate containers.

4.7.5 Sample Containers and Holding Times

CRG Laboratories will provide certified, pre-cleaned, EPA-approved containers for all samples. The container size and type, holding times, and EPA-method for the complete analyte list are provided in Table 3. Prior to shipping, CRG Laboratories will add preservative, where required, according to EPA protocols.

Table 3
Sample Handling and Storage

Sediment Matrix (in dry weight)	Method	MDL	RL	Units	Volume/Container	Holding Time
Total Trace Metals in Sediment Analysis	EPA 6020	0.005 1	0.01 5	µg/g	50 g GLASS JAR	6 Months
PAHs in Sediment Analysis	EPA 8270	1	5	ng/g	50 g GLASS JAR	40 Days
Organochlorine Pesticides & PCBs in Sediment Analysis	EPA 8270	1 10	5 50	ng/g	50 g GLASS JAR	40 Days
Total Organic Carbon[8] in Sediment Determination (subcontract)	EPA 9060	0.01	0.05	% Dry Weight	50 g GLASS JAR	28 Days
Seawater Matrix	**Method**	**MDL**	**RL**	**Units**	**Volume/Container**	**Holding Time**
Total Trace Metals in Seawater Analysis	EPA 1640			µg/L	1L HDPE Plastic	6 Months
TOC[8] in Seawater Determination (subcontract)	EPA 415.1	0.100	1.00	mg/L	40 mL VOA	28 Days
Total Dissolved Organic Carbon in Seawater Determination	EPA 415.1	0.100	1.00	mg/L	40mL VOA	28 days
TSS in Water Determination	SM 2540-D	0.5	0.5	mg/L	1L HDPE Plastic	7 Days

Notes:
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
TOC = total organic carbon
TSS = total suspended solids

4.7.6 Sample Transport and Chain-of-Custody Procedures

All containerized sediment samples will be transported to the CRG Laboratories immediately after preparation is completed. Specific sample shipping procedures will be as follows:

- Each cooler containing the sediment samples will be shipped to the laboratory within 24 hours of being sealed
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage and transported in a sealed ice chest or other suitable container
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container and consultants office name and address) to enable positive identification
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage
- A generous amount of ice will be sealed in separate plastic bags and placed into the cooler

- A sealed envelope containing COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler
- The cooler lids will be secured by wrapping the coolers in strapping tape
- Signed and dated COC seals will be placed on all coolers prior to shipping

Upon transfer of sample possession to the laboratory, personnel transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples recorded by the recipient. COC forms will be used internally in the lab to track sample handling and final disposition. The Project Manager or QC Manager will be notified immediately of any discrepancies in the COC documentation.

4.7.7 Field Logbook and Forms

All field activities and observations will be noted in a field logbook during fieldwork. The field logbook will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from the SAP) and the reasons for these changes will be documented in the field logbook. The logbook will identify onsite visitors (if any) and the number of photographs taken at the sampling location (if any). The field coordinator is responsible for ensuring that the field logbook and all field data forms are correct. Requirements for logbook entries will include the following:

- Logbooks will be bound, with consecutively numbered pages
- Removal of any pages, even if illegible, will be prohibited
- Entries will be made legibly with black (or dark) waterproof ink
- Unbiased, accurate language will be used
- Entries will be made while activities are in progress or as soon afterward as possible
- Each consecutive day's first entry will be made on a new, blank page
- The date and time will appear on each page

In addition to the preceding requirements, the person recording the information must initial and date each page of the field logbook. The bottom of the page must be signed and dated by the individual who makes the last entry. Logbook corrections will be made by drawing a single line through the original entry allowing the original entry to be read.

The type of information that may be included in the field logbook and/or field data forms includes the following:

- Names of all field staff, including subcontractors
- Sampling vessel
- A record of site health and safety meetings, updates, and related monitoring
- Station name and location
- Date and collection time of each sample
- Observations made
- Sample description

5 QUALITY ASSURANCE/QUALITY CONTROL

To assess the quality of data resulting from the field sampling program, field duplicate samples, field blank samples, samples for laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses, and rinsate blank samples will be collected (where appropriate) and submitted to the contract laboratory.

For all field samples collected, field duplicate samples will be submitted at a frequency of one per 20 investigative samples or in the event that a sampling round consists of less than 20 samples, one field duplicate will be collected. Field blank samples will be collected at a frequency of one per 20 investigative samples. MS/MSD samples will be analyzed at a minimum frequency of one in 20 field investigative samples. Rinsate blanks will be submitted at a frequency of one per 20 investigative samples in the event that non dedicated sampling equipment is used.

The sampling and analysis program is summarized in Table 4, which lists the specific parameters to be measured, the number of samples to be collected, and the level of QA effort required for each matrix.

Table 4
Laboratory Quality Control Sample Analysis Summary

Sampling Activity	Sample Matrix	Analytical Parameters	Analytical Method	Investigative Samples	Field Duplicate	Field Blanks	MS/MSD/ Dup
Core Sampling	Sediment	TCL Pesticides/PCBs	SW-846 8081/8082[1]	27	1 in 20	1/day	1 in 20
		TAL Metals	SW-846 6010/7470[1]	27	1 in 20	1/day	1 in 20
		TOC	SW-846 9060[1]	27	1 in 20	1/day	1 in 20
		Grain Size	ASTM D422[3]	27	1 in 20	1/day	1 in 20
Water Sampling	Porewater	TAL Metals	Krone/SW-846	4	NC	NC	NC
	Surface Water	TAL Metals	SW-846 6010/7470[1]	4	NC	NC	NC
		DOC	SW-846 9060[1]	4	NC	NC	NC
		TOC	SW-846 9060[1]	4	NC	NC	NC
		TSS	EPA 160.2[2]	4	NC	NC	NC

Notes:
(1) Methods referenced from "Test Methods for Evaluating Solid Waste- Physical/Chemical Methods", SW-846, Third Edition, 1986 (Revised 9/94)
(2) Methods referenced from "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", EPA-600/4-82-057, July 1982 and "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983
(3) American Society for Testing and Materials (ASTM)

NC = Not collected due to insufficient volume
Dup = duplicate
MS = matrix spike
MSD = matrix spike duplicate
PCBs = polychlorinated biphenyls

5.1 Field Data

5.1.1 Duplicates

Field duplicates are additional samples collected in a sampling area at designated stations. These samples will be used to determine the natural variability associated with the sampling area, sample handling, and laboratory operations. Five percent of all samples will be duplicates and assigned a unique sample identification number. These field duplicates will not be identified as duplicates to the laboratory.

5.1.2 Splits

Field split samples are designed to monitor overall sampling and analytical precision. Blind field splits will consist of a homogenized sample that is split into two sample aliquots. Field splits will be prepared where field duplicates are prepared. Samples will be assigned a unique sample identification number. Field split samples will not be identified as splits to the laboratory.

5.2 Laboratory Data

5.2.1 Blanks

Introduction of chemical contaminants during sampling and analytical activities will be assessed by the analysis of blanks. Rinsate blanks, consisting of sampling equipment rinsates, will be generated for all chemical parameter groups at approximately 5 percent of the samples collected. These rinsate blanks will be collected at the same stations as the field duplicates and splits, thus maximizing the amount of information available to distinguish laboratory and environmental variability.

The rinsate blanks will be collected by pouring deionized water over all sampling equipment that comes in contact with the sediment. Specifically, after decontamination, the deionized water will be poured over the sampling spoon and bowl. One of the rinsate blanks will also include the hand-corer. The rinsate water will be collected in the bowl and transferred into sample bottles provided by the laboratory. Rinsate blanks will not be collected for the subsurface core tubes because sediment in contact with the core tube walls will not be sampled.

5.2.2 Matrix Spikes/Matrix Spike Duplicates

An MS/MSD sample will be analyzed at a minimum frequency of one in 20 investigative samples. Percent spike recoveries will be used to evaluate analytical accuracy while percent relative standard deviation or the relative percent difference (RPD) between matrix spike analyses will be used to assess analytical precision.

6 REFERENCES

Southern California Coastal Water Research Project (SCCWRP). 2003. Southern California Bight (Bight 03). Field Operations Manual.

APPENDIX A

HEALTH AND SAFETY PLAN

Table of Contents

CNS	Central Nervous System
dBA	Decibels
DMMP	Dredged Material Management Plan
HASP	Health and Safety Plan
HR	Heart Rate
LARE	Los Angeles River Estuary
m	meter(s)
m^3	cubic meter(s)
NEIBP	North Energy Island Borrow Pit
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PFD	Personal Flotation Device
PM	Project Manager
PPE	Personal Protective Equipment
SAP	Sampling and Analysis Plan
SSO	Site Safety Officer
USACE	United States Army Corps of Engineers

1 INTRODUCTION

This site health and safety plan (HASP) has been prepared by Anchor Environmental to address sediment sampling field activities in the harbor of Long Beach, California. This HASP addresses health and safety issues specifically for sampling activities conducted by Anchor personnel, as well as other subcontractors conducting work in Long Beach harbor. The general scope of work for this project includes collection of surface and subsurface sediment from the North Energy Island Borrow Pit (NEIBP) aquatic capping site and sample processing, which will occur on adjacent properties to the site. This HASP is intended for use by all personnel conducting field sampling activities and sample processing.

1.1 Site Background

In early 2001, the Los Angeles District of the U.S. Army Corps of Engineers (USACE) initiated the Los Angeles County Regional Dredged Material Management Plan Pilot Studies (DMMP Pilot Studies) to evaluate the feasibility of four alternatives for treating and/or disposing of contaminated dredged sediments originating from within Los Angeles County. The four alternatives evaluated were cement stabilization, sediment washing, sediment blending, and aquatic capping.

For the aquatic capping study, 105,000 cubic meters (m^3) of contaminated sediment were mechanically dredged from the Los Angeles River Estuary (LARE) in the City of Long Beach and placed into an existing pit located in the inner harbor off the coast of Long Beach. The contaminated sediment, which contained elevated concentrations of metals and polycyclic aromatic hydrocarbons (PAHs), was subsequently capped with a 1-meter (m) layer of clean sand. Water quality monitoring was conducted during all phases of construction to evaluate potential environmental impacts. Following construction, the capped site was monitored annually for 3 years to evaluate long-term cap stability, containment/isolation of the contaminated sediments, and biological re-colonization of the cap surface.

1.2 Field Activities

Field activities are described in detail in the NEIBP Aquatic Capping Disposal Alternative Year 5 monitoring Sampling and Analysis Plan (Anchor 2006). Briefly, core samples will be collected from hand by U.S. Navy divers at nine stations and benthic infauna sediment samples will be collected at 20 stations by using a van Veen grab. All health and safety issues related to diving are covered under the U.S. Navy's health and safety manual.

This HASP addresses water sample collection and sediment sample processing, including sediment logging and sample homogenization for laboratory analyses. Sample processing will occur on the dock located adjacent to the sampling site. A boat will be used to collect water samples and to transport staff and equipment from the samples sites to the dock.

2 KEY PERSONNEL AND RESPONSIBILITIES

The overall project organization and individuals responsible for implementing the work elements presented in this HASP are described below.

From Anchor Environmental, Mr. Steve Cappellino will be the Field Project Manager and primary point of contact for the USACE. Mr. Cappellino will both be responsible for administrative coordination to assure timely and successful completion of the sampling and analysis program. Mr. Cappellino will be Field Team Leader and will be responsible for ensuring the sampling program meets the objectives of the project. He will also act as the chief Site Safety Officer (SSO), with Mr. Chad Richardson of Anchor Environmental acting as the assistant SSO. In this capacity, Mr. Cappellino will lead the daily field safety meetings and ensure that all staff are provided and trained to use suitable Personal Protective Equipment for the tasks to be conducted.

Specific staff responsibilities are described in further detail below.

2.1 PM Responsibilities

The Project Manager (PM) is responsible for generating, organizing, and compiling the HASP that describes planned field activities and potential hazards that may be encountered at the site. The PM is also responsible for assuring that adequate training and site safety briefing(s) are provided to the project field team. The PM will provide a copy of this HASP to each field team member.

2.2 Project Field Staff Responsibilities

The project field staff is responsible for ensuring that data acquisition is performed in accordance with the work plan and HASP, and that deviations from the plans are based upon field conditions encountered and are well documented in the field notes. The project field staff's health and safety responsibilities include:

- Following the HASP
- Reporting to the SSO any unsafe conditions or practices
- Reporting to the SSO all facts pertaining to incidents that result in injury or exposure to toxic materials
- Reporting to the SSO equipment malfunctions or deficiencies

2.3 SSO Responsibilities

The SSO has on-site responsibility for ensuring that all team members comply with the HASP. It is the SSO's responsibility to inform other field personnel of chemical and physical hazards, as he or she becomes aware of them. Additional SSO responsibilities include:

- Conducting a daily site safety briefing for all team members
- Updating equipment or procedures to be used on site based on new information gathered during the site investigation
- Inspecting personal protective equipment (PPE) prior to on-site use
- Assisting in and evaluating the effectiveness of decontamination procedures for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles
- Enforcing the "buddy system" as appropriate for site activities
- Posting location and route to the nearest medical facility; arranging for emergency transportation to the nearest medical facility
- Posting the telephone numbers of local public emergency services (i.e., police and fire)
- Stopping operations that threaten the health and safety of the field team or surrounding populace
- Observing field team members for signs of exposure, stress, or other conditions related to pre-existing physical conditions or site work activities

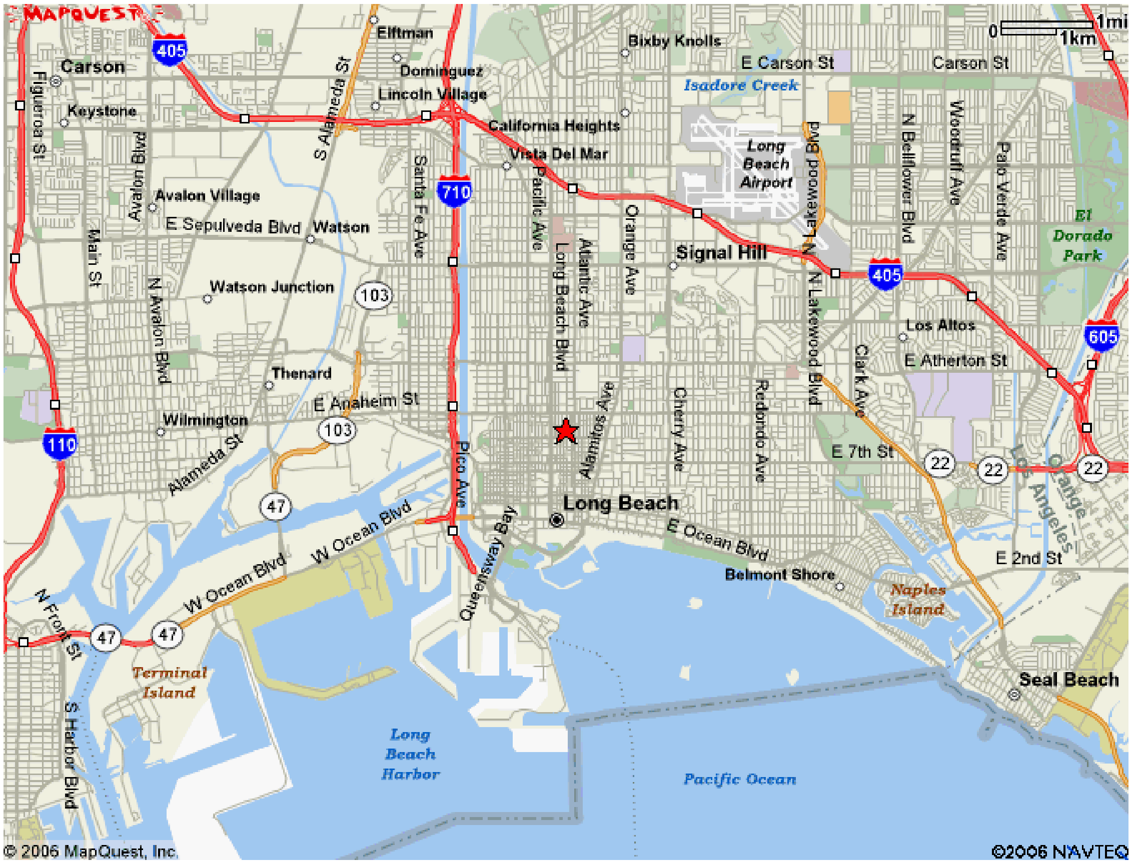
2.4 Contacts

Name	Role	Affiliation	Phone	Mobil Phone
Steve Cappellino	Project Manager	Anchor Environmental	949-833-7150	949-322-8258
Chad Richardson	Assistant	Anchor Environmental	949-833-7153	619-218-6820
Jim Fields	Study Manager	USACE LA District	213-452-3403	213-280-8565
Misty Mercier	Lab Manager	CRG Laboratories	310-533-5190	310-420-4290 Sample pickup number
Scott Johnson	Subcontractor Benthic Sampling	Aquatic Bioassay & Consulting	805-643-5621	
Dr. Joseph Germano	Subcontractor SPI	Germano and Associates	425-865-0199	

2.5 Emergency Telephone Numbers

In the event of a medical emergency, 911 will be dialed first and then the SSO will be notified. If transportation off of the water is needed, the Coast Guard of Long Beach will also be contacted by hailing them on Channel 16 using the VHF radio on the sample vessel. The nearest medical facility is St. Mary Medical Center and the phone number is (562) 491-9000.

St. Mary Medical Center is located at 1050 Linden Avenue, Long Beach California, 90813. From the Harbor Marina, go north to E Shoreline Drive. Go left on E Shoreline Drive and go right onto Pine Street. From Pine Street, go right on E Ocean Boulevard for approximately two blocks and go north (left) onto Long Beach Boulevard. Travel approximately three-fourths (3/4) of mile north on Long Beach Boulevard, go right on E 10th Street, and make a left on Linden Avenue. Directions to the hospital are provided in the attached map.



3 HAZARD ANALYSES

The potential hazards to personnel working at the NEIBP site for this project have been identified as chemical contamination, physical safety hazards (related to limited access areas, slip, trip, falls on walking/working surfaces), working with heavy equipment; noise; sunburn, heat stress, and biological hazards.

General information for chemical and physical hazards is provided in the following paragraphs.

3.1 Chemical Hazards

Health hazards associated with potential chemical exposures at the NEIBP site as identified by the available analytical chemistry data from the site include toxicity that may occur following: inhalation of chemical vapors potentially released from the sediment surface and direct contact with potentially contaminated sediment. Detected constituents exist for a wide variety of metals, organics, and PAHs.

3.1.1 Organochlorine Pesticides

Organochlorine pesticides are solids at ambient temperatures with no volatility or flammability problems. They are generally lipophilic, making them a potential hazard by means of skin absorption. In addition to skin exposure, inhalation/ingestion of contaminated dusts presents a potential hazard. Health effects of organochlorine pesticide poisoning by ingestion, inhalation of dusts or by skin absorption can include liver and kidney damage and Central Nervous System (CNS) effects. Symptoms of acute CNS toxicity include numbness, staggering gait, nausea, dizziness, headache, confusion, tremors, and seizures. Symptoms of chronic toxicity include loss of weight, loss of appetite, mild anemia, muscle weakness, headache, dizziness, memory loss, convulsions. Any person who suspects he is suffering from organochlorine pesticide poisoning should seek medical attention. The primary method of protection against exposure to pesticides in sediment and surface water is by avoiding skin contact.

3.1.2 Metals

Metal and metal ions present no volatility or flammability problems. They can present both acute and chronic effects if the host material is inhaled in the form of a dust or fume. Metals such as chromium, nickel, cadmium, silver and zinc and their ions can cause irritation of mucous membranes and lung tissues. Chromates (ionic chromium compounds in the +6 oxidation state) are known human carcinogens when inhaled. To minimize inhalation of chromates, host dusts should be minimized as much as possible. The primary method of protection against exposure to metals in sediment and surface water is by avoiding skin contact.

3.2 Physical Hazards

The following physical hazards may be encountered:

- Heat Stress
- Electrical Hazards, Utilities and Power Lines
- Noise/Hearing Conservation
- Slip/Trip Hazards
- Sunburn
- Biological Hazards

3.2.1 Hand Tools

A variety of hand tools, machines and equipment will be available to employees to perform routine tasks onsite. All workers should be trained in proper operation and maintenance of tools and equipment.

3.2.2 Slips, Trips, Falls, and Ergonomics

Uneven ground and surfaces may be encountered during some activities at the site. The risk of injury due to slips, trips, and falls will be increased in areas of uneven ground, construction, or non-routine activities. Extreme caution is advised if it becomes necessary to walk or work in these areas. Special accommodations may be necessary in the event of extreme hazard conditions.

Some work may involve lifting and moving heavy and awkward objects such as core sampling equipment and sediment cores. Workers will be instructed on proper lifting procedures. In some cases, such as drum handling, material handling equipment may be required.

Accidents involving physical hazards can directly injure field personnel and can create additional hazards such as increased exposure to chemicals due to damaged protective equipment. Working at heights or in limited access areas, and around open excavations and heavy equipment presents physical hazards. Field personnel should maintain awareness for potential safety hazards, and should immediately inform the SSO of any new hazards so that corrective measures can be taken.

3.2.3 Noise

Noise is a potential hazard in areas where heavy equipment including winches, power tools, pumps, or generators are operated. Heavy equipment operation may produce noise levels that reach or exceed 85 decibels (dBA), the action level established by the Occupational Safety and Health Administration (OSHA). Elevated noise levels will be evaluated by the SSO. Exposure to elevated noise levels can lead to temporary or permanent hearing loss, and can also cause muscle tension and irritability. The SSO will ensure hearing protection is utilized when noise levels are elevated.

3.2.4 Sunburn

Working outdoors on sunny days for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

3.2.5 Heat Stress

If staff choose to work in enclosed PPE (e.g., Tyvek suits), the combination of physical activity and potentially hot weather, may result in heat related injuries for this sampling event. The SSO or designate shall monitor all personnel for signs of heat related injuries and remove any individual exhibiting signs of possible heat stress or heat related injuries to the support zone for rest and evaluation. The potential for heat stress is a concern when field activities are performed on warm, sunny days, and is accentuated when chemical protective clothing is worn. Heat stress prevention measures and monitoring may be implemented if site temperatures are above 70° F.

Precautions to prevent heat stress may include work/rest cycles so that rest periods are taken before excessive fatigue occurs, and regular intake of water to replace what is lost from sweating. Work/rest cycles may be established based on monitoring the heart rate (pulse) of each individual worker. Rest breaks should be long enough to reduce the heart rate (HR) below levels calculated according to the following method:

- The worker will initially determine their resting HR prior to starting work activities.
- At the start of the first rest period, the worker will determine their HR. This initial HR should not exceed the individual's age-adjusted maximum HR, which equals [(0.7) (220-age in years)]. At 1 minute into the rest period, the recovery HR will be determined. The recovery HR should not exceed 110 beats per minute.
- If the initial HR exceeds the age-adjusted maximum HR, or the 1-minute recovery HR is greater than 110 beats per minute, then the next work period will be decreased by 10 minutes.

Heat stress due to water loss can be prevented. To prevent dehydration, water intake must approximate sweat loss. Water intake guidelines are as follows:

1. The sense of thirst is not an adequate regulator of water replacement needs during heat exposure. Therefore, water must be replaced at prescribed intervals.
    - Before work begins, drink two 8-ounce glasses of water
    - During each rest period, drink at least two 8-ounce glasses of water

2. Plain water, served cool, is excellent. An adequate supply of potable water and drinking cups will be readily available to provide water during resting periods.

3. Adding salt to water is not recommended. However, other fluids, in addition water, could include dilute fruit juices and electrolyte replacement drinks diluted 3:1 with water. Do not use salt tablets!

At any time field team members recognize the signs or symptoms of heat stress prior to a scheduled rest period, they will notify the SSO immediately in order that a rest period can be called. Heat stress, if not prevented, results in heat stress illnesses. Two critical illnesses, if not recognized and treated immediately, can become life threatening. These are heat exhaustion and heat stroke. Heat exhaustion will result if the prevention measures described above are not implemented. Ignoring the signs and symptoms of heat exhaustion will lead to the development of heat stroke.

Heat stroke is an immediate, life-threatening condition that results because the body's heat regulating mechanisms shut down and the body cannot cool itself sufficiently. As heat is excessively stored in the body, brain damage can result causing permanent disability or death.

3.2.6 Heat Exhaustion

The signs and symptoms of heat exhaustion are headache; dizziness; nausea; weakness; fainting; profuse sweating; loss of appetite; approximately normal body temperature; dilated pupils; weak and rapid pulse; shallow and rapid breathing; possible cramps in abdomen and extremities; difficulty walking; cool and sweaty skin to the touch; pale to ashen gray coloring.

First aid for heat exhaustion is as follows:

- Immediately remove the victim to the support area, or if you are the victim, proceed to the support area.
- Start cooling, but be careful not to cause a chill (i.e., rest in the shade and apply a wet towel to the forehead; open up and/or remove clothing as much as practical, especially chemical-resistant clothing).
- Drink cool water slowly, but only if conscious, not in shock.
- If vomiting, and/or the signs and symptoms are not lessening within an hour, call for emergency help and/or transport the victim to the emergency room. It is likely that a heat exhaustion victim will be unable to work for the remainder of the day.

3.2.7 Heat Stroke (a.k.a. Sun Stroke)

The signs and symptoms of heat stroke are hot, dry skin to the touch; reddish coloring; body temperature more than 105° F; no sweating; mental confusion; deep, rapid breathing that sounds like snoring progressing to shallow, weak breathing; headache; dizziness; nausea; vomiting; weakness; dry mouth; convulsions, muscular twitching, sudden collapse; possible unconsciousness.

First aid for heat stroke is as follows:

- Immediately remove the victim to the support area
- Cool the victim rapidly using whatever means are available, including: shade; opening up and/or removing clothing; soaking clothing/skin with water and fanning; placing the victim in vehicle using air conditioning on maximum
- Do not give drinking water to the victim
- Treat for shock, if needed
- Transport the victim to the emergency room or call for emergency help; no exceptions for heat stroke victim

3.3 Working on Boats

Employees walking or working on unguarded decks of floating work platforms shall be protected with U.S. Coast Guard-approved life jacket or buoyant work vest. Employees working on decks of boats unprotected by passive rail systems shall wear a personal flotation device (PFD). A PFD is not required when working within an enclosed cab or equipment compartment on a barge or work platform. All employee staff shall carefully review this policy prior to each application, as necessary, to ensure that requirements are met and that reasonable precautions are taken to prevent an accident.

4 HEALTH AND SAFETY ACTIVITIES

The following subsections detail general health and safety-related requirements and project specific activities that will be performed pursuant to implementation of this project.

4.1 Training Requirements

All staff directly handling or processing sediment samples have completed training in hazard recognition and basic health and safety issues as required by the occupational safety and health regulations contained in 29 CFR 1910.120 (e). Field personnel will be familiar with the requirements of this HASP, and will participate in site activity and safety briefings provided by the project SSO. Safety briefings will be conducted prior to the start of and periodically during the field activities.

4.2 Personal Protective Equipment

Personal protective equipment (PPE) requirements and use on this project is based on a project-specific hazard analysis. Anchor Environmental will be responsible for distribution of all PPE, which is expected to include latex gloves, protective work boots, safety glasses, and possibly Tyvek suites. Hard hats will be worn when operating heavy equipment.

5 ENVIRONMENTAL MONITORING PLANS

The current action levels for the purpose of protecting field personnel target the potential chemicals of concern and physical hazards. If any unusual observations such as odor, staining, symptoms, etc. are noted, the SSO will be contacted, work stopped and the potential for exposure reevaluated prior to the commencement of site operations.

5.1 Medical Surveillance

Special medical tests or examinations are not anticipated for field personnel assigned to the project. Participation in a medical surveillance program is not anticipated for this project

5.2 Work Practices

Safe work practices are part of assuring a safe and healthful working environment. Safe work practices to be employed during the entire progress of fieldwork are as follows:

- Set up, assemble, and check out all equipment for integrity and proper function before starting work activities.
- Do not use faulty or suspect equipment.
- Use only new and intact protective clothing. Change the suit, gloves, etc. if they tear.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance at all times.
- Do not smoke, eat, drink or apply cosmetics during while in the contaminated areas of the site, or prior to decontamination.
- Wash hands, face, and arms with distilled water prior to taking rest breaks, lunch break, and leaving the site at the end of the workday. A wash station will be provided to allow for site personnel to wash their hands, face, and arms.
- Check in and out with the SSO upon arrival and departure from the site.
- Perform decontamination procedures completely.
- Notify the SSO immediately if there is an accident that causes an injury or illness.
- Use the buddy system when working in the contaminated or hazardous areas.
- Use respirators correctly and as required by the site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-face piece seal; do not wear contact lenses when the use of a respirator is required; cartridge and filter units shall be checked and maintained in accordance with manufacturer instructions; the face piece shall be washed regularly.

5.3 Decontamination

Decontamination will take place in the decontamination area identified. All field personnel, PPE, and sampling equipment leaving the work area will be decontaminated to prevent the spread of hazardous materials. All workers will wash hands, arms and face after removing PPE and prior to leaving the site. Hand washing and the availability of decon water is essential since these are primarily dermal hazards. Disposable items will be bagged for disposal along with other hazardous wastes removed from property. Sampling equipment will be decontaminated using the procedure detailed in the project sampling and analysis plan.

5.4 Emergency Procedures

In the event of an emergency on site, the project SSO will direct the course of action. It may be necessary for the SSO to depend on the other on site personnel for assistance. The SSO will call for emergency assistance if needed. As soon as practical, the SSO will contact the PM. All staff assigned to the project will be briefed on the procedures and their responsibilities for implementation. In the event of a medical emergency, dial 911 first.