FINAL

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Appendix B
HUNTERS POINT SHIPYARD PARCEL F
ESTCP DEMONSTRATION PLAN

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SITE-SPECIFIC HEALTH AND SAFETY PLAN

Field Sampling Activities at Hunters Point Shipyard in San Francisco, California

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ACRONYMS AND ABBREVIATIONS

AC	activated carbon
ACGIH	American Conference of Governmental Industrial Hygienists
AEI	Aquatic Environments, Inc.
APR	Air Purifying Respirator
ARSO	Assistant Radiation Safety Officer
BBP	blood-borne pathogens
BTEX	benzene, toluene, ethylbenzene, and xylene
Cal-OSHA	California Occupational Safety and Health Administration
CCR	California Code of Regulations
CEI	Compass Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CNS	central nervous system
COPEC	chemical of potential ecological concern
CPR	cardiopulmonary resuscitation
DP	demonstration plan
ESTCP	Environmental Security Technology Certification Program
FS	Feasibility Study
FSP	Field Sampling Plan
GI	gastrointestinal
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Site Health and Safety Officer
IR	Installation Restoration
IRP	Installation Restoration Program
MSDS	Material Safety Data Sheet
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PPE	personal protective equipment
ppm	parts per million
RSO	Radiation Safety Officer
RWQCB	Regional Water Quality Control Board
RCP	Radiological Control Plan
S-HASP	Site-Specific Health and Safety Plan
SPMDs	semipermeable membrane devices

STEL	short-term exposure limit
TLV	threshold limit value
TPH	total petroleum hydrocarbons
TTECI	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.
TWA	time-weighted average
UV	ultraviolet
WESI	Williams Environmental Services, Inc.

1.0 INTRODUCTION

This Site-Specific Health and Safety Plan (S-HASP) delineates the basic safety requirements for field activities to be performed at Hunters Point Shipyard (HPS) from November 2005 through June 2008. These activities will be conducted to support an Environmental Security Technology Certification Program (ESTCP) Demonstration Plan (DP). This S-HASP was prepared in compliance with the requirements of the California Occupational Safety and Health Administration (Cal-OSHA) standard for Hazardous Waste Operations and Emergency Response (Title 8 CCR, GISO 5192). This S-HASP should be used in conjunction with the ESTCP DP.

The provisions set forth in this S-HASP apply to all contractors and subcontractors (field personnel). Subcontractors may elect to modify these provisions, but only to upgrade or increase safety activities. This S-HASP may not thoroughly address all hazards associated with any specialized subcontractor operations; in this situation, subcontractors shall be responsible for developing their own Health and Safety Plans and procedures to adequately address their scope of operations at this site.

This S-HASP addresses the potential hazards that may be encountered for this project. If unanticipated changes in site or working conditions occur which are not addressed by this plan, addenda shall be provided.

1.1 Site Location and Background

HPS is situated on a peninsula in the southeast corner of San Francisco, CA. The peninsula is bounded on the north, east, and south by San Francisco Bay and on the west by the Bayview Hunters Point district. HPS comprises about 955 acres, with approximately 400 acres of offshore sediments. From 1945 to 1974, the Navy used HPS predominantly for ship repair and maintenance. HPS was deactivated in 1974 and remained relatively unused until 1976, when it was leased to Triple A Machine Shop, a private ship repair company. In 1986, the Navy resumed occupancy of HPS, but closed the Base in 1991.

Historical site activities at HPS resulted in the release of chemicals to the environment, including offshore sediments. Environmental restoration activities are conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Super-fund Amendments and Reauthorization Act of 1986 (SARA). The facility was closed under the Defense Base Realignment and Closure Act of 1990 (BRAC) and is in the process of conversion to nonmilitary use.

1.2 Scope of Work

The overall purpose of ESTCP DP project is to demonstrate that activated carbon (AC) sorbent mixed with sediment is a cost-effective, in situ, non-removal, management strategy for reducing the bioavailability of PCBs in offshore sediments at HPS site. The scope of the ESTCP DP is to:

1) Demonstrate and compare the effectiveness, in terms of homogeneity and depth of AC application, of two available large-scale mixing technologies,
2) Demonstrate and validate that AC treatment reduces the aqueous PCB availability and PCB bioaccumulation results in field tests, and
3) Evaluate sediment resuspension and PCB release.

Specific details regarding data collection activities are provided in the Quality Assurance Project Plan (QAPP) for the ESTCP DP. Detailed DQOs for the primary and secondary performance criteria are

provided in Tables A-2 and A-3 of the ESTCP DP. DQOs were developed following the guidelines presented in the United States Environmental Protection Agency's seven-step DQO process (U.S. EPA, 2000).

Five test plots (labeled C-G) of 370 ft^2 area will be used in the field study and analyzed in a "before and after treatment" experimental design. After pre-treatments samples are taken, two subcontractors to Stanford will apply treatments to four of the five plots, leaving one plot to serve as a control.

The first contractor, Aquatic Environments, Inc. (AEI), has a barge-like machine (called an Aquamog, Figure A-3) with a rotovator attachment that is typically used to disrupt weed growth in marshy areas. In the field demonstration, AEI will be responsible for the mobilization, storage, operation, and demobilization of the Aquamog to the Hunters Point Naval Shipyard field site in January 2006. In the field demonstration, the Aquamog will be deployed on the water during high tide and allowed to settle onto the sediment surface at low tide to do treatments on Plots C and D as shown in Figure A-2 of the QAPP. AEI will supply an ARGO amphibious support vehicle and any auxiliary equipment to the demonstration site that will be necessary to complete the treatments. Before mobilization of the Aquamog, AEI is also responsible for the design, development, and testing of a delivery system for transferring AC from the deck of the Aquamog to the plot surface. Besides delivering AC to the sediment surface, the Aquamog has a rotovator attachment that will be used to mix transferred AC into sediments into Plot D to an approximate depth of one foot. The depth of the mixing can be controlled by the speed and downward pressure of the rotovator. The rotovator attachment will also be used to mix (only) the sediments in Plot C to a depth of one foot. Plot E will receive no treatment as serve as the control plot.

The second contractor, Compass Environmental, Inc. (CEI) [formerly Williams Environmental Services, Inc. (WESI)], owns an injection system used traditionally for sediment solidification with cement mortar (Figure A-4). In Jan. 2006, CEI will provide its patented rake injector and other equipment necessary to support the treatments of Plots F and G. This equipment will be located on the shore with the injector arm reaching out to Plots F and G. Via a slurry, AC will be injected and mixed into the upper one foot of tidal zone sediments for Plot F. For Plot G, the sediments will be mixed using the rake injector mixers with no application of a AC slurry. CEI will provide the data necessary to demonstrate that the requisite carbon mass has been added to Plot F. CEI will record data such as slurry flow rate, slurry density, pump time, and slurry volume pumped into each test plot.

Because transportation, mobilization and operation of the equipment for these two subcontractors require specially trained personnel performing non-standard field operations, AEI and CEI shall be responsible for developing their own Health and Safety Plans and procedures to adequately address their scope of operations at this site. This S-HASP covers the hazards associated with field sampling activities.

The schedule of sampling and analysis that will occur before and after plot treatments is summarized in Table A-1 of the QAPP. Several types of field sampling activities will be performed for the ESTCP DP (most one-month before and 6- and 18-months after treatments occur):

- One-month deployments of test clams in PVC tubes sunk in plots
- Collection of indigenous amphipods in plots
- One-month deployments of semipermeable membrane devices (SPMDs) in plots
- Collection of benthic community samples from quadrats taken in plots
- Collection of push sediment core samples from plots
- Sampling of water column above plots at high tide

2.0 PROJECT SAFETY AUTHORITY

Personnel responsible for project safety are the Project Manager and the Site Health and Safety Officer (HSO) or his/her designee.

The Project Manager is responsible for the provisions and submittal of this plan, and for advising the HSO on health and safety matters. The Project Manager has the authority to provide for the auditing of compliance with the provisions of this plan, suspension or modification of work practices, and administration of disciplinary actions for individuals whose conduct does not meet the requirements set forth herein. The Project Manager may elect to give the HSO authority to administer disciplinary actions for individuals whose conduct does not meet the requirements set forth herein.

The HSO is responsible for the dissemination of the information contained in this plan to all personnel assigned to the project, and to the responsible representative of each Navy subcontractor firm working on the project. The senior field team member may also be designated as the HSO. As such, he or she is responsible for maintaining, performing or providing the following as necessary:

- Verification of that field team members are supervised by a HSO or designee that has completed the medical surveillance program examinations, and 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training.
- Daily tailgate discussion of the site safety plan. Documentation of tailgate safety meetings in field notebook.
- Documentation of all accidents or S-HASP violations.
- Emergency contacts as needed.
- Implementation of Decontamination/Contamination Reduction Procedures (see Section 9.0).

The HSO or his/her designee has the authority to suspend work any time he or she determines that the health and safety practices at the site are inadequate. In such cases, the HSO also shall inform the Project Manager of individuals whose conduct is not consistent with the requirements of the plan.

The HSO has the responsibility to check in with the field Project Manager each day before commencing field operations. The HSO will disseminate any new information provided to the field team during tailgate safety meetings.

3.0 MEDICAL SURVEILLANCE

Any field personnel engaged in project operations that expose them to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances shall be participants in a Medical Surveillance program. These persons must be medically evaluated and cleared for use of respiratory protection devices and protective clothing for working with hazardous materials by the examining physician(s). The medical clearance shall be current within one year through at least the last day of field operations. The applicable requirements under the Cal-OSHA standards for HAZWOPER (Title 8 CCR, GISO 5192) and the Respiratory Protection Program (Title 8 CCR, GISO 5144) will be observed.

All field personnel shall bring proof of medical clearance from an approved source to the job site for inspection before beginning work. The HSO will be responsible for reviewing the proof of medical

clearance in accordance with the requirements described above and documenting this review in the field notes before those persons can commence work.

4.0 SAFETY/ORIENTATION TRAINING

This section presents the general and site-specific training requirements for this project in accordance with regulatory and client requirements. All field personnel shall bring proof of required training to the job site for inspection before beginning work. Training shall be provided by a qualified person and must cover certain content requirements. The HSO will be responsible for reviewing the proof of training in accordance with the requirements described below and documenting this review in the field notes before those persons may begin work.

4.1 General Training Requirements

General training requirements that apply to field personnel on this project are described below. The majority of the field staff meet or exceed the minimum requirements as defined below and are 40 hour HAZWOPER trained.

4.1.1 HAZWOPER

Field personnel engaged in project operations that potentially expose them to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances shall be supervised by the HSO who has satisfied the following training requirements. These requirements must be satisfied in accordance with the CAL OSHA standard for HAZWOPER (Title 8 CCR, GISO 5192):

- Initial 40-hour HAZWOPER training; and,
- Annual 8-hour HAZWOPER refresher training current within one year.
- One-time only 8-hour HAZWOPER Supervisor training in addition to initial 40-hour HAZWOPER and 8- hour HAZWOPER training.

4.1.2 First Aid

At least one team member shall have current first aid training including adult cardiopulmonary resuscitation (CPR) and blood-borne pathogens (BBP) training. Current training for the purposes of this S-HASP is as follows: (1) first aid training current within three years, (2) adult CPR current within one year, and (3) BBP training current within one year. In addition, the HSO is CPR/First Aid/BBP trained as well.

4.1.3 Respirator Training and Fit-Testing

It is not reasonably anticipated that employees on site will be exposed at or above the action levels or permissible exposure limits for chemical hazards present at the site due to the fact that samples collected are wet sediment samples, leaving little potential for significant exposures via inhalation of dusts or vapors. Therefore respirator training or fit testing will not be required for the HPS sediment sampling activities. In the event that conditions change and it is determined that respiratory protection is warranted, team members shall be provided appropriate Air Purifying Respirator (APRs) and appropriate fit-testing current within one year. Fit testing shall be performed on the make, model, and size of the full-face APR to be worn for any required task.

4.2 Site-Specific Training

All potential field personnel will review this S-HASP before commencing work as part of the site-specific safety training for this project. The HSO will review the S-HASP before field operations begin and will conduct daily tailgate safety meetings to bring up appropriate health and safety concerns and discuss any changes in field conditions. Field personnel will certify their review by signing a HASP training record form (Appendix A) or signing the field notebook after the tailgate safety meeting. The Project Manager is responsible for distributing this S-HASP to appropriate personnel and verifying review by obtaining signed review forms or copies of field notes. Signed review forms or copies of field notes will be placed in project files and in field personnel medical files.

Whenever a change of conditions on-site occurs that may affect safety, the HSO or his/her designee will conduct a tailgate safety meeting if appropriate. Changing site conditions that may affect safety include the following:

- Change of field personnel;
- Change in work activity;
- Change in weather conditions; and,
- Visitors on site.

All training sessions, safety meetings, and safety briefings will be documented by the HSO or his/her designee in the field notebook, or on Tailgate Safety Meeting Record forms (Appendix B). Documentation will include a brief description of topics addressed and the signatures of all training attendees.

4.3 Navy Subcontractor Documentation

Navy subcontractor employees shall maintain proof of qualification and completion of all required training onsite. This information can be satisfied by either: (1) an employer's certification statement including a summary report of all required training and medical surveillance completion dates for each individual, or (2) individual training certificates and medical clearance reports for each individual.

5.0 HAZARD ASSESSMENT

This section discusses the identification of general, task, or activity-specific and site-specific hazards associated with planned field activities for this project. Physical, chemical, and biological hazards are addressed separately. The job hazard analysis identifies the potential hazards associated with near-water safety and includes a description of the control measures to be implemented, a list of equipment with any applicable inspection, and training requirements.

5.1 Physical Hazards

General physical hazards present during field sampling activities could include the following:

- Tripping over hoses, pipes, tools, equipment or uneven terrain;
- Slipping on wet or oily surfaces;
- Injury due to lifting heavy sediment samples or equipment;
- Working over or near water
- Entanglement or injury from rotating or energized parts of mixing equipment;

- Exposure to noise generated by motors and pumps;
- Insufficient or faulty protective equipment; and
- Insufficient or faulty operations, equipment, or tools.

Other site-specific physical hazards may include any of the following:

- Hypothermia from exposure to potentially cool air temperatures and windy conditions;
- Sunburn, windburn;
- Damage to eyes from sun exposure (ultraviolet [UV] radiation); and
- Bites from snakes or stinging insects.

Safety precautions for general and site-specific hazards are addressed in Table 5-1 and Section 7.0 of this S-HASP.

5.2 Chemical Hazards

Chemicals that have been detected in shoreline areas and are therefore potentially present in sediments include metals, low- and high-molecular-weight PAHs, benzene, toluene, ethylbenzene, and xylene (BTEX), total petroleum hydrocarbons (TPH), organotins, polychlorinated biphenyls (PCBs), and radium dials/radioactive contamination. For ease of reference, the potential physical and chemical hazards expected and protective measures used to promote worker safety are provided together in Table 5-1. A list of historical chemicals or constituents occurring at the site along with their toxicological properties is presented in Table 5-2. More details regarding specific chemicals expected to be present are provided in the following sections.

Table 5-1. Hazards and Protective Measures for Hunters Point Sampling Activities

Potential Hazards	Methods to Ensure Worker Safety
Physical Hazards	
Injuries Caused by Tripping or Slipping	Regular job site reconnaissance will be conducted to identify, and eliminate if practicable the hazards. Sturdy steel-toed rubber or neoprene boots with non-slip soles should be worn when working on or around vessels and docks. Long pants shall be worn to prevent abrasion in the event of a slip, trip or fall.
Lifting, Manual Labor	The HSO or designee will identify ergonomic factors and will develop measures to prevent injury. Proper lifting techniques and warm-up will be used before strenuous tasks. Special hand protection will be required where indicated.
Working near water	Coordination with facility personnel, establishment of communications, and implementation of water safety requirements/measures will be used to ensure worker safety. Work will always be performed by a team of at least two persons, never one person working alone. Personnel working in water above waist height will be required to use a Personal Flotation Device
Heavy Mixing Equipment	Workers will wear hardhats while mixing equipment is in operation. Work will always be performed by a team of at least two persons, never one person working alone. Wearing loose clothing around operating machinery (i.e., engines, etc.) will be prohibited; loose hair shall be appropriately secured
Noise	Personnel will wear hearing protection (ear plugs or ear muffs) when working around noisy equipment, such as motors and pumps/
Solar Radiation	Protective clothing, eyewear, and sun block will be worn.
Weather	If lightning or thunder is seen or heard, then all personnel will cease sampling and seek shelter until the threat of lightning strikes passes.
Cold Stress/	Appropriate foul weather gear will be worn when necessary. This includes waterproof or

Potential Hazards	Methods to Ensure Worker Safety
Hypothermia	resistant boots, insulated leather gloves and rain gear. Training as appropriate
Snakes and Stinging Insects such as Spiders, Wasps and Bees	The HSO will identify areas where workers could contact snakes and/or stinging insects and will determine actions needed to rectify the problem. Workers will not be allowed to work near insects where an unreasonable risk is present. Identify workers with allergies and ensure that appropriate emergency treatment is available.
Chemical Hazards	
Skin and Eye Irritation from Contact with Chemicals	Workers will wear appropriate chemically compatible personal protective equipment (PPE) dependent on the task (see Section 8.0), especially when collecting sediments. Good hygienic practices will be employed including frequent washing of the hands forearms and face, especially prior to eating or drinking. Eating or drinking is not permitted where samples have been handled or stored.
Radium Dials/ Radioactive Contamination	All samples will be handled with gloves and decontaminated in accordance with the approved protocols (TtFW 2004). Any samples found to be contaminated by radiation will be segregated and held for evaluation/disposal.
Biohazard or Infectious Materials	Gloves are to be worn when handling materials that are biohazard or infectious. Wash hands thoroughly after handling these materials and prior to eating or drinking. Do not eat or drink in areas where these materials are handled or stored. Disinfect work surfaces to prevent spread of contamination. Disinfect any wounds or cuts and prevent recontamination by using appropriate PPE. Seek medical attention as needed.

Table 5-2. Toxicological Properties of Chemical Compounds Potentially Present in Hunters Point Sediments

Class/Compounds (examples)	Principal Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
ORGANIC COMPOUNDS			
Aromatic Hydrocarbons			
Benzene	Inh, Ing, Skin	Central nervous system (CNS) depression; skin, eyes and upper respiratory tract irritation	Carcinogen, blood change leukemogenic
Ethylbenzene	Inh, Ing, Skin	Skin, eyes, nose and throat irritation	Skin rash
N-hexane	Inh, Ing, Skin	CNS depression; eyes and nose irritation	Skin irritation peripheral neuropathy
Toluene	Inh, Ing, Skin	CNS depression; skin, eyes, and respiratory tract irritation	Dermatitis
Xylene	Inh, Ing, Skin	Dizziness; nose, throat, skin, and eye irritation; olfactory changes; irritant; poison; distortion; hallucination; CNS effects	Cardiac arrhythmia
Petroleum Distillates			
Gasoline, Diesel	Inh, Skin, Ing	Anesthesia, dizziness, headache, nausea, vomiting, sleepiness, fatigue, disorientation, depression, unconsciousness, respiratory tract irritation, sore throat, cough	Dermatitis, headache, mood shifts, CNS effects, fatigue
Semivolatile Organic Compounds			
Polychlorinated biphenyls (PCB)	Skin, Inh, Ing	Irritatant to eyes; chloracne	Liver damage; reproductive effects; [potential occupational carcinogen]
Polycyclic Aromatic Hydrocarbons (as PAHs)	Skin, Inh, Ing	Irritant to skin, vomiting, photosensitization, headache	As a class overall, can be considered mutagenic and tumorigenic with several compounds known carcinogens; also causes liver damage
Organic Metals			
Organotins	Skin, Inh, Ing	Irritation eyes, skin, respiratory system; headache, dizziness; psychoneurologic disturbance; sore throat, cough; abdominal pain, vomiting;	Urine retention; paresis, focal anesthesia; skin burns, pruritus; in animals: hemolysis; hepatic necrosis; kidney damage
INORGANIC COMPOUNDS			
Metals			
Chromium (VI)	Skin, Inh, Ing	Skin, respiratory tract irritation, dermatitis, skin ulceration	Carcinogen, lung and skin effects, nasal septum perforation
Chromium	Skin, Inh, Ing	Skin, respiratory tract irritation	Lung disease
Lead	Inh, Ing	GI distress, kidney failure	Neuropathy, CNS anemia
Mercury	Ihl, Skin, Ing	Skin irritant. Inhalation of vapors may cause pneumonitis. May affect CNS and kidneys. Effect may be delayed.	Affects central nervous system and kidneys, resulting in irritability, emotional instability, tremor, mental and memory disturbances, speech disorders. May cause inflammation and discoloration of the gums.

Class/Compounds (examples)	Principal Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Nickel	Skin, Inh, Ing	Skin, nasal irritation, respiratory tract irritation	Carcinogen, lung, GI system disease
Zinc	Inh, Ing	Metal fume fever, skin irritation	GI system effects, dermatitis

GI = gastrointestinal.
Ing = ingestion.
Inh = inhalation.
Skin = skin absorption.

5.2.1 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) are present in coal tar, petroleum hydrocarbons, and other sources and are used in a variety of industrial products. Some PAHs are recognized human carcinogens. Exposure by any route to PAHs and other recognized human carcinogens shall be maintained at the absolute practicable minimum level. Sampling will involve the collection of wet sediments using a grab sampler; therefore, the exposure to PAHs should be minimal. Sediment samples collected previously at HPS indicated that PAH concentrations were generally below or equal to ambient levels in San Francisco Bay. The primary route of exposure is anticipated to be via dermal exposure and ingestion. These hazards will be controlled by proper use of PPE and personal hygiene practices including frequent and thorough hand washing as well as the designation of a clean area for eating and drinking.

5.2.2 Polychlorinated Biphenyls

PCBs, also referred to as Aroclors, are synthetic industrial products that have been commonly used as cooling fluids and electrical insulators. PCBs are common contaminants of oily-type waste and are found around railroad tracks and in industrial areas and dumps. PCBs are recognized environmental pollutants and human carcinogens. Work involving contact with PCBs exceeding 100 µg/g (specify dermal or inhalation) (i.e., parts per million [ppm]) may require special medical evaluation and approval of the HSO. Historical concentrations of PCBs found in Hunters Point sediments were considerably below this concentration.

PCBs are skin absorbable and appropriate precautions shall be implemented. Handling of samples that may be contaminated with PCBs shall be performed wearing appropriate chemically compatible PPE (gloves, safety glasses, and face shield where warranted.). Sampling will involve the collection of wet sediments using a grab sampler; therefore, the exposure to PCBs should be minimal.

In addition, precautions should be implemented to prevent inhalation of dusts that may be contaminated with PCB's. Process samples that are suspected to contain PCBs are to be stored and handled in well-ventilated areas and hands, forearms and face are to be washed with soap and water after sample processing.

Although OSHA has not set standards for each specific PCB, occupational exposures for chlorodiphenyl 42% chlorine and 54% chlorine are defined in 29 CFR 1910.1000, Table Z-1. Limits for these air contaminants are 1 mg/m^3 and 0.5 mg/m^3 respectively.

5.2.3 Petroleum Hydrocarbons

Petroleum hydrocarbons such as gasoline and diesel fuel may include a wide range of substances, some of which may pose substantive human health hazards. The aromatic volatile petroleum hydrocarbons including BTEX compounds are generally of greater concern, in part because they are more likely to exist in the worker's breathing zone. In moderate exposures, BTEX compounds all produce similar acute effects including headache, narcosis, and anesthesia. Table 5-2 summarizes the exposure criteria and health effects of BTEX. Among the aromatic volatile petroleum hydrocarbons, benzene is the primary substance of concern because of its status as a known carcinogen and association with leukemia and aplastic anemia in chronic exposure situations.

The permissible exposure limits (PELs) set by the Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs)-2004 for airborne exposure are provided in Table 5-3 for BTEX. Even high concentrations (ppm to percent level) of volatile organic compounds are not reasonably expected to present airborne concentrations at or approaching OSHA PELs or ACGIH TLVs considering the volume of sediments to be sampled and processed during field activities. Furthermore, all work will be conducted in open-air conditions. Considering the relative volatility of each compound and the open working conditions, these compounds are not reasonably expected to present inhalation exposures of concern to worker health and safety. Sampling will involve the collection of wet sediments using a grab sampler; therefore, the exposure to volatile organic compounds should be minimal.

TABLE 5-3. OSHA PELS AND ACGIH TLVS FOR SELECTED VOLATILE ORGANIC COMPOUNDS

Compound	OSHA PELs		ACGIH TLVs	
	TWA[(a)] (ppm)	STEL[(b)] (ppm)	TWA[(a)] (ppm)	STEL[(b)] (ppm)
Benzene	1.0	5.0	0.5	2.5
Toluene	200	300	50	–
Ethylbenzene	100	-	100	125
Xylene (*o*-, *m*-, *p*- isomers)	100	-	100	150

(a) **TWA**: Time-weighted average is the employee's average airborne exposure in any 8-hour work shift of a 40-hour workweek, which shall not be exceeded.

(b) **STEL**: Short-term exposure limit is the employee's 15-minute TWA airborne exposure, which shall not be exceeded at any time during a workday.

Petroleum hydrocarbons can also be absorbed through the skin if contact with highly contaminated sediments is made. Dermal exposures will be controlled through the use of PPE as described in Section 8.0.

5.2.4 Explosion and Fire

The types of hydrocarbons potentially expected to be present (gasoline and diesel fuel) are not expected to generate vapors at explosive concentrations during any of the tasks to be performed. All work will be conducted in open-air conditions. Therefore, the potential for vapors to reach explosive concentrations is minimal and vapor monitoring will not be necessary.

5.2.5 Heavy Metals and Organotins

A variety of heavy metals may be encountered as contaminants in sediments. Some metals are highly toxic; others are also recognized human carcinogens. As these materials are not volatile unless heated to extremely high temperatures, control by proper use of PPE and personal hygiene practices will prevent significant exposure. Sampling will involve the collection of wet sediments using grab samplers under ambient temperatures; therefore, the exposure to volatile metals or airborne particulate should be negligible.

5.2.6 Radioactive Contamination

Historically, radium dials were disposed of in the Parcel E landfill adjacent to the study area. Therefore, all sediment samples collected as part of the Treatability Study will be scanned for radioactivity by Tetra Tech EC, Inc. (TTECI) field personnel according to the Radiological Control Plan, attached as Appendix C. It should be noted that the Radiological Control Plan (RCP) was developed by Tetra Tech Foster Wheeler (TtFW), which is now called TTECI, in 2004 for onshore survey and removal activities conducted for the Navy in Parcel E and, therefore, not all elements and language of the plan are pertinent to the Parcel F Treatability Study. For example, although the RCP includes descriptions of procedures for personnel radiation surveys, radiation screening for the Treatability Study will be limited only to the on-site screening of collected sediment samples. The RCP sections pertinent to the Treatability Study are: Section 4.0 (Instrumentation and Procedures), Section 5.0 (Detection Sensitivity), Section 7.1 and 7.2 (Survey and Decontamination Procedures).

Table 5-4 provides acceptable levels of contamination based on the NRC Reg. Guide 1.86 limits. Should levels of contamination exceeding those listed in Table 5-4 be encountered during the surveys, appropriate decontamination methods in accordance with Section 7.2 of the TtFW Radiological Control Plan will be implemented.

TABLE 5-4. RADIATION CONTAMINATION LIMITS

Radionuclide	Fixed (dpm/100 cm^2)	Loose (dpm/100 cm^2)	Total (dpm/100 cm^2)
Alpha	100 α	20 α	120 α
Beta (Strontium-90)	1,000 β^-	200 β^-	1,200 β^-
Beta / Gamma	5,000 β^-, γ	1,000 β^-,γ	6,000 β^-,γ

Notes:

Types of radiation: α - alpha, γ - gamma, β^- - beta
cm^2 – square centimeters
dpm – disintegrations per minute

The TTECI RSO (or ARSO) will determine if decontamination is required and direct the field team leader on the process. In addition, the sampler and any other contaminated equipment will be decontaminated. All operations involving radioactive contamination will be carried out in conformance with the procedures described in the TtFW RCP in Appendix C (TtFW 2004).

5.2.7 Unidentified Chemicals

Chemicals not previously identified or considered may be present in Hunters Point sediments. Exposure to unidentified chemicals by any route shall be maintained at the absolute practicable minimum level to prevent casual contact with chemicals. Control by proper use of PPE and personal hygiene practices will prevent significant exposure.

Considering the small volume of sampling media to be disturbed, the type of media (wet sediments), the historical concentrations in shoreline areas of the site and the open working conditions of all field operations, significant inhalation exposures at or approaching OSHA or ACGIH exposure limits are not reasonably expected. However, skin or dermal absorption of the contaminants potentially present in sediments is considered a potential route of entry and will be controlled through the use of PPE (i.e., chemical-resistant gloves, wet suits, and booties) as described in Section 8.0 of this S-HASP. Ingestion is not considered a significant route of entry for these chemicals on this project. However, the use of PPE and standard safety procedures (no eating or drinking in operations areas) will minimize the potential for ingestion of sediment-associated contaminants.

5.3 Biological Hazards

Multiple biological hazards may be present at the Hunters Point site and are identified in Table 5-1 along with control measures to be implemented. Field personnel shall carefully review this section.

Work in shallow bayous may expose personnel to a variety of aquatic hazards. Project personnel shall not wade barefoot while performing project work. Appropriate footwear includes boots or waders. Free swimming is prohibited (see also Section 5.4.1).

Samples that are retrieved as part of the sample acquisition process may contain organic materials that contain biohazard/infectious materials (such as partially decomposed animal or vegetative materials, or parasites). Gloves shall be worn when handling these materials. Additionally, any open wound or punctures should be covered to prevent infection. All areas should be disinfected as needed to prevent the spread of potentially hazardous materials and to prevent the contamination of samples. In the event that someone receives a cut, puncture, or abrasion, appropriate first aid should be administered to prevent infection.

5.4 Task-Specific Hazards

The following tasks have specific hazards and control measures that are described below.

5.4.1 Work Near Water

When working over or near water, there is a potential for personnel to fall in and the danger of drowning exists. Work within 15 feet of unobstructed access to water shall be performed in accordance with the requirements given below.

- Personnel will use the buddy system at all times.
- Personnel working in water above waist height will be required to use a Personal Flotation Device
- Swimming shall be prohibited for personnel, unless necessary to prevent injury or loss of life.

5.4.2 Noise

Working near a motors and pumps can subject workers to noise exposures in excess of allowable limits. The use of ear plugs or ear muffs is mandatory when noise prevents conversation in a normal voice at a distance of 3 feet. This "rule of thumb" is an indication that noise levels may exceed the OSHA action level of 85 decibels. All personnel required to wear hearing protection, as provided by this section, shall be in a hearing conservation program in compliance with 29 CFR Section 1910.95 and 8 CCR Section 5096.

6.0 AIR MONITORING AND CONTROL MEASURES

No area air monitoring is planned because inhalation exposures of concern are not reasonably anticipated for any of the project activities to be performed (see Section 5.2 of this S-HASP). In the event that conditions change and it is determined that respiratory protection is warranted, team members shall be provided appropriate Air Purifying Respirator (APRs) and appropriate fit-testing current within one year. Fit testing shall be performed on the make, model, and size of the full-face APR to be worn for any required task.

7.0 GENERAL PROJECT SAFETY REQUIREMENTS

7.1 General Safety Precautions

The project operations shall be conducted with the following minimum safety requirements employed:

- Sample radiation scanning will be required.
- Smoking will not be permitted on project property.
- Eating and drinking will be restricted to areas that are designated.
- Wearing loose clothing around operating machinery (i.e., engines, etc.) will be prohibited; loose hair shall be appropriately secured.
- Work boots with steel toe and shank shall be worn during all field work activities.
- Hard hats, long-sleeve shirts, long pants and sunscreen will be worn as appropriate to prevent sunburn/windburn.
- Layers of clothing are recommended to prevent hypothermia.
- In warm weather, regular work breaks will be made to afford consumption of drinking water and to limit the possibility of hyperthermia.
- All personnel shall be required to thoroughly wash hands, forearms and face before eating or drinking. Personnel shall only eat or drink in areas designated for the purpose.

- Gross decontamination and removal or disposal of all personal protective equipment shall be performed prior to exiting the process area.

- The HSO and all field employees will be responsible to identify and alert other field team members to physical hazards present at the site.

Additional safety precautions for specific operations are described in Section 8.0 of this S-HASP.

7.2 Symptoms of Chemical Exposure

Field operations personnel shall inform each other of non-visual symptoms that may indicate chemical exposure such as:

- Headaches;
- Dizziness;
- Difficulty breathing;
- Nausea;
- Vomiting;
- Blurred vision;
- Cramps;
- Irritation of eyes, skin, or respiratory tract;
- Changes in complexion or skin discoloration;
- Changes in apparent motor coordination;
- Changes in personality or demeanor;
- Excessive salivation or changes in papillary response; and,
- Changes in speech ability or pattern.

7.3 Cold Stress

Adverse climate conditions such as cold weather are important considerations in planning and conducting site operations. The largest danger regarding cold stress is hypothermia, which occurs when the body's core temperature drops below 96.8°F. Conditions that could induce such a drop are immersion in low-temperature water and exposure to extremely cold ambient temperatures. Work warming regimens will be instituted as necessary as determined by the HSO. Signs and symptoms of a low body core temperature are shivering, a lower mental alertness, less ability to make rational decisions, and loss of consciousness.

When working in cold environments, specific steps should be taken to lessen the chances of cold-related injuries. These include the following:

- Protecting of exposed skin surfaces with appropriate clothing (such as face masks, handwear, and footwear) that insulates, stays dry, and blocks wind
- Shielding the work area with windbreaks to reduce the cooling effects of wind
- Providing equipment for keeping workers' hands warm by including warm air jets and radiant heaters in addition to insulated gloves
- Using adequate insulating clothing to maintain a body core temperature of above 96.8°F
- Providing extra insulating clothing on site

Clinical signs of cold stress are listed in Table 7-1.

Table 7-1. Cold Stress Clinical Signs

Core Temperature	Clinical Signs
98.6°F	Normal oral temperature
96.8°F	Metabolic rate increases in an attempt to compensate for heat loss
95.0°F	Maximum shivering
93.2°F	Victim conscious and responsive, with a normal blood pressure
91.4°F	Severe hypothermia below this temperature
89.6-87.8°F	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated but react to light
86.0°F – 84.2°F	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases

7.4 Hypothermia

A potential for hypothermia from exposure to potentially cool air temperatures, windy conditions, and low water temperatures exists. The signs of hypothermia include shivering, numbness, glassy stare, reduction of rational decision-making, apathy, weakness, impaired judgment, or a loss of consciousness. To care for workers that have hypothermia, the following steps should be taken:

- Gently move the person to a warm place.
- Remove any wet clothing from the person and dry the person.
- Warm the person SLOWLY by wrapping them in blankets or by putting dry clothing on the person.
- Hot water bottles and chemical hot packs may be used when the person is first wrapped in a towel or blanket. Focus on warming the trunk or core of the body first (e.g. place warm water bottles under arms.)
- DO NOT WARM PERSON TOO QUICKLY, such as immersing him or her in warm water. Rapid warming can cause dangerous heart rhythms.

7.5 Heat Stress

Due to the time of year a portion of this project will be conducted during, it is possible heat related illness is a concern. All personnel will be briefed on the signs and symptoms of heat related illnesses and treatments. Factors which increase the risk of heat induced problems are as follows:

- High physical exertion.
- Being unaccustomed to working in heat.
- Wearing protective clothing that traps body heat
- Age- Older people may have less body water and lower sweat gland efficiency.
- Being overweight- which makes the body work harder to perform tasks.

- Medications that can interfere with normal body reactions to heat.

When working in hot environments, specific steps should be taken to lessen the chances of heat-related illnesses. These include the following:

- Ensuring that all employees drink plenty of fluids (Gatorade® or its equivalent)
- Ensuring that frequent breaks are scheduled so overheating does not occur
- Revising work schedules, when necessary, to take advantage of the cooler parts of the day (such as working from 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).

TABLE 7-2. SIGNS AND SYMPTOMS OF HEAT RELATED ILLNESSES AND TREATMENTS

HEAT INDUCED PROBLEMS			
Problem	**Body Response**	**Signs and Symptoms**	**Treatment**
Heat Cramps	• The body loses too much salt from heavy exertion in heat.	• Painful spasms of muscles used during work.	• Increase fluid intake with electrolytes (Unless otherwise indicated by a doctor). • Take frequent breaks, preferably in a cool area.
Heat Exhaustion	• The body can't replace fluids and/or salt lost in sweating. • Perspiration in heat is important because it cools the body as it evaporates.	• Weakness, dizziness, nausea. • Pale or flushed appearance. • Sweating, moist and clammy skin.	• Move to a cool place. • Loosen clothes and apply cool compresses. • Drink water slowly. • Elevate feet 8-12 inches.
Heat Stroke	• The body no longer sweats and holds so much heat that body temperature reaches dangerous levels. • **Heat stroke is a medical EMERGENCY and can lead to delirium, convulsions, unconsciousness, or death.**	• DRY, hot reddish skin, and LACK OF SWEATING! • High body temperature and strong, rapid pulse. • Chills • Confusion	• **Treat as a MEDICAL EMERGENCY!** • Call for EMS or a doctor immediately! • Move to a cool area immediately. • Use cool water to soak person's clothes and body. • Fan the body. • Don't give fluids if victim is unconscious.

EMS = Emergency Medical Services

8.0 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

PPE consists of standard safety equipment required on the site and special safety equipment required for specific tasks or activities. Navy contractors and subcontractors (field personnel) will provide their own PPE. All field personnel are expected to come to work with proper safety equipment as specified in this S-HASP; equipment will be supplied by their respective employers. In addition, all field personnel entering the site shall comply with any task-specific safety requirements.

The level of equipment required at the site will depend on the activities being performed. This level may be revised as conditions change as determined by the HSO. The PPE selection will be determined based on its potential use, and the manufacturer's permeation and degradation properties for the contaminants being worked with. A description of the proposed initial PPE for all fieldwork at this site and for sample collection activities is presented below.

The minimum required protective clothing for all fieldwork at Hunters Point consists of the following:

- Safety glasses;
- Leather work boots with steel toe and shank;
- Long pants;
- Short-sleeved shirt or short-sleeved T-shirt;
- Hard hat (as required for coring or mixing equipment operations);
- Personal flotation device when working in water greater than waist deep;
- Protective gloves-leather and chemical resistant;
- Ear plugs (as required); and
- Rubber over-the-sock boot with steel toe and shank (optional).

9.0 DECONTAMINATION/CONTAMINATION REDUCTION PROCEDURES

Boots, clothing, gloves, and other equipment can become contaminated by direct exposure to potentially contaminated sediments. Decontamination of PPE will consist of washing PPE with soap and water to remove sediment. A decontamination station will be designated, configured, and secured at the site if appropriate. Contaminated disposable PPE or clothing will be placed in appropriate storage or disposal receptacles and removed from the site within 90 days to a proper disposal facility. All decontamination fluids and solids will be controlled and contained in appropriate containers and removed from the site within 90 days to a proper disposal facility. Decontamination zones or areas will be established in the process areas. These zones/areas will be sufficiently large to allow separation of decontamination/processing support from the radiation monitoring areas.

Radioactive contamination may be present at the site and samples will be scanned onsite for radioactivity by trained TTECI personnel. Procedures for performing radioactive contamination surveys and decontaminating equipment and materials are provided in Section 7.2 of the TtFW Radiation Control Plan (TtFW 2004) (see Appendix C).

10.0 EMERGENCY RESPONSE PROCEDURES

Project personnel shall carefully review the aforementioned procedures. This section describes emergency equipment to be taken into the field and site-specific procedures to be followed in case of an emergency.

10.1 Emergency Equipment

First aid and BBP kits will be taken into the field each day during sampling and related field activities. To assure immediate access to first aid and BBP supplies, kits will be provided for each field team if these teams will be working in separate locations. Portable fire extinguishers shall be available in all areas where gas powered pumps or engines will be used.

10.2 General Emergency Procedures

In the event of a fire, explosion, physical injury or illness due to physical or chemical exposure, the appropriate parties should be contacted using the phone numbers listed at the end of this section. In addition to notifying the Hunters Point Contact, the HSO or designee shall notify the Stanford Project Manager (Dennis W. Smithenry) as soon as possible after appropriate emergency services have been notified and appropriate measures taken to protect people, environment, and property. Weather radios, two-way radios, and/or cell phones shall be in working condition and available for all field activities.

10.3 BBP Control Plan

All personnel should be aware of the potential to transmit disease from contact with body fluids. Personnel should assume that all bodily fluids are potentially infectious and use appropriate precautions. Controls to be considered are as follows:

- Use of the victim's hand to control initial bleeding;
- Use of available protective gear (Tyvek®, gloves, safety glasses) to prevent contact;
- Wash promptly after contact with body fluids;
- Use barrier mask while giving CPR;
- Decontaminate any area contaminated with bodily fluids with a 10:1 solution of water to bleach as soon as possible.

10.4 Medical Emergency Procedures

For injuries or illness other than very minor cuts or scrapes, a physician's attention is required. **For treatment of potentially life-threatening injury or illness, call 911 for assistance**.

For treatment of minor injuries or illness, personnel should be transported to San Francisco General Hospital (or the alternative, St. Luke's Hospital). Directions to these hospitals from the site are indicated on a map provided in Appendix D.

11.0 REFERENCES

Stanford. 2005. *Draft ESTCP Demonstration Plan for Field Testing of Activated Carbon Mixing and In Situ Stabilization of PCBs in Sediment at Hunters Point Shipyard Parcel F.* Prepared by Stanford University, Stanford, CA. July.

Tetra Tech FW, Inc. 2004. *Final Characterization Work Plan*. Metal Debris Reef and Metal Slag Areas, Parcel E, Hunters Point Shipyard, San Francisco, California. Appendix D: Final Radiation Control Plan. June 18.

Emergency Telephone Numbers

Ambulance		911
Police		911
Hospital		911
Fire Department		(415) 822-6779
HPS Base Security		(415) 330-0500
HPS Base Police		(415) 330-0565
HPS Base Contact		(415) 811-1613
California Office of Emergency Services		(800) 852-7550
City of San Francisco CIH (Ed Ochi)		(415) 671-3171
EPA Region 9, Environmental Emergencies		(415) 744-2000
OSHA Region 9		(415) 744-6670
RCRA Hotline		(800) 424-9346
U.S. Department of Transportation		(415) 744-3115
EPA National Response Center		(800) 424-8802
Poison Control Center		(800) 876-4766
Office of Emergency Services		(800) 852-7550 (916) 262-1621
City of San Francisco CIH (Ed Ochi)		(415) 671-3171
California DTSC		(916) 255-2002
California EPA		(916) 445-3846
TOXLINE		(301) 496-1131
CHEMTREC		(800) 424-9300
San Francisco General Hospital Emergency Room		(415) 206-8111
General Information		(415) 206-8000
Medical Center		(415) 206-8492
Alternate Hospital (St. Luke's Hospital)		(415) 641-6625
Tetra Tech Health and Safety Officer—Glynis Foulk		(916) 853-4561
Field Project Manager – Dennis Smithenry	(Office)	(650)723-8574
	(Cellular)	(650)814-1832
San Francisco General Hospital – Emergency		911
California OSHA		(213) 736-3041
California Department of Fish and Game		(310) 590-5132
BCO Radiation Safety Officer (RSO) - Craig Jensen	(Office)	(614) 424-5170
	(Cellular)	(614) 402-5386
BCO Assistant RSO - Leonard Davis	(Office)	(614) 424-4368
	(Pager)	(614) 786-3419

APPENDIX A

Site-Specific Health and Safety Training Record Forms

SITE-SPECIFIC HEALTH AND SAFETY PLAN (S-HASP)
TRAINING RECORD

S-HASP Title/Revision No. Site-Specific Health and Safety Plan for Hunters Point

Site Health and Safety Officer _____ Project Number _____

I have read the S-HASP presented herein and fully understand the material covered. I understand that I am responsible for compliance with the requirements of this HASP and I agree to abide by the same. I also had the opportunity to discuss the information presented in the HASP, and to ask any questions about the information that I want clarified. I understand that this record will become a permanent part of my employee health and safety training file.

Date	Print Name	Signature

APPENDIX B

Tailgate Safety Meeting Record Forms

TAILGATE SAFETY MEETING RECORD FORM

DAILY TAILGATE SAFETY MEETING FORM

Date:_____ Time:_____

Project Number:_____

Project Name: _____

Specific Location: _____

Type of Work:_____

_____

Chemicals Present:_____

SAFETY TOPICS DISCUSSED

Protective Clothing/Equipment: _____

_____

Hazards of Chemicals Present: _____

_____

Physical Hazards: _____

_____

Special Hazards: _____

_____

Other Topics: _____

_____

ATTENDEES

Name (printed)	Signature

APPENDIX C

TtFW FINAL
RADIOLOGICAL CONTROL PLAN
(SURVEY AND SAMPLING PLAN)
REVISION 0
JUNE 18, 2004

Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190

Contract No. N68711-98-D-5713
CTO No. 0072

FINAL

RADIOLOGICAL CONTROL PLAN
(Survey and Sampling Plan)
Revision 0
June 18, 2004

METAL DEBRIS REEF AND METAL SLAG AREAS
PARCEL E, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-04-1970

Prepared by

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Abid Loan, P.E.
TtFW Project Manager

ABBREVIATIONS AND ACRONYMS

α	alpha
β	beta
γ	gamma
µCi/mL	microcurie per milliliter (activity)
µR/hr	microroentgens per hour
AHA	Activity Hazard Analysis
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
BHASP	Building Health and Safety Plan
cm	centimeters
cm^2	square centimeters
cpm	counts per minute
Cs-137	Cesium 137
DAC	derived airborne concentration
DON	Department of the Navy
dpm	disintegrations per minute
EPA	U.S. Environmental Protection Agency
HPS	Hunters Point Shipyard
keV	kiloelection volt
LLRW	Low-level Radioactive Waste
MeV	megaelectron volt
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
m/s	meters per second
NaI	sodium iodide
NRC	Nuclear Regulatory Commission
NWT	New World Technology
pCi/g	picocurie per gram
PPE	personal protective equipment
PRG	Preliminary Remediation Goal
RASO	Radiological Affairs Support Office
RCP	Radiological Control Plan
RCT	Radiological Control Technician

ABBREVIATIONS AND ACRONYMS
(Continued)

RSOR	Radiation Safety Office Representative
RWP	radiation work permit
SHSP	Site-Specific Health and Safety Plan
SHSS	Site Health and Safety Specialist
SOP	STANDARD OPERATING PROCEDURE
TCRA	time critical removal action
TLD	thermo-luminescent dosimeter
TTECI	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.

INTRODUCTION

This Radiological Control Plan (RCP), supplemented with guidance provided in the Site-Specific Health and Safety Plan (SHSP), New World Technology (NWT) Field Operating Procedures, and the Radiological Health Program, details radiological controls to be performed in support of the site characterization that will be conducted to support a time-critical removal action (TCRA) for removing metal debris and radioactive sources and/or contamination from the metal debris reef and the metal slag areas within Parcel E, located at Hunters Point Shipyard (HPS), San Francisco, California. The Department of the Navy (DON) has determined upon review of the site's operational history and site-specific investigative data that metal debris reef and metal slag areas contain radioactive devices, thus requiring a response action. Prior to a removal action in these two areas, additional site characterization of the sediments is necessary and is discussed herein. A separate Work Plan and RCP will be prepared for the removal action.

The RCP will be used as a control document by all field personnel engaged in the implementation of the Work Plan. Included in this RCP are field surveillance procedures, sampling procedures, decontamination procedures, release requirements, and data gathering methods that will be used during the implementation of this RCP.

Tetra Tech EC, Inc. (TTECI) personnel will conduct the hands-on work while NWT personnel will perform the radiological control and oversight for the work being conducted. All personnel performing work will be trained in general radiation safety practices. Specific radiation work permits (RWPs) will be used during performance of all work associated with the implementation of this Work Plan.

OBJECTIVES

The specific objectives for this RCP are as follows:

- Address the radiological survey procedures to be implemented during the implementation of the Work Plan.
- Address survey and sampling procedures.
- Address decontamination procedures.
- Identify radiological controls used during the performance of this Work Plan.
- Identify the release levels for equipment and personnel.

BACKGROUND

Site location and background are detailed in Section 2.0 of the Characterization Work Plan for Metal Debris Reef and Metal Slag Areas (Characterization Work Plan) (TtFW, 2004).

PREREQUISITES

Prerequisites for the initiation of activities described within this document include completion of a Building Health and Safety Plan (BHASP), Activity Hazard Analyses (AHA), required notifications, as well as the procurement of services, equipment, and materials necessary to perform the work. Additional activities will include a pre-work radiological evaluation of the designated work areas.

RADIOLOGICAL HEALTH AND SAFETY

The NWT *Radiological Health Program Manual* (NWT, 2002), supplemented with field-related Standard Operating Procedures (SOPs), is utilized to address controls necessary for radiologically safe and correct operations. Critical requirements resulting from each of the aforementioned documents include the presence of a Site Health and Safety Specialist (SHSS) at active work locations to ensure implementation of SHSP and BHASP driven criteria. Additionally, an American National Standards Institute (ANSI)-qualified Radiological Control Technician (RCT) will be present at active work areas to ensure implementation of required RWP criteria. Air monitoring, including initial baseline sampling to determine radiological background conditions, will be performed as necessary during boring activities. Personal protective equipment (PPE) levels, dictated by radiological considerations, will be assigned or modified, according to the approved RWP. For additional details relevant to radiological issues, reference can be made to the *Radiological Health Program Manual* (NWT, 2002).

ALARA

The basic concept in radiation protection specifies that exposures to ionizing radiation and releases of radioactive material should be managed to reduce collective doses to workers and the public as low as reasonably achievable (ALARA). It is the intent of this RCP to take into consideration the concepts of ALARA during the course of the work carried out by the Characterization Work Plan (TtFW) for the metal reef and metal slag areas.

TRAINING

All personnel conducting fieldwork under the Characterization Work Plan will be provided with general awareness training for radiation. General awareness training provides the worker with a basic knowledge of the hazards, health concerns and protective practices related to radiation and radioactive materials. Training will be documented on the appropriate NWT form. A copy will be kept in the project field office while the original will be maintained at the NWT corporate headquarters in Livermore, California.

DOSIMETRY

All personnel conducting fieldwork under the Characterization Work Plan will be issued and required to wear a thermal luminescent dosimeter (TLD) to monitor and track occupational exposure. All personnel issued a TLD will complete the Nuclear Regulatory Commission (NRC) Form 4 for occupational exposure. Each completed Form 4 will be maintained by NWT at the Livermore office with a copy kept on site.

RADIATION WORK PERMITS

A RWP shall be prepared and will specify the activities to be performed and all radiological safety requirements for the work. All personnel assigned to site work will be required to read, understand the requirements, and sign the RWP prior to beginning work.

Project Task Management

All radiological surveys, RWPs, air sampling, and documentation required to be completed, will be performed in accordance with the applicable NWT SOP. The following sections identify how the tasks will be managed with the utilization of the RWP.

Purpose of the Radiation Work Permit

RWPs provide guidelines specifying the appropriate personnel protective measures within the scope of the work based upon the radiological conditions in the area. The RWP will also provide a complete document addressing existing radiological conditions, work scope and limitations, radiological limitations, PPE requirements, dosimetry requirements, ALARA considerations, and specific instructions to Health Physics Technicians and radiation workers. An RWP should not be used unless a radiological survey has been performed in the work area within the last 24 hours or there is reasonable assurance that conditions have not changed as determined by the Health Physics Supervisor or his/her designee.

Development of the Radiation Work Permit

The Health Physics Supervisor shall perform, or assign a Health Physics Technician to perform a survey of the work area. Prior to performing a work area survey, the surveyor shall be as knowledgeable as possible about the nature of the work to be performed (surface or sub-surface surveying, drilling, sample collection, equipment repair, decontamination, jack hammering, etc.), the specific component or equipment to be worked on, the positions the workers may take to perform the work (kneeling on the ground, leaning against one component to work on another, etc.), and the possibility of the presence of highly radioactive debris.

All surveys used to assess work conditions in preparation for a job shall clearly describe all the radiological hazards present in the work area. The following guidelines should be considered when performing a work area survey:

- What are the contamination, radiation, and airborne radioactivity levels at the position(s) where the individual is to work?
- Where are designated radiation, high radiation, contaminated area boundaries?
- Are there any special radiological hazards or hot spots to avoid?
- Is the area currently wet or greasy or will it become wet or greasy from the work?
- If work on a specific component is required, what are the contact and 30 cm dose rates for the component?
- Is there or could there be any highly radioactive debris present?
- What additional safety hazards may be encountered at the jobsite?

Upon completion of the radiological survey, the survey shall be reviewed/approved by the Health Physics Supervisor. A clear description of the work activity is very important. Information regarding the exact location and scope of work is essential to adequately establish the current and anticipated radiological conditions in the area.

The Health Physics Technician shall complete the RWP, entering all existing radiological conditions, source of survey information, and the survey number.

Review and Approval of the Radiation Work Permit

The Health Physics Supervisor or his/her designee shall review Section I through Section V for accuracy and correctness as necessary. Upon completion of the review, the Health Physics Supervisor or his/her designee shall sign and approve the RWP for use unless there are industrial hygiene/safety aspects which could impact upon the safe completion of the work of the RWP. In this case, the Industrial

Hygiene/Safety Technician shall review the RWP and ascertain that the proposed work description is acceptably safe and is accordance with the provisions of the SHSP.
The Health Physics Supervisor or his/her designee will then submit the RWP to the Radiation Safety Office Representative (RSOR) for review and approval.

Management of the Radiation Work Permit

In the event of conditions or scope of the work changes that do not justify the generation of a new RWP, two modifications or extensions of the RWP may be made by the Health Physics Supervisor. Appropriate radiological surveys will be performed in the work area at the end of each day or if there is reasonable assurance that conditions may have changed. This is to ensure that the RWP is adequate for the field conditions encountered. Upon termination of an RWP, the original RWP will be retained in the permanent project file. All other copies will be kept at an NWT designated office.

Implementation of the Radiation Work Permit

Prior to the initial use of any RWP, the user(s) shall read, and sign Section VI (Personnel Authorized to Perform Work & Acceptance of Responsibility) of the RWP to indicate that he/she understands the requirements of the RWP. Any questions shall be answered by the Health Physics Supervisor. Prior to the initial use of the RWP, the Health Physics Supervisor or his/her designee shall conduct a pre-job briefing with the work crew members. Pre-job briefings shall be documented on Forms NWT-025 (Industrial Hygiene/Safety) or NWT-026 (Health Physics) and accompanied by a NWT-027 Training Record. A copy of the RWP will be kept at the work area location at all times.
Upon completion of the modification or extension of the RWP and prior to use, the approval/review signatories of the original RWP shall initial and note agreement with the modification by placing "R-1/initials" or "R-2/initials" and the date in the block for RWP approval by position. The Health Physics Supervisor shall communicate all changes made to the RWP to the affected work crew and work crew supervisors prior to the commencement of work covered under the RWP.

RADIATION DETECTION INSTRUMENTATION

During the performance of this RCP, different instrumentation will have to be used to detect the various forms of radioactive material that may be present. Table D.4-1 identifies the instrumentation that may be used for the RCP objectives. Each instrument is explained in further detail in the following sections.

TABLE D.4-1

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Measurement/ Technique	Type of Instrumentation		Typical Background	Typical Efficiency (%)	Detection Sensitivity
	Detector	Meter			
Surface gamma scans	NaI 2-inch x 2-inch Scintillation Ludlum Model 44-10	Ludlum Model-2350-1 Data Logger	100 to 12,000 cpm; varies with calibration γ	N/A	150-1500 cpm γ.
Static alpha/beta	Large-area scintillation, Ludlum Model 43-89 (100 cm^2)	Count rate meter Ludlum Model-2360 Data Logger	100-200 cpm β 5-10 cpm α	~6 β total efficiency ~12 α total efficiency	~ 110 dpm/100 cm^2 β ~ 20 dpm/100 cm^2 α
Direct Measurement Static gamma	NaI 2-inch x 2-inch Scintillation Ludlum Model 44-10	Ludlum Model-2350-1 Data Logger	100 to 12,000 cpm; varies with calibration γ	N/A	200 cpm-2000 cpm γ. Varies with Calibration.
Exposure Rates	NaI Scintillation Micro R Meter Ludlum Model-19	(Same as detector)	7-8 μR/hr	N/A	2 μR/hr
Gross alpha/beta on smears (Swipes)	Protean Low Background Gas Flow Proportional Counter IPC9025		1-5 cpm β 0-0.5 cpm α	~62 β ~27 α	4-10 dpm/100 cm^2 β 5-10 dpm/100 cm^2 α

Notes:

α – alpha cpm – counts per minute
β – beta dpm – disintegrations per minute
γ – gamma N/A – not applicable
μR/hr – microRoentgens per hour NaI – sodium iodide
cm^2 – square centimeters

INSTRUMENT FOR ALPHA/BETA SURVEYS

Surveys for alpha/beta radiation will be performed using a Ludlum Model 2360 Scaler/Ratemeter Data Logger equipped with a logging command device as well as a Ludlum Model 43-89 probe. The

instrumentation measures alpha and beta radiation levels and presents data in a scaler (digital display) or rate meter (analog display) mode. Static measurements for particulate radiations are instantaneously recorded by the rate meter after positioning the detector, a scintillation probe, directly over a designated surveillance surface and recording "scan" ranges or collecting "static" measurements. Measurements are obtained by traversing an area at a maximum speed (scan rate) of approximately 0.5 meters per second (m/s) and slowly sweeping the detector assembly serpentine (snakelike, "S"-shaped) pattern, while maintaining the detector approximately 0.25 inches (6 millimeters) above the area surveyed. Once the actual background levels are established, the static time requirement will be calculated.

INSTRUMENT FOR GAMMA SURVEYS

Surveys for gamma (photon) radiation will be performed using a Ludlum Model 2350-1 Data Logger equipped with a command device and a Ludlum Model 44-10 scintillation detector, which utilizes a 2-inch by 2-inch sodium iodide (NaI) crystal. Capable of detecting gamma photon energies ranging from 60 kiloelectron volts (keV) to 3 megaelectron volts (MeV), the instrument is programmed to respond to the full spectrum of gamma photon energies. Static photon measurements require positioning the detector assembly approximately 4 inches (10 cm) above the designated surveillance surface and completing a stationary 60-second survey. Scan measurements are obtained by traversing a path at a maximum speed (scan rate) of approximately 0.5 m/s and slowly sweeping the detector assembly in a serpentine (snakelike, S-shaped) pattern, while maintaining the detector 2.5 to 4 inches (6 to 10 cm) above the area surveyed. NaI scintillation detectors are very sensitive to gamma radiation and are ideal for locating elevated radiation levels above background. The instruments will be utilized with the detection discriminator set to full open.

INSTRUMENT FOR EXPOSURE RATE SURVEYS

Exposure rate surveys, obtained approximately 1 meter from contact with area surfaces, are conducted with use of a Ludlum Model 19 MicroR meter. Compatible with anticipated exposure rates, the instrument is equipped with an internally mounted 1-inch by 1-inch NaI scintillation detector that is integral to the meter housing. The MicroR meter provides optimum performance in measuring low-level gamma photon radiation readings, which are readily provided on the meter face in units of microRoentgens per hour (μR/hr). Readings will be obtained after allowing the instrument to stabilize for approximately 1 minute.

INSTRUMENT FOR SWIPE SAMPLES

Standard swipe samples will be collected for the analysis of removable contaminants. Swipe samples, also referred to as smears, will be obtained at discrete points from equipment and materials. All samples will be processed using a Protean IPC 9025 counter. The Protean IPC 9025 is a gas flow proportional alpha/beta radiation counter, which features a low background counting chamber. A microprocessor allows for data processing, and the unit provides a full range of simultaneous alpha and beta analysis at levels required for environmental release surveillance. Data is reported in units of disintegrations per minute (dpm) per 100 cm^2.

DETECTION SENSITIVITY –
MINIMUM DETECTABLE CONCENTRATION

STATIC MDC

The static minimum detectable concentration (MDC) represents the level of radioactivity, on a surface, that is practically achievable by the overall measurement process. The conventional equation is used to calculate instrument MDC in units of dpm per 100 cm^2.

EQUATION 1

$$MDC = \frac{3 + 4.65\sqrt{C_B}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\,cm^2} T_B}$$

where:

C_B	=	Background counts in time T_B (min)
T_B	=	Background counting time (min)
ε_ι	=	the instrument efficiency (count per particle)
ε_s	=	the contaminated surface efficiency (particle per disintegration)
W_A	=	the area of the detector window (cm^2)

SCAN MDC

The scan MDC is derived from the minimum detectable count rate (MDCR) by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. The MDCR accounts for the background level, performance criteria (d^1), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.
The scan MDC for structure surfaces is calculated using Equation 2.

EQUATION 2

Scan

$$MDC = \frac{MDCR}{\sqrt{P} * \varepsilon_i * \varepsilon_s \frac{W_A}{100\,cm^2}}$$

where:

MDCR	=	as discussed in Section 5.2.1
ε_ι	=	the instrument efficiency (count per particle)
ε_s	=	the contaminated surface efficiency (particles per disintegration)
W_A	=	the area of the detector window (cm^2)
P	=	surveyor efficiency

SCANNING MINIMAL DETECTABLE COUNT RATE, GAMMA

MDCR is the minimum detectable number of net source counts in the scan interval, for an ideal observer, that can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in d^1) as shown in Equation 3.

EQUATION 3

$$MDCR = d^1 \sqrt{b_i \text{ x } 60/i}$$

where:

d^1 = index of sensitivity (α and β error)
b_i = number of background counts in scan time interval (count)
i = scan or observation interval (s)

RADIOLOGICAL CONTROL PROCEDURES

Radiological control procedures will be implemented to support bore sampling activities at the metal debris reef and metal slag areas. These procedures are intended to protect the health and safety of workers and general public, comply with the NWT radioactive material license requirements under which the work is to be performed, and to minimize the liability of TTECI and the DON to risks associated with radioactive materials.

Radiological control procedures are required for the following work phases and activities:

- Equipment and material surveys
- Operational checks and use of calibrated radiological survey instruments
- Radiological surveys and calibration documentation (Note: Only survey instruments that have been calibrated within the last 12 months by a facility authorized by an agreement state or the NRC will be used. Calibration documentation will be maintained on site.)
- Radiological postings
- Sampling activities
- RWPs
- Documentation and notifications

SURVEY PROCEDURES

The following protocol will be used for conducting radiological surveys, supplemented with any additional requirements listed in the NWT Radioactive Material License and SOPs. Oversight will be provided by the on-site TTECI Radiation Safety Officer and NWT Radiation Safety Office Representative (RSOR).

GENERAL SURVEY PROCEDURES

At a minimum, the following steps will be used in conducting all radiological surveys associated with the performance of the Characterization Work Plan. Additional steps are included in subsequent portions of this RCP. NWT SOPs will be used in conjunction with this RCP. All surveys will be performed by a qualified RCT.

1. Perform routine instrument operational checks by visually inspecting the equipment for damage, confirmation of current calibration by inspecting the attached calibration sticker, battery check, and response check.
2. The average background will be determined by performing at least 10 measurements at different locations within the designated background reference area. The reference area, once selected, will be identified using site maps or global positioning system (GPS) as appropriate. The detector probe should be held approximately 4 inches from the surface area for beta/gamma and 0.25 inches from the surface area for alpha radiation. The detector should be allowed to stabilize for at least 30 seconds before a background count is taken. The average of all of the counts taken will be the background. Background scan ranges will also be collected for reference data.
3. The 3-sigma value, lower limit of detection and MDC will be calculated using the results of the average background and recorded in the radiological logbook and on the appropriate NWT form.
4. All daily instrument check and background measurements shall be documented on the appropriate forms referenced in the NWT operating procedures. (Note: All NWT forms will be kept on file in the field office. Copies will be submitted to others when required.)
5. Personnel performing the surveys will typically wear Level D PPE (hard hat, steel-toed boots, reflective vest, eye protection, and gloves).
6. The entire surface area of the equipment or material shall be surveyed with the instrument used to perform the background measurements. Technicians should move slowly (less than 1.5 feet per second) over the surface area, keeping the detector probe approximately 4 inches from the surface area for beta/gamma and 0.25 inches from the surface area for alpha radiation.
7. In addition to the generation of field surveillance documentation, as required by NWT SOPs, survey results will be documented in the radiological field logbook. Personnel performing the surveys will manually enter results in the radiological logbook.
8. Qualified personnel shall survey, in a pre-designated low background area, their hands, feet, and clothing before leaving the work area. Personnel that are not qualified to self-survey will be surveyed by a qualified technician. Any contaminated clothing

will be removed and placed into a waste bag and stored with the other waste pending further characterization. Surveys will be performed using a calibrated alpha/beta scintillation detector and in accordance with NWT SOPs.

Incoming Equipment Surveys

In addition to the general procedures set forth in this document, incoming equipment and materials will be subject to the following guidelines.

1. Table D.7-1 provides acceptable levels of contamination based on the NRC Reg. Guide 1.86 limits. Should levels of contamination exceeding those listed in Table D.7-1 be encountered during the surveys, appropriate decontamination methods in accordance with NWT SOPs will be implemented.

TABLE D.7-1

RADIATION CONTAMINATION LIMITS

Radionuclide	Fixed (dpm/100 cm^2)	Loose (dpm/100 cm^2)
Alpha	100 α	20 α
Beta (Strontium-90)	1,000 β^-	200 β^-
Beta / Gamma	5,000 β^-, γ	1000 β^-,γ

Notes:

Types of radiation: α - alpha, γ - gamma, β^- - beta
cm^2 – square centimeters
dpm – disintegrations per minute

2. Equipment will be surveyed for existing contamination levels prior to being placed into service.
3. Surveys will consist of 100 percent scan for alpha/beta contamination. Swipes will be taken to ensure that there is no removable contamination present. Should the levels exceed those listed in Table D.7-1, the equipment will not be permitted to be placed into service and will be requested to be returned to the source.

Boring Surveys

In addition to the general procedures set forth in this document, the following guidelines will be used prior to placing equipment and materials at the borehole location.

1. Once a borehole location has been identified, a survey for gamma radiation will be conducted at the immediate area where the sample is to be collected. Additional surveys will be conducted in a 5-foot radius to document existing radiation levels and help keep personnel exposure ALARA.
2. Surveys will consist of 100 percent scan for gamma radiation and a 1-minute static count at the boring location. Should the static measurement exceed 1½ times background, a new location will be selected for boring.

3. In order to control occupational and environmental exposures, monitoring and trending for airborne radioactive material will be conducted during any evolution that disturbs the surface. Controls (i.e., misting with water, use of HEPA vacuum cleaners or filtration units or use of work area containments) will be implemented to ensure that airborne concentrations well below 10 percent of the applicable derived airborne concentration (DAC) value for workers and the public.

   If airborne concentrations exceed the established levels, all work will stop until engineering controls are put into place that will maintain the airborne concentrations below the established DAC values. If engineering controls cannot be put into place or the airborne concentrations cannot be maintained below the established DAC, all work will stop and notifications will be made. Table D.7-2 identifies the DAC for potential radionuclides that may be encountered.

TABLE D.7-2

DERIVED AIRBORNE CONCENTRATION

Radionuclide	Public		Worker	
	DAC (μCi/mL)	10% DAC (μCi/mL)	DAC (μCi/mL)	10% DAC (μCi/mL)
Radium (Ra)-226	9.0E-13	9.0E-14	3.0E-10	3.0E-11
Uranium (U)-235	6.0E-14	6.0E-15	2.0E-11	2.0E-12
Cesium (Cs)-137	2.0E-10	2.0E-11	6.0E-8	6.0E-9
Plutonium (Pu)-239	2.0E-14	2.0E-15	7.0E-12	7.0E-13
Strontium (Sr)-90	3.0E-11	3.0E-12	8.0E-9	8.0E-10

Notes:

μCi/mL – microcurie per milliliter (activity)
DAC - derived airborne concentration
Ref 10 Code of Federal Regulations 20, App B

Sampling Activities

1. Bore samples will be analyzed using gamma spectroscopy analysis. The focus of the analysis will be the photons emitted from radionuclides identified in Table A.8-2 of the Sampling and Analysis Plan (TtFW, 2004; Appendix A). A region of interest around the appropriate energy ranges will allow quantification of the nuclides and daughter products.
2. The comparison of sample activity results with the limiting levels is to be based on a gamma spectral analysis of each sample. The lower detection limit will be set *a priori* to a level no greater than .5 of the cleanup levels specified in Table D.7-3. The guidance values are directly related to the risk posed by the nuclides in equilibrium with daughter products through defined exposure pathways.

TABLE D.7-3

EPA PRELIMINARY REMEDIATION GOALS

Radionuclide	Industrial Reuse – Soil[a] (pCi/g)
Americium (Am)-241	7.8[b]
Plutonium (Pu)-239	14.3
Radium (Ra)-226	1 > background, not to exceed 2
Uranium (U)-235	0.57[b]
Cesium (Cs)-137	0.13[b]
Sr-90	10.7 [b]

Notes:

[a] U.S. Environmental Protection Agency Preliminary Remediation Goals (PRGs) for soil for outdoor worker (EPA, 2002)

[b] Decay-corrected PRG for industrial reuse provided by EPA Region IX.

pCi/g – picocuries per gram

3. All samples obtained will be monitored using field instrumentation to determine the potential presence of external loose surface contamination and dose rates. Any sample with a dose rate exceeding 150 percent of the established background level will not be submitted for gamma spectral analysis. If surface contamination is indicated on the sample container, decontaminate the container prior to submission for analysis.
4. Samples will be obtained at a rate of three per borehole (a total of 90 samples). Each will be analyzed on site in the NWT laboratory by gamma spectroscopy. Ten percent of the samples will be forwarded for additional analysis to include, gamma spectroscopy, gross alpha, gross beta, isotopic Pu, isotopic U, and Strontium (Sr)-90, at an accredited laboratory for quality assurance cross check. The laboratory shall be accredited under the National Voluntary Laboratory Accreditation Program. Additional samples may be obtained and analyzed based on field survey results of the cores. Any core area that exceeds background readings by a factor of 3 sigma should be submitted for analysis.
5. All samples will be logged by survey unit, assigned a distinct identification number and shipped for analysis under sample chain-of-custody forms.
6. The samples should be of sufficient quantity, approximately 500 grams, to support the minimum detection level requirement.
7. The original samples will be maintained and stored until the results of the analysis are made available and reviewed and it has been verified that the sample does not exceed the action level. Samples will be archived until released for disposal by Radiological Affairs Support Office.

Personnel Surveys

Personnel conducting fieldwork shall have a whole body survey ("frisk"), by a qualified technician, in a pre-designated low background area, before leaving the work area. Any contaminated clothing will be removed and placed into a waste bag and stored with the other waste pending further characterization. A qualified technician, in a pre-designated low background area will also survey tools, materials, and equipment before being removed from the work area each day. Surveys will be performed using a calibrated alpha/beta scintillator.

Outgoing Equipment Surveys

In addition to the general procedures set forth in this document, outgoing equipment and materials will be subject to the additional guidelines.

1. A release survey will be performed prior to the equipment and/or materials leaving HPS. All surveys will be documented on the appropriate NWT form and given a unique survey number.
2. Surveys will consist of a 100 percent scan for alpha/beta contamination. Swipes will be taken to ensure that there is no removable contamination present per SOP. Should the levels exceed those listed in Table D.7-1, the equipment will not be permitted to leave the site, and appropriate decontamination methods will be taken.

DECONTAMINATION PROCEDURES

Surveillance results may at times dictate the gross decontamination of equipment and materials. In such instances, to prevent the uncontrolled spread of loose contaminants, any materials or equipment initially identified as radiologically contaminated will be immediately secured. The assigned RCT will also ensure that the NWT RSOR is promptly informed of the situation. Prior to transport of such materials or equipment to a designated decontamination pad, such processes will first be evaluated for radiological impact. Instructions unique to such transfer, including the actual decontamination process, will be outlined in a separate job-specific RWP with pre-job brief requirements per applicable NWT SOPs.

POST-WORK AREA SURVEILLANCE

At the daily conclusion of the boring operations, areas where work was performed will be surveyed for contaminants. Survey results will be compared to data defining pre-work conditions to determine if further remedial actions or additional controls are necessary.

POINT SOURCE AND CONTAMINATED MATERIAL REMOVAL PROCEDURE

Should surveys identify a discrete point source on the surface or in a core sample or levels of contamination are found to be present that exceed those specified in Table D.7-1, the source or material will be removed per the procedure detailed below.

1. Removal and storage of any point sources and/or contaminated materials will be performed under the supervision of a qualified RCT.
2. Personnel performing removal of point sources and/or contaminated materials will wear modified Level D PPE (Tyvek coveralls and booties, gloves, hard hats, and eye protection).
3. When a point source has been identified, the source will be removed and placed into an appropriately sized clear plastic bag. The source will be given a unique identification number and recorded in the radiological logbook. All point sources will be stored in a separate steel drum from other contaminated materials found and removed during the surveys.

4. For the core samples, any sediment surrounding a discrete source in the core sample will also be removed to a distance of 1 foot in each direction and placed into a lined 55-gallon drum.

5. In the case of radiologically contaminated materials or debris not associated with a point source, such materials will be removed and placed into a lined 55-gallon drum.

6. All bags and drums will be marked with a unique identification number that will be assigned and recorded in the radiological logbook.

7. Any filled 55-gallon steel drum(s) generated during this process will be placed in storage until the material can be characterized for total activity and isotopes.

8. A description and photographic detail of any point sources or contaminated objects, related activity (in counts per minute) and disposition shall be entered in the radiological field logbook.

9. Drums of radioactive material, as well as any materials or equipment used to perform contamination removal, shall be surveyed prior to being removed from the work area. A handheld Ludlum Model 2360 survey meter equipped with a Ludlum Model 43-89 scintillation detector shall be used by a qualified RCT to perform all release surveys. Follow-up swipes will be taken on all drums, materials and equipment and analyzed using the Protean gas proportional detector prior to leaving the work area. The release limits are presented in Table D.7-1.

10. Any drums and/or equipment, which do not meet the release criteria of Table D.7-1 will be decontaminated using damp rags. Rags used to decontaminate equipment will be bagged and placed in a waste drum. Equipment that cannot be decontaminated by using only damp rags will be bagged and stored with the waste until such time it can be decontaminated at a dedicated decontamination area.

11. Qualified personnel shall survey, in a pre-designated low background area, their hands, feet, and clothing before leaving the work area. Personnel that are not qualified to self-survey will be surveyed by a qualified RCT. Any contaminated clothing will be removed and placed into a waste bag and stored with the other waste pending further characterization. Surveys will be performed using a calibrated alpha/beta scintillation detector.

12. Radioactive material generated during this project will be stored in Building 406. Material from this project will be segregated from other radioactive materials, currently stored in Building 406, which were generated from other projects.

REFERENCES

New World Technology (NWT). 2002. *Radiological Health Program Manual*. July.

Tetra Tech FW, Inc. (TtFW). 2004. *Draft Characterization Work Plan for Metal Debris Reef and Metal Slab Areas. Parcel E, Hunters Point Shipyard, San Francisco, California*. April.

U.S. Environmental Protection Agency (EPA). 2002. *Region 9 Preliminary Remediation Goals 2002*. San Francisco, California.

APPENDIX D

Hospital Information and Location Map

Hospital Information

San Francisco General Hospital
1001 Potrero Avenue
San Francisco, California 94110
(415) 206-8376

DIRECTIONS TO SAN FRANCISCO GENERAL HOSPITAL (3.0 miles):

- Exit HPS main gate on Innes Avenue and proceed 0.5 miles west to Hunter Point Boulevard, which becomes Evans Avenue. Proceed 1.5 miles west on Evans Avenue, passing Third Street and Highway 280, to Cesar Chavez (Army) Street.
- Left onto Cesar Chavez (Army) Street, and proceed 0.5 miles west, passing Highway 101, to Potrero Avenue.
- Right onto Potrero Avenue, proceed 0.25 miles north into the hospital entrance.
- A route map to the hospital is shown in Appendix A.

St. Luke's Hospital
3555 Cesar Chavez (Army) Street
San Francisco, California 94110
(415) 647-8600

DIRECTIONS TO ST. LUKE'S HOSPITAL (3.4 miles):

- Exit HPS main gate on Innes Avenue and proceed 0.5 miles west to Hunter Point Boulevard, which becomes Evans Avenue. Proceed 1.5 miles west on Evans Avenue to Cesar Chavez (Army) Street, passing Third Street and Highway 280.
- Left onto Cesar Chavez (Army) Street, proceed 1 mile west, passing Highway 101 and Potrero Avenue, and into the Hospital entrance at the intersection of Cesar Chavez/Valencia.

A route map to each hospital is shown in the following figures.

Map to San Francisco General Hospital (shown as "B") from Hunters Point (shown as "A")

Map to St. Luke's Hospital (shown as "B") from Hunters Point (shown as "A")