SFUND RECORDS CTR
2253292

Final

Parcel B Technical Memorandum in Support of a Record of Decision Amendment

Hunters Point Shipyard
San Francisco, California

December 12, 2007

Volume II of III
Appendices A through D

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Prepared under:
Naval Facilities Engineering Command
Contract Number N62473-07-D-3213
Contract Task Order 019

APPENDIX A
PARCEL B HUMAN HEALTH RISK ASSESSMENT

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... A-vii

A1.0 INTRODUCTION A-1

A2.0 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY A-3

A3.0 CONCEPTUAL SITE MODEL A-5

A3.1 SOURCES OF SITE CHEMICALS A-5
A3.2 AFFECTED ENVIRONMENTAL MEDIA A-5
A3.3 CHEMICAL RELEASE AND TRANSPORT MECHANISMS A-5
A3.4 POTENTIALLY EXPOSED RECEPTORS A-5
A3.5 POTENTIALLY COMPLETE EXPOSURE PATHWAYS A-7
A3.5.1 Soil Exposure Pathways A-7
A3.5.2 Groundwater Exposure Pathways A-8

A4.0 DATA EVALUATION AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN A-9

A4.1 DATA EVALUATION A-9
A4.2 DATA REDUCTION A-10
A4.2.1 Duplicate Data A-11
A4.2.2 Multiple Analyses A-11
A4.3 DATA GROUPING A-11
A4.3.1 Data Grouping for Soil A-11
A4.3.2 Data Grouping for Groundwater A-12
A4.4 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN A-15

A5.0 EXPOSURE ASSESSMENT A-17

A5.1 EXPOSURE POINTS AND EXPOSURE POINT CONCENTRATIONS A-17
A5.1.1 EPCs for Soil A-18
A5.1.2 EPCs for Groundwater A-19
A5.1.3 Exposure Point Concentrations for Media Not Sampled A-21
A5.2 CHEMICAL INTAKE ESTIMATES A-24

A6.0 TOXICITY ASSESSMENT A-26

A6.1 ROUTE-TO-ROUTE EXTRAPOLATION A-27
A6.2 SURROGATES A-27

A6.3 TRICHLOROETHENE A-27
A6.4 LEAD A-28

A7.0 RISK CHARACTERIZATION METHODS A-28

A7.1 RISK CHARACTERIZATION FOR SOIL EXPOSURES AND CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER A-28
A7.1.1 Characterization of Cancer Risks A-28
A7.1.2 Characterization of Noncancer Hazards A-29
A7.2 RISK CHARACTERIZATION FOR RESIDENTIAL AND INDUSTRIAL EXPOSURE TO GROUNDWATER A-30
A7.2.1 Characterization of Cancer Risks A-31
A7.2.2 Characterization of Noncancer Hazards A-32
A7.3 INTERPRETATION OF HAZARD AND RISK LEVELS A-33
A7.4 EVALUATION OF LEAD A-33

A8.0 RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT A-34

A8.1 HUMAN HEALTH RISK ASSESSMENT RESULTS AND IDENTIFICATION OF CHEMICALS OF CONCERN BASED ON PLANNED REUSE A-35
A8.1.1 Soil – Total Risk A-35
A8.1.2 Soil – Incremental Risk A-36
A8.1.3 Groundwater A-37
A8.2 RESIDENTIAL EXPOSURE SCENARIO A-39
A8.2.1 Soil – Total Risk A-39
A8.2.2 Soil – Incremental Risk A-40
A8.2.3 Groundwater A-40
A8.3 INDUSTRIAL EXPOSURE SCENARIO A-40
A8.3.1 Soil – Total Risk A-40
A8.3.2 Soil – Incremental Risk A-41
A8.3.3 Groundwater A-41
A8.4 RECREATIONAL EXPOSURE SCENARIO A-41
A8.4.1 Soil – Total Risk A-41
A8.4.2 Soil – Incremental Risk A-42
A8.5 CONSTRUCTION WORKER EXPOSURE SCENARIO A-42
A8.5.1 Soil – Total Risk A-42
A8.5.2 Soil – Incremental Risk A-42
A8.5.3 Groundwater A-43

A9.0 UNCERTAINTY ANALYSIS A-43

A9.1 METALS IN SOIL BELOW AMBIENT LEVELS A-44

A9.2 SLOPE FACTOR FOR TCE A-44

A9.3 BOUNDARIES FOR VAPOR INTRUSION RISKS A-45

A9.4 DERMAL CONTACT WITH GROUNDWATER FOR RESIDENTIAL SCENARIO A-45

A9.5 ASSUMPTIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER ... A-47

A9.6 DETECTION LIMITS FOR GROUNDWATER MONITORING DATA A-47

A9.7 SCREENING LEVELS FOR GROUNDWATER VAPOR INTRUSION A-48

A9.8 POTENTIAL HYDRAULIC COMMUNICATION AND RISKS FROM RESIDENTIAL DOMESTIC USE OF GROUNDWATER A-48

A9.9 POST-2004 GROUNDWATER CONCENTRATIONS A-49

A10.0 REFERENCES A-51

Attachment

A1 Total Risk and Hazard Calculation Results for Soil Exposure (provided on compact disc only)

A2 Incremental Risk and Hazard Calculation Results for Soil Exposure (provided on compact disc only)

A3 Risk and Hazard Calculation Results for Groundwater Vapor Intrusion and Domestic Use

A4 Groundwater Plume Delineation Methodology

A5 Groundwater-to-Outdoor Air Model for Construction Worker Trench Exposure

A6 Derivation of Hunters Point Shipyard Risk-Based Concentration for Lead

A7 Trichloroethene Uncertainty Analysis

A8 Soil and Groundwater Analytical Data Used for Human Health Risk Assessment (provided on compact disc only)

LIST OF FIGURES

A-1 Conceptual Site Model

A-2 Total Risk – Surface Soil (0 to 2 ft bgs) Based on Planned Reuse

A-3 Total Risk – Subsurface Soil (0 to 10 ft bgs) Based on Planned Reuse

A-4 Incremental Risk – Surface Soil (0 to 2 ft bgs) Based on Planned Reuse

A-5 Incremental Risk – Subsurface Soil (0 to 10 ft bgs) Based on Planned Reuse

A-6 Groundwater Vapor Intrusion Risks in A-Aquifer Based on Planned Reuse

A-7 Groundwater Domestic Use Risks in B-Aquifer, Residential Exposure Scenario

A-8 Potential Lateral Extent of Groundwater Vapor Intrusion Risks in A-Aquifer with Parcel and Grid Information

A-9 Potential Lateral Extent of Groundwater Vapor Intrusion Risks in A-Aquifer with Utility Information

LIST OF TABLES

A-1 Human Health Risk Assessment Potentially Complete Exposure Pathways

A-2 Dermal Absorption Factors and Volatilization Factors for Chemicals of Potential Concern

A-3 Chemical Data and Uptake Factors for Ingestion of Homegrown Produce Pathway

A-4 Intake Equation and Parameters for Ingestion of Soil

A-5 Intake Equation and Parameters for Dermal Contact with Soil

A-6 Intake Equation and Parameters for Inhalation of Volatile and Particulate Chemicals from Soil

A-7 Intake Equation and Parameters for Ingestion of Homegrown Produce

A-8 Intake Equation and Parameters for Dermal Contact with Groundwater

A-9 Intake Equation and Parameters for Inhalation of Volatile Chemicals from Groundwater in Trench

A-10 Permeability Constants for Chemicals of Potential Concern

A-11 Slope Factors for Chemicals of Potential Concern

A-12 Reference Doses for Chemicals of Potential Concern

A-13 Groundwater Risk-Based Screening Levels

A-14 Target Organs and Systems for Chemicals of Potential Concern

A-15 Total Risk – Summary of Cancer Risks and Hazard Indices by Planned Reuse, Surface Soil (0 to 2 feet bgs)

A-16 Total Risk – Summary of Cancer Risks and Hazard Indices by Planned Reuse, Subsurface Soil (0 to 10 feet bgs)

A-17 Total Risk – Risk Characterization Analysis for Surface Soil (0 to 2 feet bgs) by Planned Reuse

A-18 Total Risk – Risk Characterization Analysis for Subsurface Soil (0 to 10 feet bgs) by Planned Reuse

A-19 Incremental Risk – Summary of Cancer Risks and Hazard Indices by Planned Reuse, Surface Soil (0 to 2 feet bgs)

A-20 Incremental Risk – Summary of Cancer Risks and Hazard Indices by Planned Reuse, Subsurface Soil (0 to 10 feet bgs)

A-21 Incremental Risk – Risk Characterization Analysis for Surface Soil (0 to 2 feet bgs) by Planned Reuse

A-22 Incremental Risk – Risk Characterization Analysis for Subsurface Soil (0 to 10 feet bgs) by Planned Reuse

A-23 Risk Characterization Analysis for A-Aquifer Groundwater Based on Planned Reuse

A-24 Risk Characterization Analysis for B-Aquifer Groundwater with Potential Hydraulic Communication

A-25 Summary of Uncertainties

A-26 Cancer Risks and Noncancer Hazards Associated with Metals at Concentrations Equal to HPALs

A-27 Evaluation of Potential Risks from Residential Domestic Use of the A-Aquifer, IR-10A Plume, Assuming Hydraulic Communication with B-Aquifer

A-28 Evaluation of Potential Risks from Residential Domestic Use of the A-Aquifer, IR-10B Plume, Assuming Hydraulic Communication with B-Aquifer

A-29 Evaluation of Potential Risks from Residential Domestic Use of the A-Aquifer, IR-25 Plume, Assuming Hydraulic Communication with B-Aquifer

µg/L	Microgram per liter
95UCL	95 percent upper confidence limit
BCT	Base Realignment and Closure Cleanup Team
bgs	Below ground surface
Cal/EPA	California Environmental Protection Agency
cm^2	Square centimeters
COC	Chemical of concern
COPC	Chemical of potential concern
DTSC	Department of Toxic Substances Control
DU-RBSL	Domestic use risk-based screening level
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
F_{oc}	Fraction of organic carbon
HGAL	Hunters Point groundwater ambient level
HHRA	Human health risk assessment
HI	Hazard index
HPAL	Hunters Point ambient level
HPS	Hunters Point Shipyard
HQ	Hazard quotient
IR	Installation Restoration
K_{oc}	Organic carbon-water partition coefficient
K_{ow}	Octanol-water partition coefficient
m^3	Cubic meters
mg/kg	Milligram per kilogram
mg/kg-day	Milligram per kilogram per day
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
RBSL	Risk-based screening level
RfD	Reference dose
RI	Remedial investigation

RME	Reasonable maximum exposure
SF	Slope factor
SQL	Sample quantitation limit
TCRA	Time-critical removal action
TCE	Trichloroethene
Tetra Tech	Tetra Tech EM Inc.
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment
VI-RBSL	Vapor intrusion risk-based screening level
VOC	Volatile organic compound

A1.0 INTRODUCTION

This appendix presents the revised baseline human health risk assessment (HHRA) for Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California. The original HHRA for Parcel B was conducted in 1996 (PRC Environmental Management, Inc. [PRC] and others 1996) as part of the remedial investigation (RI) for Parcel B. The original HHRA was the basis for the 1997 record of decision), remedial design, and subsequent excavations in 1998 and 1999. The Navy revised the original HHRA in 2000 to update cleanup goals for soil; these revised goals were then presented in an explanation of significant differences (see Section 2.1.5 of the Technical Memorandum in Support of a Record of Decision Amendment [TMSRA]). The Navy revised the remedial design and conducted a second round of remedial action excavations during 2000 to 2001. All these additional data were incorporated into a revised HHRA, released in January 2003. An additional soil removal in 2004 resulted in additional excavation and data collection. This HHRA revises the 2003 HHRA to account for the data collected during the 2004 removals as well as updates to U.S. Environmental Protection Agency (EPA) and the California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment's toxicity values and exposure assumptions. Data associated with sample locations excavated and removed during the activities in 1998 to 2001 and in 2004 are excluded from this HHRA. In addition, groundwater data collected up to and including quarter 20 (October to December 2004) as part of the Parcel B remedial action monitoring program at HPS are included in this HHRA. Lastly, the HHRA was revised based on meetings with the HPS Base Realignment and Closure Cleanup Team (BCT) during 2003 and 2004.

The specific objectives of this revised baseline HHRA are as follows:

- Estimate the potential risks to human health associated with potential future land use scenarios
- Identify the environmental media and contaminants that pose the primary health concerns
- Identify the environmental media and contaminants that are likely to pose little or no threat to human health
- Provide a foundation for assessing the need for further response actions

Additionally, this revised baseline HHRA incorporates changes in regulatory guidance and toxicological criteria that have occurred since the original HHRA was prepared in 1996.

HPS operated as a commercial dry dock facility from about 1867 until 1940 when the Navy acquired title to the land and began developing it for various shipyard activities. From 1945 to 1974, the Navy used the shipyard primarily as a maintenance and repair facility. The Navy discontinued activities at HPS in 1974 and the shipyard remained relatively unused until 1976. In 1976, the Navy leased most of HPS, including all of the area now known as Parcel B, to the Triple A Machine Shop (Triple A). Triple A operated a commercial ship repair facility from

July 1976 to June 1986, but did not vacate the property until March 1987. During the lease period, Triple A used dry docks, berths, machine shops, power plants, various offices, and warehouses to repair commercial and Navy vessels. Triple A also subleased portions of the property to various other businesses. The Navy resumed occupancy of HPS in 1986.

Historically, the dominant land use of Parcel B has been for office and commercial buildings and industrial activities, such as fuel distribution, sandblasting, painting, machining, acid mixing, and metal fabrication. Most of Parcel B is covered with concrete or asphalt and buildings. The western portion of Parcel B, including Installation Restoration (IR) Program sites IR-07 and IR-18, is unimproved and covered only with soil and minor vegetation.

Based on the City and County of San Francisco's reuse plan (San Francisco Redevelopment Agency 1997), Parcel B is expected to be zoned to accommodate mixed uses, including a mixed residential/retail area, a research and development area, a cultural and educational area, and open space. The mixed-use and research and development areas could include upper-story housing, live/work arrangements, and a variety of commercial enterprises, artist studios, retail and business services and ground-level residences. The cultural and educational area could include museums. The open space areas will provide public access and use of the waterfront as well as provide a corridor for the Bay Trail (hiking and bicycle access) close to the shoreline (San Francisco Redevelopment Agency 1997). The reuse planning was incorporated into the human health risk assessment (for example, areas where residential exposure applies) together with agreements with the BCT on the HHRA methodology to evaluate risks to human health at Parcel B.

The remainder of this appendix is organized as follows:

- Section A2.0 presents an overview of the methodology used for the HHRA.
- Section A3.0 discusses the conceptual site model for Parcel B.
- Section A4.0 presents the data evaluation and identification of chemicals of potential concern (COPC).
- Section A5.0 contains the exposure assessment.
- Section A6.0 presents the toxicity assessment.
- Section A7.0 discusses the risk characterization methodology.
- Section A8.0 presents the results of the risk characterization.
- Section A9.0 contains an uncertainty analysis.
- Section A10.0 lists the references used to prepare this appendix.

Figures, tables, and attachments are presented after Section A10.0. Attachments A1 and A2 contain tables and figures that detail the results of the risk evaluation for exposure to soil. Attachment A3 contains tables and figures that detail the results of the risk evaluation for exposure to groundwater. Attachment A4 describes the methodology used to delineate groundwater plumes for assessing exposure to groundwater at Parcel B. Attachment A5 describes the groundwater-to-outdoor air model used to evaluate inhalation exposure in a trench. Attachment A6 describes the methodology used to evaluate exposure to lead. Attachment A7 contains a quantitative analysis of uncertainties associated with toxicity criteria for trichloroethene (TCE). Lastly, Attachment A8 lists all of the analytical data for soil and groundwater used for the HHRA.

A2.0 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The Navy developed the methodology used to prepare the HHRA in consultation with EPA Region 9 and the Department of Toxic Substances Control (DTSC). The following guidance documents were used to develop the methodology:

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A) (EPA 1989)
- Preliminary Endangerment Assessment Guidance Manual (Cal/EPA 1999a)
- Region 9 preliminary remediation goals (PRG) (EPA 2004a)
- Subsurface vapor intrusion guidance (EPA 2002a)

In addition, the following approaches developed by the HPS BCT (Tetra Tech EM Inc. [Tetra Tech] 2003; Navy 2004) and the Navy were used in this revised baseline HHRA. These approaches were developed specifically for HHRAs at HPS.

- Use of 2,500-square-foot exposure areas (grids) to evaluate residential exposures and 0.5-acre exposure areas to evaluate nonresidential exposures
- Evaluation of the homegrown produce pathway for residential exposures
- Evaluation of recreational exposures
- For evaluation of exposures to groundwater, use of 12 rounds of groundwater monitoring data to delineate groundwater plumes, establish exposure areas, and develop representative exposure concentrations
- Use of a risk-based screening approach to evaluate exposures to groundwater from vapor intrusion and domestic use

- Quantitative analysis of the uncertainties associated with the toxicity criteria for TCE on risk estimates

- Inclusion of both a total risk assessment and an incremental risk assessment for the evaluation of risks from exposure to soil at Parcel B. All chemicals are included as COPCs for the total risk evaluation, regardless of concentration, except for the essential nutrients calcium, magnesium, potassium, and sodium. The total risk evaluation estimates the risks posed by chemicals at the site, including any present at concentrations at or below background levels. The above essential nutrients and metals with maximum measured concentrations below Hunters Point ambient levels (HPAL) are excluded as COPCs for the incremental risk evaluation. The incremental risk evaluation also estimates risks posed by chemicals at the site, but does not include the risks from chemicals present at or below background levels.

The framework of this revised baseline HHRA consists of the following six basic steps.

- **Conceptual Site Model:** This step involves evaluating potential exposure pathways to the COPCs and human populations that might be exposed to them under current or future site conditions.

- **Data Evaluation and Identification of COPCs:** This step consists of evaluating the analytical data for usability in the baseline HHRA, grouping analytical data by exposure areas and by medium, and selecting COPCs in site media.

- **Exposure Assessment:** This step quantifies exposure to the identified COPCs for exposure pathways that are potentially complete. Exposure point concentrations (EPC) are estimated from measured or modeled concentrations, and pathway-specific intakes (doses) are estimated using hypothetical receptors for evaluation in the subsequent risk calculations.

- **Toxicity Assessment:** This step consists of compiling toxicity values that characterize potential adverse health effects from exposure to COPCs.

- **Risk Characterization:** This step combines the results of the previous steps to characterize quantitatively potential risks to human health associated with exposure to COPCs at the area evaluated. Both potential cancer risks and noncancer hazard indices (HI), a measure of the potential for adverse health effects other than cancer, are evaluated.

- **Uncertainty Analysis:** This step analyzes the major uncertainties associated with the risks calculated.

A3.0 CONCEPTUAL SITE MODEL

This section presents the conceptual site model for Parcel B. A conceptual site model summarizes information on sources of chemicals at the site, affected environmental media that represent sources of exposure to chemicals at the site, chemical release and transport mechanisms for affected media, potentially exposed receptors, and potential exposure pathways for each receptor. The conceptual site model for Parcel B is presented on Figure A-1. Each of the components of the conceptual site model is discussed below.

A3.1 SOURCES OF SITE CHEMICALS

Details on historical uses of Parcel B are presented in Section 2.0 of the Parcel B TMSRA.

A3.2 AFFECTED ENVIRONMENTAL MEDIA

Historical uses of Parcel B have resulted in chemical releases to soil and groundwater at Parcel B. Chemicals detected in soil at Parcel B include metals, volatile organic compounds (VOC), semivolatile organic compounds, polynuclear aromatic hydrocarbons, pesticides, and polychlorinated biphenyls. Chemicals detected in groundwater at Parcel B include metals, VOCs, and polynuclear aromatic hydrocarbons. Further information on affected environmental media and findings of the site characterization is presented in Section 2.0 of the Parcel B TMSRA.

A3.3 CHEMICAL RELEASE AND TRANSPORT MECHANISMS

Chemical release and transport mechanisms for the chemicals detected at Parcel B are shown on Figure A-1. Based on these mechanisms, chemicals in soil and groundwater at Parcel B may also migrate to ambient (outdoor) air, indoor air, and vegetation.

A3.4 POTENTIALLY EXPOSED RECEPTORS

The redevelopment plan outlines the planned reuses for Parcel B (San Francisco Redevelopment Agency 1997). Parcel B was divided into redevelopment blocks to facilitate identification of the areas of Parcel B associated with specific planned reuses. Each redevelopment block was then assigned a number. Figure 3-1 of the Parcel B TMSRA shows the locations of each of the redevelopment blocks assigned to Parcel B, the associated number, and the specific planned reuse for each. According to the redevelopment plan, most of the planned reuse for Parcel B is mixed use and research and development (San Francisco Redevelopment Agency 1997)—that is, residential reuse. Other planned reuses of Parcel B include educational/cultural (industrial reuse) and open space (recreational reuse). The table below summarizes the planned reuses for each redevelopment block at Parcel B.

Redevelopment Block	Planned Reuse	Associated Exposure Scenario
1	Mixed Use	Residential
2	Research and Development	
3	Research and Development	
4	Mixed Use	
5	Research and Development	
6	Research and Development	
7	Mixed Use	
8	Mixed Use	
9	Mixed Use	
12	Mixed Use	
15	Mixed Use	
16	Educational/Cultural	Industrial
BOS-1	Open Space	Recreational
BOS-2	Open Space	
BOS-3	Open Space	

The following potential receptors were selected for evaluation in this revised baseline HHRA based on the planned reuses at Parcel B:

- Resident (adult and child)
- Industrial worker (adult)
- Recreational user (adult and child)
- Construction worker (adult)

Although it was not directly associated with a specific planned reuse for Parcel B, a construction worker was identified as a potential receptor because it is possible that exposure to site contaminants may occur as a result of excavation and trenching, both during and after parcel redevelopment. Only potential future exposures were evaluated in this revised HHRA, based on the planned reuses outlined above. Current exposures were not evaluated in this HHRA because Parcel B is not currently used.

In addition to evaluating risks based on the planned reuse for each redevelopment block, the HHRA also evaluated risks to potential receptors identified for each redevelopment block, regardless of the planned reuse. These additional evaluations provided information on potential risks for all potential reuses, in the event that the redevelopment plan is revised.

A3.5 POTENTIALLY COMPLETE EXPOSURE PATHWAYS

According to guidance from EPA (1989), a complete exposure pathway consists of four elements:

- A source and mechanism of chemical release
- A retention or transport medium (or media in cases involving transfer of chemicals)
- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- Presence of a receptor population and an exposure route (such as ingestion) at the contact point

If any of these elements is missing (except in a case where the source itself is the point of exposure), then the exposure pathway is considered incomplete. For example, if receptor contact with the source or transport medium does not occur, then the exposure pathway is incomplete and is not quantitatively evaluated for risk. Similarly, if human contact with an exposure medium is not possible, the exposure pathway is considered incomplete and is not evaluated.

As shown on Figure A-1, potentially complete exposure pathways are designated by a "C" in the conceptual site model. Incomplete (or negligible) exposure pathways are designated by an "I." Quantitative risk evaluations (that is, calculation of numerical cancer and noncancer risk estimates) were conducted for exposure pathways identified in the conceptual site model as potentially complete. As previously described, historical uses of Parcel B have resulted in chemicals released to soil and groundwater. As shown in the conceptual site model, chemicals in soil may be transferred to outdoor air from wind erosion or volatilization, or to vegetation from root uptake. Chemicals in groundwater may be transferred to outdoor air in a construction trench from volatilization, to indoor air from vapor intrusion, and to indoor air from volatilization of groundwater during domestic use. Table A-1 presents a matrix that summarizes the exposure pathways identified as potentially complete for Parcel B; these pathways are discussed below.

A3.5.1 Soil Exposure Pathways

Exposure pathways identified as potentially complete for soil for all receptors include incidental soil ingestion, dermal contact with soil, and inhalation of volatile and particulate chemicals released from soil to outdoor air (Tetra Tech 2003; Navy 2004). Ingestion of homegrown produce was also identified as a potentially complete exposure pathway for residential receptors because root uptake of chemicals in soil may result in transfer of chemicals in soil to vegetation. Exposure to soil was assessed for two depth intervals in this revised baseline HHRA: surface soil (0 to 2 feet below ground surface [bgs]), and subsurface soil (0 to 10 feet bgs). Industrial and residential receptors were evaluated for two soil scenarios, one for exposure to surface soil,

and one for exposure to subsurface soil. The surface soil scenario assumes that minimal development of the site results in relatively little disturbance to the distribution of contaminants in soil, such that contact is restricted to contaminants at the surface. The subsurface soil scenario assumes intrusive development of the site and extensive excavation, making deeper soils available at the surface for contact. Exposure to recreational receptors was assumed to be limited to the shallower, surface soil depth interval, based on the assumption that intrusive site development activities are not expected in areas planned for open space reuse. Construction worker receptors were assumed to be exposed to the deeper, subsurface soil depth interval, based on the assumption that construction workers will be involved with intrusive soil excavation.

A3.5.2 Groundwater Exposure Pathways

Groundwater at Parcel B is present in several hydrostratigraphic units: an overlying, shallow A-aquifer, a deeper B-aquifer, and a bedrock aquifer. Section 2.0 of the Parcel B TMSRA provides additional information on the hydrogeology of Parcel B. Exposure pathways identified as potentially complete for groundwater include inhalation of volatile chemicals released from A-aquifer groundwater to indoor air from vapor intrusion (residential and industrial receptors) and domestic use of B-aquifer groundwater (residential receptors). Exposure to volatile chemicals in groundwater from vapor intrusion was limited to the A-aquifer because the A-aquifer overlies the B-aquifer and is assumed to act as a barrier to upward migration of volatile contaminants from underlying aquifers. No groundwater exposure pathways were identified as potentially complete for recreational receptors because recreation is assumed to occur outdoors, and these receptors are not expected to contact groundwater at the site during recreation.

Exposure by residential and industrial receptors to A-aquifer groundwater was assumed to be limited to groundwater vapor intrusion since groundwater in the A-aquifer is not considered suitable for drinking water. The beneficial use evaluation for Parcel B groundwater is detailed in Appendix E of the Parcel B TMSRA. Although the evaluation of the B-aquifer suggests that it should not be considered a potential source of drinking water, exposure pathways associated with residential domestic use of groundwater in the B-aquifer were included in the HHRA based on meetings with the BCT on the HHRA methodology, and because the groundwater in the B-aquifer has not been exempted from the potential municipal and domestic beneficial uses specified in the Water Quality Control Plan for the San Francisco Bay Region. This assumption provides an additional measure of conservatism with respect to the protection of human health at HPS.

Construction workers were also assumed to be exposed to groundwater in the A-aquifer during trenching because A-aquifer groundwater water at Parcel B is relatively shallow, at 9.76 feet bgs on average (based on February 2002 water level measurements for Parcel B [Tetra Tech 2004]). Exposure pathways identified as potentially complete for the construction worker are dermal contact with A-aquifer groundwater and inhalation of volatile chemicals released from A-aquifer groundwater to outdoor air in a construction trench.

Exposure to contaminants in the B-aquifer is assumed to be limited to residential receptors, which are assumed to use groundwater from the B-aquifer for domestic use. Exposure to groundwater in the bedrock aquifer was not evaluated because no information indicated the need to investigate the bedrock aquifer and no monitoring wells were installed in the bedrock aquifer.

A4.0 DATA EVALUATION AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section discusses the process used to evaluate, reduce, and group the analytical data for Parcel B, and describes the methods used to identify COPCs for quantitative evaluation in the HHRA.

A4.1 DATA EVALUATION

All analytical data for soil collected during the Parcel B RI and ensuing investigations and all groundwater data collected for Parcel B, consisting of the last 12 rounds of sampling at each well and for each chemical through monitoring quarter 20 (October to December 2004), were initially considered for evaluation in the HHRA. Data associated with these investigations are further described in Section 2.3 of the Parcel B TMSRA. The data set for groundwater was based on the approach for the groundwater risk evaluation for HPS, as discussed in meetings with EPA, DTSC, and the Navy in 2003 and 2004.

The validated analytical data used in the HHRA for Parcel B are presented in Attachment A8 to this appendix. All chemicals detected or estimated (J-qualified) in one or more samples of surface soil, subsurface soil, or groundwater were incorporated in the HHRA datasets for each exposure area. If a chemical was not detected in any samples for the exposure area, then the chemical was excluded from further evaluation from that exposure area. For soil, results for chemicals that were nondetected (U- and UJ-qualified) were incorporated into the HHRA by using a proxy concentration of one-half of the sample quantitation limit for each exposure area evaluated, provided the chemical was detected at least once in the exposure area (see Section A5.1.1). For groundwater, U- and UJ-qualified data were excluded from the HHRA to reduce the influence of historical nondetected results on the EPCs (see Section A5.1.2). Consistent with EPA guidance, only data qualified as rejected (R) were considered unusable for the risk assessment (EPA 1989).

Two samples of groundwater at Parcel B were collected outside of the proper monitoring well screen interval during June and August 2004 (Barajas & Associates, Inc. 2007). Samples collected outside of the well screen interval may not be representative of groundwater conditions in the water-bearing unit. However, these two samples were collected at locations associated with treatability studies and were not included in the HHRA data set for groundwater (Barajas & Associates, Inc. 2007).

As discussed, groundwater data collected through monitoring quarter 20 (October to December 2004) were included for quantitative evaluation in the HHRA. Additional groundwater monitoring data for Parcel B have been collected since 2004, but were not included in the

HHRA. Section A9.9 qualitatively evaluates the effects of more recent (post-2004) concentrations in groundwater on the results of the HHRA.

Data reduction and grouping for the soil and groundwater data are discussed in the following sections.

A4.2 DATA REDUCTION

In addition to the data quality evaluation, reduction processes were implemented for the data used in this revised baseline HHRA. Field data collected using real-time monitoring equipment (for example, detections of VOCs in air by photoionization detectors during monitoring events) were not used in this HHRA because these data are not analyzed using EPA-approved methods. Detection of VOCs during monitoring events provides information only about general concentrations of VOCs, but does not identify compounds and therefore cannot be incorporated into this risk evaluation.

Data collected from sample locations that have been excavated were excluded from the risk evaluation for the HHRA soil data set. Data collected from post-excavation confirmation samples were included in the HHRA, provided these samples were from locations that were not subsequently excavated.

Only groundwater data from monitoring wells was included in the risk evaluation for the HHRA groundwater data set; groundwater from temporary monitoring locations (for example, piezometers) were not included in the risk evaluation. Groundwater data from samples collected from temporary groundwater monitoring locations are less reliable because the piezometers may not have been purged before they were sampled, the groundwater in the piezometers may not have had sufficient time to stabilize and equilibrate, and groundwater from piezometers may contain artificially high total dissolved solids or total suspended solids (or both). These constituents may be artificially elevated because piezometer samples are generally collected from the top or bottom of the water stream, rather than from a screened interval within the middle of the stream.

In addition, data collected from monitoring wells associated with treatability studies at Parcel B were excluded from the data set used for plume delineation, beginning with data collected from the initiation of the treatability study, and including data collected following completion of the treatability studies. The monitoring well locations and sample dates associated with data excluded from the data set are identified in Attachment A4. These data were excluded from the data set for the HHRA because plume concentrations have not yet stabilized following treatability studies, and temporal fluctuations associated with nonstabilized plume concentrations may contribute to uncertainties with the HHRA. Data collected from the monitoring wells associated with treatability studies before initiation of the studies were retained in the data set used for the HHRA.

Duplicate data and data analyzed using multiple analytical methods were treated as described below.

A4.2.1 Duplicate Data

The following procedure was used for cases where duplicate samples were collected to assess laboratory precision to calculate the result used in the HHRA for each chemical analyzed in the duplicate samples:

- If both results were detected, then the average of the detected results was used.
- If one result was detected and the other was not detected (was below the reporting limit), then one-half of the reporting limit was used as a proxy concentration for the nondetected sample and an average of the concentrations was used.
- If both results were not detected, then the average of the reporting limit for both samples was used to represent the nondetectable result.

A4.2.2 Multiple Analyses

The following procedure was used to calculate the result used in the HHRA for each chemical for cases where chemicals in an individual sample were analyzed using more than one analytical method (for example, EPA Methods 8210 and 8270 for naphthalene), except for total metals and dissolved metals.

- If both results were detected, then the highest detected result was used.
- If one result was detected and the other was not detected, then the detected result was used.
- If both results were not detected, then the lowest nondetectable result was used.

Data for total metals were used in this HHRA for groundwater samples with both total metals (unfiltered) and dissolved metals (filtered) results for a sampling event (EPA 1989). If the sampling event only included one analysis, then the results of that analysis were used in this HHRA.

A4.3 DATA GROUPING

Validated data for soil and groundwater were grouped for evaluation in this revised baseline HHRA using the methods described below.

A4.3.1 Data Grouping for Soil

Based on the reasonably anticipated land uses identified in Section A3.4, Parcel B was divided into 0.5-acre exposure areas (approximately 150 feet by 150 feet) and 2,500-square-foot exposure areas. The 0.5-acre exposure area size was selected by the HPS BCT and the City and

County of San Francisco as a reasonable estimate for a light industrial lot in the San Francisco Bay area. EPA, DTSC, and the Navy selected the 2,500-square-foot exposure area as a reasonable estimate for a residential lot because it is a minimum residential lot size for a single-family home allowed by the San Francisco planning code (City and County of San Francisco 1995). This revised baseline HHRA refers to each 0.5-acre exposure area at Parcel B as an "industrial grid" and to each 2,500-square-foot exposure area as a "residential grid." Industrial exposure to soil at Parcel B was evaluated for each industrial grid and residential exposure to soil at Parcel B was evaluated for each residential grid. This HHRA assumed that recreational and construction worker exposures occurred over an area equivalent to the 0.5-acre industrial grid. Each industrial grid was therefore also evaluated for recreational and construction worker exposures.

As discussed in Section A3.4, this HHRA also evaluated risks for each potential receptor for each redevelopment block, regardless of the planned reuse. For this reason, areas planned for industrial and recreational reuse were also divided into residential grids, and areas planned for residential reuse were also divided into industrial grids. Hence, residential, industrial, recreational, and construction worker exposures were evaluated for each redevelopment block, regardless of planned reuse. This HHRA also assigned each grid was assigned a unique identification number, referred to as the "grid number."

Data for soil were grouped by both residential and industrial grids. In addition to this grouping, data were assigned to the following two subsets, corresponding to the following depth intervals.

- Surface soils are represented by samples collected from 0 to 2 feet bgs, where 2 feet represents the deepest end-depth interval.
- Subsurface soils are represented by samples collected from 0 to 10 feet bgs, where 10 feet represents the deepest end-depth interval.

As detailed in Section A3.5, residential and industrial receptors are evaluated for exposure to both surface soil and subsurface soil (under separate evaluations), while recreational receptors are evaluated for exposure only to surface soil, and construction worker receptors are evaluated for exposure only to subsurface soil.

Summary statistics for analytical data for surface and subsurface soil, corresponding to each residential and industrial grid, are presented in Tables A1-1 through A1-4 of Attachment A1 to this appendix. Attachment A8 lists all of the analytical data for soil used for the HHRA.

A4.3.2 Data Grouping for Groundwater

Based on the potential exposure pathways identified in Section A3.5, exposure to volatile contaminants in groundwater in the A-aquifer may occur to residential and industrial receptors as a result of subsurface vapor intrusion to indoor air. Two steps were used to establish the areal extent that should be used to assess vapor intrusion risks at Parcel B. First, plume boundaries

were established based on delineation of measured concentrations of VOCs in A-aquifer groundwater to nondetectable levels. Next, groundwater data for the A-aquifer were grouped based on the delineated plume boundaries. The groundwater data set used for plume delineation is described in Section A4.1 of this appendix and includes all groundwater data collected for Parcel B, consisting of the last 12 rounds of sampling at each well and for each chemical through monitoring quarter 20 (October to December 2004). Because one of the groundwater plumes transgresses into Parcel C, groundwater data from Parcel B and Parcel C within the plume boundary were included in the plume data set. The groundwater data set, which consists of both historical and current groundwater data for Parcel B, was based on meetings with EPA, DTSC, and the Navy in 2003 and 2004.

Data collected from the A-aquifer that did not fall within a delineated plume boundary were grouped by associated residential exposure areas (2,500-square-foot grids) and industrial exposure areas (0.5-acre grids), following the approach described in Section A4.3.1 for soil data.

Data collected from the B-aquifer were grouped by using the same plume delineation boundaries developed for the A-aquifer to evaluate residential exposure to groundwater in the B-aquifer from domestic use. In addition, the grouping assumed a vertical extrapolation of the plume boundary from the A-aquifer to the B-aquifer. Although contaminant plumes have not been identified in the B-aquifer at Parcel B, this approach was used to aid reporting risk results over collocated exposure areas.

Three A-aquifer plume areas were identified for Parcel B:

- Installation Restoration Site (IR)-10A plume
- IR-10B plume
- IR-25 plume

Specific details on the plume delineation methodology and the nature and extent of contamination associated with each of the plumes are provided in Attachment A4 to this appendix. Unlike the IR-10A and IR-25 plumes, the IR-10B plume was delineated based on measured concentrations of chromium VI (also know as hexavalent chromium), rather than of VOCs. Although chromium VI is not considered volatile, groundwater in the IR-10B area has historically been contaminated by chromium VI. In addition, carbon disulfide has been detected in the IR-10B plume. Although no complete exposure pathways are identified for residential, industrial, and recreational exposure to chromium VI in the A-aquifer, a complete exposure pathway exists for chromium VI in the A-aquifer for construction worker receptors (dermal contact with groundwater). Inhalation of carbon disulfide in the A-aquifer is also a complete pathway for the construction worker receptor, as well as for residential and industrial receptors.

Table A4-1 of Attachment A4 lists the wells associated with each of the plumes identified; data associated with these wells were combined to form the groundwater data set for the HHRA for each plume. Data collected from wells that are not associated with a plume were grouped by associated residential and industrial grid for evaluation in the HHRA.

Table A4-1 also indicates for each groundwater monitoring location if communication occurs between the A- and B-aquifers. The potential for hydraulic communication between the A- and B-aquifers is limited to small areas in the western portion of Parcel B (see Section 2.2.4 of the TMSRA). The B-aquifer is predominantly absent from other areas of Parcel B.

None of the three A-aquifer plumes identified for this baseline HHRA was assumed to be in communication with the B-aquifer because the B-aquifer either was not present or had only a limited presence in the location of the IR-10A, IR-10B, and IR-25 plumes. As discussed in Section A3.5.2, potential exposure to groundwater in the B-aquifer may occur under a residential domestic use scenario. Because the potential for hydraulic communication between the A- and B-aquifers at Parcel B is considered unlikely, the HHRA does not include characterization of risks from residential domestic use of groundwater at each of the A-aquifer plume areas. However, an analysis of the potential uncertainty associated with exclusion of this evaluation for the A-aquifer plume areas is provided in Section A9.8.

For the non-plume exposure areas where communication between aquifers was identified, the HHRA evaluated potential residential risks for domestic use under two cases: first using solely B-aquifer data, and second using a combination of A- and B-aquifer data to account for potential hydraulic communication between the two aquifers. Four exposure areas (residential grids) at Parcel B have groundwater monitoring data located in an area where hydraulic communication may occur between the A- and B-aquifers: B0238 (IR18MW100B), B0337 (IR18MW101B), B0139 (IR18MW21A, IR18MW21AD), and B0237 (PA18MW09A). Each of these grids was evaluated for potential risks from domestic use of groundwater. Grids B0238 and B0337 were evaluated for potential risks from domestic use with B-aquifer data only because no corresponding A-aquifer data were available for these grids. Grids B0139 and B0237 were evaluated for potential risks from domestic use with A-aquifer data only because B-aquifer data were not available for these grids.

Summary statistics for analytical data for A-aquifer groundwater, corresponding to the plumes identified, are presented in Tables A3-1, A3-2, and A3-3 in Attachment A3 to this appendix. Summary statistics for A-aquifer data collected from wells that are not associated with plumes ("non-plume wells") are presented in Tables A3-4 and A3-5 of Attachment A3 for residential and industrial grids. Tables A3-6 and A3-7 of Attachment A3 present summary statistics for analytical data for the B-aquifer groundwater data set with potential hydraulic communication and the B-aquifer groundwater data set without hydraulic communication, respectively, collected from non-plume wells. Attachment A8 lists all of the analytical data for groundwater used for the HHRA.

The plumes delineated in Attachment A4 are only for use in the HHRA evaluation. The plumes delineated in Attachment A4 do not represent current-day plume sizes at Parcel B because the plume delineation is based on the groundwater data set for the HHRA, which consists of the last 12 rounds of sampling at each well and for each chemical through monitoring quarter 20 (October to December 2004). Figure 4-2 of the Parcel B TMSRA shows an overlay of the current plume boundaries and the plume boundaries established for the HHRA. The plumes, based on current data, are substantially smaller than the sizes established for use in the HHRA. In addition, current concentrations of chemicals measured in each plume area are substantially less than historical concentrations. (See Section 4.1 of the Parcel B TMSRA for further discussion of current concentrations observed for each plume area.) As such, this HHRA likely overestimates risks from exposure to groundwater at Parcel B (see Attachment A4).

A4.4 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

COPCs are chemicals that are carried through the quantitative exposure and risk characterization portions of the HHRA. COPCs represent the chemicals assumed to account for the majority of any estimated health effects at a site. COPCs were selected for surface soil, subsurface soil, A-aquifer groundwater, and B-aquifer groundwater based on the data groupings discussed in Sections A4.3.1 and A4.3.2 and the steps described below. Steps 1 and 2 were used to select COPCs for the total risk assessment for soil and the risk assessment for groundwater. An additional Step 3 was also used to select COPCs for the incremental risk assessment for soil.

- **Step 1** – The validated analytical data for soil and groundwater were tabulated. A preliminary list was developed of all of the chemicals detected in one or more samples of surface soil, subsurface soil, or groundwater. All detected organic and inorganic chemicals were included in this step, regardless of concentration, including chemicals with J-qualified results. All detected organic chemicals were identified as COPCs. All detected inorganic chemicals not considered essential human nutrients were identified as COPCs for the total risk evaluation (see Step 2). All detected inorganic chemicals not considered essential human nutrients and that exceeded background levels were identified as COPCs for the incremental risk evaluation (see Step 3).

- **Step 2** – Inorganic chemicals considered essential human nutrients (that is, calcium, magnesium, potassium, and sodium) were excluded as COPCs. EPA guidance states that these nutrients may be deleted because of their low toxicities when they are detected at environmental concentrations (EPA 1989). Although iron is also considered an essential nutrient, it was retained as a COPC for the HHRA because of the potential toxicity associated with exposure to iron at high concentrations.

- **Step 3** – As discussed in Section A2.0, this HHRA includes both a total and an incremental risk assessment for soil. Metals measured at maximum concentrations that were equal to or below HPALs were excluded as COPCs for the incremental risk assessment. HPALs represent ambient concentrations of metals in soil in the HPS area and are available for most of the metals detected in soil at Parcel B (PRC 1995). The HPALs are summarized below.

Metal	HPAL (mg/kg)	Metal	HPAL (mg/kg)
Antimony	9.05	Manganese	1,431
Arsenic	11.1	Mercury	2.28
Barium	314	Molybdenum	2.68
Beryllium	0.71	Nickel	See note 1
Cadmium	3.14	Selenium	1.95
Chromium	See note 1	Silver	1.43
Cobalt	See note 1	Thallium	0.81
Copper	124	Vanadium	117
Iron	58,000	Zinc	110
Lead	8.99		

Notes:

1 HPALs for chromium, cobalt, and nickel were calculated on a grid-specific basis for each residential grid and each industrial grid with analytical data for these metals using a regression approach. The regression approach for these metals is detailed in Tetra Tech (1999).

mg/kg Milligram per kilogram

As stated, the incremental risk assessment for soil excludes chemicals measured at maximum concentrations that do not exceed HPALs. However, some metals at ambient levels are associated with cancer risks or noncancer hazards above levels typically considered thresholds. Section A9.1 provides an analysis of cancer risks and noncancer hazards associated with ambient levels of metals in soil at HPS.

Hunters Point groundwater ambient levels (HGAL) have been developed for groundwater in the A-aquifer at HPS, and are likely applicable for groundwater in the B-aquifer. However, data for inorganic chemicals in the B-aquifer was not compared to HGALs in the HHRA as a conservative approach, and, incremental risks were not assessed for the groundwater domestic use evaluation.

Two sets of COPCs for groundwater were identified for the IR-10A, IR-10B, and IR-25 plumes and for each residential and industrial grid associated with non-plume wells. The first set of COPCs for groundwater was limited to all detected volatile chemicals to evaluate the groundwater vapor intrusion exposure pathway for residential and industrial receptors. Volatile chemicals are defined for this HHRA as chemicals with a molecular weight less than 200 grams per mole (g/mole) and Henry's law constant greater than 10^{-5} atmosphere-cubic meters per mole (EPA 2004a). For this HHRA, mercury in groundwater is considered volatile because mercury may dissolve in groundwater and partition from an aqueous to a gaseous phase. A second set of COPCs for groundwater was also identified using the first two steps outlined above and includes

both volatile and nonvolatile chemicals to evaluate exposures to groundwater by the construction worker in the A-aquifer.

As recommended by Cal/EPA (1993), data for specific total petroleum hydrocarbon indicator chemicals (for example, benzene, toluene, and benzo[a]pyrene) were used to assess potential human health risk from total petroleum hydrocarbons contamination. Nonchemical-specific data for total petroleum hydrocarbons should be excluded from evaluation in the risk assessment because they are considered inadequate and insufficient to evaluate risk from total petroleum hydrocarbon contamination (Cal/EPA 1993); therefore, nonspecific total petroleum hydrocarbon compounds were not identified as COPCs for this HHRA.

Tables A1-1, A1-2, A1-3, and A1-4 of Attachment A1 present analytical data summary statistics for each COPC evaluated for total risk. Tables A2-1, A2-2, A2-3, and A2-4 of Attachment A2 present analytical data summary statistics for each COPC evaluated for incremental risk. Tables A3-1 through A3-7 of Attachment A3 list the COPCs for groundwater and present summary statistics for analytical data for each groundwater COPC. Statistics were developed separately for each grid with analytical data in the tables.

A5.0 EXPOSURE ASSESSMENT

An exposure assessment identifies potential human receptors that could be exposed to site-related chemicals, as well as the routes, magnitude, frequency, and duration of the potential exposures. The principal objective of this evaluation is to identify reasonable maximum exposures (RME). As defined by EPA (1989), the RME is the maximum exposure that is reasonably expected to occur at a site. The potential human receptors and potentially complete exposure pathways for the receptors identified were presented in Section A3.0, Conceptual Site Model. The remainder of this section describes the process used to estimate EPCs and to quantify pathway-specific RME chemical intakes for each receptor. Central tendency exposures, as defined in EPA (1989), were not evaluated in this revised baseline HHRA.

A5.1 EXPOSURE POINTS AND EXPOSURE POINT CONCENTRATIONS

Potential exposure points are identified based on anticipated population activity patterns and the relationship of the activities to the presence of contaminated media. A location is identified as an exposure point if a human might contact (for example, ingest) a contaminated medium (for example, soil) at that location. Each residential and industrial grid was considered a separate exposure point for this HHRA to evaluate exposures to soil and exposure to groundwater not associated with plumes. The area encompassed by each plume (see Attachment A3 to this appendix) was considered a separate groundwater exposure point for each of the groundwater plumes (IR-10A, IR-10B, and IR-25). Potential exposure to COPCs is assumed to occur uniformly throughout each exposure point.

The concentration in the medium (for example, subsurface soil) that a receptor may be exposed to is called the EPC. EPCs were calculated for all COPCs in all media sampled: surface soils

(0 to 2 feet bgs), subsurface soils (0 to 10 feet bgs), A-aquifer groundwater, and B-aquifer groundwater. The methods used to calculate EPCs for soil and groundwater are described below in Sections A5.1.1 and A5.1.2, respectively.

As shown in the conceptual site model (see Figure A-1), chemicals in soil may be transferred to outdoor air from wind erosion or volatilization, or to vegetation from root uptake. Chemicals in groundwater may be transferred to outdoor air in a construction trench from volatilization, indoor air from vapor intrusion, and indoor air from volatilization of groundwater during domestic use. Data for outdoor and indoor air and vegetation were not available for Parcel B. EPCs in outdoor air (from volatile and particulate chemicals in soil), outdoor air in a construction trench (from volatile chemicals in groundwater), indoor air (from groundwater vapor intrusion), and homegrown produce (from root uptake of chemicals in soil) were therefore estimated using the methods described in Section A5.1.3.

A5.1.1 EPCs for Soil

The 95 percent upper confidence limit (95UCL) of the arithmetic mean was used as the EPC for each COPC in soil unless the maximum value was less than the 95UCL, in which case the maximum concentration was used as the EPC. The 95UCL for each COPC in soil in each grid was calculated using the following methodology. This methodology is consistent with the approach used for the HHRA for soil in the draft final RI report for Parcel B (PRC and others 1996) and follows the methodology recently re-established for soil HHRAs for HPS (Tetra Tech 2003; Navy 2004):

- Statistical testing was conducted to determine data distribution for sample sizes with a minimum of four samples and four detections. The Shapiro-Wilk W-test was used to determine the distribution of the data for samples sizes less than or equal to 50 with at least four detections. Conversely, the D'Agostino test was used to determine the distribution of the data for sample sizes greater than or equal to 50 with at least four detections.

- The 95UCLs were calculated using EPA (1992) guidance for data found to be normally or lognormally distributed.

- If distribution testing showed that data follow a non-parametric distribution, then a 95UCL was calculated for both a normal and lognormal distribution following EPA guidance (EPA 1992). In this case, the higher of the two 95UCL values was selected as the representative 95UCL. Nondetected results for COPCs were incorporated into calculation of 95 UCL concentrations by using one-half of the sample quantitation limit as a proxy concentration for nondetected results (EPA 1989).

- Distribution testing was not conducted for samples sizes with less than four samples, and the maximum concentration was used as the EPC.

EPCs for each COPC in surface soil and subsurface soil in the total risk assessment are shown in Tables A1-1, A1-2, A1-3, and A1-4 of Attachment A1. EPCs for each COPC in surface soil and subsurface soil for the incremental risk assessment are shown in Tables A2-1, A2-2, A2-3, and A2-4 of Attachment A2. These tables also present the results of the distribution testing for each COPC and the calculated 95UCLs.

Although more recent guidance on calculation of EPCs is available (see Section A5.1.2), the previous guidance provided by EPA (1992) was used to calculate EPCs for soil in this revised HHRA in accordance with the recent methodology established for soil HHRAs for HPS (Tetra Tech 2003; Navy 2004). In many cases, the maximum concentration is used as the EPC because of the relatively few sample points and detections for each grid (that is, less than four samples and four detected results), resulting in a conservative estimate of potential risks.

A5.1.2 EPCs for Groundwater

Separate EPCs for groundwater were developed to evaluate exposure areas associated with plumes and exposure areas that are not associated with plumes (see Section A4.3.2). The lesser of the 95UCL or maximum concentration was used as the EPC for each COPC in each plume to evaluate exposures associated with the IR-10A, IR-10B, and IR-25 plumes. The methods used to calculate 95UCLs for each plume are described below. Tables A3-1, A3-2, and A3-3 of Attachment A3 present summary statistics for analytical data for each plume-based exposure area.

The maximum detected concentration was used as the EPC for exposure areas that are not associated with plumes (that is, for areas with monitoring wells that do not fall within the plume boundaries delineated in Attachment A3). Tables A3-4, A3-5, A3-6, and A3-7 of Attachment A3 present summary statistics for analytical data, including maximum concentrations (EPCs), for exposure areas that are not associated with plumes.

The methods used to calculate EPCs for groundwater associated with plumes is based on more recent EPA methodology (*ProUCL Version 3.0 User Guide* [Singh, Singh, and Maichle 2004]). This methodology incorporates the Lilliefors Test, rather than the D'Agostino Test, to determine distributions for data sets exceeding 50 samples. Only detected results were used to calculate the EPCs for groundwater associated with plumes. Nondetected results (that is, U- and UJ-qualified data), were not included in the EPC calculation.

The calculation of groundwater EPCs for plume-based exposure areas was restricted to detected results to limit the uncertainty associated with the EPCs. The groundwater data set for the HHRA consisted of samples collected over a number of years (that is, the last 12 rounds of sampling). Use of 12 rounds of sampling can introduce significant uncertainty to the EPCs for groundwater because sampling methods for groundwater have varied over time and groundwater is a dynamic medium. For example, earlier sampling methods for groundwater at HPS are frequently associated with elevated detection limits that exceed maximum detected concentrations. The approach used in developing groundwater EPCs limits the influence of

historical nondetected results on the calculated EPCs. This approach differs from EPA methodology for calculating EPCs, which recommends use of one-half of the sample quantitation limit (SQL) as a proxy concentration for nondetected results (EPA 1992). However, the analytical results for some chemicals measured in groundwater at Parcel B consist of nondetected results for which one-half of the SQL exceeds the detected results. To address the potential underestimate of risks associated with limiting the data set used to calculate groundwater EPCs for plume-based exposure areas to only detected results, risks from exposure to groundwater were evaluated for both an RME scenario and a maximum concentration exposure (MAX) scenario. This approach provides an additional measure of conservatism to the risk evaluation for plume-based exposure areas because risks calculated using maximum concentrations as EPCs represent worst-case scenario results. The potential uncertainties associated with elevated detection limits for groundwater data on the risk evaluation for groundwater are discussed in Section A9.6.

Statistical estimations lack statistical power and cannot be confidently estimated for data sets with fewer than six samples (EPA 2000). As discussed above, only detected results were used to calculate EPCs for groundwater for plume-based exposure areas; the maximum detected concentration was used as the EPC for data sets with fewer than six detections, rather than with six samples. A 95UCL was used as the EPC for COPCs in groundwater associated with plumes for data sets consisting of six or more detections. The following methods were used to calculate the underlying distribution for each chemical, population summary statistics, and EPCs.

Distribution tests: Distribution testing was conducted for all samples with at least six measurements. Formal tests were conducted using well-established goodness-of-fit tests. The Shapiro-Wilk W-Test ($n < 50$) and Lilliefors Test ($n > 50$) were used to evaluate normal and lognormal distributions. The Anderson-Darling and Kolmogorov-Smirnov Test were used to evaluate gamma distributions (Singh, Singh, and Maichle 2004; EPA 2002b). A Type I error rate (α) of 0.05 (equivalent to 5 percent) was used to interpret the significance of each test. A Type I error rate of 0.05 means that there is a 5 percent chance that the null hypothesis will be rejected when it is true, leading to the false conclusion.

Chemical data confirmed as following a normal, lognormal, or gamma distribution based on the outcome of the two goodness-of-fit tests are listed as "normal (N)", "lognormal (L)," or "gamma (G)" in the summary tables (see Tables A3-1, A3-2, and A3-3 of Attachment A3). Chemical data that were not confirmed as following one of these three distributions are listed as "nonparametric (NP)" in the summary tables.

Calculation of Population Parameters and Selection of the EPC: The one-sided UCLs on the mean were calculated for chemicals with at least six samples. Recommendations in Singh, Singh, and Maichle (2004) are based on three properties measured for individual samples: (1) best-fit distribution, (2) relative degree of skewness, and (3) relative sample size. The recommendations for calculating an EPC for normal, gamma, lognormal, and nonparametric distributions are provided by the ProUCL software (EPA 2004b). EPCs for data that follow a normal distribution or that exhibit low skewness (standard deviation of the natural logarithms of the data less than 0.50) are based on a UCL calculated using the Student's t-statistic. After a

sample-by-sample evaluation of the three properties described above, a UCL is calculated based on one of the parametric or nonparametric methods listed below.

Parametric Methods	Nonparametric Methods	
Student's t UCL	Chebyshev inequality UCL	Central limit theorem
Approximate gamma UCL	Bootstrap t UCL	Modified-t statistic
Adjusted gamma UCL	Hall's bootstrap UCL	Adjusted-CLT
Land's H-UCL	Modified-t UCL	Percentile bootstrap
Minimum variance	Standard bootstrap UCL	Jackknife UCL
Unbiased estimator (MVUE) Chebyshev UCL		

The UCL calculated using the MVUE Chebyshev or nonparametric Chebyshev method can be based on a 95, 97.5, or 99 percent one-sided UCL. The 95UCLs calculated for groundwater for plume-based exposure areas are shown in Tables A3-1, A3-2, and A3-3 of Attachment A3. These tables also present the results of the distribution testing for each chemical. If the calculated 95UCL was greater than the maximum concentration, then the maximum concentration was used as the EPC for the RME scenario. For the MAX scenario, maximum concentrations were used as EPCs.

A5.1.3 Exposure Point Concentrations for Media Not Sampled

As discussed in Sections A3.0 and A5.1, COPCs in soil and groundwater may be transferred to outdoor air, indoor air, and vegetation (homegrown produce) from the following mechanisms:

- Wind erosion of particulate chemicals from soil to outdoor air
- Volatilization from soil to outdoor air
- Vapor intrusion from groundwater to indoor air
- Volatilization from groundwater to indoor air during domestic use
- Volatilization from groundwater to outdoor air in a construction trench
- Uptake of chemicals in soil through plant roots into homegrown produce

Samples were not collected of outdoor air, indoor air, or vegetation at Parcel B. In the absence of direct measurements of chemical concentrations in air and vegetation, models were used to estimate EPCs in outdoor air, indoor air, and homegrown produce as a result of the transfer mechanisms. These models are discussed below. EPCs for indoor air as a result of vapor intrusion of groundwater and volatilization from domestic use of groundwater were not calculated because a risk-based screening assessment was used to quantify risks from exposure to COPCs in groundwater (see Section A7.2).

A5.1.3.1 Outdoor Air – Particulate COPCs Released from Soil

EPCs of particulates released from soil to outdoor air were estimated using EPCs for soil as the source term and the methodology provided by EPA Region 9 in its memorandum that describes the derivation of PRGs (EPA 2004a). To derive the EPCs in outdoor air, the EPC for soil was multiplied by the reciprocal of the EPA (2004a) default particulate emission factor of 1.316E+09 cubic meters per kilogram, which is a non-chemical-specific value that relates chemical concentrations in soil to airborne concentrations that may be inhaled.

A5.1.3.2 Outdoor Air – Volatile COPCs Released from Soil

Chemical-specific volatilization factors, which relate concentrations of volatile chemicals in soil to airborne concentrations that may be inhaled, were used to estimate concentrations in outdoor air from volatile COPCs in soil. Volatilization factors were taken from EPA Region 9 guidance (EPA 2004a) and are summarized in Table A-2. The EPC for soil was multiplied by the reciprocal of the volatilization factor to estimate EPCs in outdoor air. As discussed in Section A4.4, mercury in groundwater is considered volatile because mercury may dissolve in groundwater and partition from an aqueous to a gaseous phase. When present in soil, partitioning of mercury to a gaseous phase is minimal because mercury in soil complexes with anions and forms mercury compounds with limited mobility and volatility. For this reason, mercury in soil is not considered volatile and is only evaluated as a particulate COPC when released to air (see Section A5.1.3.1).

A5.1.3.3 Indoor Air – Vapor Intrusion of Volatile COPCs in Groundwater

Subsurface vapor intrusion of volatile COPCs in groundwater into a hypothetical residential or standard industrial building was evaluated for the industrial and residential exposure scenarios. A risk-based screening assessment was used to calculate risks from groundwater vapor intrusion, based on EPCs for groundwater developed for each A-aquifer plume and non-plume exposure area and risk-based screening levels (RBSL). Section A7.2 provides further details on this approach. EPCs were not modeled for indoor air from EPCs in groundwater because a risk-based screening assessment approach was used to evaluate groundwater vapor intrusion.

A5.1.3.4 Indoor Air – Volatilization of COPCs in Groundwater during Domestic Use

Volatilization of volatile COPCs in groundwater into household air during domestic use of groundwater was evaluated for the residential exposure scenario based on EPCs for groundwater developed for the B-aquifer. A risk-based screening assessment was used to calculate risks from domestic use of groundwater (see Section A7.2). Section A7.2 provides further details on this approach. EPCs were not developed for indoor air based on volatilization of COPCs in groundwater during domestic use because a risk-based screening assessment approach was used to evaluate risks from domestic use of groundwater.

A5.1.3.5 *Outdoor Air – Volatile COPCs Released from Groundwater in a Construction Trench*

Chemical-specific volatilization factors that relate concentrations of volatile chemicals in groundwater accumulated in a construction trench to airborne concentrations that may be inhaled by construction workers were used to estimate EPCs from volatile COPCs in groundwater. The volatilization factors for this scenario were calculated based on guidance from the Virginia Department of Environmental Quality (2005). This guidance combines a vadose zone model to estimate volatilization of gaseous COPCs from groundwater into a trench and a box model to estimate dispersion of the COPCs from the air inside the trench into aboveground air. A full description of the models used to estimate volatilization into a construction trench is provided in Attachment A5 to this appendix.

A5.1.3.6 *Homegrown Produce – Uptake of COPCs in Soil through Plant Roots*

Ingestion of COPCs that are transferred from soil to homegrown produce via uptake through plant roots was evaluated for the residential exposure scenario. Direct measurements of chemical concentrations in homegrown produce are not available for Parcel B because homegrown produce is not currently grown there. EPCs for homegrown produce were calculated based on EPCs for COPCs in soil and soil-to-plant uptake factors that estimate the root uptake of inorganic and organic chemicals in soil and translocation of chemicals to edible plant parts (U.S. Department of Energy 1984). Table A-3 lists the uptake factors for each COPC in soil.

Uptake factors for inorganic COPCs were obtained from U.S. Department of Energy (1984). The EPC for soil was multiplied by the uptake factor to estimate EPCs in homegrown produce from inorganic COPCs.

Equations from Cal/EPA were used to derive the uptake factors for nonvolatile organic COPCs (Cal/EPA 2003). These equations relate the octanol-water partition coefficient (K_{ow}) and the organic carbon-water partition coefficient (K_{oc}) of the contaminant and the fraction of organic carbon (F_{oc}) in the soil to calculate the uptake factor. The equation used to calculate the uptake factor is as follows:

$$UF = \frac{(0.03 \times K_{ow}{}^{0.77}) + 0.82}{(K_{oc})(F_{oc})} \qquad \text{(A-1)}$$

where

UF	=	Soil-to-plant uptake factor
K_{ow}	=	Octanol-water partition coefficient (cubic centimeters per gram)
K_{oc}	=	Organic carbon-water partition coefficient (cubic centimeters per gram)
F_{oc}	=	Fraction organic carbon in soil (unitless)

F_{oc} was assumed to be 0.1, a value appropriate to soil used for the production of food crops (Cal/EPA 2003). If K_{oc} values are unavailable, they were estimated based on chemical-specific K_{ow} values using the following equation (Lyman and others 1990):

$$Log\ K_{oc} = log\ K_{ow} - 0.21 \qquad \text{(A-2)}$$

Consistent with EPA guidance, a correction factor was applied to lipophilic COPCs (EPA 1998). Lipophilic chemicals were defined for this HHRA as polychlorinated biphenyls, polynuclear aromatic hydrocarbons, pesticides, and semivolatile organic compounds. EPA (1998) recommends a correction factor of 0.01 for lipophilic COPCs (log K_{ow} greater than 4); that is, the uptake factor calculated for lipophilic COPCs using Equation A-1 should be multiplied by the correction factor of 0.01 to calculate a corrected uptake factor. EPA does not recommend use of a correction factor for COPCs with a log K_{ow} less than 4. Table A-3 lists the uptake factors for nonvolatile organic COPCs derived using the above equations and the values and sources of the chemical data used to derive the uptake factors.

Risks associated with VOCs were not evaluated in the homegrown produce pathway. VOCs are typically low-molecular-weight chemicals that do not persist or bioaccumulate in the environment (EPA 1994b). In addition, VOCs are expected to be lost during soil tilling, planting, and food preparation, such as peeling, cleaning, and cooking.

A5.2 CHEMICAL INTAKE ESTIMATES

Estimates of exposure are based on the EPCs (as described in Section A5.1) and scenario-specific assumptions and intake parameters. Consistent with EPA guidance (EPA 1995), exposure estimates (intakes) were calculated for an RME scenario for each receptor and exposure pathway and are expressed in terms of milligrams of chemical per kilogram body weight per day (mg/kg-day). The RME represents the highest exposure reasonably expected to occur and is calculated using the 95UCL and the RME exposure parameters.

EPA-derived exposure algorithms were used to estimate the chemical intakes for each route of exposure. Equation A-3 is a generic equation for calculating chemical intake as follows (EPA 1989):

$$I = \frac{C \times CR \times EF \times ED}{BW \times AT} \qquad \text{(A-3)}$$

where

I	=	Intake: the amount of chemical at the exchange boundary (mg/kg-day)
C	=	Chemical concentration: the EPC (for example, milligrams per kilogram [mg/kg] for soil)
CR	=	Contact rate: the amount of contaminated medium contacted per unit of time or event; may be the ingestion rate, inhalation rate, or dermal contact rate (for example, milligram per day for the ingestion rate of soil)
EF	=	Exposure frequency: how often the exposure occurs (days per year)
ED	=	Exposure duration: the number of years in which a receptor comes in contact with the contaminated medium (years)
BW	=	Body weight: the average body weight of the receptor over the exposure period (kilograms)
AT	=	Averaging time: the period over which exposure is averaged (days); for carcinogens, the averaging time is 25,550 days on the basis of a lifetime exposure of 70 years (average life expectancy), and for noncarcinogens, the averaging time is equal to the exposure duration multiplied by the number of days in a year (365 days)

Pathway-specific variations of Equation A-3 were used to calculate intakes of COPCs in soil for residential, industrial, recreational, and construction worker receptors, and COPCs in groundwater for construction worker receptors. Tables A-4 through A-9 present the pathway-specific equations and receptor-specific exposure assumptions used to calculate intakes. The calculation of chemical intake for the dermal contact with soil exposure pathway (all receptors) requires chemical-specific dermal absorption factors; these factors are shown in Table A-2. The calculation of chemical intake for the dermal contact with groundwater exposure pathway (construction worker) requires chemical-specific permeability constants; these factors are shown in Table A-10. Standard (default) exposure assumptions for evaluating construction worker contact with groundwater during excavation or trenching are not available from EPA or DTSC. The assumptions selected for this exposure scenario were based on professional judgment; the likelihood that the selected assumptions may contribute to an over- or underestimate of risks is discussed in Section A9.5.

Chemical intakes from groundwater exposure pathways for residential receptors (ingestion, inhalation during household use, and vapor intrusion) and industrial receptors (vapor intrusion) were not calculated because a risk-based screening assessment was used to quantify risks from exposure to COPCs in groundwater for these receptors (see Section A7.2).

A6.0 TOXICITY ASSESSMENT

The toxicity assessment identifies toxicity values used to quantify potential adverse health effects associated with exposure to COPCs at Parcel B. These toxicity values include references doses (RfD) for noncancer health effects and slope factors (SF) for estimating cancer risks. An RfD represents an estimated daily intake of a COPC that is expected to pose no appreciable risk of harmful effects to human health, including sensitive populations, over a lifetime. RfDs are specific to each chemical and exposure route such as inhalation or ingestion.

The SF is an upper-bound estimate of the probability of a cancer response per unit dose of a carcinogen over a lifetime. The cancer risk estimate associated with a given intake of a cancer COPC was estimated by multiplying the intake by the SF for each COPC. SFs assume that no threshold exists for the initiation of cancer and are specific to each chemical and exposure route.

Toxicity values were obtained from the following hierarchy of sources. If the SF from an EPA source (Tiers 2 through 6) was higher than the Cal/EPA SF (Tier 1), then the more conservative (higher) SF was used in the HHRA.

- Tier 1 – Cal/EPA's Office of Environmental Health Hazard Assessment's toxicity criteria database (Cal/EPA 2005a), which contains approved SFs. The SFs in this database have undergone review and are recognized toxicity values for evaluations in California.
- Tier 2 – EPA's Integrated Risk Information System (EPA 2005). The RfDs and SFs have undergone review and are recognized as agency-wide consensus information.
- Tier 3 – EPA's Provisional Peer-Reviewed Toxicity Values database, which is an online database that contains approved RfDs and SFs (EPA 2004c). The RfDs and SFs provided in this database have undergone review and are recognized as consensus information.
- Tier 4 – Other EPA values, as presented in the EPA Region 9 PRG table (EPA 2004a).
- Tier 5 – EPA's Health Effects Assessment Summary Tables (EPA 1997).
- Tier 6 – For noncancer effects from inhalation route exposures, Cal/EPA Office of Environmental Health Hazard Assessment chronic reference exposure levels (Cal/EPA 2005b).

Tables A-11 and A-12, respectively, present the SFs and RfDs used in the HHRA. Special considerations for route-to-route extrapolations, selection of surrogates, evaluation of TCE, and evaluation of lead are discussed in Sections A6.1 through A6.4.

A6.1 ROUTE-TO-ROUTE EXTRAPOLATION

Toxicity values are available for only one route of exposure (that is, for only the inhalation or the oral exposure routes) for some chemicals. In some of these cases, route-to-route extrapolations were conducted so that toxicity values developed for one route of exposure (for example, the oral route) can be applied to another (for example, the inhalation route). This approach assumes that toxicity is identical regardless of the route of exposure. Route-to-route extrapolations are recommended for organic compounds by the State of California (Cal/EPA 1992) and are used by EPA Region 9 to develop PRGs (EPA 2004a).

Route-to-route extrapolations were used for organic COPCs for the following cases:

- If an oral toxicity value (RfD or SF) had been assigned for an organic compound but no inhalation toxicity value was available, the oral toxicity value was also used as the inhalation toxicity value.
- If an inhalation toxicity value had been assigned for an organic compound but no oral toxicity value was available, the inhalation toxicity value was also used as the oral toxicity value.

Route-to-route extrapolations were not used for metals because toxicological endpoints for metals depend heavily on the exposure route (EPA 2004a). Route-to-route extrapolations for organic compounds and other exceptions to the RfDs and SFs used in the HHRA are denoted with an "R" (for "route extrapolated") in Table A-12. Oral absorption efficiency was assumed to be 100 percent for all COPCs; that is, oral toxicity values were not adjusted for absorption efficiency to evaluate the dermal pathway.

A6.2 SURROGATES

Because of a lack of toxicity values for some COPCs, chemical surrogates were used to avoid data gaps in the HHRA. Chemical surrogates were selected based on similar chemical structure and are identified in Tables A-11 and A-12.

A6.3 TRICHLOROETHENE

EPA withdrew its previously published toxicity values for TCE in 1988. EPA has not published finalized toxicity values for TCE since the original values were withdrawn because of uncertainties relating to the science of TCE toxicity. In 2001, EPA's Office of Research and Development completed a preliminary draft reassessment of health risks posed by TCE (EPA 2001). This preliminary draft reassessment proposes toxicity values that are much more conservative than the values withdrawn by EPA, and these suggested toxicity values are now the subject of much debate. As such, the scientific community is divided on whether to use the withdrawn values, the new suggested values, or some other values for calculating risks.

As a result, the SFs developed by Cal/EPA for TCE, although less conservative than the EPA (2001) provisional cancer SFs for TCE, were used to evaluate cancer risks from exposure to TCE. A quantitative analysis of the uncertainties associated with the SFs for TCE is presented in Section A9.0 and Attachment A7. Uncertainties specific to the provisional cancer SFs for TCE were analyzed in this HHRA because the differences between the EPA provisional SFs for TCE, EPA's withdrawn SFs for TCE, and the Cal/EPA SFs for TCE are significant and can affect the risk results. Although provisional or draft toxicity criteria are used to evaluate several other COPCs, use of provisional or draft values for these other COPCs does not affect the risk results.

A6.4 LEAD

No RfD or SF is currently available for evaluating health risks from exposure to lead. Therefore, the HHRA evaluated the potential for human health effects from exposure to lead by comparing EPCs for lead with a HPS-specific risk-based concentration for lead for residential and recreational receptors. These values also were compared with the EPA Region 9 industrial PRG for lead for industrial and construction worker receptors. Section A7.4 and Attachment A6 detail the methodology used to evaluate lead.

A7.0 RISK CHARACTERIZATION METHODS

The final step in this revised baseline HHRA is characterization of the potential risks associated with exposure to COPCs. Risks from exposure to soil for all receptors and from construction worker exposure to groundwater were characterized using the methodology provided in EPA (1989); Section A7.1 details this methodology. Risks from industrial and residential exposure to groundwater were characterized using a risk-based screening assessment approach; Section A7.2 presents this methodology. Section A7.3 discusses the interpretation of hazard and risk levels. Section A7.4 discusses the risk characterization approach for lead. The results of the risk characterization for Parcel B are presented in Section A8.0.

A7.1 RISK CHARACTERIZATION FOR SOIL EXPOSURES AND CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER

The general methodology for estimating cancer risks and HIs for soil exposures for all receptors and construction worker exposure to groundwater follows EPA (1989) and is presented in Section A7.1.1 for cancer risks and in Section A7.1.2 for noncancer health hazards.

A7.1.1 Characterization of Cancer Risks

Risks associated with exposure to chemicals classified as carcinogens are estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of an exposure (EPA 1989). The estimated risk is expressed as a unitless probability.

Three steps are used in estimating cancer risks for chemicals classified as carcinogens. First, the chemical intake is multiplied by the chemical-specific SF to derive a cancer risk estimate for a single chemical and pathway. The calculation is based on the following relationship:

$$Chemical\text{-}Specific\ Cancer\ Risk = Intake\ (mg/kg\text{-}day) \times SF\ (mg/kg\text{-}day)^{-1} \quad \text{(A-4)}$$

Second, the individual chemical cancer risks are assumed to be additive to estimate the cancer risk associated with exposure to multiple carcinogens for a single exposure pathway, as follows:

$$Pathway\text{-}Specific\ Cancer\ Risk = \sum Chemical\text{-}Specific\ Cancer\ Risk \quad \text{(A-5)}$$

Third, pathway-specific risks are summed for each receptor to estimate the total cancer risk. For exposures scenarios for which both an adult and child receptor are evaluated (that is, residential and recreational), the estimated cancer risk is based on the sum of the risk estimated for the adult receptor plus the child receptor. Hence, for the residential receptor, the estimated cancer risk is based on the sum of the risk estimated for the adult resident and the child resident. Likewise, for the recreational receptor, the estimated cancer risk is based on the sum of the risk estimated for the adult recreational user and the child recreational user.

A7.1.2 Characterization of Noncancer Hazards

The potential for exposure that may result in adverse health effects other than cancer is evaluated by comparing the intake with an RfD for chemicals that are not classified as carcinogens and for those carcinogens known to cause adverse health effects other than cancer. A three-step approach is used as described below:

Calculate a chemical-specific hazard quotient (HQ) based on the following equation:

$$Hazard\ Quotient = \frac{Intake\ (mg/kg\text{-}day)}{RfD\ (mg/kg\text{-}day)} \quad \text{(A-6)}$$

Next, sum the HQs for all chemicals to evaluate the potential for noncancer health effects from simultaneous exposure to multiple chemicals, yielding an HI as follows:

$$Hazard\ Index = \sum HQ \quad \text{(A-7)}$$

Third, sum pathway-specific HIs to estimate a total HI for each receptor.

The total noncancer HI for the residential and recreational receptors is based on the total HI estimated for the child receptor because the intake for children of soil, groundwater, and air per unit body mass is higher. (Hence, noncancer HIs for a child receptor are always higher than noncancer HIs for an adult receptor for similar exposures.)

A7.2 RISK CHARACTERIZATION FOR RESIDENTIAL AND INDUSTRIAL EXPOSURE TO GROUNDWATER

Residential and industrial receptors were evaluated for exposure to groundwater from vapor intrusion. Residential receptors were also evaluated for exposure to groundwater from domestic use. Based on meetings between EPA, DTSC, and the Navy in 2003 and 2004, the risks from these exposure pathways are based on a risk-based screening assessment.

The risk-based screening assessment is a streamlined approach that uses the ratio of EPCs to RBSLs. For this HHRA, RBSLs for domestic use of groundwater (DU-RBSL) were used to estimate cancer risks and noncancer hazard indices from residential exposure to B-aquifer groundwater. These DU-RBSLs were calculated based on the EPA (2004a) Region 9 methodology for development of tap water PRGs. RBSLs for groundwater vapor intrusion (VI-RBSL) were used to estimate cancer risks and HIs from residential and industrial exposure to A-aquifer groundwater. These VI-RBSLs were calculated based on the EPA (2002a) methodology for development of groundwater vapor intrusion screening concentrations. The calculated RBSLs correspond to a cancer risk of 10^{-6} or an HI of 1 based on standardized equations that combine standard exposure assumptions and EPA and Cal/EPA toxicity values.

The risk estimates developed using the risk-based screening approach represent the risk for all exposure pathways evaluated by the RBSLs (that is, the exposure pathways evaluated by the EPA Region 9 tap water PRGs for domestic use and EPA groundwater screening levels for groundwater vapor intrusion). These risk estimates are numerically equivalent to the estimates obtained using the EPA (1989) "forward calculation methodology," which involves calculating risks using contaminant concentrations, exposure assumptions, and toxicity values (see Section A6.0). They are numerically equivalent if the exposure pathways and assumptions used to derive the RBSLs are the same as are used in the forward calculations.

DU-RBSLs for domestic use were calculated based on the EPA (2004a) Region 9 methodology for development of tap water PRGs. The calculated DU-RBSLs are identical to the EPA Region 9 tap water PRGs with one exception: the toxicity values used for calculation of the DU-RBSLs are based on the toxicity value hierarchy described in Section A6.0 (Tables A-11 and A-12 list the toxicity criteria used to calculate DU-RBSLs.) The EPA tap water PRGs evaluate residential exposure to groundwater from ingestion and from inhalation of VOCs released from groundwater to indoor air during household use. Similar to the EPA tap water PRGs, the calculated DU-RBSLs do not account for exposure from dermal contact with groundwater; Section A9.4 addresses the uncertainties associated with excluding this exposure pathway on the risk results.

VI-RBSLs were calculated based on the EPA (2002a) methodology for development of groundwater vapor intrusion screening concentrations. The calculated VI-RBSLs are identical to the groundwater vapor intrusion screening concentrations provided in Table 2c of EPA's "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)" (EPA 2002a) with one exception: the toxicity values used for calculation of the VI-RBSLs are based on the toxicity value hierarchy described in Section A6.0 (Tables A-11 and A-12 list the toxicity criteria used to calculate DU-RBSLs.)

The following factors were considered in using the EPA (2002a) methodology for developing screening levels for groundwater vapor intrusion in the risk-based screening assessment for groundwater; these factors also apply to the calculated VI-RBSLs:

- The screening concentrations provided in Table 2c of EPA (2002a) are based on generic attenuation factors that assume minimum reduction of contaminant concentrations caused by diffusive, advective, and other attenuating mechanisms. These conditions are similar to conditions in groundwater and soil at HPS, where groundwater is relatively shallow and vadose zone soils are fairly coarse (see Section 2.0 of the Parcel B TMSRA).

- The screening concentrations provided in Table 2c of EPA (2002a) for some chemicals are based on federal maximum contaminant levels; for these chemicals, a VI-RBSL was calculated following the methodology provided in EPA (2002a) for deriving screening concentrations for vapor intrusion, and the calculated VI-RBSL was used in lieu of the maximum contaminant level.

- The screening concentrations provided in Table 2c of EPA (2002a) are considered protective of residential exposure. For evaluation of industrial exposures, VI-RBSLs for industrial exposure via groundwater vapor intrusion were calculated using the methodology provided in EPA (2002a) and the assumptions provided in Table A-6 of this appendix for industrial worker exposure to air.

Table A-13 lists the calculated DU-RBSLs and VI-RBSLs for groundwater used for this HHRA. Table A-13 indicates in boldface when use of the toxicity hierarchy described in Section A6.0 results in a DU-RBSL that differs from the respective EPA (2004a) tap water PRG, or a vapor intrusion RBSL that differs from the respective EPA (2002a) groundwater vapor intrusion screening concentration.

Cancer risks and noncancer hazards were calculated by comparing site EPCs of each COPC with the corresponding RBSL, as detailed in the following text. As discussed in Section A5.1.2, for plume-based exposure areas, risks were evaluated for both an RME and MAX scenario. For the RME scenario, the EPC was based on the lesser of the 95UCL and maximum concentration. For the MAX scenario, the EPC was based on the maximum concentration. For nonplume-based exposure areas, EPCs were based on maximum concentrations.

A7.2.1 Characterization of Cancer Risks

The cancer risk associated with exposure to a single chemical for COPCs that are carcinogens is calculated as follows:

$$Cancer\ risk = (EPC/RBSL) \times 10^{-6} \qquad \text{(A-8)}$$

where:

EPC = Exposure point concentration (microgram per liter [µg/L])

RBSL = Risk-based screening level (µg/L)

Individuals may be exposed to more than one chemical at a given site. The total risk from exposure to multiple chemicals is calculated using the following equation:

$$Total\ risk = 10^{-6} \times \{EPC_1/RBSL_1 + EPC_2/RBSL_2 + \ldots EPC_n/RBSL_n\} \quad \text{(A-9)}$$

Where:

Total risk = Total cancer risk from exposure to all chemicals (unitless)

EPC_n = Exposure point concentration of chemical *n* (µg/L)

$RBSL_n$ = Risk-based screening level for chemical *n* (µg/L)

A7.2.2 Characterization of Noncancer Hazards

The potential for receptors to develop adverse health effects for COPCs not classified as carcinogens and for carcinogens known to cause adverse health effects other than cancer is evaluated by comparing EPCs with noncancer RBSLs as follows:

$$Hazard\ quotient = EPC/RBSL \quad \text{(A-10)}$$

where

EPC = Exposure point concentration (µg/L)

RBSL = Risk-based screening level (µg/L)

The HQs for all chemicals are summed to evaluate the potential for noncancer effects from exposure to multiple chemicals, yielding an HI as follows:

$$Hazard\ index = EPC_1/RBSL_1 + EPC_2/RBSL_2 + \ldots + EPC_n/RBSL_n \quad \text{(A-11)}$$

where:

EPC_n = Exposure point concentration of chemical *n* (µg/L)

$RBSL_n$ = Risk-based screening level for chemical *n* (µg/L)

A7.3 INTERPRETATION OF HAZARD AND RISK LEVELS

EPA guidance on exposure levels considered protective of human health is presented to aid in interpreting the results of the risk assessment. In the National Oil and Hazardous Substances Pollution Contingency Plan, EPA defined general remedial action goals for sites on the National Priorities List (Title 40 of the *Code of Federal Regulations* Part 300.430). The goals include a range for residual cancer risk, which is "an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}," or 1 in 10,000 to 1 in 1,000,000. The goals set out in the National Oil and Hazardous Substances Pollution Contingency Plan are applied once a decision to remediate a site has been made. A more recent EPA directive provides additional guidance on the role of the HHRA in supporting risk management decisions, and in particular, determining whether remedial action is necessary (EPA 1991). Specifically, the guidance states, "Where cumulative carcinogenic risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the noncancer HQ is less than 1, action generally is not warranted unless there are adverse environmental impacts." EPA Region 9 has stated, however, that action may be taken to address risks between 10^{-4} and 10^{-6}. In addition, DTSC has stated that it considers 10^{-6} as the point of departure for risk management decisions. To be protective of human health, therefore, the BCT has chosen to use 10^{-6}, the lower end of the residual 10^{-4} to 10^{-6} risk range set out in the National Oil and Hazardous Substances Pollution Contingency Plan, as a threshold level for cancer risks for HPS.

An HI of less than 1.0 indicates that adverse noncancer health effects are not expected. In accordance with EPA guidance (EPA 1989), the HHRA further evaluated exposure areas with total HIs that exceeded 1. Noncancer health effects associated with exposure to multiple COPCs may not be cumulative if the COPCs affect different target organs or systems within the body. Therefore, the HHRA segregates the HI by target organ or system and assumes that the potential for noncancer health effects exists only if the highest total segregated HI for a target organ or system exceeded 1. Table A-14 identifies the target organs affected by each COPC for Parcel B; this information was used, as necessary, to segregate HIs by target organ. Information on target organs was obtained from Integrated Risk Information System (EPA 2005), Health Effects Assessment Summary Tables (EPA 1997), Provisional Peer Reviewed Toxicity Values for Superfund database (EPA 2004c), and the Agency for Toxic Substances and Disease Registry (2005).

A7.4 EVALUATION OF LEAD

The HHRA evaluated the potential for human health effects from exposure to lead by comparing EPCs for lead with an HPS-specific risk-based concentration for lead (155 mg/kg) for residential and recreational receptors and the EPA (2004a) Region 9 industrial PRG for lead (800 mg/kg) for industrial and construction worker receptors. The HPS risk-based concentration for lead was developed using the Cal/EPA (1999b) LeadSpread model and EPA's Integrated Exposure Uptake Biokinetic model. The methodology for development of the HPS risk-based concentration for lead is presented in Attachment A6 to this appendix. The Region 9 industrial PRG for lead was developed by EPA using EPA's adult lead model (EPA 1996). These models are designed to predict the concentration of lead in soil associated with a target blood lead level of 10 micrograms per deciliter, the EPA threshold level of concern (EPA 1994a). Adverse health effects are not expected to occur from exposure to lead below the risk-based concentration or PRG.

A8.0 RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT

This section summarizes the results of this revised baseline HHRA for Parcel B. Future residential, industrial worker, construction worker, and recreational receptors were evaluated in the HHRA. Both total and incremental risks were evaluated in the HHRA for soil exposures. Results of the total risk evaluation include risks and hazards for metals present at or below background levels (that is, HPALs). Results of the incremental risk evaluation do not include the risk or hazard contribution for metals where the maximum concentrations are at or below HPALs.

As discussed in Section A3.4, risks from exposure to soil and groundwater were evaluated for each redevelopment block both for the specific exposure scenario associated with the planned reuse of each redevelopment block and for the other potential exposure scenarios identified for Parcel B, regardless of the planned reuse. Using this approach, risks for each redevelopment block were evaluated for residential, industrial, recreational, and construction worker exposures. The HHRA results based on the specific planned reuse of each redevelopment block are presented in Section A8.1.

Section A8.1 also identifies the chemicals of concern (COC) for soil and groundwater at Parcel B (that is, the chemical-specific risks exceed 10^{-6} or the chemical-specific HIs exceed 1.0) based on the exposure scenarios associated with the planned reuse for each redevelopment block. As discussed in Section A.5.1.2, plume-based exposure areas (A-aquifer only) are evaluated for both an RME and a MAX scenario. If results of the MAX scenario indicate additional chemicals for which the cancer risk exceeds 10^{-6} or the chemical-specific HIs exceeds 1.0 that were not identified in the RME scenario, then these chemicals are also identified as COCs. For the B-aquifer, the COCs are based on the risk results for each exposure area evaluated, regardless of the planned reuse(s) associated with the exposure area. In addition, HHRA results for each exposure scenario (residential, industrial, recreational, and construction worker), regardless of the planned reuse, are presented in Sections A8.2 through A8.5. These nonreuse-specific evaluations provide information on potential risks for all potential reuses in the event that the redevelopment plan is revised.

Attachments A1 and A2 contain tables and figures that summarize the risk and hazard results for the total and incremental risk evaluations for soil. Attachment A3 contains tables that summarize the risk and hazard results for groundwater. The figures contained in these attachments present risk results with respect to the cancer risk threshold of 10^{-6}, the noncancer HI threshold of 1.0, and the risk-based concentration for lead.

In accordance with EPA guidance, risk and hazard estimates in the HHRA should be presented to only one significant figure (EPA 1989). However, tables contained in Attachments A1, A2, and A3 and referenced in the discussion below present chemical-specific risk results with additional significant figures to facilitate review of the risk calculations.

A8.1 HUMAN HEALTH RISK ASSESSMENT RESULTS AND IDENTIFICATION OF CHEMICALS OF CONCERN BASED ON PLANNED REUSE

Based on the San Francisco's redevelopment plan (San Francisco Redevelopment Agency 1997), the following reuses are planned for each redevelopment block at Parcel B.

Redevelopment Block	Planned Reuse	Associated Exposure Scenario
1	Mixed Use	Residential
2	Research and Development	
3	Research and Development	
4	Mixed Use	
5	Research and Development	
6	Research and Development	
7	Mixed Use	
8	Mixed Use	
9	Mixed Use	
12	Mixed Use	
15	Mixed Use	
16	Educational/Cultural	Industrial
BOS-1	Open Space	Recreational
BOS-2	Open Space	
BOS-3	Open Space	

This section discusses the risk results for each exposure scenario associated with these planned reuses and identifies the COCs based on the planned reuse for each redevelopment block. COCs are those COPCs with a chemical-specific risk that exceeds 10^{-6} or a chemical-specific HI that exceeds 1.0.

A8.1.1 Soil – Total Risk

Tables A-15 and A-16 summarize the total risk results for each grid where the total cancer risk exceeds 10^{-6} or noncancer HI exceeds 1.0 from exposure to surface and subsurface soil based on planned reuse. These risk results are also shown on Figures A-2 and A-3. The grids presented in Tables A-15 and A-16 and shown on Figures A-2 and A-3 were evaluated further to identify the COCs and assess the contribution of each potentially complete exposure pathway for each COC to the calculated risks and hazards. Tables A-17 and A-18 present this evaluation.

The following chemicals are identified as COCs in at least one grid, based on planned reuse and results of the total risk evaluation for soil.

Exposure Scenario	COCs in Surface Soil, Total Risk	COCs in Subsurface Soil, Total Risk
Industrial	None	Arsenic Benzo(a)anthracene Benzo(a)pyrene
Recreational	Aroclor-1254 Aroclor-1260 Arsenic Benzo(a)pyrene Lead	Not applicable
Residential	Antimony Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene bis(2-Ethylhexyl)phthalate Copper Dibenz(a,h)anthracene Dieldrin Heptachlor epoxide Indeno(1,2,3-cd)pyrene Iron Lead Manganese Nickel Tetrachloroethene Trichloroethene Vanadium Zinc	Antimony Aroclor-1254 Aroclor-1260 Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene beta-BHC bis(2-Ethylhexyl)phthalate Cadmium Copper Dibenz(a,h)anthracene Dieldrin Heptachlor epoxide Indeno(1,2,3-cd)pyrene Iron Lead Manganese Mercury Naphthalene Nickel Tetrachloroethene Trichloroethene Vanadium Zinc

A8.1.2 Soil – Incremental Risk

Tables A-19 and A-20 summarize the incremental risk results for each grid where the incremental cancer risk exceeds 10^{-6} or the noncancer HI exceeds 1.0 from exposure to surface and subsurface soil based on planned reuse. These risk results are also shown in Figures A-4 and A-5. As discussed in Section A2.0, the incremental risk does not include the risk or hazard contribution from metals at maximum concentrations at or below HPALs. The grids presented in Tables A-19 and A-20 and shown on Figures A-4 and A-5 were evaluated further to identify the COCs and assess the contribution of each potentially complete exposure pathway for each COC to the calculated risks and hazards. Tables A-21 and A-22 present this evaluation.

The following chemicals are identified as COCs in at least one grid, based on planned reuse and results of the incremental risk evaluation for soil. Approximately 69 percent of the grids identified in the total risk evaluation for surface soil as having a cancer risk exceeding 10^{-6} or a noncancer HI greater than 1.0, no longer exceed those risk thresholds following the incremental

risk evaluation. Similarly, approximately 43 percent of the grids identified in the total risk evaluation for subsurface soil as having exceedances no longer exceed the cancer and noncancer risk thresholds following the incremental risk evaluation.

Exposure Scenario	COCs in Surface Soil, Incremental Risk	COCs in Subsurface Soil, Incremental Risk
Industrial	None	Arsenic Benzo(a)anthracene Benzo(a)pyrene
Recreational	Aroclor-1254 Aroclor-1260 Arsenic Benzo(a)pyrene Lead	Not applicable
Residential	Antimony Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene bis(2-Ethylhexyl)phthalate Copper Dibenz(a,h)anthracene Dieldrin Heptachlor epoxide Indeno(1,2,3-cd)pyrene Lead Manganese Tetrachloroethene Trichloroethene Zinc	Antimony Aroclor-1254 Aroclor-1260 Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene beta-BHC bis(2-Ethylhexyl)phthalate Cadmium Copper Dibenz(a,h)anthracene Dieldrin Heptachlor epoxide Indeno(1,2,3-cd)pyrene Iron Lead Manganese Mercury Naphthalene Tetrachloroethene Trichloroethene Vanadium Zinc

A8.1.3 Groundwater

Table A-23 summarizes the risk results from exposure to groundwater in the A-aquifer, based on planned reuse. Risk results shown on this table are limited to those exposure areas for which the cancer risk exceeds 10^{-6} or the noncancer HI exceeds 1.0. These risk results are also shown on Figure A-6. As discussed in Section A3.5.2, exposure to groundwater in the A-aquifer based on the planned reuses for Parcel B is limited to inhalation exposure from groundwater vapor intrusion by residential and industrial receptors. As shown in Figure A-6, a cancer risk exceeding 10^{-6} is associated with exposure to groundwater via vapor intrusion at the IR-10A and IR-25 plumes and two non-plume exposure areas (grid numbers B1528 and AY04). A noncancer hazard in excess of 1.0 is also associated with the IR-10A and IR-25 plumes and one non-plume exposure area (grid number B4516). Risks from exposure to the IR-25 plume were

calculated based on groundwater data from Parcels B and C because this plume transverses the boundary of Parcel B and extends into Parcel C. The risk and hazard results shown on Figure A-6 for the IR-25 plume are limited to the area of the plume within Parcel B.

Table A-23 also identifies the COCs associated with the A-aquifer plumes and the percent contribution of each COC to the total cancer risk and HI calculated for each plume. COCs also were identified for three non-plume exposure areas with excess cancer risks or noncancer hazards that are not associated with plumes; information for these areas is also shown on Table A-23. The chemicals are identified as COCs in groundwater in the A-aquifer based on planned reuse.

Exposure Scenario	COCs in Groundwater, A-aquifer
Industrial	Chloroform
Recreational	Not applicable
Residential	1,2,4-Trichlorobenzene 1,2,4-Trimethylbenzene 1,2-Dichlorobenzene 1,2-Dichloroethane 1,2-Dichloroethene (total) 1,2-Dichloropropane 1,3,5-Trimethylbenzene 1,4-Dichlorobenzene 2-Methylnaphthalene[1] Benzene Bromodichloromethane Chlorobenzene Chloroethane Chloroform cis-1,2-Dichloroethene Dichlorodifluoromethane Methylene chloride Naphthalene Tetrachloroethene trans-1,2-Dichloroethene Trichloroethene Trichlorofluoromethane Vinyl chloride

Notes: 1 = Chemical is a COC based on the MAX scenario (see Sections A5.1.2 and A8.0).

Table A-24 shows the risk results from exposure to groundwater in the B-aquifer. These risk results are also shown on Figure A-7. The risk results shown on Table A-24 are limited to those exposure areas for which the cancer risk exceeds 10^{-6} or the noncancer HI exceeds 1.0. The risk results for groundwater in the B-aquifer, which was evaluated for residential exposure from domestic use, are based on each exposure area evaluated, regardless of planned reuse.

As discussed in Section A4.3.2, the B-aquifer is predominantly absent from most areas of Parcel B except the western portion of the parcel. Exposure areas evaluated for domestic use exposure to groundwater in the B-aquifer were limited to four nonplume exposure areas in the western portion of Parcel B. Because the potential for hydraulic communication between the A- and B-aquifers exists in this portion of the parcel, the HHRA evaluated potential risks from

domestic use of groundwater under two cases: first using solely B-aquifer data, and second using a combination of A- and B-aquifer data, when available, to account for potential hydraulic communication between the two aquifers in some areas of Parcel B. Detailed risk characterization analysis and identification of COCs presented in Table A-24 for the B-aquifer were limited to risk results that account for potential hydraulic communication between the A- and B-aquifers because these results provide a more conservative estimate of potential risks from exposure to the B-aquifer (that is, risks evaluated for the B-aquifer using a combination of A- and B-aquifer data result in more COCs than risks evaluated using solely B-aquifer data). COCs for the B-aquifer are summarized below.

Exposure Scenario	COCs in Groundwater, B-aquifer[1]
Residential	1,4-Dichlorobenzene
	Antimony
	Arsenic
	Benzene
	Chloroethane
	Manganese
	Pentachlorophenol
	Thallium
	Trichloroethene

Notes:

1 COCs in the B-aquifer are identified based on evaluation of risks using a combination of A- and B-aquifer data, when available, to account for potential hydraulic communication in some areas of Parcel B.

A8.2 RESIDENTIAL EXPOSURE SCENARIO

Residential receptors were evaluated for total and incremental risks from exposure to soil (incidental ingestion, dermal contact, inhalation of volatile and particulate chemicals released to ambient air, and ingestion of homegrown produce) and risks from exposure to groundwater (vapor intrusion and domestic use).

A8.2.1 Soil – Total Risk

Surface Soil (0 to 2 feet bgs): Tables A1-5 and A1-11 of Attachment A1 present the risk and hazard results by exposure pathway for residential exposure to surface soil for each residential grid. Table A1-17 summarizes the total cancer risks and HIs for surface soil by grid. Table A1-23 presents the results of the evaluation of lead in surface soil. Figure A1-1 of Attachment A1 summarizes the results of the risk evaluation for residential exposure to surface soil.

Subsurface Soil (0 to 10 feet bgs): Tables A1-6 and A1-12 of Attachment A1 present the risk and hazard results by exposure pathway for residential exposure to surface soil for each residential grid. Table A1-18 summarizes the total cancer risks and HIs for subsurface soil by grid. Table A1-23 presents the results of the evaluation of lead in subsurface soil. Figure A1-2

of Attachment A1 summarizes the results of the risk evaluation for residential exposure to subsurface soil.

A8.2.2 Soil – Incremental Risk

Surface Soil (0 to 2 feet bgs): Tables A2-5 and A2-11 of Attachment A2 present the risk and hazard results by exposure pathway for residential exposure to surface soil for each residential grid. Table A2-17 summarizes the total cancer risks and HIs for surface soil by grid. Table A2-23 presents the results of the evaluation of lead in surface soil. Figure A2-1 of Attachment A2 summarizes the results of the risk evaluation for residential exposure to surface soil.

Subsurface Soil (0 to 10 feet bgs): Tables A2-6 and A2-12 of Attachment A2 present the risk and hazard results by exposure pathway for residential exposure to subsurface soil for each residential grid. Table A2-18 summarizes the total cancer risks and HIs for subsurface soil by grid. Table A2-23 presents the results of the evaluation of lead in subsurface soil. Figure A2-2 of Attachment A2 summarizes the results of the risk evaluation for residential exposure to subsurface soil.

A8.2.3 Groundwater

Tables A3-8, A3-11, A3-14, and A3-17 of Attachment A3 present the risk and hazard results for residential exposure to groundwater vapor intrusion (A-aquifer only) for the IR-10A plume, IR-10B plume, IR-25 plume, and non-plume exposure areas. Figure A3-1 of Attachment A3 shows the results of the evaluation of groundwater vapor intrusion for residential receptors. Tables A3-20 and A3-21 present the risk and hazard results for residential exposure to groundwater from domestic use (B-aquifer). Figure A3-2 shows the results of the risk evaluation for domestic use of groundwater.

A8.3 INDUSTRIAL EXPOSURE SCENARIO

Industrial receptors were evaluated for exposure to soil (incidental ingestion, dermal contact, and inhalation of volatile and particulate chemicals released to ambient air) and groundwater (vapor intrusion).

A8.3.1 Soil – Total Risk

Surface Soil (0 to 2 feet bgs): Tables A1-7 and A1-13 of Attachment A1 present the risk and hazard results by exposure pathway for industrial exposure to surface soil for each industrial grid. Table A1-19 summarizes the total cancer risks and HIs for surface soil by grid. Table A1-24 presents the results of the evaluation of lead in surface soil. Figure A1-3 of Attachment A1 summarizes the results of the total risk evaluation for industrial exposure to surface soil.

Subsurface Soil (0 to 10 feet bgs): Tables A1-8 and A1-14 of Attachment A1 present the total risk and hazard results by exposure pathway for industrial exposure to subsurface soil for each industrial grid. Table A1-20 summarizes the total cancer risks and HIs for subsurface soil by grid. Table A1-24 presents the results of the evaluation of lead in subsurface soil. Figure A1-4 of Attachment A1 summarizes the results of the total risk evaluation for industrial exposure to subsurface soil.

A8.3.2 Soil – Incremental Risk

Surface Soil (0 to 2 feet bgs): Tables A2-7 and A2-13 of Attachment A2 present the incremental risk and hazard results by exposure pathway for industrial exposure to surface soil for each industrial grid. Table A2-19 summarizes the incremental cancer risks and HIs for surface soil by grid. Table A2-24 presents the results of the evaluation of lead in surface soil. Figure A2-3 of Attachment A2 summarizes the results of the incremental risk evaluation for industrial exposure to surface soil.

Subsurface Soil (0 to 10 feet bgs): Tables A2-8 and A2-14 of Attachment A2 present the incremental risk and hazard results by exposure pathway for industrial exposure to subsurface soil for each industrial grid. Table A2-20 summarizes the incremental cancer risks and HIs for subsurface soil by grid. Table A2-24 presents the results of the evaluation of lead in subsurface soil. Figure A2-4 of Attachment A2 summarizes the results of the incremental risk evaluation for industrial exposure to subsurface soil.

A8.3.3 Groundwater

Tables A3-9, A3-12, A3-15, and A3-18 of Attachment A3 present the risk and hazard results for industrial exposure to groundwater vapor intrusion (A-aquifer only) for the IR-10A plume, IR-10B plume, IR-25 plume, and non-plume exposure areas. Figure A3-3 of Attachment A3 shows the results of the evaluation of groundwater vapor intrusion for industrial receptors.

A8.4 RECREATIONAL EXPOSURE SCENARIO

Recreational receptors were evaluated for exposure to soil (incidental ingestion, dermal contact, inhalation of volatile and particulate chemicals released to ambient air). Exposure to soil was limited to surface soil (0 to 2 feet bgs) for this receptor.

A8.4.1 Soil – Total Risk

Tables A1-9 and A1-15 of Attachment A1 present the total risk and hazard results by exposure pathway for recreational exposure to surface soil for each industrial grid. (Exposures to soil for a recreational receptor are evaluated using the industrial-sized grid; see Section A4.3.1.) Table A1-21 summarizes the total cancer risks and HIs for surface soil by grid. Table A1-24

presents the results of the evaluation of lead in surface soil. Figure A1-5 of Attachment A1 summarizes the results of the total risk evaluation for recreational exposure to surface soil.

A8.4.2 Soil – Incremental Risk

Tables A2-9 and A2-15 of Attachment A2 present the incremental risk and hazard results by exposure pathway for recreational exposure to surface soil for each industrial grid. (Exposures to soil for a recreational receptor are evaluated using the industrial-sized grid; see Section A4.3.1.) Table A2-21 summarizes the incremental cancer risks and HIs for surface soil by grid. Table A2-24 presents the results of the evaluation of lead in surface soil. Figure A2-5 of Attachment A2 summarizes the results of the incremental risk evaluation for recreational exposure to surface soil.

A8.5 CONSTRUCTION WORKER EXPOSURE SCENARIO

Construction worker receptors were evaluated for exposure to soil (incidental ingestion, dermal contact, and inhalation of volatile and particulate chemicals released to ambient air) and groundwater (dermal contact and inhalation of volatile chemicals released to air in a construction trench). Exposure to soil was limited to subsurface soil (0 to 10 feet bgs) for this receptor.

A8.5.1 Soil – Total Risk

Tables A1-10 and A1-16 of Attachment A1 present the total risk and hazard results by exposure pathway for construction worker exposure to subsurface soil for each industrial grid. (Exposures to soil for a construction worker are evaluated using the industrial-sized grid; see Section A4.3.1.) Table A1-22 summarizes the total cancer risks and HIs for subsurface soil by grid. Table A1-24 presents the results of the evaluation of lead in subsurface soil. Figure A1-6 of Attachment A1 summarizes the results of the total risk evaluation for construction worker exposure to subsurface soil.

A8.5.2 Soil – Incremental Risk

Tables A2-10 and A2-16 of Attachment A2 present the incremental risk and hazard results by exposure pathway for construction worker exposure to subsurface soil for each industrial grid. (Exposures to soil for a construction worker are evaluated using the industrial-sized grid; see Section A4.3.1.) Table A2-22 summarizes the incremental cancer risks and HIs for subsurface soil by grid. Table A2-24 presents the results of the evaluation of lead in subsurface soil. Figure A2-6 of Attachment A2 summarizes the results of the incremental risk evaluation for construction worker exposure to subsurface soil.

A8.5.3 Groundwater

Tables A3-10, A3-13, A3-16, and A3-19 of Attachment A3 present the risk and hazard results for construction worker exposure to groundwater via dermal contact and inhalation of volatile chemicals that are released to construction trench air for the IR-10A plume, IR-10B plume, IR-25 plume, and non-plume exposure areas. Figure A3-4 of Attachment A3 shows the results of the groundwater evaluation for the construction worker receptor.

A9.0 UNCERTAINTY ANALYSIS

Varying degrees of uncertainty at each stage of the HHRA arise from assumptions made in the risk assessment and the limitations of the data used to calculate risks. Uncertainty and variability are also inherent in the exposure assessment, toxicity values, and risk characterization. Table A-25 lists both general and site-specific uncertainties associated with this HHRA.

The effect of uncertainties is overestimation or underestimation of the actual cancer risk or HI. In general, the risk assessment process is based on use of conservative (health-protective) assumptions that, when combined, are intended to overestimate the actual risk. However, a small possibility exists that risks were underestimated.

The remainder of this discussion focuses on the following uncertainties specific to this HHRA:

- The influence of metals in soil at or below ambient levels on this HHRA
- Use of a SF for TCE developed by Cal/EPA, rather than the EPA provisional SF for TCE
- Assumption that the exposure area for vapor intrusion risks from groundwater is consistent with the plume boundaries delineated for COPCs in groundwater
- Dermal contact with groundwater for the residential exposure scenario
- Assumptions for construction worker exposure to groundwater
- Detection limits for groundwater monitoring data
- Use of generic, non-site-specific RBSLs to calculate risks from groundwater vapor intrusion.
- Potential hydraulic communication and risks from residential domestic use of groundwater
- Effect of post-2004 groundwater concentrations on the results of this HHRA

A9.1 METALS IN SOIL BELOW AMBIENT LEVELS

Both total and incremental risks were assessed for exposure to soil to account for the contribution of naturally occurring concentrations of metals at HPS. The evaluation of total risk for soil included all chemicals, regardless of concentration, except for the essential nutrients calcium, magnesium, potassium, and sodium. The essential nutrients and metals with maximum measured concentrations below HPALs were excluded as COPCs for the evaluation of incremental risk.

The differences in risk and hazard results between the evaluation of total and incremental risk are attributed to the risks and hazards associated with ambient levels of metals at HPS. At ambient concentrations (that is, HPALs), some metals at HPS are associated with cancer risks in excess of 10^{-6} and noncancer hazards in excess of 1.0. Table A-26 presents the cancer risks and noncancer hazards associated with exposure to metals at concentrations equal to HPALs; risks and hazards are presented in this table for each of the exposure scenarios associated with planned reuse (residential, industrial, and recreational). As shown in Table A-26, the contribution of ambient levels of metals to cancer risk and HI estimates is significant. For example, the cancer risk associated with residential exposure to arsenic at a concentration equal to the HPAL for arsenic (11.1 mg/kg) is 2.9E-04. The HI associated with residential exposure to manganese at a concentration equal to the HPAL for manganese (1,431 mg/kg) is 1.7. Collectively, all metals at ambient levels contribute to a cancer risk of 3E-04 for a residential receptor and of 3E-05 for industrial and recreational receptors. For noncancer hazards, metals at ambient levels collectively contribute to an HI of 11 for residential receptors, 0.2 for industrial receptors, and 0.7 for recreational receptors.

This evaluation shows that total risk, which includes metals present at concentrations at or below HPALs, likely overestimates risks and hazards associated with Navy releases of chemicals, as concentrations of metals are at or below HPALs in many exposure areas at Parcel B. The incremental risk evaluation excludes risks and hazards from metals where the maximum concentrations do not exceed HPALs. Still, the results of the incremental evaluation should be considered with the information contained in Table A-26, as the contribution of ambient levels to risks and hazards at HPS is significant for some metals.

A9.2 SLOPE FACTOR FOR TCE

As discussed in Section A6.0, the provisional cancer SFs derived by EPA (2001) for TCE, although more conservative than the SFs derived by Cal/EPA, were not used in the HHRA. The draft risk assessment that is the basis for the provisional EPA SFs for TCE is being reviewed currently by the National Academy of Sciences and, as such, does not represent EPA policy. The SFs developed by Cal/EPA were used to evaluate cancer risks from exposure to TCE. Uncertainties specific to the provisional cancer SFs for TCE were analyzed in this HHRA because the difference between the provisional SFs for TCE and the Cal/EPA SFs for TCE is significant and can affect the risk results. Attachment A7 contains a detailed discussion of the uncertainties associated with the SFs for TCE.

A9.3 BOUNDARIES FOR VAPOR INTRUSION RISKS

As discussed in Section A4.3.2, plume boundaries for evaluation of groundwater vapor intrusion were established based on delineation of volatile COPCs in the A-aquifer to nondetectable (below reporting limit) levels. Then, vapor intrusion risks were applied to each residential and industrial grid encompassed by the boundaries of the plumes. This approach assumes that the exposure area for groundwater vapor intrusion risks is consistent with the plume boundaries; however; EPA states that it is reasonable to assume that subsurface vapors may migrate laterally up to 100 feet (EPA 2002a). Figure A-8 portrays the potential lateral extent, or 100-foot "inhalation risk buffer zone," that the calculated groundwater vapor intrusion risks may extend. In this figure, the plume boundaries delineated in Section A4.3.2 were expanded laterally in each direction by 100 feet to account for the distance vapors may travel laterally from a source in groundwater. This buffer zone for inhalation risk was also applied to non-plume wells with volatile COPCs (see Figure A-8).

Preferential pathways, which consist of utility conduits, subsurface drains, and buried pipelines that intersect vapor sources or vapor migration pathways, may allow subsurface vapors to migrate more than 100 feet laterally (EPA 2002a). These preferential pathways are considered significant if they are associated with high gas permeability and are of sufficient volume and proximity to a building such that the pathways may influence vapor intrusion into the building (EPA 2002a). Figure A-9 shows the subsurface utilities at Parcel B; these utilities may influence the extent that subsurface vapors may migrate beyond the 100-foot inhalation risk buffer zone depicted in Figure A-8.

A9.4 DERMAL CONTACT WITH GROUNDWATER FOR RESIDENTIAL SCENARIO

As discussed in Section A7.2, tap water PRGs were used in this HHRA to evaluate domestic use of groundwater for the residential receptor. The tap water PRGs are used to evaluate residential exposure to groundwater from ingestion and from inhalation of VOCs released from groundwater to indoor air during household use. The tap water PRGs are limited to an assessment of exposure to groundwater from the oral and inhalation exposure pathways and do not account for exposure from the dermal exposure pathway.

The potential for intake of nonvolatile COPCs from the dermal exposure pathway relative to intake of COPCs from the oral exposure pathway was evaluated using information provided in EPA (2004d) on the relative percentage of dermal exposure compared with oral exposures for non-volatile COPCs. Although several volatile COPCs were identified, partitioning risks between oral and dermal exposures for volatile COPCs is not necessary because the tap water PRGs account for the inhalation route of exposure. As a result, this evaluation addresses the uncertainties associated with exclusion of the dermal exposure pathway on the risk results for residential domestic use of groundwater for nonvolatile COCs.

Grids B0238, B0337, B0139, and B0237 were evaluated for potential risks from domestic use of groundwater (see Tables A3-20 and A3-21 of Attachment A3). The table on the following page lists the nonvolatile COPCs evaluated for each of these grids and the relative percentage of

potential dermal exposure compared with oral exposure for each COPC. Exposure from the oral route is represented in this table by ingestion of 2 liters of water per day (EPA 2004d). Information was not available for four of the nonvolatile COPCs for the B-aquifer: cobalt, iron, molybdenum, and zinc. In addition, information was not available for seven additional COPCs (for example, aluminum and alpha-chlordane) from A-aquifer wells that were included in the evaluation of domestic use to account for hydraulic communication between the A- and B-aquifers.

Chemical of Potential Concern	Dermal/Oral (%)
Antimony	3.5
Arsenic	0.55
Barium	7.5
Beryllium	75
Chromium	40
Chromium VI	42
Copper	0.92
Manganese	8.8
Mercury	7.5
Nickel	2.6
Silver	7.55
Thallium	0.52
Vanadium	20

Source: EPA (2004d)

The table above shows that risks from domestic use of groundwater at Parcel B, which were calculated using a risk-based screening assessment and EPA Region 9 tap water PRGs, may be slightly to moderately underestimated for some metals. The risk results for grids B0238, B0139, and B02327, calculated using the risk-based screening approach and tap water PRGs, exceeded the cancer risk threshold of 10^{-6} or the noncancer threshold HI of 1.0; inclusion of the dermal pathway would not change these results. The noncancer HI calculated for grid B0337 is 0.66, which is less than the threshold HI. The relative percentage of dermal-to-oral exposures for the COPCs identified for this grid ranges from 2.6 percent for nickel to 42 percent for chromium VI. Even if the relative percentage of dermal-to-oral exposure for all COPCs for grid B0337 is assumed to be 42 percent, the HI for this grid would not exceed the threshold HI of 1.0. A dermal pathway HI exceeding 0.34 would be required to exceed a total HI of 1.0 for this grid (0.66 + 0.34 = 1.0). A relative dermal-to-oral exposure percentage of 42 percent, if assumed for all COPCs for grid B0337, results in an HI contribution from the dermal pathway of 0.28. This contribution is below the minimum dermal HI contribution of 0.34 needed to exceed a threshold noncancer HI of 1.0. Cancer risks contributed by the dermal pathway were not assessed for grid B0337 because none of the COPCs identified for this grid is carcinogenic.

A9.5 ASSUMPTIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER

As discussed in Section A5.2, default (standard) exposure assumptions for evaluating construction worker contact with groundwater during excavation or trenching are not available from EPA or DTSC. The assumptions selected for this exposure scenario were based on professional judgment; in general, the assumptions used for length of exposure to groundwater are consistent with EPA and DTSC default assumptions recommended for evaluation of construction worker contact with soil (that is, 8 hours per day, 250 days per year for one year). For evaluating of inhalation of volatile chemicals from groundwater during trenching activities, an inhalation rate of 20 cubic meters (m^3) per day was assumed. This rate is consistent with the inhalation rate used to evaluate construction worker exposure to chemicals released from soil to ambient air. For evaluating dermal contact with groundwater, a skin surface area of 2,370 square centimeters (cm^2) was assumed, corresponding to exposure to the lower legs. The surface area assumed for dermal contact with groundwater is lower than the surface area assumed for construction worker dermal contact with soil (5,700 cm^2) by approximately a factor of two. This difference, however, is not considered significant because the other assumptions used to evaluate dermal contact with groundwater by construction workers are conservative (that is, exposure time, frequency, and duration), and when compounded in the calculation of risks and hazards, are unlikely to result in an underestimate of potential risks for this scenario.

A9.6 DETECTION LIMITS FOR GROUNDWATER MONITORING DATA

As discussed in Section A5.1.2, the groundwater data set for the HHRA is based on the last 12 rounds of sampling, and earlier sampling methods for groundwater at HPS are frequently associated with elevated detection limits that exceed maximum detected concentrations. For plume-based exposure areas, calculation of EPCs for groundwater was limited to detected concentrations in order to limit the influence of historical nondetected results on the calculated EPCs. To address the potential that risks may be underestimated based on limiting the data set used to calculate groundwater EPCs for plume-based exposure areas to detected results, risks from exposure to groundwater were evaluated for both an RME scenario and a MAX scenario and COCs (that, is chemicals for which the cancer risk exceeds 10^{-6} or the chemical-specific HIs exceeds 1.0) were identified based on both the RME and MAX scenarios.

In some cases, detection limits for groundwater monitoring data exceed risk-based screening concentrations for human health. Chemicals for which the number of detected results is zero are not included as COPCs in the HHRA. If results for a chemical are nondetected in all samples, but the SQLs for the chemical consistently exceeded screening concentrations, then it is possible that the chemical may be present at concentrations associated with health risks, but was not identified as a COPC for evaluation in the HHRA. In these cases, a small possibility exists that the exclusion of these chemicals as COPCs may result in underestimate of potential risks. However, the overall HHRA process is based on use of conservative, health-protective assumptions that, when combined, are intended to overestimate the actual risk.

A9.7 SCREENING LEVELS FOR GROUNDWATER VAPOR INTRUSION

Based on meetings between EPA, DTSC, and the Navy in 2003 and 2004, VI-RBSLs, which are based on the generic screening concentrations provided in Table 2c of EPA (2002a), were used in this HHRA to calculate risks for the groundwater vapor intrusion exposure pathway. This approach was used in lieu of site-specific modeling with the Johnson-Ettinger (1991) vapor model because the EPA (2002a) model assumptions (such a depth to groundwater and soil physical properties) used to calculate the generic screening criteria are similar to the properties of soil and groundwater at HPS. Site conditions at HPS (shallow depth to groundwater and coarse soils; see Section 2.0 of the Parcel B TMSRA) do not differ significantly enough from the conditions assumed for the generic screening values to warrant detailed modeling using the Johnson-Ettinger model.

The Navy evaluated risks from vapor intrusion for selected groundwater plumes at HPS using both generic EPA (2002a) risk-based screening values for vapor intrusion and site-specific modeling. These two approaches were used to evaluate whether the generic values would represent conditions at HPS and would not result in a significant overestimate of potential risks. The results of this evaluation showed that risks calculated ratiometrically using generic EPA risk-based vapor intrusion screening values are comparable to site-specific risks calculated using the Johnson-Ettinger model adjusted for HPS-specific values for depth to groundwater and physical properties of the soil. Risks calculated using the generic EPA screening values were higher than the modeled results by approximately a factor of two. The difference results from an assumed basement exposure scenario in the generic EPA screening values, whereas the modeled results were based on a slab-on-grade exposure scenario because of the shallow depth to groundwater at HPS (roughly 9 to 10 feet bgs). This difference is not considered significant for risk results, which are represented by order-of-magnitude estimates.

A9.8 POTENTIAL HYDRAULIC COMMUNICATION AND RISKS FROM RESIDENTIAL DOMESTIC USE OF GROUNDWATER

As discussed in Section A4.3.2, the HHRA did not include characterization of potential risks from residential domestic use of groundwater for the A-aquifer plume areas (IR-10A, IR-10B, IR-25) because the B-aquifer either was not present or had only a limited presence in the location of these plumes. Therefore, it was assumed that hydraulic communication of the A-aquifer with the B-aquifer does not occur in these areas. Nevertheless, as part of the analysis of potential uncertainties associated with the HHRA, risks from residential domestic use of groundwater in each of the A-aquifer-plume areas were calculated, assuming that hydraulic communication occurs and pumping groundwater in the B-aquifer results in transport of chemicals detected in the A-aquifer downward into the B-aquifer. For this analysis, it was conservatively assumed that dilution or attenuation of chemical concentrations between the A- and B-aquifers does not occur. Potential risks for this scenario were calculated using DU-RBSLs, derived following the methodology described in Section A7.2. Tables A-27, A-28, and A-29 present the calculated risks associated with residential exposure to groundwater in each of the A-aquifer plume areas, assuming hydraulic communication with the B-aquifer. Risks were calculated for both the RME and MAX scenario. Results of this evaluation show that total cancer risks for each of the plume-

based exposure area exceeds the threshold of 1E-06 and total noncancer hazards exceed the threshold of 1.0. For the IR-10A and IR-25 plume areas, these results are consistent with the risk evaluation findings for residential exposure to chemicals in the A-aquifer via vapor intrusion. Risks and hazards for the IR-10B plume, based on the exposure via vapor intrusion, were found to be below thresholds.

A9.9 POST-2004 GROUNDWATER CONCENTRATIONS

As discussed in Section A4.1, groundwater data collected through monitoring quarter 20 (October to December 2004) were evaluated in the HHRA. Additional groundwater monitoring data for Parcel B have been collected since 2004. The Navy evaluated the effects of more recent (post-2004) concentrations in groundwater on the results of the HHRA. The evaluation consisted of review of nine additional quarters of groundwater monitoring results for Parcel B (January 2005 through March 2007), as reported in quarterly sampling reports (Kleinfelder 2006a, 2006b, 2006c; CE2 and Kleinfelder 2006, 2007a, 2007b, 2007c, 2007d, 2007e). Detected results from this sampling period were compared with VI-RBSLs for groundwater (see Table A-13). This evaluation showed that the results for TCE and vinyl chloride at the IR-10A plume-based exposure area, chloroform at grid AI08, dichlorofluoromethane at grid B4516, and mercury at grid AY02 exceeded VI-RBSLs. In addition, methyl acetate was detected in samples collected at grid AJ07. Further evaluation of these findings indicated the following:

- TCE at the IR-10A plume: The subsequent analytical results for TCE from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a COC; that is, more recent data show that TCE would remain a COC for the IR-10A exposure area because the maximum concentration continues to exceed the residential VI-RBSL. Results of 34 samples collected from five monitoring wells exceeded the residential VI-RBSL for TCE of 2.9 µg/L. The planned reuse associated with the redevelopment blocks encompassed by the IR-10A plume-based exposure area is mixed use, and the residential VI-RBSL was used to evaluate analytical results. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of TCE was 270 µg/L at well IR10MW71A. This concentration is less than the maximum concentration of TCE at IR-10A evaluated in the HHRA of 610 µg/L.

- Vinyl chloride at the IR-10A plume: The subsequent analytical results for vinyl chloride from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a COC; that is, more recent data show that vinyl chloride would remain a COC for the IR-10A exposure area because the maximum concentration continues to exceed the residential VI-RBSL. Results of 29 samples collected from four monitoring wells exceeded the residential VI-RBSL for vinyl chloride of 0.29 µg/L. As discussed above for TCE, the residential VI-RBSL was used to evaluate vinyl chloride for the IR-10A exposure area. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of vinyl chloride was 81 µg/L at well IR10MW61A. This concentration is less than the maximum concentration of vinyl chloride at IR-10A evaluated in the HHRA of 170 µg/L.

- Chloroform at grid AI08: The subsequent analytical results for chloroform from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. The result (1.4 µg/L) for one sample collected from a single monitoring well (IR07MW26A) exceeded the residential VI-RBSL for chloroform of 0.70 µg/L. However, the planned reuse associated with the location of grid AI08 is open space (recreational). As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid AI08 in the HHRA as a result. Therefore, recreational health risks are not associated with exposure to groundwater at grid AI08, regardless of analytical results.

- Dichlorofluoromethane at grid B4516: The subsequent results for dichlorofluoromethane from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a COC; that is, more recent data show that dichlorofluoromethane would remain a COC for grid B4516 because the maximum concentration continues to exceed the residential VI-RBSL. Results of four samples collected from a single monitoring well exceeded the residential VI-RBSL for dichlorofluoromethane of 14.3 µg/L. The planned reuse associated with the location of grid B4516 is mixed use, and the residential VI-RBSL was used to evaluate analytical results. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of dichlorofluoromethane was 26 µg/L at well IR26MW41A. This concentration is less than the maximum concentration of dichlorofluoromethane at grid B4516 evaluated in the HHRA of 59 µg/L.

- Mercury at grid AY02: The subsequent analytical results for mercury from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. Results of seven samples collected from two monitoring wells (IR26MW47A and IR26MW49A) exceeded the residential VI-RBSL for mercury of 0.68 µg/L. The maximum detected concentration of mercury from these two samples was 1.7 µg/L at well IR26MW47A. However, the planned reuse associated with the location of grid AY02 is open space (recreational). As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid AY02 in the HHRA as a result. Therefore, health risks are not associated with exposure to groundwater at grid AY02, regardless of analytical results.

- Methyl acetate at grid AJ07: The subsequent analytical results for methyl acetate from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. Methyl acetate was detected in two samples from a single monitoring well (IR07MW20A1) at grid AJ07. Methyl acetate is a volatile chemical that was not detected in the groundwater data set evaluated in the HHRA. However, the planned reuse associated with the location of grid AJ07 is open space (recreational). As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid AJ07 in the HHRA as a result. Therefore, health risks are not associated with exposure to groundwater at grid AJ07, regardless of analytical results.

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FIGURES

PRIMARY SOURCE	PRIMARY RELEASE MECHANISM	SECONDARY SOURCE	SECONDARY RELEASE MECHANISM	TERTIARY SOURCE	TERTIARY RELEASE MECHANISM	QUATERNARY SOURCE	EXPOSURE ROUTE	PRIMARY RECEPTORS			
								Future Industrial Worker	Future Construction Worker	Future Recreational User	Future Resident
Parcel B IR Sites	Spills and Leaks	Surface Soil (0 to 2 feet bgs)					Ingestion	C	I*	C	C
							Dermal Contact	C	I*	C	C
			Root Uptake	Homegrown Produce			Ingestion	I	I	I	C
			Wind Suspension	Outdoor Air (Particulates)			Inhalation	C	I*	C	C
			Volatilization	Outdoor Air (VOCs)			Inhalation	C	I*	C	C
		Subsurface Soil (0 to 10 feet bgs)					Ingestion	C	C	I	C
							Dermal Contact	C	C	I	C
			Root Uptake	Homegrown Produce			Ingestion	I	I	I	C
			Wind Suspension	Outdoor Air (Particulates)			Inhalation	C	C	I	C
			Volatilization	Outdoor Air (VOCs)			Inhalation	C	C	I	C
				Indoor Air (VOCs)			Inhalation	I	I	I	I
			Infiltration and Percolation	Groundwater (A-aquifer)			Ingestion	I	I	I	I[a]
							Dermal Contact	I	C	I	I[a]
					Volatilization (Construction)	Construction Trench Air (VOCs)	Inhalation	I	C	I	I
					Volatilization (Domestic Use)	Indoor Air (VOCs)	Inhalation	I	I	I	I[a]
					Volatilization (Vapor Intrusion)	Indoor Air (VOCs)	Inhalation	C	I	I	C
				Groundwater (B-aquifer)			Ingestion	I	I	I	C
							Dermal Contact	I	I	I	C[b]
					Volatilization (Domestic Use)	Indoor Air (VOCs)	Inhalation	I	I	I	C

Notes:

* See subsurface soil exposure pathways

a Although groundwater domestic use exposure pathways are incomplete for the A-aquifer, to address the potential for exposure resulting from hydraulic communication between the A- and B-aquifers for exposure areas B0139 and B0237, A-aquifer data are used to evaluate potential risks for these exposure areas.

b Addressed in Uncertainty Analysis (see Section A9.0)

bgs Below ground surface

C Potentially complete exposure pathway

I Incomplete or negligible exposure pathway

IR Installation Restoration

VOC Volatile organic compound

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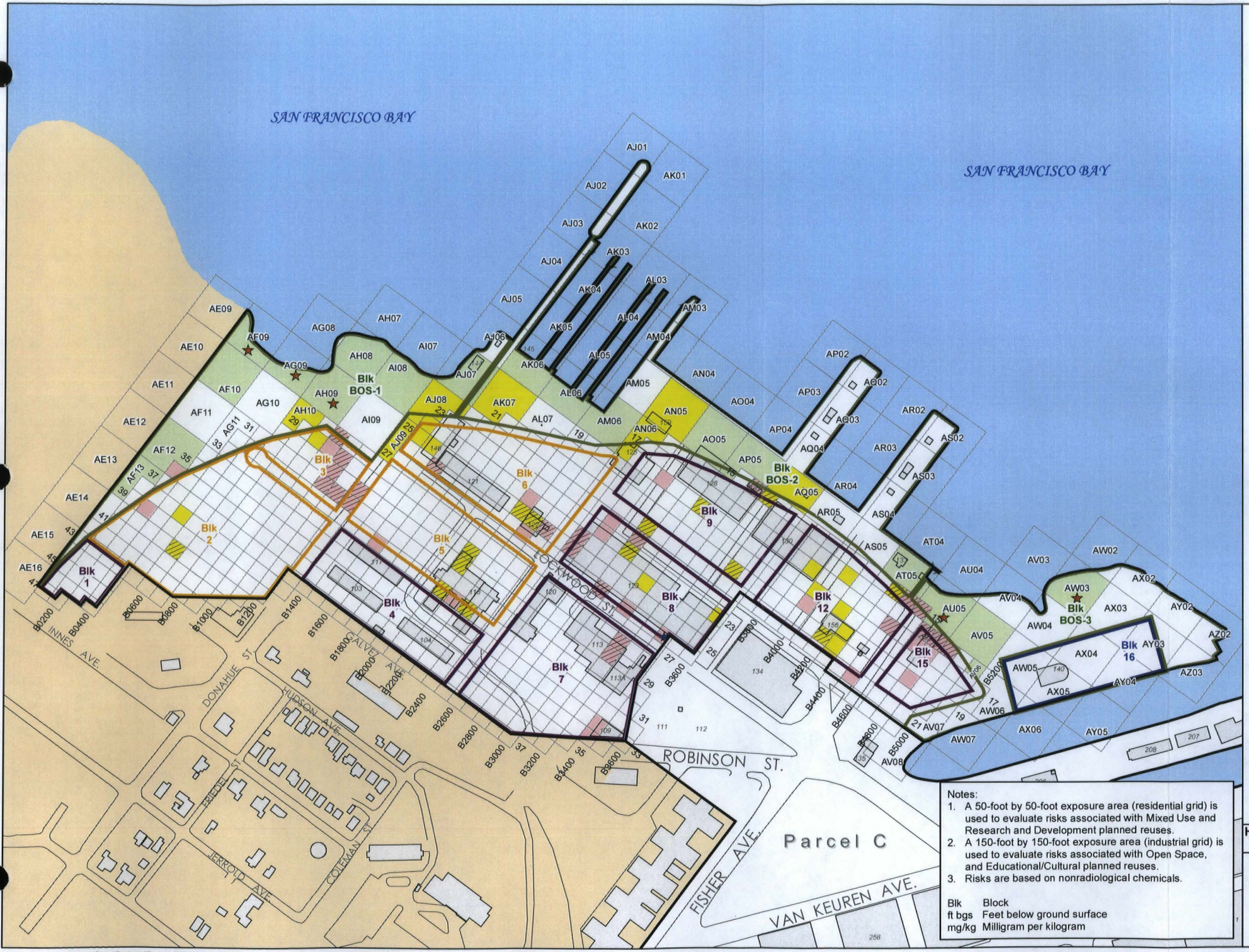
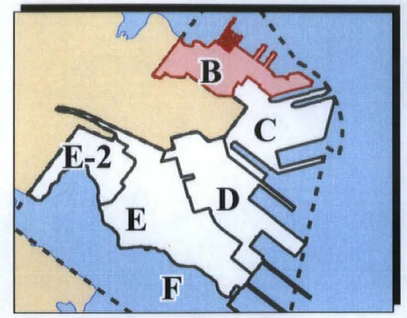
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-1
CONCEPTUAL SITE MODEL

TMSRA for Parcel B





Location Map

- ★ Residential Lead Concentration > 155 mg/kg
- ★ Recreational Lead Concentration > 155 mg/kg
- Road
- Residential Cancer Risk > 1E-06
- Recreational Cancer Risk > 1E-06
- Residential and Recreational Cancer Risk ≤ 1E-06
- Highest Segregated Hazard Index >1
- No Data
- Parcel Boundary
- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- 128 Building
- Non-Navy Property
- San Francisco Bay

N

0 300 600

Scale in Feet

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Notes:
1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Open Space, and Educational/Cultural planned reuses.
3. Risks are based on nonradiological chemicals.

Blk Block
ft bgs Feet below ground surface
mg/kg Milligram per kilogram

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U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-2
TOTAL RISK - SURFACE SOIL
(0 TO 2 FT BGS)
BASED ON PLANNED REUSE
TMSRA for Parcel B

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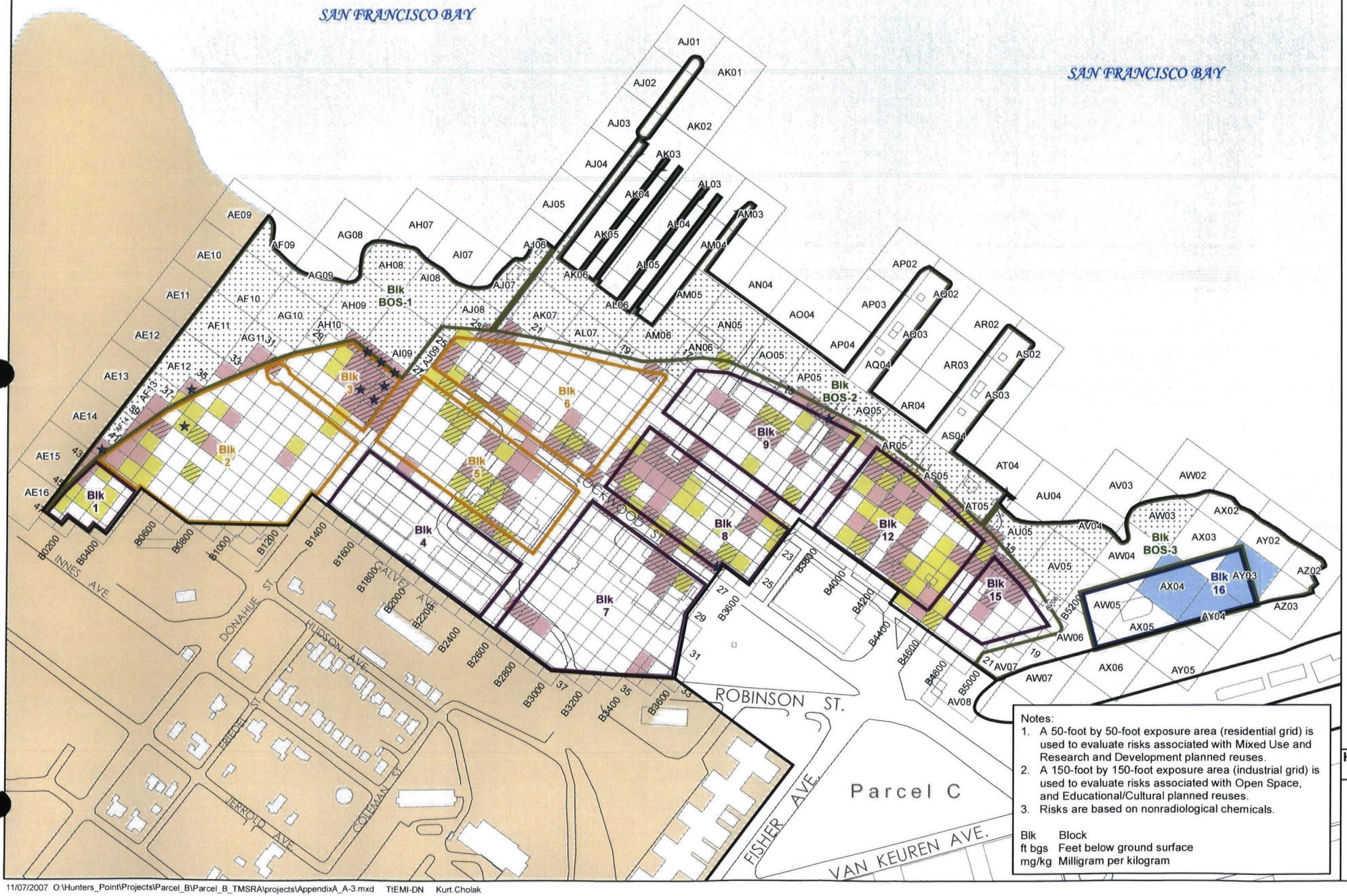

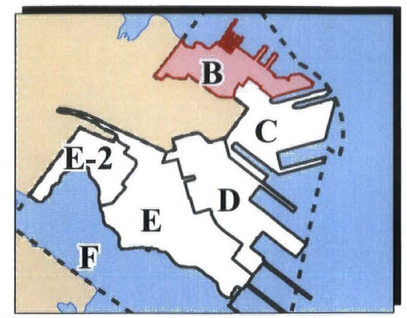

Location Map

- ★ Residential Lead Concentration > 155 mg/kg
- Road
- Industrial Cancer Risk > 1E-06
- Residential Cancer Risk > 1E-06
- Residential Cancer Risk ≤ 1E-06
- Highest Segregated Hazard Index > 1
- Data Available; Recreational Scenario Not Evaluated for Subsurface Soil
- No Data
- Parcel Boundary
- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- 128 Building
- Non-Navy Property
- San Francisco Bay

N

0 300 600

Scale in Feet

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Consulting Engineers and Scientists

Notes:
1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Open Space, and Educational/Cultural planned reuses.
3. Risks are based on nonradiological chemicals.

Blk Block
ft bgs Feet below ground surface
mg/kg Milligram per kilogram

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-3
TOTAL RISK - SUBSURFACE SOIL
(0 TO 10 FT BGS)
BASED ON PLANNED REUSE
TMSRA for Parcel B

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SAN FRANCISCO BAY

SAN FRANCISCO BAY

Parcel C

Blk BOS-1

Blk BOS-2

Blk BOS-3

Blk 1

Blk 2

Blk 3

Blk 4

Blk 5

Blk 6

Blk 7

Blk 8

Blk 9

Blk 12

Blk 15

Blk 16

INNES AVE.

DONAHUE ST.

GALVEZ AVE.

HUDSON AVE.

FRIEDELL ST.

JERROLD AVE.

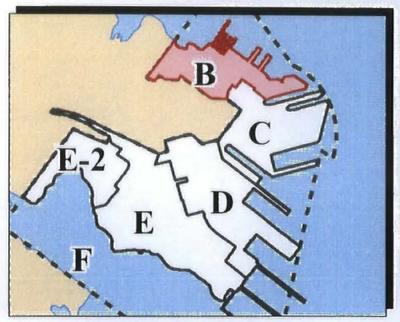
COLEMAN ST.

LOCKWOOD ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.



Location Map

- ★ Residential Lead Concentration > 155 mg/kg
- ★ Recreational Lead Concentration > 155 mg/kg
- Road
- Residential Cancer Risk > 1E-06
- Recreational Cancer Risk > 1E-06
- Residential and Recreational Cancer Risk ≤ 1E-06
- Highest Segregated Hazard Index > 1
- No Data
- Parcel Boundary
- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- 128 Building
- Non-Navy Property
- San Francisco Bay

N

0 300 600

Scale in Feet

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Notes:
1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Open Space, and Educational/Cultural planned reuses.
3. Risks are based on nonradiological chemicals.

Blk Block
ft bgs Feet below ground surface
mg/kg Milligram per kilogram

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-4
INCREMENTAL RISK - SURFACE SOIL
(0 TO 2 FT BGS)
BASED ON PLANNED REUSE
TMSRA for Parcel B

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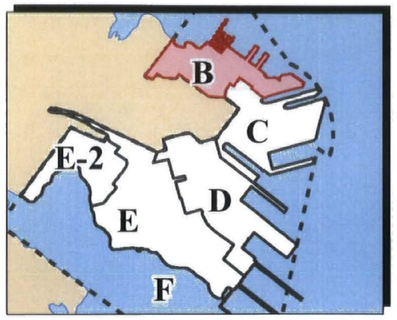
SAN FRANCISCO BAY

SAN FRANCISCO BAY

Blk 1
Blk 2
Blk 3
Blk 4
Blk 5
Blk 6
Blk 7
Blk 8
Blk 9
Blk 12
Blk 15
Blk 16
Blk BOS-1
Blk BOS-2
Blk BOS-3

INNES AVE.
DONAHUE ST.
HUDSON AVE.
CALVEZ AVE.
LOCKWOOD ST.
ROBINSON ST.
FISHER AVE.
VAN KEUREN AVE.
FRIEDELL ST.
JERROLD AVE.
COLEMAN ST.

Parcel C



Location Map

★ Residential Lead Concentration > 155 mg/kg
Road
Industrial Cancer Risk > 1E-06
Residential Cancer Risk > 1E-06
Residential Cancer Risk ≤ 1E-06
Highest Segregated Hazard Index > 1
Data Available; Recreational Scenario Not Evaluated for Subsurface Soil
No Data
Parcel Boundary
Research and Development
Mixed Use
Open Space
Educational/Cultural
128 Building
Non-Navy Property
San Francisco Bay

N

0 300 600
Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Notes:
1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Open Space, and Educational/Cultural planned reuses.
3. Risks are based on nonradiological chemicals.

Blk Block
ft bgs Feet below ground surface
mg/kg Milligram per kilogram

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-5
INCREMENTAL RISK - SUBSURFACE SOIL (0 TO 10 FT BGS) BASED ON PLANNED REUSE
TMSRA for Parcel B

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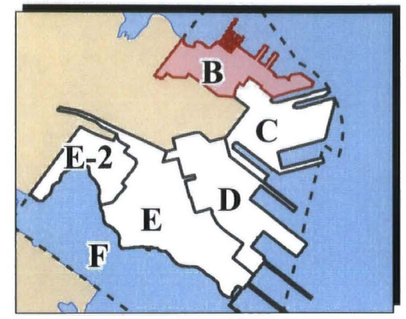
SAN FRANCISCO BAY

SAN FRANCISCO BAY



Location Map

- Road
- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Residential Cancer Risk > 1E-06
- Industrial Cancer Risk > 1E-06
- Residential and Industrial Cancer Risk ≤ 1E-06
- Highest Segregated Hazard Index >1
- No Data
- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- Parcel Boundary
- 128 Building
- Non-Navy Property
- San Francisco Bay

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Notes:
1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Open Space, and Educational/Cultural planned reuses.
3. Results are based on the Reasonable Maximum Exposure scenario.
4. Risks are based on nonradiological chemicals.

Blk Block
IR Installation restoration

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-6
GROUNDWATER VAPOR INTRUSION RISKS IN A-AQUIFER BASED ON PLANNED REUSE
TMSRA for Parcel B

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SAN FRANCISCO BAY

SAN FRANCISCO BAY

Risk estimates for B-aquifer with potential hydraulic communication between the A- and B-Aquifers

IR-10A PLUME

IR-10B PLUME

IR-25 PLUME

LOCKWOOD ST.

INNES AVE.

DONAHUE ST.

CALVEZ AVE.

HUDSON AVE.

FRIEDELL ST.

JERROLD AVE.

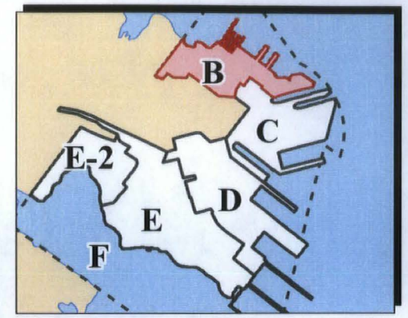
COLEMAN ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.

Parcel C



Location Map

- Road
- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Residential Cancer Risk > 1E-06
- Residential Cancer Risk ≤ 1E-06
- Highest Segregated Hazard Index > 1
- Parcel Boundary
- 128 Building
- Non-Navy Property
- San Francisco Bay

Notes:

1. Results are based on the reasonable maximum exposure scenario.
2. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with residential exposures.
3. Risks are based on nonradiological chemicals.

IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-7
GROUNDWATER DOMESTIC USE RISKS IN B-AQUIFER, RESIDENTIAL EXPOSURE SCENARIO

TMSRA for Parcel B

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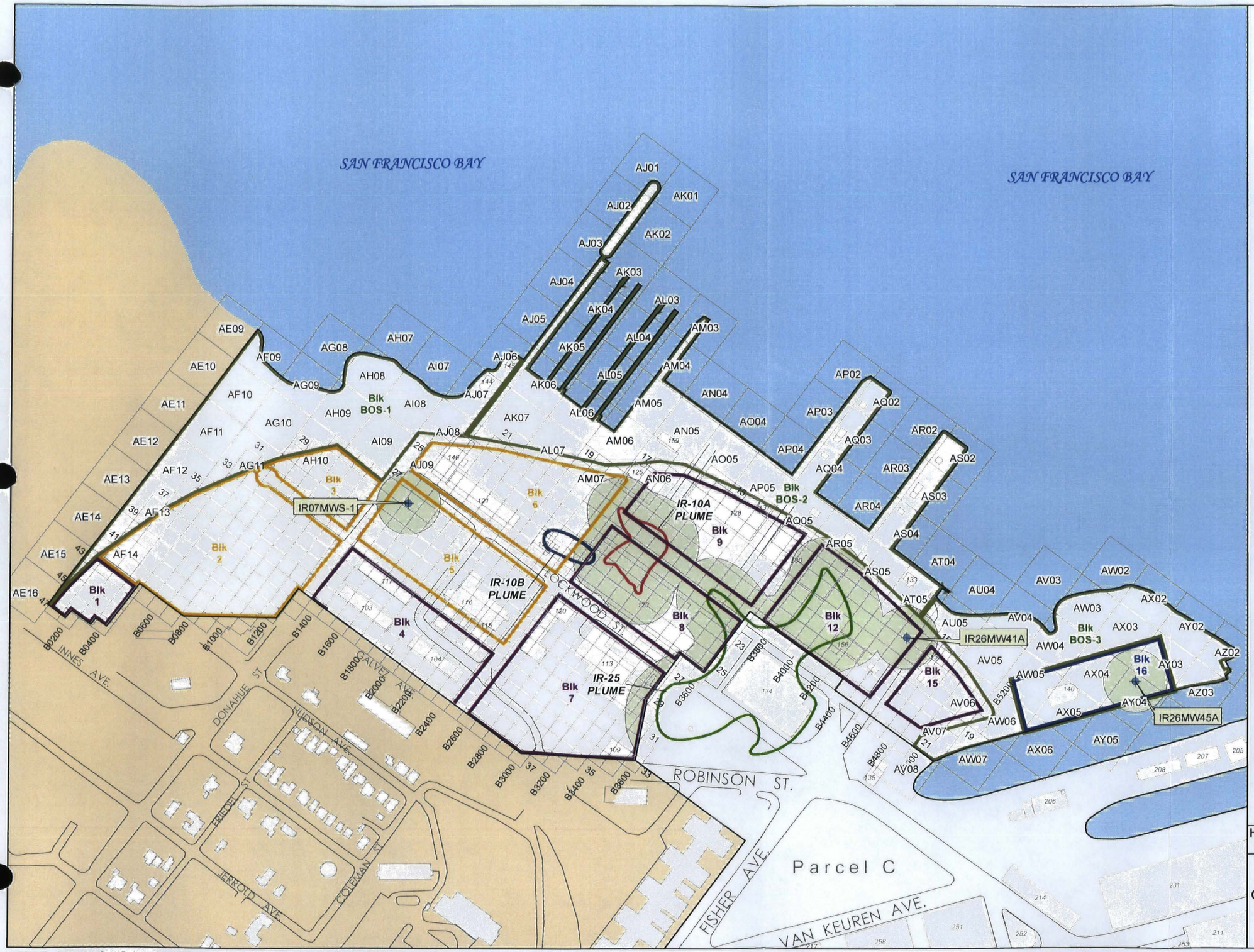

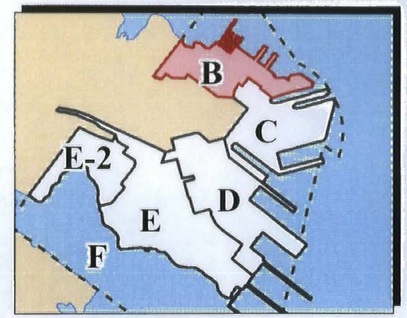

Location Map

- Road
- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Potential Lateral Extent of Vapor Intrusion Risks
- No Data
- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- Parcel Boundary
- 128 Building
- Non-Navy Property
- San Francisco Bay

Notes:

1. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with Mixed Use and Research and Development planned reuses.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with Educational/Cultural and Open Space planned reuses.

Blk Block
IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-8
POTENTIAL LATERAL EXTENT OF GROUNDWATER VAPOR INTRUSION RISKS IN A-AQUIFER WITH PARCEL AND GRID INFORMATION
TMSRA for Parcel B

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SAN FRANCISCO BAY

SAN FRANCISCO BAY

IR07MWS-1

IR-10A PLUME

IR-10B PLUME

IR-25 PLUME

IR26MW41A

IR26MW45A

ROCKWOOD ST.

INNES AVE.

GALVEZ AVE.

DONAHUE ST.

HUDSON AVE.

BRIDGE

TERRACE AVE.

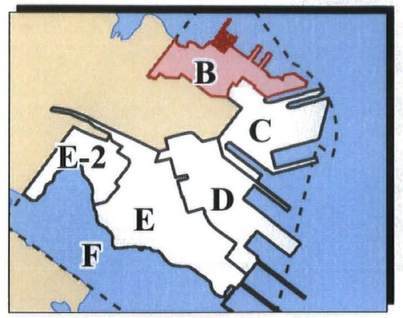
COLEMAN ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.

Parcel C



Location Map

- Monitoring Well
- Underground Utility
- Road
- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Potential Lateral Extent of Vapor Intrusion Risks
- Parcel Boundary
- 128 Building
- Non-Navy Property
- San Francisco Bay

Notes:
1. Results are based on the reasonable maximum exposure scenario.
2. Risks are based on nonradiological chemicals.

Blk Block
IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A-9
POTENTIAL LATERAL EXTENT OF GROUNDWATER VAPOR INTRUSION RISKS IN A-AQUIFER WITH UTILITY INFORMATION

TMSRA for Parcel B

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TABLES

TABLE A-1: HUMAN HEALTH RISK ASSESSMENT POTENTIALLY COMPLETE EXPOSURE PATHWAYS

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

		SOIL								GROUNDWATER							
		0 – 2 feet				0 – 10 feet				A-Aquifer					B-Aquifer and Bedrock		
Exposure Scenario	Grid Size	Ingestion	Dermal	Inhalation (particulates and VOCs)	Home-grown Produce	Ingestion	Dermal	Inhalation (particulates and VOCs)	Home-grown Produce	Ingestion	Dermal	Inhalation (household use)	Inhalation (vapor intrusion)	Inhalation (construction trench)	Ingestion	Dermal	Inhalation (household use)
Residential	2,500 ft^2	●	●	●	●	●	●	●	●	--	--	--	●	--	●[a]	●[a,b]	●[a]
Industrial	0.5 acre	●	●	●	--	●	●	●	--	--	--	--	●	--	--	--	--
Recreational	0.5 acre	●	●	●	--	--	--	--	--	--	--	--	--	--	--	--	--
Construction	0.5 acre	--	--	--	--	●	●	●	--	--	●	--	--	●	--	--	--

Notes:

-- Not quantitatively evaluated in HHRA

● Quantitatively evaluated in HHRA

a Although groundwater domestic use exposure pathways are incomplete for the A-aquifer, to address the potential for exposure resulting from hydraulic communication between the A- and B-aquifers for exposure areas B0139 and B0237, A-aquifer data are used to evaluate potential risks for these exposure areas.

b Addressed in Uncertainty Analysis (see Section A9.0)

ft^2 Square foot

HHRA Human health risk assessment

VOC Volatile organic compound

TABLE A-2: DERMAL ABSORPTION FACTORS AND VOLATILIZATION FACTORS FOR CHEMICALS OF POTENTIAL CONCERN

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Dermal Absorption Factor[a]	Volatilization Factor[a]
Metals		
Aluminum	--	--
Antimony	--	--
Arsenic	0.03	--
Barium	--	--
Beryllium	--	--
Cadmium	0.001	--
Chromium [b]	--	--
Chromium VI	--	--
Cobalt	--	--
Copper	--	--
Iron	--	--
Manganese	--	--
Mercury	--	--
Molybdenum	--	--
Nickel	--	--
Selenium	--	--
Silver	--	--
Thallium	--	--
Vanadium	--	--
Zinc	--	--
Semivolatile Organic Compounds		
2-Chlorophenol	--	9.7E+03
4-Methylphenol	0.1	--
4-Nitrophenol	0.1	--
Azobenzene	0.1	--
Benzoic acid	0.1	--
Benzyl alcohol	0.1	--
bis(2-Ethylhexyl)phthalate	0.1	--
Carbazole	0.1	--
Dibenzofuran	--	6.5E+05
di-n-Butylphthalate	0.1	--
di-n-Octylphthalate	0.1	--
n-Nitrosodiphenylamine	0.10	--
Pentachlorophenol	0.25	--
Phenol	0.1	--

TABLE A-2: DERMAL ABSORPTION FACTORS AND VOLATILIZATION FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Dermal Absorption Factor[a]	Volatilization Factor[a]
Polynuclear Aromatic Hydrocarbons		
2-Methylnaphthalene [c]	--	4.3E+04
Acenaphthene	--	1.8E+05
Acenaphthylene [c]	--	1.8E+05
Anthracene	--	7.0E+05
Benzo(a)anthracene	0.13	--
Benzo(a)pyrene	0.13	--
Benzo(b)fluoranthene	0.13	--
Benzo(g,h,i)perylene	0.13	--
Benzo(k)fluoranthene	0.13	--
Chrysene	0.13	--
Dibenz(a,h)anthracene	0.13	--
Fluoranthene	0.13	--
Fluorene	--	3.6E+05
Indeno(1,2,3-cd)pyrene	0.13	--
Naphthalene	--	4.3E+04
Phenanthrene [d]	--	7.0E+05
Pyrene	--	3.8E+06
Pesticides/Polychlorinated Biphenyls		
4,4'-DDD	0.03	--
4,4'-DDE	0.03	--
4,4'-DDT	0.03	--
Aldrin	0.1	--
alpha-BHC	0.04	--
alpha-Chlordane [e]	0.04	--
Aroclor-1242 [f]	0.14	--
Aroclor-1248 [f]	0.14	--
Aroclor-1254	0.14	--
Aroclor-1260 [f]	0.14	--
beta-BHC	0.04	--
delta-BHC [g]	0.0	--
Dieldrin	0.1	--
Endosulfan I [h]	0.1	--
Endosulfan II [h]	0.1	--
Endosulfan sulfate [h]	0.1	--
Endrin	0.1	--
Endrin aldehyde [i]	0.1	--
Endrin ketone [i]	0.10	--
gamma-BHC	0.04	--

TABLE A-2: DERMAL ABSORPTION FACTORS AND VOLATILIZATION FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Dermal Absorption Factor[a]	Volatilization Factor[a]
Pesticides/Polychlorinated Biphenyls (Continued)		
gamma-Chlordane[e]	0.04	--
Heptachlor	0.10	--
Heptachlor epoxide	0.10	--
Methoxychlor	0.10	--
Volatile Organic Compounds		
1,1,1-Trichloroethane	--	2.2E+03
1,1,2-Trichloroethane	--	6.5E+03
1,1-Dichloroethane	--	2.4E+03
1,1-Dichloroethene	--	1.4E+03
1,1-Dichloropropene	--	1.8E+03
1,2,4-Trimethylbenzene	--	2.0E+04
1,2-Dichloroethane	--	3.9E+03
1,2-Dichloroethene (Total)[j]	--	2.9E+03
1,3,5-Trimethylbenzene	--	8.0E+03
2-Hexanone[k]	--	1.9E+04
4-Methyl-2-pentanone	--	2.5E+04
Acetone	--	1.3E+04
Benzene	--	2.7E+03
Carbon disulfide	--	1.2E+03
Chlorobenzene	--	6.3E+03
Chloroform	--	2.7E+03
Chloromethane	--	1.2E+03
cis-1,2-Dichloroethene	--	2.9E+03
Ethylbenzene	--	5.4E+03
m,p-Xylenes[l]	--	6.1E+03
Methylene chloride	--	2.5E+03
N-Butylbenzene	--	1.1E+04
o-Xylene[l]	--	6.1E+03
para-Isopropyl toluene	--	4.0E+03
sec-Butylbenzene	--	8.3E+03
Tetrachloroethene	--	2.6E+03
Toluene	--	4.0E+03
trans-1,2-Dichloroethene	--	2.3E+03
Trichloroethene	--	3.3E+03
Trichlorofluoromethane	--	1.3E+03
Xylene (Total)[l]	--	6.1E+03

TABLE A-2: DERMAL ABSORPTION FACTORS AND VOLATILIZATION FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Dermal Absorption Factor[a]	Volatilization Factor[a]
Other		
Cyanide[m]	0.1	--
Dibutyltin[n]	0.1	--
Monobutyltin[n]	0.1	--
Tetrabutyltin[n]	0.1	--
Tributyltin[n]	0.1	--

Notes:

a All values are taken from EPA Region 9 preliminary remediation goals (PRG) table (EPA 2004a).
b Chromium III was used as a surrogate.
c Naphthalene was used as a surrogate.
d Anthracene was used as a surrogate.
e Chlordane was used as a surrogate.
f Aroclor-1254 was used as a surrogate.
g Beta-BHC was used as a surrogate.
h Endosulfan was used as a surrogate.
i Endrin was used as a surrogate.
j Cis-1,2-Dichloroethane was used as a surrogate.
k 2-Butanone was used as a surrogate.
l Xylenes were used as surrogates.
m Free cyanide was used as a surrogate.
n Tributyltin oxide was used as a surrogate.

--	Not available or not applicable	DDE	Dichlorodiphenyldichloroethene
BHC	Hexachlorocyclohexane	DDT	Dichlorodiphenyltrichloroethane
DDD	Dichlorodiphenyldichloroethane	EPA	U.S. Environmental Protection Agency

Source:

EPA 2004a. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Available Online at:
http://www.epa.gov/region09/waste/sfund/prg/index.htm

TABLE A-3: CHEMICAL DATA AND UPTAKE FACTORS FOR INGESTION OF HOMEGROWN PRODUCE PATHWAY

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	K_{ow}	Source	K_{oc}	Source	UF[a]
Metals					
Aluminum	--	--	--	--	1.1E-04
Antimony	--	--	--	--	5.2E-03
Arsenic	--	--	--	--	1.0E-03
Barium	--	--	--	--	2.6E-03
Beryllium	--	--	--	--	2.6E-04
Cadmium	--	--	--	--	2.6E-02
Chromium	--	--	--	--	7.8E-04
Chromium VI	--	--	--	--	7.8E-04
Cobalt	--	--	--	--	1.2E-03
Copper	--	--	--	--	4.4E-02
Iron	--	--	--	--	1.7E-04
Lead	--	--	--	--	1.6E-03
Manganese	--	--	--	--	8.7E-03
Mercury	--	--	--	--	3.5E-02
Molybdenum	--	--	--	--	1.0E-02
Nickel	--	--	--	--	1.0E-02
Selenium	--	--	--	--	4.4E-03
Silver	--	--	--	--	1.7E-02
Thallium	--	--	--	--	7.0E-05
Vanadium	--	--	--	--	5.2E-04
Zinc	--	--	--	--	1.6E-01
Semivolatile Organic Compounds					
2-Chlorophenol	--	--	--	--	--
4-Methylphenol	8.5E+01	EPA 1990	5.2E+01	Calculate	3.3E-01
4-Nitrophenol	8.1E+01	EPA 1990	5.0E+01	Calculate	3.4E-01
Azobenzene	6.6E+03	HSDB 2005	4.1E+03	Calculate	6.6E-02
Benzoic acid	7.4E+01	EPA 1990	4.6E+01	Calculate	3.6E-01
Benzyl alcohol	1.3E+01	EPA 1990	7.8E+00	Calculate	1.3E+00
bis(2-Ethylhexyl)phthalate	9.5E+03	EPA 1990	5.9E+03	EPA 1990	6.0E-02
Carbazole	5.2E+03	RAIS 2005	1.1E+04	RAIS 2005	2.0E-02
Dibenzofuran	--	--	--	--	--
di-n-Butylphthalate	4.0E+05	EPA 1990	1.7E+05	EPA 1990	3.6E-04
di-n-Octylphthalate	1.6E+09	EPA 1990	9.7E+07	Calculate	3.7E-04
n-Nitrosodiphenylamine	3.7E+02	EPA 1990	2.3E+02	Calculate	1.6E-01
Pentachlorophenol	1.0E+05	EPA 1990	5.3E+04	EPA 1990	4.0E-04
Phenol	2.9E+01	EPA 1990	1.4E+01	EPA 1990	8.6E-01

TABLE A-3: CHEMICAL DATA AND UPTAKE FACTORS FOR INGESTION OF HOMEGROWN PRODUCE PATHWAY (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	K_{ow}	Source	K_{oc}	Source	UF[a]
Polynuclear Aromatic Hydrocarbons					
2-Methylnaphthalene	--	--	--	--	--
Acenaphthene	--	--	--	--	--
Acenaphthylene	--	--	--	--	--
Anthracene	--	--	--	--	--
Benzo(a)anthracene	4.0E+05	EPA 1990	1.4E+06	EPA 1990	4.5E-05
Benzo(a)pyrene	1.2E+06	EPA 1990	5.5E+06	EPA 1990	2.5E-05
Benzo(b)fluoranthene	1.2E+06	EPA 1990	5.5E+05	EPA 1990	2.5E-04
Benzo(g,h,i)perylene[b]	--	--	--	--	--
Benzo(k)fluoranthene	1.2E+06	EPA 1990	5.5E+05	EPA 1990	2.5E-04
Chrysene	4.1E+05	EPA 1990	2.0E+05	EPA 1990	3.1E-04
Dibenz(a,h)anthracene	6.3E+06	EPA 1990	3.3E+06	EPA 1990	1.6E-04
Fluoranthene	7.9E+04	EPA 1990	3.8E+04	EPA 1990	4.7E-04
Fluorene	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	3.2E+06	EPA 1990	1.6E+06	EPA 1990	1.9E-04
Naphthalene	--	--	--	--	--
Phenanthrene	--	--	--	--	--
Pyrene	--	--	--	--	--
Pesticides/Polychlorinated Biphenyls					
4,4'-DDD	1.6E+06	EPA 1990	7.7E+05	EPA 1990	2.31E-04
4,4'-DDE	1.0E+07	EPA 1990	4.4E+06	EPA 1990	1.67E-04
4,4'-DDT	1.6E+06	EPA 1990	2.4E+05	EPA 1990	7.22E-04
Aldrin	2.0E+05	EPA 1990	9.6E+04	EPA 1990	3.78E-04
alpha-BHC	7.9E+03	EPA 1990	3.8E+03	EPA 1990	8.16E-02
alpha-Chlordane	2.1E+03	EPA 1990	1.4E+05	EPA 1990	8.30E-04
Aroclor-1242	1.3E+04	EPA 1990	8.0E+03	Calculate	5.62E-04
Aroclor-1248	5.6E+05	EPA 1990	3.5E+05	Calculate	2.32E-04
Aroclor-1254	1.1E+06	EPA 1990	4.3E+04	EPA 1990	3.10E-03
Aroclor-1260	1.4E+07	EPA 1990	8.5E+06	Calculate	1.11E-04
beta-BHC	7.9E+03	EPA 1990	3.8E+03	EPA 1990	8.16E-02
delta-BHC	1.3E+04	EPA 1990	6.6E+03	EPA 1990	6.65E-04
Dieldrin	3.2E+03	EPA 1990	1.7E+03	EPA 1990	9.22E-02
Endosulfan I	3.6E+03	EPA 1990	2.2E+03	Calculate	7.80E-02
Endosulfan II	4.2E+03	EPA 1990	2.6E+03	Calculate	7.47E-02
Endosulfan sulfate	4.6E+03	EPA 1990	2.8E+03	Calculate	7.29E-02
Endrin	2.2E+05	EPA 1990	1.3E+05	Calculate	2.89E-04
Endrin aldehyde	2.2E+05	EPA 1990	1.3E+05	Calculate	2.89E-04
Endrin ketone	2.2E+05	EPA 1990	1.3E+05	Calculate	2.89E-04

TABLE A-3: CHEMICAL DATA AND UPTAKE FACTORS FOR INGESTION OF HOMEGROWN PRODUCE PATHWAY (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	K_{ow}	Source	K_{oc}	Source	UF[a]
Pesticides/Polychlorinated Biphenyls (Continued)					
gamma-BHC (Lindane)	7.9E+03	EPA 1990	1.1E+03	EPA 1990	2.87E-01
gamma-Chlordane	2.1E+03	EPA 1990	1.4E+05	EPA 1990	8.30E-04
Heptachlor	2.5E+04	EPA 1990	1.2E+04	EPA 1990	6.17E-04
Heptachlor epoxide	5.0E+02	EPA 1990	2.2E+02	EPA 1990	2.01E-01
Methoxychlor	4.8E+04	EPA 1990	8.0E+04	EPA 1990	1.51E-04
Volatile Organic Compounds					
1,1,1-Trichloroethane	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--
1,1-Dichloropropene	--	--	--	--	--
1,2,4-Trimethylbenzene	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--
1,2-Dichloroethene (Total)	--	--	--	--	--
1,3,5-Trimethylbenzene	--	--	--	--	--
2-Hexanone	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--
Acetone	--	--	--	--	--
Benzene	--	--	--	--	--
Carbon disulfide	--	--	--	--	--
Chlorobenzene	--	--	--	--	--
Chloroform	--	--	--	--	--
Chloromethane	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--
Ethylbenzene	--	--	--	--	--
m,p-Xylenes	--	--	--	--	--
Methylene chloride	--	--	--	--	--
N-Butylbenzene	--	--	--	--	--
o-Xylene	--	--	--	--	--
para-Isopropyl toluene	--	--	--	--	--
sec-Butylbenzene	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--
Toluene	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--
Trichloroethene	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--
Xylene (Total)	--	--	--	--	--

TABLE A-3: CHEMICAL DATA AND UPTAKE FACTORS FOR INGESTION OF HOMEGROWN PRODUCE PATHWAY (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	K_{ow}	Source	K_{oc}	Source	UF[a]
Other					
Cyanide	--	--	--	--	--
Dibutyltin	--	--	--	--	1.04E-03
Monobutyltin	--	--	--	--	1.04E-03
Tetrabutyltin	--	--	--	--	1.04E-03
Tributyltin	--	--	--	--	1.04E-03

Notes:

a UFs obtained from DOE (1984) for metals and Cal/EPA (2003) for organic chemicals.

b Pyrene was used as a surrogate.

-- Not available or not applicable

BHC Hexachlorocyclohexane

Calculate K_{oc} was calculated using the Equation 5-2 in Section A5.1.3.6 of Appendix A.

DDD Dichlorodiphenyldichloroethane

DDE Dichlorodiphenyldichloroethene

DDT Dichlorodiphenyltrichloroethane

DOE U.S. Department of Energy

EPA U.S. Environmental Protection Agency

K_{oc} Organic carbon partition coefficient

K_{ow} Octanol-water partition coefficient

UF Soil-to-plant uptake factor

Sources:

California Environmental Protection Agency (Cal/EPA). 2003a. *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.* Office of Environmental and Health Hazard Assessment. August.

DOE. 1984. "A Review and Analysis of Parameters Assessing Transport of Environmentally Released Radionuclides Through Agriculture." Prepared by C.F. Baes, II, and others. Oak Ridge National Laboratory. September.

EPA. 1990. "Basics of Pump-and-Treat Groundwater Remediation Technology." EPA/600/8-90/003. March. Online at: http://www.epa.gov/oerrpage/superfund/resources/remedy/pdf/6008-90003-s.pdf

Hazardous Substances Database. 2005. Last updated January 13. Accessed on March 29. Available Online at: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Oak Ridge National Laboratory, Risk Assessment Information System. 2005. Chemical-Specific Factors. Last Updated March 22. Accessed on March 29. Available Online at: http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf

TABLE A-4: INTAKE EQUATION AND PARAMETERS FOR INGESTION OF SOIL

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{EPC_{soil} \times FI \times IRS \times EF \times ED \times MCF}{BW \times AT}$$

Parameter	Resident[a]		Industrial Worker[a]	Recreator[b]		Construction Worker[c]
	Adult	Child		Adult	Child	
Exposure point concentration (EPC) in soil (mg/kg)	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected
Fraction ingested (FI) (unitless)	1	1	1	1	1	1
Soil ingestion rate (IRS) (mg/day)	100	200	50[d]	16[e]	32[e]	330
Exposure frequency (EF) (days/year)	350	350	250	250[e]	250[e]	250
Exposure duration (ED) (years)	24	6	25	24	6	1
Mass conversion factor (MCF) (kg/mg)	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
Body weight (BW) (kilograms)	70	15	70	70	15	70
Averaging time for noncarcinogens (AT) (days)	8,760	2,190	9,125	8,760	2,190	365
Averaging time for carcinogens (AT) (days)	25,550	25,550	25,550	25,550	25,550	25,550

Notes:

a All exposure parameters are based on EPA (2004a) unless otherwise noted.

b Values based on a resident unless otherwise noted.

c Values based on EPA (2002c).

d Value is the soil ingestion rate for indoor worker (EPA 2002c).

e Based on Navy (2004a).

95UCL	95th percent upper confidence limit on the arithmetic mean	mg/day	Milligram per day
EPA	U.S. Environmental Protection Agency	mg/kg	Milligram per kilogram
kg/mg	Kilogram per milligram	mg/kg-day	Milligram per kilogram per day

Sources:

EPA. 2002c. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." Office of Solid Waste and Emergency Response (OSWER). OSWER 9355.4-24. December.

EPA. 2004a. "Region IX Preliminary Remediation Goals (PRG) Table." October 1. Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

U.S. Department of the Navy. 2004a. Memorandum Regarding Proposed Path Forward for the Parcel B Human Health Risk Assessment. From Keith S. Forman, Base Realignment and Closure Environmental Coordinator. To Michael Work, EPA Region 9; Tom Lanphar, California Department of Toxic Subtances Control; Jim Ponton, California Regional Water Quality Control Board, San Francisco Bay Region. April 14.

TABLE A-5: INTAKE EQUATION AND PARAMETERS FOR DERMAL CONTACT WITH SOIL

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{EPC_{soil} \times SA \times AF \times ABS \times EF \times ED \times MCF}{BW \times AT}$$

Parameter	Resident[a]		Industrial Worker[a]	Recreator[b]		Construction Worker[c]
	Adult	Child		Adult	Child	
Exposure point concentration (EPC) in soil (mg/kg)	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected	95UCL of mean or maximum detected
Body surface area (SA) (cm^2/day)	5,700	2,800	3,300	5,700	2,800	5,700
Soil adherence factor (AF) (mg/cm^2)	0.07	0.2	0.2	0.07	0.2	0.8
Dermal absorption fraction (ABS) (unitless)	Chemical-specific	Chemical-specific	Chemical-specific	Chemical-specific	Chemical-specific	Chemical-specific
Exposure frequency (EF) (days per year)	350	350	250	250[d]	250[d]	250
Exposure duration (ED) (years)	24	6	25	24	6	1
Mass conversion factor (MCF) (kg/mg)	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
Body weight (BW) (kilograms)	70	15	70	70	15	70
Averaging time for noncarcinogens (AT) (days)	8,760	2,190	9,125	8,760	2,190	365
Averaging time for carcinogens (AT) (days)	25,550	25,550	25,550	25,550	25,550	25,550

Notes:

a All exposure parameters are based on U.S. Environmental Protection Agency (2004a) unless otherwise noted.

b Values based on a resident unless otherwise noted.

c Value based on exposure parameters for construction worker (Department of Toxic Substances Control 2000).

d Based on U.S. Department of the Navy (2004a).

95UCL	95 percent upper confidence limit on the arithmetic mean	mg/cm^2	Milligram per square centimeters
cm^2/day	Square centimeter per day	mg/kg	Milligram per kilograms
kg/mg	Kilogram per milligram	mg/kg-day	Milligram per kilogram per day

Sources:

Department of Toxic Substances Control. 2000. "Memorandum Guidance for the Dermal Exposure Pathway." Human and Ecological Risk Division. January 7.

U.S. Department of the Navy. 2004a. Memorandum Regarding Proposed Path Forward for the Parcel B Human Health Risk Assessment. From Keith S. Forman, Base Realignment and Closure Environmental Coordinator. To Michael Work, EPA Region 9; Tom Lanphar, California Department of Toxic Subtances Control; Jim Ponton, California Regional Water Quality Control Board, San Francisco Bay Region. April 14.

U.S. Environmental Protection Agency. 2004a. "Region IX Preliminary Remediation Goals (PRG) Table." October 1. Available Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

TABLE A-6: INTAKE EQUATION AND PARAMETERS FOR INHALATION OF VOLATILE AND PARTICULATE CHEMICALS FROM SOIL

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{EPC_{air} \times IR \times ET \times EF \times ED}{BW \times AT}$$

Parameter	Resident[a]		Industrial Worker[a]	Recreator[b]		Construction Worker[c]
	Adult	Child		Adult	Child	
Exposure point concentration (EPC) in air (mg/m^3)	Chemical-specific[d]	Chemical-specific[d]	Chemical-specific[d]	Chemical-specific[d]	Chemical-specific[d]	Chemical-specific[d]
Inhalation rate (IR) (m^3/hour)	0.83	0.42	2.5	0.83	0.42	2.5
Exposure Time (ET) (hour/day)	24	24	8	2.5	2.5	8
Exposure frequency (EF) (days/year)	350	350	250	250[e]	250[e]	250
Exposure duration (ED) (years)	24	6	25	24	6	1
Body weight (BW) (kilograms)	70	15	70	70	15	70
Averaging time for noncarcinogens (AT) (days)	8,760	2,190	9,125	8,760	2,190	365
Averaging time for carcinogens (AT) (days)	25,550	25,550	25,550	25,550	25,550	25,550

Notes:

a All exposure parameters are based on EPA (2004a) unless otherwise noted.

b Values based on a resident unless otherwise noted.

c Values based on EPA (2002c).

d Chemical-specific exposure concentrations in air (m^3/day) are derived using the methodology presented in EPA (2004a).

e Based on U.S. Department of the Navy (2004a).

EPA U.S. Environmental Protection Agency

m^3/hour Cubic meter per hour

mg/kg-day Milligram per kilogram per day

mg/m^3 Milligram per cubic meter

Sources:

EPA. 2002c. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." Office of Solid Waste and Emergency Response (OSWER). OSWER 9355.4-24. December.

EPA. 2004a. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Available Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

U.S. Department of the Navy. 2004a. Memorandum Regarding Proposed Path Forward for the Parcel B Human Health Risk Assessment. From Keith S. Forman, Base Realignment and Closure Environmental Coordinator. To Michael Work, EPA Region 9; Tom Lanphar, California Department of Toxic Subtances Control; Jim Ponton, California Regional Water Quality Control Board, San Francisco Bay Region. April 14.

TABLE A-7: INTAKE EQUATION AND PARAMETERS FOR INGESTION OF HOMEGROWN PRODUCE

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{C_{soil} \times UF \times CR \times EF \times ED \times MCF}{BW \times AT}$$

Parameter	Resident[a]	
	Adult	Child
Concentration in soil (C_{soil}) (mg/kg)	95UCL of mean or maximum detected	95UCL of mean or maximum detected
Uptake factor (UF) (ug contaminant/g-plant) × (µg contaminant/g-soil)	Chemical-specific	Chemical-specific
Consumption rate (CR) (g/day)	122[b]	79[b]
Exposure frequency (EF) (days/year)	350	350
Exposure duration (ED) (years)	24	6
Conversion factor (MCF) (kg/g)	10^{-3}	10^{-3}
Body weight (BW) (kilograms)	70	15
Averaging time for noncarcinogens (AT) (days)	8,760	2,190
Averaging time for carcinogens (AT) (days)	25,550	25,550

Notes:

a All exposure parameters are based on EPA (2004a) unless otherwise noted.

b Values based on the Parcel B remedial investigation report (PRC Environmental Management, Inc. and others 1996)

µg Microgram
95UCL 95 percent upper confidence limit on the arithmetic mean
EPA U.S. Environmental Protection Agency
g Gram
g/day Gram per day
kg/g Kilogram per gram
mg/kg Milligram per kilogram
mg/kg-day Milligram per kilogram per day

Sources:

EPA. 2004a. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Online at:
http://www.epa.gov/region09/waste/sfund/prg/index.htm

PRC Environmental Management, Inc., Harding Lawson Associates, Levine-Fricke-Recon, and Uribe & Associates. 1996. "Draft Final Parcel B Remedial Investigation Report, Hunters Point Shipyard, San Francisco, California." June 3.

TABLE A-8: INTAKE EQUATION AND PARAMETERS FOR DERMAL CONTACT WITH GROUNDWATER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{EPC_{gw} \times SA \times Kp \times ET \times EF \times ED \times MCF}{BW \times AT}$$

Parameter	Construction Worker[a]
Exposure point concentration (EPC) in groundwater (mg/L)	Chemical-specific
Skin surface area (SA) (cm^2/day)	2,370[b]
Dermal permeability constant (Kp) (cm/hour)	Chemical-specific
Exposure time (ET) (hours/day)	8
Exposure frequency (EF) (days/year)	250
Exposure duration (ED) (years)	1
Mass Conversion factor (MCF) (L/cm^3)	10^{-3}
Body weight (BW) (kilograms)	70
Averaging time for noncarcinogens (AT) (days)	365
Averaging time for carcinogens (AT) (days)	25,550

Notes:

a All exposure parameters are based on EPA (2002c) unless otherwise noted.

b Skin surface area is the 50th percentile of the lower legs for a gender-neutral construction worker, taken from Exhibit C-1 of EPA RAGS Part E (EPA 2004d).

cm/hour Centimeter per hour
cm^2/day Square centimeter per day
EPA U.S. Environmental Protection Agency
L/cm^3 Liter per cubic centimeter
mg/kg-day Milligram per kilogram per day
mg/L Milligram per liter
RAGS Risk Assessment Guidance for Superfund

Sources:

EPA. 2002c. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." Office of Solid Waste and Emergency Response (OSWER). OSWER 9355.4-24. December.

EPA. 2004d. "Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final." Office of Emergency and Remedial Response. Washington, D.C. 20460. EPA/540/R-99/005, OSWER 9285.7-02EP, PB99-963312, July.

TABLE A-9: INTAKE EQUATION AND PARAMETERS FOR INHALATION OF VOLATILE CHEMICALS FROM GROUNDWATER IN TRENCH

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

$$Intake\ (mg/kg\text{-}day) = \frac{EPC_{gw} \times IR \times EF \times ED \times VFg}{BW \times AT}$$

Parameter	Construction Worker[a]
Exposure point concentration (EPC) in groundwater (mg/L)	Chemical-specific
Inhalation rate (IR) (m^3/day)	20
Exposure frequency (EF) (days/year)	250
Exposure duration (ED) (years)	1
Groundwater volatilization factor (VFg) (L/m^3)	Chemical-specific[b]
Body weight (BW) (kilograms)	70
Averaging time for noncarcinogens (AT) (days)	365
Averaging time for carcinogens (AT) (days)	25,550

Notes:

a All exposure parameters are based on EPA (2002c).

b The volatilization factor was determined using the VDEQ (2005) guidance for exposure of workers to volatile chemicals in a construction/utility trench.

EPA U.S. Environmental Protection Agency
L/m^3 Liter per cubic meter
m^3/day Cubic meter of air per day
mg/kg-day Milligram per kilogram per day
mg/L Milligram per liter
VDEQ Virginia Department of Environmental Quality

Sources:

EPA. 2002c. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." Office of Solid Waste and Emergency Response (OSWER). OSWER 9355.4-24. December.

VDEQ. 2005. "Voluntary Remediation Program Risk Assessment Guidance." Section 3.2.2, Exposure of Workers to Volatiles in a Construction/Utility Trench. January.

TABLE A-10: PERMEABILITY CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Permeability Constant[a]
Metals	
Aluminum	1.0E-03
Antimony	1.0E-03
Arsenic	1.0E-03
Barium	1.0E-03
Beryllium	1.0E-03
Cadmium	1.0E-03
Chromium [b]	1.0E-03
Chromium VI	2.0E-03
Cobalt	4.0E-04
Copper	1.0E-03
Iron	1.0E-03
Lead	1.0E-04
Manganese	1.0E-03
Mercury	1.0E-03
Molybdenum	1.0E-03
Nickel	2.0E-04
Selenium	1.0E-03
Silver	6.0E-04
Thallium	1.0E-03
Vanadium	1.0E-03
Zinc	6.0E-04
Semivolatile Organic Compounds	
2,4-Dimethylphenol	1.1E-02
2,4-Dinitrotoluene	3.1E-03
2,4,6-Trichlorophenol	3.5E-02
2,6-Dinitrotoluene	2.1E-03
2-Methylphenol	7.7E-03
4-Methylphenol	7.7E-03
Benzoic acid	5.7E-03
bis(2-Ethylhexyl)phthalate	2.5E-02
Butylbenzylphthalate[c]	1.5E-04
Caprolactam [c]	1.5E-04
Carbazole [c]	1.5E-04
Dibenzofuran [c]	1.5E-04
Diethylphthalate	3.9E-03
di-n-Octylphthalate [c]	1.5E-04
Hexachloroethane	3.0E-02

TABLE A-10: PERMEABILITY CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Permeability Constant[a]
Semivolatile Organic Compounds (Continued)	
Pentachlorophenol	3.9E-01
Phenol	4.3E-03
Polynuclear Aromatic Hydrocarbons	
1,6,7-Trimethylnaphthalene[d]	4.7E-02
1-Methylnaphthalene[d]	4.7E-02
1-Methylphenanthrene[d]	4.7E-02
2,6-Dimethylnaphthalene[d]	4.7E-02
2-Methylnaphthalene[d]	4.7E-02
Acenaphthene[d]	4.7E-02
Acenaphthylene[d]	4.7E-02
Anthracene[e]	1.4E-01
Benzo(a)anthracene	4.7E-01
Benzo(a)pyrene	7.0E-01
Benzo(b)fluoranthene	7.0E-01
Chrysene	4.7E-01
Fluoranthene	2.2E-01
Fluorene[c]	1.5E-04
Naphthalene	4.7E-02
Phenanthrene	1.4E-01
Pyrene[d]	4.7E-02
Pesticides/Polychlorinated Biphenyls	
4,4'-DDE	1.6E-01
4,4'-DDT	2.7E-01
Aldrin	1.4E-03
alpha-BHC[f]	1.1E-02
alpha-Chlordane[g]	3.8E-02
Aroclor-1260	1.5E-04
beta-BHC[f]	1.1E-02
delta-BHC[f]	1.1E-02
Dieldrin	1.2E-02
Endosulfan sulfate[c]	1.5E-04
Endrin ketone[h]	1.2E-02
gamma-Chlordane[g]	3.8E-02
Heptachlor	8.6E-03
Heptachlor epoxide[i]	8.6E-03
Heptachlor epoxide A[i]	8.6E-03

TABLE A-10: PERMEABILITY CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Permeability Constant[a]
Volatile Organic Compounds	
1,1,1-Trichloroethane	1.3E-02
1,1,2,2-Tetrachloroethane	6.9E-03
1,1,2-Trichloro-1,2,2-trifluoroethane[c]	1.5E-04
1,1-Dichloroethane	6.7E-03
1,1-Dichloroethene	1.2E-02
1,2,3-Trichlorobenzene[j]	6.6E-02
1,2,4-Trichlorobenzene	6.6E-02
1,2,4-Trimethylbenzene[c]	1.5E-04
1,2-Dichlorobenzene	4.1E-02
1,2-Dichloroethane	4.2E-03
1,2-Dichloroethene (Total)[k]	7.7E-03
1,2-Dichloropropane	7.8E-03
1,3,5-Trimethylbenzene[c]	1.5E-04
1,3-Dichlorobenzene	5.8E-02
1,4-Dichlorobenzene	4.2E-02
2-Butanone	9.6E-04
2-Hexanone[l]	9.6E-04
2-Chloronaphthalene[d]	4.7E-02
4-Methyl-2-pentanone	2.7E-03
Acetone	1.5E-04
Acetophenone[c]	1.5E-04
Benzene	1.5E-02
Biphenyl[c]	1.5E-04
Bromodichloromethane	4.6E-03
Bromomethane	2.8E-03
Carbon disulfide	1.7E-02
Chlorobenzene	2.8E-02
Chloroethane	6.1E-03
Chloroform	6.8E-03
Chloromethane	3.3E-03
cis-1,2-Dichloroethene[k]	7.7E-03
Cyclohexane[c]	1.5E-04
Dibenzothiophene[m]	1.5E-04
Dichlorodifluoromethane	9.0E-03
Ethylbenzene	4.9E-02
Isopropylbenzene[c]	1.5E-04
m,p-Xylenes[n]	5.3E-02

TABLE A-10: PERMEABILITY CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Permeability Constant[a]
Volatile Organic Compounds (Continued)	
Methylcyclohexane [c]	1.5E-04
Methylene chloride	3.5E-03
o-Xylene [n]	5.3E-02
para-Isopropyltoluene [c]	1.5E-04
Styrene	3.7E-02
tert-butyl Methyl ether [c]	1.5E-04
Tetrachloroethene	3.3E-02
Toluene	3.1E-02
trans-1,2-Dichloroethene	7.7E-03
Trichloroethene	1.2E-02
Trichlorofluoromethane	1.3E-02
Vinyl acetate [c]	1.6E-04
Vinyl chloride	5.6E-03
Xylene (Total) [n]	5.3E-02
Other	
Cyanide	1.0E-03

Notes:

a Permeability constants (Kp) taken from Exhibit B-2 of EPA (2004d). A default value of 1.0E-03 was assumed for inorganics lacking a Kp; the Kp of water (1.5E-04) was assumed as the default value for organics lacking a Kp.
b Chromium III was used as a surrogate.
c Water was used as a surrogate.
d Naphthalene was used as a surrogate.
e Phenanthrene was used as a surrogate.
f Gamma-BHC was used as a surrogate.
g Chlordane was used as a surrogate.
h Endrin was used as a surrogate.
i Heptachlor was used as a surrogate.
j 1,2,4-Trichlorobenzene was used as a surrogate.
k Trans-1,2-Dichloroethene was used as a surrogate.
l 2-Butanone was used as a surrogate.
m Fluorene was used as a surrogate.
n m-Xylene was used as a surrogate.

BHC Hexachlorocyclohexane
DDE Dichlorodiphenyldichloroethene
DDT Dichlorodiphenyltrichloroethane
EPA U.S. Environmental Protection Agency

Source:

EPA. 2004d. "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final." Office of Emergency and Remedial Response. Washington, D.C. 20460, EPA/540/R-99/005, OSWER 9285.7-02EP, PB99-963312, July.

TABLE A-11: SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral Cancer SF [a]		Inhalation Cancer SF [a]	
	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source
Metals				
Aluminum	--	--	--	--
Antimony	--	--	--	--
Arsenic	9.5E+00	Cal/EPA 2005a	1.5E+01	EPA 2005
Barium	--	--	--	--
Beryllium	--	--	8.4E+00	EPA 2005
Cadmium	--	--	1.5E+01	Cal/EPA 2005a
Chromium [c]	--	--	--	--
Chromium VI	--	--	5.1E+02	Cal/EPA 2005a
Cobalt	--	--	9.8E+00	EPA 2004b
Copper	--	--	--	--
Iron	--	--	--	--
Lead	--	--	--	--
Manganese	--	--	--	--
Mercury	--	--	--	--
Molybdenum	--	--	--	--
Nickel	--	--	9.1E-01	Cal/EPA 2005a
Selenium	--	--	--	--
Silver	--	--	--	--
Thallium	--	--	--	--
Vanadium	--	--	--	--
Zinc	--	--	--	--
Semivolatile Organic Compounds				
2,4-Dimethylphenol	--	--	--	--
2,4-Dinitrotoluene	6.8E-01	EPA 2004a	6.8E-01	EPA 2004a
2,4,6-Trichlorophenol	7.0E-02	Cal/EPA 2005a	7.0E-02	Cal/EPA 2005a
2,6-Dinitrotoluene	6.8E-01	EPA 2005	6.8E-01	R
2-Chlorophenol	--	--	--	--
2-Methylphenol	--	--	--	--
4-Methylphenol	--	--	--	--
4-Nitrophenol	--	--	--	--
Azobenzene	1.1E-01	EPA 2005	1.1E-01	EPA 2005
Benzoic acid	--	--	--	--
Benzyl alcohol	--	--	--	--
bis(2-Ethylhexyl)phthalate	1.4E-02	EPA 2005	1.4E-02	Cal/EPA 2005a
Butylbenzylphthalate	--	--	--	--
Caprolactam	--	--	--	--

TABLE A-11: SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral Cancer SF [a]		Inhalation Cancer SF [a]	
	Cancer SF (mg/kg-day)$^{-1}$	Source	Cancer SF (mg/kg-day)$^{-1}$	Source
Semivolatile Organic Compounds (Continued)				
Carbazole	2.0E-02	EPA 1997	2.0E-02	Cal/EPA 2005a
Dibenzofuran	--	--	--	--
Diethylphthalate	--	--	--	--
di-n-Butylphthalate	--	--	--	--
di-n-Octylphthalate	--	--	--	--
Hexachloroethane	3.9E-02	Cal/EPA 2005a	3.9E-02	Cal/EPA 2005a
n-Nitrosodiphenylamine	9.0E-03	Cal/EPA 2005a	9.0E-03	Cal/EPA 2005a
Pentachlorophenol	1.2E-01	EPA 2005	1.2E-01	Cal/EPA 2005a
Phenol	--	--	--	--
Polynuclear Aromatic Hydrocarbons				
1,6,7-Trimethylnaphthalene [d]	--	--	--	--
1-Methylnaphthalene [d]	--	--	--	--
1-Methylphenanthrene [e]	--	--	--	--
2,6-Dimethylnaphthalene [d]	--	--	--	--
2-Methylnaphthalene	--	--	--	--
Acenaphthene	--	--	--	--
Acenaphthylene	--	--	--	--
Anthracene	--	--	--	--
Benzo(a)anthracene	1.2E+00	Cal/EPA 2005a	7.3E-01	Cal/EPA 2005a
Benzo(a)pyrene	1.2E+01	Cal/EPA 2005a	7.3E+00	Cal/EPA 2005a
Benzo(b)fluoranthene	1.2E+00	Cal/EPA 2005a	7.3E-01	Cal/EPA 2005a
Benzo(g,h,i)perylene [f]	--	--	--	--
Benzo(k)fluoranthene	1.2E+00	Cal/EPA 2005a	3.9E-01	Cal/EPA 2005a
Chrysene	1.2E-01	Cal/EPA 2005a	3.9E-02	Cal/EPA 2005a
Dibenz(a,h)anthracene	7.3E+00	NCEA [b]	7.3E+00	Cal/EPA 2005a
Fluoranthene	--	--	--	--
Fluorene	--	--	--	--
Indeno(1,2,3-cd)pyrene	1.2E+00	Cal/EPA 2005a	7.3E-01	Cal/EPA 2005a
Naphthalene	1.2E-01	Cal/EPA 2005a	1.2E-01	Cal/EPA 2005a
Phenanthrene [e]	--	--	--	--
Pyrene	--	--	--	--
Pesticides/Polychlorinated Biphenyls				
4,4'-DDD	2.4E-01	EPA 2005	2.4E-01	Cal/EPA 2005a
4,4'-DDE	3.4E-01	EPA 2005	3.4E-01	Cal/EPA 2005a
4,4'-DDT	3.4E-01	EPA 2005	3.4E-01	EPA 2005
Aldrin	1.7E+01	EPA 2005	1.7E+01	EPA 2005

TABLE A-11: SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral Cancer SF [a]		Inhalation Cancer SF [a]	
	Cancer SF (mg/kg-day)$^{-1}$	Source	Cancer SF (mg/kg-day)$^{-1}$	Source
Pesticides/Polychlorinated Biphenyls (Continued)				
alpha-BHC	6.3E+00	EPA 2005	6.3E+00	EPA 2005
alpha-Chlordane	1.3E+00	Cal/EPA 2005a	1.2E+00	Cal/EPA 2005a
Aroclor-1242	2.0E+00	EPA 2005	2.0E+00	EPA 2005
Aroclor-1248	2.0E+00	EPA 2005	2.0E+00	EPA 2005
Aroclor-1254	2.0E+00	EPA 2005	2.0E+00	EPA 2005
Aroclor-1260	2.0E+00	EPA 2005	2.0E+00	EPA 2005
beta-BHC	1.8E+00	EPA 2005	1.8E+00	EPA 2005
delta-BHC	--	--	--	--
Dieldrin	1.6E+01	EPA 2005	1.6E+01	EPA 2005
Endosulfan I [g]	--	--	--	--
Endosulfan II [g]	--	--	--	--
Endosulfan sulfate [g]	--	--	--	--
Endrin	--	--	--	--
Endrin aldehyde [h]	--	--	--	--
Endrin ketone [h]	--	--	--	--
gamma-BHC	1.3E+00	EPA 1997	1.3E+00	Cal/EPA 2005a
gamma-Chlordane	1.3E+00	Cal/EPA 2005a	1.2E+00	Cal/EPA 2005a
Heptachlor	4.5E+00	EPA 2005	4.6E+00	EPA 2005
Heptachlor epoxide	9.1E+00	EPA 2005	9.1E+00	EPA 2005
Heptachlor epoxide A [i]	9.1E+00	EPA 2005	9.1E+00	EPA 2005
Methoxychlor	--	--	--	--
Volatile Organic Compounds				
1,1,1-Trichloroethane	--	--	--	--
1,1,2,2-Tetrachloroethane	2.7E-01	Cal/EPA 2005a	2.0E-01	EPA 2005
1,1,2-Trichloro-1,2,2-trifluoroethane	--	--	--	--
1,1,2-Trichloroethane	7.2E-02	Cal/EPA 2005a	5.7E-02	Cal/EPA 2005a
1,1-Dichloroethane	5.7E-03	Cal/EPA 2005a	5.7E-03	Cal/EPA 2005a
1,1-Dichloroethene	--	--	--	--
1,1-Dichloropropene [j]	1.0E-01	EPA 2005	5.5E-02	Cal/EPA 2005a
1,2,3-Trichlorobenzene	3.6E-03	Cal/EPA 2005a	--	--
1,2,4-Trichlorobenzene	3.6E-03	Cal/EPA 2005a	--	--
1,2,4-Trimethylbenzene	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--
1,2-Dichloroethane	9.1E-02	EPA 2005	9.1E-02	EPA 2005
1,2-Dichloroethene (Total) [k]	--	--	--	--

TABLE A-11: SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral Cancer SF [a]		Inhalation Cancer SF [a]	
	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source
Volatile Organic Compounds (Continued)				
1,2-Dichloropropane	6.8E-02	EPA 1997	6.8E-02	EPA 2004a
1,3,5-Trimethylbenzene	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--
1,4-Dichlorobenzene	2.4E-02	EPA 1997	4.0E-02	Cal/EPA 2005a
2-Butanone	--	--	--	--
2-Chloronaphthalene	--	--	--	--
2-Hexanone [l]	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--
Acetone	--	--	--	--
Acetophenone	--	--	--	--
Benzene	1.0E-01	Cal/EPA 2005a	1.0E-01	Cal/EPA 2005a
Biphenyl	--	--	--	--
Bromodichloromethane	1.3E-01	Cal/EPA 2005a	1.3E-01	Cal/EPA 2005a
Bromomethane	--	--	--	--
Carbon disulfide	--	--	--	--
Chlorobenzene	--	--	--	--
Chloroethane	2.9E-03	EPA 2004a	2.9E-03	Cal/EPA 2005a
Chloroform	3.1E-02	Cal/EPA 2005a	8.1E-02	EPA 2005
Chloromethane	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--
Cyclohexane	--	--	--	--
Dibenzothiophene [m]	--	--	--	--
Dichlorodifluoromethane	--	--	--	--
Ethylbenzene	--	--	--	--
Isopropylbenzene	--	--	--	--
m,p-Xylenes	--	--	--	--
Methylcyclohexane	--	--	--	--
Methylene chloride	1.4E-02	Cal/EPA 2005a	3.5E-03	Cal/EPA 2005a
N-Butylbenzene	--	--	--	--
o-Xylene	--	--	--	--
para-Isopropyltoluene [n]	--	--	--	--
sec-Butylbenzene	--	--	--	--
Styrene	--	--	--	--
tert-butyl Methyl ether	1.8E-03	Cal/EPA 2005a	9.1E-04	Cal/EPA 2005a
Tetrachloroethene	5.4E-01	NCEA [b]	2.1E-02	NCEA [b]
Toluene	--	--	--	--

TABLE A-11: SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral Cancer SF [a]		Inhalation Cancer SF [a]	
	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source	Cancer SF $(mg/kg\text{-}day)^{-1}$	Source
Volatile Organic Compounds (Continued)				
trans-1,2-Dichloroethene	--	--	--	--
Trichloroethene	1.3E-02	Cal/EPA 2005a	7.0E-03	Cal/EPA 2005a
Trichlorofluoromethane	--	--	--	--
Vinyl acetate	--	--	--	--
Vinyl chloride (adult) [o]	7.5E-01	EPA 2005	2.7E-01	Cal/EPA 2005a
Vinyl chloride (lifetime)	1.5E+00	EPA 2005	2.7E-01	Cal/EPA 2005a
Xylene (Total)	--	--	--	--
Other				
Cyanide	--	--	--	--
Dibutyltin [p]	--	--	--	--
Monobutyltin [p]	--	--	--	--
Tetrabutyltin [p]	--	--	--	--
Tributyltin [p]	--	--	--	--

Notes:

a	Toxicity values were obtained from the hierarchy of sources described in Section A6.0.	j	1,3-Dichloropropene was used as a surrogate.
b	As cited in EPA (2004a).	k	Cis-1,2-Dichloroethene was used as a surrogate.
c	Chromium III was used as a surrogate.	l	2-Butanone was used as a surrogate.
d	2-Methylnaphthalene was used as a surrogate.	m	Fluroene was used as a surrogate.
e	Anthracene was used as a surrogate.	n	Isopropylbenzene was used as a surrogate.
f	Pyrene was used as a surrogate.	o	The oral SF for vinyl chloride is based on EPA (2004a).
g	Endosulfan was used as a surrogate.	p	Tributyltin oxide was used as a surrogate.
h	Endrin was used as a surrogate.		
i	Heptachlor epoxide was used as a surrogate.		

--	Toxicity value not available	EPA	U.S. Environmental Protection Agency
BHC	Hexachlorocyclohexane	mg/kd-day	Milligram per kilogram per day
Cal/EPA	California Environmental Protection Agency	NCEA	National Center for Environmental Assessment
DDD	Dichlorodiphenyldichloroethane	R	Route-to-route extrapolation
DDE	Dichlorodiphenyldichloroethene	SF	Slope factor
DDT	Dichlorodiphenyltrichloroethane		

Sources:

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TABLE A-12: REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral RfD[a]		Inhalation RfD[a]	
	RfD (mg/kg-day)	Source	RfD (mg/kg-day)	Source
Metals				
Aluminum	1.0E+00	EPA 2004c	1.4E-03	EPA 2004c
Antimony	4.0E-04	EPA 2005	--	--
Arsenic	3.0E-04	EPA 2005	8.6E-06	Cal/EPA 2005b
Barium	2.0E-01	EPA 2005	1.4E-04	EPA 1997
Beryllium	2.0E-03	EPA 2005	5.7E-06	EPA 2005
Cadmium	5.0E-04	EPA 2005	5.7E-06	Cal/EPA 2005b
Chromium [c]	1.5E+00	EPA 2005	--	--
Chromium VI	3.0E-03	EPA 2005	2.9E-05	EPA 2005
Cobalt	2.0E-02	EPA 2004c	5.7E-06	EPA 2004c
Copper	3.7E-02	EPA 1997	--	--
Iron	3.0E-01	NCEA [b]	--	--
Lead	--	--	--	--
Manganese	2.4E-02	EPA 2005	1.4E-05	EPA 2005
Manganese (produce pathway only)	7.1E-02	EPA 2005	1.4E-05	EPA 2005
Mercury	3.0E-04	EPA 2005	2.6E-05	Cal/EPA 2005b
Molybdenum	5.0E-03	EPA 2005	--	--
Nickel	2.0E-02	EPA 2005	1.4E-05	Cal/EPA 2005b
Selenium	5.0E-03	EPA 2005	5.7E-03	Cal/EPA 2005b
Silver	5.0E-03	EPA 2005	--	--
Thallium	6.6E-05	EPA 2004a	--	--
Vanadium	1.0E-03	NCEA [b]	--	--
Zinc	3.0E-01	EPA 2005	--	--
Semivolatile Organic Compounds				
2,4,6-Trichlorophenol	1.0E-04	NCEA 2004	1.0E-04	R
2,4-Dimethylphenol	2.0E-02	EPA 2005	2.0E-02	R
2,4-Dinitrotoluene	2.0E-03	EPA 2005	2.0E-03	R
2,6-Dinitrotoluene	1.0E-03	EPA 1997	1.0E-03	R
2-Chlorophenol	5.0E-03	EPA 2005	5.0E-03	R
2-Methylphenol	5.0E-02	EPA 2005	5.0E-02	R
4-Methylphenol	5.0E-03	EPA 1997	5.0E-03	R
4-Nitrophenol [d]	5.0E-04	EPA 2005	5.7E-04	EPA 1997
Azobenzene	--	--	--	--
Benzoic acid	4.0E+00	EPA 2005	4.0E+00	R
Benzyl alcohol	3.0E-01	EPA 1997	3.0E-01	EPA 1997
bis(2-Ethylhexyl)phthalate	2.0E-02	EPA 2005	2.0E-02	R
Butylbenzylphthalate	2.0E-01	EPA 2005	2.0E-01	R
Caprolactam	5.0E-01	EPA 2005	5.0E-01	R
Carbazole	--	--	--	--
Dibenzofuran	2.0E-03	NCEA [b]	2.0E-03	R

TABLE A-12: REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral RfD[a]		Inhalation RfD[a]	
	RfD (mg/kg-day)	Source	RfD (mg/kg-day)	Source
Semivolatile Organic Compounds (Continued)				
Diethylphthalate	8.0E-01	EPA 2005	8.0E-01	R
di-n-Butylphthalate	1.0E-01	EPA 2005	1.0E-01	R
di-n-Octylphthalate	4.0E-02	EPA 2004c	4.0E-02	R
Hexachloroethane	1.0E-03	EPA 2005	1.0E-03	R
n-Nitrosodiphenylamine	2.0E-02	EPA 2004c	2.0E-02	R
Pentachlorophenol	3.0E-02	EPA 2005	3.0E-02	R
Phenol	3.0E-01	EPA 2005	3.0E-01	R
Polynuclear Aromatic Hydrocarbons				
1,6,7-Trimethylnaphthalene[e]	4.0E-03	EPA 2005	4.0E-03	R
1-Methylnaphthalene[e]	4.0E-03	EPA 2005	4.0E-03	R
1-Methylphenanthrene[f]	3.0E-01	EPA 2005	3.0E-01	R
2,6-Dimethylnaphthalene[e]	4.0E-03	EPA 2005	4.0E-03	R
2-Methylnaphthalene	4.0E-03	EPA 2005	4.0E-03	R
Acenaphthene	6.0E-02	EPA 2005	6.0E-02	R
Acenaphthylene[g]	6.0E-02	EPA 2005	6.0E-02	R
Anthracene	3.0E-01	EPA 2005	3.0E-01	R
Benzo(a)anthracene	--	--	--	--
Benzo(a)pyrene	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--
Benzo(g,h,i)perylene[h]	3.0E-02	EPA 2005	3.0E-02	R
Benzo(k)fluoranthene	--	--	--	--
Chrysene	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--
Fluoranthene	4.0E-02	EPA 2005	4.0E-02	R
Fluorene	4.0E-02	EPA 2005	4.0E-02	R
Indeno(1,2,3-cd)pyrene	--	--	--	--
Naphthalene	2.0E-02	EPA 2005	8.6E-04	EPA 2005
Phenanthrene[f]	3.0E-01	EPA 2005	3.0E-01	R
Pyrene	3.0E-02	EPA 2005	3.0E-02	R
Pesticides/Polychlorinated Biphenyls				
4,4'-DDD	--	--	--	--
4,4'-DDE	--	--	--	--
4,4'-DDT	5.0E-04	EPA 2005	5.0E-04	R
Aldrin	3.0E-05	EPA 2005	3.0E-05	R
alpha-BHC	5.0E-04	NCEA[b]	5.0E-04	R
alpha-Chlordane[i]	5.0E-04	EPA 2005	2.0E-04	EPA 2005
Aroclor-1242[j]	2.0E-05	EPA 2005	2.0E-05	R
Aroclor-1248[j]	2.0E-05	EPA 2005	2.0E-05	R
Aroclor-1254	2.0E-05	EPA 2005	2.0E-05	R

TABLE A-12: REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral RfD[a] RfD (mg/kg-day)	Oral RfD[a] Source	Inhalation RfD[a] RfD (mg/kg-day)	Inhalation RfD[a] Source
Pesticides/Polychlorinated Biphenyls (Continued)				
Aroclor-1260[j]	2.0E-05	EPA 2005	2.0E-05	R
beta-BHC	2.0E-04	NCEA[b]	2.0E-04	R
delta-BHC[k]	2.0E-04	NCEA[b]	2.0E-04	R
Dieldrin	5.0E-05	EPA 2005	5.0E-05	R
Endosulfan I[l]	6.0E-03	EPA 2005	6.0E-03	R
Endosulfan II[l]	6.0E-03	EPA 2005	6.0E-03	R
Endosulfan sulfate[l]	6.0E-03	EPA 2005	6.0E-03	R
Endrin	3.0E-04	EPA 2005	3.0E-04	R
Endrin aldehyde[m]	3.0E-04	EPA 2005	3.0E-04	R
Endrin ketone[m]	3.0E-04	EPA 2005	3.0E-04	R
gamma-BHC	3.0E-04	EPA 2005	3.0E-04	R
gamma-Chlordane[i]	5.0E-04	EPA 2005	2.0E-04	EPA 2005
Heptachlor	5.0E-04	EPA 2005	5.0E-04	R
Heptachlor epoxide	1.3E-05	EPA 2005	1.3E-05	R
Heptachlor epoxide A[n]	1.3E-05	EPA 2005	1.3E-05	R
Methoxychlor	5.0E-03	EPA 2005	5.0E-03	R
Volatile Organic Compounds				
1,1,1-Trichloroethane	2.8E-01	NCEA[b]	6.3E-01	EPA 2004c
1,1,2,2-Tetrachloroethane	6.0E-02	EPA 2004c	6.0E-02	R
1,1,2-Trichloro-1,2,2-trifluoroethane	3.0E+01	EPA 2005	8.6E+00	EPA 1997
1,1,2-Trichloroethane	4.0E-03	EPA 2005	4.0E-03	R
1,1-Dichloroethane	1.0E-01	EPA 1997	1.4E-01	EPA 1997
1,1-Dichloroethene	5.0E-02	EPA 2005	5.7E-02	EPA 2005
1,1-Dichloropropene[o]	3.0E-02	EPA 2005	5.7E-03	EPA 2005
1,2,3-Trichlorobenzene[p]	1.0E-02	EPA 2005	1.1E-03	EPA 2004c
1,2,4-Trichlorobenzene	1.0E-02	EPA 2005	1.1E-03	EPA 2004c
1,2,4-Trimethylbenzene	5.0E-02	EPA 2004c	1.7E-03	EPA 2004c
1,2-Dichlorobenzene	9.0E-02	EPA 2005	5.7E-02	EPA 1997
1,2-Dichloroethane	2.0E-02	NCEA[b]	1.4E-03	NCEA[b]
1,2-Dichloroethene (Total)[q]	1.0E-02	EPA 2004c	1.0E-02	R
1,2-Dichloropropane	1.1E-03	R	1.1E-03	EPA 2005
1,3,5-Trimethylbenzene	5.0E-02	EPA 2004c	1.7E-03	EPA 2004c
1,3-Dichlorobenzene	3.0E-02	NCEA[b]	3.0E-02	R
1,4-Dichlorobenzene	3.0E-02	NCEA[b]	2.3E-01	EPA 2005
2-Butanone	6.0E-01	EPA 2005	1.4E+00	EPA 2005
2-Chloronaphthalene	8.0E-02	EPA 2005	8.0E-02	R
2-Hexanone[r]	6.0E-01	EPA 2005	1.4E+00	EPA 2005
4-Methyl-2-pentanone	8.0E-02	EPA 1997	8.6E-01	EPA 2005
Acetone	9.0E-01	EPA 2005	9.0E-01	R

TABLE A-12: REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral RfD[a]		Inhalation RfD[a]	
	RfD (mg/kg-day)	Source	RfD (mg/kg-day)	Source
Volatile Organic Compounds (Continued)				
Acetophenone	1.0E-01	EPA 2005	--	--
Benzene	4.0E-03	EPA 2005	8.6E-03	EPA 2005
Biphenyl	5.0E-02	EPA 2005	5.0E-02	R
Bromodichloromethane	2.0E-02	EPA 2005	2.0E-02	R
Bromomethane	1.4E-03	EPA 2005	1.4E-03	EPA 2005
Carbon disulfide	1.0E-01	EPA 2005	2.0E-01	EPA 2005
Chlorobenzene	2.0E-02	EPA 2005	1.7E-02	NCEA[b]
Chloroethane	4.0E-01	NCEA[b]	2.9E+00	EPA 2005
Chloroform	1.0E-02	EPA 2005	1.4E-02	NCEA[b]
Chloromethane	2.6E-02	R	2.6E-02	EPA 2005
cis-1,2-Dichloroethene	1.0E-02	EPA 2004c	1.0E-02	R
Cyclohexane	1.7E+00	R	1.7E+00	EPA 2005
Dibenzothiophene[s]	4.0E-02	EPA 2005	4.0E-02	R
Dichlorodifluoromethane	2.0E-01	EPA 2005	5.7E-02	EPA 1997
Ethylbenzene	1.0E-01	EPA 2005	2.9E-01	EPA 2005
Isopropylbenzene	1.0E-01	EPA 2005	1.1E-01	EPA 2005
m,p-Xylenes[t]	2.0E-01	EPA 2005	2.9E-02	EPA 2005
Methylcyclohexane	8.6E-01	R	8.6E-01	EPA 1997
Methylene chloride	6.0E-02	EPA 2005	8.6E-01	EPA 1997
N-Butylbenzene	4.0E-02	NCEA[b]	4.0E-02	R
o-Xylene[t]	2.0E-01	EPA 2005	2.9E-02	EPA 2005
para-Isopropyltoluene[u]	1.0E-01	EPA 2005	1.1E-01	EPA 2005
sec-Butylbenzene	4.0E-02	NCEA[b]	4.0E-02	R
Styrene	2.0E-01	EPA 2005	2.9E-01	EPA 2005
tert-butyl Methyl ether	8.6E-01	R	8.6E-01	EPA 2005
Tetrachloroethene	1.0E-02	EPA 2005	1.0E-02	R
Toluene	2.0E-01	EPA 2005	1.1E-01	EPA 2005
trans-1,2-Dichloroethene	2.0E-02	EPA 2005	2.0E-02	R
Trichloroethene	--	--	1.7E-01	Cal/EPA 2005b
Trichlorofluoromethane	3.0E-01	EPA 2005	2.0E-01	EPA 1997
Vinyl acetate	1.0E+00	EPA 1997	5.7E-02	EPA 2005
Vinyl chloride	3.0E-03	EPA 2005	2.9E-02	EPA 2005
Xylene (Total)[t]	2.0E-01	EPA 2005	2.9E-02	EPA 2005
Other				
Cyanide[v]	2.0E-02	EPA 2005	--	--
Dibutyltin[w]	3.0E-04	EPA 2005	--	--
Monobutyltin[w]	3.0E-04	EPA 2005	--	--
Tetrabutyltin[w]	3.0E-04	EPA 2005	--	--
Tributyltin[w]	3.0E-04	EPA 2005	--	--

TABLE A-12: REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Oral RfD[a] RfD (mg/kg-day)	Oral RfD[a] Source	Inhalation RfD[a] RfD (mg/kg-day)	Inhalation RfD[a] Source

Notes:

a	Toxicity values were obtained from the hierarchy of sources described in Section A6.0 of Appendix A.
b	As cited in EPA (2004a).
c	Chromium III was used as a surrogate.
d	Nitrobenzene was used as a surrogate.
e	2-Methylnaphthalene was used as a surrogate.
f	Anthracene was used as a surrogate.
g	Acenaphthene was used as a surrogate.
h	Pyrene was used as a surrogate.
i	Chlordane was used as a surrogate.
j	Arochlor-1254 was used as a surrogate.
k	Beta-BHC was used as a surrogate.
l	Endosulfan was used as a surrogate.
m	Endrin was used as a surrogate.
n	Heptachlor epoxide was used as a surrogate.
o	1,3-Dichloropropene was used as a surrogate.
p	1,2,4-Trichlorobenzene was used as a surrogate.
q	Cis-1,2-Dichloroethene was used as a surrogate.
r	2-Butanone was used as a surrogate.
s	Fluroene was used as a surrogate.
t	Xylenes was used as a surrogate.
u	Isopropylbenzene was used as a surrogate.
v	Free cyanide was used as a surrogate.
w	Tributyltin oxide was used as a surrogate.

--	Toxicity value not available	EPA	U.S. Environmental Protection Agency
BHC	Hexachlorocyclohexane	mg/kd-day	Milligram per kilogram per day
Cal/EPA	California Environmental Protection Agency	NCEA	National Center for Environmental Assessment
DDD	Dichlorodiphenyldichloroethane	R	Route-to-route extrapolation
DDE	Dichlorodiphenyldichloroethene	RfD	Reference dose
DDT	Dichlorodiphenyltrichloroethane		

Sources:

Cal/EPA. 2005b. Chronic Reference Exposure Levels, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. February. Available Online address: http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html

EPA. 1997. "Health Effects Assessment Summary Tables (HEAST): Annual Update, FY 1997." EPA-540-R-97-036. National Center for Environmental Assessment, Office of Research and Development and Office of Emergency and Remedial Response. July 31.

EPA. 2004a. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Available Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

EPA. 2004c. Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV). Downloaded from http://hhpprtv.ornl.gov/ on June 26, 2004.

EPA. 2005. Integrated Risk Information System (IRIS). Accessed on March 31. Available Online at: http://www.epa.gov/iris/subst/index.html

TABLE A-13: GROUNDWATER RISK-BASED SCREENING LEVELS
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Domestic Use RBSL [a]		Vapor Intrusion RBSL [a]		
	Cancer Effects (µg/L)	Noncancer Effects (µg/L)	Residential Cancer Effects (µg/L)	Industrial Cancer Effects (µg/L)	Residential and Industrial Noncancer Effects (µg/L)
Metals					
Aluminum	--	3.6E+04	NV	NV	NV
Antimony	--	1.5E+01	NV	NV	NV
Arsenic	7.1E-03	1.1E+01	NV	NV	NV
Barium	--	**7.3E+03**	NV	NV	NV
Beryllium	--	7.3E+01	NV	NV	NV
Chromium [b]	--	5.5E+04	NV	NV	NV
Chromium VI	--	1.1E+02	NV	NV	NV
Cobalt	--	7.3E+02	NV	NV	NV
Copper	--	1.5E+03	NV	NV	NV
Iron	--	1.1E+04	NV	NV	NV
Lead [c]	--	1.5E+01	NV	NV	NV
Manganese	--	8.8E+02	NV	NV	NV
Mercury	--	1.1E+01	--	--	6.8E-01
Molybdenum	--	1.8E+02	NV	NV	NV
Nickel	--	7.3E+02	NV	NV	NV
Silver	--	1.8E+02	NV	NV	NV
Thallium	--	2.4E+00	NV	NV	NV
Vanadium	--	3.6E+01	NV	NV	NV
Zinc	--	1.1E+04	NV	NV	NV
Semivolatile Organic Compounds					
Caprolactam	--	1.8E+04	NV	NV	NV
Pentachlorophenol	5.6E-01	1.1E+03	NV	NV	NV
Polynuclear Aromatic Hydrocarbons					
1,6,7-Trimethylnaphthalene [d]	NE	NE	--	--	**7.1E+02**
1-Methylnaphthalene [d]	NE	NE	--	--	**7.1E+02**
1-Methylphenanthrene [e]	NE	NE	--	--	**1.9E+05**
2,6-Dimethylnaphthalene [d]	NE	NE	--	--	**7.1E+02**
2-Methylnaphthalene	NE	NE	--	--	**7.1E+02**
Acenaphthene	NE	NE	--	--	**3.3E+04**
Acenaphthylene [f]	NE	NE	--	--	**3.3E+04**
Anthracene	NE	NE	--	--	**3.9E+05**
Fluorene	NE	NE	--	--	**4.4E+04**
Naphthalene	NE	NE	**3.6E+00**	6.0E+00	1.5E+02
Phenanthrene [e]	NE	NE	--	--	**1.9E+05**
Pyrene	NE	NE	--	--	**2.3E+05**
Pesticides/Polychlorinated Biphenyls					
alpha-Chlordane [g]	5.1E-02	1.8E+01	NV	NV	NV
gamma-Chlordane [g]	5.1E-02	1.8E+01	NV	NV	NV
Heptachlor	1.5E-02	1.8E+01	NV	NV	NV

TABLE A-13: GROUNDWATER RISK-BASED SCREENING LEVELS (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Domestic Use RBSL [a]		Vapor Intrusion RBSL [a]		
	Cancer Effects (µg/L)	Noncancer Effects (µg/L)	Residential Cancer Effects (µg/L)	Industrial Cancer Effects (µg/L)	Residential and Industrial Noncancer Effects (µg/L)
Volatile Organic Compounds					
1,1,1-Trichloroethane	NE	NE	--	--	3.1E+03
1,1,2,2-Tetrachloroethane	NE	NE	3.0E+00	5.1E+00	**1.5E+04**
1,1,2-Trichloro-1,2,2-trifluoroethane	NE	NE	--	--	1.3E+03
1,1-Dichloroethane	NE	NE	**6.5E+00**	1.1E+01	2.1E+03
1,1-Dichloroethene	NE	NE	--	--	1.9E+02
1,2,3-Trichlorobenzene [l]	NE	NE	--	--	**6.6E+01**
1,2,4-Trichlorobenzene	NE	NE	--	--	**6.6E+01**
1,2,4-Trimethylbenzene	NE	NE	--	--	2.5E+01
1,2-Dichlorobenzene	NE	NE	--	--	2.6E+03
1,2-Dichloroethane	NE	NE	**2.3E+00**	3.9E+00	**1.2E+02**
1,2-Dichloroethene (Total) [m]	NE	NE	--	--	2.1E+02
1,2-Dichloropropane	NE	NE	1.1E+00	1.8E+00	3.4E+01
1,3,5-Trimethylbenzene	NE	NE	--	--	**1.9E+01**
1,3-Dichlorobenzene	NE	NE	--	--	**1.3E+03**
1,4-Dichlorobenzene	**3.0E-01**	6.6E+02	**2.1E+00**	3.6E+00	8.1E+03
2-Butanone	NE	NE	--	--	**4.4E+06**
2-Chloronaphthalene	NE	NE	--	--	**1.4E+04**
2-Hexanone [n]	NE	NE	--	--	**4.4E+06**
4-Methyl-2-pentanone	NE	NE	--	--	**5.2E+05**
Acetone	--	5.5E+03	--	--	**2.0E+06**
Acetophenone [o]	--	1.3E+03	--	--	7.5E+05
Benzene	**1.1E-01**	4.4E+01	**3.7E-01**	6.3E-01	**1.3E+02**
Biphenyl	NE	NE	--	--	**1.4E+04**
Bromodichloromethane	NE	NE	**1.0E+00**	1.7E+00	1.1E+03
Bromomethane	NE	NE	--	--	1.9E+01
Carbon disulfide	--	1.0E+03	--	--	5.6E+02
Chlorobenzene	--	1.1E+02	--	--	3.9E+02
Chloroethane	4.6E+00	8.6E+03	**6.5E+00**	1.1E+01	**2.3E+04**
Chloroform	NE	NE	**7.0E-01**	1.2E+00	**3.3E+02**
Chloromethane	NE	NE	--	--	**9.2E+01**
cis-1,2-Dichloroethene	--	6.1E+01	--	--	2.1E+02
Cyclohexane	NE	NE	--	--	**7.3E+02**
Dibenzofuran	NE	NE	--	--	**1.3E+04**
Dibenzothiophene [p]	NE	NE	--	--	**4.4E+04**
Dichlorodifluoromethane	NE	NE	--	--	1.4E+01
Ethylbenzene	NE	NE	--	--	3.1E+03
Isopropylbenzene	NE	NE	--	--	**7.8E+00**
m,p-Xylenes	NE	NE	--	--	**3.4E+02**
Methylcyclohexane	NE	NE	--	--	**1.7E+02**
Methylene chloride	NE	NE	**2.7E+01**	4.6E+01	3.4E+04
o-Xylene	NE	NE	--	--	**3.4E+02**
para-Isopropyltoluene [q]	NE	NE	--	--	**8.2E+02**
Styrene	NE	NE	--	--	9.0E+03

TABLE A-13: GROUNDWATER RISK-BASED SCREENING LEVELS (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical of Potential Concern	Domestic Use RBSL [a]		Vapor Intrusion RBSL [a]		
	Cancer Effects (µg/L)	Noncancer Effects (µg/L)	Residential Cancer Effects (µg/L)	Industrial Cancer Effects (µg/L)	Residential and Industrial Noncancer Effects (µg/L)
Volatile Organic Compounds (Continued)					
tert-butyl Methyl ether	**1.0E+01**	5.2E+03	**3.9E+02**	6.5E+02	1.3E+05
Tetrachloroethene	NE	NE	**5.4E-01**	9.0E-01	**4.6E+01**
Toluene	--	7.2E+02	--	--	1.4E+03
trans-1,2-Dichloroethene	NE	NE	--	--	1.8E+02
Trichloroethene	**1.4E+00**	**1.2E+03**	**2.9E+00**	4.8E+00	**1.4E+03**
Trichlorofluoromethane	NE	NE	--	--	1.8E+02
Vinyl acetate	NE	NE	--	--	9.5E+03
Vinyl chloride	NE	NE	**2.8E-02**	4.8E-02	9.0E+01
Xylene (Total)	NE	NE	--	--	**3.4E+02**

Notes:

a See Section A7.2 for derivation of RBSLs. Domestic use RBSLs are identical to the EPA (2004a) tap water PRGs and vapor intrusion RBSLs are identical to the EPA (2002a) vapor intrusion screening concentrations except that the toxicity values used to calculate the RBSLs are based on the HPS hierarchy for toxicity values described in Section A6.0. The derived RBSLs are shown in boldface when use of the HPS hierarchy for toxicity values results in a domestic use RBSL that differs from the respective EPA (2004a) tap water PRG, or a vapor intrusion RBSL that differs from the respective EPA (2002a) groundwater vapor intrusion screening concentration. This comparison was not done for industrial vapor intrusion RBSLs because industrial exposure is not evaluted in EPA (2002a).

b Chromium III was used as a surrogate.

c The California Drinking Water Standard for lead was used as the tap water PRG.

d 2-Methylnaphthalene was used as a surrogate.

e Anthracene was used as a surrogate.

f Acenaphthene was used as a surrogate.

g Chlordane was used as a surrogate.

h Beta-BHC was used as a surrogate.

i Endosulfan was used as a surrogate.

j Endrin was used as a surrogate.

k Heptachlor epoxide was used as a surrogate.

l 1,2,4-Trichlorobenzene was used as a surrogate.

m Cis-1,2-Dichloroethene was used as a surrogate.

n 2-Butanone was used as a surrogate.

o Ethylbenzene was used as a surrogate.

p Fluorene was used as a surrogate.

q Isopropylbenzene was used as a surrogate.

µg/L Microgram per liter
-- Toxicity value not available
BHC Hexachlorocyclohexane
DDE Dichlorodiphenyldichloroethene
DDT Dichlorodiphenyltrichloroethane
EPA U.S. Environmental Protection Agency
NV Chemical is not considered volatile
RBSL Risk-based screening level

Sources:

EPA. 2002a. "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." Draft. Federal Register. November 29. Available Online at: http://www.epa.gov/correctiveaction/eis/vapor/complete.pdf

EPA. 2004a. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Available Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

TABLE A-14: TARGET ORGANS AND SYSTEMS FOR CHEMICALS OF POTENTIAL CONCERN

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

COPC	CNS	Kidney	Blood	GI	Cardio-vascular	Liver	Skin	Body Weight	Adrenal	Reproductive System	Respiratory System	Immune System	Eyes	Whole Body	General Toxicity	Organ Weight	Non-Specific
Metals																	
Aluminum	X																
Antimony			X											X			
Arsenic							X										
Barium																	X
Beryllium				X							X						
Cadmium		X									X						
Chromium																	X
Chromium VI											X						
Cobalt			X								X						
Copper				X													
Iron						X											
Lead																	
Manganese	X																
Mercury	X											X					
Molybdenum			X														
Nickel								X								X	
Selenium	X			X	X												
Silver							X										
Thallium			X														
Vanadium		X															
Zinc			X														
Semivolatile Organic Compounds																	
2,4-Dimethylphenol																	X
2,4-Dimethylphenol			X											X			
2,4-Dinitrotoluene	X					X											
2,6-Dinitrotoluene	X	X	X			X								X			
2-Chlorophenol										X							
2-Methylphenol	X							X									
4-Methylphenol	X							X			X						
4-Nitrophenol																	X
Azobenzene																	
Benzoic acid																	X
Benzyl alcohol				X										X			
bis(2-Ethylhexyl)phthalate																X	
Butylbenzylphthalate																X	
Caprolactam								X									
Carbazole																	
Dibenzofuran		X															
Diethylphthalate										X						X	
di-n-Butylphthalate														X			
di-n-Octylphthalate						X			X						X		
Hexachloroethane		X												X			
n-Nitrosodiphenylamine								X					X	X			
Pentachlorophenol		X				X											
Phenol										X							

TABLE A-14: TARGET ORGANS AND SYSTEMS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

COPC	CNS	Kidney	Blood	GI	Cardio-vascular	Liver	Skin	Body Weight	Adrenal	Reproductive System	Respiratory System	Immune System	Eyes	Whole Body	General Toxicity	Organ Weight	Non-Specific
Polynuclear Aromatic Hydrocarbons																	
1,6,7-Trimethylnaphthalene											X						
1-Methylnaphthalene											X						
1-Methylphenanthrene																	X
2,6-Dimethylnaphthalene											X						
2-Methylnaphthalene											X						
Acenaphthene						X											
Acenaphthylene								X			X						
Anthracene																	X
Benzo(a)anthracene																	
Benzo(a)pyrene																	
Benzo(b)fluoranthene																	
Benzo(g,h,i)perylene		X															
Benzo(k)fluoranthene																	
Chrysene																	
Dibenz(a,h)anthracene																	
Fluoranthene		X	X			X											
Fluorene			X														
Indeno(1,2,3-cd)pyrene																	
Naphthalene								X			X						
Phenanthrene																	X
Pyrene		X															
Pesticides/Polychlorinated Biphenyls																	
4,4'-DDD																	
4,4'-DDE																	
4,4'-DDT						X											
Aldrin						X											
alpha-BHC		X				X											
alpha-Chlordane						X											
Aroclor-1242												X					
Aroclor-1248												X					
Aroclor-1254												X					
Aroclor-1260												X					
beta-BHC		X				X											
delta-BHC		X				X											
Dieldrin						X											
Endosulfan I		X						X									
Endosulfan II		X						X									
Endosulfan sulfate		X						X									
Endrin						X											
Endrin aldehyde						X											
Endrin ketone						X											
gamma-BHC		X				X											
gamma-Chlordane						X											
Heptachlor																X	
Heptachlor epoxide																X	

TABLE A-14: TARGET ORGANS AND SYSTEMS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

COPC	CNS	Kidney	Blood	GI	Cardio-vascular	Liver	Skin	Body Weight	Adrenal	Reproductive System	Respiratory System	Immune System	Eyes	Whole Body	General Toxicity	Organ Weight	Non-Specific
Pesticides/Polychlorinated Biphenyls (Continued)																	
Heptachlor epoxide A																X	
Methoxychlor										X							
Volatile Organic Compounds																	
1,1,1-Trichloroethane	X					X											
1,1,2,2-Tetrachloroethane						X										X	
1,1,2-Trichloro-1,2,2-Trifluorethane	X																
1,1,2-Trichloroethane			X														
1,1-Dichloroethane																	X
1,1-Dichloroethene						X											
1,1-Dichloropropene											X						
1,2,3-Trichlorobenzene									X						X		
1,2,4-Trichlorobenzene									X						X		
1,2,4-Trimethylbenzene	X		X					X			X					X	
1,2-Dichlorobenzene																	X
1,2-Dichloroethane																	X
1,2-Dichloroethene (Total)			X														
1,2-Dichloropropane											X						
1,3,5-Trimethylbenzene	X		X					X			X					X	
1,3-Dichlorobenzene																	X
1,4-Dichlorobenzene																X	
2-Butanone								X		X							
2-Chloronaphthalene					X						X					X	
2-Hexanone								X		X							
4-Methyl-2-pentanone		X				X								X		X	
Acetone		X															
Acetophenone															X		
Benzene			X														
Biphenyl		X															
Bromodichloromethane		X															
Bromomethane				X							X						
Carbon disulfide	X									X							
Chlorobenzene						X											
Chloroethane										X					X		
Chloroform						X											
Chloromethane																	X
cis-1,2-Dichloroethene			X														
Cyclohexane										X							
Dibenzothiophene			X														
Dichlorodifluoromethane								X									
Ethylbenzene		X				X									X		
Isopropylbenzene																X	
m,p-Xylenes	X							X							X		
Methylcyclohexane		X															
Methylene chloride						X											
N-Butylbenzene		X				X											
o-Xylene	X							X							X		

TABLE A-14: TARGET ORGANS AND SYSTEMS FOR CHEMICALS OF POTENTIAL CONCERN (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

COPC	CNS	Kidney	Blood	GI	Cardio-vascular	Liver	Skin	Body Weight	Adrenal	Reproductive System	Respiratory System	Immune System	Eyes	Whole Body	General Toxicity	Organ Weight	Non-Specific
Volatile Organic Compounds (Continued)																	
para-Isopropyltoluene																X	
sec-Butylbenzene																X	
Styrene	X		X			X											
Methyl tert butyl ether		X		X									X			X	
Tetrachloroethene	X	X				X		X									
Toluene	X															X	
trans-1,2-Dichloroethene			X														
Trichloroethene	X	X				X				X					X		
Trichlorofluoromethane														X	X		
Vinyl acetate		X									X			X		X	
Vinyl chloride						X											
Xylene (Total)	X							X							X		
Other																	
Cyanide								X							X		
Dibutyltin												X					
Monobutyltin												X					
Tetrabutyltin												X					
Tributyltin												X					

Notes: Target organ information obtained from EPA (1997, 2004c, 2005) and ATSDR (2005).

BHC: Hexachlorocyclohexane
CNS: Central nervous system
COPC: Chemical of potential concern
DDD: Dichlorodiphenyldichloroethane
DDE: Dichlorodiphenyldichloroethene
DDT: Dichlorodiphenyltrichloroethane
EPA: U.S. Environmental Protection Agency
GI: Gastrointestinal system
X: Target organ for chemical shown

Sources.
EPA. 1997. "Health Effects Assessment Summary Tables (HEAST): Annual Update, FY 1997." EPA-540-R-97-036. National Center for Environmental Assessment, Office of Research and Development and Office of Emergency and Remedial Response. July 31
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Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Last updated on January 26. Accessed on March 31. Available Online at: http://www.atsdr.cdc.gov/toxfaq.html

TABLE A-15: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SURFACE SOIL (0 TO 2 FEET BGS)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
2	RD	B0336	**1E-04**	5E+00	<1
2	RD	B0339	**1E-04**	4E+00	<1
2	RD	B0538	4E-08	3E+00	<1
2	RD	B0640	9E-08	6E+00	**2E+00**
3	RD	B0929	1E-07	5E+00	<1
3	RD	B1028	**1E-04**	1E+01	**8E+00**
3	RD	B1029	**1E-04**	4E+00	<1
3	RD	B1129	**1E-04**	5E+00	**2E+00**
3	RD	B1130	**1E-04**	9E+00	**2E+00**
3	RD	B1131	**2E-04**	1E+01	**3E+00**
3	RD	B1231	**2E-04**	7E+00	**2E+00**
3	RD	B1330	**3E-04**	9E+00	**2E+00**
3	RD	B1331	**1E-04**	6E+00	**2E+00**
5	RD	B1632	**1E-04**	2E+00	<1
5	RD	B2129	2E-07	7E+00	**5E+00**
5	RD	B2130	2E-07	8E+00	**4E+00**
5	RD	B2132	1E-07	7E+00	**3E+00**
5	RD	B2232	**2E-04**	2E+00	<1
5	RD	B2332	3E-07	1E+01	**8E+00**
6	RD	B1424	7E-07	<1	<1
6	RD	B1425	--	<1	<1
6	RD	B1525	7E-11	<1	<1
6	RD	B1626	**5E-05**	9E+00	**4E+00**
6	RD	B2224	**6E-06**	--	--
6	RD	B2225	4E-07	1E+01	**6E+00**
6	RD	B2325	2E-07	8E+00	**5E+00**
6	RD	B2326	**9E-05**	5E+00	<1
6	RD	B2425	**1E-04**	1E+01	**3E+00**
7	MU	B3228	**2E-04**	1E+01	**3E+00**
7	MU	B3229	**2E-04**	8E+00	**2E+00**
7	MU	B3433	**7E-05**	4E+00	<1
7	MU	B3434	**1E-04**	4E+00	<1
8	MU	B3426	**7E-05**	4E+00	<1
8	MU	B3623	2E-07	<1	<1
8	MU	B2624	**9E-05**	7E+00	**3E+00**
8	MU	B2625	**9E-05**	6E+00	**3E+00**
8	MU	B2722	**1E-04**	4E+00	<1
8	MU	B2723	**2E-06**	<1	<1
8	MU	B2922	**1E-04**	6E+00	**2E+00**
8	MU	B2923	2E-07	6E+00	**3E+00**
8	MU	B2926	**2E-04**	7E+00	**2E+00**
8	MU	B3124	1E-06	--	--
8	MU	B3126	**1E-04**	2E+00	<1
9	MU	B2818	**2E-06**	--	--
9	MU	B2921	2E-07	8E+00	**5E+00**
9	MU	B3118	2E-07	9E+00	**3E+00**
9	MU	B3315	**1E-04**	8E+00	**3E+00**
9	MU	B3415	2E-07	9E+00	**3E+00**

TABLE A-15: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SURFACE SOIL (0 TO 2 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
9	MU	B3520	9E-08	7E+00	**2E+00**
12	MU	B3917	--	<1	<1
12	MU	B4019	**7E-05**	2E+00	<1
12	MU	B4116	--	<1	<1
12	MU	B4218	9E-09	2E+00	<1
12	MU	B4220	--	3E+00	**2E+00**
12	MU	B4319	--	<1	<1
12	MU	B4320	--	2E+00	<1
12	MU	B4321	--	<1	<1
12	MU	B4415	3E-08	4E+00	**2E+00**
12	MU	B4515	**9E-05**	6E+00	**2E+00**
12	MU	B4517	**1E-04**	5E+00	**2E+00**
12	MU	B4521	**7E-05**	5E+00	<1
12	MU	B4615	**1E-04**	8E+00	**3E+00**
15	MU	B4716	**1E-04**	9E+00	**2E+00**
15	MU	B4717	**2E-05**	4E+00	<1
15	MU	B4816	**6E-05**	6E+00	**2E+00**
15	MU	B4817	**9E-05**	5E+00	<1
15	MU	B4819	**9E-05**	4E+00	<1
15	MU	B4916	**2E-05**	8E+00	**3E+00**
BOS-1	OS	AF09	**7E-06**	<1	<1
BOS-1	OS	AF10	**6E-06**	<1	<1
BOS-1	OS	AF12	**2E-05**	<1	<1
BOS-1	OS	AF13	**1E-05**	<1	<1
BOS-1	OS	AG09	**1E-05**	<1	<1
BOS-1	OS	AH08	**1E-05**	<1	<1
BOS-1	OS	AH09	**2E-05**	<1	<1
BOS-1	OS	AI08	**2E-05**	<1	<1
BOS-1	OS	AJ07	**1E-05**	<1	<1
BOS-1	OS	AJ08	2E-07	<1	<1
BOS-2	OS	AK06	**2E-05**	<1	<1
BOS-2	OS	AK07	2E-11	<1	<1
BOS-2	OS	AL06	**3E-05**	<1	<1
BOS-2	OS	AM06	**7E-06**	<1	<1
BOS-2	OS	AN05	3E-09	<1	<1
BOS-2	OS	AN06	7E-09	<1	<1
BOS-2	OS	AO05	**1E-05**	<1	<1
BOS-2	OS	AP05	**1E-05**	<1	<1
BOS-2	OS	AQ05	1E-08	<1	<1
BOS-2	OS	AT05	**9E-06**	<1	<1
BOS-3	OS	AU05	**2E-05**	2E+00	<1
BOS-3	OS	AV05	**2E-05**	<1	<1
BOS-3	OS	AW03	**8E-05**	2E+00	<1

Notes:

--	Not applicable
bgs	Below ground surface
MU	Mixed use (residential exposure scenario)
OS	Open space (recreational exposure scenario)
RD	Research and development (residential exposure scenario)
RME	Reasonable maximum exposure

TABLE A-16: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
1	MU	B0143	**2E-06**	--	--
1	MU	B0144	**2E-06**	--	--
1	MU	B0145	4E-08	--	--
1	MU	B0146	2E-10	<1	<1
1	MU	B0243	4E-07	--	--
1	MU	B0245	3E-09	--	--
1	MU	B0344	3E-09	--	--
1	MU	B0345	5E-09	--	--
2	RD	B0142	**9E-06**	<1	<1
2	RD	B0238	**2E-06**	<1	<1
2	RD	B0239	**2E-06**	<1	<1
2	RD	B0240	**3E-06**	<1	<1
2	RD	B0241	**7E-06**	<1	<1
2	RD	B0242	**9E-06**	<1	<1
2	RD	B0336	**2E-04**	6E+00	<1
2	RD	B0337	5E-07	<1	<1
2	RD	B0339	**1E-04**	9E+00	**4E+00**
2	RD	B0340	1E-06	<1	<1
2	RD	B0341	**3E-06**	<1	<1
2	RD	B0342	4E-09	--	--
2	RD	B0434	**2E-04**	<1	<1
2	RD	B0437	7E-07	<1	<1
2	RD	B0438	3E-07	<1	<1
2	RD	B0441	1E-06	<1	<1
2	RD	B0442	3E-07	<1	<1
2	RD	B0533	**7E-05**	<1	<1
2	RD	B0536	6E-08	<1	<1
2	RD	B0538	1E-07	8E+00	**3E+00**
2	RD	B0636	**2E-04**	<1	<1
2	RD	B0638	**2E-06**	<1	<1
2	RD	B0640	4E-07	1E+01	**7E+00**
2	RD	B0738	8E-08	<1	<1
2	RD	B1035	4E-07	<1	<1
2	RD	B1036	**3E-06**	<1	<1
2	RD	B1133	--	<1	<1
2	RD	B1138	2E-08	<1	<1
3	RD	B0532	**4E-05**	<1	<1
3	RD	B0632	**6E-05**	1E+01	**9E+00**
3	RD	B0928	**9E-05**	7E+00	**2E+00**
3	RD	B0929	9E-07	6E+00	<1
3	RD	B0930	4E-08	<1	<1
3	RD	B1028	**2E-04**	2E+01	**7E+00**
3	RD	B1029	**5E-04**	1E+01	**6E+00**
3	RD	B1030	**2E-04**	4E+00	<1
3	RD	B1128	**2E-04**	7E+00	**2E+00**
3	RD	B1129	**2E-04**	2E+01	**7E+00**
3	RD	B1130	**3E-04**	2E+01	**6E+00**
3	RD	B1131	**3E-04**	1E+01	**4E+00**
3	RD	B1132	--	<1	<1

TABLE A-16: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
3	RD	B1228	**2E-04**	6E+00	<1
3	RD	B1229	**2E-04**	7E+00	**2E+00**
3	RD	B1230	**2E-04**	8E+00	**2E+00**
3	RD	B1231	**2E-04**	7E+00	**2E+00**
3	RD	B1328	**2E-04**	2E+01	**9E+00**
3	RD	B1329	**2E-04**	8E+00	**2E+00**
3	RD	B1330	**3E-03**	2E+01	**8E+00**
3	RD	B1331	**1E-03**	1E+01	**3E+00**
5	RD	B1427	--	<1	<1
5	RD	B1527	9E-08	5E+00	**2E+00**
5	RD	B1628	3E-07	9E+00	**6E+00**
5	RD	B1632	**1E-04**	2E+00	<1
5	RD	B1727	3E-07	9E+00	**5E+00**
5	RD	B1728	2E-07	8E+00	**4E+00**
5	RD	B1729	2E-07	6E+00	**3E+00**
5	RD	B1928	**2E-04**	1E+01	**3E+00**
5	RD	B1930	**1E-04**	7E+00	**4E+00**
5	RD	B1931	2E-07	7E+00	**3E+00**
5	RD	B2028	1E-07	<1	<1
5	RD	B2030	3E-07	9E+00	**6E+00**
5	RD	B2032	3E-07	1E+01	**6E+00**
5	RD	B2127	**2E-06**	<1	<1
5	RD	B2128	**3E-06**	<1	<1
5	RD	B2129	**4E-05**	1E+01	**6E+00**
5	RD	B2130	4E-07	1E+01	**8E+00**
5	RD	B2131	3E-07	1E+01	**6E+00**
5	RD	B2132	1E-07	7E+00	**3E+00**
5	RD	B2228	**4E-06**	<1	<1
5	RD	B2230	**2E-05**	6E+00	**2E+00**
5	RD	B2232	**2E-04**	1E+01	**6E+00**
5	RD	B2332	4E-07	1E+01	**8E+00**
6	RD	B1424	9E-07	<1	<1
6	RD	B1425	**1E-04**	1E+01	**4E+00**
6	RD	B1426	**2E-04**	1E+01	**4E+00**
6	RD	B1523	**1E-04**	8E+00	**3E+00**
6	RD	B1525	7E-11	<1	<1
6	RD	B1526	--	<1	<1
6	RD	B1622	**1E-04**	6E+00	**2E+00**
6	RD	B1623	**1E-04**	1E+01	**4E+00**
6	RD	B1626	**7E-05**	1E+01	**4E+00**
6	RD	B1723	**1E-04**	6E+00	**2E+00**
6	RD	B1826	**1E-04**	1E+01	**4E+00**
6	RD	B2026	**1E-04**	5E+00	<1
6	RD	B2224	**6E-06**	--	--
6	RD	B2225	4E-07	1E+01	**5E+00**
6	RD	B2226	**1E-04**	5E+00	**2E+00**
6	RD	B2325	3E-07	9E+00	**5E+00**
6	RD	B2326	**9E-05**	1E+01	**5E+00**
6	RD	B2419	**2E-04**	1E+01	**7E+00**

TABLE A-16: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
6	RD	B2425	**8E-05**	1E+01	**5E+00**
6	RD	B2526	**7E-05**	6E+00	**2E+00**
7	MU	B2635	**9E-05**	4E+00	**3E+00**
7	MU	B2727	**3E-04**	1E+01	**3E+00**
7	MU	B2735	**4E-04**	6E+00	**3E+00**
7	MU	B2835	**1E-04**	2E+00	<1
7	MU	B3127	**1E-04**	2E+00	**2E+00**
7	MU	B3128	**1E-04**	2E+00	**2E+00**
7	MU	B3228	**2E-04**	1E+01	**5E+00**
7	MU	B3229	**2E-04**	8E+00	**2E+00**
7	MU	B3328	1E-07	6E+00	**3E+00**
7	MU	B3433	**9E-05**	5E+00	<1
7	MU	B3434	**9E-05**	4E+00	<1
8	MU	B2623	5E-07	<1	<1
8	MU	B2624	**1E-04**	9E+00	**4E+00**
8	MU	B2625	**9E-05**	9E+00	**5E+00**
8	MU	B2722	**1E-04**	1E+01	**4E+00**
8	MU	B2723	**1E-05**	2E+00	**2E+00**
8	MU	B2724	**3E-05**	<1	<1
8	MU	B2725	5E-07	7E+00	**3E+00**
8	MU	B2726	**7E-05**	9E+00	**4E+00**
8	MU	B2823	**2E-04**	1E+01	**4E+00**
8	MU	B2824	**1E-05**	<1	<1
8	MU	B2826	--	<1	<1
8	MU	B2922	**1E-04**	8E+00	**3E+00**
8	MU	B2923	**2E-04**	2E+01	**1E+01**
8	MU	B2924	**9E-05**	<1	<1
8	MU	B2925	**7E-05**	<1	<1
8	MU	B2926	**2E-04**	1E+01	**3E+00**
8	MU	B3023	9E-09	<1	<1
8	MU	B3024	2E-08	<1	<1
8	MU	B3026	--	<1	<1
8	MU	B3124	1E-06	--	--
8	MU	B3126	**9E-05**	1E+01	**7E+00**
8	MU	B3226	--	<1	<1
8	MU	B3324	--	--	--
8	MU	B3326	**7E-05**	1E+01	**5E+00**
8	MU	B3422	**3E-06**	<1	<1
8	MU	B3423	**1E-04**	7E+00	**2E+00**
8	MU	B3425	1E-07	8E+00	**3E+00**
8	MU	B3426	**2E-04**	1E+01	**7E+00**
8	MU	B3522	--	<1	<1
8	MU	B3525	--	<1	<1
8	MU	B3622	6E-07	2E+00	**2E+00**
8	MU	B3623	2E-07	<1	<1
9	MU	B2716	3E-07	8E+00	**6E+00**
9	MU	B2818	**2E-06**	--	--
9	MU	B2918	**1E-04**	7E+00	**2E+00**
9	MU	B2921	**1E-04**	1E+01	**6E+00**

TABLE A-16: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
9	MU	B3117	--	2E+00	**2E+00**
9	MU	B3118	**1E-04**	1E+01	**3E+00**
9	MU	B3215	**2E-04**	2E+00	<1
9	MU	B3217	--	2E+00	**2E+00**
9	MU	B3218	**8E-05**	2E+00	**2E+00**
9	MU	B3220	--	<1	<1
9	MU	B3315	**1E-04**	1E+01	**4E+00**
9	MU	B3316	9E-07	<1	<1
9	MU	B3415	**7E-05**	1E+01	**3E+00**
9	MU	B3418	**6E-05**	1E+01	**6E+00**
9	MU	B3421	**2E-04**	1E+01	**6E+00**
9	MU	B3515	**2E-04**	<1	<1
9	MU	B3516	**1E-04**	8E+00	**2E+00**
9	MU	B3520	3E-07	1E+01	**6E+00**
9	MU	B3615	--	<1	<1
12	MU	B3715	**2E-04**	<1	<1
12	MU	B3718	**3E-04**	1E+01	**5E+00**
12	MU	B3815	1E-06	5E+00	**4E+00**
12	MU	B3816	**2E-04**	8E+00	**2E+00**
12	MU	B3817	--	<1	<1
12	MU	B3915	**2E-04**	9E+00	**3E+00**
12	MU	B3916	5E-10	2E+00	**2E+00**
12	MU	B3917	**6E-06**	<1	<1
12	MU	B3918	--	<1	<1
12	MU	B3919	**3E-06**	2E+00	<1
12	MU	B3920	6E-07	--	--
12	MU	B4015	1E-06	2E+00	**2E+00**
12	MU	B4016	**2E-06**	2E+00	<1
12	MU	B4017	**2E-04**	3E+00	**2E+00**
12	MU	B4018	4E-07	2E+00	<1
12	MU	B4019	**9E-05**	7E+00	**3E+00**
12	MU	B4020	7E-08	3E+00	**3E+00**
12	MU	B4115	**2E-05**	2E+00	<1
12	MU	B4116	**2E-05**	3E+00	**3E+00**
12	MU	B4117	6E-07	<1	<1
12	MU	B4215	1E-06	<1	<1
12	MU	B4217	**9E-05**	5E+00	**2E+00**
12	MU	B4218	**8E-05**	7E+00	**2E+00**
12	MU	B4219	**1E-04**	7E+00	**2E+00**
12	MU	B4220	**2E-04**	9E+00	**3E+00**
12	MU	B4315	**3E-04**	1E+01	**3E+00**
12	MU	B4319	--	<1	<1
12	MU	B4320	**8E-05**	8E+00	**2E+00**
12	MU	B4321	--	<1	<1
12	MU	B4415	3E-08	5E+00	**2E+00**
12	MU	B4417	--	<1	<1
12	MU	B4418	4E-07	<1	<1
12	MU	B4419	8E-07	<1	<1
12	MU	B4420	5E-07	<1	<1

TABLE A-16: TOTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
12	MU	B4421	7E-07	<1	<1
12	MU	B4515	**9E-05**	6E+00	**2E+00**
12	MU	B4517	**2E-04**	7E+00	**3E+00**
12	MU	B4518	5E-07	<1	<1
12	MU	B4519	4E-07	<1	<1
12	MU	B4520	**4E-06**	<1	<1
12	MU	B4521	**7E-05**	5E+00	<1
12	MU	B4615	**1E-04**	8E+00	**3E+00**
12	MU	B4616	2E-07	8E+00	**4E+00**
12	MU	B4617	**9E-05**	7E+00	**3E+00**
12	MU	B4620	4E-08	<1	<1
12	MU	B4621	8E-07	5E+00	**2E+00**
15	MU	B4716	**2E-04**	2E+01	**1E+01**
15	MU	B4717	**9E-05**	5E+00	<1
15	MU	B4816	**9E-05**	6E+00	**2E+00**
15	MU	B4817	**9E-05**	5E+00	<1
15	MU	B4818	**1E-04**	7E+00	**2E+00**
15	MU	B4819	**9E-05**	4E+00	<1
15	MU	B4916	**7E-05**	8E+00	**3E+00**
15	MU	B4917	**7E-05**	6E+00	**2E+00**
16	E/C	AX04	**1E-04**	<1	<1
16	E/C	AY03	**6E-05**	<1	<1
16	E/C	AY04	**1E-05**	<1	<1

Notes:

--	Not applicable
bgs	Below ground surface
E/C	Educational/cultural (industrial exposure scenario)
MU	Mixed use (residential exposure scenario)
RD	Research and development (residential exposure scenario)
RME	Reasonable maximum exposure

TABLE A-17: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
2	RD	B0336	1E-04	5E+00	<1	Metal	ARSENIC	C	4.2 - 4.2	4.20E+00	1/1	1.10E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
2	RD	B0339	1E-04	4E+00	<1	Metal	ARSENIC	C	4 - 4	4.00E+00	1/1	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
2	RD	B0640	9E-08	6E+00	2E+00	Metal	IRON	NC	34500 - 34500	3.45E+04	1/1	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	566 - 566	5.66E+02	1/1	5.82E-08	--	--	--	--	1.87E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
3	RD	B1028	1E-04	1E+01	8E+00	Metal	ANTIMONY	NC	67.9 - 67.9	6.79E+01	1/1	--	--	--	--	--	6.65E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	5.3 - 5.3	5.30E+00	1/1	1.38E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	30000 - 30000	3.00E+04	1/1	--	--	--	--	--	1.37E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	368 - 368	3.68E+02	1/1	3.78E-08	--	--	--	--	1.22E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							ZINC	NC	383 - 383	3.83E+02	1/1	--	--	--	--	--	1.03E+00	1.6 %	0 %	0 %	98.4 %	109.86	Yes
						PAH	BENZO(A)PYRENE	C	0.046 - 0.046	4.60E-02	1/1	1.23E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/1	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
3	RD	B1029	1E-04	4E+00	<1	Metal	ARSENIC	C	4.4 - 4.4	4.40E+00	1/2	1.15E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						Pest/PCB	DIELDRIN	C	0.002 - 0.002	2.00E-03	1/2	3.03E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	2 - 2	2.00E+00	1/2	1.75E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--	--	--
3	RD	B1129	1E-04	5E+00	2E+00	Metal	ARSENIC	C	4.1 - 4.1	4.10E+00	1/1	1.07E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33400 - 33400	3.34E+04	1/1	--	--	--	--	--	1.52E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							VANADIUM	NC	76.5 - 76.5	7.65E+01	1/1	--	--	--	--	--	1.18E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
3	RD	B1130	1E-04	9E+00	2E+00	Metal	ARSENIC	C	5 - 5	5.00E+00	1/1	1.31E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	376 - 376	3.76E+02	1/1	--	--	--	--	--	2.36E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	33100 - 33100	3.31E+04	1/1	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	399 - 399	3.99E+02	1/1	4.10E-08	--	--	--	--	1.32E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.16 - 0.16	1.60E-01	1/1	4.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1131	2E-04	1E+01	3E+00	Metal	ARSENIC	C	5.8 - 5.8	5.80E+00	1/1	1.52E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	432 - 432	4.32E+02	1/1	--	--	--	--	--	2.71E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	36000 - 36000	3.60E+04	1/1	--	--	--	--	--	1.64E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	465 - 465	4.65E+02	1/1	4.78E-08	--	--	--	--	1.54E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	0.48 - 0.48	4.80E-01	1/1	1.30E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.42 - 0.42	4.20E-01	1/1	1.13E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.49 - 0.49	4.90E-01	1/1	1.45E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.34 - 0.34	3.40E-01	1/1	1.00E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.078 - 0.078	7.80E-02	1/1	1.35E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
3	RD	B1231	2E-04	7E+00	2E+00	Metal	ARSENIC	C	6.3 - 6.3	6.30E+00	1/1	1.65E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	282 - 282	2.82E+02	1/1	--	--	--	--	--	1.77E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	31400 - 31400	3.14E+04	1/1	--	--	--	--	--	1.43E+00	93.6 %	0 %	0 %	6.4 %	58000	No
						PAH	BENZO(A)ANTHRACENE	C	0.51 - 0.51	5.10E-01	1/1	1.38E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.37 - 0.37	3.70E-01	1/1	9.92E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1330	3E-04	9E+00	2E+00	Metal	ARSENIC	C	11.2 - 11.2	1.12E+01	1/1	2.93E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	Yes
							COPPER	NC	301 - 301	3.01E+02	1/1	--	--	--	--	--	1.89E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	27000 - 27000	2.70E+04	1/1	--	--	--	--	--	1.23E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	465 - 465	4.65E+02	1/1	4.78E-08	--	--	--	--	1.54E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.084 - 0.084	8.40E-02	1/1	2.25E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--

TABLE A-17: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
3	RD	B1331	1E-04	6E+00	2E+00	Metal	ARSENIC	C	4.9 - 4.9	4.90E+00	1/1	1.28E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	34500 - 34500	3.45E+04	1/1	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	439 - 439	4.39E+02	1/1	4.51E-08	--	--	--	--	1.45E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1632	1E-04	2E+00	<1	Metal	ARSENIC	C	4.6 - 4.6	4.60E+00	1/1	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
5	RD	B2129	2E-07	7E+00	5E+00	Metal	IRON	NC	25900 - 25900	2.59E+04	1/1	--	--	--	--	--	1.18E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1410 - 1410	1.41E+03	1/1	1.45E-07	--	--	--	--	4.67E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2130	2E-07	8E+00	4E+00	Metal	IRON	NC	38300 - 38300	3.83E+04	1/1	--	--	--	--	--	1.74E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1200 - 1200	1.20E+03	1/1	1.23E-07	--	--	--	--	3.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2132	1E-07	7E+00	3E+00	Metal	IRON	NC	32400 - 32400	3.24E+04	1/1	--	--	--	--	--	1.48E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	914 - 914	9.14E+02	1/1	9.40E-08	--	--	--	--	3.03E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2232	2E-04	2E+00	<1	Metal	ARSENIC	C	6.4 - 6.4	6.40E+00	1/1	1.67E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
5	RD	B2332	3E-07	1E+01	8E+00	Metal	IRON	NC	37500 - 37500	3.75E+04	1/1	--	--	--	--	--	1.71E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	2390 - 2390	2.39E+03	1/1	2.46E-07	--	--	--	--	7.91E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1626	5E-05	9E+00	4E+00	Metal	ARSENIC	C	1.7 - 1.7	1.70E+00	1/2	4.44E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--		11.1	No
							IRON	NC	23700 - 33100	3.31E+04	2/2	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	788 - 998	9.98E+02	2/2	--	--	--	--	--	1.18E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	79.4 - 1300	1.30E+03	2/2	1.34E-07	--	--	--	--	4.30E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						VOC	TETRACHLOROETHENE	C	2.8 - 2.8	2.80E+00	1/1	5.80E-06	40.8 %	0 %	59.2 %	0 %	<1	--	--	--	--	--	--
6	RD	B2224	6E-06	--	--	PAH	BENZO(A)PYRENE	C	0.13 - 0.13	1.30E-01	1/1	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
6	RD	B2225	4E-07	1E+01	6E+00	Metal	IRON	NC	33500 - 45000	4.50E+04	3/3	--	--	--	--	--	2.05E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	584 - 1220	1.22E+03	3/3	--	--	--	--	--	1.45E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	390 - 1940	1.94E+03	3/3	2.00E-07	--	--	--	--	6.42E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2325	2E-07	8E+00	5E+00	Metal	IRON	NC	35400 - 35400	3.54E+04	1/1	--	--	--	--	--	1.61E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1440 - 1440	1.44E+03	1/1	1.48E-07	--	--	--	--	4.77E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2326	9E-05	5E+00	<1	Metal	ARSENIC	C	3.6 - 3.6	3.60E+00	1/1	9.40E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
6	RD	B2425	1E-04	1E+01	3E+00	Metal	ARSENIC	C	2.1 - 6.4	4.10E+00	6/8	1.07E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	23500 - 40100	4.01E+04	3/3	--	--	--	--	--	1.83E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	753 - 1270	1.27E+03	3/3	--	--	--	--	--	1.51E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	141 - 1040	1.04E+03	3/3	1.07E-07	--	--	--	--	3.44E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	34.7 - 66.7	6.67E+01	3/3	--	--	--	--	--	1.03E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
7	MU	B3228	2E-04	1E+01	3E+00	Metal	ARSENIC	C	7.4 - 7.4	7.40E+00	1/1	1.93E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	36400 - 36400	3.64E+04	1/1	--	--	--	--	--	1.66E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	763 - 2640	2.31E+03	5/5	--	--	--	--	--	2.74E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	765 - 765	7.65E+02	1/1	7.87E-08	--	--	--	--	2.53E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
7	MU	B3229	2E-04	8E+00	2E+00	Metal	ARSENIC	C	6.2 - 6.2	6.20E+00	1/1	1.62E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	38700 - 38700	3.87E+04	1/1	--	--	--	--	--	1.76E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1450 - 1450	1.45E+03	1/1	--	--	--	--	--	1.72E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	624 - 624	6.24E+02	1/1	6.42E-08	--	--	--	--	2.07E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	66.3 - 66.3	6.63E+01	1/1	--	--	--	--	--	1.02E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
7	MU	B3433	7E-05	4E+00	<1	Metal	ARSENIC	C	2.6 - 2.6	2.60E+00	1/1	6.79E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
7	MU	B3434	1E-04	4E+00	<1	Metal	ARSENIC	C	3 - 3.7	3.70E+00	2/2	9.66E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No

TABLE A-17: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
8	MU	B2624	9E-05	7E+00	3E+00	Metal	ARSENIC	C	3.4 - 3.4	3.40E+00	1/1	8.88E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	30200 - 30200	3.02E+04	1/1	--	--	--	--	--	1.38E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	868 - 868	8.68E+02	1/1	8.93E-08	--	--	--	--	2.87E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2625	9E-05	6E+00	3E+00	Metal	ARSENIC	C	3.6 - 3.6	3.60E+00	1/1	9.40E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	28100 - 28100	2.81E+04	1/1	--	--	--	--	--	1.28E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	817 - 817	8.17E+02	1/1	8.40E-08	--	--	--	--	2.70E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2722	1E-04	4E+00	<1	Metal	ARSENIC	C	4.5 - 4.5	4.50E+00	1/1	1.18E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
8	MU	B2723	2E-06	<1	<1	VOC	TRICHLOROETHENE	C	4.9 - 4.9	4.90E+00	1/1	1.66E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2922	1E-04	6E+00	2E+00	Metal	ARSENIC	C	3.9 - 3.9	3.90E+00	1/1	1.02E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	35900 - 35900	3.59E+04	1/1	--	--	--	--	--	1.63E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							VANADIUM	NC	78.3 - 78.3	7.83E+01	1/1	--	--	--	--	--	1.21E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
8	MU	B2923	2E-07	6E+00	3E+00	Metal	IRON	NC	32100 - 32100	3.21E+04	1/1	--	--	--	--	--	1.46E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1900 - 1900	1.90E+03	1/1	--	--	--	--	--	2.25E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	73.6 - 73.6	7.36E+01	1/1	--	--	--	--	--	1.14E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
8	MU	B2926	2E-04	7E+00	2E+00	Metal	ARSENIC	C	1 - 8.9	8.90E+00	2/2	2.32E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	25100 - 34200	3.42E+04	2/2	--	--	--	--	--	1.56E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	42.9 - 560	5.60E+02	2/2	5.76E-08	--	--	--	--	1.85E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.039 - 0.039	3.90E-02	1/2	1.05E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
8	MU	B3126	1E-04	2E+00	<1	Metal	ARSENIC	C	5.3 - 5.3	5.30E+00	1/2	1.38E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
8	MU	B3426	7E-05	4E+00	<1	Metal	ARSENIC	C	2.8 - 2.8	2.80E+00	1/1	7.31E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							LEAD	NC	163 - 163	1.63E+02	1/1	--	--	--	--	--	--	--	--	--	--	8.99	Yes
9	MU	B2818	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.048 - 0.048	4.80E-02	1/3	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
9	MU	B2921	2E-07	8E+00	5E+00	Metal	IRON	NC	26300 - 26300	2.63E+04	1/1	--	--	--	--	--	1.20E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	908 - 908	9.08E+02	1/1	--	--	--	--	--	1.08E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1500 - 1500	1.50E+03	1/1	1.54E-07	--	--	--	--	4.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3118	2E-07	9E+00	3E+00	Metal	IRON	NC	46000 - 46000	4.60E+04	1/1	--	--	--	--	--	2.09E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	951 - 951	9.51E+02	1/1	--	--	--	--	--	1.13E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	961 - 961	9.61E+02	1/1	9.88E-08	--	--	--	--	3.18E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3315	1E-04	8E+00	3E+00	Metal	ARSENIC	C	4 - 4	4.00E+00	1/1	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	37100 - 37100	3.71E+04	1/1	--	--	--	--	--	1.69E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1020 - 1020	1.02E+03	1/1	--	--	--	--	--	1.21E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	799 - 799	7.99E+02	1/1	8.22E-08	--	--	--	--	2.64E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3415	2E-07	9E+00	3E+00	Metal	IRON	NC	47400 - 47400	4.74E+04	1/1	--	--	--	--	--	2.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	961 - 961	9.61E+02	1/1	--	--	--	--	--	1.14E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	982 - 982	9.82E+02	1/1	1.01E-07	--	--	--	--	3.25E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	79.7 - 79.7	7.97E+01	1/1	--	--	--	--	--	1.23E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
9	MU	B3520	9E-08	7E+00	2E+00	Metal	IRON	NC	37100 - 37100	3.71E+04	1/1	--	--	--	--	--	1.69E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	999 - 999	9.99E+02	1/1	--	--	--	--	--	1.19E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	430 - 430	4.30E+02	1/1	4.42E-08	--	--	--	--	1.42E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	74.9 - 74.9	7.49E+01	1/1	--	--	--	--	--	1.16E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4019	7E-05	2E+00	<1	Metal	ARSENIC	C	1.7 - 2.7	2.70E+00	2/2	7.05E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	1110 - 1160	1.16E+03	2/2	--	--	--	--	--	1.38E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
12	MU	B4220	--	3E+00	2E+00	Metal	MANGANESE	NC	933 - 2040	2.04E+03	3/3	--	--	--	--	--	2.42E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes

TABLE A-17: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
12	MU	B4415	3E-08	4E+00	2E+00	Metal	IRON	NC	22700 - 22700	2.27E+04	1/1	--	--	--	--	--	1.03E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1240 - 1240	1.24E+03	1/1	--	--	--	--	--	1.47E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
12	MU	B4515	9E-05	6E+00	2E+00	Metal	ARSENIC	C	3.4 - 3.4	3.40E+00	1/1	8.88E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33100 - 33100	3.31E+04	1/1	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1020 - 1020	1.02E+03	1/1	--	--	--	--	--	1.21E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							VANADIUM	NC	71.9 - 71.9	7.19E+01	1/1	--	--	--	--	--	1.11E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4517	1E-04	5E+00	2E+00	Metal	ARSENIC	C	5.2 - 5.2	5.20E+00	1/1	1.36E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33300 - 33300	3.33E+04	1/1	--	--	--	--	--	1.52E+00	93.6 %	0 %	0 %	6.4 %	58000	No
12	MU	B4521	7E-05	5E+00	<1	Metal	ARSENIC	C	2.6 - 2.6	2.60E+00	1/1	6.79E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
12	MU	B4615	1E-04	8E+00	3E+00	Metal	ARSENIC	C	4.6 - 4.6	4.60E+00	1/1	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33200 - 33200	3.32E+04	1/1	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	2390 - 2390	2.39E+03	1/1	--	--	--	--	--	2.84E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	73.1 - 73.1	7.31E+01	1/1	--	--	--	--	--	1.13E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
15	MU	B4716	1E-04	9E+00	2E+00	Metal	ARSENIC	C	3.7 - 3.7	3.70E+00	1/2	9.66E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	18500 - 38500	3.85E+04	2/2	--	--	--	--	--	1.75E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	658 - 1440	1.44E+03	2/2	--	--	--	--	--	1.71E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	194 - 342	3.42E+02	2/2	3.52E-08	--	--	--	--	1.13E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	1.2 - 1.2	1.20E+00	1/4	3.24E-06	69.5 %	28.5 %	0 %	2 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.88 - 0.88	8.80E-01	1/4	2.36E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	1.8 - 1.8	1.80E+00	1/4	5.32E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.43 - 0.43	4.30E-01	1/4	1.27E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.38 - 0.38	3.80E-01	1/4	6.56E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
							INDENO(1,2,3-CD)PYRENE	C	0.99 - 0.99	9.90E-01	1/4	2.85E-06	65.3 %	26.8 %	0 %	8.0 %	--	--	--	--	--	--	--
15	MU	B4717	2E-05	4E+00	<1	Metal	ARSENIC	C	0.75 - 0.75	7.50E-01	1/1	1.96E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4816	6E-05	6E+00	2E+00	Metal	ARSENIC	C	2.2 - 2.2	2.20E+00	1/1	5.75E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	25400 - 25400	2.54E+04	1/1	--	--	--	--	--	1.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
15	MU	B4817	9E-05	5E+00	<1	Metal	ARSENIC	C	3.3 - 3.3	3.30E+00	1/1	8.62E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4819	9E-05	4E+00	<1	Metal	ARSENIC	C	3.5 - 3.5	3.50E+00	1/1	9.14E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4916	2E-05	8E+00	3E+00	Metal	ARSENIC	C	0.67 - 0.67	6.70E-01	1/1	1.75E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	36500 - 36500	3.65E+04	1/1	--	--	--	--	--	1.66E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	893 - 893	8.93E+02	1/1	9.18E-08	--	--	--	--	2.96E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
BOS-1	OS	AF09	7E-06	<1	<1	Metal	ARSENIC	C	2.3 - 2.5	2.50E+00	2/2	6.73E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
							LEAD	NC	93 - 340	3.40E+02	2/2	--	--	--	--		--	--	--	--		8.99	Yes
BOS-1	OS	AF10	6E-06	<1	<1	Metal	ARSENIC	C	1.2 - 2.2	2.20E+00	2/2	5.92E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-1	OS	AF12	2E-05	<1	<1	Metal	ARSENIC	C	3.9 - 6.2	6.20E+00	3/3	1.67E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-1	OS	AF13	1E-05	<1	<1	Metal	ARSENIC	C	4 - 4	4.00E+00	1/1	1.08E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-1	OS	AG09	1E-05	<1	<1	Metal	ARSENIC	C	2.1 - 3.8	3.40E+00	6/6	9.15E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
							LEAD	NC	36 - 210	1.62E+02	6/6	--	--	--	--		--	--	--	--		8.99	Yes
						Pest/PCB	AROCLOR-1260	C	0.025 - 1.6	1.05E+00	6/6	1.41E-06	26.6 %	73.4 %	0 %		<1	--	--	--		--	--
BOS-1	OS	AH08	1E-05	<1	<1	Metal	ARSENIC	C	0.575 - 4.5	4.50E+00	9/10	1.21E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
						PAH	BENZO(A)PYRENE	C	0.029 - 0.16	1.44E-01	6/10	1.10E-06	28.0 %	71.9 %	0 %		--	--	--	--		--	--

TABLE A-17: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
BOS-1	OS	AH09	2E-05	<1	<1	Metal	ARSENIC	C	1.7 - 4.6	3.01E+00	8/9	8.11E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
							LEAD	NC	4 - 800	5.36E+02	9/9	--	--	--	--		--	--	--	--		8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.026 - 0.3405	1.90E-01	7/9	1.46E-06	28.0 %	71.9 %	0 %		--	--	--	--		--	--
						Pest/PCB	AROCLOR-1260	C	0.016 - 3.5	3.50E+00	8/8	4.71E-06	26.6 %	73.4 %	0 %		<1	--	--	--		--	--
BOS-1	OS	AI08	2E-05	<1	<1	Metal	ARSENIC	C	1.6 - 5.2	4.04E+00	8/8	1.09E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
						PAH	BENZO(A)PYRENE	C	0.038 - 0.46	2.96E-01	6/8	2.26E-06	28.0 %	71.9 %	0 %		--	--	--	--		--	--
BOS-1	OS	AJ07	1E-05	<1	<1	Metal	ARSENIC	C	2.7 - 5.3	4.54E+00	4/5	1.22E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AK06	2E-05	<1	<1	Metal	ARSENIC	C	0.92 - 7.8	7.80E+00	2/5	2.10E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AL06	3E-05	<1	<1	Metal	ARSENIC	C	4.1 - 9.5	9.50E+00	2/2	2.56E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AM06	7E-06	<1	<1	Metal	ARSENIC	C	2.6 - 2.6	2.60E+00	1/1	7.00E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AO05	1E-05	<1	<1	Metal	ARSENIC	C	4.1 - 4.1	4.10E+00	1/1	1.10E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AP05	1E-05	<1	<1	Metal	ARSENIC	C	4 - 4	4.00E+00	1/2	1.08E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-2	OS	AT05	9E-06	<1	<1	Metal	ARSENIC	C	3.4 - 3.4	3.40E+00	1/2	9.15E-06	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-3	OS	AU05	2E-05	2E+00	<1	Metal	ARSENIC	C	2.2 - 4.6	4.60E+00	3/4	1.24E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
							LEAD	NC	2.35 - 760	7.60E+02	6/6	--	--	--	--		--	--	--	--		8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.032 - 0.51	5.10E-01	4/9	3.90E-06	28.0 %	71.9 %	0 %		--	--	--	--		--	--
						Pest/PCB	AROCLOR-1254	C	1.1 - 1.1	1.10E+00	1/7	1.48E-06	26.6 %	73.4 %	0 %		<1	--	--	--		--	--
							AROCLOR-1260	C	0.073 - 3.1	3.10E+00	3/7	4.17E-06	26.6 %	73.4 %	0 %		<1	--	--	--		--	--
BOS-3	OS	AV05	2E-05	<1	<1	Metal	ARSENIC	C	6 - 6	6.00E+00	1/1	1.62E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	No
BOS-3	OS	AW03	8E-05	2E+00	<1	Metal	ARSENIC	C	7.7 - 28	2.80E+01	2/2	7.54E-05	62.8 %	37.2 %	0 %		<1	--	--	--		11.1	Yes
							LEAD	NC	80 - 230	2.30E+02	2/2	--	--	--	--		--	--	--	--		8.99	Yes
						Pest/PCB	AROCLOR-1260	C	0.2 - 2.7	2.70E+00	2/2	3.64E-06	26.6 %	73.4 %	0 %		<1	--	--	--		--	--

Notes:

All concentrations shown in mg/kg.

--	Not applicable or chemical is not a COC for this endpoint
*	Not available; comparison to ambient levels based on regression analysis
	Not evaluated because exposure pathway is incomplete
bgs	Below ground surface
C	Cancer effect
COC	Chemical of concern
DF	Detection frequency
EPC	Exposure point concentration
HI	Hazard index
HPAL	Hunters Point ambient level
mg/kg	Milligram per kilogram
MU	Mixed use (residential exposure scenario)
NC	Noncancer effect
RD	Residential development
RME	Reasonable maximum exposure
OS	Open space
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
Pest	Pesticide
SVOC	Semivolatile organic compound
VOC	Volatile organic compound

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
1	MU	B0143	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.014 - 0.059	5.90E-02	2/2	1.58E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
1	MU	B0144	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.024 - 0.051	5.10E-02	2/4	1.37E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0142	9E-06	<1	<1	Metal	LEAD	NC	2 - 230.5	2.31E+02	7/7	--	--	--	--	--	--	--	--	--	--	8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.016 - 0.12	1.07E-01	5/7	2.87E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.092 - 0.235	2.35E-01	2/5	4.06E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
2	RD	B0238	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.025 - 0.0595	5.44E-02	5/6	1.46E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0239	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.018 - 0.05	5.00E-02	3/3	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0240	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.012 - 0.047	4.70E-02	3/3	1.26E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0241	7E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.009 - 0.31	1.40E-01	13/14	3.76E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0242	9E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.03 - 0.22	2.20E-01	3/3	5.90E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.061 - 0.061	6.10E-02	1/1	1.05E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
2	RD	B0336	2E-04	6E+00	<1	Metal	ARSENIC	C	4.2 - 7.8	7.80E+00	3/3	2.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							LEAD	NC	45.3 - 240	2.40E+02	3/3	--	--	--	--	--	--	--	--	--	--	8.99	Yes
2	RD	B0339	1E-04	9E+00	4E+00	Metal	ARSENIC	C	3.2 - 4	4.00E+00	2/3	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	13200 - 46900	4.69E+04	3/3	--	--	--	--	--	2.14E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	24.1 - 1320	1.32E+03	3/3	1.36E-07	--	--	--	--	4.37E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
2	RD	B0341	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.008 - 0.074	5.50E-02	8/9	1.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
2	RD	B0434	2E-04	<1	<1	Metal	ARSENIC	C	6 - 6	6.00E+00	1/1	1.57E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
2	RD	B0438	3E-07	<1	<1	Metal	LEAD	NC	30.1 - 478	4.78E+02	5/5	--	--	--	--	--	--	--	--	--	--	8.99	Yes
2	RD	B0533	7E-05	<1	<1	Metal	ARSENIC	C	2.5 - 2.5	2.50E+00	1/1	6.53E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
2	RD	B0538	1E-07	8E+00	3E+00	Metal	IRON	NC	23000 - 56900	5.69E+04	3/3	--	--	--	--	--	2.59E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	183 - 422	4.22E+02	3/3	4.34E-08	--	--	--	--	1.3968986	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	53.6 - 149	1.49E+02	3/3	--	--	--	--	--	2.30E+00	82.9 %	0 %	0 %	17.1 %	117.17	Yes
2	RD	B0636	2E-04	<1	<1	Metal	ARSENIC	C	2.6 - 6.8	6.26E+00	4/5	1.63E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
2	RD	B0640	4E-07	1E+01	7E+00	Metal	IRON	NC	34500 - 54900	5.49E+04	3/3	--	--	--	--	--	2.4996112	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	615 - 1190	1.19E+03	3/3	--	--	--	--	--	1.41E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	566 - 2220	2.22E+03	3/3	2.28E-07	--	--	--	--	7.35E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
2	RD	B1036	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.072 - 0.076	7.60E-02	2/4	2.04E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B0532	4E-05	<1	<1	Metal	ARSENIC	C	1.2 - 1.4	1.40E+00	2/2	3.66E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						PAH	BENZO(A)PYRENE	C	0.035 - 0.13	1.30E-01	2/2	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B0632	6E-05	1E+01	9E+00	Metal	ARSENIC	C	0.73 - 2.2	2.12E+00	5/5	5.54E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	59300 - 59300	5.93E+04	1/1	--	--	--	--	--	2.70E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							MANGANESE	NC	930 - 930	9.30E+02	1/1	--	--	--	--	--	1.1032152	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	2660 - 2660	2.66E+03	1/1	2.74E-07	--	--	--	--	8.81E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
3	RD	B0928	9E-05	7E+00	2E+00	Metal	ARSENIC	C	3.5 - 3.5	3.50E+00	1/1	9.14E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	34900 - 34900	3.49E+04	1/1	--	--	--	--	--	1.59E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	575 - 575	5.75E+02	1/1	5.91E-08	--	--	--	--	1.90E+00	19.3 %	0 %	1.0 %	79.6 %	*	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

													Percent Contribution by Exposure Pathway to Total RME Cancer Risk					Percent Contribution by Exposure Pathway to Total RME HI				Metals	
Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
3	RD	B1028	2E-04	2E+01	7E+00	Metal	ANTIMONY	NC	1.8 - 67.9	6.79E+01	5/6	--	--	--	--	--	6.65E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	3.8 - 7.6	6.71E+00	6/6	1.75E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	26800 - 64300	5.07E+04	6/6	--	--	--	--	--	2.3091731	93.6 %	0 %	0 %	6.4 %	58000	Yes
							LEAD	NC	12.4 - 840	8.40E+02	7/7	--	--	--	--	--	--	--	--	--	--	8.99	Yes
							NICKEL	NC	46.6 - 564	4.25E+02	6/6	4.37E-08	--	--	--	--	1.41E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.031 - 0.046	4.60E-02	4/7	1.23E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/6	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
3	RD	B1029	5E-04	1E+01	6E+00	Metal	ARSENIC	C	4.4 - 10.3	6.98E+00	5/7	1.82E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	16000 - 40600	3.06E+04	7/7	--	--	--	--	--	1.3929093	93.6 %	0 %	0 %	6.4 %	58000	No
						PAH	BENZO(A)PYRENE	C	0.011 - 0.041	4.10E-02	6/7	1.10E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C,NC	0.074 - 14	5.93E+00	5/7	2.81E-05	66.1 %	29.2 %	0 %	4.7 %	5.44E+00	69.6 %	27.3 %	0 %	3.1 %	--	--
							DIELDRIN	C,NC	0.002 - 0.18	1.80E-01	3/7	2.73E-04	1.7 %	0.5 %	0 %	97.8 %	1.74E+00	2.7 %	0.7 %	0 %	96.6 %	--	--
							HEPTACHLOR EPOXIDE	C	0.001 - 0.003	3.00E-03	3/7	5.57E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	2 - 2	2.00E+00	1/7	1.75E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--	--	--
3	RD	B1030	2E-04	4E+00	<1	Metal	ARSENIC	C	7.3 - 7.3	7.30E+00	1/1	1.91E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
3	RD	B1128	2E-04	7E+00	2E+00	Metal	ARSENIC	C	4.7 - 7.7	7.30E+00	8/8	1.91E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	20700 - 39800	3.18E+04	8/8	--	--	--	--	--	1.45E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							LEAD	NC	39.2 - 575	3.63E+02	9/9	--	--	--	--	--	--	--	--	--	--	8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.018 - 0.32	2.22E-01	5/12	5.94E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1129	2E-04	2E+01	7E+00	Metal	ANTIMONY	NC	1.6 - 78.1	5.46E+01	10/10	--	--	--	--	--	5.34E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	4 - 6.1	5.24E+00	8/10	1.37E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	20.6 - 365	3.49E+02	10/10	--	--	--	--	--	2.20E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	18300 - 38700	3.19E+04	10/10	--	--	--	--	--	1.45E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	60.7 - 596	3.35E+02	10/10	3.45E-08	--	--	--	--	1.1101654	19.3 %	0 %	1.0 %	79.6 %	*	No
							ZINC	NC	58.1 - 958	5.92E+02	10/10	--	--	--	--	--	1.59E+00	1.6 %	0 %	0 %	98.4 %	109.86	Yes
						PAH	BENZO(A)PYRENE	C	0.009 - 0.1115	8.51E-02	8/10	2.28E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	AROCLOR-1254	C	0.02 - 0.16	1.24E-01	4/10	1.33E-06	29.1 %	12.9 %	0 %	58.0 %	<1	--	--	--	--	--	--
							AROCLOR-1260	C,NC	0.037 - 2.5	2.50E+00	7/10	1.18E-05	66.1 %	29.2 %	0 %	4.7 %	2.29E+00	69.6 %	27.3 %	0 %	3.1 %	--	--
							BETA-BHC	C	0.004 - 0.008	8.00E-03	2/10	1.21E-06	1.9 %	0.2 %	0 %	97.9 %	<1	--	--	--	--	--	--
							DIELDRIN	C	0.009 - 0.051	4.20E-02	5/10	6.38E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.002 - 0.008	4.39E-03	4/10	8.15E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	3.2 - 9.3	9.30E+00	2/10	8.15E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--	--	--

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
3	RD	B1130	3E-04	2E+01	6E+00	Metal	ANTIMONY	NC	4.3 - 49.5	4.95E+01	7/7	--	--	--	--	--	4.84E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	3.8 - 10.8	7.95E+00	7/7	2.08E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	27.1 - 1120	6.38E+02	7/7	--	--	--	--	--	4.01E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	16600 - 61000	4.43E+04	7/7	--	--	--	--	--	2.02E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							LEAD	NC	62.8 - 203	1.64E+02	7/7	--	--	--	--	--	--	--	--	--	--	8.99	Yes
							MANGANESE	NC	304 - 1180	8.65E+02	7/7	--	--	--	--	--	1.03E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	60.9 - 466	3.61E+02	7/7	3.71E-08	--	--	--	--	1.19E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	0.023 - 0.76	4.25E-01	7/7	1.15E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.013 - 0.57	5.70E-01	7/7	1.53E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.018 - 0.68	6.80E-01	6/7	2.01E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.012 - 0.52	5.20E-01	6/7	1.54E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.012 - 0.12	8.82E-02	5/7	1.52E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C	0.04 - 1.1	6.34E-01	6/7	3.00E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--	--	--
							DIELDRIN	C	0.002 - 0.054	2.84E-02	4/7	4.31E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
							HEPTACHLOR EPOXIDE	C,NC	0.002 - 0.015	1.50E-02	5/7	2.79E-05	0.8 %	0.2 %	0 %	99.0 %	1.19E+00	1.2 %	0.3 %	0 %	98.4 %	--	--
3	RD	B1131	3E-04	1E+01	4E+00	Metal	ARSENIC	C	3.3 - 13.3	9.16E+00	6/7	2.39E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	Yes
							COPPER	NC	17.9 - 826	5.71E+02	7/7	--	--	--	--	--	3.58E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	10900 - 63200	4.95E+04	7/7	--	--	--	--	--	2.26E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							MANGANESE	NC	346 - 1200	9.34E+02	7/7	--	--	--	--	--	1.11E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							MERCURY	NC	0.08 - 2.6	2.60E+00	7/7	--	--	--	--	--	1.63E+00	6.8 %	0 %	0 %	93.2 %	2.28	Yes
							NICKEL	NC	24.3 - 858	5.32E+02	7/7	5.47E-08	--	--	--	--	1.76E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	0.009 - 0.57	3.98E-01	7/7	1.08E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.008 - 0.42	3.16E-01	7/7	8.47E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.01 - 0.49	3.56E-01	7/7	1.05E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.032 - 0.078	7.80E-02	4/7	1.35E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.001 - 0.001	1.00E-03	1/7	1.86E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
3	RD	B1228	2E-04	6E+00	<1	Metal	ARSENIC	C	3.4 - 7.6	6.67E+00	5/5	1.74E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							LEAD	NC	100 - 286	2.41E+02	5/5	--	--	--	--	--	--	--	--	--	--	8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.017 - 0.096	6.88E-02	6/6	1.84E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1229	2E-04	7E+00	2E+00	Metal	ARSENIC	C	2.9 - 7.6	6.92E+00	4/5	1.81E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	18800 - 33600	3.05E+04	5/5	--	--	--	--	--	1.39E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							LEAD	NC	64.7 - 707	5.58E+02	5/5	--	--	--	--	--	--	--	--	--	--	8.99	Yes
							MERCURY	NC	0.05 - 2.6	1.86E+00	5/5	--	--	--	--	--	1.17E+00	6.8 %	0 %	0 %	93.2 %	2.28	Yes
							NICKEL	NC	66.5 - 442	3.06E+02	5/5	3.14E-08	--	--	--	--	1.01E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.017 - 0.084	7.51E-02	5/5	2.01E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1230	2E-04	8E+00	2E+00	Metal	ANTIMONY	NC	2 - 24.85	1.64E+01	5/5	--	--	--	--	--	1.61E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	3.35 - 5	5.00E+00	5/5	1.31E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	20750 - 25600	2.54E+04	5/5	--	--	--	--	--	1.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							LEAD	NC	60.3 - 184	1.77E+02	5/5	--	--	--	--	--	--	--	--	--	--	8.99	Yes
						PAH	BENZO(A)PYRENE	C	0.014 - 0.12	9.58E-02	5/5	2.57E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C	0.23 - 0.23	2.30E-01	1/5	1.09E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--	--	--
							DIELDRIN	C	0.0085 - 0.0085	8.50E-03	1/5	1.29E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/5	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
3	RD	B1231	2E-04	7E+00	2E+00	Metal	ARSENIC	C	2.6 - 6.3	6.28E+00	4/4	1.64E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	22.6 - 282	2.40E+02	4/4	--	--	--	--	--	1.51E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	17600 - 31400	3.03E+04	4/4	--	--	--	--	--	1.38E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	68.4 - 342	3.42E+02	4/4	3.52E-08	--	--	--	--	1.13E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	0.51 - 0.51	5.10E-01	1/4	1.38E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.011 - 0.37	3.70E-01	2/4	9.92E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
3	RD	B1328	2E-04	2E+01	9E+00	Metal	ARSENIC	C	3.6 - 9.4	8.17E+00	5/5	2.13E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	18900 - 49200	4.58E+04	5/5	--	--	--	--	--	2.08E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	415 - 3980	3.98E+03	5/5	--	--	--	--	--	4.72E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							MERCURY	NC	0.07 - 6	6.00E+00	5/5	--	--	--	--	--	3.77E+00	6.8 %	0 %	0 %	93.2 %	2.28	Yes
							NICKEL	NC	50.3 - 1760	1.39E+03	5/5	1.43E-07	--	--	--	--	4.60E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						Pest/PCB	AROCLOR-1260	C	0.03 - 0.23	2.30E-01	2/5	1.09E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--	--	--
							DIELDRIN	C	0.002 - 0.003	3.00E-03	2/5	4.55E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
3	RD	B1329	2E-04	8E+00	2E+00	Metal	ARSENIC	C	5.9 - 7.6	7.60E+00	3/3	1.99E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	17400 - 37500	3.75E+04	3/3	--	--	--	--	--	1.71E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	324 - 926	9.26E+02	3/3	--	--	--	--	--	1.10E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	165 - 551	5.51E+02	3/3	5.67E-08	--	--	--	--	1.82E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.039 - 0.087	8.70E-02	3/3	2.33E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.001 - 0.001	1.00E-03	1/3	1.86E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
3	RD	B1330	3E-03	2E+01	8E+00	Metal	ARSENIC	C,NC	4.6 - 123.95	1.24E+02	5/5	3.24E-03	56.6 %	5.4 %	0 %	38.0 %	7.91E+00	66.8 %	5.6 %	0.1 %	27.5 %	11.1	Yes
							COPPER	NC	28.9 - 507	4.15E+02	5/5	--	--	--	--	--	2.61E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	23400 - 36000	3.36E+04	5/5	--	--	--	--	--	1.53E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	431 - 1040	8.86E+02	5/5	--	--	--	--	--	1.05E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	62 - 465	3.77E+02	5/5	3.88E-08	--	--	--	--	1.25E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	0.05 - 0.685	6.85E-01	4/5	1.85E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.0535 - 0.25	2.50E-01	4/5	6.70E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							NAPHTHALENE	C	3.75 - 3.75	3.75E+00	1/5	2.25E-06	31.3 %	0 %	68.7 %	0 %	<1	--	--	--	--	--	--
						Pest/PCB	AROCLOR-1254	C	0.49 - 0.49	4.90E-01	1/5	5.27E-06	29.1 %	12.9 %	0 %	58.0 %	<1	--	--	--	--	--	--
							DIELDRIN	C	0.017 - 0.017	1.70E-02	1/5	2.58E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.004 - 0.004	4.00E-03	1/5	7.43E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--	--	--
3	RD	B1331	1E-03	1E+01	3E+00	Metal	ARSENIC	C,NC	4.9 - 50	5.00E+01	2/2	1.31E-03	56.6 %	5.4 %	0 %	38.0 %	3.19E+00	66.8 %	5.6 %	0.1 %	27.5 %	11.1	Yes
							COPPER	NC	33.8 - 330	3.30E+02	2/2	--	--	--	--	--	2.07E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	34000 - 34500	3.45E+04	2/2	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	120 - 439	4.39E+02	2/2	4.51E-08	--	--	--	--	1.45E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1527	9E-08	5E+00	2E+00	Metal	IRON	NC	28500 - 28500	2.85E+04	1/1	--	--	--	--	--	1.30E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	486 - 486	4.86E+02	1/1	5.00E-08	--	--	--	--	1.61E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1628	3E-07	9E+00	6E+00	Metal	IRON	NC	36800 - 36800	3.68E+04	1/1	--	--	--	--	--	1.68E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1690 - 1690	1.69E+03	1/1	1.74E-07	--	--	--	--	5.59E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1632	1E-04	2E+00	<1	Metal	ARSENIC	C	2.6 - 4.6	4.60E+00	3/3	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						PAH	BENZO(A)PYRENE	C	0.02 - 0.058	5.80E-02	2/3	1.55E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
5	RD	B1727	3E-07	9E+00	5E+00	Metal	IRON	NC	29200 - 43200	4.32E+04	2/2	--	--	--	--	--	1.97E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1470 - 1560	1.56E+03	2/2	1.60E-07	--	--	--	--	5.16E+00	19.3 %	0 %	1.0 %	79.6 %	*	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
5	RD	B1728	2E-07	8E+00	4E+00	Metal	IRON	NC	27800 - 27800	2.78E+04	1/1	--	--	--	--	--	1.27E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	878 - 878	8.78E+02	1/1	--	--	--	--	--	1.04E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1160 - 1160	1.16E+03	1/1	1.19E-07	--	--	--	--	3.84E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1729	2E-07	6E+00	3E+00	Metal	IRON	NC	26400 - 26400	2.64E+04	1/1	--	--	--	--	--	1.20E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1010 - 1010	1.01E+03	1/1	1.04E-07	--	--	--	--	3.34E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1928	2E-04	1E+01	3E+00	Metal	ARSENIC	C	7.5 - 7.5	7.50E+00	1/1	1.96E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	45400 - 45400	4.54E+04	1/1	--	--	--	--	--	2.07E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	925 - 925	9.25E+02	1/1	--	--	--	--	--	1.10E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	875 - 875	8.75E+02	1/1	9.00E-08	--	--	--	--	2.90E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	66.6 - 66.6	6.66E+01	1/1	--	--	--	--	--	1.03E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
5	RD	B1930	1E-04	7E+00	4E+00	Metal	ARSENIC	C	4.1 - 4.1	4.10E+00	1/1	1.07E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	29700 - 29700	2.97E+04	1/1	--	--	--	--	--	1.35E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1060 - 1060	1.06E+03	1/1	1.09E-07	--	--	--	--	3.51E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B1931	2E-07	7E+00	3E+00	Metal	IRON	NC	34600 - 34600	3.46E+04	1/1	--	--	--	--	--	1.58E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	996 - 996	9.96E+02	1/1	1.02E-07	--	--	--	--	3.30E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2030	3E-07	9E+00	6E+00	Metal	IRON	NC	35500 - 35500	3.55E+04	1/1	--	--	--	--	--	1.62E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1730 - 1730	1.73E+03	1/1	1.78E-07	--	--	--	--	5.73E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2032	3E-07	1E+01	6E+00	Metal	IRON	NC	46400 - 46400	4.64E+04	1/1	--	--	--	--	--	2.11E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	887 - 887	8.87E+02	1/1	--	--	--	--	--	1.05E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1730 - 1730	1.73E+03	1/1	1.78E-07	--	--	--	--	5.73E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2127	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.01 - 0.048	4.80E-02	4/9	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
5	RD	B2128	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.085 - 0.085	8.50E-02	1/4	2.28E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
5	RD	B2129	4E-05	1E+01	6E+00	Metal	ARSENIC	C	1.7 - 1.7	1.70E+00	1/5	4.44E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	24300 - 40700	3.78E+04	5/5	--	--	--	--	--	1.72E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	615 - 1100	9.78E+02	5/5	--	--	--	--	--	1.16E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	808 - 1760	1.74E+03	5/5	1.79E-07	--	--	--	--	5.75E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2130	4E-07	1E+01	8E+00	Metal	IRON	NC	38300 - 51200	5.12E+04	2/2	--	--	--	--	--	2.33E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	703 - 1090	1.09E+03	2/2	--	--	--	--	--	1.29E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1200 - 2530	2.53E+03	2/2	2.60E-07	--	--	--	--	8.37E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2131	3E-07	1E+01	6E+00	Metal	IRON	NC	36100 - 40000	3.96E+04	4/4	--	--	--	--	--	1.80E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	672 - 911	8.83E+02	4/4	--	--	--	--	--	1.05E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							MERCURY	NC	1.6 - 1.6	1.60E+00	1/4	--	--	--	--	--	1.01E+00	6.8 %	0 %	0 %	93.2 %	2.28	No
							NICKEL	NC	1440 - 1900	1.85E+03	4/4	1.91E-07	--	--	--	--	6.13E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2132	1E-07	7E+00	3E+00	Metal	IRON	NC	32400 - 32400	3.24E+04	1/1	--	--	--	--	--	1.48E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	914 - 914	9.14E+02	1/1	9.40E-08	--	--	--	--	3.03E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2228	4E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.1 - 0.1	1.00E-01	1/2	2.68E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
5	RD	B2230	2E-05	6E+00	2E+00	Metal	ARSENIC	C	0.83 - 0.83	8.30E-01	1/1	2.17E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	31100 - 31100	3.11E+04	1/1	--	--	--	--	--	--	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	735 - 735	7.35E+02	1/1	7.56E-08	--	--	--	--	--	19.3 %	0 %	1.0 %	79.6 %	*	No
5	RD	B2232	2E-04	1E+01	6E+00	Metal	ARSENIC	C	1.9 - 6.4	6.40E+00	2/4	1.67E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	11300 - 44000	4.40E+04	4/4	--	--	--	--	--	2.00E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	86.2 - 1770	1.77E+03	4/4	1.82E-07	--	--	--	--	5.86E+00	19.3 %	0 %	1.0 %	79.6 %	*	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Metals: HPAL	Maximum Concentration Exceeds HPAL?
5	RD	B2332	4E-07	1E+01	8E+00	Metal	IRON	NC	37500 - 47400	4.74E+04	3/3	--	--	--	--	--	2.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	714 - 959	9.59E+02	3/3	--	--	--	--	--	1.14E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1730 - 2390	2.39E+03	3/3	2.46E-07	--	--	--	--	7.91E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1425	1E-04	1E+01	4E+00	Metal	ARSENIC	C	1.4 - 4.4	4.40E+00	2/2	1.15E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	44.2 - 180	1.80E+02	2/2	--	--	--	--	--	1.13E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	40100 - 41900	4.19E+04	2/2	--	--	--	--	--	1.91E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1010 - 1200	1.20E+03	2/2	1.23E-07	--	--	--	--	3.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.05 - 0.05	5.00E-02	1/4	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
6	RD	B1426	2E-04	1E+01	4E+00	Metal	ARSENIC	C	1.5 - 9.1	9.10E+00	3/3	2.38E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							CADMIUM	NC	0.89 - 4.1	4.10E+00	3/8	6.95E-09	--	--	--	--	1.19E+00	8.8 %	0 %	0 %	91.1 %	3.14	Yes
							IRON	NC	23000 - 49700	4.97E+04	3/3	--	--	--	--	--	2.26E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	700 - 1550	1.55E+03	3/3	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	230 - 1200	1.20E+03	3/3	1.23E-07	--	--	--	--	3.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.044 - 0.1	1.00E-01	2/4	2.68E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						Pest/PCB	DIELDRIN	C	0.002 - 0.002	2.00E-03	1/2	3.03E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--	--	--
6	RD	B1523	1E-04	8E+00	3E+00	Metal	ARSENIC	C	3.6 - 4.6	4.60E+00	2/2	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	23500 - 37600	3.76E+04	2/2	--	--	--	--	--	1.71E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	383 - 955	9.55E+02	2/2	9.82E-08	--	--	--	--	3.16E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1622	1E-04	6E+00	2E+00	Metal	ARSENIC	C	5.7 - 5.7	5.70E+00	1/1	1.49E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	34500 - 34500	3.45E+04	1/1	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	484 - 484	4.84E+02	1/1	4.98E-08	--	--	--	--	1.60E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1623	1E-04	1E+01	4E+00	Metal	ARSENIC	C	3.1 - 7.75	5.12E+00	9/10	1.34E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	31300 - 46800	3.88E+04	10/10	--	--	--	--	--	1.77E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	459 - 1340	9.66E+02	10/10	--	--	--	--	--	1.15E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	470 - 1740	1.10E+03	10/10	1.13E-07	--	--	--	--	3.63E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1626	7E-05	1E+01	4E+00	Metal	ARSENIC	C	0.95 - 3.9	2.35E+00	6/9	6.13E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							COPPER	NC	5.4 - 186	1.86E+02	9/9	--	--	--	--	--	1.17E+00	5.5 %	0 %	0 %	94.5 %	124.31	Yes
							IRON	NC	23300 - 40600	3.43E+04	9/9	--	--	--	--	--	1.56E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	79.4 - 1660	1.17E+03	9/9	1.20E-07	--	--	--	--	3.86E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.042 - 0.042	4.20E-02	1/7	1.13E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
						VOC	TETRACHLOROETHENE	C	2.8 - 2.8	2.80E+00	1/7	5.80E-06	40.8 %	0 %	59.2 %	0 %	<1	--	--	--	--	--	--
6	RD	B1723	1E-04	6E+00	2E+00	Metal	ARSENIC	C	4.3 - 4.3	4.30E+00	1/1	1.12E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33700 - 33700	3.37E+04	1/1	--	--	--	--	--	1.53E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	526 - 526	5.26E+02	1/1	5.41E-08	--	--	--	--	1.74E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B1826	1E-04	1E+01	4E+00	Metal	ARSENIC	C	4.1 - 4.1	4.10E+00	1/2	1.07E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	27000 - 40600	4.06E+04	2/2	--	--	--	--	--	1.85E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	450 - 879	8.79E+02	2/2	--	--	--	--	--	1.04E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	760 - 1080	1.08E+03	2/2	1.11E-07	--	--	--	--	3.58E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	29 - 70.8	7.08E+01	2/2	--	--	--	--	--	1.09E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
6	RD	B2026	1E-04	5E+00	<1	Metal	ARSENIC	C	4 - 4	4.00E+00	1/1	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						PAH	BENZO(A)PYRENE	C	0.045 - 0.045	4.50E-02	1/1	1.21E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
6	RD	B2224	6E-06	--	--	PAH	BENZO(A)PYRENE	C	0.13 - 0.13	1.30E-01	1/2	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
6	RD	B2225	4E-07	1E+01	5E+00	Metal	IRON	NC	27800 - 45000	3.82E+04	8/8	--	--	--	--	--	1.74E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	584 - 1220	9.26E+02	8/8	--	--	--	--	--	1.10E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	371 - 1940	1.57E+03	8/8	1.62E-07	--	--	--	--	5.21E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2226	1E-04	5E+00	2E+00	Metal	ARSENIC	C	4.85 - 4.85	4.85E+00	1/1	1.27E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	26500 - 26500	2.65E+04	1/1	--	--	--	--	--	1.21E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	475 - 475	4.75E+02	1/1	4.89E-08	--	--	--	--	1.57E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.0805 - 0.0805	8.05E-02	1/1	2.16E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
6	RD	B2325	3E-07	9E+00	5E+00	Metal	IRON	NC	35400 - 41900	4.19E+04	2/2	--	--	--	--	--	1.91E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1440 - 1540	1.54E+03	2/2	1.58E-07	--	--	--	--	5.10E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2326	9E-05	1E+01	5E+00	Metal	ARSENIC	C	0.91 - 3.6	3.60E+00	2/3	9.40E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	19800 - 40000	4.00E+04	3/3	--	--	--	--	--	1.82E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	436 - 1500	1.50E+03	3/3	1.54E-07	--	--	--	--	4.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2419	2E-04	1E+01	7E+00	Metal	ARSENIC	C	2.2 - 7	7.00E+00	3/4	1.83E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	27800 - 41700	4.01E+04	4/4	--	--	--	--	--	1.82E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	511 - 1990	1.99E+03	4/4	2.04E-07	--	--	--	--	6.58E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2425	8E-05	1E+01	5E+00	Metal	ARSENIC	C	1.3 - 6.4	3.12E+00	7/12	8.15E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	23500 - 40600	3.81E+04	7/7	--	--	--	--	--	1.73E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	478 - 1270	1.01E+03	7/7	--	--	--	--	--	1.19E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	141 - 1710	1.38E+03	7/7	1.42E-07	--	--	--	--	4.58E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
6	RD	B2526	7E-05	6E+00	2E+00	Metal	ARSENIC	C	2.7 - 2.7	2.70E+00	1/1	7.05E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	32000 - 32000	3.20E+04	1/1	--	--	--	--	--	1.46E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	725 - 725	7.25E+02	1/1	7.46E-08	--	--	--	--	2.40E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
7	MU	B2635	9E-05	4E+00	3E+00	Metal	ARSENIC	C	2.4 - 3.6	3.60E+00	3/3	9.40E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							ZINC	NC	96.9 - 1040	1.04E+03	3/3	--	--	--	--	--	2.79E+00	1.6 %	0 %	0 %	98.4 %	109.86	Yes
7	MU	B2727	3E-04	1E+01	3E+00	Metal	ARSENIC	C	11 - 11	1.10E+01	1/1	2.87E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	66500 - 66500	6.65E+04	1/1	--	--	--	--	--	3.03E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							MANGANESE	NC	561 - 1920	1.26E+03	8/8	--	--	--	--	--	1.49E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	978 - 978	9.78E+02	1/1	1.01E-07	--	--	--	--	3.24E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	94.1 - 94.1	9.41E+01	1/1	--	--	--	--	--	1.45E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
7	MU	B2735	4E-04	6E+00	3E+00	Metal	ARSENIC	C	2.8 - 15.1	1.51E+01	2/2	3.94E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	Yes
							MANGANESE	NC	493 - 1370	1.37E+03	2/2	--	--	--	--	--	1.63E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							ZINC	NC	138 - 947	9.47E+02	2/2	--	--	--	--	--	2.54E+00	1.6 %	0 %	0 %	98.4 %	109.86	Yes
						PAH	BENZO(A)PYRENE	C	0.052 - 0.052	5.20E-02	1/2	1.39E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
7	MU	B2835	1E-04	2E+00	<1	Metal	ARSENIC	C	4.8 - 4.8	4.80E+00	1/1	1.25E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
7	MU	B3127	1E-04	2E+00	2E+00	Metal	ARSENIC	C	4.4 - 4.4	4.40E+00	1/2	1.15E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	824 - 1160	1.16E+03	2/2	--	--	--	--	--	1.38E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
7	MU	B3128	1E-04	2E+00	2E+00	Metal	ARSENIC	C	4.4 - 4.8	4.80E+00	2/6	1.25E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	641 - 1870	1.47E+03	6/6	--	--	--	--	--	1.74E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
7	MU	B3228	2E-04	1E+01	5E+00	Metal	ARSENIC	C	4.3 - 9.9	8.95E+00	4/5	2.34E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							CADMIUM	NC	1.6 - 3.6	3.60E+00	4/4	6.10E-09	--	--	--	--	1.04E+00	8.8 %	0 %	0 %	91.1 %	3.14	Yes
							IRON	NC	26000 - 36400	3.64E+04	4/4	--	--	--	--	--	1.66E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	288 - 8500	2.15E+03	18/18	--	--	--	--	--	2.56E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	330 - 1500	1.38E+03	4/4	1.42E-07	--	--	--	--	4.57E+00	19.3 %	0 %	1.0 %	79.6 %	*	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
7	MU	B3229	2E-04	8E+00	2E+00	Metal	ARSENIC	C	3.7 - 6.2	6.20E+00	2/2	1.62E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	29500 - 38700	3.87E+04	2/2	--	--	--	--	--	1.76E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	390 - 1450	1.45E+03	2/2	--	--	--	--	--	1.72E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	86.1 - 624	6.24E+02	2/2	6.42E-08	--	--	--	--	2.07E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	66.3 - 67.1	6.71E+01	2/2	--	--	--	--	--	1.03E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
7	MU	B3328	1E-07	6E+00	3E+00	Metal	IRON	NC	25000 - 25000	2.50E+04	1/1	--	--	--	--	--	1.14E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	790 - 790	7.90E+02	1/1	8.12E-08	--	--	--	--	2.62E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
7	MU	B3433	9E-05	5E+00	<1	Metal	ARSENIC	C	2.6 - 3.4	3.40E+00	3/3	8.88E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
7	MU	B3434	9E-05	4E+00	<1	Metal	ARSENIC	C	2.7 - 3.7	3.35E+00	8/8	8.76E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
8	MU	B2624	1E-04	9E+00	4E+00	Metal	ARSENIC	C	0.86 - 3.9	3.90E+00	4/4	1.02E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	24300 - 35600	3.56E+04	4/4	--	--	--	--	--	1.62E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	788 - 1150	1.15E+03	4/4	1.18E-07	--	--	--	--	3.81E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						VOC	TRICHLOROETHENE	C	0.002 - 14	4.41E+00	19/23	1.50E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2625	9E-05	9E+00	5E+00	Metal	ARSENIC	C	3.6 - 3.6	3.60E+00	1/3	9.40E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	28100 - 34400	3.44E+04	3/3	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	817 - 1580	1.58E+03	3/3	1.62E-07	--	--	--	--	5.23E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2722	1E-04	1E+01	4E+00	Metal	ARSENIC	C	1.7 - 4.5	4.20E+00	4/4	1.10E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	17700 - 59700	5.49E+04	4/4	--	--	--	--	--	2.50E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							NICKEL	NC	145 - 1360	1.28E+03	4/4	1.32E-07	--	--	--	--	4.24E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2723	1E-05	2E+00	2E+00	Metal	MANGANESE	NC	1390 - 1390	1.39E+03	1/1	--	--	--	--	--	1.65E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
						VOC	TRICHLOROETHENE	C	0.00076 - 121	2.86E+01	26/26	9.73E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2724	3E-05	<1	<1	VOC	TRICHLOROETHENE	C	0.064 - 100	1.00E+02	21/22	3.40E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2725	5E-07	7E+00	3E+00	Metal	IRON	NC	37800 - 37800	3.78E+04	1/1	--	--	--	--	--	1.72E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	935 - 935	9.35E+02	1/1	9.62E-08	--	--	--	--	3.10E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2726	7E-05	9E+00	4E+00	Metal	ARSENIC	C	2.8 - 2.8	2.80E+00	1/1	7.31E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	41000 - 41000	4.10E+04	1/1	--	--	--	--	--	1.87E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	509 - 1400	1.40E+03	3/3	--	--	--	--	--	1.66E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1100 - 1100	1.10E+03	1/1	1.13E-07	--	--	--	--	3.64E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B2823	2E-04	1E+01	4E+00	Metal	ARSENIC	C	2.3 - 8	4.48E+00	6/10	1.17E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	27100 - 37800	3.59E+04	10/10	--	--	--	--	--	1.64E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	416 - 3210	1.23E+03	21/21	--	--	--	--	--	1.46E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	334 - 1730	1.22E+03	10/10	1.25E-07	--	--	--	--	4.02E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						VOC	TRICHLOROETHENE	C	0.033 - 230	1.62E+02	49/50	5.51E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2824	1E-05	<1	<1	VOC	TRICHLOROETHENE	C	0.076 - 170	3.69E+01	32/37	1.25E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2922	1E-04	8E+00	3E+00	Metal	ARSENIC	C	1.4 - 4.6	4.60E+00	4/4	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	3000 - 40700	4.07E+04	4/4	--	--	--	--	--	1.85E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	659 - 1020	9.97E+02	4/4	--	--	--	--	--	1.18E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	284 - 914	8.86E+02	4/4	9.11E-08	--	--	--	--	2.93E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	44.1 - 78.3	7.50E+01	4/4	--	--	--	--	--	1.16E+00	82.9 %	0 %	0 %	17.1 %	117.17	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
8	MU	B2923	2E-04	2E+01	1E+01	Metal	ARSENIC	C	1.2 - 11.7	5.06E+00	5/10	1.32E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	Yes
							IRON	NC	24000 - 43100	4.23E+04	4/4	--	--	--	--	--	1.93E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	480 - 41400	1.12E+04	11/11	--	--	--	--	--	1.33E+01	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	159 - 1270	1.23E+03	4/4	1.26E-07	--	--	--	--	4.07E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	61.7 - 82	8.13E+01	4/4	--	--	--	--	--	1.25E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
						VOC	TRICHLOROETHENE	C	0.005 - 63.5	6.35E+01	28/28	2.16E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2924	9E-05	<1	<1	Metal	ARSENIC	C	3 - 3	3.00E+00	1/1	7.84E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						VOC	TRICHLOROETHENE	C	0.01 - 90.3	2.10E+01	10/16	7.15E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--	--	--
8	MU	B2925	7E-05	<1	<1	Metal	ARSENIC	C	0.46 - 4.2	2.53E+00	6/9	6.61E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
8	MU	B2926	2E-04	1E+01	3E+00	Metal	ARSENIC	C	1 - 8.9	5.70E+00	6/7	1.49E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							CADMIUM	NC	0.81 - 7.9	7.90E+00	3/13	1.34E-08	--	--	--	--	2.29E+00	8.8 %	0 %	0 %	91.1 %	3.14	Yes
							IRON	NC	21000 - 36700	3.44E+04	7/7	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	42.9 - 1310	1.04E+03	7/7	1.07E-07	--	--	--	--	3.46E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.03 - 0.039	3.90E-02	2/6	1.05E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
8	MU	B3126	9E-05	1E+01	7E+00	Metal	ARSENIC	C	0.89 - 8.6	3.37E+00	7/18	8.81E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	40000 - 44200	4.42E+04	2/2	--	--	--	--	--	2.01E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	357 - 1620	1.04E+03	19/19	--	--	--	--	--	1.23E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	640 - 2220	2.22E+03	2/2	2.28E-07	--	--	--	--	7.35E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B3326	7E-05	1E+01	5E+00	Metal	ARSENIC	C	2.8 - 2.8	2.80E+00	1/1	7.31E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	51000 - 51000	5.10E+04	1/1	--	--	--	--	--	2.32E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1500 - 1500	1.50E+03	1/1	1.54E-07	--	--	--	--	4.97E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B3422	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.015 - 0.065	6.50E-02	3/8	1.74E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
8	MU	B3423	1E-04	7E+00	2E+00	Metal	ARSENIC	C	4.4 - 5.1	5.10E+00	2/2	1.33E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	26400 - 34000	3.40E+04	2/2	--	--	--	--	--	1.55E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	725 - 1260	1.26E+03	2/2	--	--	--	--	--	1.49E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	564 - 568	5.68E+02	2/2	5.84E-08	--	--	--	--	1.88E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B3425	1E-07	8E+00	3E+00	Metal	IRON	NC	38900 - 38900	3.89E+04	1/1	--	--	--	--	--	1.77E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	305 - 2040	1.29E+03	14/14	--	--	--	--	--	1.53E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	905 - 905	9.05E+02	1/1	9.31E-08	--	--	--	--	3.00E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	68.3 - 68.3	6.83E+01	1/1	--	--	--	--	--	1.05E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
8	MU	B3426	2E-04	1E+01	7E+00	Metal	ARSENIC	C	2.6 - 6.4	6.40E+00	4/4	1.67E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	22000 - 55600	5.56E+04	4/4	--	--	--	--	--	2.53E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							LEAD	NC	2 - 163	1.63E+02	4/4	--	--	--	--	--	--	--	--	--	--	8.99	Yes
							MANGANESE	NC	622 - 1070	1.06E+03	4/4	--	--	--	--	--	1.25E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	132 - 2440	2.17E+03	4/4	2.23E-07	--	--	--	--	7.19E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
8	MU	B3622	6E-07	2E+00	2E+00	Metal	MANGANESE	NC	647 - 2230	1.62E+03	9/9	--	--	--	--	--	1.92E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
9	MU	B2716	3E-07	8E+00	6E+00	Metal	IRON	NC	29500 - 29500	2.95E+04	1/1	--	--	--	--	--	1.34E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1690 - 1690	1.69E+03	1/1	1.74E-07	--	--	--	--	5.59E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B2818	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.048 - 0.048	4.80E-02	1/3	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
9	MU	B2918	1E-04	7E+00	2E+00	Metal	ARSENIC	C	4.9 - 4.9	4.90E+00	1/1	1.28E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	34000 - 34000	3.40E+04	1/1	--	--	--	--	--	1.55E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	888 - 888	8.88E+02	1/1	--	--	--	--	--	1.05E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	544 - 544	5.44E+02	1/1	5.59E-08	--	--	--	--	1.80E+00	19.3 %	0 %	1.0 %	79.6 %	*	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Metals: HPAL	Maximum Concentration Exceeds HPAL?
9	MU	B2921	1E-04	1E+01	6E+00	Metal	ARSENIC	C	4 - 4	4.00E+00	1/4	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	20300 - 32400	3.17E+04	4/4	--	--	--	--	--	1.44E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	508 - 908	8.96E+02	4/4	--	--	--	--	--	1.06E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	250 - 1710	1.71E+03	4/4	1.76E-07	--	--	--	--	5.66E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3117	--	2E+00	2E+00	Metal	MANGANESE	NC	703 - 1470	1.36E+03	5/5	--	--	--	--	--	1.61E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
9	MU	B3118	1E-04	1E+01	3E+00	Metal	ARSENIC	C	1.8 - 6	4.67E+00	5/6	1.22E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	36400 - 51900	5.19E+04	3/3	--	--	--	--	--	2.36E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	491 - 2640	1.55E+03	25/25	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	664 - 961	9.61E+02	3/3	9.88E-08	--	--	--	--	3.18E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	57 - 94.7	9.47E+01	3/3	--	--	--	--	--	1.46E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
9	MU	B3215	2E-04	2E+00	<1	Metal	ARSENIC	C	6.4 - 6.4	6.40E+00	1/3	1.67E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
						PAH	BENZO(A)PYRENE	C	0.01 - 0.11	1.10E-01	2/6	2.95E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.009 - 0.0595	5.95E-02	2/6	1.03E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
9	MU	B3217	--	2E+00	2E+00	Metal	MANGANESE	NC	1120 - 1550	1.55E+03	2/2	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
9	MU	B3218	8E-05	2E+00	2E+00	Metal	ARSENIC	C	2.7 - 2.9	2.90E+00	2/2	7.58E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	954 - 1750	1.56E+03	6/6	--	--	--	--	--	1.85E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
9	MU	B3315	1E-04	1E+01	4E+00	Metal	ARSENIC	C	0.66 - 6.5	4.56E+00	8/8	1.19E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	29300 - 37100	3.71E+04	3/3	--	--	--	--	--	1.69E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	763 - 1020	1.02E+03	3/3	--	--	--	--	--	1.21E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	799 - 1230	1.23E+03	3/3	1.26E-07	--	--	--	--	4.07E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)PYRENE	C	0.009 - 0.12	1.04E-01	5/13	2.79E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
9	MU	B3415	7E-05	1E+01	3E+00	Metal	ANTIMONY	NC	4.3 - 21.7	2.17E+01	3/3	--	--	--	--	--	2.12E+00	32.7 %	0 %	0 %	67.3 %	9.05	Yes
							ARSENIC	C	1.3 - 3.7	2.46E+00	5/10	6.44E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	37700 - 83200	7.46E+04	5/5	--	--	--	--	--	3.40E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							LEAD	NC	2.7 - 165	1.65E+02	2/4	--	--	--	--	--	--	--	--	--	--	8.99	Yes
							MANGANESE	NC	714 - 1160	1.02E+03	8/8	--	--	--	--	--	1.21E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	12.9 - 982	8.38E+02	5/5	8.62E-08	--	--	--	--	2.77E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	69.4 - 113	1.11E+02	5/5	--	--	--	--	--	1.71E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
						PAH	BENZO(A)PYRENE	C	0.01 - 0.064	6.40E-02	3/10	1.72E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
9	MU	B3418	6E-05	1E+01	6E+00	Metal	ARSENIC	C	1.3 - 2.2	2.20E+00	2/2	5.75E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	41000 - 41000	4.10E+04	2/2	--	--	--	--	--	1.87E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	889 - 1040	1.04E+03	2/2	--	--	--	--	--	1.23E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	1060 - 1950	1.95E+03	2/2	2.01E-07	--	--	--	--	6.45E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3421	2E-04	1E+01	6E+00	Metal	ARSENIC	C	4.3 - 8.2	8.20E+00	2/3	2.14E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	36500 - 39900	3.99E+04	3/3	--	--	--	--	--	1.82E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	869 - 1600	1.60E+03	3/3	--	--	--	--	--	1.90E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	620 - 1720	1.72E+03	3/3	1.77E-07	--	--	--	--	5.69E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
9	MU	B3515	2E-04	<1	<1	Metal	ARSENIC	C	5.9 - 5.9	5.90E+00	1/1	1.54E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
			2E-04	<1	<1	PAH	BENZO(A)PYRENE	C	0.015 - 0.05	5.00E-02	3/10	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
9	MU	B3516	1E-04	8E+00	2E+00	Metal	ARSENIC	C	3 - 4	4.00E+00	2/2	1.04E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	25800 - 44500	4.45E+04	2/2	--	--	--	--	--	2.03E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	920 - 944	9.44E+02	2/2	--	--	--	--	--	1.12E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	409 - 562	5.62E+02	2/2	5.78E-08	--	--	--	--	1.86E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	50 - 89.7	8.97E+01	2/2	--	--	--	--	--	1.38E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
9	MU	B3520	3E-07	1E+01	6E+00	Metal	IRON	NC	31200 - 37100	3.71E+04	2/2	--	--	--	--	--	1.69E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	904 - 999	9.99E+02	2/2	--	--	--	--	--	1.19E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	430 - 1690	1.69E+03	2/2	1.74E-07	--	--	--	--	5.59E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	17.3 - 74.9	7.49E+01	2/2	--	--	--	--	--	1.16E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B3715	2E-04	<1	<1	Metal	ARSENIC	C	6.4 - 6.4	6.40E+00	1/1	1.67E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
12	MU	B3718	3E-04	1E+01	5E+00	Metal	ARSENIC	C	3.7 - 9.8	9.80E+00	2/4	2.56E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	21900 - 44500	4.32E+04	4/4	--	--	--	--	--	1.97E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	590 - 2320	1.50E+03	9/9	--	--	--	--	--	1.78E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	474 - 1400	1.40E+03	4/4	1.44E-07	--	--	--	--	4.63E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	17 - 105	1.05E+02	4/4	--	--	--	--	--	1.62E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B3815	1E-06	5E+00	4E+00	Metal	MANGANESE	NC	550 - 3190	3.12E+03	4/4	--	--	--	--	--	3.70E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
12	MU	B3816	2E-04	8E+00	2E+00	Metal	ARSENIC	C	3.8 - 5.8	5.80E+00	2/3	1.52E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	14200 - 36500	3.65E+04	3/3	--	--	--	--	--	1.66E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	579 - 2220	1.35E+03	14/14	--	--	--	--	--	1.60E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	46.2 - 528	5.28E+02	3/3	5.43E-08	--	--	--	--	1.75E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	32 - 79.1	7.91E+01	3/3	--	--	--	--	--	1.22E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B3915	2E-04	9E+00	3E+00	Metal	ARSENIC	C	4.9 - 8.1	8.10E+00	3/6	2.12E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	14500 - 42200	4.22E+04	2/2	--	--	--	--	--	1.92E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	274 - 1430	8.78E+02	17/17	--	--	--	--	--	1.04E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	49.7 - 781	7.81E+02	2/2	8.03E-08	--	--	--	--	2.59E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	38.4 - 79.6	7.96E+01	2/2	--	--	--	--	--	1.23E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
						PAH	BENZO(A)PYRENE	C	0.025 - 0.2	2.00E-01	3/14	5.36E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
12	MU	B3916	5E-10	2E+00	2E+00	Metal	MANGANESE	NC	471 - 1400	1.39E+03	4/4	--	--	--	--	--	1.65E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
12	MU	B3917	6E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.028 - 0.15	1.50E-01	3/7	4.02E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
12	MU	B3919	3E-06	2E+00	<1	PAH	BENZO(A)PYRENE	C	0.022 - 0.0505	5.05E-02	2/2	1.35E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
12	MU	B4015	1E-06	2E+00	2E+00	Metal	MANGANESE	NC	676 - 1930	1.35E+03	8/8	--	--	--	--	--	1.60E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
12	MU	B4016	2E-06	2E+00	<1	PAH	BENZO(A)PYRENE	C	0.038 - 0.038	3.80E-02	1/5	1.02E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
12	MU	B4017	2E-04	3E+00	2E+00	Metal	ARSENIC	C	6.8 - 6.8	6.80E+00	1/1	1.78E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	904 - 1830	1.83E+03	2/2	--	--	--	--	--	2.17E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
						PAH	BENZO(A)ANTHRACENE	C	0.028 - 0.71	7.10E-01	2/5	1.92E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.032 - 0.42	4.20E-01	2/5	1.13E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.044 - 0.55	5.50E-01	2/5	1.63E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.039 - 0.34	3.40E-01	2/5	1.00E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.14 - 0.14	1.40E-01	1/5	2.42E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
12	MU	B4019	9E-05	7E+00	3E+00	Metal	ARSENIC	C	1.7 - 3.3	3.30E+00	3/3	8.62E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	30000 - 30000	3.00E+04	1/1	--	--	--	--	--	1.37E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	389 - 3520	2.43E+03	9/9	--	--	--	--	--	2.89E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	76.1 - 76.1	7.61E+01	1/1	--	--	--	--	--	1.17E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
						PAH	BENZO(A)PYRENE	C	0.038 - 0.038	3.80E-02	1/5	1.02E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
12	MU	B4020	7E-08	3E+00	3E+00	Metal	MANGANESE	NC	1060 - 2410	2.41E+03	3/3	--	--	--	--	--	2.86E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
12	MU	B4115	2E-05	2E+00	<1	Metal	ARSENIC	C	0.55 - 0.74	7.40E-01	2/2	1.93E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
12	MU	B4116	2E-05	3E+00	3E+00	Metal	ARSENIC	C	0.63 - 0.63	6.30E-01	1/1	1.65E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	635 - 4310	2.13E+03	13/13	--	--	--	--	--	2.52E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
12	MU	B4217	9E-05	5E+00	2E+00	Metal	ARSENIC	C	3.5 - 3.5	3.50E+00	1/1	9.14E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							MANGANESE	NC	674 - 1440	1.41E+03	5/5	--	--	--	--	--	1.67E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
12	MU	B4218	8E-05	7E+00	2E+00	Metal	ARSENIC	C	2.9 - 2.9	2.90E+00	1/3	7.58E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	15000 - 34900	3.49E+04	3/3	--	--	--	--	--	1.59E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	231 - 884	8.84E+02	3/3	--	--	--	--	--	1.05E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	3 - 489	4.89E+02	3/3	5.03E-08	--	--	--	--	1.62E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	48.3 - 87.3	8.73E+01	3/3	--	--	--	--	--	1.35E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4219	1E-04	7E+00	2E+00	Metal	ARSENIC	C	2.8 - 5.3	5.30E+00	2/2	1.38E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	27600 - 35100	3.51E+04	2/2	--	--	--	--	--	1.60E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	507 - 1470	1.47E+03	2/2	--	--	--	--	--	1.74E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	300 - 401	4.01E+02	2/2	4.12E-08	--	--	--	--	1.33E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	46.8 - 80.2	8.02E+01	2/2	--	--	--	--	--	1.24E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4220	2E-04	9E+00	3E+00	Metal	ARSENIC	C	3.7 - 5.8	5.80E+00	2/4	1.52E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33500 - 44400	4.44E+04	2/2	--	--	--	--	--	2.02E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	399 - 2040	1.31E+03	10/10	--	--	--	--	--	1.55E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	293 - 886	8.86E+02	2/2	9.11E-08	--	--	--	--	2.93E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	67.3 - 96.1	9.61E+01	2/2	--	--	--	--	--	1.48E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4315	3E-04	1E+01	3E+00	Metal	ARSENIC	C	9.8 - 9.8	9.80E+00	1/1	2.56E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	70000 - 70000	7.00E+04	1/1	--	--	--	--	--	3.19E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							MANGANESE	NC	1240 - 1240	1.24E+03	1/1	--	--	--	--	--	1.47E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	991 - 991	9.91E+02	1/1	1.02E-07	--	--	--	--	3.28E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	102 - 102	1.02E+02	1/1	--	--	--	--	--	1.57E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4320	8E-05	8E+00	2E+00	Metal	ARSENIC	C	2.5 - 3.2	3.20E+00	2/6	8.36E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	30700 - 47500	4.75E+04	2/2	--	--	--	--	--	2.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	766 - 1450	1.38E+03	6/6	--	--	--	--	--	1.64E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	207 - 588	5.88E+02	2/2	6.05E-08	--	--	--	--	1.95E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	58.2 - 79.2	7.92E+01	2/2	--	--	--	--	--	1.22E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4415	3E-08	5E+00	2E+00	Metal	IRON	NC	22700 - 34400	3.44E+04	2/2	--	--	--	--	--	1.57E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1060 - 1240	1.24E+03	2/2	--	--	--	--	--	1.47E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
12	MU	B4515	9E-05	6E+00	2E+00	Metal	ARSENIC	C	3.4 - 3.4	3.40E+00	1/1	8.88E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33100 - 33100	3.31E+04	1/1	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1020 - 1020	1.02E+03	1/1	--	--	--	--	--	1.21E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							VANADIUM	NC	71.9 - 71.9	7.19E+01	1/1	--	--	--	--	--	1.11E+00	82.9 %	0 %	0 %	17.1 %	117.17	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI				Metals	
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	HPAL	Maximum Concentration Exceeds HPAL?
12	MU	B4517	2E-04	7E+00	3E+00	Metal	ARSENIC	C	5.2 - 7.1	7.10E+00	2/2	1.85E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	33300 - 35100	3.51E+04	2/2	--	--	--	--	--	1.60E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	811 - 1870	1.87E+03	2/2	--	--	--	--	--	2.22E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	55.4 - 71.7	7.17E+01	2/2	--	--	--	--	--	1.11E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4520	4E-06	<1	<1	Pest/PCB	AROCLOR-1260	C	0.038 - 0.78	7.80E-01	3/7	3.70E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--	--	--
12	MU	B4521	7E-05	5E+00	<1	Metal	ARSENIC	C	1.6 - 2.6	2.60E+00	3/3	6.79E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
12	MU	B4615	1E-04	8E+00	3E+00	Metal	ARSENIC	C	2.8 - 4.6	4.60E+00	2/2	1.20E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	26200 - 33200	3.32E+04	2/2	--	--	--	--	--	1.51E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1190 - 2390	2.39E+03	2/2	--	--	--	--	--	2.84E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	56.5 - 73.1	7.31E+01	2/2	--	--	--	--	--	1.13E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4616	2E-07	8E+00	4E+00	Metal	IRON	NC	42000 - 42000	4.20E+04	1/1	--	--	--	--	--	1.91E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							NICKEL	NC	1230 - 1230	1.23E+03	1/1	1.26E-07	--	--	--	--	4.07E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
12	MU	B4617	9E-05	7E+00	3E+00	Metal	ARSENIC	C	3.3 - 3.3	3.30E+00	1/1	8.62E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	44500 - 44500	4.45E+04	1/1	--	--	--	--	--	2.03E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1930 - 1930	1.93E+03	1/1	--	--	--	--	--	2.29E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							VANADIUM	NC	117 - 117	1.17E+02	1/1	--	--	--	--	--	1.80E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
12	MU	B4621	8E-07	5E+00	2E+00	Metal	IRON	NC	27000 - 27000	2.70E+04	1/1	--	--	--	--	--	1.23E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	1190 - 1190	1.19E+03	1/1	--	--	--	--	--	1.41E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
15	MU	B4716	2E-04	2E+01	1E+01	Metal	ARSENIC	C	3.5 - 6.5	6.50E+00	3/8	1.70E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	12400 - 59200	4.16E+04	8/8	--	--	--	--	--	1.89E+00	93.6 %	0 %	0 %	6.4 %	58000	Yes
							MANGANESE	NC	132 - 2030	1.44E+03	8/8	--	--	--	--	--	1.71E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	Yes
							NICKEL	NC	22.4 - 2940	2.94E+03	8/8	3.02E-07	--	--	--	--	9.73E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
						PAH	BENZO(A)ANTHRACENE	C	1.2 - 1.2	1.20E+00	1/11	3.24E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--	--	--
							BENZO(A)PYRENE	C	0.88 - 0.88	8.80E-01	1/11	2.36E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	1.8 - 1.8	1.80E+00	1/11	5.32E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.43 - 0.43	4.30E-01	1/11	1.27E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.38 - 0.38	3.80E-01	1/11	6.56E-06	66.2 %	27.2 %	0 %	6.7 %	--	--	--	--	--	--	--
							INDENO(1,2,3-CD)PYRENE	C	0.99 - 0.99	9.90E-01	1/11	2.85E-06	65.3 %	26.8 %	0 %	8.0 %	--	--	--	--	--	--	--
15	MU	B4717	9E-05	5E+00	<1	Metal	ARSENIC	C	0.75 - 3.8	3.61E+00	4/4	9.44E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4816	9E-05	6E+00	2E+00	Metal	ARSENIC	C	2.2 - 3.4	3.40E+00	2/3	8.88E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	14400 - 25400	2.54E+04	3/3	--	--	--	--	--	1.16E+00	93.6 %	0 %	0 %	6.4 %	58000	No
15	MU	B4817	9E-05	5E+00	<1	Metal	ARSENIC	C	2.3 - 3.3	3.30E+00	3/3	8.62E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4818	1E-04	7E+00	2E+00	Metal	ARSENIC	C	2.5 - 5.5	5.50E+00	3/3	1.44E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	25500 - 37500	3.75E+04	3/3	--	--	--	--	--	1.71E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	672 - 974	9.74E+02	3/3	--	--	--	--	--	1.16E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	127 - 434	4.34E+02	3/3	4.46E-08	--	--	--	--	1.44E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	59.2 - 79.1	7.91E+01	3/3	--	--	--	--	--	1.22E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
15	MU	B4819	9E-05	4E+00	<1	Metal	ARSENIC	C	2.5 - 3.5	3.50E+00	2/2	9.14E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
15	MU	B4916	7E-05	8E+00	3E+00	Metal	ARSENIC	C	0.67 - 2.5	2.50E+00	4/4	6.53E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	28000 - 36500	3.65E+04	4/4	--	--	--	--	--	1.66E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	479 - 890	8.68E+02	4/4	--	--	--	--	--	1.03E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	230 - 893	8.31E+02	4/4	8.55E-08	--	--	--	--	2.75E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	48.6 - 65	6.50E+01	4/4	--	--	--	--	--	1.00E+00	82.9 %	0 %	0 %	17.1 %	117.17	No

TABLE A-18: TOTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI: Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Metals: HPAL	Metals: Maximum Concentration Exceeds HPAL?
15	MU	B4917	7E-05	6E+00	2E+00	Metal	ARSENIC	C	1.9 - 2.6	2.60E+00	2/2	6.79E-05	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--	11.1	No
							IRON	NC	21300 - 36800	3.68E+04	2/2	--	--	--	--	--	1.68E+00	93.6 %	0 %	0 %	6.4 %	58000	No
							MANGANESE	NC	232 - 911	9.11E+02	2/2	--	--	--	--	--	1.08E+00	44.9 %	0 %	2.9 %	52.2 %	1431.18	No
							NICKEL	NC	79.1 - 359	3.59E+02	2/2	3.69E-08	--	--	--	--	1.19E+00	19.3 %	0 %	1.0 %	79.6 %	*	No
							VANADIUM	NC	59.5 - 71.5	7.15E+01	2/2	--	--	--	--	--	1.10E+00	82.9 %	0 %	0 %	17.1 %	117.17	No
16	E/C	AX04	1E-04	<1	<1	Metal	ARSENIC	C	0.8 - 55.2	5.52E+01	4/7	1.27E-04	71.6 %	28.4 %	0 %		<1	--	--	--		11.1	Yes
						PAH	BENZO(A)PYRENE	C	0.042 - 0.8	8.00E-01	4/7	4.56E-06	36.8 %	63.2 %	0 %		--	--	--	--		--	--
16	E/C	AY03	6E-05	<1	<1	Metal	ARSENIC	C	3.475 - 54.1	2.15E+01	13/17	4.96E-05	71.6 %	28.4 %	0 %		<1	--	--	--		11.1	Yes
						PAH	BENZO(A)ANTHRACENE	C	0.012 - 1.9	1.90E+00	13/17	1.08E-06	36.8 %	63.2 %	0 %		--	--	--	--		--	--
							BENZO(A)PYRENE	C	0.0175 - 2.1	2.04E+00	13/17	1.16E-05	36.8 %	63.2 %	0 %		--	--	--	--		--	--
16	E/C	AY04	1E-05	<1	<1	Metal	ARSENIC	C	3.3 - 12.4	6.08E+00	6/11	1.40E-05	71.6 %	28.4 %	0 %		<1	--	--	--		11.1	Yes

Notes:

All concentrations shown in mg/kg.

--	Not applicable or chemical is not a COC for this endpoint
*	Not available; comparison to ambient levels based on regression analysis
	Not evaluated because exposure pathway is incomplete
bgs	Below ground surface
BHC	Benzene hexachloride
C	Cancer effect
COC	Chemical of concern
DF	Detection frequency
E/C	Educational/cultural (industrial exposure scenario)
EPC	Exposure point concentration
HI	Hazard index
HPAL	Hunters Point ambient level
mg/kg	Milligram per kilogram
MU	Mixed use (residential exposure scenario)
NC	Noncancer effect
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
Pest	Pesticide
SVOC	Semivolatile organic compound
RD	Residential development
RME	Reasonable maximum exposure
VOC	Volatile organic compound

TABLE A-19: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SURFACE SOIL (0 TO 2 FEET BGS)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
2	RD	B0336	5E-08	<1	<1
2	RD	B0339	6E-09	<1	<1
2	RD	B0538	--	<1	<1
2	RD	B0640	--	<1	<1
3	RD	B0929	8E-08	<1	<1
3	RD	B1028	**6E-06**	8E+00	**8E+00**
3	RD	B1029	**7E-06**	<1	<1
3	RD	B1129	3E-09	<1	<1
3	RD	B1130	**6E-06**	3E+00	**2E+00**
3	RD	B1131	**2E-05**	3E+00	**3E+00**
3	RD	B1231	**1E-05**	2E+00	**2E+00**
3	RD	B1330	**3E-04**	4E+00	**2E+00**
3	RD	B1331	9E-07	<1	<1
5	RD	B1632	9E-07	<1	<1
5	RD	B2129	--	<1	<1
5	RD	B2130	--	<1	<1
5	RD	B2132	--	<1	<1
5	RD	B2232	1E-09	<1	<1
5	RD	B2332	--	<1	<1
6	RD	B1424	7E-07	--	--
6	RD	B1626	**6E-06**	<1	<1
6	RD	B2224	**6E-06**	--	--
6	RD	B2225	4E-08	<1	<1
6	RD	B2325	--	<1	<1
6	RD	B2326	--	<1	<1
6	RD	B2425	2E-07	2E+00	<1
7	MU	B3228	1E-09	3E+00	**3E+00**
7	MU	B3229	--	2E+00	**2E+00**
7	MU	B3433	4E-08	<1	<1
7	MU	B3434	--	<1	<1
8	MU	B2624	--	<1	<1
8	MU	B2625	--	<1	<1
8	MU	B2722	5E-09	<1	<1
8	MU	B2723	**2E-06**	<1	<1
8	MU	B2922	1E-08	<1	<1
8	MU	B2923	1E-07	3E+00	**3E+00**
8	MU	B2926	1E-06	<1	<1
8	MU	B3124	1E-06	--	--
8	MU	B3126	--	--	--
8	MU	B3426	--	<1	<1
8	MU	B3623	2E-07	<1	<1
9	MU	B2818	**2E-06**	--	--
9	MU	B2921	--	<1	<1
9	MU	B3118	--	<1	<1
9	MU	B3315	3E-08	<1	<1
9	MU	B3415	--	<1	<1
9	MU	B3520	--	<1	<1

TABLE A-19: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SURFACE SOIL (0 TO 2 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
12	MU	B4218	--	<1	<1
12	MU	B4220	--	2E+00	**2E+00**
12	MU	B4415	--	<1	<1
12	MU	B4515	1E-07	<1	<1
12	MU	B4517	--	<1	<1
12	MU	B4521	--	<1	<1
12	MU	B4615	--	3E+00	**3E+00**
15	MU	B4716	**4E-05**	4E+00	**2E+00**
15	MU	B4717	--	<1	<1
15	MU	B4816	5E-08	<1	<1
15	MU	B4817	--	<1	<1
15	MU	B4819	--	<1	<1
15	MU	B4916	--	<1	<1
BOS-1	OS	AF09	6E-07	<1	<1
BOS-1	OS	AF10	5E-07	<1	<1
BOS-1	OS	AF12	3E-08	<1	<1
BOS-1	OS	AF13	8E-10	<1	<1
BOS-1	OS	AG09	**3E-06**	<1	<1
BOS-1	OS	AH08	1E-06	<1	<1
BOS-1	OS	AH09	**8E-06**	<1	<1
BOS-1	OS	AI08	**4E-06**	<1	<1
BOS-1	OS	AJ07	1E-06	<1	<1
BOS-1	OS	AJ08	2E-07	--	--
BOS-2	OS	AK06	3E-07	<1	<1
BOS-2	OS	AK07	--	<1	<1
BOS-2	OS	AL06	--	<1	<1
BOS-2	OS	AM06	--	<1	<1
BOS-2	OS	AN05	--	<1	<1
BOS-2	OS	AN06	7E-09	<1	<1
BOS-2	OS	AO05	--	<1	<1
BOS-2	OS	AP05	9E-09	<1	<1
BOS-2	OS	AQ05	--	<1	<1
BOS-2	OS	AT05	2E-08	<1	<1
BOS-3	OS	AU05	**1E-05**	<1	<1
BOS-3	OS	AV05	6E-07	<1	<1
BOS-3	OS	AW03	**8E-05**	<1	<1

Notes:

--	Not applicable
bgs	Below ground surface
MU	Mixed use (residential exposure scenario)
OS	Open space (recreational exposure scenario)
RD	Research and development (residential exposure scenario)
RME	Reasonable maximum exposure

TABLE A-20: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
1	MU	B0143	**2E-06**	--	--
1	MU	B0144	**2E-06**	--	--
1	MU	B0145	4E-08	--	--
1	MU	B0146	--	<1	<1
1	MU	B0243	4E-07	--	--
1	MU	B0245	3E-09	--	--
1	MU	B0344	3E-09	--	--
1	MU	B0345	5E-09	--	--
2	RD	B0142	**9E-06**	<1	<1
2	RD	B0238	**2E-06**	<1	<1
2	RD	B0239	**2E-06**	<1	<1
2	RD	B0240	**3E-06**	<1	<1
2	RD	B0241	**7E-06**	<1	<1
2	RD	B0242	**9E-06**	<1	<1
2	RD	B0336	5E-08	<1	<1
2	RD	B0337	5E-07	<1	<1
2	RD	B0339	1E-06	<1	<1
2	RD	B0340	1E-06	<1	<1
2	RD	B0341	**3E-06**	<1	<1
2	RD	B0342	4E-09	--	--
2	RD	B0434	1E-07	<1	<1
2	RD	B0437	7E-07	<1	<1
2	RD	B0438	3E-07	<1	<1
2	RD	B0441	1E-06	<1	<1
2	RD	B0442	3E-07	<1	<1
2	RD	B0533	1E-06	--	--
2	RD	B0536	6E-08	<1	<1
2	RD	B0538	--	3E+00	**2E+00**
2	RD	B0636	--	--	--
2	RD	B0638	**2E-06**	<1	<1
2	RD	B0640	--	<1	<1
2	RD	B0738	8E-08	<1	<1
2	RD	B1035	4E-07	<1	<1
2	RD	B1036	**3E-06**	<1	<1
3	RD	B0532	**4E-06**	<1	<1
3	RD	B0632	5E-09	3E+00	**3E+00**
3	RD	B0928	**2E-06**	<1	<1
3	RD	B0929	9E-07	<1	<1
3	RD	B0930	4E-08	<1	<1
3	RD	B1028	**7E-06**	1E+01	**7E+00**
3	RD	B1029	**3E-04**	8E+00	**5E+00**
3	RD	B1030	1E-07	<1	<1
3	RD	B1128	**1E-05**	2E+00	<1
3	RD	B1129	**1E-04**	1E+01	**7E+00**
3	RD	B1130	**1E-04**	1E+01	**6E+00**
3	RD	B1131	**3E-04**	1E+01	**4E+00**
3	RD	B1228	**3E-06**	2E+00	<1
3	RD	B1229	**3E-06**	2E+00	<1
3	RD	B1230	**2E-05**	3E+00	**2E+00**

TABLE A-20: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
3	RD	B1231	**1E-05**	2E+00	**2E+00**
3	RD	B1328	**7E-06**	1E+01	**9E+00**
3	RD	B1329	**6E-06**	2E+00	<1
3	RD	B1330	**3E-03**	1E+01	**8E+00**
3	RD	B1331	**1E-03**	6E+00	**3E+00**
5	RD	B1427	--	--	--
5	RD	B1527	--	<1	<1
5	RD	B1628	--	<1	<1
5	RD	B1632	**2E-06**	<1	<1
5	RD	B1727	--	<1	<1
5	RD	B1728	--	<1	<1
5	RD	B1729	--	<1	<1
5	RD	B1928	--	<1	<1
5	RD	B1930	--	<1	<1
5	RD	B1931	--	<1	<1
5	RD	B2028	1E-07	<1	<1
5	RD	B2030	--	<1	<1
5	RD	B2032	--	<1	<1
5	RD	B2127	**2E-06**	<1	<1
5	RD	B2128	**3E-06**	<1	<1
5	RD	B2129	4E-08	<1	<1
5	RD	B2130	--	<1	<1
5	RD	B2131	--	<1	<1
5	RD	B2132	--	<1	<1
5	RD	B2228	**4E-06**	<1	<1
5	RD	B2230	3E-08	<1	<1
5	RD	B2232	1E-09	<1	<1
5	RD	B2332	--	<1	<1
6	RD	B1626	**7E-06**	2E+00	<1
6	RD	B1723	--	<1	<1
6	RD	B1826	1E-08	<1	<1
6	RD	B2026	**2E-06**	<1	<1
6	RD	B2224	**6E-06**	--	--
6	RD	B2225	1E-07	<1	<1
6	RD	B2226	**3E-06**	<1	<1
6	RD	B2325	4E-08	<1	<1
6	RD	B2326	--	<1	<1
6	RD	B2419	--	<1	<1
6	RD	B2425	2E-07	2E+00	<1
6	RD	B2526	1E-08	<1	<1
6	RD	B1424	9E-07	<1	<1
6	RD	B1425	**2E-06**	<1	<1
6	RD	B1426	**8E-06**	4E+00	**2E+00**
6	RD	B1523	--	<1	<1
6	RD	B1526	--	<1	<1
6	RD	B1622	--	<1	<1
6	RD	B1623	--	<1	<1
7	MU	B2635	7E-07	3E+00	**3E+00**
7	MU	B2727	--	6E+00	**3E+00**

TABLE A-20: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
7	MU	B2735	**4E-04**	4E+00	**3E+00**
7	MU	B2835	6E-07	<1	<1
7	MU	B3127	--	<1	<1
7	MU	B3128	--	2E+00	**2E+00**
7	MU	B3228	7E-09	4E+00	**3E+00**
7	MU	B3229	1E-06	2E+00	**2E+00**
7	MU	B3328	--	<1	<1
7	MU	B3433	4E-08	<1	<1
7	MU	B3434	--	<1	<1
8	MU	B2623	5E-07	<1	<1
8	MU	B2624	1E-06	<1	<1
8	MU	B2625	--	<1	<1
8	MU	B2722	1E-08	3E+00	**2E+00**
8	MU	B2723	**1E-05**	<1	<1
8	MU	B2724	**3E-05**	<1	<1
8	MU	B2725	4E-07	<1	<1
8	MU	B2726	3E-08	<1	<1
8	MU	B2823	**6E-05**	2E+00	**2E+00**
8	MU	B2824	**1E-05**	<1	<1
8	MU	B2826	--	--	--
8	MU	B2922	2E-08	<1	<1
8	MU	B2923	**2E-04**	1E+01	**1E+01**
8	MU	B2924	**7E-06**	<1	<1
8	MU	B2926	1E-06	3E+00	**2E+00**
8	MU	B3023	9E-09	<1	<1
8	MU	B3024	2E-08	<1	<1
8	MU	B3026	--	--	--
8	MU	B3124	1E-06	--	--
8	MU	B3126	1E-07	2E+00	**2E+00**
8	MU	B3324	--	--	--
8	MU	B3326	1E-08	<1	<1
8	MU	B3422	**3E-06**	<1	<1
8	MU	B3423	1E-07	<1	<1
8	MU	B3425	--	2E+00	**2E+00**
8	MU	B3426	1E-07	<1	<1
8	MU	B3522	--	<1	<1
8	MU	B3622	6E-07	2E+00	**2E+00**
8	MU	B3623	2E-07	<1	<1
9	MU	B2716	--	<1	<1
9	MU	B2818	**2E-06**	--	--
9	MU	B2918	--	<1	<1
9	MU	B2921	1E-08	<1	<1
9	MU	B3117	--	2E+00	**2E+00**
9	MU	B3118	3E-07	2E+00	**2E+00**
9	MU	B3215	**6E-06**	<1	<1
9	MU	B3217	--	2E+00	**2E+00**
9	MU	B3218	--	2E+00	**2E+00**
9	MU	B3220	--	<1	<1
9	MU	B3315	**4E-06**	<1	<1

TABLE A-20: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
9	MU	B3316	9E-07	<1	<1
9	MU	B3415	**3E-06**	6E+00	**3E+00**
9	MU	B3418	--	<1	<1
9	MU	B3421	2E-07	2E+00	**2E+00**
9	MU	B3515	**2E-06**	<1	<1
9	MU	B3516	--	<1	<1
9	MU	B3520	--	<1	<1
9	MU	B3615	--	<1	<1
12	MU	B3715	4E-07	<1	<1
12	MU	B3718	8E-09	2E+00	**2E+00**
12	MU	B3815	1E-06	5E+00	**4E+00**
12	MU	B3816	3E-09	2E+00	**2E+00**
12	MU	B3915	**8E-06**	<1	<1
12	MU	B3916	3E-10	<1	<1
12	MU	B3917	**6E-06**	<1	<1
12	MU	B3919	**3E-06**	--	--
12	MU	B3920	6E-07	--	--
12	MU	B4015	1E-06	2E+00	**2E+00**
12	MU	B4016	**2E-06**	<1	<1
12	MU	B4017	**2E-05**	2E+00	**2E+00**
12	MU	B4018	4E-07	<1	<1
12	MU	B4019	1E-06	3E+00	**3E+00**
12	MU	B4020	7E-08	3E+00	**3E+00**
12	MU	B4115	5E-07	<1	<1
12	MU	B4116	--	3E+00	**3E+00**
12	MU	B4117	6E-07	<1	<1
12	MU	B4215	1E-06	<1	<1
12	MU	B4217	--	2E+00	**2E+00**
12	MU	B4218	1E-06	<1	<1
12	MU	B4219	1E-07	2E+00	**2E+00**
12	MU	B4220	--	2E+00	**2E+00**
12	MU	B4315	8E-07	4E+00	**3E+00**
12	MU	B4320	--	2E+00	**2E+00**
12	MU	B4415	--	<1	<1
12	MU	B4418	4E-07	<1	<1
12	MU	B4419	8E-07	<1	<1
12	MU	B4420	5E-07	<1	<1
12	MU	B4421	7E-07	<1	<1
12	MU	B4515	1E-07	<1	<1
12	MU	B4517	--	3E+00	**2E+00**
12	MU	B4518	5E-07	<1	<1
12	MU	B4519	4E-07	<1	<1
12	MU	B4520	**4E-06**	<1	<1
12	MU	B4521	3E-07	<1	<1
12	MU	B4615	--	3E+00	**3E+00**
12	MU	B4616	--	<1	<1
12	MU	B4617	2E-08	3E+00	**2E+00**
12	MU	B4620	4E-08	<1	<1
12	MU	B4621	8E-07	<1	<1

TABLE A-20: INCREMENTAL RISK - SUMMARY OF CANCER RISKS AND HAZARD INDICES BY PLANNED REUSE, SUBSURFACE SOIL (0 TO 10 FEET BGS) (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	RME Cancer Risk	RME Hazard Index	RME Segregated Hazard Index
15	MU	B4716	**4E-05**	5E+00	**2E+00**
15	MU	B4717	--	<1	<1
15	MU	B4816	5E-08	<1	<1
15	MU	B4817	--	<1	<1
15	MU	B4818	--	<1	<1
15	MU	B4819	--	<1	<1
15	MU	B4916	--	<1	<1
15	MU	B4917	5E-08	<1	<1
16	E/C	AX04	**1E-04**	<1	<1
16	E/C	AY03	**6E-05**	<1	<1
16	E/C	AY04	**1E-05**	<1	<1

Notes:

--	Not applicable
bgs	Below ground surface
E/C	Educational/cultural (industrial exposure scenario)
MU	Mixed use (residential exposure scenario)
RD	Research and development (residential exposure scenario)
RME	Reasonable maximum exposure

TABLE A-21: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI			
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
3	RD	B1028	6E-06	8E+00	8E+00	Metal	ANTIMONY	NC	67.9 - 67.9	6.79E+01	1/1	--	--	--	--	--	6.65E+00	32.7 %	0 %	0 %	67.3 %
							ZINC	NC	383 - 383	3.83E+02	1/1	--	--	--	--	--	1.03E+00	1.6 %	0 %	0 %	98.4 %
						PAH	BENZO(A)PYRENE	C	0.046 - 0.046	4.60E-02	1/1	1.23E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/1	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
3	RD	B1029	7E-06	<1	<1	Pest/PCB	DIELDRIN	C	0.002 - 0.002	2.00E-03	1/2	3.03E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	2 - 2	2.00E+00	1/2	1.75E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--
3	RD	B1130	6E-06	3E+00	2E+00	Metal	COPPER	NC	376 - 376	3.76E+02	1/1	--	--	--	--	--	2.36E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)PYRENE	C	0.16 - 0.16	1.60E-01	1/1	4.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1131	2E-05	3E+00	3E+00	Metal	COPPER	NC	432 - 432	4.32E+02	1/1	--	--	--	--	--	2.71E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)ANTHRACENE	C	0.48 - 0.48	4.80E-01	1/1	1.30E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.42 - 0.42	4.20E-01	1/1	1.13E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.49 - 0.49	4.90E-01	1/1	1.45E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.34 - 0.34	3.40E-01	1/1	1.00E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.078 - 0.078	7.80E-02	1/1	1.35E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
3	RD	B1231	1E-05	2E+00	2E+00	Metal	COPPER	NC	282 - 282	2.82E+02	1/1	--	--	--	--	--	1.77E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)ANTHRACENE	C	0.51 - 0.51	5.10E-01	1/1	1.38E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.37 - 0.37	3.70E-01	1/1	9.92E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1330	3E-04	4E+00	2E+00	Metal	ARSENIC	C	11.2 - 11.2	1.12E+01	1/1	2.93E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--
							COPPER	NC	301 - 301	3.01E+02	1/1	--	--	--	--	--	1.89E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)PYRENE	C	0.084 - 0.084	8.40E-02	1/1	2.25E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
6	RD	B1626	6E-06	<1	<1	VOC	TETRACHLOROETHENE	C	2.8 - 2.8	2.80E+00	1/1	5.80E-06	40.8 %	0 %	59.2 %	0 %	<1	--	--	--	--
6	RD	B2224	6E-06	--	--	PAH	BENZO(A)PYRENE	C	0.13 - 0.13	1.30E-01	1/1	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
7	MU	B3228	1E-09	3E+00	3E+00	Metal	MANGANESE	NC	763 - 2640	2.31E+03	5/5	--	--	--	--	--	2.74E+00	44.9 %	0 %	2.9 %	52.2 %
7	MU	B3229	--	2E+00	2E+00	Metal	MANGANESE	NC	1450 - 1450	1.45E+03	1/1	--	--	--	--	--	1.72E+00	44.9 %	0 %	2.9 %	52.2 %
8	MU	B2723	2E-06	<1	<1	VOC	TRICHLOROETHENE	C	4.9 - 4.9	4.90E+00	1/1	1.66E-06	6.0%	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2923	1E-07	3E+00	3E+00	Metal	MANGANESE	NC	1900 - 1900	1.90E+03	1/1	--	--	--	--	--	2.25E+00	44.9 %	0 %	2.9 %	52.2 %
8	MU	B3426	--	<1	<1	Metal	LEAD	NC	163 - 163	1.63E+02	1/1	--	--	--	--	--	--	--	--	--	--
9	MU	B2818	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.048 - 0.048	4.80E-02	1/3	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B4220	--	2E+00	2E+00	Metal	MANGANESE	NC	933 - 2040	2.04E+03	3/3	--	--	--	--	--	2.42E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4615	--	3E+00	3E+00	Metal	MANGANESE	NC	2390 - 2390	2.39E+03	1/1	--	--	--	--	--	2.84E+00	44.9 %	0 %	2.9 %	52.2 %
15	MU	B4716	4E-05	4E+00	2E+00	Metal	MANGANESE	NC	658 - 1440	1.44E+03	2/2	--	--	--	--	--	1.71E+00	44.9 %	0 %	2.9 %	52.2 %
						PAH	BENZO(A)ANTHRACENE	C	1.2 - 1.2	1.20E+00	1/4	3.24E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.88 - 0.88	8.80E-01	1/4	2.36E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	1.8 - 1.8	1.80E+00	1/4	5.32E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.43 - 0.43	4.30E-01	1/4	1.27E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.38 - 0.38	3.80E-01	1/4	6.56E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
							INDENO(1,2,3-CD)PYRENE	C	0.99 - 0.99	9.90E-01	1/4	2.85E-06	65.3 %	26.8 %	0 %	7.9 %	--	--	--	--	--
BOS-1	OS	AF09	6E-07	<1	<1	Metal	LEAD	NC	93 - 340	3.40E+02	2/2	--	--	--	--		--	--	--	--	
BOS-1	OS	AG09	3E-06	<1	<1	Metal	LEAD	NC	36 - 210	1.62E+02	6/6	--	--	--	--		--	--	--	--	
						Pest/PCB	AROCLOR-1260	C	0.025 - 1.6	1.05E+00	6/6	1.41E-06	26.6 %	73.4 %	0 %		<1	--	--	--	

TABLE A-21: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SURFACE SOIL (0 TO 2 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI	COC		Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI			
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
BOS-1	OS	AH09	8E-06	<1	<1	Metal	LEAD	NC	4 - 800	5.36E+02	9/9	--	--	--	--		--	--	--	--	
						PAH	BENZO(A)PYRENE	C	0.026 - 0.3405	1.90E-01	7/9	1.46E-06	28.1%	71.9 %	0 %		--	--	--	--	
						Pest/PCB	AROCLOR-1260	C	0.016 - 3.5	3.50E+00	8/8	4.71E-06	26.6 %	73.4 %	0 %		<1	--	--	--	
BOS-1	OS	AI08	4E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.038 - 0.46	2.96E-01	6/8	2.26E-06	28.1%	71.9 %	0 %		--	--	--	--	
BOS-3	OS	AU05	1E-05	<1	<1	Metal	LEAD	NC	2.35 - 760	7.60E+02	6/6	--	--	--	--		--	--	--	--	
						PAH	BENZO(A)PYRENE	C	0.032 - 0.51	5.10E-01	4/9	3.90E-06	28.1%	71.9 %	0 %		--	--	--	--	
						Pest/PCB	AROCLOR-1254	C	1.1 - 1.1	1.10E+00	1/7	1.48E-06	26.6 %	73.4 %	0 %		<1	--	--	--	
							AROCLOR-1260	C	0.073 - 3.1	3.10E+00	3/7	4.17E-06	26.6 %	73.4 %	0 %		<1	--	--	--	
BOS-3	OS	AW03	8E-05	<1	<1	Metal	ARSENIC	C	7.7 - 28	2.80E+01	2/2	7.54E-05	62.8 %	37.2 %	0 %		<1	--	--	--	
							LEAD	NC	80 - 230	2.30E+02	2/2	--	--	--	--		--	--	--	--	
						Pest/PCB	AROCLOR-1260	C	0.2 - 2.7	2.70E+00	2/2	3.64E-06	26.6 %	73.4 %	0 %		<1	--	--	--	

Notes: All concentrations shown in mg/kg.

--	Not applicable or chemical is not a COC for this endpoint
	Not evaluated because exposure pathway is incomplete
bgs	Below ground surface
C	Cancer effect
COC	Chemical of concern
DF	Detection frequency
EPC	Exposure point concentration
HI	Hazard index
mg/kg	Milligram per kilogram
MU	Mixed use (residential exposure scenario)
NC	Noncancer effect
OS	Open space (recreational exposure scenario)
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
Pest	Pesticide
RD	Research and development (residential exposure scenario)
RME	Reasonable maximum exposure
VOC	Volatile organic compound

TABLE A-22: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI			
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
1	MU	B0143	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.014 - 0.059	5.90E-02	2/2	1.58E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
1	MU	B0144	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.024 - 0.051	5.10E-02	2/4	1.37E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0142	9E-06	<1	<1	Metal	LEAD	NC	2 - 230.5	2.31E+02	7/7	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.016 - 0.12	1.07E-01	5/7	2.87E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.092 - 0.235	2.35E-01	2/5	4.06E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
2	RD	B0238	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.025 - 0.0595	5.44E-02	5/6	1.46E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0239	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.018 - 0.05	5.00E-02	3/3	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0240	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.012 - 0.047	4.70E-02	3/3	1.26E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0241	7E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.009 - 0.31	1.40E-01	13/14	3.76E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0242	9E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.03 - 0.22	2.20E-01	3/3	5.90E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.061 - 0.061	6.10E-02	1/1	1.05E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
2	RD	B0336	5E-08	<1	<1	Metal	LEAD	NC	45.3 - 240	2.40E+02	3/3	--	--	--	--	--	--	--	--	--	--
2	RD	B0341	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.008 - 0.074	5.50E-02	8/9	1.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
2	RD	B0438	3E-07	<1	<1	Metal	LEAD	NC	30.1 - 478	4.78E+02	5/5	--	--	--	--	--	--	--	--	--	--
2	RD	B0538	--	3E+00	2E+00	Metal	VANADIUM	NC	53.6 - 149	1.49E+02	3/3	--	--	--	--	--	2.30E+00	82.9 %	0 %	0 %	17.1 %
2	RD	B1036	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.072 - 0.076	7.60E-02	2/4	2.04E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B0532	4E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.035 - 0.13	1.30E-01	2/2	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B0632	5E-09	3E+00	3E+00	Metal	IRON	NC	59300 - 59300	5.93E+04	1/1	--	--	--	--	--	2.70E+00	93.6 %	0 %	0 %	6.4 %
3	RD	B1028	7E-06	1E+01	7E+00	Metal	ANTIMONY	NC	1.8 - 67.9	6.79E+01	5/6	--	--	--	--	--	6.65E+00	32.7 %	0 %	0 %	67.3 %
							IRON	NC	26800 - 64300	5.07E+04	6/6	--	--	--	--	--	2.31E+00	93.6 %	0 %	0 %	6.4 %
							LEAD	NC	12.4 - 840	8.40E+02	7/7	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.031 - 0.046	4.60E-02	4/7	1.23E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/6	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
3	RD	B1029	3E-04	8E+00	5E+00	PAH	BENZO(A)PYRENE	C	0.011 - 0.041	4.10E-02	6/7	1.10E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C,NC	0.074 - 14	5.93E+00	5/7	2.81E-05	66.1 %	29.2 %	0 %	4.7 %	5.44E+00	69.6 %	27.3 %	0 %	3.1 %
							DIELDRIN	C,NC	0.002 - 0.18	1.80E-01	3/7	2.73E-04	1.7 %	0.5 %	0 %	97.8 %	1.74E+00	2.7 %	0.7 %	0 %	96.6 %
							HEPTACHLOR EPOXIDE	C	0.001 - 0.003	3.00E-03	3/7	5.57E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	2 - 2	2.00E+00	1/7	1.75E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--
3	RD	B1128	1E-05	2E+00	<1	Metal	LEAD	NC	39.2 - 575	3.63E+02	9/9	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.018 - 0.32	2.22E-01	5/12	5.94E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1129	1E-04	1E+01	7E+00	Metal	ANTIMONY	NC	1.6 - 78.1	5.46E+01	10/10	--	--	--	--	--	5.34E+00	32.7 %	0 %	0 %	67.3 %
							COPPER	NC	20.6 - 365	3.49E+02	10/10	--	--	--	--	--	2.20E+00	5.5 %	0 %	0 %	94.5 %
							ZINC	NC	58.1 - 958	5.92E+02	10/10	--	--	--	--	--	1.59E+00	1.6 %	0 %	0 %	98.4 %
						PAH	BENZO(A)PYRENE	C	0.009 - 0.1115	8.51E-02	8/10	2.28E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	AROCLOR-1254	C	0.02 - 0.16	1.24E-01	4/10	1.33E-06	29.1 %	12.9 %	0 %	58.0 %	<1	--	--	--	--
							AROCLOR-1260	C,NC	0.037 - 2.5	2.50E+00	7/10	1.18E-05	66.1 %	29.2 %	0 %	4.7 %	2.29E+00	69.6 %	27.3 %	0 %	3.1 %
							BETA-BHC	C	0.004 - 0.008	8.00E-03	2/10	1.21E-06	1.9 %	0.2 %	0 %	97.9 %	<1	--	--	--	--
							DIELDRIN	C	0.009 - 0.051	4.20E-02	5/10	6.38E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.002 - 0.008	4.39E-03	4/10	8.15E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
						SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	C	3.2 - 9.3	9.30E+00	2/10	8.15E-06	2.5 %	0.8 %	0 %	96.7 %	<1	--	--	--	--

TABLE A-22: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI			
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
3	RD	B1130	1E-04	1E+01	6E+00	Metal	ANTIMONY	NC	4.3 - 49.5	4.95E+01	7/7	--	--	--	--	--	4.84E+00	32.7 %	0 %	0 %	67.3 %
							COPPER	NC	27.1 - 1120	6.38E+02	7/7	--	--	--	--	--	4.01E+00	5.5 %	0 %	0 %	94.5 %
							IRON	NC	16600 - 61000	4.43E+04	7/7	--	--	--	--	--	2.02E+00	93.6 %	0 %	0 %	6.4 %
							LEAD	NC	62.8 - 203	1.64E+02	7/7	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)ANTHRACENE	C	0.023 - 0.76	4.25E-01	7/7	1.15E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.013 - 0.57	5.70E-01	7/7	1.53E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.018 - 0.68	6.80E-01	6/7	2.01E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.012 - 0.52	5.20E-01	6/7	1.54E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.012 - 0.12	8.82E-02	5/7	1.52E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C	0.04 - 1.1	6.34E-01	6/7	3.00E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--
							DIELDRIN	C	0.002 - 0.054	2.84E-02	4/7	4.31E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
							HEPTACHLOR EPOXIDE	C,NC	0.002 - 0.015	1.50E-02	5/7	2.79E-05	0.8 %	0.2 %	0 %	99.0 %	1.19E+00	1.2 %	0.3 %	0 %	98.5 %
3	RD	B1131	3E-04	1E+01	4E+00	Metal	ARSENIC	C	3.3 - 13.3	9.16E+00	6/7	2.39E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--
							COPPER	NC	17.9 - 826	5.71E+02	7/7	--	--	--	--	--	3.58E+00	5.5 %	0 %	0 %	94.5 %
							IRON	NC	10900 - 63200	4.95E+04	7/7	--	--	--	--	--	2.26E+00	93.6 %	0 %	0 %	6.4 %
							MERCURY	NC	0.08 - 2.6	2.60E+00	7/7	--	--	--	--	--	1.63E+00	6.8 %	0 %	0 %	93.2 %
						PAH	BENZO(A)ANTHRACENE	C	0.009 - 0.57	3.98E-01	7/7	1.08E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.008 - 0.42	3.16E-01	7/7	8.47E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.01 - 0.49	3.56E-01	7/7	1.05E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.032 - 0.078	7.80E-02	4/7	1.35E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.001 - 0.001	1.00E-03	1/7	1.86E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
3	RD	B1228	3E-06	2E+00	<1	Metal	LEAD	NC	100 - 286	2.41E+02	5/5	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.017 - 0.096	6.88E-02	6/6	1.84E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1229	3E-06	2E+00	<1	Metal	LEAD	NC	64.7 - 707	5.58E+02	5/5	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.017 - 0.084	7.51E-02	5/5	2.01E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1230	2E-05	3E+00	2E+00	Metal	ANTIMONY	NC	2 - 24.85	1.64E+01	5/5	--	--	--	--	--	1.61E+00	32.7 %	0 %	0 %	67.3 %
							LEAD	NC	60.3 - 184	1.77E+02	5/5	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.014 - 0.12	9.58E-02	5/5	2.57E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	AROCLOR-1260	C	0.23 - 0.23	2.30E-01	1/5	1.09E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--
							DIELDRIN	C	0.0085 - 0.0085	8.50E-03	1/5	1.29E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.002 - 0.002	2.00E-03	1/5	3.71E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
3	RD	B1231	1E-05	2E+00	2E+00	Metal	COPPER	NC	22.6 - 282	2.40E+02	4/4	--	--	--	--	--	1.51E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)ANTHRACENE	C	0.51 - 0.51	5.10E-01	1/4	1.38E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.011 - 0.37	3.70E-01	2/4	9.92E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
3	RD	B1328	7E-06	1E+01	9E+00	Metal	MANGANESE	NC	415 - 3980	3.98E+03	5/5	--	--	--	--	--	4.72E+00	44.9 %	0 %	2.9 %	52.2 %
							MERCURY	NC	0.07 - 6	6.00E+00	5/5	--	--	--	--	--	3.77E+00	6.8 %	0 %	0 %	93.2 %
						Pest/PCB	AROCLOR-1260	C	0.03 - 0.23	2.30E-01	2/5	1.09E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--
							DIELDRIN	C	0.002 - 0.003	3.00E-03	2/5	4.55E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
3	RD	B1329	6E-06	2E+00	<1	PAH	BENZO(A)PYRENE	C	0.039 - 0.087	8.70E-02	3/3	2.33E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	HEPTACHLOR EPOXIDE	C	0.001 - 0.001	1.00E-03	1/3	1.86E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--

TABLE A-22: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

													Percent Contribution by Exposure Pathway to Total RME Cancer Risk					Percent Contribution by Exposure Pathway to Total RME HI			
Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
3	RD	B1330	3E-03	1E+01	8E+00	Metal	ARSENIC	C,NC	4.6 - 123.95	1.24E+02	5/5	3.24E-03	56.6 %	5.4 %	0 %	38.0 %	7.91E+00	66.8 %	5.6 %	0.1 %	27.5 %
							COPPER	NC	28.9 - 507	4.15E+02	5/5	--	--	--	--	--	2.61E+00	5.5 %	0 %	0 %	94.5 %
						PAH	BENZO(A)ANTHRACENE	C	0.05 - 0.685	6.85E-01	4/5	1.85E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.0535 - 0.25	2.50E-01	4/5	6.70E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							NAPHTHALENE	C	3.75 - 3.75	3.75E+00	1/5	2.25E-06	31.3 %	0 %	68.7 %	0 %	<1	--	--	--	--
						Pest/PCB	AROCLOR-1254	C	0.49 - 0.49	4.90E-01	1/5	5.27E-06	29.1 %	12.9 %	0 %	58.0 %	<1	--	--	--	--
							DIELDRIN	C	0.017 - 0.017	1.70E-02	1/5	2.58E-05	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
							HEPTACHLOR EPOXIDE	C	0.004 - 0.004	4.00E-03	1/5	7.43E-06	0.8 %	0.2 %	0 %	99.0 %	<1	--	--	--	--
3	RD	B1331	1E-03	6E+00	3E+00	Metal	ARSENIC	C,NC	4.9 - 50	5.00E+01	2/2	1.31E-03	56.6 %	5.4 %	0 %	38.0 %	3.19E+00	66.8 %	5.6 %	0.1 %	27.5 %
							COPPER	NC	33.8 - 330	3.30E+02	2/2	--	--	--	--	--	2.07E+00	5.5 %	0 %	0 %	94.5 %
5	RD	B1632	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.02 - 0.058	5.80E-02	2/3	1.55E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
5	RD	B2127	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.01 - 0.048	4.80E-02	4/9	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
5	RD	B2128	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.085 - 0.085	8.50E-02	1/4	2.28E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
5	RD	B2228	4E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.1 - 0.1	1.00E-01	1/2	2.68E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
6	RD	B1425	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.05 - 0.05	5.00E-02	1/4	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
6	RD	B1426	8E-06	4E+00	2E+00	Metal	CADMIUM	NC	0.89 - 4.1	4.10E+00	3/8	6.95E-09	--	--	--	--	1.19E+00	8.8 %	0 %	0 %	91.2 %
							MANGANESE	NC	700 - 1550	1.55E+03	3/3	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %
						PAH	BENZO(A)PYRENE	C	0.044 - 0.1	1.00E-01	2/4	2.68E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						Pest/PCB	DIELDRIN	C	0.002 - 0.002	2.00E-03	1/2	3.03E-06	1.7 %	0.5 %	0 %	97.8 %	<1	--	--	--	--
6	RD	B1626	7E-06	2E+00	<1	PAH	BENZO(A)PYRENE	C	0.042 - 0.042	4.20E-02	1/7	1.13E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
						VOC	TETRACHLOROETHENE	C	2.8 - 2.8	2.80E+00	1/7	5.80E-06	40.8 %	0 %	59.2 %	0 %	<1	--	--	--	--
6	RD	B2026	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.045 - 0.045	4.50E-02	1/1	1.21E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
6	RD	B2224	6E-06	--	--	PAH	BENZO(A)PYRENE	C	0.13 - 0.13	1.30E-01	1/2	3.48E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
6	RD	B2226	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.0805 - 0.0805	8.05E-02	1/1	2.16E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
7	MU	B2635	7E-07	3E+00	3E+00	Metal	ZINC	NC	96.9 - 1040	1.04E+03	3/3	--	--	--	--	--	2.79E+00	1.6 %	0 %	0 %	98.4 %
7	MU	B2727	--	6E+00	3E+00	Metal	IRON	NC	66500 - 66500	6.65E+04	1/1	--	--	--	--	--	3.03E+00	93.6 %	0 %	0 %	6.4 %
							MANGANESE	NC	561 - 1920	1.26E+03	8/8	--	--	--	--	--	1.49E+00	44.9 %	0 %	2.9 %	52.2 %
7	MU	B2735	4E-04	4E+00	3E+00	Metal	ARSENIC	C	2.8 - 15.1	1.51E+01	2/2	3.94E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--
							ZINC	NC	138 - 947	9.47E+02	2/2	--	--	--	--	--	2.54E+00	1.6 %	0 %	0 %	98.4 %
						PAH	BENZO(A)PYRENE	C	0.052 - 0.052	5.20E-02	1/2	1.39E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
7	MU	B3128	--	2E+00	2E+00	Metal	MANGANESE	NC	641 - 1870	1.47E+03	6/6	--	--	--	--	--	1.74E+00	44.9 %	0 %	2.9 %	52.2 %
7	MU	B3228	7E-09	4E+00	3E+00	Metal	CADMIUM	NC	1.6 - 3.6	3.60E+00	4/4	6.10E-09	--	--	--	--	1.04E+00	8.8 %	0 %	0 %	91.2 %
							MANGANESE	NC	288 - 8500	2.15E+03	18/18	--	--	--	--	--	2.56E+00	44.9 %	0 %	2.9 %	52.2 %
7	MU	B3229	1E-06	2E+00	2E+00	Metal	MANGANESE	NC	390 - 1450	1.45E+03	2/2	--	--	--	--	--	1.72E+00	44.9 %	0 %	2.9 %	52.2 %
8	MU	B2722	1E-08	3E+00	2E+00	Metal	IRON	NC	17700 - 59700	5.49E+04	4/4	--	--	--	--	--	2.50E+00	93.6 %	0 %	0 %	6.4 %
8	MU	B2723	1E-05	<1	<1	VOC	TRICHLOROETHENE	C	0.00076 - 121	2.86E+01	26/26	9.73E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2724	3E-05	<1	<1	VOC	TRICHLOROETHENE	C	0.064 - 100	1.00E+02	21/22	3.40E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2823	6E-05	2E+00	2E+00	Metal	MANGANESE	NC	416 - 3210	1.23E+03	21/21	--	--	--	--	--	1.46E+00	44.9 %	0 %	2.9 %	52.2 %
						VOC	TRICHLOROETHENE	C	0.033 - 230	1.62E+02	49/50	5.51E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2824	1E-05	<1	<1	VOC	TRICHLOROETHENE	C	0.076 - 170	3.69E+01	32/37	1.25E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--

TABLE A-22: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

													Percent Contribution by Exposure Pathway to Total RME Cancer Risk					Percent Contribution by Exposure Pathway to Total RME HI			
Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion	Chemical-specific HI	Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
8	MU	B2923	2E-04	1E+01	1E+01	Metal	ARSENIC	C	1.2 - 11.7	5.06E+00	5/10	1.32E-04	56.6 %	5.4 %	0 %	38.0 %	<1	--	--	--	--
							MANGANESE	NC	480 - 41400	1.12E+04	11/11	--	--	--	--	--	1.33E+01	44.9 %	0 %	2.9 %	52.2 %
						VOC	TRICHLOROETHENE	C	0.005 - 63.5	6.35E+01	28/28	2.16E-05	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2924	7E-06	<1	<1	VOC	TRICHLOROETHENE	C	0.01 - 90.3	2.10E+01	10/16	7.15E-06	6.0 %	0 %	94.0 %	0 %	<1	--	--	--	--
8	MU	B2926	1E-06	3E+00	2E+00	Metal	CADMIUM	NC	0.81 - 7.9	7.90E+00	3/13	1.34E-08	--	--	--	--	2.29E+00	8.8 %	0 %	0 %	91.2 %
8	MU	B3126	1E-07	2E+00	2E+00	Metal	MANGANESE	NC	357 - 1620	1.04E+03	19/19	--	--	--	--	--	1.23E+00	44.9 %	0 %	2.9 %	52.2 %
8	MU	B3422	3E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.015 - 0.065	6.50E-02	3/8	1.74E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
8	MU	B3425	--	2E+00	2E+00	Metal	MANGANESE	NC	305 - 2040	1.29E+03	14/14	--	--	--	--	--	1.53E+00	44.9 %	0 %	2.9 %	52.2 %
8	MU	B3426	1E-07	<1	<1	Metal	LEAD	NC	2 - 163	1.63E+02	4/4	--	--	--	--	--	--	--	--	--	--
8	MU	B3622	6E-07	2E+00	2E+00	Metal	MANGANESE	NC	647 - 2230	1.62E+03	9/9	--	--	--	--	--	1.92E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B2818	2E-06	--	--	PAH	BENZO(A)PYRENE	C	0.048 - 0.048	4.80E-02	1/3	1.29E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
9	MU	B3117	--	2E+00	2E+00	Metal	MANGANESE	NC	703 - 1470	1.36E+03	5/5	--	--	--	--	--	1.61E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B3118	3E-07	2E+00	2E+00	Metal	MANGANESE	NC	491 - 2640	1.55E+03	25/25	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B3215	6E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.01 - 0.11	1.10E-01	2/6	2.95E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.009 - 0.0595	5.95E-02	2/6	1.03E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
9	MU	B3217	--	2E+00	2E+00	Metal	MANGANESE	NC	1120 - 1550	1.55E+03	2/2	--	--	--	--	--	1.84E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B3218	--	2E+00	2E+00	Metal	MANGANESE	NC	954 - 1750	1.56E+03	6/6	--	--	--	--	--	1.85E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B3315	4E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.009 - 0.12	1.04E-01	5/13	2.79E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
9	MU	B3415	3E-06	6E+00	3E+00	Metal	ANTIMONY	NC	4.3 - 21.7	2.17E+01	3/3	--	--	--	--	--	2.12E+00	32.7 %	0 %	0 %	67.3 %
							IRON	NC	37700 - 83200	7.46E+04	5/5	--	--	--	--	--	3.40E+00	93.6 %	0 %	0 %	6.4 %
							LEAD	NC	2.7 - 165	1.65E+02	2/4	--	--	--	--	--	--	--	--	--	--
						PAH	BENZO(A)PYRENE	C	0.01 - 0.064	6.40E-02	3/10	1.72E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
9	MU	B3421	2E-07	2E+00	2E+00	Metal	MANGANESE	NC	869 - 1600	1.60E+03	3/3	--	--	--	--	--	1.90E+00	44.9 %	0 %	2.9 %	52.2 %
9	MU	B3515	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.015 - 0.05	5.00E-02	3/10	1.34E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B3718	8E-09	2E+00	2E+00	Metal	MANGANESE	NC	590 - 2320	1.50E+03	9/9	--	--	--	--	--	1.78E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B3815	1E-06	5E+00	4E+00	Metal	MANGANESE	NC	550 - 3190	3.12E+03	4/4	--	--	--	--	--	3.70E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B3816	3E-09	2E+00	2E+00	Metal	MANGANESE	NC	579 - 2220	1.35E+03	14/14	--	--	--	--	--	1.60E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B3915	8E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.025 - 0.2	2.00E-01	3/14	5.36E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B3917	6E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.028 - 0.15	1.50E-01	3/7	4.02E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B3919	3E-06	--	--	PAH	BENZO(A)PYRENE	C	0.022 - 0.0505	5.05E-02	2/2	1.35E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B4015	1E-06	2E+00	2E+00	Metal	MANGANESE	NC	676 - 1930	1.35E+03	8/8	--	--	--	--	--	1.60E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4016	2E-06	<1	<1	PAH	BENZO(A)PYRENE	C	0.038 - 0.038	3.80E-02	1/5	1.02E-06	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
12	MU	B4017	2E-05	2E+00	2E+00	Metal	MANGANESE	NC	904 - 1830	1.83E+03	2/2	--	--	--	--	--	2.17E+00	44.9 %	0 %	2.9 %	52.2 %
						PAH	BENZO(A)ANTHRACENE	C	0.028 - 0.71	7.10E-01	2/5	1.92E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.032 - 0.42	4.20E-01	2/5	1.13E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	0.044 - 0.55	5.50E-01	2/5	1.63E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.039 - 0.34	3.40E-01	2/5	1.00E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.14 - 0.14	1.40E-01	1/5	2.42E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
12	MU	B4019	1E-06	3E+00	3E+00	Metal	MANGANESE	NC	389 - 3520	2.43E+03	9/9	--	--	--	--	--	2.89E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4020	7E-08	3E+00	3E+00	Metal	MANGANESE	NC	1060 - 2410	2.41E+03	3/3	--	--	--	--	--	2.86E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4116	--	3E+00	3E+00	Metal	MANGANESE	NC	635 - 4310	2.13E+03	13/13	--	--	--	--	--	2.52E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4217	--	2E+00	2E+00	Metal	MANGANESE	NC	674 - 1440	1.41E+03	5/5	--	--	--	--	--	1.67E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4219	1E-07	2E+00	2E+00	Metal	MANGANESE	NC	507 - 1470	1.47E+03	2/2	--	--	--	--	--	1.74E+00	44.9 %	0 %	2.9 %	52.2 %

TABLE A-22: INCREMENTAL RISK - RISK CHARACTERIZATION ANALYSIS FOR SUBSURFACE SOIL (0 TO 10 FEET BGS) BY PLANNED REUSE (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Grid Number	Total RME Cancer Risk	Total RME HI	RME Segregated HI		COC	Basis for COC	Range of Detected Concentrations	RME EPC	DF	Chemical-Specific Cancer Risk	Percent Contribution by Exposure Pathway to Total RME Cancer Risk				Chemical-specific HI	Percent Contribution by Exposure Pathway to Total RME HI			
													Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion		Incidental Ingestion	Dermal Contact	Inhalation (Releases to Ambient Air)	Home-grown Produce Ingestion
12	MU	B4220	--	2E+00	2E+00	Metal	MANGANESE	NC	399 - 2040	1.31E+03	10/10	--	--	--	--	--	1.55E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4315	8E-07	4E+00	3E+00	Metal	IRON	NC	70000 - 70000	7.00E+04	1/1	--	--	--	--	--	3.19E+00	93.6 %	0 %	0 %	6.4 %
12	MU	B4320	--	2E+00	2E+00	Metal	MANGANESE	NC	766 - 1450	1.38E+03	6/6	--	--	--	--	--	1.64E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4517	--	3E+00	2E+00	Metal	MANGANESE	NC	811 - 1870	1.87E+03	2/2	--	--	--	--	--	2.22E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4520	4E-06	<1	<1	Pest/PCB	AROCLOR-1260	C	0.038 - 0.78	7.80E-01	3/7	3.70E-06	66.1 %	29.2 %	0 %	4.7 %	<1	--	--	--	--
12	MU	B4615	--	3E+00	3E+00	Metal	MANGANESE	NC	1190 - 2390	2.39E+03	2/2	--	--	--	--	--	2.84E+00	44.9 %	0 %	2.9 %	52.2 %
12	MU	B4617	2E-08	3E+00	2E+00	Metal	MANGANESE	NC	1930 - 1930	1.93E+03	1/1	--	--	--	--	--	2.29E+00	44.9 %	0 %	2.9 %	52.2 %
15	MU	B4716	4E-05	5E+00	2E+00	Metal	IRON	NC	12400 - 59200	4.16E+04	8/8	--	--	--	--	--	1.89E+00	93.6 %	0 %	0 %	6.4 %
							MANGANESE	NC	132 - 2030	1.44E+03	8/8	--	--	--	--	--	1.71E+00	44.9 %	0 %	2.9 %	52.2 %
						PAH	BENZO(A)ANTHRACENE	C	1.2 - 1.2	1.20E+00	1/11	3.24E-06	69.5 %	28.5 %	0 %	2.0 %	--	--	--	--	--
							BENZO(A)PYRENE	C	0.88 - 0.88	8.80E-01	1/11	2.36E-05	70.1 %	28.8 %	0 %	1.1 %	--	--	--	--	--
							BENZO(B)FLUORANTHENE	C	1.8 - 1.8	1.80E+00	1/11	5.32E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							BENZO(K)FLUORANTHENE	C	0.43 - 0.43	4.30E-01	1/11	1.27E-06	63.6 %	26.1 %	0 %	10.3 %	--	--	--	--	--
							DIBENZ(A,H)ANTHRACENE	C	0.38 - 0.38	3.80E-01	1/11	6.56E-06	66.2 %	27.2 %	0 %	6.6 %	--	--	--	--	--
							INDENO(1,2,3-CD)PYRENE	C	0.99 - 0.99	9.90E-01	1/11	2.85E-06	65.3 %	26.8 %	0 %	7.9 %	--	--	--	--	--
16	E/C	AX04	1E-04	<1	<1	Metal	ARSENIC	C	0.8 - 55.2	5.52E+01	4/7	1.27E-04	71.6 %	28.4 %	0 %		<1	--	--	--	
						PAH	BENZO(A)PYRENE	C	0.042 - 0.8	8.00E-01	4/7	4.56E-06	36.8 %	63.2 %	0 %		--	--	--	--	
16	E/C	AY03	6E-05	<1	<1	Metal	ARSENIC	C	3.475 - 54.1	2.15E+01	13/17	4.96E-05	71.6 %	28.4 %	0 %		<1	--	--	--	
						PAH	BENZO(A)ANTHRACENE	C	0.012 - 1.9	1.90E+00	13/17	1.08E-06	36.8 %	63.2 %	0 %		--	--	--	--	
							BENZO(A)PYRENE	C	0.0175 - 2.1	2.04E+00	13/17	1.16E-05	36.8 %	63.2 %	0 %		--	--	--	--	
16	E/C	AY04	1E-05	<1	<1	Metal	ARSENIC	C	3.3 - 12.4	6.08E+00	6/11	1.40E-05	71.6 %	28.4 %	0 %		<1	--	--	--	

Notes:
All concentrations shown in mg/kg.
-- Not applicable or chemical is not a COC for this endpoint
Not evaluated because exposure pathway is incomplete
bgs Below ground surface
BHC Benzene hexachloride
C Cancer effect
COC Chemical of concern
DF Detection frequency
E/C Educational/cultural (industrial exposure scenario)
EPC Exposure point concentration
HI Hazard index
mg/kg Milligram per kilogram
MU Mixed use (residential exposure scenario)
NC Noncancer effect
PAH Polynuclear aromatic hydrocarbon
PCB Polychlorinated biphenyl
Pest Pesticide
RD Research and development (residential exposure scenario)
RME Reasonable maximum exposure
VOC Volatile organic compound

TABLE A-23: RISK CHARACTERIZATION ANALYSIS FOR A-AQUIFER GROUNDWATER BASED ON PLANNED REUSE
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse	Exposure Area	Total RME Cancer Risk	Total RME HI	RME Segregated HI	Exposure Pathway	Source Aquifer for Exposure Pathway	Total RME Cancer Risk for Exposure Pathway	Total RME HI for Exposure Pathway		COC	Basis for COC	DF	RME Concentration (µg/L)	Chemical-Specific Cancer Risk	Percent Contribution to Total RME Cancer Risk for Exposure Pathway	Chemical-Specific HI	Percent Contribution to Total RME HI for Exposure Pathway
8, 9	MU	IR-10A Plume	6.04E-03	2.55E+00	2.03E+00	Vapor Intrusion	A	6.04E-03	2.55E+00	VOC	CHLOROFORM	C	12 / 61	4.3E+00	6.2E-06	0.1%	<1	--
											TRICHLOROETHENE	C	51 / 61	1.9E+02	6.4E-05	1.1%	<1	--
											VINYL CHLORIDE	C	8 / 61	1.7E+02	6.0E-03	98.8%	1.9E+00	73.7%
8, 12	MU	IR-25 Plume	9.87E-02	6.89E+02	3.31E+02	Vapor Intrusion	A	9.87E-02	6.89E+02	VOC	1,2,4-TRICHLOROBENZENE	NC	17 / 278	1.1E+02	--	--	1.6E+00	0.2%
											1,2,4-TRIMETHYLBENZENE	NC	7 / 37	9.1E+01	--	--	3.6E+00	0.5%
											1,2-DICHLOROBENZENE	NC	72 / 288	1.1E+04	--	--	4.4E+00	0.6%
											1,2-DICHLOROETHANE	C, NC	61 / 309	2.5E+04	1.1E-02	10.9%	2.0E+02	29.7%
											1,2-DICHLOROETHENE (TOTAL)	NC	28 / 89	8.2E+03	--	--	3.9E+01	5.7%
											1,2-DICHLOROPROPANE	C, NC	16 / 309	2.2E+02	2.0E-04	0.2%	6.5E+00	0.9%
											1,3,5-TRIMETHYLBENZENE	NC	4 / 37	2.2E+01	--	--	1.2E+00	0.2%
											1,4-DICHLOROBENZENE	C	58 / 290	3.7E+03	1.7E-03	1.8%	<1	--
											2-METHYLNAPHTHALENE[a]	NC	23 / 141	9.2E+02	--	--	1.3E+00	3.7%
											BENZENE	C	78 / 314	9.3E+01	2.5E-04	0.3%	<1	--
											BROMODICHLOROMETHANE	C	3 / 309	1.3E+02	1.3E-04	0.1%	<1	--
											CHLOROBENZENE	NC	38 / 306	1.5E+03	--	--	3.9E+00	0.6%
											CHLOROETHANE	C	11 / 309	5.1E+01	7.8E-06	0.0%	<1	--
											CHLOROFORM	C	18 / 309	1.3E+01	1.9E-05	0.0%	<1	--
											CIS-1,2-DICHLOROETHENE	NC	104 / 246	1.5E+04	--	--	7.1E+01	10.3%
											MERCURY	NC	13 / 130	3.6E+00	--	--	5.2E+00	0.8%
											METHYLENE CHLORIDE	C	10 / 309	2.0E+02	7.4E-06	0.0%	<1	--
											NAPHTHALENE	C, NC	39 / 178	2.0E+02	5.7E-05	0.1%	1.3E+00	0.2%
											TETRACHLOROETHENE	C, NC	65 / 309	1.4E+04	2.6E-02	26.3%	3.0E+02	43.6%
											TRANS-1,2-DICHLOROETHENE	NC	51 / 246	8.3E+02	--	--	4.5E+00	0.7%
											TRICHLOROETHENE	C, NC	115 / 309	3.6E+03	1.2E-03	1.3%	2.5E+00	0.4%
											TRICHLOROFLUOROMETHANE	NC	17 / 211	3.0E+03	--	--	1.7E+01	2.5%
											VINYL CHLORIDE	C, NC	97 / 309	1.7E+03	5.8E-02	59.2%	1.8E+01	2.7%
5	RD	B1528	1.86E-06	2.16E-02	2.16E-02	Vapor Intrusion	A	1.86E-06	2.16E-02	VOC	TETRACHLOROETHENE	C	1 / 3	1.0E+00	1.9E-06	100.0%	<1	--
12	MU	B4219	--	2.94E+00	2.94E+00	Vapor Intrusion	A	--	2.94E+00	VOC	MERCURY	NC	2 / 3	2.0E+00	--	--	2.9E+00	100.0%
12	MU	B4516	--	4.32E+00	4.19E+00	Vapor Intrusion	A	--	4.32E+00	VOC	DICHLORODIFLUOROMETHANE	NC	9 / 12	5.9E+01	--	--	4.1E+00	95.9%
15	MU	B5117	--	1.35E+00	1.34E+00	Vapor Intrusion	A	--	1.35E+00	VOC	MERCURY	NC	3 / 4	9.1E-01	--	--	1.3E+00	99.1%
16	E/C	AY04	3.41E-06	3.80E-01	3.68E-01	Vapor Intrusion	A	3.41E-06	3.80E-01	VOC	CHLOROFORM	C	3 / 6	4.0E+00	3.4E-06	100.0%	<1	--

Notes:
All concentrations shown in micrograms per liter (µg/L).
Risk results shown are based on inhalation exposure to A-aquifer groundwater via vapor intrusion to indoor air.
Unless noted,chemicals listed are based on results for the RME scenario.

a Chemical is a COC based on the MAX scenario (seeSection A5.1.2). Results shown are for the MAX scenario.
-- Not applicable or chemical is not a COC for this endpoint
C Cancer effect
COC Chemical of concern
DF Detection frequency
E/C Educational/cultural (industrial exposure scenario)
HI Hazard index
IR Installation restoration
MAX Maximum concentration exposure
MU Mixed use (residential exposure scenario)
NC Noncancer effect
RD Research and development (residential exposure scenario)
RME Reasonable maximum exposure
VOC Volatile organic compound

TABLE A-24: RISK CHARACTERIZATION ANALYSIS FOR B-AQUIFER GROUNDWATER WITH POTENTIAL HYDRAULIC COMMUNICATION
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Planned Reuse[a]	Exposure Area	Total RME Cancer Risk	Total RME HI	RME Segregated HI	Exposure Pathway	Source Aquifer for Exposure Pathway	Total RME Cancer Risk for Exposure Pathway	Total RME HI for Exposure Pathway		COC	Basis for COC	DF	RME Concentration (µg/L)	Chemical-Specific Cancer Risk	Percent Contribution to Total RME Cancer Risk for Exposure Pathway	Chemical-Specific HI	Percent Contribution to Total RME HI for Exposure Pathway
2	RD	B0238	8.90E-04	1.43E+00	5.75E-01	Domestic Use	B	8.90E-04	1.43E+00	Metal	ARSENIC	C	1 / 5	6.3E+00	8.9E-04	100.0%	<1	--
BOS-1	OS	B0139	1.40E-03	8.13E+00	3.74E+00	Domestic Use	B	1.40E-03	8.13E+00	Metal	ANTIMONY[b]	NC	2 / 14	2.1E+01	--	--	1.5E+00	17.8%
											ARSENIC[b]	C	4 / 13	9.5E+00	1.3E-03	95.8%	<1	--
											MANGANESE[b]	NC	14 / 14	1.4E+03	--	--	1.6E+00	19.1%
											THALLIUM[b]	NC	3 / 12	8.4E+00	--	--	3.5E+00	42.7%
										SVOC	PENTACHLOROPHENOL[b]	C	1 / 10	2.4E+01	4.3E-05	3.1%	<1	--
										VOC	1,4-DICHLOROBENZENE[b]	C	3 / 14	4.1E-01	1.4E-06	0.10%	<1	--
											BENZENE[b]	C	1 / 14	1.0E+00	9.0E-06	0.65%	<1	--
											CHLOROETHANE[b]	C	1 / 14	1.3E+01	2.8E-06	0.20%	<1	--
											TRICHLOROETHENE[b]	C	1 / 14	2.0E+00	1.4E-06	0.10%	<1	--
BOS-1	OS	B0237	--	3.78E+00	2.75E+00	Domestic Use	B	--	3.78E+00	Metal	MANGANESE[b]	NC	3 / 3	2.4E+03	--	--	2.8E+00	72.7%

Notes:
All concentrations shown in micrograms per liter (µg/L).
Risk results shown are based on based on residential exposure to B-aquifer groundater from domestic use.
Risk results are based on B-aquifer data combined with A-aquifer data to address potential hydraulic communication between the A- and B-aquifers. For some exposure points, both A- and B-aquifer data may not be available. In these cases, the summary statistics shown are based on the available data.

a The risk chracterization analysis for domestic use of groundwater in the B-aquifer is based on risk results parcel-wide, regardless of planned reuse.
b Chemical is a COC based on A-aquifer data and potential hydraulic communication with the B-aquifer; B-aquifer data are not available for this chemical at this exposure point.
-- Not applicable or chemical is not a COC for this endpoint
C Cancer effect
COC Chemical of concern
DF Detection frequency
HI Hazard index
NC Noncancer effect
OS Open space (recreational exposure scenario)
RD Research and development (residential exposure scenario)
RME Reasonable maximum exposure
SVOC Semivolatile organic compound
VOC Volatile organic compound

TABLE A-25: SUMMARY OF UNCERTAINTIES

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Item	Effect on Human Health Risk Assessment	Potential Magnitude of Effect on Risk
Data Evaluation		
The data set and plume delineation for groundwater was based on the last 12 rounds of results for each chemical at each monitoring well. In some cases, data collected more than 5 years ago was used to evaluate risks.	May overestimate risks from exposure to groundwater for all receptors evaluated. Present-day concentrations and sizes of present-day plumes are not large as the concentrations and plume sizes evaluated in the HHRA (see Section 4.1.2.1 of the revised Parcel B TMSRA).	High Overestimate
Systematic or random errors in the chemical analysis may yield erroneous data.	May underestimate risk because data may be overly viewed as nondetected or estimated as a result of laboratory errors or assumptions in the chemical analysis. These factors could result in fewer detected results or assured results for specific samples or analyses.	Low Underestimate
Sufficient samples may not have been taken to characterize the media evaluated, especially with respect to currently available data for soil.	This item may underestimate or overestimate risk because calculated risks for an exposure area may be based on very few samples, which may or may not be representative of the area at large.	Moderate Under- or Overestimate
Subsurface soil data for VOCs were not used to evaluate subsurface vapor intrusion to indoor air.	May underestimate risk from subsurface soil vapor intrusion into indoor air since there is potential for vapor migration into indoor air from subsurface soils. However, VOCs are not found extensively throughout Parcel B soils.	Low Underestimate
Selection of Chemicals of Potential Concern		
All detected metals in soil were included as COPCs for the total risk evaluation, regardless of concentration.	For the total risk evaluation, this assumption may overestimate risks associated with Navy releases because concentrations of some metals are below HPALs. The cancer risk and noncancer hazard associated concentrations corresponding to HPALs exceeds 1E-06 and 1.0, for some metals. See Section A9.1 of Appendix A for further discussion.	High Overestimate
All detected metals in groundwater were included as COPCs, regardless of concentration.	May overestimate risks because measured concentrations of some metals are likely to be consistent with ambient levels. However, ambient levels for groundwater are not available for the B-aquifer for HPS.	Moderate Overestimate
Exposure Assessment		
Assumption that EPCs exist uniformly across the exposure area for the entire duration of exposure.	May overestimate risks because this assumption does not account for reductions to COPC concentrations that may results from biodegradation, chemical oxidation, hydrolysis, or other chemical removal processes.	Moderate Overestimate
Use of maximum detected groundwater concentrations as the EPC for exposure areas not associated with plumes.	May overestimate risks because use of maximum concentrations does not account for seasonal fluctuations or degradation processes. Present-day concentrations of COPCs in groundwater are discussed in Section 4.1.2.1 of the revised Parcel B TMSRA.	Moderate Overestimate

TABLE A-25: SUMMARY OF UNCERTAINTIES (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Item	Effect on Human Health Risk Assessment	Potential Magnitude of Effect on Risk
Exposure Assessment (Continued)		
Use of data for groundwater, rather than indoor air, to evaluate risks from vapor intrusion.	May overestimate risk because actual indoor air samples were not used to calculate risk.	Moderate Overestimate
Exposure assumptions for construction worker involved with trenching activities.	Exposure assumptions for construction worker trenching activities include an exposure time of 8 hours per day and an exposure frequency of 250 days for 1 year. These assumptions may overestimate risks calculated for dermal contact with groundwater accumulated in a trench because it is unlikely that all construction activities over the duration of a year will occur in a trench containing standing groundwater.	Moderate Overestimate
	The amount of exposed skin surface area assumed for evaluation of dermal exposure to groundwater by construction workers (2,730 cm^2) is less than the skin surface area used to evaluate exposure to soil (5,700 cm^2). However, this difference is not considered significant because the other assumptions (exposure time, frequency, and duration) are conservative and when compounded, are unlikely to result in an underestimate of risks.	Low Underestimate
The EPA (2004a) default PEF was used to estimate risks from inhalation of airborne particulate chemicals released from soil.	For residential receptors, this assumption may overestimate risks because the model used by EPA (2004a) to derive the default PEF is valid only for exposure areas from 0.5 to 500 acres. The size of the residential exposure areas for HPS is 0.057 acre (2,500 ft^2).	Low Overestimate
	For construction worker receptors, this assumption may underestimate risks because the default PEF does not account for particulate emissions associated with construction activities, which typically involves a higher degree of disturbance to soil than the amount of disturbance from wind erosion.	Low Overestimate
Size of exposure areas.	May underestimate or overestimate risk because exposure may not be confined to the sizes of the areas selected for evaluation (2,500 ft^2 for residential exposure; 0.5 acre for industrial, recreational, and construction worker exposures). EPCs for COPCs in adjacent exposure areas may be higher or lower.	Moderate Under- or Overestimate
Size of plumes through delineation.	May overestimate risk because the plume delineation is based on the groundwater data set for the HHRA, which consists of the last 12 rounds of sampling at each well and for each chemical through monitoring quarter 20 (October to December 2004). The delineated plumes in Attachment A4 do not represent current-day plume sizes at Parcel B; the plume sizes based on current data are substantially smaller than were established for use in the HHRA (see Section 4.1 and Figure 4-2 of the Parcel B TMSRA).	Moderate Overestimate
The standard assumptions regarding body weight, period exposed, life expectancy, population characteristics, and lifestyle may not be representative of any actual exposure situation.	May overestimate risk associated with exposure to contaminants at the site because other environmental conditions may affect potential receptors, and health-related concerns may not necessarily be attributed to residual contaminants at the site.	Moderate Overestimate

TABLE A-25: SUMMARY OF UNCERTAINTIES (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Item	Effect on Human Health Risk Assessment	Potential Magnitude of Effect on Risk
Exposure Assessment (Continued)		
The amount of media intake is assumed to be constant and representative of the exposed population.	May overestimate risk to potential receptors because individual intake could be less or more than the amount assumed in the risk evaluation. Furthermore, it is assumed that a receptor may intake the same amount of media over the entire exposure duration, which is unlikely to happen in actuality.	Moderate Under- or Overestimate
Assumption of daily, long-term exposure for residential, industrial, and recreational receptors.	Thirty years of exposure is assumed for residential receptors, 25 years for industrial receptors, and 30 years for recreational receptors. These durations may overestimate exposure to these receptors because average intake or exposure could be less than is assumed in the risk evaluation. The assumption that residents will reside in the same dwelling for most of their lifetime is a very conservative estimate. Likewise, the assumption that industrial workers will be employed at the same location for 25 years and that recreational users will visit the same exposure location for 30 years is a very conservative estimate.	Moderate to High Overestimate
Toxicity Assessment		
Use of Cal/EPA SFs to estimate risks from exposure to TCE, rather than the draft EPA oral SFs.	May underestimate risks from exposure to TCE if the draft EPA SFs for TCE are finalized without change. See Section A9.2 and Attachment A7 of Appendix A for further discussion.	High Underestimate
The statistical methods used to extrapolate from high to low doses using experimental animal data.	Animal studies administer high doses of a test chemical to laboratory animals, and the reported response is extrapolated to the much lower doses that are likely for human exposure. Very little experimental data are available on the nature of the dose-response relationship at low doses. Because of this uncertainty, EPA has selected a conservative model to estimate the low-dose relationship, and EPA uses an upper-bound estimate (typically a 95 percent upper confidence limit of the slope predicted by the extrapolation model) as the SF. An upper-bound estimate of potential cancer risks is obtained with this SF.	Moderate to High Overestimate
Route-to-route extrapolations and surrogate chemicals were used to calculate risks when toxicity values were unavailable for a given COPC or route of exposure.	Extrapolations introduce some uncertainty into the risk and hazard estimates. Furthermore, the use of oral toxicity values to assess the dermal pathway introduces additional uncertainty into the results; risks may be overestimated or underestimated using this approach. Surrogate chemicals also tend to introduce some uncertainty because of the underlying assumption that the target chemical affects the same target organ or exerts the same method of carcinogenesis at the same effective dose as the surrogate chemical.	Moderate Under- or Overestimate
Risk Characterization		
Assumption that the exposure area for risks calculated for groundwater vapor intrusion is consistent with the boundaries delineated for groundwater plumes in the A-aquifer.	May underestimate risks from vapor intrusion because preferential pathways near areas of VOC contamination in groundwater may result in later migration of VOCs. See Section A9.3 of Appendix A for further discussion.	Moderate Underestimate

TABLE A-25: SUMMARY OF UNCERTAINTIES (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Item	Effect on Human Health Risk Assessment	Potential Magnitude of Effect on Risk
Risk Characterization (Continued)		
Use of EPA Region IX tap water PRGs for calculation of risks from residential exposure to groundwater does not account for dermal exposure.	May underestimate risks from residential exposure B-aquifer groundwater because dermal contact with groundwater is a potentially complete exposure pathway for residential receptors. See Section A9.4 of Appendix A for further discussion.	Low Underestimate
Use of non-site-specific groundwater vapor intrusion risk-based screening criteria to calculate risks from vapor intrusion and assumptions of steady state, one-dimensional vapor transport inherent in screening criteria.	May overestimate risk because the model assumes chemical concentrations are at steady state. Overall available mass may decrease over time through degradation and transformation processes.	High Overestimate
	The use of vapor intrusion screening criteria is based on default attenuation factors, which may overestimate risk as because vapor attenuation factors are conservative to ensure protection of potential exposure.	Moderate Overestimate
Use of non-site-specific groundwater vapor intrusion risk-based screening criteria to calculate risks from vapor intrusion and assumptions of steady state, one-dimensional vapor transport inherent in screening criteria.	Generic screening criteria may overestimate risks because site-specific information, such as depth to groundwater and lack of a basement exposure area, are not considered. See Section A9.5 of Appendix A for further discussion.	Moderate Overestimate
Assumption that risks from carcinogens with different target organs are additive.	This assumption contributes to the uncertainty in the risk assessment and may result in underestimated or overestimated risks, depending on whether the interactions among the COPCs are synergistic or antagonistic.	Moderate Under- or Overestimate
Magnification of uncertainty in risk estimates through the multiplicative combination of many upper-bound, conservative assumptions for EPCs, chemical intake, and toxicity criteria.	May overestimate risks because upper-bound, conservative assumptions are compounded in the HHRA.	High Overestimate

Notes:

Cal/EPA	California Environmental Protection Agency	HPS	Hunters Point Shipyard
cm^2	Square centimeters	PEF	Particulate emission factor
COPC	Chemical of potential concern	PRG	Preliminary remediation goal
EPA	U.S. Environmental Protection Agency	SF	Slope factor
EPC	Exposure point concentration	TCE	Trichloroethene
ft^2	Square feet	TMSRA	Technical Memorandum in Support of a Record of Decision
HHRA	Human health risk assessment		
HPAL	Hunters Point ambient level	VOC	Volatile organic compound

Source:

EPA. 2004a. "EPA Region 9 Preliminary Remediation Goals (PRG) 2004." Region IX PRGs Table 2002 Update, including Memorandum. From Stanford Smucker, EPA Region 9 Regional Toxicologist. To PRG Table Users. October 1. Available on-line at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

TABLE A-26: CANCER RISKS AND NONCANCER HAZARDS ASSOCIATED WITH METALS AT CONCENTRATIONS EQUAL TO HPALS

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

		Residential User		Industrial Worker		Recreational User	
Analyte	HPAL[a]	CR	HI	CR	HI	CR	HI
Antimony	9.05	--	8.9E-01	--	1.1E-02	--	3.3E-02
Arsenic	11.1	2.9E-04	7.1E-01	2.6E-05	2.5E-02	3.0E-05	8.2E-02
Barium	314.36	--	4.2E-02	--	1.1E-03	--	2.4E-03
Beryllium	0.71	6.7E-10	5.1E-03	3.2E-10	1.9E-04	5.0E-11	5.2E-04
Cadmium	3.14	5.3E-09	9.1E-01	2.5E-09	3.2E-03	4.0E-10	9.4E-03
Copper	124.31	--	7.8E-01	--	1.6E-03	--	4.9E-03
Iron	58,000	--	2.6E+00	--	9.5E-02	--	2.8E-01
Lead	8.99	--	--	--	--	--	--
Manganese	1,431.18	--	1.7E+00	--	4.4E-02	--	9.1E-02
Mercury	2.28	--	1.4E+00	--	3.7E-03	--	1.1E-02
Molybdenum	2.68	--	3.5E-02	--	2.6E-04	--	7.8E-04
Selenium	1.95	--	1.4E-02	--	1.9E-04	--	5.7E-04
Silver	1.43	--	2.9E-02	--	1.4E-04	--	4.2E-04
Thallium	0.81	--	1.6E-01	--	6.0E-03	--	1.8E-02
Vanadium	117.17	--	1.8E+00	--	5.7E-02	--	1.7E-01
Zinc	109.86	--	2.9E-01	--	1.8E-04	--	5.4E-04
	TOTAL	**3E-04**	**11**	**3E-05**	**0.2**	**3E-05**	**0.7**

Notes:

a HPALs for chromium, cobalt, and nickel were calculated on a grid-specific basis for each residential grid and each industrial grid with analytical data for these metals using a regression approach. The regression approach for these metals is detailed in Tetra Tech EM Inc. (1999).

-- Not applicable
CR Cancer risk
HI Hazard index
HPAL Hunters Point ambient level

Source:

Tetra Tech EM Inc. 1999. Draft Final Technical Memorandum, Nickel Screening and Implementation Plan, Hunters Point Shipyard, San Francisco, California. August 4.

TABLE A-27: EVALUATION OF POTENTIAL RISKS FROM RESIDENTIAL DOMESTIC USE OF THE A-AQUIFER, IR-10A PLUME, ASSUMING HYDRAULIC COMMUNICATION WITH B-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Exposure Area	Analyte	EPC		MAX Scenario		RME Scenario	
		MAX (µg/L)	RME [a] (µg/L)	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
IR-10A Plume	1,1-DICHLOROETHANE	4.00E-01	4.00E-01	2.03E-07	4.93E-04	2.03E-07	4.93E-04
	1,1-DICHLOROETHENE	9.40E-01	9.40E-01	--	2.77E-03	--	2.77E-03
	1,2-DICHLOROETHANE	1.80E-01	1.80E-01	1.46E-06	1.79E-02	1.46E-06	1.79E-02
	1,2-DICHLOROETHENE (TOTAL)	6.60E+01	2.33E+01	--	1.08E+00	--	3.83E-01
	ALUMINUM	3.41E+03	3.41E+03	--	9.34E-02	--	9.34E-02
	ANTIMONY	4.66E+01	3.85E+01	--	3.19E+00	--	2.64E+00
	ARSENIC	3.00E+00	2.79E+00	4.24E-04	2.74E-01	3.94E-04	2.54E-01
	BARIUM	8.54E+02	2.74E+02	--	1.17E-01	--	3.76E-02
	BENZENE	3.00E-01	3.00E-01	2.71E-06	6.83E-03	2.71E-06	6.83E-03
	BERYLLIUM	1.40E+00	1.40E+00	--	1.92E-02	--	1.92E-02
	BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+02	1.20E+02	2.50E-05	1.64E-01	2.50E-05	1.64E-01
	BROMOMETHANE	3.00E-01	3.00E-01	--	3.46E-02	--	3.46E-02
	CADMIUM	3.00E+00	3.00E+00	--	1.64E-01	--	1.64E-01
	CARBON DISULFIDE	1.00E+00	1.00E+00	--	9.59E-04	--	9.59E-04
	CHLOROFORM	6.00E+00	4.31E+00	3.94E-05	7.51E-02	2.83E-05	5.39E-02
	CHROMIUM	3.54E+01	3.54E+01	--	6.47E-04	--	6.47E-04
	CIS-1,2-DICHLOROETHENE	2.00E+02	6.87E+01	--	3.29E+00	--	1.13E+00
	COBALT	1.55E+01	1.55E+01	--	2.12E-02	--	2.12E-02
	COPPER	3.95E+01	2.22E+01	--	2.71E-02	--	1.52E-02
	IRON	5.53E+03	5.53E+03	--	5.05E-01	--	5.05E-01
	LEAD	5.80E+00	5.80E+00	--	3.87E-01	--	3.87E-01
	MANGANESE	1.79E+03	8.04E+02	--	2.04E+00	--	9.18E-01
	METHYLENE CHLORIDE	4.00E-01	4.00E-01	1.90E-07	2.47E-04	1.90E-07	2.47E-04
	MOLYBDENUM	3.28E+01	3.28E+01	--	1.80E-01	--	1.80E-01
	NAPHTHALENE	4.00E-01	4.00E-01	4.30E-06	6.45E-02	4.30E-06	6.45E-02
	NICKEL	9.38E+01	5.05E+01	--	1.28E-01	--	6.92E-02
	SELENIUM	7.30E+00	7.30E+00	--	4.00E-02	--	4.00E-02
	SILVER	2.07E+01	2.07E+01	--	1.13E-01	--	1.13E-01
	TERT-BUTYL METHYL ETHER	5.00E-01	5.00E-01	4.78E-08	9.59E-05	4.78E-08	9.59E-05
	TOLUENE	4.00E-01	4.00E-01	--	5.53E-04	--	5.53E-04
	TRANS-1,2-DICHLOROETHENE	3.90E+01	1.05E+01	--	3.21E-01	--	8.61E-02
	TRICHLOROETHENE	6.10E+02	1.85E+02	4.35E-04	6.41E+01	1.32E-04	1.95E+01
	VANADIUM	7.06E+01	7.06E+01	--	1.93E+00	--	1.93E+00
	VINYL CHLORIDE	1.70E+02	1.70E+02	5.38E-03	2.37E+00	5.38E-03	2.37E+00
	ZINC	2.08E+02	1.92E+02	--	1.90E-02	--	1.76E-02
			TOTAL	**6.3E-03**	**8.1E+01**	**6.0E-03**	**3.1E+01**

Notes:

a The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then MAX is used as the RME EPC.

µg/L Microgram per liter
-- Not applicable
95 UCL 95 percent upper confidence level
EPC Exposure point concentration
MAX Maximum detected concentration
RME Reasonable maximum exposure

TABLE A-28: EVALUATION OF POTENTIAL RISKS FROM RESIDENTIAL DOMESTIC USE OF THE A-AQUIFER, IR-10B PLUME, ASSUMING HYDRAULIC COMMUNICATION WITH B-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Exposure Area	Analyte	EPC		MAX Scenario		RME Scenario	
		MAX (µg/L)	RME [a] (µg/L)	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
IR-10B Plume	ALUMINUM	2.18E+01	2.18E+01	--	5.96E-04	--	5.96E-04
	ANTIMONY	5.20E+00	5.20E+00	--	3.56E-01	--	3.56E-01
	ARSENIC	4.80E+00	4.80E+00	6.78E-04	4.38E-01	6.78E-04	4.38E-01
	BARIUM	9.53E+02	3.28E+02	--	1.31E-01	--	4.50E-02
	BERYLLIUM	1.75E-01	1.75E-01	--	2.40E-03	--	2.40E-03
	BIS(2-ETHYLHEXYL)PHTHALATE	7.83E+01	7.83E+01	1.63E-05	1.07E-01	1.63E-05	1.07E-01
	CARBON DISULFIDE	9.60E-01	9.60E-01	--	9.21E-04	--	9.21E-04
	CHROMIUM	1.14E+03	8.24E+02	--	2.08E-02	--	1.51E-02
	CHROMIUM VI	5.50E+02	3.26E+02	--	5.02E+00	--	2.97E+00
	COBALT	9.28E+00	7.14E+00	--	1.27E-02	--	9.78E-03
	COPPER	2.58E+01	2.58E+01	--	1.77E-02	--	1.77E-02
	IRON	3.26E+02	3.26E+02	--	2.98E-02	--	2.98E-02
	MANGANESE	4.54E+02	2.82E+02	--	5.18E-01	--	3.22E-01
	MERCURY	5.50E-02	5.50E-02	--	5.02E-03	--	5.02E-03
	MOLYBDENUM	6.80E+00	6.80E+00	--	3.73E-02	--	3.73E-02
	NICKEL	2.07E+01	1.73E+01	--	2.83E-02	--	2.37E-02
	SELENIUM	5.10E+00	5.10E+00	--	2.79E-02	--	2.79E-02
	SILVER	6.85E+00	6.85E+00	--	3.75E-02	--	3.75E-02
	THALLIUM	1.02E+01	1.02E+01	--	4.23E+00	--	4.23E+00
	VANADIUM	3.42E+01	1.37E+01	--	9.37E-01	--	3.75E-01
	ZINC	1.52E+02	1.52E+02	--	1.39E-02	--	1.39E-02
			TOTAL	**6.9E-04**	**1.2E+01**	**6.9E-04**	**9.1E+00**

Notes:

a The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

µg/L Microgram per liter

-- Not applicable

95 UCL 95 percent upper confidence level

EPC Exposure point concentration

MAX Maximum detected concentration

RME Reasonable maximum exposure

TABLE A-29: EVALUATION OF POTENTIAL RISKS FROM RESIDENTIAL DOMESTIC USE OF THE A-AQUIFER, IR-25 PLUME, ASSUMING HYDRAULIC COMMUNICATION WITH B-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Exposure Area	Analyte	EPC		MAX Scenario		RME Scenario	
		MAX (µg/L)	RME [a] (µg/L)	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
IR-25 Plume	1,1,1-TRICHLOROETHANE	7.20E+02	7.20E+02	--	2.27E-01	--	2.27E-01
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	1.40E+02	5.42E+01	--	2.37E-03	--	9.16E-04
	1,1-DICHLOROETHANE	5.00E+00	3.10E+00	2.54E-06	6.16E-03	1.58E-06	3.82E-03
	1,1-DICHLOROETHENE	4.20E+01	2.20E+01	--	1.24E-01	--	6.51E-02
	1,2,3-TRICHLOROBENZENE	5.60E-01	5.60E-01	3 04E-08	7.82E-02	3.04E-08	7 82E-02
	1,2,4-TRICHLOROBENZENE	2.00E+02	1.07E+02	1.08E-05	2.79E+01	5.83E-06	1.50E+01
	1,2,4-TRIMETHYLBENZENE	9.30E+01	9.06E+01	--	7.54E+00	--	7.35E+00
	1,2-DICHLOROBENZENE	6.20E+04	1.12E+04	--	1.68E+02	--	3.03E+01
	1,2-DICHLOROETHANE	1.50E+05	2.50E+04	1.22E+00	1.49E+04	2.03E-01	2.48E+03
	1,2-DICHLOROETHENE (TOTAL)	5.70E+04	8.17E+03	--	9.37E+02	--	1.34E+02
	1,2-DICHLOROPROPANE	3.50E+02	2.18E+02	2.12E-03	5.07E+01	1.32E-03	3.16E+01
	1,3,5-TRIMETHYLBENZENE	2.20E+01	2.20E+01	--	1.78E+00	--	1.78E+00
	1,3-DICHLOROBENZENE	6.30E+02	2.69E+02	--	3.45E+00	--	1.48E+00
	1,4-DICHLOROBENZENE	1.50E+04	3.70E+03	5.06E-02	2 26E+01	1.25E-02	5.59E+00
	1,6,7-TRIMETHYLNAPHTHALENE	4.00E-01	4.00E-01	--	1.64E-02	--	1.64E-02
	1-METHYLNAPHTHALENE	4.00E+00	4.00E+00	--	1.64E-01	--	1.64E-01
	1-METHYLPHENANTHRENE	5.00E-02	5.00E-02	--	2.74E-05	--	2.74E-05
	2,4-DIMETHYLPHENOL	1.60E+04	1.60E+04	--	2.19E+01	--	2.19E+01
	2,4-DINITROTOLUENE	4.90E+03	4.90E+03	5.02E-02	6.71E+01	5.02E-02	6.71E+01
	2,6-DIMETHYLNAPHTHALENE	2.00E+00	2.00E+00	--	8.22E-02	--	8.22E-02
	2-BUTANONE	2.90E+01	2.90E+01	--	4.16E-03	--	4.16E-03
	2-CHLORONAPHTHALENE	1.00E+00	1.00E+00	--	2.05E-03	--	2.05E-03
	2-METHYLNAPHTHALENE	9.20E+02	4.86E+02	--	3.78E+01	--	2.00E+01
	2-METHYLPHENOL	3.80E+03	3.80E+03	--	2.08E+00	--	2.08E+00
	4,4'-DDE	1.90E-02	1.90E-02	9.61E-08	--	9.61E-08	--
	4,4'-DDT	9.40E-03	9.40E-03	4.75E-08	5.15E-04	4.75E-08	5.15E-04
	4-METHYL-2-PENTANONE	9.00E+00	9.00E+00	--	4.52E-03	--	4.52E-03
	4-METHYLPHENOL	9.10E+03	9.10E+03	--	4.99E+01	--	4.99E+01
	ACENAPHTHENE	8.90E+01	6.80E+01	--	2.44E-01	--	1.86E-01
	ACENAPHTHYLENE	2.00E+00	2.00E+00	--	5.48E-03	--	5.48E-03
	ACETONE	2.10E+03	1.82E+03	--	3.84E-01	--	3.33E-01
	ACETOPHENONE	6.00E+00	6.00E+00	--	4.48E-03	--	4.48E-03
	ALPHA-CHLORDANE	7.90E-03	7.90E-03	1.55E-07	4.33E-04	1.55E-07	4.33E-04
	ALUMINUM	4.48E+03	3.79E+03	--	1.23E-01	--	1.04E-01
	ANTHRACENE	4.00E+00	2.50E+00	--	2.19E-03	--	1.37E-03
	ANTIMONY	4.01E+01	2.14E+01	--	2.75E+00	--	1.46E+00
	AROCLOR-1260	1.10E+01	1.10E+01	3.27E-04	1.51E+01	3.27E-04	1.51E+01
	ARSENIC	1.43E+01	5.65E+00	2.02E-03	1.31E+00	7.98E-04	5.16E-01
	BARIUM	9.24E+02	2.38E+02	--	1.27E-01	--	3.26E-02
	BENZENE	4.00E+02	9.33E+01	3.62E-03	9.11E+00	8.43E-04	2.13E+00
	BENZO(A)ANTHRACENE	3.10E+00	3.10E+00	5.61E-05	--	5.61E-05	--
	BENZO(A)PYRENE	2.10E-01	2.10E-01	3.80E-05	--	3.80E-05	--
	BENZO(B)FLUORANTHENE	5.50E-02	5.50E-02	9.82E-07	--	9.82E-07	--
	BENZOIC ACID	1.50E+01	1.50E+01	--	1.03E-04	--	1.03E-04
	BERYLLIUM	1.10E+00	6.76E-01	--	1.51E-02	--	9.26E-03
	BETA-BHC	8.40E-03	8.40E-03	2.25E-07	1.15E-03	2.25E-07	1.15E-03
	BIPHENYL	1.00E+01	1.00E+01	--	3.29E-02	--	3.29E-02
	BROMODICHLOROMETHANE	1.30E+02	1.30E+02	1.53E-03	1.07E+00	1.53E-03	1.07E+00
	BUTYLBENZYLPHTHALATE	6.00E+00	6.00E+00	--	8.22E-04	--	8.22E-04
	CADMIUM	6.40E+00	4.21E+00	--	3.51E-01	--	2.31E-01
	CARBAZOLE	4.50E+00	3.88E+00	1 34E-06	--	1.15E-06	--

TABLE A-29: EVALUATION OF POTENTIAL RISKS FROM RESIDENTIAL DOMESTIC USE OF THE A-AQUIFER, IR-25 PLUME, ASSUMING HYDRAULIC COMMUNICATION WITH B-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Exposure Area	Analyte	EPC		MAX Scenario		RME Scenario	
		MAX (µg/L)	RME [a] (µg/L)	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
IR-25 Plume	CARBON DISULFIDE	6.55E+01	5.31E+01	--	6.28E-02	--	5.10E-02
	CHLOROBENZENE	2.30E+03	1.53E+03	--	2.17E+01	--	1.44E+01
	CHLOROETHANE	8.10E+01	5.06E+01	1.75E-05	9.43E-03	1.09E-05	5.89E-03
	CHLOROFORM	3.90E+01	1.34E+01	2.56E-04	4.88E-01	8.81E-05	1.68E-01
	CHLOROMETHANE	4.00E-01	4.00E-01	--	2.53E-03	--	2.53E-03
	CHROMIUM	9.85E+01	9.85E+01	--	1.80E-03	--	1.80E-03
	CHROMIUM VI	1.15E+02	1.15E+02	--	1.05E+00	--	1.05E+00
	CHRYSENE	2.00E+02	2.00E+02	9.49E-04	--	9.49E-04	--
	CIS-1,2-DICHLOROETHENE	5.80E+04	1.48E+04	--	9.53E+02	--	2.44E+02
	COBALT	8.88E+01	1.87E+01	--	1.22E-01	--	2.56E-02
	COPPER	5.82E+01	1.73E+01	--	3.99E-02	--	1.19E-02
	CYANIDE	7.60E-01	7.60E-01	--	1.04E-03	--	1.04E-03
	CYCLOHEXANE	5.10E-01	5.10E-01	--	4.93E-05	--	4.93E-05
	DELTA-BHC	9.70E-03	9.70E-03	2.60E-07	1.33E-03	2.60E-07	1.33E-03
	DIBENZOFURAN	3.20E+01	1.45E+01	--	2.63E+00	--	1.19E+00
	DIBENZOTHIOPHENE	1.00E-01	1.00E-01	--	4.11E-04	--	4.11E-04
	DICHLORODIFLUOROMETHANE	4.20E+00	4.20E+00	--	1.06E-02	--	1.06E-02
	DIELDRIN	6.00E-02	6.00E-02	1.43E-05	3.29E-02	1.43E-05	3.29E-02
	DIETHYLPHTHALATE	1.00E+01	1.00E+01	--	3.42E-04	--	3.42E-04
	ENDOSULFAN SULFATE	7.50E-02	7.50E-02	--	3.42E-04	--	3.42E-04
	ENDRIN KETONE	*1.00E-01*	*1.00E-01*	--	9.13E-03	--	9.13E-03
	ETHYLBENZENE	1.50E+01	6.42E+00	--	1.12E-02	--	4.79E-03
	FLUORANTHENE	1.70E+01	7.35E+00	--	1.16E-02	--	5.03E-03
	FLUORENE	1.30E+02	2.33E+01	--	5.34E-01	--	9.56E-02
	GAMMA-CHLORDANE	1.10E-02	1.10E-02	2.15E-07	6.03E-04	2.15E-07	6.03E-04
	HEPTACHLOR	1.30E-02	1.30E-02	8.70E-07	7.12E-04	8.70E-07	7.12E-04
	HEPTACHLOR EPOXIDE	3.00E-02	3.00E-02	4.06E-06	6.32E-02	4.06E-06	6.32E-02
	HEPTACHLOR EPOXIDE A	5.50E-02	5.50E-02	7.44E-06	1.16E-01	7.44E-06	1.16E-01
	HEXACHLOROETHANE	7.00E+00	7.00E+00	4.11E-06	1.92E-01	4.11E-06	1.92E-01
	IRON	5.50E+05	2.45E+04	--	5.02E+01	--	2.24E+00
	ISOPROPYLBENZENE	4.40E+00	1.93E+00	--	6.68E-03	--	2.94E-03
	LEAD	1.70E+01	8.68E+00	--	1.13E+00	--	5.79E-01
	M,P-XYLENES	2.80E+01	2.80E+01	--	1.36E-01	--	1.36E-01
	MANGANESE	*1.21E+04*	*3.16E+03*	--	1.38E+01	--	3.60E+00
	MERCURY	8.00E+00	3.56E+00	--	7.31E-01	--	3.25E-01
	METHYLCYCLOHEXANE	7.20E-01	7.20E-01	--	1.38E-04	--	1.38E-04
	METHYLENE CHLORIDE	2.00E+02	2.00E+02	9.49E-05	1.23E-01	9.49E-05	1.23E-01
	MOLYBDENUM	3.56E+01	1.78E+01	--	1.95E-01	--	9.78E-02
	NAPHTHALENE	3.70E+02	2.04E+02	3.98E-03	5.96E+01	2.19E-03	3.29E+01
	NICKEL	2.60E+02	5.62E+01	--	3.56E-01	--	7.69E-02
	O-XYLENE	1.60E+01	1.60E+01	--	7.78E-02	--	7.78E-02
	PARA-ISOPROPYL TOLUENE	3.40E+01	3.40E+01	--	5.17E-02	--	5.17E-02
	PENTACHLOROPHENOL	6.10E+03	6.10E+03	1.09E-02	5.57E+00	1.09E-02	5.57E+00
	PHENANTHRENE	5.90E+02	2.01E+02	--	3.23E-01	--	1.10E-01
	PHENOL	2.30E+03	2.30E+03	--	2.10E-01	--	2.10E-01
	PYRENE	9.00E+00	4.68E+00	--	4.93E-02	--	2.56E-02
	SELENIUM	*6.42E+01*	*3.19E+01*	--	3.52E-01	--	1.75E-01
	SILVER	1.26E+01	1.26E+01	--	6.90E-02	--	6.90E-02
	STYRENE	7.90E+00	7.90E+00	--	4.81E-03	--	4.81E-03
	TERT-BUTYL METHYL ETHER	7.10E+00	3.66E+00	6.79E-07	1.36E-03	3.50E-07	7.02E-04
	TETRACHLOROETHENE	7.20E+04	1.39E+04	6.91E-01	1.18E+03	1.34E-01	2.29E+02

TABLE A-29: EVALUATION OF POTENTIAL RISKS FROM RESIDENTIAL DOMESTIC USE OF THE A-AQUIFER, IR-25 PLUME, ASSUMING HYDRAULIC COMMUNICATION WITH B-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Exposure Area	Analyte	EPC		MAX Scenario		RME Scenario	
		MAX (µg/L)	RME [a] (µg/L)	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
IR-25 Plume	THALLIUM	5.27E+01	1.53E+01	--	2.19E+01	--	6.36E+00
	TOLUENE	6.60E+01	3.56E+01	--	9.12E-02	--	4.92E-02
	TRANS-1,2-DICHLOROETHENE	2.40E+03	8.27E+02	--	1.97E+01	--	6.80E+00
	TRICHLOROETHENE	1.80E+04	3.57E+03	1.29E-02	1.89E+03	2.55E-03	3.75E+02
	TRICHLOROFLUOROMETHANE	5.90E+03	3.04E+03	--	4.58E+00	--	2.36E+00
	VANADIUM	5.67E+01	1.14E+01	--	1.55E+00	--	3.13E-01
	VINYL CHLORIDE	6.60E+03	1.66E+03	2.09E-01	9.19E+01	5.27E-02	2.32E+01
	XYLENE (TOTAL)	1.50E+02	1.07E+02	--	7.29E-01	--	5.21E-01
	ZINC	2.58E+03	7.36E+02	--	2.36E-01	--	6.72E-02
			TOTAL	**2.26E+00**	**2.06E+04**	**4.74E-01**	**3.84E+03**

Notes:

a The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

µg/L Microgram per liter
-- Not applicable
95 UCL 95 percent upper confidence level
EPC Exposure point concentration
MAX Maximum detected concentration
RME Reasonable maximum exposure

ATTACHMENT A1
TOTAL RISK AND HAZARD CALCULATION RESULTS FOR SOIL EXPOSURE
(PROVIDED ON COMPACT DISC ONLY)

ATTACHMENT A2
INCREMENTAL RISK AND HAZARD CALCULATION RESULTS FOR SOIL EXPOSURE (PROVIDED ON COMPACT DISC ONLY)

ATTACHMENT A3
RISK AND HAZARD CALCULATION RESULTS FOR GROUNDWATER VAPOR INTRUSION AND DOMESTIC USE

FIGURES

A3-1 Groundwater Vapor Intrusion Risks in A-Aquifer, Residential Exposure Scenario

A3-2 Groundwater Domestic Use Risks in B-Aquifer, Residential Exposure Scenario

A3-3 Groundwater Vapor Intrusion Risks in A-Aquifer, Industrial Exposure Scenario

A3-4 Trench Groundwater Risks in A-Aquifer, Construction Worker Exposure Scenario

TABLES

A3-1 Groundwater Data Statistical Summary, IR-10A Plume, A-Aquifer

A3-2 Groundwater Data Statistical Summary, IR-10B Plume, A-Aquifer

A3-3 Groundwater Data Statistical Summary, IR-25 Plume, A-Aquifer

A3-4 Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, A-Aquifer

A3-5 Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer

A3-6 Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication

A3-7 Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer

A3-8 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, IR-10A Plume, A-Aquifer

A3-9 Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, IR-10A Plume, A-Aquifer

A3-10 Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, IR-10A Plume, A-Aquifer

A3-11 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, IR-10B Plume, A-Aquifer

A3-12 Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, IR-10B Plume, A-Aquifer

A3-13 Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, IR-10B Plume, A-Aquifer

A3-14 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, IR-25 Plume, A-Aquifer

A3-15 Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, IR-25 Plume, A-Aquifer

A3-16 Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, IR-25 Plume, A-Aquifer

TABLES (Continued)

A3-17 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer

A3-18 Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer

A3-19 Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer

A3-20 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication

A3-21 Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer

SAN FRANCISCO BAY

SAN FRANCISCO BAY

IR-10A PLUME

IR-10B PLUME

IR-25 PLUME

LOCKWOOD ST.

INNES AVE.

DONAHUE ST.

GALVEZ AVE.

HUDSON AVE.

FRIEDELL ST.

JERROLD AVE.

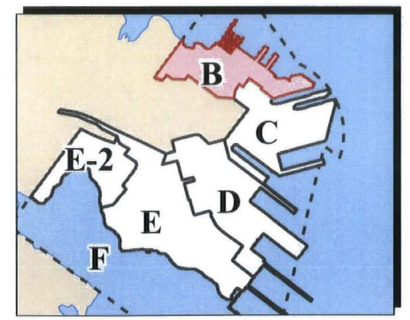
COLEMAN ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.

Parcel C



Location Map

- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Parcel Boundary
- Highest Segregated Hazard Index > 1
- Residential Cancer Risk > 1E-06
- Residential Cancer Risk ≤ 1E-06
- Road
- 128 Building
- San Francisco Bay
- Non-Navy Property

Notes:
1. Results are based on the reasonable maximum exposure scenario.
2. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with residential exposures.
3. Risks are based on nonradiological chemicals.

IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A3-1
GROUNDWATER VAPOR INTRUSION RISKS IN A-AQUIFER, RESIDENTIAL EXPOSURE SCENARIO

TMSRA for Parcel B

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SAN FRANCISCO BAY

SAN FRANCISCO BAY

Risk estimates for B-aquifer with potential hydraulic communication between the A- and B-Aquifers

IR-10A PLUME

IR-10B PLUME

IR-25 PLUME

LOCKWOOD ST.

CALVET AVE.

INNES AVE.

DONAHUE ST.

HUDSON AVE.

FRIEDELL ST.

JERROLD AVE.

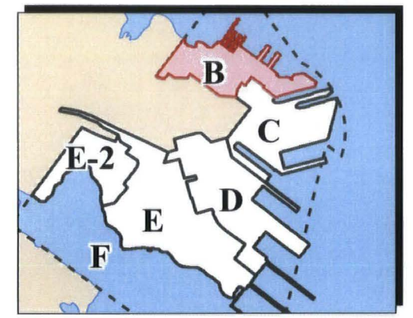
COLEMAN ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.

Parcel C



Location Map

- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Highest Segregated Hazard Index > 1
- Residential Cancer Risk > 1E-06
- Residential Cancer Risk ≤ 1E-06
- Parcel Boundary
- Road
- 128 Building
- San Francisco Bay
- Non-Navy Property

Notes:
1. Results are based on the reasonable maximum exposure scenario.
2. A 50-foot by 50-foot exposure area (residential grid) is used to evaluate risks associated with residential exposures.
3. Risks are based on nonradiological chemicals.

IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A3-2
GROUNDWATER DOMESTIC USE RISKS IN B-AQUIFER, RESIDENTIAL EXPOSURE SCENARIO

TMSRA for Parcel B

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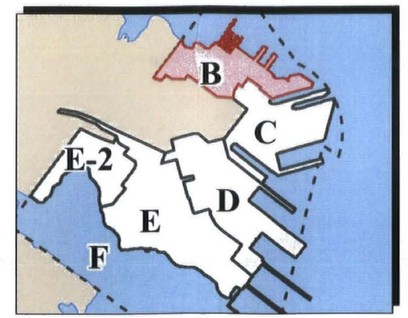
SAN FRANCISCO BAY

SAN FRANCISCO BAY



Location Map

- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- Parcel Boundary
- No Data
- Highest Segregated Hazard Index > 1
- Vapor Intrusion Cancer Risk > 1E-06
- Vapor Intrusion Cancer Risk ≤ 1E-06
- Road
- 128 Building
- San Francisco Bay
- Non-Navy Property

Notes:
1. Results are based on the reasonable maximum exposure scenario.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with industrial exposures.
3. Risks are based on nonradiological chemicals.

IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A3-3
GROUNDWATER VAPOR INTRUSION RISKS IN A-AQUIFER, INDUSTRIAL EXPOSURE SCENARIO

TMSRA for Parcel B

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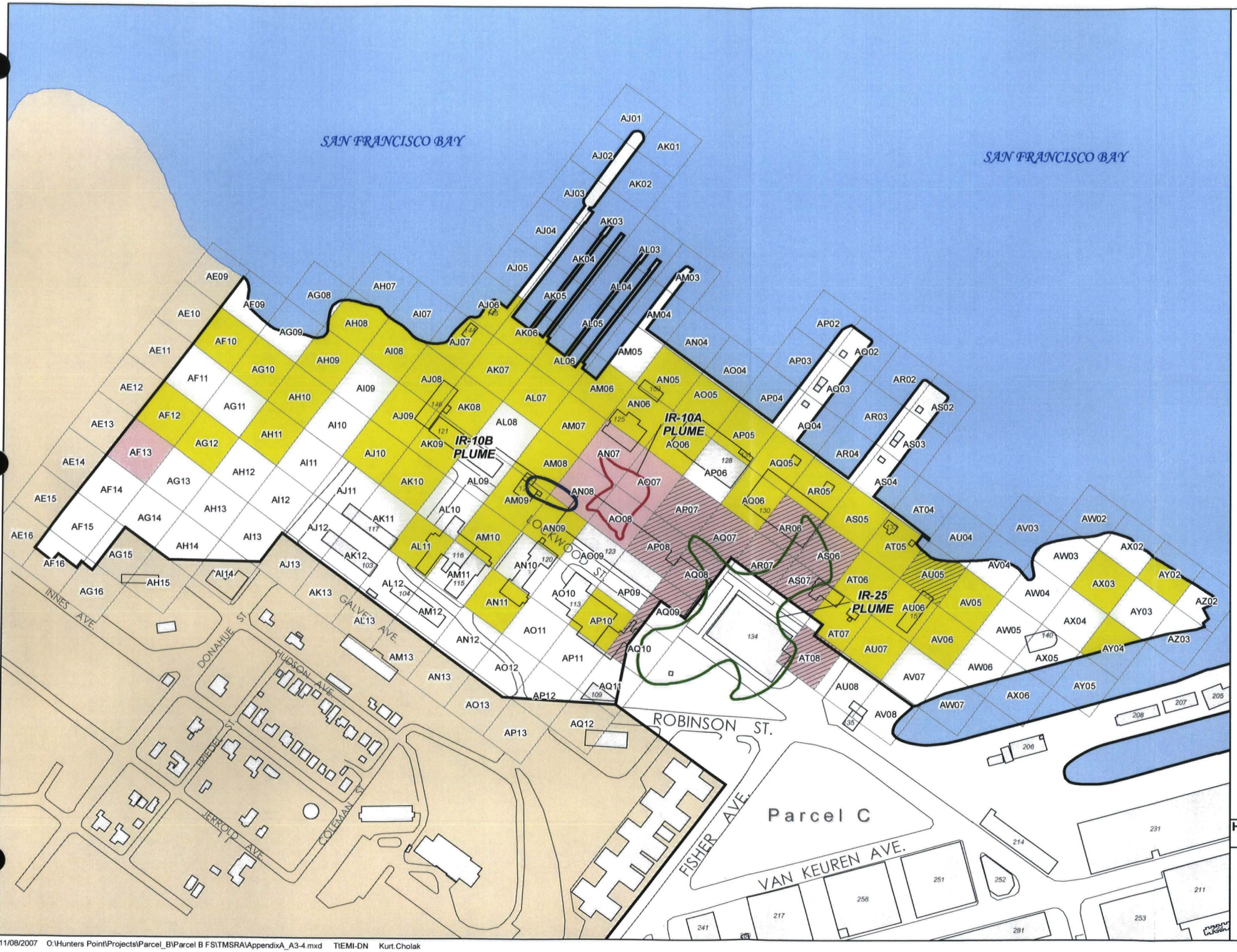

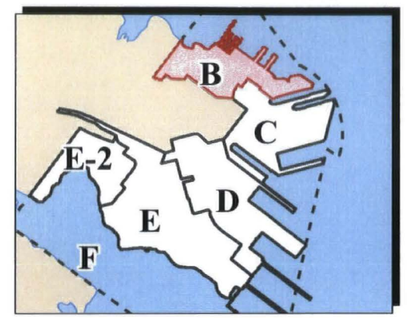

Location Map

- IR-10A Plume
- IR-10B Plume
- IR-25 Plume
- No Data
- Highest Segregated Hazard Index > 1
- Construction Worker Cancer Risk > 1E-06
- Construction Worker Cancer Risk ≤ 1E-06
- Parcel Boundary
- Road
- 128 Building
- San Francisco Bay
- Non-Navy Property

Notes:
1. Results are based on the reasonable maximum exposure scenario.
2. A 150-foot by 150-foot exposure area (industrial grid) is used to evaluate risks associated with industrial exposures.
3. Risks are based on nonradiological chemicals.

IR Installation Restoration

N

0 300 600

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A3-4
TRENCH GROUNDWATER RISKS IN A-AQUIFER, CONSTRUCTION WORKER EXPOSURE SCENARIO

TMSRA for Parcel B

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TABLE A3-1: GROUNDWATER DATA STATISTICAL SUMMARY, IR-10A PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8,9	IR-10A Plume	1,1-DICHLOROETHANE	V	µg/L	2.60E-01	J	4.00E-01	J	IR10MW59A	3 / 57	0.5 - 10	NA	NT	(1)
		1,1-DICHLOROETHENE	V	µg/L	3.00E-01	J	9.40E-01		IR10MW71A	4 / 57	0.5 - 10	NA	NT	(1)
		1,2-DICHLOROETHANE	V	µg/L	1.80E-01	J	1.80E-01	J	IR10MW75A	1 / 61	0.5 - 10	NA	NT	(1)
		1,2-DICHLOROETHENE (TOTAL)	V	µg/L	4.00E-01	J	6.60E+01		IR10MW13A1	14 / 19	5 - 10	2.33E+01	G	(2)
		ALUMINUM		µg/L	1.77E+01	J	3.41E+03		IR10MW28A	4 / 22	5 - 59	NA	NT	(1)
		ANTIMONY		µg/L	5.30E+00		4.66E+01		IR10MW13A2	6 / 22	2 - 27.6	3.85E+01	G	(2)
		ARSENIC		µg/L	1.20E+00		3.00E+00	J	IR10MW28A	7 / 22	1.2 - 5.1	2.79E+00	N	(3)
		BARIUM		µg/L	6.05E+01		8.54E+02		IR10MW28A	22 / 22	--	2.74E+02	G	(2)
		BENZENE	V	µg/L	3.00E-01	J	3.00E-01	J	IR10MW59A	1 / 56	0.5 - 10	NA	NT	(1)
		BERYLLIUM		µg/L	2.70E-01		1.40E+00		IR10MW28A	4 / 24	0.081 - 2	NA	NT	(1)
		BIS(2-ETHYLHEXYL)PHTHALATE		µg/L	1.20E+02		1.20E+02		IR10MW13A1	1 / 25	2 - 72	NA	NT	(1)
		BROMOMETHANE	V	µg/L	3.00E-01	J	3.00E-01	J	IR10MW28A	1 / 57	0.5 - 10	NA	NT	(1)
		CADMIUM		µg/L	3.00E+00		3.00E+00		IR10MW32A	1 / 22	0.1 - 4	NA	NT	(1)
		CARBON DISULFIDE	V	µg/L	6.10E-01		1.00E+00		IR10MW28A	2 / 41	0.5 - 10	NA	NT	(1)
		CHLOROFORM	V	µg/L	2.00E-01	J	6.00E+00		IR10MW33A	12 / 61	0.5 - 10	4.31E+00	L	(4)
		CHROMIUM		µg/L	1.20E+00		3.54E+01		IR10MW28A	5 / 34	0.7 - 10	NA	NT	(1)
		CIS-1,2-DICHLOROETHENE	V	µg/L	2.50E-01	J	2.00E+02		IR10MW71A	48 / 54	0.5 - 5	6.87E+01	NP	(5)
		COBALT		µg/L	3.30E+00	J	1.55E+01		IR10MW28A	5 / 22	0.61 - 10.4	NA	NT	(1)
		COPPER		µg/L	1.70E+00	J	3.95E+01		IR10MW13A1	8 / 22	1.6 - 3.6	2.22E+01	N	(3)
		IRON		µg/L	2.65E+01		5.53E+03		IR10MW28A	4 / 22	4.8 - 182	NA	NT	(1)
		LEAD		µg/L	1.20E+00		5.80E+00	J	IR10MW28A	2 / 22	0.9 - 7	NA	NT	(1)
		MANGANESE		µg/L	2.21E+01		1.79E+03		IR10MW13A2	22 / 22	--	8.04E+02	G	(2)
		METHYLENE CHLORIDE	V	µg/L	3.00E-01		4.00E-01		IR10MW33A	3 / 57	0.3 - 10	NA	NT	(1)
		MOLYBDENUM		µg/L	4.00E+00		3.28E+01		IR10MW28A	4 / 20	2.3 - 15	NA	NT	(1)
		NAPHTHALENE	V	µg/L	4.00E-01	J	4.00E-01	J	IR10MW13A2	1 / 25	10 - 20	NA	NT	(1)
		NICKEL		µg/L	7.30E+00	J	9.38E+01		IR10MW28A	11 / 22	4.3 - 29.5	5.05E+01	G	(2)
		SELENIUM		µg/L	4.20E+00	J	7.30E+00		IR10MW13A2	3 / 22	1.9 - 19	NA	NT	(1)
		SILVER		µg/L	1.62E+01		2.07E+01		IR10MW13A2	2 / 22	0.42 - 6.2	NA	NT	(1)
		TERT-BUTYL METHYL ETHER	V	µg/L	5.00E-01		5.00E-01		IR10MW28A	1 / 46	0.5 - 0.75	NA	NT	(1)
		TOLUENE	V	µg/L	2.00E-01	J	4.00E-01	J	IR10MW28A	2 / 56	0.49 - 10	NA	NT	(1)
		TRANS-1,2-DICHLOROETHENE	V	µg/L	3.00E-01	J	3.90E+01		IR10MW71A	15 / 54	0.3 - 5	1.05E+01	L	(4)

TABLE A3-1: GROUNDWATER DATA STATISTICAL SUMMARY, IR-10A PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8, 9	IR-10A Plume (Continued)	TRICHLOROETHENE	V	µg/L	3.50E-01	6.10E+02	IR10MW71A	51 / 61	0.5 - 10	1.85E+02	NP	(6)
		VANADIUM		µg/L	3.40E+00	7.06E+01	IR10MW13A2	13 / 22	1.1 - 4.3	7.98E+01	NP	(5)
		VINYL CHLORIDE	V	µg/L	6.00E-01	1.70E+02	IR10MW61A	8 / 61	0.5 - 17	2.32E+02	NP	(5)
		ZINC		µg/L	4.60E+00	2.08E+02	IR10MW28A	6 / 22	1 - 19.7	1.92E+02	G	(2)

Notes:

See Section A5.1.2 for a description of the statistical methods used.

a — All statistics were estimated using ProUCL software, Version 3.0 (EPA 2004b) using detected concentrations only.

µg/L — Microgram per liter
-- — Detection frequency is 100 percent
95 UCL — One-sided 95 percent upper confidence limit of the mean
G — Gamma distribution confirmed using ProUCL.
IR — Installation Restoration
J — Estimated concentration
L — Lognormal distribution confirmed using ProUCL.
N — Normal distribution confirmed using ProUCL.
NA — Not applicable (not calculated)
NP — Nonparametric distribution confirmed using ProUCL.
NT — Distribution was not tested if the detected sample size was less than six.
V — Chemical is considered volatile.

(1) The number of detected samples was less than six, which precludes the establishment of confident estimations.
(2) 95 percent (%) UCL calculated using Approximate Gamma UCL method
(3) 95% UCL calculated using Student's-t UCL method
(4) 95% UCL calculated using 95% Chebyshev (MVUE) UCL method
(5) 95% UCL calculated using 99% Chebyshev (Mean, Sd) UCL method
(6) 95% UCL calculated using 97.5% Chebyshev (MVUE) UCL method

Source:

U.S. Environmental Protection Agency (EPA). 2004b. ProUCL Version 3.0. EPA Statistical Program Package. April. Available on line: http://www.epa.gov/nerlesd1/tsc/form.htm.

TABLE A3-2: GROUNDWATER DATA STATISTICAL SUMMARY, IR-10B PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
6, 8	IR-10B Plume	ALUMINUM	µg/L	2.18E+01	2.18E+01	IR10MW12A	1 / 17	5 - 2000	NA	NT	(1)
		ANTIMONY	µg/L	5.20E+00 J	5.20E+00 J	IR61MW05A	1 / 17	2.3 - 600	NA	NT	(1)
		ARSENIC	µg/L	2.30E+00 J	4.80E+00 J	IR10MW12A	5 / 16	1.2 - 100	NA	NT	(1)
		BARIUM	µg/L	1.13E+02	9.53E+02	IR61MW05A	16 / 17	172 - 172	3.28E+02	NP	(2)
		BERYLLIUM	µg/L	1.75E-01	1.75E-01	IR10MW12A	1 / 18	0.081 - 50	NA	NT	(1)
		BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	7.83E+01	7.83E+01	IR10MW12A	1 / 11	2 - 36.5	NA	NT	(1)
		CARBON DISULFIDE V	µg/L	9.60E-01	9.60E-01	IR10MW12A	1 / 24	0.5 - 10	NA	NT	(1)
		CHROMIUM	µg/L	6.95E-01	1.14E+03	IR10MW12A	13 / 22	0.68 - 100	8.24E+02	G	(3)
		CHROMIUM VI	µg/L	1.90E+01 J	5.50E+02	IR10MW12A	11 / 24	10 - 50	3.26E+02	N	(4)
		COBALT	µg/L	3.30E+00	9.28E+00	IR10MW12A	6 / 17	0.56 - 500	7.14E+00	G	(3)
		COPPER	µg/L	3.10E+00	2.58E+01	IR10MW12A	4 / 17	1 - 3.4	NA	NT	(1)
		IRON	µg/L	8.75E+00	3.26E+02	IR61MW05A	2 / 17	9.4 - 1000	NA	NT	(1)
		MANGANESE	µg/L	1.59E+01	4.54E+02	IR61MW05A	16 / 17	5 - 5	2.82E+02	N	(4)
		MERCURY V	µg/L	5.50E-02 J	5.50E-02 J	IR61MW05A	1 / 17	0.084 - 0.41	NA	NT	(1)
		MOLYBDENUM	µg/L	9.25E-01	6.80E+00 J	IR10MW12A	3 / 15	1.1 - 15	NA	NT	(1)
		NICKEL	µg/L	5.50E+00 J	2.07E+01	IR61MW05A	10 / 17	10.6 - 400	1.73E+01	N	(4)
		SELENIUM	µg/L	3.90E+00	5.10E+00 J	IR61MW05A	3 / 17	1.9 - 350	NA	NT	(1)
		SILVER	µg/L	6.85E+00	6.85E+00	IR10MW12A	1 / 17	0.42 - 100	NA	NT	(1)
		THALLIUM	µg/L	3.20E+00 J	1.02E+01	IR61MW05A	2 / 17	1.7 - 250	NA	NT	(1)
		VANADIUM	µg/L	1.20E+00	3.42E+01	IR10MW12A	10 / 17	2.5 - 500	1.37E+01	G	(3)
		ZINC	µg/L	2.20E+00	1.52E+02	IR61MW05A	4 / 17	1 - 600	NA	NT	(1)

Notes: See Section A5.1.2 for a description of the statistical methods used.

a All statistics were estimated using ProUCL software, Version 3.0 (EPA 2004b) using detected concentrations only.

µg/L	Microgram per liter	N	Normal distribution confirmed using ProUCL.
95 UCL	One-sided 95 percent upper confidence limit of the mean	NA	Not applicable (not calculated)
G	Gamma distribution confirmed using ProUCL.	NP	Nonparametric distribution confirmed using ProUCL.
IR	Installation Restoration	NT	Distribution was not tested if the detected sample size was less than six.
J	Estimated concentration	V	Chemical is considered volatile.

(1) The number of detected samples was less than six, which precludes the establishment of confident estimations.

(2) 95 percent (%) UCL calculated using Mod-t UCL (Adjusted for skewness) method

(3) 95% UCL calculated using Approximate Gamma UCL method

(4) 95% UCL calculated using Student's-t UCL method

Source.

U.S. Environmental Protection Agency (EPA). 2004b. ProUCL Version 3.0. EPA Statistical Program Package. April. Available on line: http://www.epa.gov/nerlesd1/tsc/form.htm.

TABLE A3-3: GROUNDWATER DATA STATISTICAL SUMMARY, IR-25 PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8, 12	IR-25 Plume	1,1,1-TRICHLOROETHANE	V	µg/L	1.40E-01	J	7.20E+02	J	IR25MW15A1	5 / 309	0.5 - 10000	NA	NT	(1)
		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	V	µg/L	4.40E-01	J	1.40E+02	J	IR25MW52A	20 / 181	0.5 - 1000	5.42E+01	G	(2)
		1,1-DICHLOROETHANE	V	µg/L	1.70E-01	J	5.00E+00		IR06MW22A	9 / 309	0.5 - 10000	3.10E+00	N	(3)
		1,1-DICHLOROETHENE	V	µg/L	1.40E-01	J	4.20E+01		IR25MW15A1	16 / 309	0.5 - 10000	2.20E+01	G	(2)
		1,2,3-TRICHLOROBENZENE	V	µg/L	5.00E-01		5.60E-01		IR25MW15A2	2 / 81	0.5 - 1000	NA	NT	(1)
		1,2,4-TRICHLOROBENZENE	V	µg/L	2.90E+00		2.00E+02	J	IR25MW19A	17 / 278	0.24 - 1000	1.07E+02	L	(4)
		1,2,4-TRIMETHYLBENZENE	V	µg/L	3.40E+00		9.30E+01		IR25MW19A	7 / 37	1 - 1000	9.06E+01	L	(4)
		1,2-DICHLOROBENZENE	V	µg/L	2.70E-01	J	6.20E+04	J	IR25MW15A1	72 / 288	0.5 - 500	1.12E+04	NP	(5)
		1,2-DICHLOROETHANE	V	µg/L	3.00E-01	J	1.50E+05		IR25MW15A1	61 / 309	0.5 - 5500	2.50E+04	G	(6)
		1,2-DICHLOROETHENE (TOTAL)	V	µg/L	1.50E+00		5.70E+04		IR25MW15A1	28 / 89	0.5 - 5500	8.17E+03	NP	(5)
		1,2-DICHLOROPROPANE	V	µg/L	2.00E+00		3.50E+02	J	IR25MW19A	16 / 309	0.5 - 10000	2.18E+02	G	(2)
		1,3,5-TRIMETHYLBENZENE	V	µg/L	7.90E-01		2.20E+01		IR25MW15A1	4 / 37	1 - 1000	NA	NT	(1)
		1,3-DICHLOROBENZENE	V	µg/L	2.00E-01	J	6.30E+02		IR25MW19A	18 / 289	0.5 - 1000	2.69E+02	G	(6)
		1,4-DICHLOROBENZENE	V	µg/L	2.20E-01	J	1.50E+04		IR25MW19A	58 / 290	0.5 - 500	3.70E+03	G	(6)
		1,6,7-TRIMETHYLNAPHTHALENE	V	µg/L	4.00E-01	J	4.00E-01	J	IR06MW22A	2 / 2	--	NA	NT	(1)
		1-METHYLNAPHTHALENE	V	µg/L	1.50E-02		4.00E+00	J	IR06MW22A	2 / 2	--	NA	NT	(1)
		1-METHYLPHENANTHRENE	V	µg/L	1.00E-02		5.00E-02	J	IR06MW22A	2 / 2	--	NA	NT	(1)
		2,4-DIMETHYLPHENOL		µg/L	8.00E+00	J	1.60E+04		IR25MW15A1	9 / 118	10 - 1000	1.61E+04	G	(6)
		2,4-DINITROTOLUENE		µg/L	4.90E+03	J	4.90E+03	J	IR25MW11A	1 / 129	10 - 1000	NA	NT	(1)
		2,6-DIMETHYLNAPHTHALENE	V	µg/L	2.00E-01		2.00E+00	J	IR06MW22A	2 / 2	--	NA	NT	(1)
		2-BUTANONE	V	µg/L	7.00E-01	J	2.90E+01		IR06MW22AD	3 / 231	2 - 100000	NA	NT	(1)
		2-CHLORONAPHTHALENE	V	µg/L	1.00E+00		1.00E+00		IR25MW15A2	1 / 128	10 - 1000	NA	NT	(1)
		2-METHYLNAPHTHALENE	V	µg/L	4.50E-01		9.20E+02	J	IR25MW11A	23 / 141	0.02 - 200	4.86E+02	NP	(7)
		2-METHYLPHENOL		µg/L	4.00E+00	J	3.80E+03		IR25MW15A1	5 / 117	5 - 1000	NA	NT	(1)
		4,4'-DDE		µg/L	1.90E-02	J	1.90E-02	J	IR06MW42A	1 / 36	0.02 - 2	NA	NT	(1)
		4,4'-DDT		µg/L	9.40E-03	J	9.40E-03	J	IR06MW42A	1 / 36	0.02 - 2	NA	NT	(1)
		4-METHYL-2-PENTANONE	V	µg/L	9.00E+00	J	9.00E+00	J	IR25MW15A1	1 / 186	2 - 50000	NA	NT	(1)
		4-METHYLPHENOL		µg/L	1.50E+00		9.10E+03		IR25MW15A1	8 / 118	10 - 1000	1.38E+04	G	(6)
		ACENAPHTHENE	V	µg/L	4.00E-01		8.90E+01		IR06MW42A	42 / 145	5 - 1000	6.80E+01	NP	(7)
		ACENAPHTHYLENE	V	µg/L	6.00E-01	J	2.00E+00	J	IR06MW42A	3 / 145	2 - 1000	NA	NT	(1)
		ACETONE	V	µg/L	4.30E+00	J	2.10E+03		IR25MW903B	9 / 182	2 - 100000	1.82E+03	G	(6)
		ACETOPHENONE	V	µg/L	2.00E+00	J	6.00E+00	J	IR06MW42A	2 / 8	10 - 10	NA	NT	(1)
		ALPHA-CHLORDANE		µg/L	7.90E-03	J	7.90E-03	J	IR06MW42A	1 / 36	0.0099 - 1	NA	NT	(1)
		ALUMINUM		µg/L	1.57E+01		4.48E+03		IR25MW11A	14 / 110	2.6 - 1130	3.79E+03	NP	(7)

TABLE A3-3: GROUNDWATER DATA STATISTICAL SUMMARY, IR-25 PLUME, A-AQUIFER (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8, 12	IR-25 Plume (Continued)	ANTHRACENE	V	µg/L	7.40E-02		4.00E+00	J	IR06MW42A	18 / 145	0.2 - 1000	2.50E+00	N	(3)
		ANTIMONY		µg/L	2.10E+00		4.01E+01		IR06MW44A	16 / 109	1.9 - 600	2.14E+01	G	(2)
		AROCLOR-1260		µg/L	8.00E-01		1.10E+01	J	IR25MW15A2	5 / 58	0.2 - 25	NA	NT	(1)
		ARSENIC		µg/L	1.50E+00		1.43E+01		IR06MW22AD	75 / 152	1.2 - 13.4	5.65E+00	L	(8)
		BARIUM		µg/L	8.90E+00		9.24E+02		IR06MW41A	107 / 109	52.4 - 187.5	2.38E+02	L	(8)
		BENZENE	V	µg/L	1.20E-01	J	4.00E+02		IR25MW19A	78 / 314	0.5 - 10000	9.33E+01	L	(8)
		BENZO(A)ANTHRACENE		µg/L	3.50E-02		3.10E+00		IR25MW22A	2 / 144	0.2 - 1000	NA	NT	(1)
		BENZO(A)PYRENE		µg/L	2.10E-01		2.10E-01		IR25MW19A	1 / 144	0.2 - 1000	NA	NT	(1)
		BENZO(B)FLUORANTHENE		µg/L	5.50E-02		5.50E-02		IR25MW19A	1 / 143	0.2 - 1000	NA	NT	(1)
		BENZOIC ACID		µg/L	1.50E+01		1.50E+01		IR06MW30A	1 / 50	50 - 200	NA	NT	(1)
		BERYLLIUM		µg/L	1.25E-01		1.10E+00	J	IR06MW45A	12 / 155	0.081 - 50	6.76E-01	N	(3)
		BETA-BHC		µg/L	8.40E-03	J	8.40E-03	J	IR06MW42A	1 / 36	0.01 - 1	NA	NT	(1)
		BIPHENYL	V	µg/L	1.00E-01	J	1.00E+01	J	IR06MW42A	3 / 10	0.02 - 10	NA	NT	(1)
		BROMODICHLOROMETHANE	V	µg/L	5.60E+00		1.30E+02		IR25MW19A	3 / 309	0.5 - 10000	NA	NT	(1)
		BUTYLBENZYLPHTHALATE		µg/L	6.00E+00		6.00E+00		IR06MW30A	1 / 128	4 - 1000	NA	NT	(1)
		CADMIUM		µg/L	3.30E-01		6.40E+00		IR06MW44A	7 / 110	0.1 - 50	4.21E+00	N	(3)
		CARBAZOLE		µg/L	7.00E-01	J	4.50E+00	J	IR06MW42A	7 / 82	10 - 1000	3.88E+00	N	(3)
		CARBON DISULFIDE	V	µg/L	2.40E-01	J	6.55E+01		IR24MW04A	14 / 219	0.5 - 10000	5.31E+01	NP	(7)
		CHLOROBENZENE	V	µg/L	2.20E-01	J	2.30E+03		IR25MW15A1	38 / 306	0.5 - 10000	1.53E+03	NP	(7)
		CHLOROETHANE	V	µg/L	1.50E+01	J	8.10E+01		IR06MW30A	11 / 309	0.5 - 10000	5.06E+01	N	(3)
		CHLOROFORM	V	µg/L	2.00E-01	J	3.90E+01	J	IR25MW15A1	18 / 309	0.26 - 10000	1.34E+01	L	(4)
		CHLOROMETHANE	V	µg/L	4.00E-01	J	4.00E-01	J	IR06MW32A	1 / 309	0.5 - 10000	NA	NT	(1)
		CHROMIUM		µg/L	6.70E-01		9.85E+01		IR06MW49F	21 / 160	0.41 - 100	1.28E+02	NP	(7)
		CHROMIUM VI		µg/L	7.10E+00	J	1.15E+02		IR06MW49F	8 / 133	10 - 148	2.14E+02	NP	(7)
		CHRYSENE		µg/L	3.10E-01		2.00E+02	J	IR25MW11A	2 / 146	0.2 - 1000	NA	NT	(1)
		CIS-1,2-DICHLOROETHENE	V	µg/L	1.60E-01	J	5.80E+04		IR25MW15A1	104 / 246	0.5 - 25	1.48E+04	NP	(7)
		COBALT		µg/L	7.90E-01	J	8.88E+01		IR25MW15A2	40 / 109	0.4 - 500	1.87E+01	L	(8)
		COPPER		µg/L	1.00E+00		5.82E+01		IR06MW40A	33 / 110	0.5 - 250	1.73E+01	NP	(9)
		CYANIDE		µg/L	7.60E-01		7.60E-01		IR06MW34A	1 / 1	--	NA	NT	(1)
		CYCLOHEXANE	V	µg/L	5.10E-01	J	5.10E-01	J	IR25MW16A	1 / 77	0.5 - 100	NA	NT	(1)
		DELTA-BHC		µg/L	9.70E-03	J	9.70E-03	J	IR06MW42A	1 / 36	0.01 - 1	NA	NT	(1)
		DIBENZOFURAN	V	µg/L	1.00E+00	J	3.20E+01		IR06MW42A	30 / 129	10 - 1000	1.45E+01	NP	(9)
		DIBENZOTHIOPHENE	V	µg/L	9.00E-02		1.00E-01	J	IR06MW22A	2 / 2	--	NA	NT	(1)
		DICHLORODIFLUOROMETHANE	V	µg/L	1.70E+00		4.20E+00		IR25MW52A	4 / 211	0.5 - 1000	NA	NT	(1)

TABLE A3-3: GROUNDWATER DATA STATISTICAL SUMMARY, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8, 12	IR-25 Plume (Continued)	DIELDRIN		µg/L	6.00E-02	J	6.00E-02	J	IR25MW15A1	1 / 36	0.02 - 2	NA	NT	(1)
		DIETHYLPHTHALATE		µg/L	5.50E+00		1.00E+01	J	IR06MW42A	2 / 128	10 - 1000	NA	NT	(1)
		ENDOSULFAN SULFATE		µg/L	7.50E-02		7.50E-02		IR25MW16A	1 / 36	0.02 - 2	NA	NT	(1)
		ENDRIN KETONE		µg/L	1.00E-01		1.00E-01		IR25MW15A1	1 / 34	0.02 - 2	NA	NT	(1)
		ETHYLBENZENE	V	µg/L	2.70E-01	J	1.50E+01		IR25MW15A1	23 / 314	0.5 - 10000	6.42E+00	G	(2)
		FLUORANTHENE		µg/L	3.00E-01		1.70E+01		IR06MW42A	23 / 146	0.2 - 1000	7.35E+00	G	(2)
		FLUORENE	V	µg/L	2.00E-01		1.30E+02	J	IR25MW11A	30 / 145	1 - 1000	2.33E+01	L	(8)
		GAMMA-CHLORDANE		µg/L	1.10E-02		1.10E-02		IR25MW18A	1 / 36	0.01 - 1	NA	NT	(1)
		HEPTACHLOR		µg/L	1.30E-02	J	1.30E-02	J	IR06MW42A	1 / 36	0.0087 - 1	NA	NT	(1)
		HEPTACHLOR EPOXIDE		µg/L	3.00E-02	J	3.00E-02	J	IR25MW15A1	1 / 34	0.01 - 0.2	NA	NT	(1)
		HEPTACHLOR EPOXIDE A		µg/L	5.50E-02	J	5.50E-02	J	IR25MW15A1	1 / 2	0.0099 - 0.0099	NA	NT	(1)
		HEXACHLOROETHANE		µg/L	7.00E+00		7.00E+00		IR25MW16A	1 / 128	10 - 1000	NA	NT	(1)
		IRON		µg/L	1.14E+01		5.50E+05		IR25MW19A	79 / 135	4.6 - 2500	2.45E+04	L	(8)
		ISOPROPYLBENZENE	V	µg/L	1.10E-01	J	4.40E+00		IR25MW15A1	12 / 118	0.5 - 1000	1.93E+00	G	(2)
		LEAD		µg/L	1.25E+00		1.70E+01		IR06MW45A	12 / 107	0.7 - 100	8.68E+00	G	(2)
		M,P-XYLENES	V	µg/L	1.10E+00		2.80E+01	J	IR25MW15A1	3 / 32	0.5 - 50	NA	NT	(1)
		MANGANESE		µg/L	6.90E-01		1.21E+04		IR20MW17A	114 / 118	0.34 - 5	3.16E+03	G	(2)
		MERCURY	V	µg/L	7.00E-02		8.00E+00		IR06MW44A	13 / 130	0.019 - 0.5	3.56E+00	G	(2)
		METHYLCYCLOHEXANE	V	µg/L	7.20E-01	J	7.20E-01	J	IR25MW16A	1 / 77	0.5 - 100	3.27E+02	G	(6)
		METHYLENE CHLORIDE	V	µg/L	3.00E-01		2.00E+02	J	IR25MW15A1	10 / 309	0.37 - 5500	NA	NT	(1)
		MOLYBDENUM		µg/L	1.80E+00	J	3.56E+01		IR06MW48F	19 / 89	0.4 - 33.2	1.78E+01	G	(2)
		NAPHTHALENE	V	µg/L	5.50E-01		3.70E+02		IR25MW19A	39 / 178	1 - 1000	2.04E+02	L	(4)
		NICKEL		µg/L	2.30E+00		2.60E+02		IR25MW17A	60 / 114	1.3 - 400	5.62E+01	G	(2)
		O-XYLENE	V	µg/L	1.10E-01	J	1.60E+01	J	IR25MW15A1	5 / 32	0.5 - 50	NA	NT	(1)
		PARA-ISOPROPYL TOLUENE	V	µg/L	2.00E+00		3.40E+01		IR25MW19A	3 / 37	1 - 1000	NA	NT	(1)
		PENTACHLOROPHENOL		µg/L	3.00E+00	J	6.10E+03	J	IR25MW11A	2 / 119	24 - 2600	NA	NT	(1)
		PHENANTHRENE	V	µg/L	3.00E-01		5.90E+02	J	IR25MW11A	37 / 146	1 - 1000	2.01E+02	NP	(7)
		PHENOL		µg/L	2.30E+01	J	2.30E+03		IR25MW15A1	5 / 118	10 - 1000	NA	NT	(1)
		PYRENE	V	µg/L	3.00E-01		9.00E+00	J	IR06MW42A	21 / 145	0.2 - 1000	4.68E+00	N	(3)
		SELENIUM		µg/L	2.95E+00		6.42E+01	J	IR06MW45A	12 / 106	2 - 35	3.19E+01	NP	(9)
		SILVER		µg/L	7.30E-01	J	1.26E+01		IR10MW14A	3 / 109	0.42 - 100	NA	NT	(1)
		STYRENE	V	µg/L	7.90E+00		7.90E+00		IR25MW15A1	1 / 218	0.5 - 10000	NA	NT	(1)
		TERT-BUTYL METHYL ETHER	V	µg/L	1.90E-01	J	7.10E+00	J	IR25MW901B	11 / 204	0.5 - 10000	3.66E+00	NP	(9)
		TETRACHLOROETHENE	V	µg/L	1.80E-01	J	7.20E+04		IR25MW19A	65 / 309	0.5 - 5500	1.39E+04	G	(6)

TABLE A3-3: GROUNDWATER DATA STATISTICAL SUMMARY, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits	95 UCL (Distribution) (a)		95 UCL Rationale
8, 12	IR-25 Plume (Continued)	THALLIUM		µg/L	1.60E+00		5.27E+01		IR25MW17A	17 / 109	0.08 - 164	1.53E+01	G	(2)
		TOLUENE	V	µg/L	1.20E-01	J	6.60E+01	J	IR25MW19A	45 / 314	0.5 - 10000	3.56E+01	NP	(7)
		TRANS-1,2-DICHLOROETHENE	V	µg/L	1.40E-01	J	2.40E+03		IR25MW19A	51 / 246	0.3 - 1000	8.27E+02	NP	(7)
		TRICHLOROETHENE	V	µg/L	1.80E-01	J	1.80E+04		IR25MW19A	115 / 309	0.3 - 5500	3.57E+03	NP	(7)
		TRICHLOROFLUOROMETHANE	V	µg/L	2.50E-01	J	5.90E+03	J	IR25MW52A	17 / 211	0.5 - 1000	3.04E+03	NP	(5)
		VANADIUM		µg/L	1.10E+00		5.67E+01		IR06MW40A	56 / 109	0.38 - 500	1.14E+01	L	(8)
		VINYL CHLORIDE	V	µg/L	4.00E-01	J	6.60E+03		IR25MW15A1	97 / 309	0.5 - 10000	1.66E+03	NP	(7)
		XYLENE (TOTAL)	V	µg/L	3.40E-01		1.50E+02		IR25MW19A	27 / 289	0.5 - 10000	1.07E+02	NP	(7)
		ZINC		µg/L	3.60E+00		2.58E+03		IR20MW17A	40 / 110	1 - 600	7.36E+02	NP	(7)

Notes: See Section A5.1.2 for a description of the statistical methods used.

a All statistics were estimated using ProUCL software, Version 3.0 (EPA 2004b) using detected concentrations only.

µg/L Microgram per liter
-- Detection frequency is 100 percent
95 UCL One-sided 95 percent upper confidence limit of the mean
G Gamma distribution confirmed using ProUCL.
IR Installation Restoration
J Estimated concentration
L Lognormal distribution confirmed using ProUCL.
N Normal distribution confirmed using ProUCL.
NA Not applicable (not calculated)
NP Nonparametric distribution confirmed using ProUCL.
NT Distribution was not tested if the detected sample size was less than six.
V Chemical is considered volatile.

(1) The number of detected samples was less than six, which precludes the establishment of confident estimations.
(2) 95 percent (%) UCL calculated using Approximate Gamma UCL method
(3) 95% UCL calculated using Student's-t UCL method
(4) 95% UCL calculated using 95% Chebyshev (MVUE) UCL method
(5) 95% UCL calculated using Hall's Bootstrap UCL method
(6) 95% UCL calculated using Adjusted Gamma UCL method
(7) 95% UCL calculated using 99% Chebyshev (Mean, Sd) UCL method
(8) 95% UCL calculated using H-UCL method
(9) 95% UCL calculated using 95% Chebyshev (Mean, Sd) UCL method

Source:

U.S. Environmental Protection Agency (EPA). 2004b. ProUCL Version 3.0. EPA Statistical Program Package. April. Available on line: http://www.epa.gov/nerlesd1/tsc/form.htm.

Table A3-4: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, A-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
3	B0931	1,1-DICHLOROETHANE	V	µg/L	3.60E-01 J	3.60E-01 J	IR07MW27A	1 / 11	0.5 - 10
		MERCURY	V	µg/L	2.30E-01	2.30E-01	IR07MW27A	1 / 11	0.019 - 0.2
		TRICHLOROETHENE	V	µg/L	2.00E-01 J	2.00E-01 J	IR07MW27A	1 / 11	0.5 - 10
5	B1527	2-METHYLNAPHTHALENE	V	µg/L	2.70E+00	2.70E+00	UT03MW11A	1 / 3	10 - 10
		ACENAPHTHENE	V	µg/L	2.65E+00	2.65E+00	UT03MW11A	1 / 3	10 - 10
		CARBON DISULFIDE	V	µg/L	2.00E-01 J	2.00E-01 J	UT03MW11A	1 / 12	0.5 - 10
		MERCURY	V	µg/L	5.60E-02 J	2.50E-01	UT03MW11A	2 / 14	0.1 - 0.2
5	B1528	TETRACHLOROETHENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MWS-1	1 / 3	5 - 5
5	B2031	2-METHYLNAPHTHALENE	V	µg/L	3.00E+00	1.10E+01	UT02MW15A	2 / 4	10 - 10
		FLUORENE	V	µg/L	3.00E+00	6.00E+00	UT02MW15A	2 / 4	10 - 10
		MERCURY	V	µg/L	9.75E-02	9.75E-02	UT02MW15A	1 / 3	0.1 - 0.1
5	B2531	MERCURY	V	µg/L	1.50E-01 J	1.50E-01 J	IR62MW08A	1 / 3	0.1 - 0.1
6	B2420	BROMOMETHANE	V	µg/L	2.75E-01	2.75E-01	PA50MW01A	1 / 12	0.5 - 2
		CIS-1,2-DICHLOROETHENE	V	µg/L	1.60E-01 J	2.50E-01 J	PA50MW01A	4 / 12	0.5 - 0.5
		MERCURY	V	µg/L	7.50E-02 J	7.50E-02 J	PA50MW01A	1 / 11	0.1 - 0.2
		TOLUENE	V	µg/L	3.00E-01 J	3.00E-01 J	PA50MW01A	1 / 12	0.5 - 2
9	B2818	1,2-DICHLOROETHANE	V	µg/L	3.60E-01 J	3.60E-01 J	IR10MW31A1	1 / 12	0.5 - 0.5
		CARBON DISULFIDE	V	µg/L	2.90E-01 J	2.90E-01 J	IR10MW31A1	1 / 12	0.5 - 2
		MERCURY	V	µg/L	4.40E-02 J	3.70E-01	IR10MW31A1	3 / 9	0.053 - 0.2
		TRICHLOROETHENE	V	µg/L	2.25E-01	2.25E-01	IR10MW31A1	1 / 12	0.5 - 2
9	B3021	CIS-1,2-DICHLOROETHENE	V	µg/L	1.90E-01 J	1.90E-01 J	IR10MW79A	1 / 5	0.5 - 5
		TOLUENE	V	µg/L	2.70E-01 J	2.70E-01 J	IR10MW79A	1 / 4	0.5 - 0.5
		XYLENE (TOTAL)	V	µg/L	2.00E-01 J	2.00E-01 J	IR10MW79A	1 / 4	0.5 - 0.5
9	B3418	CARBON DISULFIDE	V	µg/L	3.00E+00 J	3.00E+00 J	IR46MW38A	1 / 3	10 - 10
12	B3718	M,P-XYLENES	V	µg/L	7.00E-01 J	7.00E-01 J	IR46MW37A	1 / 3	1 - 1
		MERCURY	V	µg/L	8.30E-02 J	1.30E-01 J	IR46MW37A	4 / 13	0.059 - 0.2
		TOLUENE	V	µg/L	4.00E-01 J	4.00E-01 J	IR46MW37A	1 / 12	0.5 - 10
12	B4219	MERCURY	V	µg/L	1.65E-01	2.00E+00	IR20MW01A	2 / 3	0.2 - 0.2
12	B4419	MERCURY	V	µg/L	3.20E-01	3.20E-01	IR20MW11A	1 / 3	0.06 - 0.1

Table A3-4: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits
12	B4516	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	V	µg/L	1.00E+01		6.60E+01		IR26MW41A	11 / 12	10 - 10
		1,2-DICHLOROBENZENE	V	µg/L	1.00E+00	J	1.00E+00	J	IR26MW41A	1 / 12	0.5 - 10
		CARBON DISULFIDE	V	µg/L	1.70E+00		1.80E+00		IR26MW41A	2 / 12	0.5 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	2.00E-01	J	2.90E-01	J	IR26MW41A	4 / 12	0.5 - 10
		DICHLORODIFLUOROMETHANE	V	µg/L	1.00E+01		5.90E+01		IR26MW41A	9 / 12	0.5 - 10
		MERCURY	V	µg/L	2.90E-02	J	2.90E-02	J	IR26MW41A	1 / 12	0.1 - 0.2
		TRICHLOROFLUOROMETHANE	V	µg/L	9.80E-01		1.40E+01		IR26MW41A	11 / 12	10 - 10
15	B4819	CARBON DISULFIDE	V	µg/L	4.00E-01		4.00E-01		IR26MW44A	1 / 3	0.5 - 0.5
		MERCURY	V	µg/L	1.30E-01	J	1.30E-01	J	IR26MW44A	1 / 4	0.1 - 0.11
15	B5117	CARBON DISULFIDE	V	µg/L	7.00E+00	J	7.00E+00	J	PA50MW02A	1 / 3	10 - 10
		MERCURY	V	µg/L	1.80E-01		9.10E-01		PA50MW02A	3 / 4	0.1 - 0.1
16	B5708	ACENAPHTHENE	V	µg/L	8.00E-01		3.50E+00		IR26MW46A	2 / 2	--
		FLUORENE	V	µg/L	3.00E+00		3.00E+00		IR26MW46A	1 / 2	10 - 10
		MERCURY	V	µg/L	2.10E-01		2.10E-01		IR26MW46A	1 / 10	0.019 - 0.2
		PHENANTHRENE	V	µg/L	6.00E-01		3.00E+00		IR26MW46A	2 / 2	--
		PYRENE	V	µg/L	2.95E+00		2.95E+00		IR26MW46A	1 / 2	10 - 10
16	B5810	CHLOROFORM	V	µg/L	3.00E+00	J	4.00E+00	J	IR26MW45A	3 / 6	10 - 10
		MERCURY	V	µg/L	2.50E-01		2.50E-01		IR26MW45A	1 / 6	0.1 - 0.1
16	B5910	MERCURY	V	µg/L	1.70E-01	J	1.70E-01	J	IR26MW48A	1 / 11	0.022 - 0.2
BOS-1	B0128	XYLENE (TOTAL)	V	µg/L	1.00E+00	J	1.00E+00	J	IR07MW25AD	1 / 5	10 - 10
BOS-1	B0139	1,4-DICHLOROBENZENE	V	µg/L	2.70E-01	J	4.10E-01	J	IR18MW21A	3 / 14	0.5 - 10
		ACETONE	V	µg/L	3.00E+00	J	3.00E+00	J	IR18MW21A	1 / 14	5 - 10
		ACETOPHENONE	V	µg/L	2.00E+00	J	3.00E+00		IR18MW21A	2 / 8	10 - 10
		BENZENE	V	µg/L	1.00E+00	J	1.00E+00	J	IR18MW21A	1 / 14	0.5 - 10
		CARBON DISULFIDE	V	µg/L	9.00E+00	J	9.00E+00	J	IR18MW21AD	2 / 14	0.5 - 10
		CHLOROBENZENE	V	µg/L	5.00E-01	J	4.00E+00	J	IR18MW21AD	11 / 14	10 - 10
		CHLOROETHANE	V	µg/L	1.30E+01		1.30E+01		IR18MW21A	1 / 14	0.5 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	3.00E-01	J	3.40E-01	J	IR18MW21A	3 / 11	0.5 - 10
		MERCURY	V	µg/L	2.75E-02		2.75E-02		IR18MW21AD	1 / 14	0.047 - 0.2
		TERT-BUTYL METHYL ETHER	V	µg/L	3.50E-01	J	8.30E-01	J	IR18MW21A	2 / 11	0.5 - 10
		TOLUENE	V	µg/L	2.00E+00	J	2.00E+00	J	IR18MW21A	1 / 14	0.5 - 10
		TRICHLOROETHENE	V	µg/L	2.00E+00	J	2.00E+00	J	IR18MW21A	1 / 14	0.5 - 10
BOS-1	B0228	ETHYLBENZENE	V	µg/L	3.80E-01	J	3.80E-01	J	IR07MW25A	1 / 4	0.5 - 0.5

Table A3-4: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	B0328	1,2-DICHLOROETHANE	V	µg/L	1.40E-01 J	1.40E-01 J	IR07MW21A1	1 / 10	0.5 - 10
		TOLUENE	V	µg/L	7.40E-01	9.00E-01 J	IR07MW24AD	2 / 10	0.5 - 10
BOS-1	B0335	1,2-DICHLOROETHENE (TOTAL)	V	µg/L	3.00E-01 J	3.00E-01 J	IR07MW23A	1 / 9	5 - 10
		CHLOROBENZENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MW23A	1 / 12	0.5 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	5.20E-01	1.00E+01 J	IR07MW23A	5 / 8	10 - 10
		TERT-BUTYL METHYL ETHER	V	µg/L	2.40E-01 J	2.40E-01 J	IR07MW23A	1 / 10	0.5 - 10
		TRICHLOROETHENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MW23A	1 / 12	0.5 - 10
BOS-1	B0528	1,1,2,2-TETRACHLOROETHANE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MW21A1D	1 / 10	1 - 10
		2-HEXANONE	V	µg/L	4.00E+00 J	4.00E+00 J	IR07MW21A1D	1 / 10	5 - 10
		VINYL ACETATE	V	µg/L	2.00E+00 J	2.00E+00 J	IR07MW21A1D	1 / 6	10 - 10
BOS-1	B0529	CIS-1,2-DICHLOROETHENE	V	µg/L	1.60E-01 J	2.10E-01 J	IR07MW24A	2 / 4	0.5 - 0.5
		TERT-BUTYL METHYL ETHER	V	µg/L	2.00E-01 J	2.00E-01 J	IR07MW24A	1 / 4	0.5 - 0.5
BOS-1	B0827	1,2,4-TRICHLOROBENZENE	V	µg/L	2.00E+00 J	2.00E+00 J	IR07MWS-4DD	1 / 5	10 - 10
		BENZENE	V	µg/L	2.25E+00	2.25E+00	IR07MWS-4D	1 / 9	5 - 10
		CHLOROBENZENE	V	µg/L	2.25E+00	2.25E+00	IR07MWS-4D	1 / 9	5 - 10
		MERCURY	V	µg/L	1.60E-01 J	1.60E-01 J	IR07MWS-4DD	1 / 9	0.1 - 0.4
		TOLUENE	V	µg/L	2.75E+00	2.75E+00	IR07MWS-4D	1 / 9	5 - 10
BOS-1	B0828	TRICHLOROETHENE	V	µg/L	2.50E-01 J	2.50E-01 J	IR07MWS-4	1 / 4	0.5 - 0.5
BOS-1	B0923	MERCURY	V	µg/L	1.10E-01 J	1.50E-01 J	IR07MW26AD	2 / 10	0.1 - 0.4
BOS-1	B1420	1,2-DICHLOROETHANE	V	µg/L	1.95E-01	1.95E-01	IR07MW20A1	1 / 14	0.5 - 10
		TETRACHLOROETHENE	V	µg/L	2.25E+00	2.25E+00	IR07MW20A2	1 / 14	0.5 - 10
		TOLUENE	V	µg/L	5.90E-01	5.90E-01	IR07MW20A1	1 / 14	0.5 - 10
		XYLENE (TOTAL)	V	µg/L	5.10E-01	5.10E-01	IR07MW20A1	1 / 14	0.5 - 10
BOS-1	B1422	CARBON DISULFIDE	V	µg/L	3.00E+00 J	3.00E+00 J	IR07MWS-2D	1 / 3	5 - 5
		MERCURY	V	µg/L	3.50E-01	3.50E-01	IR07MWS-2D	1 / 3	0.2 - 0.4
BOS-1	B1423	CARBON DISULFIDE	V	µg/L	2.00E+00 J	2.00E+00 J	IR07MWS-2	1 / 12	0.5 - 10
		MERCURY	V	µg/L	6.90E-02 J	1.40E-01	IR07MWS-2	2 / 12	0.1 - 0.21
BOS-2	B1720	CHLOROFORM	V	µg/L	5.25E-01	5.25E-01	IR07MW19A	1 / 12	0.5 - 10
		TOLUENE	V	µg/L	2.15E-01	2.15E-01	IR07MW19A	1 / 12	0.5 - 10
BOS-2	B2117	MERCURY	V	µg/L	1.00E-01 J	1.00E-01 J	IR60MW08A	1 / 4	0.1 - 0.1
BOS-2	B2517	MERCURY	V	µg/L	8.50E-02	8.50E-02	PA24MW01A	1 / 3	0.1 - 0.2
		NAPHTHALENE	V	µg/L	3.00E+00	3.00E+00	PA24MW01A	1 / 3	10 - 10

Table A3-4: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	B3314	CARBON DISULFIDE	V	µg/L	1.10E+01	1.10E+01	PA24MW02A	1 / 6	0.5 - 10
		TERT-BUTYL METHYL ETHER	V	µg/L	2.00E+00 J	4.10E+00 J	IR46MW47A	2 / 2	--
BOS-2	B3613	1,1-DICHLOROETHANE	V	µg/L	4.75E-01	6.00E-01 J	IR46MW48A	3 / 3	--
		CARBON DISULFIDE	V	µg/L	3.00E+00	3.00E+00	IR46MW48A	1 / 3	0.5 - 1
		M,P-XYLENES	V	µg/L	6.00E-01 J	6.00E-01 J	IR46MW48A	1 / 3	1 - 1
BOS-2	B3614	1,1-DICHLOROETHANE	V	µg/L	2.00E+00 J	2.00E+00 J	IR46MW40A2	1 / 3	10 - 10
BOS-2	B3714	1,1-DICHLOROETHANE	V	µg/L	2.00E+00	3.50E+00	IR46MW40A3	2 / 6	10 - 10
		CARBON DISULFIDE	V	µg/L	3.50E+00	1.45E+01	IR46MW40A	3 / 6	10 - 10
BOS-2	B3814	ETHYLBENZENE	V	µg/L	5.75E-01	5.75E-01	IR24MW07A	1 / 3	0.9 - 0.95
		M,P-XYLENES	V	µg/L	9.00E-01	9.00E-01	IR24MW07A	1 / 3	1 - 1
		TOLUENE	V	µg/L	4.50E-01	4.50E-01	IR24MW07A	1 / 3	0.5 - 0.5
BOS-2	B3914	CARBON DISULFIDE	V	µg/L	2.10E+01	2.10E+01	PA24MW03AD	1 / 4	1 - 10
		M,P-XYLENES	V	µg/L	7.00E-01 J	7.00E-01 J	IR24MW05A	1 / 3	1 - 1
		PYRENE	V	µg/L	1.00E+00 J	3.00E+00 J	PA24MW03AD1	2 / 5	10 - 400
		TOLUENE	V	µg/L	3.00E-01 J	3.00E-01 J	IR24MW05A	1 / 8	0.5 - 10
BOS-2	B4014	M,P-XYLENES	V	µg/L	9.00E-01 J	9.00E-01 J	IR24MW06A	1 / 3	1 - 1
BOS-2	B4314	CARBON DISULFIDE	V	µg/L	5.00E+00	5.00E+00	IR46MW41A	1 / 3	10 - 10
BOS-3	B4614	MERCURY	V	µg/L	5.90E-01	5.90E-01	IR26MW40A	1 / 3	0.1 - 0.1
BOS-3	B4814	MERCURY	V	µg/L	1.90E-01	1.90E-01	IR26MW42A	1 / 3	0.1 - 0.1
		TOLUENE	V	µg/L	5.00E-01 J	5.00E-01 J	IR26MW42A	1 / 3	0.5 - 0.5
BOS-3	B4915	1,2-DICHLOROETHENE (TOTAL)	V	µg/L	6.00E+00	9.00E+00 J	IR26MW43A	3 / 3	--
BOS-3	B6006	MERCURY	V	µg/L	1.80E-01 B	2.80E+00	IR26MW47A	12 / 12	--

Notes:

The maximum concentration was used as the exposure point concentration for non-plume wells. See Section A5.1.2 in Appendix A for a description of the statistical methods used.

-- Not applicable; detection frequency is 100 percent.
µg/L Micrograms per liter
B The reported value is greater than the instrument detection limit, but less than the contract required detection limits.
J Estimated concentration
RB Redevelopment block
V Chemical is considered volatile.

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
2	AG12	BARIUM	µg/L	2.40E+01	5.72E+01	IR18MW22A	3 / 3	--
		MANGANESE	µg/L	1.42E+02 J	1.98E+02	IR18MW22A	3 / 3	--
		THALLIUM	µg/L	3.07E+01 J	3.07E+01 J	IR18MW22A	1 / 1	--
		VANADIUM	µg/L	1.00E+01	1.00E+01	IR18MW22A	1 / 3	3.9 - 13.1
3	AH10	ALUMINUM	µg/L	3.27E+01 J	1.63E+02 J	IR07MWS-4	2 / 4	100 - 200
		ANTIMONY	µg/L	7.80E+00 J	3.56E+01	IR07MWS-4	2 / 4	60 - 60
		ARSENIC	µg/L	4.00E+00 J	7.60E+00 J	IR07MWS-4	2 / 4	10 - 10
		BARIUM	µg/L	8.77E+01 J	2.55E+02 J	IR07MWS-4	4 / 4	--
		BERYLLIUM	µg/L	5.20E-01 J	5.20E-01 J	IR07MWS-4	1 / 4	2 - 5
		CADMIUM	µg/L	1.10E+00 J	1.10E+00 J	IR07MWS-4	1 / 4	5 - 5
		COBALT	µg/L	5.40E+00 J	1.84E+01	IR07MWS-4	4 / 4	--
		COPPER	µg/L	2.40E+00 J	2.40E+00 J	IR07MWS-4	1 / 4	5 - 25
		IRON	µg/L	3.19E+02	1.04E+03	IR07MWS-4	3 / 3	--
		LEAD	µg/L	1.56E+01	1.56E+01	IR07MWS-4	1 / 4	5 - 10
		MANGANESE	µg/L	2.66E+03	8.34E+03	IR07MWS-4	4 / 4	--
		NICKEL	µg/L	5.80E+00 J	1.22E+01 J	IR07MWS-4	4 / 4	--
		THALLIUM	µg/L	5.30E+00 J	5.30E+00 J	IR07MWS-4	1 / 4	5 - 25
		TRICHLOROETHENE V	µg/L	2.50E-01 J	2.50E-01 J	IR07MWS-4	1 / 4	0.5 - 0.5
		VANADIUM	µg/L	1.10E+00 J	1.10E+00 J	IR07MWS-4	1 / 3	50 - 50

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
3	AH11	1,1-DICHLOROETHANE	V	µg/L	3.60E-01 J	3.60E-01 J	IR07MW27A	1 / 11	0.5 - 10
		ALUMINUM		µg/L	3.16E+01 J	3.16E+01 J	IR07MW27A	1 / 11	5.6 - 2000
		ANTIMONY		µg/L	3.50E+00 J	1.34E+01 J	IR07MW27A	2 / 11	2.3 - 600
		ARSENIC		µg/L	1.28E+01 J	5.11E+01	IR07MW27A	8 / 11	2 - 26.1
		BARIUM		µg/L	2.95E+01 J	6.34E+02	IR07MW27A	11 / 11	--
		BUTYLBENZYLPHTHALATE		µg/L	1.00E+01 J	1.00E+01 J	IR07MW27A	1 / 3	10 - 10
		CAPROLACTAM		µg/L	4.70E+00 J	4.70E+00 J	IR07MW27A	1 / 3	10 - 10
		CHROMIUM		µg/L	1.20E+00 J	1.50E+00 J	IR07MW27A	2 / 11	1 - 100
		COBALT		µg/L	9.60E-01 J	5.90E+00	IR07MW27A	4 / 11	0.46 - 500
		COPPER		µg/L	1.20E+00 J	8.60E+00 J	IR07MW27A	3 / 11	2.3 - 250
		DIETHYLPHTHALATE		µg/L	1.00E+01 J	1.00E+01 J	IR07MW27A	1 / 3	10 - 10
		IRON		µg/L	1.43E+02	3.69E+03	IR07MW27A	3 / 10	16 - 1000
		MANGANESE		µg/L	1.21E+02	6.69E+03	IR07MW27A	11 / 11	--
		MERCURY	V	µg/L	2.30E-01	2.30E-01	IR07MW27A	1 / 11	0.019 - 0.2
		MOLYBDENUM		µg/L	2.40E+00 J	3.20E+00 J	IR07MW27A	2 / 8	2 - 7
		NICKEL		µg/L	2.40E+00 J	7.04E+01	IR07MW27A	8 / 11	3.6 - 400
		TRICHLOROETHENE	V	µg/L	2.00E-01 J	2.00E-01 J	IR07MW27A	1 / 11	0.5 - 10
		VANADIUM		µg/L	4.10E+00 J	1.76E+01 J	IR07MW27A	10 / 11	3 - 3
		ZINC		µg/L	8.90E+00 J	1.16E+02	IR07MW27A	3 / 11	4.7 - 600
5	AJ10	ARSENIC		µg/L	1.50E+00 J	1.50E+00 J	IR07MWS-1	1 / 3	2 - 2.5
		BARIUM		µg/L	3.25E+02	3.95E+02	IR07MWS-1	3 / 3	--
		COBALT		µg/L	1.09E+01 J	1.96E+01	IR07MWS-1	3 / 3	--
		IRON		µg/L	2.79E+02 J	2.79E+02 J	IR07MWS-1	1 / 3	25.3 - 47.4
		LEAD		µg/L	2.10E+00 J	2.10E+00 J	IR07MWS-1	1 / 3	1.6 - 2
		MANGANESE		µg/L	2.23E+03 J	2.52E+03 J	IR07MWS-1	3 / 3	--
		NICKEL		µg/L	1.43E+02 J	3.22E+02	IR07MWS-1	3 / 3	--
		TETRACHLOROETHENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MWS-1	1 / 3	5 - 5

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
5	AK10	ARSENIC	µg/L	1.55E+00	8.60E+00	UT03MW10A	3 / 6	1.7 - 7.4
		BARIUM	µg/L	1.98E+01	6.67E+01	UT03MW10A	4 / 6	26.7 - 31.7
		CHROMIUM	µg/L	5.30E+00	5.30E+00	UT02MW17A	2 / 6	0.7 - 8.2
		COBALT	µg/L	1.60E+00	1.60E+00	UT03MW10A	1 / 6	0.6 - 1.1
		IRON	µg/L	1.03E+03	1.03E+03	UT03MW10A	1 / 6	17.6 - 85.9
		MANGANESE	µg/L	4.66E+01	1.88E+02	UT03MW10A	5 / 6	14.6 - 14.6
		MOLYBDENUM	µg/L	2.90E+01	2.90E+01	UT03MW10A	1 / 6	1.1 - 5.7
		NICKEL	µg/L	7.90E+00	7.90E+00	UT03MW10A	1 / 6	4.2 - 18.1
		SELENIUM	µg/L	2.40E+00	2.40E+00	UT03MW10A	1 / 6	1.8 - 3.5
		SILVER	µg/L	7.40E-01	7.40E-01	UT03MW10A	1 / 6	0.5 - 0.8
		VANADIUM	µg/L	2.05E+00	4.90E+00	UT03MW10A	6 / 6	--
5	AL11	2-METHYLNAPHTHALENE V	µg/L	3.00E+00	1.10E+01	UT02MW15A	2 / 7	10 - 10
		ALPHA-BHC	µg/L	4.00E-02	4.00E-02	UT02MW15A	1 / 6	0.05 - 0.05
		ALUMINUM	µg/L	3.49E+01	3.49E+01	UT02MW16A	1 / 6	35.3 - 65.1
		ARSENIC	µg/L	1.90E+00	2.50E+00	UT02MW16A	4 / 6	1.3 - 1.6
		BARIUM	µg/L	4.25E+01	1.16E+02	UT02MW15A	5 / 6	40.4 - 40.4
		BETA-BHC	µg/L	8.00E-02	8.00E-02	UT02MW15A	1 / 6	0.05 - 0.05
		COBALT	µg/L	2.10E+00	7.50E+00	UT02MW15A	6 / 6	--
		COPPER	µg/L	2.80E+00	6.85E+00	UT02MW15A	3 / 6	1.75 - 4.1
		DELTA-BHC	µg/L	2.75E-02	2.75E-02	UT02MW15A	1 / 6	0.05 - 0.05
		FLUORENE V	µg/L	3.00E+00	6.00E+00	UT02MW15A	2 / 7	10 - 10
		HEXACHLOROETHANE	µg/L	5.00E+00	5.00E+00	UT02MW15A	1 / 6	10 - 35
		IRON	µg/L	6.98E+01	5.63E+02	UT02MW15A	3 / 6	15.6 - 89.1
		MANGANESE	µg/L	1.83E+02	1.55E+03	UT02MW15A	6 / 6	--
		MERCURY V	µg/L	9.75E-02	9.75E-02	UT02MW15A	1 / 6	0.1 - 0.1
		NICKEL	µg/L	7.60E+00	3.59E+01	UT02MW15A	4 / 6	15.5 - 16.1
		SELENIUM	µg/L	2.67E+00	2.67E+00	UT02MW15A	1 / 6	2.2 - 3.5
		THALLIUM	µg/L	2.40E+00	2.40E+00	UT02MW16A	1 / 6	1 - 4
		VANADIUM	µg/L	6.50E-01	3.10E+00	UT02MW16A	4 / 6	1.1 - 1.1

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
5	AM10	BARIUM		µg/L	7.80E+02 J	8.88E+02	IR62MW07A	3 / 3	--
		CADMIUM		µg/L	3.80E+00	3.80E+00	IR62MW07A	1 / 3	0.2 - 0.2
		COBALT		µg/L	8.00E+00 J	1.20E+01	IR62MW07A	3 / 3	--
		MANGANESE		µg/L	1.71E+03 J	2.14E+03	IR62MW07A	3 / 3	--
		MOLYBDENUM		µg/L	2.80E+00	2.80E+00	IR62MW07A	1 / 3	1.8 - 3.1
		NICKEL		µg/L	5.04E+01 J	6.65E+01	IR62MW07A	3 / 3	--
		THALLIUM		µg/L	5.90E+00	9.30E+00 J	IR62MW07A	2 / 3	1.9 - 1.9
		VANADIUM		µg/L	1.30E+00	2.60E+00	IR62MW07A	3 / 3	--
6	AJ09	2-METHYLNAPHTHALENE	V	µg/L	2.70E+00	2.70E+00	UT03MW11A	1 / 3	10 - 10
		ACENAPHTHENE	V	µg/L	2.65E+00	2.65E+00	UT03MW11A	1 / 3	10 - 10
		ANTIMONY		µg/L	1.70E+00	1.70E+00	UT03MW11A	1 / 14	1.9 - 60
		ARSENIC		µg/L	1.33E+00	1.75E+00	UT03MW11A	2 / 13	1.6 - 10
		BARIUM		µg/L	6.49E+01 J	1.60E+02	UT03MW11A	12 / 14	92.3 - 200
		CARBON DISULFIDE	V	µg/L	2.00E-01 J	2.00E-01 J	UT03MW11A	1 / 12	0.5 - 10
		CHROMIUM		µg/L	4.80E+00	1.04E+01	UT03MW11A	8 / 14	2 - 10
		COBALT		µg/L	1.60E+00	2.15E+00	UT03MW11A	2 / 14	0.71 - 50
		COPPER		µg/L	1.67E+01 J	1.67E+01 J	UT03MW11A	1 / 14	1 - 7.1
		IRON		µg/L	1.80E+01 J	3.48E+02	UT03MW11A	5 / 14	16 - 100
		LEAD		µg/L	2.40E+00 J	1.36E+01 J	UT03MW11A	4 / 14	0.7 - 10
		MANGANESE		µg/L	8.44E+01	5.06E+02	UT03MW11A	13 / 14	15 - 15
		MERCURY	V	µg/L	5.60E-02 J	2.50E-01	UT03MW11A	2 / 14	0.1 - 0.2
		MOLYBDENUM		µg/L	2.10E+00 J	2.10E+00 J	UT03MW11A	1 / 13	0.9 - 3
		NICKEL		µg/L	4.30E+00 J	2.22E+01	UT03MW11A	9 / 14	10.3 - 40
		SELENIUM		µg/L	1.83E+00	7.45E+00	UT03MW11A	4 / 13	2.5 - 12.7
		THALLIUM		µg/L	1.50E+00	1.63E+01	UT03MW11A	3 / 14	2.1 - 25
		VANADIUM		µg/L	1.13E+00	3.40E+00 J	UT03MW11A	6 / 14	1 - 50
		ZINC		µg/L	2.89E+01	3.21E+01	UT03MW11A	3 / 14	1 - 79.7

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
6	AK08	ALUMINUM	µg/L	1.29E+02	1.29E+02	IR07MWP-1	1 / 3	21.6 - 25.7
		ARSENIC	µg/L	4.65E+00	4.65E+00	IR07MWP-1	1 / 3	2.5 - 6
		BARIUM	µg/L	4.00E+01	7.01E+01	IR07MWP-1	3 / 3	--
		CADMIUM	µg/L	3.25E+00	3.25E+00	IR07MWP-1	1 / 3	2.3 - 3.4
		CHROMIUM	µg/L	8.45E+00	1.26E+03	IR07MWP-1	3 / 3	--
		COBALT	µg/L	2.65E+01	1.61E+02	IR07MWP-1	3 / 3	--
		COPPER	µg/L	4.33E+00	1.63E+01	IR07MWP-1	2 / 3	4 - 4
		IRON	µg/L	2.76E+03	5.05E+04	IR07MWP-1	3 / 3	--
		MANGANESE	µg/L	7.93E+02	2.59E+03	IR07MWP-1	3 / 3	--
		MOLYBDENUM	µg/L	1.43E+01	3.21E+01	IR07MWP-1	2 / 3	5.1 - 5.1
		NICKEL	µg/L	8.91E+02	7.12E+03	IR07MWP-1	3 / 3	--
		SILVER	µg/L	3.40E+00	3.40E+00	IR07MWP-1	1 / 3	1.7 - 4.9
		VANADIUM	µg/L	1.10E+00	1.10E+00	IR07MWP-1	1 / 3	1.6 - 3.9
		ZINC	µg/L	2.49E+01	2.93E+01	IR07MWP-1	2 / 3	16.5 - 16.5
6	AK09	ALUMINUM	µg/L	2.00E+02	2.00E+02	UT03MW16A	1 / 6	18.8 - 69.1
		ANTIMONY	µg/L	6.30E+00	6.30E+00	UT03MW12A	1 / 6	1.6 - 3
		ARSENIC	µg/L	1.55E+00	2.00E+00	UT03MW12A	3 / 6	1.3 - 2.8
		BARIUM	µg/L	5.90E+01	3.50E+02	UT03MW16A	6 / 6	--
		CADMIUM	µg/L	5.70E-01	5.70E-01	UT03MW16A	1 / 6	0.1 - 0.3
		COBALT	µg/L	1.49E+00	4.00E+00	UT03MW16A	6 / 6	--
		COPPER	µg/L	2.90E+00	6.20E+00	UT03MW12A	2 / 6	1 - 1.9
		IRON	µg/L	1.49E+01	3.13E+02	UT03MW16A	4 / 6	25.55 - 40.7
		MANGANESE	µg/L	3.61E+02	8.10E+02	UT03MW12A	6 / 6	--
		NICKEL	µg/L	8.15E+00	3.33E+01	UT03MW16A	5 / 6	11.8 - 11.8
		THALLIUM	µg/L	1.95E+00	2.70E+00 J	UT03MW16A	2 / 6	1.9 - 2
		VANADIUM	µg/L	1.18E+00	1.20E+00	UT03MW16A	2 / 6	0.54 - 1.5
		ZINC	µg/L	6.80E+00	1.66E+01	UT03MW16A	2 / 6	5.6 - 22.6

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
6	AM07	ALUMINUM		µg/L	3.44E+01 J	3.44E+01 J	PA50MW01A	1 / 11	2.6 - 200
		ANTIMONY		µg/L	2.98E+01 J	2.98E+01 J	PA50MW01A	1 / 11	1.7 - 60
		ARSENIC		µg/L	4.00E+00	8.90E+00 J	PA50MW01A	5 / 10	1.9 - 10
		BARIUM		µg/L	1.20E+02	5.85E+02	PA50MW01A	10 / 11	145.5 - 145.5
		BERYLLIUM		µg/L	3.30E-01	3.30E-01	PA50MW01A	1 / 11	0.081 - 5
		BROMOMETHANE	V	µg/L	2.75E-01	2.75E-01	PA50MW01A	1 / 12	0.5 - 2
		CHROMIUM		µg/L	7.30E-01 J	7.70E+00 J	PA50MW01A	3 / 11	0.41 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	1.60E-01 J	2.50E-01 J	PA50MW01A	4 / 12	0.5 - 0.5
		COBALT		µg/L	1.30E+00 J	4.80E+00 J	PA50MW01A	4 / 11	0.5 - 50
		COPPER		µg/L	3.62E+02	3.62E+02	PA50MW01A	1 / 11	0.6 - 25
		IRON		µg/L	8.97E+01 J	1.49E+02 J	PA50MW01A	3 / 11	6.7 - 40.5
		MANGANESE		µg/L	1.05E+02	7.04E+02	PA50MW01A	11 / 11	--
		MERCURY	V	µg/L	7.50E-02 J	7.50E-02 J	PA50MW01A	1 / 11	0.1 - 0.2
		MOLYBDENUM		µg/L	2.40E+00 J	4.00E+00	PA50MW01A	4 / 11	2 - 7
		NICKEL		µg/L	4.70E+00 J	1.20E+01 J	PA50MW01A	6 / 11	6.1 - 40
		SILVER		µg/L	5.80E-01	5.80E-01	PA50MW01A	1 / 11	0.42 - 10
		THALLIUM		µg/L	3.20E+00	8.90E+00 J	PA50MW01A	4 / 11	2.1 - 46
		TOLUENE	V	µg/L	3.00E-01 J	3.00E-01 J	PA50MW01A	1 / 12	0.5 - 2
		VANADIUM		µg/L	1.50E+00 J	4.40E+00	PA50MW01A	5 / 11	3.2 - 50
		ZINC		µg/L	2.65E+01	1.72E+02	PA50MW01A	2 / 11	0.8 - 60
6	AM09	BARIUM		µg/L	3.68E+02 J	4.38E+02	IR61MW04A	3 / 3	--
		COBALT		µg/L	7.40E+00 J	9.00E+00 J	IR61MW04A	3 / 3	--
		IRON		µg/L	3.72E+01 J	3.72E+01 J	IR61MW04A	1 / 3	15.7 - 78.8
		MANGANESE		µg/L	1.61E+03 J	2.03E+03	IR61MW04A	3 / 3	--
		MOLYBDENUM		µg/L	1.50E+00	1.50E+00	IR61MW04A	1 / 3	2.1 - 2.1
		NICKEL		µg/L	2.84E+01 J	3.36E+01 J	IR61MW04A	3 / 3	--
		THALLIUM		µg/L	7.00E+00 J	7.00E+00 J	IR61MW04A	1 / 3	2 - 3.1
		VANADIUM		µg/L	1.10E+00 J	1.60E+00	IR61MW04A	3 / 3	--

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
7	AN11	ARSENIC	µg/L	3.60E+00	3.60E+00	IR62MW08A	1 / 3	2.8 - 2.8
		BARIUM	µg/L	3.27E+01	4.02E+01 J	IR62MW08A	3 / 3	--
		CADMIUM	µg/L	5.00E+00	5.00E+00	IR62MW08A	1 / 3	0.2 - 0.35
		COBALT	µg/L	1.50E+00	1.90E+00 J	IR62MW08A	2 / 3	2.5 - 2.5
		IRON	µg/L	3.25E+01 J	3.96E+01 J	IR62MW08A	2 / 3	15.6 - 15.6
		MANGANESE	µg/L	2.16E+02	3.29E+02 J	IR62MW08A	3 / 3	--
		MERCURY V	µg/L	1.50E-01 J	1.50E-01 J	IR62MW08A	1 / 3	0.1 - 0.1
		MOLYBDENUM	µg/L	3.70E+00	3.70E+00	IR62MW08A	1 / 3	2.3 - 2.6
		NICKEL	µg/L	7.20E+00	1.16E+01	IR62MW08A	3 / 3	--
		THALLIUM	µg/L	3.00E+00 J	3.00E+00 J	IR62MW08A	1 / 3	1.9 - 2
		VANADIUM	µg/L	9.50E-01	2.80E+00	IR62MW08A	2 / 3	1.4 - 1.4
7	AP10	ANTIMONY	µg/L	3.28E+01	3.28E+01	IR10MW15A	1 / 5	2.1 - 18
		ARSENIC	µg/L	1.70E+00	1.70E+00	IR10MW15A	1 / 5	1.2 - 2.8
		BARIUM	µg/L	1.18E+02	3.70E+02	IR10MW15A	5 / 5	--
		BERYLLIUM	µg/L	5.40E-01	1.40E+00	IR10MW15A	2 / 5	0.1 - 2
		COBALT	µg/L	2.10E+00	2.10E+00	IR10MW15A	1 / 5	6.3 - 9
		COPPER	µg/L	3.90E+00	3.90E+00	IR10MW15A	1 / 5	1.4 - 11.8
		IRON	µg/L	1.14E+01	1.14E+01	IR10MW15A	1 / 5	9.4 - 91.2
		MANGANESE	µg/L	1.63E+02	3.74E+02	IR10MW15A	5 / 5	--
		NICKEL	µg/L	2.08E+01	3.86E+01	IR10MW15A	2 / 5	15.8 - 28.8
		SILVER	µg/L	1.85E+01	1.85E+01	IR10MW15A	1 / 5	0.6 - 1.7
		VANADIUM	µg/L	6.00E+00	8.31E+01	IR10MW15A	4 / 5	4.8 - 4.8
7	AQ10	ANTIMONY	µg/L	2.84E+01	2.84E+01	IR06MW46A	1 / 2	27.6 - 27.6
		ARSENIC	µg/L	2.50E+00	3.65E+00	IR06MW46A	3 / 3	--
		BARIUM	µg/L	3.54E+01	5.91E+01	IR06MW46A	2 / 2	--
		CHROMIUM	µg/L	1.30E+00	1.30E+00	IR06MW46A	1 / 3	3 - 3
		COPPER	µg/L	1.30E+00	1.30E+00	IR06MW46A	1 / 2	1.7 - 1.7
		MANGANESE	µg/L	1.40E+02	1.87E+02	IR06MW46A	2 / 2	--
		MOLYBDENUM	µg/L	2.18E+01	2.18E+01	IR06MW46A	1 / 1	--
		NICKEL	µg/L	4.24E+01	4.24E+01	IR06MW46A	1 / 1	--

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
9	AO06	1,2-DICHLOROETHANE	V	µg/L	3.60E-01 J	3.60E-01 J	IR10MW31A1	1 / 18	0.5 - 10
		2,6-DINITROTOLUENE		µg/L	5.80E+01	5.80E+01	IR10MW31A2	1 / 6	10 - 10
		ALUMINUM		µg/L	2.43E+02	2.43E+02	IR10MW31A1	1 / 15	6.1 - 200
		ANTIMONY		µg/L	1.68E+00	2.76E+01 J	IR10MW31A1	5 / 15	1.9 - 60
		ARSENIC		µg/L	2.60E+00 J	7.50E+00 J	IR10MW31A1	3 / 15	1.4 - 10
		BARIUM		µg/L	9.20E+00	1.10E+02	IR10MW31A2	14 / 15	55.5 - 55.5
		BERYLLIUM		µg/L	1.50E+00 J	1.50E+00 J	IR10MW31A1	1 / 15	0.081 - 5
		CARBON DISULFIDE	V	µg/L	2.90E-01 J	2.90E-01 J	IR10MW31A1	1 / 18	0.5 - 10
		CHROMIUM		µg/L	5.20E+00	6.00E+00 J	IR10MW31A1	2 / 15	0.5 - 10
		COBALT		µg/L	7.10E-01 J	3.20E+00 J	IR10MW31A1	4 / 15	0.4 - 50
		COPPER		µg/L	2.75E+00	9.50E+00 J	IR10MW31A1	3 / 15	1.2 - 25
		MANGANESE		µg/L	7.00E+00	4.71E+03	IR10MW31A2	14 / 15	20.8 - 20.8
		MERCURY	V	µg/L	4.40E-02 J	3.70E-01	IR10MW31A1	3 / 15	0.053 - 0.2
		MOLYBDENUM		µg/L	5.70E+00	1.28E+01	IR10MW31A1	10 / 15	2 - 12.6
		NICKEL		µg/L	4.30E+00 J	4.68E+01	IR10MW31A2	9 / 15	1.3 - 40
		SELENIUM		µg/L	1.03E+01	1.96E+01 J	IR10MW31A1	2 / 13	2.3 - 35
		THALLIUM		µg/L	2.70E+00 J	8.52E+01 J	IR10MW31A1	2 / 15	1.9 - 46
		TRICHLOROETHENE	V	µg/L	2.25E-01	2.25E-01	IR10MW31A1	1 / 18	0.5 - 10
		VANADIUM		µg/L	1.40E+00 J	7.05E+00	IR10MW31A2	7 / 15	0.78 - 50
		ZINC		µg/L	1.11E+01	1.70E+01 J	IR10MW31A1	4 / 15	2.3 - 60
9	AO07	CIS-1,2-DICHLOROETHENE	V	µg/L	1.90E-01 J	1.90E-01 J	IR10MW79A	1 / 10	0.5 - 5
		TOLUENE	V	µg/L	2.70E-01 J	2.70E-01 J	IR10MW79A	1 / 8	0.5 - 0.5
		XYLENE (TOTAL)	V	µg/L	2.00E-01 J	2.00E-01 J	IR10MW79A	1 / 8	0.5 - 0.5

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
9	AP07	ARSENIC	µg/L	4.00E+00	9.90E+00	IR10MW29A1	4 / 4	--
		BARIUM	µg/L	1.07E+01	1.26E+02	IR10MW29A2	4 / 4	--
		BERYLLIUM	µg/L	1.40E+00	1.40E+00	IR10MW29A2	1 / 4	0.35 - 1.075
		CADMIUM	µg/L	4.60E+00	4.60E+00	IR10MW29A2	1 / 4	2.3 - 2.8
		COBALT	µg/L	1.83E+01	1.83E+01	IR10MW29A2	1 / 4	7.9 - 12.3
		COPPER	µg/L	3.05E+00	5.80E+00	IR10MW29A2	3 / 4	1.6 - 1.6
		IRON	µg/L	1.08E+01	3.56E+01	IR10MW29A2	3 / 4	18.6 - 18.6
		LEAD	µg/L	1.55E+00	3.00E+00	IR10MW29A2	2 / 4	2 - 2
		MANGANESE	µg/L	2.01E+01	4.89E+02	IR10MW29A2	4 / 4	--
		MOLYBDENUM	µg/L	7.65E+00	6.30E+01	IR10MW29A1	3 / 4	4.4 - 4.4
		NICKEL	µg/L	4.80E+01	4.80E+01	IR10MW29A2	1 / 4	17.8 - 28.8
		SELENIUM	µg/L	1.93E+00	1.93E+00	IR10MW29A2	1 / 4	2.5 - 2.5
		VANADIUM	µg/L	5.90E+00	1.19E+01	IR10MW29A2	4 / 4	--
9	AQ06	ANTIMONY	µg/L	1.03E+01	1.03E+01	IR46MW38A	1 / 3	1.6 - 1.9
		ARSENIC	µg/L	1.03E+01	1.39E+01	IR46MW38A	2 / 3	1.3 - 1.3
		BARIUM	µg/L	5.76E+01	1.15E+02	IR46MW38A	3 / 3	--
		CARBON DISULFIDE V	µg/L	3.00E+00 J	3.00E+00 J	IR46MW38A	1 / 3	10 - 10
		CHROMIUM	µg/L	4.35E+00	4.35E+00	IR46MW38A	1 / 3	0.7 - 1
		COBALT	µg/L	2.08E+00	2.08E+00	IR46MW38A	1 / 3	0.7 - 0.85
		COPPER	µg/L	1.94E+01	1.94E+01	IR46MW38A	1 / 3	0.5 - 0.86
		IRON	µg/L	2.21E+01	2.21E+01	IR46MW38A	1 / 3	23 - 40.7
		LEAD	µg/L	1.10E+00	1.10E+00	IR46MW38A	1 / 3	0.9 - 1.3
		MANGANESE	µg/L	9.58E+01	6.57E+02	IR46MW38A	3 / 3	--
		MOLYBDENUM	µg/L	7.30E+00	1.48E+01	IR46MW38A	2 / 3	3 - 3
		NICKEL	µg/L	1.06E+01	1.06E+01	IR46MW38A	1 / 3	5.1 - 8.25
		VANADIUM	µg/L	5.45E-01	5.45E-01	IR46MW38A	1 / 3	1.1 - 4.1

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
12	AR06	ALUMINUM	µg/L	3.90E+01	4.28E+02	IR46MW37A	2 / 12	2.6 - 200
		ARSENIC	µg/L	3.10E+00 J	4.10E+00 J	IR46MW37A	2 / 11	1.6 - 10
		BARIUM	µg/L	4.40E+01 J	6.77E+01 J	IR46MW37A	11 / 12	72.5 - 72.5
		BERYLLIUM	µg/L	5.20E-01	5.20E-01	IR46MW37A	1 / 12	0.081 - 5
		CADMIUM	µg/L	2.30E+00 J	2.30E+00 J	IR46MW37A	1 / 12	0.21 - 5
		CHROMIUM	µg/L	7.10E-01	1.17E+01	IR46MW37A	3 / 12	0.5 - 10
		COBALT	µg/L	9.20E-01 J	2.50E+00	IR46MW37A	3 / 12	0.7 - 50
		IRON	µg/L	4.72E+01 J	9.41E+02	IR46MW37A	2 / 12	6.7 - 66.8
		LEAD	µg/L	4.20E+00	4.20E+00	IR46MW37A	1 / 12	0.9 - 31.1
		M,P-XYLENES V	µg/L	7.00E-01 J	7.00E-01 J	IR46MW37A	1 / 3	1 - 1
		MANGANESE	µg/L	2.24E+01	4.96E+01	IR46MW37A	12 / 12	--
		MERCURY V	µg/L	8.30E-02 J	1.30E-01 J	IR46MW37A	3 / 12	0.059 - 0.2
		MOLYBDENUM	µg/L	2.10E+00 J	3.60E+00 J	IR46MW37A	6 / 12	1.6 - 7
		NICKEL	µg/L	2.60E+00	3.18E+01 J	IR46MW37A	6 / 12	3.4 - 40
		SELENIUM	µg/L	2.63E+00	2.63E+00	IR46MW37A	1 / 11	2.8 - 35
		THALLIUM	µg/L	1.01E+01	1.08E+01	IR46MW37A	2 / 12	1.4 - 46
		TOLUENE V	µg/L	4.00E-01 J	4.00E-01 J	IR46MW37A	1 / 12	0.5 - 10
		VANADIUM	µg/L	5.20E-01	3.40E+00	IR46MW37A	3 / 12	0.38 - 50
		ZINC	µg/L	4.50E+00	3.27E+01	IR46MW37A	3 / 12	3 - 60
12	AS06	ARSENIC	µg/L	7.60E+00	7.60E+00	IR20MW06A	1 / 3	3.2 - 5
		BARIUM	µg/L	4.18E+02	1.02E+03	IR20MW06A	3 / 3	--
		COBALT	µg/L	1.72E+01	2.66E+01	IR20MW06A	2 / 3	14.5 - 14.5
		LEAD	µg/L	6.72E+01 J	6.72E+01 J	IR20MW06A	1 / 3	1.2 - 13
		MANGANESE	µg/L	1.27E+04 J	1.71E+04	IR20MW06A	3 / 3	--
		NICKEL	µg/L	8.07E+01	1.22E+02	IR20MW06A	3 / 3	--
		ZINC	µg/L	2.68E+01	3.61E+01	IR20MW06A	2 / 3	35.4 - 35.4

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
12	AS07	BARIUM		µg/L	5.03E+02	8.66E+02	IR20MW01A	3 / 3	--
		CHROMIUM		µg/L	5.70E+00	5.70E+00	IR20MW01A	1 / 3	1.8 - 2.3
		COBALT		µg/L	1.17E+01	1.20E+01	IR20MW01A	2 / 3	13.3 - 13.3
		IRON		µg/L	5.18E+03	1.55E+04	IR20MW01A	3 / 3	--
		MANGANESE		µg/L	5.83E+03	7.18E+03	IR20MW01A	3 / 3	--
		MERCURY	V	µg/L	1.65E-01	2.00E+00	IR20MW01A	2 / 3	0.2 - 0.2
		NICKEL		µg/L	2.79E+01	4.94E+01	IR20MW01A	3 / 3	--
		ZINC		µg/L	2.17E+01	2.17E+01	IR20MW01A	1 / 3	32 - 37.05
12	AT06	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	V	µg/L	1.00E+01	6.60E+01	IR26MW41A	11 / 12	10 - 10
		1,2-DICHLOROBENZENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR26MW41A	1 / 12	0.5 - 10
		ALUMINUM		µg/L	2.91E+01 J	2.91E+01 J	IR26MW41A	1 / 12	2.6 - 200
		ANTIMONY		µg/L	2.90E+00	2.90E+00	IR26MW41A	1 / 12	2.3 - 60
		ARSENIC		µg/L	3.70E+00 J	4.80E+00 J	IR26MW41A	2 / 11	1.6 - 10
		BARIUM		µg/L	3.66E+01 J	6.93E+01 J	IR26MW41A	11 / 12	50 - 50
		BERYLLIUM		µg/L	3.50E-01	3.50E-01	IR26MW41A	1 / 12	0.081 - 5
		CARBON DISULFIDE	V	µg/L	1.70E+00	1.80E+00	IR26MW41A	2 / 12	0.5 - 10
		CHROMIUM		µg/L	6.90E-01 J	1.10E+00	IR26MW41A	3 / 12	0.5 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	2.00E-01 J	2.90E-01 J	IR26MW41A	4 / 12	0.5 - 10
		COBALT		µg/L	1.30E+00 J	2.70E+00 J	IR26MW41A	5 / 12	1.7 - 50
		COPPER		µg/L	2.50E+00 J	1.68E+01 J	IR26MW41A	2 / 12	0.6 - 25
		DICHLORODIFLUOROMETHANE	V	µg/L	1.00E+01	5.90E+01	IR26MW41A	9 / 12	0.5 - 10
		IRON		µg/L	1.40E+01	1.31E+03 J	IR26MW41A	7 / 12	26.8 - 68
		MANGANESE		µg/L	2.36E+02	2.15E+03	IR26MW41A	12 / 12	--
		MERCURY	V	µg/L	2.90E-02 J	2.90E-02 J	IR26MW41A	1 / 12	0.1 - 0.2
		MOLYBDENUM		µg/L	2.10E+00	3.80E+00 J	IR26MW41A	5 / 12	2 - 7
		NICKEL		µg/L	3.28E+01 J	7.21E+01	IR26MW41A	12 / 12	--
		SILVER		µg/L	1.10E+00 J	1.10E+00 J	IR26MW41A	1 / 12	0.4 - 10
		THALLIUM		µg/L	1.90E+00	1.90E+00	IR26MW41A	1 / 12	2.1 - 46
		TRICHLOROFLUOROMETHANE	V	µg/L	9.80E-01	1.40E+01	IR26MW41A	11 / 12	10 - 10
		VANADIUM		µg/L	1.30E+00 J	8.30E+00	IR26MW41A	7 / 12	3.2 - 50
		ZINC		µg/L	3.10E+00	7.59E+01	IR26MW41A	4 / 12	2.1 - 60

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
12	AT07	ANTIMONY	µg/L	1.44E+01	1.44E+01	IR20MW11A	1 / 3	25.5 - 26.3
		ARSENIC	µg/L	1.07E+01	1.07E+01	IR20MW11A	1 / 3	3.2 - 6.5
		BARIUM	µg/L	6.60E+01	1.04E+02	IR20MW11A	3 / 3	--
		COPPER	µg/L	3.52E+00	3.52E+00	IR20MW11A	1 / 3	1.6 - 2.3
		LEAD	µg/L	1.68E+00	1.68E+00	IR20MW11A	1 / 3	1.2 - 2.4
		MANGANESE	µg/L	1.65E+02 J	3.09E+02	IR20MW11A	3 / 3	--
		MERCURY V	µg/L	3.20E-01	3.20E-01	IR20MW11A	1 / 3	0.06 - 0.1
		MOLYBDENUM	µg/L	5.95E+00	5.95E+00	IR20MW11A	1 / 3	3.3 - 5
		VANADIUM	µg/L	6.40E+00	6.40E+00	IR20MW11A	1 / 3	5 - 6.1
		ZINC	µg/L	2.96E+01	2.96E+01	IR20MW11A	1 / 3	4.1 - 25.8
15	AU06	BARIUM	µg/L	2.42E+02	2.92E+02	IR26MW36A	3 / 3	--
		CADMIUM	µg/L	4.10E+00	4.10E+00	IR26MW36A	1 / 3	0.1 - 0.2
		COBALT	µg/L	4.70E+00	6.50E+00 J	IR26MW36A	3 / 3	--
		MANGANESE	µg/L	1.14E+03	1.40E+03	IR26MW36A	3 / 3	--
		NICKEL	µg/L	2.69E+01 J	3.65E+01	IR26MW36A	3 / 3	--
		SELENIUM	µg/L	3.70E+00 J	3.70E+00 J	IR26MW36A	1 / 3	2.3 - 3.4
		THALLIUM	µg/L	1.55E+00	3.10E+00 J	IR26MW36A	2 / 3	2 - 2
		VANADIUM	µg/L	1.30E+00	1.07E+01 J	IR26MW36A	3 / 3	--
		ZINC	µg/L	7.59E+01 J	7.59E+01 J	IR26MW36A	1 / 3	3.35 - 17.7
15	AU07	ARSENIC	µg/L	4.00E+00	5.50E+00	IR26MW44A	3 / 4	7 - 7
		BARIUM	µg/L	3.52E+02	8.40E+02	IR26MW44A	4 / 4	--
		CADMIUM	µg/L	6.40E-01 J	6.40E-01 J	IR26MW44A	1 / 4	0.2 - 2
		CARBON DISULFIDE V	µg/L	4.00E-01	4.00E-01	IR26MW44A	1 / 3	0.5 - 0.5
		COBALT	µg/L	2.10E+00 J	5.00E+00	IR26MW44A	2 / 4	1.25 - 2
		IRON	µg/L	4.68E+02	2.70E+03	IR26MW44A	4 / 4	--
		MANGANESE	µg/L	1.25E+03	2.72E+03	IR26MW44A	4 / 4	--
		MERCURY V	µg/L	1.30E-01 J	1.30E-01 J	IR26MW44A	1 / 4	0.1 - 0.11
		NICKEL	µg/L	6.80E+00 J	1.62E+01	IR26MW44A	4 / 4	--
		SILVER	µg/L	3.90E-01	3.90E-01	IR26MW44A	1 / 4	0.7 - 2.5
		THALLIUM	µg/L	6.00E+00 J	4.63E+01	IR26MW44A	2 / 4	1.9 - 9.5
		ZINC	µg/L	1.50E+01 J	1.50E+01 J	IR26MW44A	1 / 4	5 - 43

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
15	AV06	ALUMINUM	µg/L	2.56E+01	2.56E+01	PA50MW02A	1 / 4	13.7 - 35.3
		ANTIMONY	µg/L	2.30E+00	1.92E+01	PA50MW02A	2 / 4	6 - 8.6
		ARSENIC	µg/L	2.95E+00	6.70E+00	PA50MW02A	3 / 4	4 - 4
		BARIUM	µg/L	2.63E+01	8.70E+01	PA50MW02A	3 / 4	48.1 - 48.1
		CADMIUM	µg/L	2.40E+00	2.40E+00	PA50MW02A	1 / 4	0.1 - 2
		CARBON DISULFIDE V	µg/L	7.00E+00 J	7.00E+00 J	PA50MW02A	1 / 3	10 - 10
		CHROMIUM	µg/L	9.85E+00	3.79E+01	PA50MW02A	4 / 4	--
		MANGANESE	µg/L	8.60E+00	1.54E+01	PA50MW02A	2 / 4	0.3 - 1
		MERCURY V	µg/L	1.80E-01	9.10E-01	PA50MW02A	3 / 4	0.1 - 0.1
		MOLYBDENUM	µg/L	4.50E+00	8.00E+00 J	PA50MW02A	4 / 4	--
		NICKEL	µg/L	2.15E+01	2.81E+01	PA50MW02A	2 / 4	3.8 - 7.4
		THALLIUM	µg/L	2.20E+00 J	7.91E+01	PA50MW02A	3 / 3	--
		VANADIUM	µg/L	3.30E+00	3.30E+00	PA50MW02A	1 / 4	1.1 - 2

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
16	AX03	ACENAPHTHENE	V	µg/L	8.00E-01	3.50E+00	IR26MW46A	2 / 2	--
		ALDRIN		µg/L	1.45E-02	1.45E-02	IR26MW46A	1 / 4	0.01 - 0.05
		ALPHA-CHLORDANE		µg/L	1.33E-02	1.33E-02	IR26MW46A	1 / 7	0.01 - 0.025
		ALUMINUM		µg/L	5.15E+03	5.15E+03	IR26MW46A	1 / 3	59 - 200
		ARSENIC		µg/L	3.40E+00 J	1.22E+01	IR26MW46A	5 / 9	2 - 10
		BARIUM		µg/L	1.13E+02	4.01E+02	IR26MW46A	3 / 3	--
		CHROMIUM		µg/L	2.00E+00 J	3.11E+01	IR26MW46A	5 / 10	0.41 - 10
		CHROMIUM VI		µg/L	8.00E+00	8.00E+00	IR26MW46A	1 / 10	10 - 20
		COBALT		µg/L	3.40E+00	3.40E+00	IR26MW46A	1 / 3	3 - 50
		COPPER		µg/L	9.00E+00	9.00E+00	IR26MW46A	1 / 10	0.6 - 25
		FLUORANTHENE		µg/L	2.80E+00	2.80E+00	IR26MW46A	1 / 2	10 - 10
		FLUORENE	V	µg/L	3.00E+00	3.00E+00	IR26MW46A	1 / 2	10 - 10
		GAMMA-CHLORDANE		µg/L	1.37E-02	1.37E-02	IR26MW46A	1 / 7	0.00615 - 0.02
		IRON		µg/L	3.96E+01	8.10E+03	IR26MW46A	3 / 3	--
		LEAD		µg/L	2.10E+00 J	2.10E+00 J	IR26MW46A	1 / 9	0.7 - 10
		MANGANESE		µg/L	7.24E+02	3.04E+03	IR26MW46A	10 / 10	--
		MERCURY	V	µg/L	2.10E-01	2.10E-01	IR26MW46A	1 / 10	0.019 - 0.2
		MOLYBDENUM		µg/L	4.50E+00	4.50E+00	IR26MW46A	1 / 2	4.7 - 4.7
		NICKEL		µg/L	1.06E+01	4.13E+01	IR26MW46A	2 / 3	40 - 40
		PHENANTHRENE	V	µg/L	6.00E-01	3.00E+00	IR26MW46A	2 / 2	--
		PYRENE	V	µg/L	2.95E+00	2.95E+00	IR26MW46A	1 / 2	10 - 10
		SELENIUM		µg/L	3.70E+00	1.21E+01	IR26MW46A	2 / 3	3.2 - 3.2
		SILVER		µg/L	1.40E+00	1.40E+00	IR26MW46A	1 / 3	1 - 1.3
		VANADIUM		µg/L	3.50E+00	1.65E+01	IR26MW46A	3 / 3	--
		ZINC		µg/L	1.64E+01	1.64E+01	IR26MW46A	1 / 10	1.4 - 60

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
16	AY04	ANTIMONY	µg/L	5.00E+00 J	7.20E+00 J	IR26MW45A	2 / 10	2 - 60
		ARSENIC	µg/L	2.60E+00 J	1.61E+01 J	IR26MW48A	5 / 15	1.9 - 10
		BARIUM	µg/L	1.09E+02 J	7.44E+02	IR26MW45A	10 / 10	--
		BERYLLIUM	µg/L	3.80E-01	3.80E-01	IR26MW48A	1 / 10	0.1 - 5
		CHLOROFORM V	µg/L	3.00E+00 J	4.00E+00 J	IR26MW45A	3 / 6	10 - 10
		CHROMIUM	µg/L	8.40E-01 J	6.08E+01	IR26MW48A	10 / 17	0.9 - 50
		CHROMIUM VI	µg/L	8.00E+00 J	8.00E+00 J	IR26MW48A	1 / 18	5.05 - 20
		COBALT	µg/L	1.60E+00 J	1.02E+01 J	IR26MW48A	5 / 10	1 - 100
		COPPER	µg/L	3.10E+00 J	2.26E+01 J	IR26MW48A	2 / 17	0.88 - 130
		HEPTACHLOR	µg/L	2.80E-02	2.80E-02	IR26MW48A	1 / 3	0.013 - 0.05
		IRON	µg/L	8.30E+01	6.02E+02	IR26MW45A	3 / 10	7 - 100
		LEAD	µg/L	7.15E+01	7.15E+01	IR26MW48A	1 / 16	0.7 - 50
		MANGANESE	µg/L	3.36E+01 J	1.82E+03	IR26MW48A	16 / 16	--
		MERCURY V	µg/L	1.70E-01 J	2.50E-01	IR26MW45A	2 / 17	0.022 - 0.2
		MOLYBDENUM	µg/L	4.80E+00	7.20E+00	IR26MW48A	3 / 9	2 - 7.95
		NICKEL	µg/L	1.43E+01 J	7.91E+01	IR26MW48A	9 / 10	20.5 - 20.5
		SELENIUM	µg/L	3.00E+00	1.14E+01 J	IR26MW48A	3 / 10	2 - 4
		SILVER	µg/L	2.10E+00 J	2.10E+00 J	IR26MW48A	1 / 10	0.6 - 5.9
		THALLIUM	µg/L	6.20E+00 J	6.20E+00 J	IR26MW48A	1 / 10	2 - 25
		VANADIUM	µg/L	8.70E-01	7.00E+00 J	IR26MW45A	8 / 10	0.9 - 3.7
		ZINC	µg/L	2.35E+00	2.00E+02	IR26MW45A	4 / 17	0.8 - 300

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AF10	1,2-DICHLOROETHANE	V	µg/L	1.40E-01	J	1.40E-01	J	IR07MW21A1	1 / 19	0.5 - 10
		ANTIMONY		µg/L	2.90E+00	J	1.96E+01		IR07MW21A1	5 / 19	2 - 600
		ARSENIC		µg/L	3.30E+00	J	3.80E+01	J	IR07MW21A1	9 / 19	2.5 - 100
		BARIUM		µg/L	7.52E+01	J	6.79E+02		IR07MW24AD	19 / 19	--
		CHROMIUM		µg/L	1.10E+00	J	5.60E+00		IR07MW21A1	4 / 19	0.8 - 100
		COBALT		µg/L	2.90E+00	J	1.16E+01	J	IR07MW25A	11 / 19	1.3 - 500
		COPPER		µg/L	3.20E+00	J	3.20E+00	J	IR07MW25A	1 / 19	1 - 29
		ETHYLBENZENE	V	µg/L	3.80E-01	J	3.80E-01	J	IR07MW25A	1 / 19	0.5 - 10
		IRON		µg/L	2.36E+01	J	1.23E+03		IR07MW25A	14 / 17	24.9 - 161
		LEAD		µg/L	2.84E+01	J	2.84E+01	J	IR07MW25A	1 / 19	0.8 - 100
		MANGANESE		µg/L	4.46E+02		6.29E+03		IR07MW25A	19 / 19	--
		MOLYBDENUM		µg/L	2.20E+00	J	2.80E+00	J	IR07MW25AD	2 / 11	1.5 - 3.2
		NICKEL		µg/L	3.50E+00	J	4.28E+01	J	IR07MW25A	17 / 19	4 - 400
		SELENIUM		µg/L	3.60E+00	J	3.60E+00	J	IR07MW24AD	1 / 19	2 - 350
		TOLUENE	V	µg/L	7.40E-01		9.00E-01	J	IR07MW24AD	2 / 19	0.5 - 10
		VANADIUM		µg/L	1.80E+00	J	4.50E+00	J	IR07MW25AD	4 / 17	1 - 500
		XYLENE (TOTAL)	V	µg/L	1.00E+00	J	1.00E+00	J	IR07MW25AD	1 / 19	0.5 - 10
		ZINC		µg/L	3.64E+01		1.56E+02		IR07MW24AD	2 / 19	3 - 600

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AF12	1,2-DICHLOROETHENE (TOTAL)	V	µg/L	3.00E-01	J	3.00E-01	J	IR07MW23A	1 / 9	5 - 10
		ALUMINUM		µg/L	3.85E+01	J	3.85E+01	J	IR07MW23A	1 / 12	5 - 200
		ANTIMONY		µg/L	3.40E+00	J	3.40E+00	J	IR07MW23A	1 / 12	2 - 60
		ARSENIC		µg/L	5.50E+00	J	5.50E+00	J	IR07MW23A	1 / 12	1.6 - 32
		BARIUM		µg/L	8.62E+01	J	6.93E+02		IR07MW23A	12 / 12	--
		CHLOROBENZENE	V	µg/L	1.00E+00	J	1.00E+00	J	IR07MW23A	1 / 12	0.5 - 10
		CHROMIUM		µg/L	1.20E+00	J	9.20E+00	J	IR07MW23A	3 / 12	0.94 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	5.20E-01		1.00E+01	J	IR07MW23A	5 / 8	10 - 10
		COBALT		µg/L	3.90E+00	J	1.05E+01	J	IR07MW23A	10 / 12	4 - 4.8
		IRON		µg/L	3.48E+02		7.37E+02		IR07MW23A	12 / 12	--
		MANGANESE		µg/L	1.79E+03		2.52E+03	J	IR07MW23A	12 / 12	--
		MOLYBDENUM		µg/L	1.60E+00	J	1.60E+00	J	IR07MW23A	1 / 12	1.3 - 5.4
		NICKEL		µg/L	2.22E+01	J	4.03E+01		IR07MW23A	12 / 12	--
		SELENIUM		µg/L	5.30E+00	J	5.30E+00	J	IR07MW23A	1 / 12	2 - 35
		TERT-BUTYL METHYL ETHER	V	µg/L	2.40E-01	J	2.40E-01	J	IR07MW23A	1 / 10	0.5 - 10
		THALLIUM		µg/L	1.00E+01		2.81E+01	J	IR07MW23A	2 / 12	2.1 - 25
		TRICHLOROETHENE	V	µg/L	1.00E+00	J	1.00E+00	J	IR07MW23A	1 / 12	0.5 - 10
		ZINC		µg/L	6.60E+00	J	2.03E+02		IR07MW23A	2 / 12	1 - 60

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AF13	1,4-DICHLOROBENZENE	V	µg/L	2.70E-01 J	4.10E-01 J	IR18MW21A	3 / 17	0.5 - 10
		ACETONE	V	µg/L	3.00E+00 J	3.00E+00 J	IR18MW21A	1 / 17	5 - 10
		ACETOPHENONE	V	µg/L	2.00E+00 J	3.00E+00	IR18MW21A	2 / 8	10 - 10
		ALPHA-CHLORDANE		µg/L	1.90E-03 J	2.10E-03 J	IR18MW21A	2 / 12	0.01 - 0.05
		ALUMINUM		µg/L	3.05E+01	3.05E+01	IR18MW21A	1 / 16	2.6 - 200
		ANTIMONY		µg/L	2.70E+00	2.11E+01 J	IR18MW21A	3 / 17	2.3 - 60
		ARSENIC		µg/L	2.50E+00 J	9.50E+00 J	IR18MW21A	4 / 16	1.6 - 10
		BARIUM		µg/L	8.16E+01	2.31E+02	IR18MW21A	17 / 17	--
		BENZENE	V	µg/L	1.00E+00 J	1.00E+00 J	IR18MW21A	1 / 17	0.5 - 10
		BERYLLIUM		µg/L	2.80E-01	2.80E-01	IR18MW21A	1 / 17	0.081 - 5
		CAPROLACTAM		µg/L	9.00E-01 J	9.00E-01 J	IR18MW21A	1 / 7	0.6 - 10
		CARBON DISULFIDE	V	µg/L	9.00E+00 J	9.00E+00 J	IR18MW21AD	2 / 17	0.5 - 10
		CHLOROBENZENE	V	µg/L	5.00E-01 J	4.00E+00 J	IR18MW21AD	11 / 17	10 - 10
		CHLOROETHANE	V	µg/L	1.30E+01	1.30E+01	IR18MW21A	1 / 17	0.5 - 10
		CHROMIUM		µg/L	7.50E-01	1.80E+00 J	IR18MW21A	2 / 17	0.6 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	3.00E-01 J	3.40E-01 J	IR18MW21A	3 / 11	0.5 - 10
		COBALT		µg/L	1.30E+00 J	1.67E+01 J	IR18MW21A	5 / 17	0.7 - 50
		COPPER		µg/L	1.40E+00 J	1.40E+00 J	IR18MW21A	1 / 17	0.6 - 25
		GAMMA-CHLORDANE		µg/L	8.30E-03 J	8.30E-03 J	IR18MW21A	1 / 12	0.003 - 0.05
		HEPTACHLOR		µg/L	1.10E-02 J	1.10E-02 J	IR18MW21A	1 / 12	0.0081 - 0.05
		IRON		µg/L	5.04E+01	1.73E+03	IR18MW21A	15 / 17	25.8 - 96.3
		LEAD		µg/L	2.30E+00 J	2.30E+00 J	IR18MW21A	1 / 16	0.7 - 10
		MANGANESE		µg/L	4.15E+02	2.41E+03 J	PA18MW09A	17 / 17	--
		MERCURY	V	µg/L	2.75E-02	2.75E-02	IR18MW21AD	1 / 17	0.047 - 0.2
		MOLYBDENUM		µg/L	2.40E+00	2.80E+00 J	IR18MW21A	4 / 16	0.52 - 5
		NICKEL		µg/L	1.70E+00	2.66E+01	PA18MW09A	6 / 17	1.8 - 40
		PENTACHLOROPHENOL		µg/L	2.40E+01	2.40E+01	IR18MW21A	1 / 13	25 - 25
		SILVER		µg/L	8.82E+00	8.82E+00	IR18MW21AD	1 / 17	0.4 - 10
		TERT-BUTYL METHYL ETHER	V	µg/L	3.50E-01 J	8.30E-01 J	IR18MW21A	2 / 11	0.5 - 10
		THALLIUM		µg/L	1.40E+00	8.35E+00	IR18MW21A	3 / 13	2.5 - 28
		TOLUENE	V	µg/L	2.00E+00 J	2.00E+00 J	IR18MW21A	1 / 17	0.5 - 10
		TRICHLOROETHENE	V	µg/L	2.00E+00 J	2.00E+00 J	IR18MW21A	1 / 17	0.5 - 10
		VANADIUM		µg/L	3.95E-01	1.30E+00	IR18MW21A	3 / 17	0.8 - 50

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AG10	1,1,2,2-TETRACHLOROETHANE	V	µg/L	1.00E+00 J	1.00E+00 J	IR07MW21A1D	1 / 14	0.5 - 10
		2-HEXANONE	V	µg/L	4.00E+00 J	4.00E+00 J	IR07MW21A1D	1 / 14	5 - 10
		ALUMINUM		µg/L	2.20E+01 J	5.64E+02	IR07MW24A	3 / 14	15.3 - 2000
		ANTIMONY		µg/L	8.70E+00 J	2.71E+01	IR07MW24A	3 / 14	3.7 - 600
		ARSENIC		µg/L	3.20E+00 J	8.00E+00	IR07MW24A	4 / 14	1.4 - 100
		BARIUM		µg/L	7.75E+01 J	1.18E+03	IR07MW21A2	14 / 14	--
		CADMIUM		µg/L	2.08E+00	2.08E+00	IR07MW21A1D	1 / 14	0.2 - 50
		CHROMIUM		µg/L	1.00E+00 J	9.70E+00 J	IR07MW24A	3 / 14	1 - 100
		CIS-1,2-DICHLOROETHENE	V	µg/L	1.60E-01 J	2.10E-01 J	IR07MW24A	2 / 5	0.5 - 1
		COBALT		µg/L	2.00E+00 J	2.18E+01	IR07MW21A2	9 / 14	4.9 - 500
		COPPER		µg/L	1.50E+00 J	1.95E+00	IR07MW21A1D	2 / 14	1.6 - 250
		IRON		µg/L	1.16E+02	1.03E+03	IR07MW24A	5 / 13	6.3 - 148
		MANGANESE		µg/L	6.20E+00	6.26E+03 J	IR07MW21A2	14 / 14	--
		MOLYBDENUM		µg/L	2.00E+00 J	4.60E+00 J	IR07MW21A2	2 / 10	1.5 - 6.2
		NICKEL		µg/L	1.42E+01	7.18E+01	IR07MW21A2	13 / 14	400 - 400
		SELENIUM		µg/L	2.80E+00 J	5.20E+00 J	IR07MW21A1D	1 / 9	2.2 - 350
		TERT-BUTYL METHYL ETHER	V	µg/L	2.00E-01 J	2.00E-01 J	IR07MW24A	1 / 8	0.5 - 5
		VANADIUM		µg/L	1.25E+00	3.10E+00 J	IR07MW24A	2 / 13	1.4 - 500
		VINYL ACETATE	V	µg/L	2.00E+00 J	2.00E+00 J	IR07MW21A1D	1 / 6	10 - 10
		ZINC		µg/L	3.30E+00 J	1.84E+02	IR07MW21A1D	4 / 14	3 - 600

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AH08	ALUMINUM	µg/L	2.12E+01 J	1.80E+02	IR07MWS-3	3 / 9	5 - 20
		ANTIMONY	µg/L	8.30E+00 J	8.30E+00 J	IR07MW26AD	1 / 9	2 - 31.1
		ARSENIC	µg/L	1.40E+00 J	5.10E+00 J	IR07MW26AD	3 / 9	2 - 8.7
		BARIUM	µg/L	9.22E+01 J	1.32E+03	IR07MWS-3	9 / 9	--
		BERYLLIUM	µg/L	5.30E-01	1.30E+00 J	IR07MW26AD	4 / 9	0.31 - 1.3
		CADMIUM	µg/L	1.10E+00 J	3.10E+00	IR07MWS-3	2 / 9	0.32 - 3.4
		CHROMIUM	µg/L	4.20E+00 J	2.35E+01	IR07MWS-3	5 / 9	3 - 9.1
		COBALT	µg/L	2.80E+00 J	2.27E+01	IR07MWS-3	5 / 9	1 - 4.9
		IRON	µg/L	1.86E+02	1.51E+03	IR07MWS-3	5 / 9	8 - 24.9
		MANGANESE	µg/L	5.62E+01	7.68E+03 J	IR07MWS-3	7 / 9	1 - 1
		MERCURY V	µg/L	1.10E-01 J	1.50E-01 J	IR07MW26AD	2 / 9	0.1 - 0.4
		MOLYBDENUM	µg/L	3.60E+00 J	4.27E+01	IR07MW26AD	2 / 9	3.1 - 7
		NICKEL	µg/L	2.90E+01 J	2.85E+02	IR07MWS-3	7 / 9	15.6 - 31
		THALLIUM	µg/L	3.20E+00 J	5.30E+00 J	IR07MW26AD	3 / 7	3 - 20
		VANADIUM	µg/L	2.20E+00 J	6.10E+00 J	IR07MW26AD	6 / 9	1.4 - 3.9
		ZINC	µg/L	1.15E+01	1.98E+02	IR07MW26AD	2 / 9	1 - 60

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AH09	1,2,4-TRICHLOROBENZENE	V	µg/L	2.00E+00 J	2.00E+00 J	IR07MWS-4DD	1 / 5	10 - 10
		ANTIMONY		µg/L	5.40E+00 J	2.31E+01	IR07MWS-4D	2 / 9	2 - 14.3
		ARSENIC		µg/L	2.30E+00	2.40E+00 J	IR07MWS-4DD	2 / 9	2 - 8.7
		BARIUM		µg/L	1.90E+01 J	7.16E+02	IR07MWS-4DD	8 / 9	10.7 - 10.7
		BENZENE	V	µg/L	2.25E+00	2.25E+00	IR07MWS-4D	1 / 9	5 - 10
		BERYLLIUM		µg/L	5.90E-01 J	1.00E+00 J	IR07MWS-4DD	2 / 9	0.11 - 1.3
		CADMIUM		µg/L	1.90E+00 J	2.10E+00 J	IR07MWS-4DD	2 / 9	0.88 - 3.4
		CHLOROBENZENE	V	µg/L	2.25E+00	2.25E+00	IR07MWS-4D	1 / 9	5 - 10
		CHROMIUM		µg/L	2.90E+00	2.45E+01 J	IR07MWS-4DD	7 / 9	2.2 - 3
		CHROMIUM VI		µg/L	1.00E+01	2.00E+01	IR07MWS-4DD	2 / 10	10 - 10
		COBALT		µg/L	4.90E+00 J	1.99E+01	IR07MWS-4D	3 / 9	1 - 4.9
		COPPER		µg/L	2.00E+00 J	6.10E+00 J	IR07MWS-4DD	3 / 9	2.3 - 14.1
		IRON		µg/L	1.28E+02	7.38E+02	IR07MWS-4DD	4 / 9	7 - 124
		MANGANESE		µg/L	2.57E+02	9.82E+02	IR07MWS-4D	5 / 9	1 - 29.9
		MERCURY	V	µg/L	1.60E-01 J	1.60E-01 J	IR07MWS-4DD	1 / 9	0.1 - 0.4
		MOLYBDENUM		µg/L	4.10E+00 J	2.57E+01	IR07MWS-4DD	4 / 9	4.8 - 12.4
		NICKEL		µg/L	1.91E+01 J	3.61E+02	IR07MWS-4D	6 / 9	13.7 - 47
		THALLIUM		µg/L	2.40E+00 J	2.40E+00 J	IR07MWS-4DD	1 / 8	2 - 20
		TOLUENE	V	µg/L	2.75E+00	2.75E+00	IR07MWS-4D	1 / 9	5 - 10
		VANADIUM		µg/L	1.10E+00 J	4.40E+00 J	IR07MWS-4DD	6 / 9	1.6 - 3.9
		ZINC		µg/L	9.35E+00	2.27E+02	IR07MWS-4DD	2 / 9	1 - 15.4

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AI08	ALUMINUM	µg/L	8.06E+02 J	8.06E+02 J	IR07MW26A	1 / 4	200 - 2000
		ANTIMONY	µg/L	2.43E+01 J	8.22E+01	IR07MW26A	2 / 4	60 - 600
		ARSENIC	µg/L	2.92E+01	2.92E+01	IR07MW26A	1 / 3	10 - 100
		BARIUM	µg/L	6.47E+01 J	2.00E+02	IR07MW26A	4 / 4	--
		BERYLLIUM	µg/L	1.70E+00 J	1.70E+00 J	IR07MW26A	1 / 4	5 - 50
		COBALT	µg/L	6.60E-01 J	1.06E+01	IR07MW26A	3 / 4	500 - 500
		COPPER	µg/L	4.34E+01 J	4.34E+01 J	IR07MW26A	1 / 4	25 - 130
		IRON	µg/L	6.35E+01 J	6.35E+01 J	IR07MW26A	1 / 3	382 - 1000
		LEAD	µg/L	9.82E+01 J	9.82E+01 J	IR07MW26A	1 / 4	10 - 50
		MANGANESE	µg/L	1.31E+02 J	2.25E+03	IR07MW26A	4 / 4	--
		NICKEL	µg/L	6.00E+00 J	6.00E+00 J	IR07MW26A	1 / 4	25 - 400
		SELENIUM	µg/L	4.45E+01 J	7.37E+01 J	IR07MW26A	2 / 4	25 - 35
		THALLIUM	µg/L	1.63E+02 J	1.63E+02 J	IR07MW26A	1 / 4	25 - 250
		VANADIUM	µg/L	3.40E+00 J	3.40E+00 J	IR07MW26A	1 / 3	250 - 500
BOS-1	AJ06	ARSENIC	µg/L	2.23E+01	2.23E+01	IR23MW14A	1 / 3	2.8 - 2.8
		BARIUM	µg/L	1.61E+02 J	2.11E+02 J	IR23MW14A	3 / 3	--
		CADMIUM	µg/L	1.40E+00	2.30E+00	IR23MW14A	2 / 3	1 - 1
		COBALT	µg/L	2.50E+00 J	2.50E+00 J	IR23MW14A	1 / 3	3 - 10.3
		IRON	µg/L	3.79E+01 J	4.49E+01 J	IR23MW14A	2 / 3	160 - 160
		MANGANESE	µg/L	6.30E+02 J	1.30E+03	IR23MW14A	3 / 3	--
		MOLYBDENUM	µg/L	2.40E+00	2.40E+00	IR23MW14A	1 / 3	3.9 - 4.5
		NICKEL	µg/L	1.79E+01 J	4.09E+01	IR23MW14A	3 / 3	--
		THALLIUM	µg/L	4.00E+00 J	4.00E+00 J	IR23MW14A	1 / 3	1.9 - 10

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AJ07	1,2-DICHLOROETHANE	V	µg/L	1.95E-01	1.95E-01	IR07MW20A1	1 / 17	0.5 - 10
		ANTIMONY		µg/L	2.05E+00	5.36E+01	IR07MW20A1	8 / 18	2.3 - 60
		ARSENIC		µg/L	2.50E+00	4.78E+00	IR07MW20A1	7 / 18	1.4 - 20
		BARIUM		µg/L	2.24E+01	7.06E+02	IR07MW20A2	17 / 18	59.6 - 59.6
		BERYLLIUM		µg/L	6.10E-01	3.75E+00	IR07MW20A1	4 / 18	0.081 - 10
		CADMIUM		µg/L	5.80E-01	4.40E+00	IR07MWP-2	7 / 18	0.6 - 10
		CHROMIUM		µg/L	5.30E+00 J	1.88E+01	IR07MW20A1	9 / 18	2.1 - 10
		CHROMIUM VI		µg/L	9.60E+00 J	1.00E+01	IR07MW20A1	3 / 19	10 - 20
		COBALT		µg/L	7.75E-01	3.38E+01	IR07MWP-2	8 / 18	0.7 - 100
		COPPER		µg/L	1.68E+00	4.06E+01	IR07MW20A2	5 / 18	0.9 - 50
		DI-N-OCTYLPHTHALATE		µg/L	4.50E+00	4.50E+00	IR07MW20A2	1 / 8	10 - 15
		IRON		µg/L	1.68E+01	1.98E+02	IR07MWP-2	3 / 18	6.3 - 200
		LEAD		µg/L	4.20E+00	4.20E+00	IR07MW20A1	1 / 17	0.7 - 20
		MANGANESE		µg/L	1.70E-01	4.45E+03	IR07MW20A2	14 / 18	0.34 - 30
		MOLYBDENUM		µg/L	2.48E+00	1.67E+01	IR07MWP-2	9 / 18	3.1 - 11.8
		NICKEL		µg/L	1.21E+01 J	6.51E+02	IR07MWP-2	16 / 18	35.1 - 80
		SELENIUM		µg/L	1.05E+01	4.35E+01	IR07MW20A1	2 / 12	2.5 - 35
		SILVER		µg/L	4.35E-01	2.05E+00	IR07MW20A1	4 / 18	0.6 - 20
		TETRACHLOROETHENE	V	µg/L	2.25E+00	2.25E+00	IR07MW20A2	1 / 17	0.5 - 10
		THALLIUM		µg/L	3.85E+00	8.00E+00	IR07MW20A1	4 / 16	1.5 - 205
		TOLUENE	V	µg/L	5.90E-01	5.90E-01	IR07MW20A1	1 / 17	0.5 - 10
		VANADIUM		µg/L	1.35E+00	6.05E+00	IR07MW20A1	7 / 18	1.4 - 100
		XYLENE (TOTAL)	V	µg/L	5.10E-01	5.10E-01	IR07MW20A1	1 / 17	0.5 - 10
		ZINC		µg/L	1.53E+01	1.53E+01	IR07MW20A2	1 / 18	1.2 - 120

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	AJ08	ALUMINUM	µg/L	2.34E+01	2.34E+01	IR07MWS-2D	1 / 15	2.6 - 2000
		ANTIMONY	µg/L	3.01E+01 J	3.01E+01 J	IR07MWS-2	1 / 15	1.7 - 600
		ARSENIC	µg/L	3.00E+00 J	4.60E+00	IR07MWS-2D	5 / 14	1.6 - 100
		BARIUM	µg/L	2.78E+01 J	9.96E+02	IR07MWS-2D	14 / 15	79 - 79
		BERYLLIUM	µg/L	5.60E-01	3.00E+00 J	IR07MWS-2	3 / 15	0.081 - 50
		CARBON DISULFIDE V	µg/L	2.00E+00 J	3.00E+00 J	IR07MWS-2D	2 / 15	0.5 - 10
		CHROMIUM	µg/L	5.60E-01	1.30E+00	IR07MWS-2	3 / 15	0.7 - 100
		COBALT	µg/L	7.20E-01 J	1.80E+01	IR07MWS-2D	4 / 15	0.75 - 500
		COPPER	µg/L	8.40E+00 J	8.40E+00 J	IR07MWS-2	1 / 15	0.9 - 130
		IRON	µg/L	1.25E+01	1.81E+03	IR07MWS-2D	6 / 15	8.9 - 1000
		LEAD	µg/L	1.14E+02	1.14E+02	IR07MWS-2	1 / 14	0.7 - 50
		MANGANESE	µg/L	3.60E+00	4.05E+03	IR07MWS-2D	12 / 15	1 - 150
		MERCURY V	µg/L	6.90E-02 J	3.50E-01	IR07MWS-2D	3 / 15	0.1 - 0.4
		MOLYBDENUM	µg/L	5.30E+00	4.28E+01	IR07MWS-2	9 / 15	4.8 - 15
		NICKEL	µg/L	5.90E+00 J	1.53E+02	IR07MWS-2D	8 / 15	11.6 - 400
		SELENIUM	µg/L	3.02E+01 J	3.02E+01 J	IR07MWS-2	1 / 11	2 - 66.1
		THALLIUM	µg/L	4.60E+00	1.58E+02 J	IR07MWS-2	5 / 13	1.5 - 250
		VANADIUM	µg/L	5.90E-01	3.60E+00 J	IR07MWS-2	3 / 15	0.38 - 500
		ZINC	µg/L	9.20E+00	2.23E+01	IR07MWS-2	2 / 15	1.4 - 600
BOS-2	AK06	ANTIMONY	µg/L	1.25E+01	1.25E+01	IR60MW04A	1 / 3	3 - 3
		ARSENIC	µg/L	2.25E+00	2.25E+00	IR60MW04A	1 / 3	2.8 - 14
		BARIUM	µg/L	8.40E+01	1.17E+02 J	IR60MW04A	3 / 3	--
		CADMIUM	µg/L	1.74E+00	1.74E+00	IR60MW04A	1 / 3	0.2 - 1.3
		COBALT	µg/L	2.45E+00	7.80E+00	IR60MW04A	3 / 3	--
		MANGANESE	µg/L	4.36E+02	7.52E+02 J	IR60MW04A	3 / 3	--
		MOLYBDENUM	µg/L	6.70E+00	8.10E+00	IR60MW04A	3 / 3	--
		NICKEL	µg/L	1.92E+01	4.22E+01	IR60MW04A	3 / 3	--
		THALLIUM	µg/L	5.70E+00	5.70E+00	IR60MW04A	1 / 3	1.9 - 10
		VANADIUM	µg/L	9.50E-01	9.50E-01	IR60MW04A	1 / 3	0.8 - 3

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	AK07	ALUMINUM	µg/L	2.03E+02	3.32E+02	IR07MW19A	2 / 12	2.6 - 230.6
		ANTIMONY	µg/L	2.88E+00	4.16E+01	IR07MW19A	4 / 12	2 - 60
		ARSENIC	µg/L	1.80E+00	4.10E+00 J	IR07MW19A	2 / 12	1.6 - 15
		BARIUM	µg/L	2.45E+01	9.62E+01 J	IR07MW19A	12 / 12	--
		BERYLLIUM	µg/L	4.50E-01	2.90E+00	IR07MW19A	4 / 12	0.081 - 10
		CADMIUM	µg/L	4.65E-01	3.40E+00	IR07MW19A	6 / 12	0.6 - 7.5
		CHLOROFORM V	µg/L	5.25E-01	5.25E-01	IR07MW19A	1 / 12	0.5 - 10
		CHROMIUM	µg/L	2.60E+00 J	1.08E+01	IR07MW19A	7 / 12	4.6 - 20
		COBALT	µg/L	9.75E-01	8.75E+00	IR07MW19A	2 / 12	0.7 - 75
		COPPER	µg/L	5.70E+00 J	5.70E+00 J	IR07MW19A	1 / 12	0.74 - 50
		IRON	µg/L	1.29E+01	4.48E+02	IR07MW19A	4 / 12	9.9 - 200
		LEAD	µg/L	2.60E+00 J	6.40E+00	IR07MW19A	2 / 11	0.7 - 20.9
		MANGANESE	µg/L	7.70E-01	2.82E+01 J	IR07MW19A	4 / 12	0.2 - 30
		MOLYBDENUM	µg/L	3.48E+00	7.10E+00 J	IR07MW19A	11 / 14	3.1 - 7
		NICKEL	µg/L	1.14E+01 J	2.83E+01 J	IR07MW19A	11 / 12	60 - 60
		SELENIUM	µg/L	3.90E+00	2.76E+01	IR07MW19A	2 / 11	2 - 35
		SILVER	µg/L	5.90E-01	1.40E+00 J	IR07MW19A	2 / 12	0.5 - 20
		THALLIUM	µg/L	5.25E+00	9.78E+01	IR07MW19A	5 / 12	1.5 - 50
		TOLUENE V	µg/L	2.15E-01	2.15E-01	IR07MW19A	1 / 12	0.5 - 10
		VANADIUM	µg/L	1.80E+00 J	1.57E+01	IR07MW19A	6 / 12	1.15 - 100
		ZINC	µg/L	2.50E+00	2.50E+00	IR07MW19A	1 / 12	1.4 - 120
BOS-2	AL06	BARIUM	µg/L	4.08E+01 J	1.02E+02	IR60MW08A	4 / 4	--
		CADMIUM	µg/L	7.20E+00	3.17E+01	IR60MW08A	2 / 4	1 - 2
		COBALT	µg/L	5.60E-01	5.60E-01	IR60MW08A	1 / 4	2 - 2.6
		IRON	µg/L	5.01E+01 J	5.01E+01 J	IR60MW08A	1 / 4	13.8 - 78.5
		MANGANESE	µg/L	1.56E+01	1.56E+01	IR60MW08A	1 / 4	1 - 3.2
		MERCURY V	µg/L	1.00E-01 J	1.00E-01 J	IR60MW08A	1 / 4	0.1 - 0.1
		MOLYBDENUM	µg/L	7.70E+00 J	7.70E+00 J	IR60MW08A	1 / 4	5.7 - 6.6
		NICKEL	µg/L	4.80E+00	7.70E+00 J	IR60MW08A	2 / 4	2 - 16.5
		SILVER	µg/L	4.70E+00	4.70E+00	IR60MW08A	1 / 4	0.7 - 3.5
		THALLIUM	µg/L	1.15E+02	1.15E+02	IR60MW08A	1 / 4	1.9 - 10
		VANADIUM	µg/L	4.50E+00	4.50E+00	IR60MW08A	1 / 4	0.8 - 4

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	AL07	ARSENIC	µg/L	2.35E+00	2.35E+00	IR60MW10A	1 / 3	2.8 - 2.8
		BARIUM	µg/L	5.28E+01 J	6.94E+01 J	IR60MW10A	3 / 3	--
		CADMIUM	µg/L	1.65E+00	2.10E+00 J	IR60MW10A	2 / 3	1.2 - 1.2
		COBALT	µg/L	8.90E-01 J	8.90E-01 J	IR60MW10A	1 / 3	0.64 - 3.1
		MANGANESE	µg/L	1.01E+01 J	3.41E+02	IR60MW10A	3 / 3	--
		MOLYBDENUM	µg/L	3.50E+00	3.50E+00	IR60MW10A	1 / 3	3.7 - 3.8
		NICKEL	µg/L	1.42E+01 J	2.56E+01	IR60MW10A	3 / 3	--
		SELENIUM	µg/L	4.70E+00 J	4.70E+00 J	IR60MW10A	1 / 3	3.4 - 3.9
		THALLIUM	µg/L	3.50E+00	8.10E+00 J	IR60MW10A	2 / 3	5.2 - 5.2
		ZINC	µg/L	2.94E+01	2.94E+01	IR60MW10A	1 / 3	14.1 - 41.9
BOS-2	AM06	ANTIMONY	µg/L	2.70E+00	2.70E+00	IR46MW43A	1 / 3	1.9 - 4.7
		BARIUM	µg/L	4.51E+01	4.51E+01	IR46MW43A	1 / 3	21.5 - 37.5
		CADMIUM	µg/L	3.60E-01	3.60E-01	IR46MW43A	1 / 3	0.1 - 0.2
		SELENIUM	µg/L	3.10E+00	3.10E+00	IR46MW43A	1 / 3	3 - 3.5
		THALLIUM	µg/L	2.15E+00	2.15E+00	IR46MW43A	1 / 3	1.5 - 2
BOS-2	AN05	BARIUM	µg/L	4.41E+01	6.60E+01	IR46MW42A	3 / 3	--
		CADMIUM	µg/L	5.80E+00	5.80E+00	IR46MW42A	1 / 3	0.42 - 2.5
		COBALT	µg/L	3.50E+00 J	3.60E+00	IR46MW42A	2 / 3	1.9 - 1.9
		COPPER	µg/L	9.30E+00	9.30E+00	IR46MW42A	1 / 3	8.7 - 10.75
		MANGANESE	µg/L	5.84E+02	1.84E+03	IR46MW42A	3 / 3	--
		NICKEL	µg/L	3.21E+01	3.42E+01 J	IR46MW42A	2 / 3	13.5 - 13.5
		THALLIUM	µg/L	3.10E+00 J	6.60E+00	IR46MW42A	2 / 3	3 - 3
		VANADIUM	µg/L	1.80E+00	1.80E+00	IR46MW42A	1 / 3	1.5 - 3.3

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	AN06	ANTIMONY	µg/L	2.10E+00	2.10E+00	PA24MW01A	1 / 3	1.9 - 27
		ARSENIC	µg/L	2.90E+00	2.90E+00	PA24MW01A	1 / 3	1.5 - 2.3
		BARIUM	µg/L	4.78E+01	1.53E+02	PA24MW01A	3 / 3	--
		CADMIUM	µg/L	1.35E+01	1.35E+01	PA24MW01A	1 / 3	0.1 - 0.2
		COBALT	µg/L	7.50E-01	1.75E+00	PA24MW01A	2 / 3	7.6 - 7.6
		MANGANESE	µg/L	8.40E+00	3.04E+03	PA24MW01A	3 / 3	--
		MERCURY V	µg/L	8.50E-02	8.50E-02	PA24MW01A	1 / 3	0.1 - 0.2
		MOLYBDENUM	µg/L	9.10E+00	9.10E+00	PA24MW01A	1 / 3	4.75 - 6.2
		NAPHTHALENE V	µg/L	3.00E+00	3.00E+00	PA24MW01A	1 / 3	10 - 10
		NICKEL	µg/L	3.10E+00	4.96E+01	PA24MW01A	2 / 3	10.75 - 10.75
		SELENIUM	µg/L	2.17E+00	2.17E+00	PA24MW01A	1 / 3	2.6 - 3.5
		THALLIUM	µg/L	2.30E+00	2.30E+00	PA24MW01A	1 / 3	4 - 10.5
		VANADIUM	µg/L	1.20E+00	1.20E+00	PA24MW01A	1 / 3	1.1 - 1.8
BOS-2	AO05	2,6-DINITROTOLUENE	µg/L	4.30E+01	1.00E+02	IR46MW39A2	2 / 9	10 - 10
		ANTIMONY	µg/L	2.50E+00	6.92E+00	IR46MW39A3	3 / 9	1.6 - 6
		BARIUM	µg/L	2.19E+01	7.91E+02	IR46MW39A3	8 / 9	55.3 - 55.3
		CADMIUM	µg/L	4.00E-01	4.00E-01	IR46MW39A	1 / 9	0.1 - 2
		CHROMIUM	µg/L	5.80E+00	2.32E+01	IR46MW39A3	2 / 9	0.7 - 3.5
		COBALT	µg/L	5.55E-01	1.83E+00	IR46MW39A3	4 / 9	0.4 - 3.5
		IRON	µg/L	1.70E+02	1.70E+02	IR46MW39A	1 / 9	10.1 - 94
		MANGANESE	µg/L	3.59E+01	1.11E+03 J	IR46MW39A	7 / 9	0.84 - 2.1
		MOLYBDENUM	µg/L	2.90E+00	8.90E+00	IR46MW39A2	3 / 9	1.2 - 5.1
		NICKEL	µg/L	6.50E+00	3.04E+01	IR46MW39A3	2 / 9	1.3 - 16
		SELENIUM	µg/L	2.30E+00	4.67E+00	IR46MW39A3	2 / 9	2.3 - 11.5
		THALLIUM	µg/L	5.55E+00	5.55E+00	IR46MW39A3	1 / 9	1.5 - 10
		VANADIUM	µg/L	7.75E-01	9.30E+00	IR46MW39A2	4 / 9	1.1 - 5.5
		ZINC	µg/L	2.08E+01	2.08E+01	IR46MW39A	1 / 9	3.1 - 21.9

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	AP05	ANTIMONY		µg/L	7.50E+00	7.50E+00	PA24MW02A	1 / 3	1.9 - 14.8
		ARSENIC		µg/L	1.60E+00	1.60E+00	PA24MW02A	1 / 3	1.5 - 5.3
		BARIUM		µg/L	4.16E+01 J	9.18E+01	PA24MW02A	3 / 3	--
		BERYLLIUM		µg/L	1.10E-01	1.10E-01	PA24MW02A	1 / 3	0.1 - 0.6
		CADMIUM		µg/L	1.63E+00	1.63E+00	PA24MW02A	1 / 3	0.1 - 0.2
		CARBON DISULFIDE	V	µg/L	1.10E+01	1.10E+01	PA24MW02A	1 / 6	0.5 - 10
		COBALT		µg/L	6.50E-01	6.50E-01	PA24MW02A	1 / 3	0.7 - 3
		COPPER		µg/L	2.87E+01	2.87E+01	PA24MW02A	1 / 3	0.2 - 0.5
		IRON		µg/L	3.71E+02	3.71E+02	PA24MW02A	1 / 3	18.8 - 25.9
		LEAD		µg/L	1.52E+01	1.52E+01	PA24MW02A	1 / 3	1 - 1.3
		MANGANESE		µg/L	1.04E+02 J	1.07E+03	PA24MW02A	3 / 3	--
		TERT-BUTYL METHYL ETHER	V	µg/L	2.00E+00 J	4.10E+00 J	IR46MW47A	2 / 2	--
		THALLIUM		µg/L	9.70E-01 J	2.70E+00	PA24MW02A	2 / 3	17 - 17
BOS-2	AQ05	1,1-DICHLOROETHANE	V	µg/L	4.75E-01	2.00E+00 J	IR46MW40A2	4 / 6	10 - 10
		BARIUM		µg/L	2.72E+01	8.17E+01	IR46MW40A2	2 / 3	20.5 - 20.5
		CADMIUM		µg/L	1.65E+01	1.65E+01	IR46MW40A2	1 / 3	0.2 - 0.24
		CARBON DISULFIDE	V	µg/L	3.00E+00	3.00E+00	IR46MW48A	1 / 6	0.5 - 10
		M,P-XYLENES	V	µg/L	6.00E-01 J	6.00E-01 J	IR46MW48A	1 / 3	1 - 1
		MANGANESE		µg/L	3.49E+02	1.74E+03	IR46MW40A2	3 / 3	--
		SELENIUM		µg/L	3.50E+00	3.50E+00	IR46MW40A2	1 / 3	3.5 - 11.5
		THALLIUM		µg/L	1.36E+01 J	1.36E+01 J	IR46MW40A2	1 / 3	1.7 - 2

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-2	AR05	1,1-DICHLOROETHANE	V	µg/L	2.00E+00	3.50E+00	IR46MW40A3	2 / 10	1 - 10
		ANTIMONY		µg/L	1.43E+00	7.50E+00	PA24MW03AD	3 / 8	1.9 - 31
		ARSENIC		µg/L	1.13E+00	2.55E+00	IR46MW40A	2 / 9	1.3 - 20
		BARIUM		µg/L	1.03E+01	4.17E+01	PA24MW03AD	7 / 9	31.35 - 33.75
		CADMIUM		µg/L	7.65E+00	7.65E+00	IR46MW40A3	1 / 9	0.1 - 4
		CARBON DISULFIDE	V	µg/L	3.50E+00	2.10E+01	PA24MW03AD	4 / 10	1 - 10
		CHROMIUM		µg/L	6.75E-01	9.00E-01	PA24MW03AD	2 / 9	0.7 - 3
		COBALT		µg/L	4.70E-01	1.37E+00	IR46MW40A3	4 / 9	0.7 - 2
		COPPER		µg/L	8.00E-01	1.82E+01	IR46MW40A3	2 / 9	0.5 - 5.1
		ENDRIN KETONE		µg/L	2.00E-03 J	2.00E-03 J	PA24MW03AD	1 / 9	0.1 - 0.15
		ETHYLBENZENE	V	µg/L	5.75E-01	5.75E-01	IR24MW07A	1 / 18	0.5 - 10
		IRON		µg/L	1.01E+02	6.90E+02	PA24MW03AD	3 / 9	18.8 - 230.5
		M,P-XYLENES	V	µg/L	7.00E-01 J	9.00E-01	IR24MW07A	2 / 6	1 - 1
		MANGANESE		µg/L	1.06E+02	1.26E+03	IR46MW40A3	9 / 9	--
		NICKEL		µg/L	2.00E+00	2.00E+00	PA24MW03AD	1 / 9	1.3 - 7.85
		PYRENE	V	µg/L	1.00E+00 J	3.00E+00 J	PA24MW03AD1	2 / 12	10 - 400
		SELENIUM		µg/L	2.90E+00	4.83E+00	IR46MW40A3	2 / 8	2.3 - 3.5
		SILVER		µg/L	8.10E-01	8.10E-01	PA24MW03AD	1 / 9	0.5 - 2
		THALLIUM		µg/L	1.65E+00	5.15E+00	IR46MW40A3	5 / 8	1.5 - 2
		TOLUENE	V	µg/L	3.00E-01 J	4.50E-01	IR24MW07A	2 / 18	0.5 - 10
		VANADIUM		µg/L	1.20E+00	2.30E+00	PA24MW03AD	3 / 9	0.6 - 3.3
		ZINC		µg/L	1.34E+01	1.34E+01	IR46MW40A	1 / 9	3.1 - 14.7
BOS-2	AS05	M,P-XYLENES	V	µg/L	9.00E-01 J	9.00E-01 J	IR24MW06A	1 / 3	1 - 1
BOS-2	AT05	ARSENIC		µg/L	2.10E+00	2.10E+00	IR46MW41A	1 / 3	1.5 - 2.8
		BARIUM		µg/L	7.91E+01	2.15E+02	IR46MW41A	3 / 3	--
		CARBON DISULFIDE	V	µg/L	5.00E+00	5.00E+00	IR46MW41A	1 / 3	10 - 10
		CHROMIUM		µg/L	6.10E-01	6.10E-01	IR46MW41A	1 / 3	0.7 - 2.5
		COBALT		µg/L	7.75E-01	1.20E+00	IR46MW41A	2 / 3	2 - 2
		MANGANESE		µg/L	1.12E+01	5.35E+02 J	IR46MW41A	3 / 3	--
		MOLYBDENUM		µg/L	1.07E+01	1.07E+01	IR46MW41A	1 / 3	9.2 - 10.5
		NICKEL		µg/L	1.83E+01	2.84E+01 J	IR46MW41A	2 / 3	13.45 - 13.45
		VANADIUM		µg/L	2.70E+00	3.00E+00	IR46MW41A	2 / 3	1.1 - 1.1

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-3	AU05	2,4,6-TRICHLOROPHENOL	µg/L	2.40E+01	2.40E+01	IR26MW40A	1 / 5	10 - 10
		ALUMINUM	µg/L	1.23E+02	1.23E+02	IR26MW42A	1 / 6	21.4 - 99.4
		ARSENIC	µg/L	2.80E+00	2.80E+00	IR26MW40A	1 / 6	1.4 - 14
		BARIUM	µg/L	4.76E+01	6.56E+02 J	IR26MW42A	6 / 6	--
		CHROMIUM	µg/L	8.40E+00	8.40E+00	IR26MW40A	1 / 6	0.4 - 9
		COBALT	µg/L	4.15E+00	7.20E+00	IR26MW42A	4 / 6	2.5 - 9.3
		COPPER	µg/L	5.00E+00	5.00E+00	IR26MW42A	1 / 6	2.1 - 7.2
		IRON	µg/L	1.16E+02	1.16E+02	IR26MW42A	1 / 6	30.9 - 78
		MANGANESE	µg/L	8.60E+02	4.92E+03	IR26MW42A	5 / 6	3 - 3
		MERCURY V	µg/L	1.90E-01	5.90E-01	IR26MW40A	2 / 6	0.1 - 0.1
		MOLYBDENUM	µg/L	1.35E+01	1.35E+01	IR26MW40A	1 / 6	2.4 - 7.4
		NICKEL	µg/L	1.80E+01	1.16E+02	IR26MW40A	6 / 6	--
		THALLIUM	µg/L	2.85E+00	4.80E+00	IR26MW40A	2 / 6	1.9 - 10
		TOLUENE V	µg/L	5.00E-01 J	5.00E-01 J	IR26MW42A	1 / 6	0.5 - 10
		VANADIUM	µg/L	1.90E+00	4.90E+00	IR26MW40A	2 / 6	0.9 - 5
		ZINC	µg/L	1.45E+02	1.45E+02	IR26MW42A	1 / 6	10.5 - 57.1
BOS-3	AV05	1,2-DICHLOROETHENE (TOTAL) V	µg/L	6.00E+00	9.00E+00 J	IR26MW43A	3 / 3	--
		ARSENIC	µg/L	2.20E+00	2.20E+00	IR26MW43A	1 / 3	1.4 - 2.8
		BARIUM	µg/L	9.69E+01	3.60E+02 J	IR26MW43A	3 / 3	--
		CADMIUM	µg/L	1.10E+00	6.20E+00	IR26MW43A	2 / 3	0.2 - 0.2
		COBALT	µg/L	2.60E+00	3.50E+00 J	IR26MW43A	2 / 3	2 - 2
		COPPER	µg/L	8.40E-01	8.40E-01	IR26MW43A	1 / 3	0.5 - 0.68
		HEPTACHLOR EPOXIDE	µg/L	1.00E-02	1.00E-02	IR26MW43A	1 / 3	0.01 - 0.01
		IRON	µg/L	2.19E+02	7.12E+02	IR26MW43A	3 / 3	--
		MANGANESE	µg/L	6.45E+02	2.08E+03 J	IR26MW43A	3 / 3	--
		NICKEL	µg/L	7.20E+00	1.20E+01 J	IR26MW43A	3 / 3	--
		SELENIUM	µg/L	2.50E+00	2.50E+00	IR26MW43A	1 / 3	2.3 - 3.9
		THALLIUM	µg/L	6.40E+00 J	6.40E+00 J	IR26MW43A	1 / 3	1.9 - 1.9
		VANADIUM	µg/L	1.10E+00	1.10E+00	IR26MW43A	1 / 3	0.82 - 1.2
		ZINC	µg/L	1.30E+01	1.30E+01	IR26MW43A	1 / 3	9.6 - 19.7

Table A3-5: Groundwater Data Statistical Summary, Industrial Exposure Areas, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-3	AY02	ALPHA-CHLORDANE	µg/L	7.00E-04 J	5.10E-03 J	IR26MW47A	2 / 7	0.01 - 0.05
		ARSENIC	µg/L	4.75E+00	1.94E+01 J	IR26MW47A	7 / 10	2.1 - 10
		BARIUM	µg/L	5.35E+01	6.73E+01	IR26MW47A	5 / 5	--
		BERYLLIUM	µg/L	4.30E-01	4.30E-01	IR26MW47A	1 / 5	0.5 - 5
		CHROMIUM	µg/L	5.20E+00 J	1.20E+01 J	IR26MW47A	8 / 12	5.4 - 50
		CHROMIUM VI	µg/L	7.50E+00	9.00E+00	IR26MW47A	2 / 12	10 - 20
		COBALT	µg/L	8.00E-01 J	8.00E-01 J	IR26MW47A	1 / 5	0.8 - 50
		COPPER	µg/L	3.00E+00	2.48E+02 J	IR26MW47A	4 / 12	0.6 - 130
		HEPTACHLOR	µg/L	2.80E-02 J	2.80E-02 J	IR26MW47A	1 / 3	0.0089 - 0.017
		MANGANESE	µg/L	5.70E-01	1.42E+01	IR26MW47A	3 / 12	0.2 - 75
		MERCURY V	µg/L	1.80E-01	2.80E+00	IR26MW47A	12 / 12	--
		MOLYBDENUM	µg/L	4.70E+00	8.30E+00	IR26MW47A	3 / 4	5.6 - 5.6
		NICKEL	µg/L	1.12E+01	2.13E+01 J	IR26MW47A	5 / 5	--
		SELENIUM	µg/L	3.00E+00	8.15E+00	IR26MW47A	2 / 5	2.5 - 3.3
		SILVER	µg/L	1.60E+00	1.60E+00	IR26MW47A	1 / 5	0.6 - 1.7
		THALLIUM	µg/L	5.50E+00 J	5.50E+00 J	IR26MW47A	1 / 5	2.1 - 25
		VANADIUM	µg/L	2.60E+00	5.00E+00	IR26MW47A	3 / 5	2.3 - 3
		ZINC	µg/L	1.65E+01	2.81E+01	IR26MW47A	2 / 12	0.8 - 300

Notes:

The maximum concentration was used as the exposure point concentration for non-plume wells. See Section A5.1.2 in Appendix A for a description of the statistical methods used.

-- Not applicable; detection frequency is 100 percent.
µg/L Microgram per liter
J Estimated concentration
RB Redevelopment block
V Chemical is considered volatile.

Table A3-6: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
2	B0238	ARSENIC	µg/L	6.30E+00 J	6.30E+00 J	IR18MW100B	1 / 5	2 - 5.4
		BARIUM	µg/L	2.71E+01 J	4.52E+01 J	IR18MW100B	5 / 5	--
		CHROMIUM	µg/L	1.31E+01	1.46E+01	IR18MW100B	3 / 5	1.6 - 2.2
		CHROMIUM VI	µg/L	2.00E+01	2.00E+01	IR18MW100B	1 / 4	10 - 10
		COBALT	µg/L	4.00E+00 J	4.10E+00 J	IR18MW100B	2 / 5	2 - 4
		IRON	µg/L	7.00E+01 J	5.06E+02	IR18MW100B	3 / 5	24.9 - 25.1
		MANGANESE	µg/L	1.81E+02	3.59E+02 J	IR18MW100B	5 / 5	--
		MOLYBDENUM	µg/L	2.30E+00 J	2.30E+00 J	IR18MW100B	1 / 5	1.6 - 7
		NICKEL	µg/L	4.90E+00 J	1.64E+01 J	IR18MW100B	5 / 5	--
		VANADIUM	µg/L	3.60E+00 J	6.10E+00 J	IR18MW100B	4 / 5	2.3 - 2.3
		ZINC	µg/L	4.00E+00 J	4.48E+01	IR18MW100B	2 / 5	4.2 - 16.1
2	B0337	ACETOPHENONE V	µg/L	6.00E-01 J	6.00E-01 J	IR18MW101B	1 / 1	--
		BARIUM	µg/L	7.34E+01 J	1.43E+02	IR18MW101B	5 / 5	--
		CHROMIUM	µg/L	1.94E+01	3.59E+01	IR18MW101B	5 / 5	--
		CHROMIUM VI	µg/L	2.00E+01	3.00E+01	IR18MW101B	3 / 3	--
		IRON	µg/L	7.54E+01	4.03E+02	IR18MW101B	3 / 5	24.9 - 28.1
		MANGANESE	µg/L	2.67E+01	8.23E+01	IR18MW101B	2 / 5	1 - 2.1
		NICKEL	µg/L	4.25E+00	1.28E+01	IR18MW101B	4 / 5	2.9 - 2.9
		VANADIUM	µg/L	5.50E+00 J	7.95E+00	IR18MW101B	5 / 5	--
		ZINC	µg/L	4.40E+00 J	4.40E+00 J	IR18MW101B	1 / 5	1 - 24.15

Table A3-6: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern		Units	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	B0139	1,4-DICHLOROBENZENE	V	µg/L	2.70E-01	J	4.10E-01	J	IR18MW21A	3 / 14	0.5 - 10
		ACETONE	V	µg/L	3.00E+00	J	3.00E+00	J	IR18MW21A	1 / 14	5 - 10
		ACETOPHENONE	V	µg/L	2.00E+00	J	3.00E+00		IR18MW21A	2 / 8	10 - 10
		ALPHA-CHLORDANE		µg/L	1.90E-03	J	2.10E-03	J	IR18MW21A	2 / 9	0.01 - 0.05
		ALUMINUM		µg/L	3.05E+01		3.05E+01		IR18MW21A	1 / 13	2.6 - 200
		ANTIMONY		µg/L	2.70E+00		2.11E+01	J	IR18MW21A	2 / 14	2.3 - 60
		ARSENIC		µg/L	2.50E+00	J	9.50E+00	J	IR18MW21A	4 / 13	1.6 - 10
		BARIUM		µg/L	8.16E+01		2.31E+02		IR18MW21A	14 / 14	--
		BENZENE	V	µg/L	1.00E+00	J	1.00E+00	J	IR18MW21A	1 / 14	0.5 - 10
		BERYLLIUM		µg/L	2.80E-01		2.80E-01		IR18MW21A	1 / 14	0.081 - 5
		CAPROLACTAM	V	µg/L	9.00E-01	J	9.00E-01	J	IR18MW21A	1 / 7	0.6 - 10
		CARBON DISULFIDE	V	µg/L	9.00E+00	J	9.00E+00	J	IR18MW21AD	2 / 14	0.5 - 10
		CHLOROBENZENE	V	µg/L	5.00E-01	J	4.00E+00	J	IR18MW21AD	11 / 14	10 - 10
		CHLOROETHANE	V	µg/L	1.30E+01		1.30E+01		IR18MW21A	1 / 14	0.5 - 10
		CHROMIUM		µg/L	7.50E-01		1.80E+00	J	IR18MW21A	2 / 14	0.6 - 10
		CIS-1,2-DICHLOROETHENE	V	µg/L	3.00E-01	J	3.40E-01	J	IR18MW21A	3 / 11	0.5 - 10
		COBALT		µg/L	1.30E+00	J	1.67E+01	J	IR18MW21A	3 / 14	0.7 - 50
		COPPER		µg/L	1.40E+00	J	1.40E+00	J	IR18MW21A	1 / 14	0.6 - 25
		GAMMA-CHLORDANE		µg/L	8.30E-03	J	8.30E-03	J	IR18MW21A	1 / 9	0.003 - 0.05
		HEPTACHLOR		µg/L	1.10E-02	J	1.10E-02	J	IR18MW21A	1 / 9	0.0081 - 0.05
		IRON		µg/L	5.04E+01		1.73E+03		IR18MW21A	14 / 14	--
		LEAD		µg/L	2.30E+00	J	2.30E+00	J	IR18MW21A	1 / 13	0.7 - 10
		MANGANESE		µg/L	4.15E+02		1.36E+03	J	IR18MW21A	14 / 14	--
		MERCURY	V	µg/L	2.75E-02		2.75E-02		IR18MW21AD	1 / 14	0.047 - 0.2
		MOLYBDENUM		µg/L	2.40E+00		2.80E+00	J	IR18MW21A	4 / 13	0.52 - 5
		NICKEL		µg/L	1.70E+00		5.50E+00	J	IR18MW21A	3 / 14	1.8 - 40
		PENTACHLOROPHENOL	V	µg/L	2.40E+01		2.40E+01		IR18MW21A	1 / 10	25 - 25
		SILVER		µg/L	8.82E+00		8.82E+00		IR18MW21AD	1 / 14	0.4 - 10
		TERT-BUTYL METHYL ETHER	V	µg/L	3.50E-01	J	8.30E-01	J	IR18MW21A	2 / 11	0.5 - 10
		THALLIUM		µg/L	1.40E+00		8.35E+00		IR18MW21A	3 / 12	2.5 - 28
		TOLUENE	V	µg/L	2.00E+00	J	2.00E+00	J	IR18MW21A	1 / 14	0.5 - 10
		TRICHLOROETHENE	V	µg/L	2.00E+00	J	2.00E+00	J	IR18MW21A	1 / 14	0.5 - 10

Table A3-6: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
BOS-1	B0139	VANADIUM	µg/L	3.95E-01	1.30E+00	IR18MW21A	3 / 14	0.8 - 50
BOS-1	B0237	ANTIMONY	µg/L	1.41E+01	1.41E+01	PA18MW09A	1 / 3	15.4 - 25.5
		BARIUM	µg/L	9.50E+01	1.16E+02	PA18MW09A	3 / 3	--
		COBALT	µg/L	3.40E+00	6.20E+00	PA18MW09A	2 / 3	8.1 - 8.1
		IRON	µg/L	6.90E+01 J	6.90E+01 J	PA18MW09A	1 / 3	25.8 - 96.3
		MANGANESE	µg/L	2.00E+03	2.41E+03 J	PA18MW09A	3 / 3	--
		NICKEL	µg/L	1.65E+01	2.66E+01	PA18MW09A	3 / 3	--

Notes:

The maximum concentration was used as the exposure point concentration for non-plume wells. See Section A5.1.2 in Appendix A for a description of the statistical methods used.

-- Not applicable; detection frequency is 100 percent.
µg/L Microgram per liter
J Estimated concentration
RB Redevelopment block
V Chemical is considered volatile.

Table A3-7: Groundwater Data Statistical Summary, Residential Exposure Areas, Non-Plume Wells, B-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Location of Maximum	Detection Frequency	Range of Detection Limits
2	B0238	ARSENIC	µg/L	6.30E+00 J	6.30E+00 J	IR18MW100B	1 / 5	2 - 5.4
		BARIUM	µg/L	2.71E+01 J	4.52E+01 J	IR18MW100B	5 / 5	--
		CHROMIUM	µg/L	1.31E+01	1.46E+01	IR18MW100B	3 / 5	1.6 - 2.2
		CHROMIUM VI	µg/L	2.00E+01	2.00E+01	IR18MW100B	1 / 4	10 - 10
		COBALT	µg/L	4.00E+00 J	4.10E+00 J	IR18MW100B	2 / 5	2 - 4
		IRON	µg/L	7.00E+01 J	5.06E+02	IR18MW100B	3 / 5	24.9 - 25.1
		MANGANESE	µg/L	1.81E+02	3.59E+02 J	IR18MW100B	5 / 5	--
		MOLYBDENUM	µg/L	2.30E+00 J	2.30E+00 J	IR18MW100B	1 / 5	1.6 - 7
		NICKEL	µg/L	4.90E+00 J	1.64E+01 J	IR18MW100B	5 / 5	--
		VANADIUM	µg/L	3.60E+00 J	6.10E+00 J	IR18MW100B	4 / 5	2.3 - 2.3
		ZINC	µg/L	4.00E+00 J	4.48E+01	IR18MW100B	2 / 5	4.2 - 16.1
2	B0337	ACETOPHENONE V	µg/L	6.00E-01 J	6.00E-01 J	IR18MW101B	1 / 1	--
		BARIUM	µg/L	7.34E+01 J	1.43E+02	IR18MW101B	5 / 5	--
		CHROMIUM	µg/L	1.94E+01	3.59E+01	IR18MW101B	5 / 5	--
		CHROMIUM VI	µg/L	2.00E+01	3.00E+01	IR18MW101B	3 / 3	--
		IRON	µg/L	7.54E+01	4.03E+02	IR18MW101B	3 / 5	24.9 - 28.1
		MANGANESE	µg/L	2.67E+01	8.23E+01	IR18MW101B	2 / 5	1 - 2.1
		NICKEL	µg/L	4.25E+00	1.28E+01	IR18MW101B	4 / 5	2.9 - 2.9
		VANADIUM	µg/L	5.50E+00 J	7.95E+00	IR18MW101B	5 / 5	--
		ZINC	µg/L	4.40E+00 J	4.40E+00 J	IR18MW101B	1 / 5	1 - 24.15

Notes:

The maximum concentration was used as the exposure point concentration for non-plume wells. See Section A5.1.2 in Appendix A for a description of the statistical methods used.

-- Not applicable; detection frequency is 100 percent.
µg/L Microgram per liter
J Estimated concentration
RB Redevelopment block
V Chemical is considered volatile.

TABLE A3-8: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR RESIDENTIAL EXPOSURE VIA VAPOR INTRUSION, IR-10A PLUME, A-AQUIFER
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-R [c] (µg/L)	Noncancer Inhalation RBSL-VI-R [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 9	1,1-DICHLOROETHANE	4.00E-01	4.00E-01	6.48E+00	2.13E+03	6.17E-08	1.88E-04	6.17E-08	1.88E-04
	1,1-DICHLOROETHENE	9.40E-01	9.40E-01	–	1.86E+02	–	5.04E-03	–	5.04E-03
	1,2-DICHLOROETHANE	1.80E-01	1.80E-01	2.33E+00	1.22E+02	7.72E-08	1.47E-03	7.72E-08	1.47E-03
	1,2-DICHLOROETHENE (TOTAL)	6.60E+01	2.33E+01	–	2.09E+02	–	3.15E-01	–	1.11E-01
	BENZENE	3.00E-01	3.00E-01	3.74E-01	1.32E+02	8.02E-07	2.27E-03	8.02E-07	2.27E-03
	BROMOMETHANE	3.00E-01	3.00E-01	–	1.92E+01	–	1.57E-02	–	1.57E-02
	CARBON DISULFIDE	1.00E+00	1.00E+00	–	5.63E+02	–	1.77E-03	–	1.77E-03
	CHLOROFORM	6.00E+00	4.31E+00	6.99E-01	3.26E+02	8.59E-06	1.84E-02	6.16E-06	1.32E-02
	CIS-1,2-DICHLOROETHENE	2.00E+02	6.87E+01	–	2.09E+02	–	9.56E-01	–	3.28E-01
	METHYLENE CHLORIDE	4.00E-01	4.00E-01	2.71E+01	3.35E+04	1.48E-08	1.19E-05	1.48E-08	1.19E-05
	NAPHTHALENE	4.00E-01	4.00E-01	3.58E+00	1.52E+02	1.12E-07	2.63E-03	1.12E-07	2.63E-03
	TERT-BUTYL METHYL ETHER	5.00E-01	5.00E-01	3.89E+02	1.25E+05	1.29E-09	4.00E-06	1.29E-09	4.00E-06
	TOLUENE	4.00E-01	4.00E-01	–	1.41E+03	–	2.83E-04	–	2.83E-04
	TRANS-1,2-DICHLOROETHENE	3.90E+01	1.05E+01	–	1.82E+02	–	2.14E-01	–	5.76E-02
	TRICHLOROETHENE	6.10E+02	1.85E+02	2.88E+00	1.41E+03	2.12E-04	4.33E-01	6.44E-05	1.32E-01
	VINYL CHLORIDE	1.70E+02	1.70E+02	2.85E-02	9.04E+01	5.97E-03	1.88E+00	5.97E-03	1.88E+00
					TOTAL	**6.2E-03**	**3.8E+00**	**6.0E-03**	**2.6E+00**

Notes:

a MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.

b The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then MAX is used as the RME EPC.

c Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L	Microgram per liter	MAX	Maximum detected concentration
–	Not applicable	RME	Reasonable maximum exposure
95 UCL	95 percent upper confidence level	RBSL-VI-R	Risk-based screening level for vapor intrusion, residential exposure scenario
EPC	Exposure point concentration		

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-9: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR INDUSTRIAL EXPOSURE VIA VAPOR INTRUSION, IR-10A PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-IW [c] (µg/L)	Noncancer Inhalation RBSL-VI-IW [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 9	1,1-DICHLOROETHANE	4.00E-01	4.00E-01	1.09E+01	2.13E+03	3.67E-08	1.88E-04	3.67E-08	1.88E-04
	1,1-DICHLOROETHENE	9.40E-01	9.40E-01	--	1.86E+02	--	5.04E-03	--	5.04E-03
	1,2-DICHLOROETHANE	1.80E-01	1.80E-01	3.92E+00	1.22E+02	4.60E-08	1.47E-03	4.60E-08	1.47E-03
	1,2-DICHLOROETHENE (TOTAL)	6.60E+01	2.33E+01	--	2.09E+02	--	3.15E-01	--	1.11E-01
	BENZENE	3.00E-01	3.00E-01	6.29E-01	1.32E+02	4.77E-07	2.27E-03	4.77E-07	2.27E-03
	BROMOMETHANE	3.00E-01	3.00E-01	--	1.92E+01	--	1.57E-02	--	1.57E-02
	CARBON DISULFIDE	1.00E+00	1.00E+00	--	5.63E+02	--	1.77E-03	--	1.77E-03
	CHLOROFORM	6.00E+00	4.31E+00	1.17E+00	3.26E+02	5.11E-06	1.84E-02	3.67E-06	1.32E-02
	CIS-1,2-DICHLOROETHENE	2.00E+02	6.87E+01	--	2.09E+02	--	9.56E-01	--	3.28E-01
	METHYLENE CHLORIDE	4.00E-01	4.00E-01	4.55E+01	3.35E+04	8.79E-09	1.19E-05	8.79E-09	1.19E-05
	NAPHTHALENE	4.00E-01	4.00E-01	6.02E+00	1.52E+02	6.64E-08	2.63E-03	6.64E-08	2.63E-03
	TERT-BUTYL METHYL ETHER	5.00E-01	5.00E-01	6.53E+02	1.25E+05	7.65E-10	4.00E-06	7.65E-10	4.00E-06
	TOLUENE	4.00E-01	4.00E-01	--	1.41E+03	--	2.83E-04	--	2.83E-04
	TRANS-1,2-DICHLOROETHENE	3.90E+01	1.05E+01	--	1.82E+02	--	2.14E-01	--	5.76E-02
	TRICHLOROETHENE	6.10E+02	1.85E+02	4.84E+00	1.41E+03	1.26E-04	4.33E-01	3.83E-05	1.32E-01
	VINYL CHLORIDE	1.70E+02	1.70E+02	4.79E-02	9.04E+01	3.55E-03	1.88E+00	3.55E-03	1.88E+00
					TOTAL	**3.7E-03**	**3.8E+00**	**3.6E-03**	**2.6E+00**

Notes:

a MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.

b The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then MAX is used as the RME EPC.

c Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L	Microgram per liter	MAX	Maximum detected concentration
--	Not applicable	RME	Reasonable maximum exposure
95 UCL	95 percent upper confidence level	RBSL-VI-IW	Risk-based screening level for vapor intrusion, industrial worker exposure scenario
EPC	Exposure point concentration		

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-10: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-10A PLUME, A-AQUIFER
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
8, 9	1,1-DICHLOROETHANE	4.00E-01	4.00E-01	4.05E-11	8.45E-10	8.86E-10	4.97E-06	7.41E-05	7.91E-05	4.05E-11	8.45E-10	8.86E-10	4.97E-06	7.41E-05	7.91E-05
	1,1-DICHLOROETHENE	9.40E-01	9.40E-01	--	--	--	4.19E-05	4.36E-04	4.78E-04	--	--	--	4.19E-05	4.36E-04	4.78E-04
	1,2-DICHLOROETHANE	1.80E-01	1.80E-01	1.82E-10	5.79E-09	5.98E-09	7.01E-06	3.18E-03	3.19E-03	1.82E-10	5.79E-09	5.98E-09	7.01E-06	3.18E-03	3.19E-03
	1,2-DICHLOROETHENE (TOTAL)	6.60E+01	2.33E+01	--	--	--	9.43E-03	1.73E-01	1.82E-01	--	--	--	3.33E-03	6.09E-02	6.42E-02
	ALUMINUM	3.41E+03	3.41E+03	--	--	--	6.33E-04	--	6.33E-04	--	--	--	6.33E-04	--	6.33E-04
	ANTIMONY	4.66E+01	3.85E+01	--	--	--	2.16E-02	--	2.16E-02	--	--	--	1.79E-02	--	1.79E-02
	ARSENIC	3.00E+00	2.79E+00	7.51E-08	--	7.51E-08	1.86E-03	--	1.86E-03	6.98E-08	--	6.98E-08	1.72E-03	--	1.72E-03
	BARIUM	8.54E+02	2.74E+02	--	--	--	7.92E-04	--	7.92E-04	--	--	--	2.54E-04	--	2.54E-04
	BENZENE	3.00E-01	3.00E-01	1.19E-09	1.25E-08	1.37E-08	2.09E-04	1.02E-03	1.23E-03	1.19E-09	1.25E-08	1.37E-08	2.09E-04	1.02E-03	1.23E-03
	BERYLLIUM	1.40E+00	1.40E+00	--	--	--	1.30E-04	--	1.30E-04	--	--	--	1.30E-04	--	1.30E-04
	BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+02	1.20E+02	1.11E-07	--	1.11E-07	2.78E-02	--	2.78E-02	1.11E-07	--	1.11E-07	2.78E-02	--	2.78E-02
	BROMOMETHANE	3.00E-01	3.00E-01	--	--	--	1.11E-04	5.68E-03	5.79E-03	--	--	--	1.11E-04	5.68E-03	5.79E-03
	CADMIUM	3.00E+00	3.00E+00	--	--	--	1.11E-03	--	1.11E-03	--	--	--	1.11E-03	--	1.11E-03
	CARBON DISULFIDE	1.00E+00	1.00E+00	--	--	--	3.15E-05	1.49E-04	1.81E-04	--	--	--	3.15E-05	1.49E-04	1.81E-04
	CHLOROFORM	6.00E+00	4.31E+00	3.35E-09	1.63E-07	1.67E-07	7.57E-04	1.01E-02	1.08E-02	2.41E-09	1.17E-07	1.20E-07	5.43E-04	7.23E-03	7.77E-03
	CHROMIUM	3.54E+01	3.54E+01	--	--	--	4.38E-06	--	4.38E-06	--	--	--	4.38E-06	--	4.38E-06
	CIS-1,2-DICHLOROETHENE	2.00E+02	6.87E+01	--	--	--	2.86E-02	5.22E-01	5.51E-01	--	--	--	9.81E-03	1.79E-01	1.89E-01
	COBALT	1.55E+01	1.55E+01	--	--	--	5.75E-05	--	5.75E-05	--	--	--	5.75E-05	--	5.75E-05
	COPPER	3.95E+01	2.22E+01	--	--	--	1.98E-04	--	1.98E-04	--	--	--	1.11E-04	--	1.11E-04
	IRON	5.53E+03	5.53E+03	--	--	--	3.42E-03	--	3.42E-03	--	--	--	3.42E-03	--	3.42E-03
	LEAD	5.80E+00	5.80E+00	--	--	--	--	--	--	--	--	--	--	--	--
	MANGANESE	1.79E+03	8.04E+02	--	--	--	1.38E-02	--	1.38E-02	--	--	--	6.22E-03	--	6.22E-03
	METHYLENE CHLORIDE	4.00E-01	4.00E-01	5.19E-11	5.51E-10	6.03E-10	4.33E-06	1.28E-05	1.71E-05	5.19E-11	5.51E-10	6.03E-10	4.33E-06	1.28E-05	1.71E-05
	MOLYBDENUM	3.28E+01	3.28E+01	--	--	--	1.22E-03	--	1.22E-03	--	--	--	1.22E-03	--	1.22E-03
	NAPHTHALENE	4.00E-01	4.00E-01	5.98E-09	1.42E-08	2.02E-08	1.74E-04	9.62E-03	9.79E-03	5.98E-09	1.42E-08	2.02E-08	1.74E-04	9.62E-03	9.79E-03
	NICKEL	9.38E+01	5.05E+01	--	--	--	1.74E-04	--	1.74E-04	--	--	--	9.37E-05	--	9.37E-05
	SELENIUM	7.30E+00	7.30E+00	--	--	--	2.71E-04	--	2.71E-04	--	--	--	2.71E-04	--	2.71E-04
	SILVER	2.07E+01	2.07E+01	--	--	--	4.61E-04	--	4.61E-04	--	--	--	4.61E-04	--	4.61E-04
	TERT-BUTYL METHYL ETHER	5.00E-01	5.00E-01	3.58E-13	1.64E-10	1.64E-10	1.62E-08	1.47E-05	1.47E-05	3.58E-13	1.64E-10	1.64E-10	1.62E-08	1.47E-05	1.47E-05
	TOLUENE	4.00E-01	4.00E-01	--	--	--	1.15E-05	9.79E-05	1.09E-04	--	--	--	1.15E-05	9.79E-05	1.09E-04
	TRANS-1,2-DICHLOROETHENE	3.90E+01	1.05E+01	--	--	--	2.79E-03	5.13E-02	5.41E-02	--	--	--	7.49E-04	1.38E-02	1.45E-02
	TRICHLOROETHENE	6.10E+02	1.85E+02	2.52E-07	1.38E-06	1.63E-06	--	8.05E-02	8.05E-02	7.67E-08	4.20E-07	4.96E-07	--	2.45E-02	2.45E-02
	VANADIUM	7.06E+01	7.06E+01	--	--	--	1.31E-02	--	1.31E-02	--	--	--	1.31E-02	--	1.31E-02
	VINYL CHLORIDE	1.70E+02	1.70E+02	1.89E-06	2.16E-05	2.35E-05	5.89E-02	1.96E-01	2.54E-01	1.89E-06	2.16E-05	2.35E-05	5.89E-02	1.96E-01	2.54E-01
	ZINC	2.08E+02	1.92E+02	--	--	--	7.72E-05	--	7.72E-05	--	--	--	7.13E-05	--	7.13E-05
			TOTAL	**2.3E-06**	**2.3E-05**	**2.5E-05**	**1.9E-01**	**1.1E+00**	**1.2E+00**	**2.2E-06**	**2.2E-05**	**2.4E-05**	**1.5E-01**	**5.0E-01**	**6.5E-01**

TABLE A3-10: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-10A PLUME, A-AQUIFER (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a	The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then MAX is used as the RME EPC.
µg/L	Microgram per liter
--	Not applicable
95 UCL	95 percent upper confidence level
EPC	Exposure point concentration
MAX	Maximum detected concentration
RME	Reasonable maximum exposure

TABLE A3-11: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR RESIDENTIAL EXPOSURE VIA VAPOR INTRUSION, IR-10B PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-R [c] (µg/L)	Noncancer Inhalation RBSL-VI-R [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
6, 8	CARBON DISULFIDE	9.60E-01	9.60E-01	--	5.63E+02	--	1.70E-03	--	1.70E-03
	MERCURY	5.50E-02	5.50E-02	--	6.80E-01	--	8.09E-02	--	8.09E-02
					TOTAL	--	**8.3E-02**	--	**8.3E-02**

Notes:

a MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.

b The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

c Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L Microgram per liter

-- Not applicable

95 UCL 95 percent upper confidence level

EPC Exposure point concentration

MAX Maximum detected concentration

RME Reasonable maximum exposure

RBSL-VI-R Risk-based screening level for vapor intrusion, residential exposure scenario

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-12: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR INDUSTRIAL EXPOSURE VIA VAPOR INTRUSION, IR-10B PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-IW [c] (µg/L)	Noncancer Inhalation RBSL-VI-IW [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
6, 8	CARBON DISULFIDE	9.60E-01	9.60E-01	--	5.63E+02	--	1.70E-03	--	1.70E-03
	MERCURY	5.50E-02	5.50E-02	--	6.80E-01	--	8.09E-02	--	8.09E-02
					TOTAL	--	8.3E-02	--	8.3E-02

Notes:

a	MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.
b	The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.
c	Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L	Microgram per liter
--	Not applicable
95 UCL	95 percent upper confidence level
EPC	Exposure point concentration
MAX	Maximum detected concentration
RME	Reasonable maximum exposure
RBSL-VI-IW	Risk-based screening level for vapor intrusion, industrial worker exposure scenario

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-13: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-10B PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
6, 8	ALUMINUM	2.18E+01	2.18E+01	--	--	--	4.04E-06	--	4.04E-06	--	--	--	4.04E-06	--	4.04E-06
	ANTIMONY	5.20E+00	5.20E+00	--	--	--	2.41E-03	--	2.41E-03	--	--	--	2.41E-03	--	2.41E-03
	ARSENIC	4.80E+00	4.80E+00	1.20E-07	--	1.20E-07	2.97E-03	--	2.97E-03	1.20E-07	--	1.20E-07	2.97E-03	--	2.97E-03
	BARIUM	9.53E+02	3.28E+02	--	--	--	8.84E-04	--	8.84E-04	--	--	--	3.05E-04	--	3.05E-04
	BERYLLIUM	1.75E-01	1.75E-01	--	--	--	1.62E-05	--	1.62E-05	--	--	--	1.62E-05	--	1.62E-05
	BIS(2-ETHYLHEXYL)PHTHALATE	7.83E+01	7.83E+01	7.26E-08	--	7.26E-08	1.81E-02	--	1.81E-02	7.26E-08	--	7.26E-08	1.81E-02	--	1.81E-02
	CARBON DISULFIDE	9.60E-01	9.60E-01	--	--	--	3.03E-05	1.43E-04	1.73E-04	--	--	--	3.03E-05	1.43E-04	1.73E-04
	CHROMIUM	1.14E+03	8.24E+02	--	--	--	1.41E-04	--	1.41E-04	--	--	--	1.02E-04	--	1.02E-04
	CHROMIUM VI	5.50E+02	3.26E+02	--	--	--	6.80E-05	--	6.80E-05	--	--	--	4.03E-05	--	4.03E-05
	COBALT	9.28E+00	7.14E+00	--	--	--	3.44E-05	--	3.44E-05	--	--	--	2.65E-05	--	2.65E-05
	COPPER	2.58E+01	2.58E+01	--	--	--	1.29E-04	--	1.29E-04	--	--	--	1.29E-04	--	1.29E-04
	IRON	3.26E+02	3.26E+02	--	--	--	2.02E-04	--	2.02E-04	--	--	--	2.02E-04	--	2.02E-04
	MANGANESE	4.54E+02	2.82E+02	--	--	--	3.51E-03	--	3.51E-03	--	--	--	2.18E-03	--	2.18E-03
	MERCURY	5.50E-02	5.50E-02	--	--	--	3.40E-05	1.17E-02	1.18E-02	--	--	--	3.40E-05	1.17E-02	1.18E-02
	MOLYBDENUM	6.80E+00	6.80E+00	--	--	--	2.52E-04	--	2.52E-04	--	--	--	2.52E-04	--	2.52E-04
	NICKEL	2.07E+01	1.73E+01	--	--	--	3.83E-05	--	3.83E-05	--	--	--	3.21E-05	--	3.21E-05
	SELENIUM	5.10E+00	5.10E+00	--	--	--	1.89E-04	--	1.89E-04	--	--	--	1.89E-04	--	1.89E-04
	SILVER	6.85E+00	6.85E+00	--	--	--	1.52E-04	--	1.52E-04	--	--	--	1.52E-04	--	1.52E-04
	THALLIUM	1.02E+01	1.02E+01	--	--	--	2.87E-02	--	2.87E-02	--	--	--	2.87E-02	--	2.87E-02
	VANADIUM	3.42E+01	1.37E+01	--	--	--	6.34E-03	--	6.34E-03	--	--	--	2.54E-03	--	2.54E-03
	ZINC	1.52E+02	1.52E+02	--	--	--	5.64E-05	--	5.64E-05	--	--	--	5.64E-05	--	5.64E-05
			TOTAL	1.9E-07	--	1.9E-07	6.4E-02	1.2E-02	7.6E-02	1.9E-07	--	1.9E-07	5.8E-02	1.2E-02	7.0E-02

Notes:

a	The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.
µg/L	Microgram per liter
--	Not applicable
95 UCL	95 percent upper confidence level
EPC	Exposure point concentration
MAX	Maximum detected concentration
RME	Reasonable maximum exposure

TABLE A3-14: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR RESIDENTIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-R [c] (µg/L)	Noncancer Inhalation RBSL-VI-R [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	1,1,1-TRICHLOROETHANE	7.20E+02	7.20E+02	--	3.13E+03	--	2.30E-01	--	2.30E-01
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETH	1.40E+02	5.42E+01	--	1.27E+03	--	1.10E-01	--	4.27E-02
	1,1-DICHLOROETHANE	5.00E+00	3.10E+00	6.48E+00	2.13E+03	7.71E-07	2.35E-03	4.78E-07	1.46E-03
	1,1-DICHLOROETHENE	4.20E+01	2.20E+01	--	1.86E+02	--	2.25E-01	--	1.18E-01
	1,2,3-TRICHLOROBENZENE	5.60E-01	5.60E-01	--	6.61E+01	--	8.47E-03	--	8.47E-03
	1,2,4-TRICHLOROBENZENE	2.00E+02	1.07E+02	--	6.61E+01	--	3.02E+00	--	1.62E+00
	1,2,4-TRIMETHYLBENZENE	9.30E+01	9.06E+01	--	2.55E+01	--	3.65E+00	--	3.56E+00
	1,2-DICHLOROBENZENE	6.20E+04	1.12E+04	--	2.56E+03	--	2.42E+01	--	4.38E+00
	1,2-DICHLOROETHANE	1.50E+05	2.50E+04	2.33E+00	1.22E+02	6.43E-02	1.23E+03	1.07E-02	2.05E+02
	1,2-DICHLOROETHENE (TOTAL)	5.70E+04	8.17E+03	--	2.09E+02	--	2.72E+02	--	3.90E+01
	1,2-DICHLOROPROPANE	3.50E+02	2.18E+02	1.09E+00	3.35E+01	3.21E-04	1.04E+01	2.00E-04	6.50E+00
	1,3,5-TRIMETHYLBENZENE	2.20E+01	2.20E+01	--	1.88E+01	--	1.17E+00	--	1.17E+00
	1,3-DICHLOROBENZENE	6.30E+02	2.69E+02	--	1.35E+03	--	4.67E-01	--	2.00E-01
	1,4-DICHLOROBENZENE	1.50E+04	3.70E+03	2.14E+00	8.08E+03	7.02E-03	1.86E+00	1.73E-03	4.58E-01
	1,6,7-TRIMETHYLNAPHTHALENE	4.00E-01	4.00E-01	--	7.07E+02	--	5.66E-04	--	5.66E-04
	1-METHYLNAPHTHALENE	4.00E+00	4.00E+00	--	7.07E+02	--	5.66E-03	--	5.66E-03
	1-METHYLPHENANTHRENE	5.00E-02	5.00E-02	--	1.90E+05	--	2.64E-07	--	2.64E-07
	2,6-DIMETHYLNAPHTHALENE	2.00E+00	2.00E+00	--	7.07E+02	--	2.83E-03	--	2.83E-03
	2-BUTANONE	2.90E+01	2.90E+01	--	4.36E+06	--	6.65E-06	--	6.65E-06
	2-CHLORONAPHTHALENE	1.00E+00	1.00E+00	--	1.41E+04	--	7.07E-05	--	7.07E-05
	2-METHYLNAPHTHALENE	9.20E+02	4.86E+02	--	7.07E+02	--	1.30E+00	--	6.87E-01
	4-METHYL-2-PENTANONE	9.00E+00	9.00E+00	--	5.24E+05	--	1.72E-05	--	1.72E-05
	ACENAPHTHENE	8.90E+01	6.80E+01	--	3.30E+04	--	2.69E-03	--	2.06E-03
	ACENAPHTHYLENE	2.00E+00	2.00E+00	--	3.30E+04	--	6.05E-05	--	6.05E-05
	ACETONE	2.10E+03	1.82E+03	--	1.98E+06	--	1.06E-03	--	9.21E-04
	ACETOPHENONE	6.00E+00	6.00E+00	--	7.54E+05	--	7.95E-06	--	7.95E-06
	ANTHRACENE	4.00E+00	2.50E+00	--	3.94E+05	--	1.02E-05	--	6.33E-06
	BENZENE	4.00E+02	9.33E+01	3.74E-01	1.32E+02	1.07E-03	3.02E+00	2.49E-04	7.05E-01
	BIPHENYL	1.00E+01	1.00E+01	--	1.42E+04	--	7.03E-04	--	7.03E-04

TABLE A3-14: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR RESIDENTIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-R [c] (µg/L)	Noncancer Inhalation RBSL-VI-R [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	BROMODICHLOROMETHANE	1.30E+02	1.30E+02	9.99E-01	1.07E+03	1.30E-04	1.22E-01	1.30E-04	1.22E-01
	CARBON DISULFIDE	6.55E+01	5.31E+01	--	5.63E+02	--	1.16E-01	--	9.43E-02
	CHLOROBENZENE	2.30E+03	1.53E+03	--	3.92E+02	--	5.86E+00	--	3.90E+00
	CHLOROETHANE	8.10E+01	5.06E+01	6.51E+00	2.25E+04	1.24E-05	3.60E-03	7.77E-06	2.25E-03
	CHLOROFORM	3.90E+01	1.34E+01	6.99E-01	3.26E+02	5.58E-05	1.20E-01	1.92E-05	4.12E-02
	CHLOROMETHANE	4.00E-01	4.00E-01	--	9.25E+01	--	4.33E-03	--	4.33E-03
	CIS-1,2-DICHLOROETHENE	5.80E+04	1.48E+04	--	2.09E+02	--	2.77E+02	--	7.09E+01
	CYCLOHEXANE	5.10E-01	5.10E-01	--	7.26E+02	--	7.03E-04	--	7.03E-04
	DIBENZOFURAN	3.20E+01	1.45E+01	--	1.31E+04	--	2.44E-03	--	1.10E-03
	DIBENZOTHIOPHENE	1.00E-01	1.00E-01	--	4.43E+04	--	2.26E-06	--	2.26E-06
	DICHLORODIFLUOROMETHANE	4.20E+00	4.20E+00	--	1.43E+01	--	2.95E-01	--	2.95E-01
	ETHYLBENZENE	1.50E+01	6.42E+00	--	3.14E+03	--	4.77E-03	--	2.04E-03
	FLUORENE	1.30E+02	2.33E+01	--	4.43E+04	--	2.93E-03	--	5.25E-04
	ISOPROPYLBENZENE	4.40E+00	1.93E+00	--	7.83E+00	--	5.62E-01	--	2.47E-01
	M,P-XYLENES	2.80E+01	2.80E+01	--	3.37E+02	--	8.30E-02	--	8.30E-02
	MERCURY	8.00E+00	3.56E+00	--	6.80E-01	--	1.18E+01	--	5.23E+00
	METHYLCYCLOHEXANE	7.20E-01	7.20E-01	--	1.71E+02	--	4.22E-03	--	4.22E-03
	METHYLENE CHLORIDE	2.00E+02	2.00E+02	2.71E+01	3.35E+04	7.38E-06	5.97E-03	7.38E-06	5.97E-03
	NAPHTHALENE	3.70E+02	2.04E+02	3.58E+00	1.52E+02	1.03E-04	2.43E+00	5.69E-05	1.34E+00
	O-XYLENE	1.60E+01	1.60E+01	--	3.37E+02	--	4.74E-02	--	4.74E-02
	PARA-ISOPROPYL TOLUENE	3.40E+01	3.40E+01	--	8.17E+02	--	4.16E-02	--	4.16E-02
	PHENANTHRENE	5.90E+02	2.01E+02	--	1.90E+05	--	3.11E-03	--	1.06E-03
	PYRENE	9.00E+00	4.68E+00	--	2.33E+05	--	3.87E-05	--	2.01E-05
	STYRENE	7.90E+00	7.90E+00	--	9.00E+03	--	8.78E-04	--	8.78E-04
	TERT-BUTYL METHYL ETHER	7.10E+00	3.66E+00	3.89E+02	1.25E+05	1.83E-08	5.68E-05	9.41E-09	2.93E-05
	TETRACHLOROETHENE	7.20E+04	1.39E+04	5.38E-01	4.64E+01	1.34E-01	1.55E+03	2.59E-02	3.00E+02
	TOLUENE	6.60E+01	3.56E+01	--	1.41E+03	--	4.67E-02	--	2.52E-02
	TRANS-1,2-DICHLOROETHENE	2.40E+03	8.27E+02	--	1.82E+02	--	1.32E+01	--	4.54E+00
	TRICHLOROETHENE	1.80E+04	3.57E+03	2.88E+00	1.41E+03	6.25E-03	1.28E+01	1.24E-03	2.54E+00

TABLE A3-14: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR RESIDENTIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-R [c] (µg/L)	Noncancer Inhalation RBSL-VI-R [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	TRICHLOROFLUOROMETHANE	5.90E+03	3.04E+03	–	1.76E+02	–	3.35E+01	–	1.73E+01
	VINYL CHLORIDE	6.60E+03	1.66E+03	2.85E-02	9.04E+01	2.32E-01	7.30E+01	5.84E-02	1.84E+01
	XYLENE (TOTAL)	1.50E+02	1.07E+02	–	3.37E+02	–	4.45E-01	–	3.18E-01
					TOTAL	**4.4E-01**	**3.5E+03**	**9.9E-02**	**6.9E+02**

Notes:

a MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.

b The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

c Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L Microgram per liter

– Not applicable

95 UCL 95 percent upper confidence level

EPC Exposure point concentration

MAX Maximum detected concentration

RME Reasonable maximum exposure

RBSL-VI-R Risk-based screening level for vapor intrusion, residential exposure scenario

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-15: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR INDUSTRIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-IW [c] (µg/L)	Noncancer Inhalation RBSL-VI-IW [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	1,1,1-TRICHLOROETHANE	7.20E+02	7.20E+02	--	3.13E+03	--	2.30E-01	--	2.30E-01
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETH	1.40E+02	5.42E+01	--	1.27E+03	--	1.10E-01	--	4.27E-02
	1,1-DICHLOROETHANE	5.00E+00	3.10E+00	1.09E+01	2.13E+03	4.59E-07	2.35E-03	2.85E-07	1.46E-03
	1,1-DICHLOROETHENE	4.20E+01	2.20E+01	--	1.86E+02	--	2.25E-01	--	1.18E-01
	1,2,3-TRICHLOROBENZENE	5.60E-01	5.60E-01	--	6.61E+01	--	8.47E-03	--	8.47E-03
	1,2,4-TRICHLOROBENZENE	2.00E+02	1.07E+02	--	6.61E+01	--	3.02E+00	--	1.62E+00
	1,2,4-TRIMETHYLBENZENE	9.30E+01	9.06E+01	--	2.55E+01	--	3.65E+00	--	3.56E+00
	1,2-DICHLOROBENZENE	6.20E+04	1.12E+04	--	2.56E+03	--	2.42E+01	--	4.38E+00
	1,2-DICHLOROETHANE	1.50E+05	2.50E+04	3.92E+00	1.22E+02	3.83E-02	1.23E+03	6.38E-03	2.05E+02
	1,2-DICHLOROETHENE (TOTAL)	5.70E+04	8.17E+03	--	2.09E+02	--	2.72E+02	--	3.90E+01
	1,2-DICHLOROPROPANE	3.50E+02	2.18E+02	1.83E+00	3.35E+01	1.91E-04	1.04E+01	1.19E-04	6.50E+00
	1,3,5-TRIMETHYLBENZENE	2.20E+01	2.20E+01	--	1.88E+01	--	1.17E+00	--	1.17E+00
	1,3-DICHLOROBENZENE	6.30E+02	2.69E+02	--	1.35E+03	--	4.67E-01	--	2.00E-01
	1,4-DICHLOROBENZENE	1.50E+04	3.70E+03	3.59E+00	8.08E+03	4.18E-03	1.86E+00	1.03E-03	4.58E-01
	1,6,7-TRIMETHYLNAPHTHALENE	4.00E-01	4.00E-01	--	7.07E+02	--	5.66E-04	--	5.66E-04
	1-METHYLNAPHTHALENE	4.00E+00	4.00E+00	--	7.07E+02	--	5.66E-03	--	5.66E-03
	1-METHYLPHENANTHRENE	5.00E-02	5.00E-02	--	1.90E+05	--	2.64E-07	--	2.64E-07
	2,6-DIMETHYLNAPHTHALENE	2.00E+00	2.00E+00	--	7.07E+02	--	2.83E-03	--	2.83E-03
	2-BUTANONE	2.90E+01	2.90E+01	--	4.36E+06	--	6.65E-06	--	6.65E-06
	2-CHLORONAPHTHALENE	1.00E+00	1.00E+00	--	1.41E+04	--	7.07E-05	--	7.07E-05
	2-METHYLNAPHTHALENE	9.20E+02	4.86E+02	--	7.07E+02	--	1.30E+00	--	6.87E-01
	4-METHYL-2-PENTANONE	9.00E+00	9.00E+00	--	5.24E+05	--	1.72E-05	--	1.72E-05
	ACENAPHTHENE	8.90E+01	6.80E+01	--	3.30E+04	--	2.69E-03	--	2.06E-03
	ACENAPHTHYLENE	2.00E+00	2.00E+00	--	3.30E+04	--	6.05E-05	--	6.05E-05
	ACETONE	2.10E+03	1.82E+03	--	1.98E+06	--	1.06E-03	--	9.21E-04
	ACETOPHENONE	6.00E+00	6.00E+00	--	7.54E+05	--	7.95E-06	--	7.95E-06
	ANTHRACENE	4.00E+00	2.50E+00	--	3.94E+05	--	1.02E-05	--	6.33E-06
	BENZENE	4.00E+02	9.33E+01	6.29E-01	1.32E+02	6.36E-04	3.02E+00	1.48E-04	7.05E-01
	BIPHENYL	1.00E+01	1.00E+01	--	1.42E+04	--	7.03E-04	--	7.03E-04

TABLE A3-15: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR INDUSTRIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-IW [c] (µg/L)	Noncancer Inhalation RBSL-VI-IW [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	BROMODICHLOROMETHANE	1.30E+02	1.30E+02	1.68E+00	1.07E+03	7.75E-05	1.22E-01	7.75E-05	1.22E-01
	CARBON DISULFIDE	6.55E+01	5.31E+01	--	5.63E+02	--	1.16E-01	--	9.43E-02
	CHLOROBENZENE	2.30E+03	1.53E+03	--	3.92E+02	--	5.86E+00	--	3.90E+00
	CHLOROETHANE	8.10E+01	5.06E+01	1.09E+01	2.25E+04	7.40E-06	3.60E-03	4.62E-06	2.25E-03
	CHLOROFORM	3.90E+01	1.34E+01	1.17E+00	3.26E+02	3.32E-05	1.20E-01	1.14E-05	4.12E-02
	CHLOROMETHANE	4.00E-01	4.00E-01	--	9.25E+01	--	4.33E-03	--	4.33E-03
	CIS-1,2-DICHLOROETHENE	5.80E+04	1.48E+04	--	2.09E+02	--	2.77E+02	--	7.09E+01
	CYCLOHEXANE	5.10E-01	5.10E-01	--	7.26E+02	--	7.03E-04	--	7.03E-04
	DIBENZOFURAN	3.20E+01	1.45E+01	--	1.31E+04	--	2.44E-03	--	1.10E-03
	DIBENZOTHIOPHENE	1.00E-01	1.00E-01	--	4.43E+04	--	2.26E-06	--	2.26E-06
	DICHLORODIFLUOROMETHANE	4.20E+00	4.20E+00	--	1.43E+01	--	2.95E-01	--	2.95E-01
	ETHYLBENZENE	1.50E+01	6.42E+00	--	3.14E+03	--	4.77E-03	--	2.04E-03
	FLUORENE	1.30E+02	2.33E+01	--	4.43E+04	--	2.93E-03	--	5.25E-04
	ISOPROPYLBENZENE	4.40E+00	1.93E+00	--	7.83E+00	--	5.62E-01	--	2.47E-01
	M,P-XYLENES	2.80E+01	2.80E+01	--	3.37E+02	--	8.30E-02	--	8.30E-02
	MERCURY	8.00E+00	3.56E+00	--	6.80E-01	--	1.18E+01	--	5.23E+00
	METHYLCYCLOHEXANE	7.20E-01	7.20E-01	--	1.71E+02	--	4.22E-03	--	4.22E-03
	METHYLENE CHLORIDE	2.00E+02	2.00E+02	4.55E+01	3.35E+04	4.39E-06	5.97E-03	4.39E-06	5.97E-03
	NAPHTHALENE	3.70E+02	2.04E+02	6.02E+00	1.52E+02	6.15E-05	2.43E+00	3.39E-05	1.34E+00
	O-XYLENE	1.60E+01	1.60E+01	--	3.37E+02	--	4.74E-02	--	4.74E-02
	PARA-ISOPROPYL TOLUENE	3.40E+01	3.40E+01	--	8.17E+02	--	4.16E-02	--	4.16E-02
	PHENANTHRENE	5.90E+02	2.01E+02	--	1.90E+05	--	3.11E-03	--	1.06E-03
	PYRENE	9.00E+00	4.68E+00	--	2.33E+05	--	3.87E-05	--	2.01E-05
	STYRENE	7.90E+00	7.90E+00	--	9.00E+03	--	8.78E-04	--	8.78E-04
	TERT-BUTYL METHYL ETHER	7.10E+00	3.66E+00	6.53E+02	1.25E+05	1.09E-08	5.68E-05	5.60E-09	2.93E-05
	TETRACHLOROETHENE	7.20E+04	1.39E+04	9.03E-01	4.64E+01	7.97E-02	1.55E+03	1.54E-02	3.00E+02
	TOLUENE	6.60E+01	3.56E+01	--	1.41E+03	--	4.67E-02	--	2.52E-02
	TRANS-1,2-DICHLOROETHENE	2.40E+03	8.27E+02	--	1.82E+02	--	1.32E+01	--	4.54E+00
	TRICHLOROETHENE	1.80E+04	3.57E+03	4.84E+00	1.41E+03	3.72E-03	1.28E+01	7.38E-04	2.54E+00

TABLE A3-15: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR INDUSTRIAL EXPOSURE VIA VAPOR INTRUSION, IR-25 PLUME, A-AQUIFER (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC [a]		Cancer Inhalation RBSL-VI-IW [c] (µg/L)	Noncancer Inhalation RBSL-VI-IW [c] (µg/L)	EPC Based on MAX		EPC Based on RME	
		MAX (µg/L)	RME [b] (µg/L)			Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
8, 12	TRICHLOROFLUOROMETHANE	5.90E+03	3.04E+03	–	1.76E+02	–	3.35E+01	–	1.73E+01
	VINYL CHLORIDE	6.60E+03	1.66E+03	4.79E-02	9.04E+01	1.38E-01	7.30E+01	3.48E-02	1.84E+01
	XYLENE (TOTAL)	1.50E+02	1.07E+02	–	3.37E+02	–	4.45E-01	–	3.18E-01
					TOTAL	**2.6E-01**	**3.5E+03**	**5.9E-02**	**6.9E+02**

Notes:

a MAX and RME EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air.

b The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

c Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

µg/L Microgram per liter

– Not applicable

95 UCL 95 percent upper confidence level

EPC Exposure point concentration

MAX Maximum detected concentration

RME Reasonable maximum exposure

RBSL-VI-IW Risk-based screening level for vapor intrusion, industrial worker exposure scenario

Source:

U.S. Environmental Protection Agency (EPA). 2002a. Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Draft. Federal Register. Volume 67. Number 230. Pages 71169 through 71172. On Line Address: http://www.epa.gov/correctiveaction/eis/vapor.htm. November 29.

TABLE A3-16: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-25 PLUME, A-AQUIFER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
8, 12	1,1,1-TRICHLOROETHANE	7.20E+02	7.20E+02	--	--	--	6.20E-03	2.57E-02	3.19E-02	--	--	--	6.20E-03	2.57E-02	3.19E-02
	1,1,2-TRICHLORO-1,2,2-TRIFLUORO	1.40E+02	5.42E+01	--	--	--	1.30E-07	3.10E-04	3.10E-04	--	--	--	5.03E-08	1.20E-04	1.20E-04
	1,1-DICHLOROETHANE	5.00E+00	3.10E+00	5.06E-10	1.06E-08	1.11E-08	6.21E-05	9.27E-04	9.89E-04	3.14E-10	6.55E-09	6.86E-09	3.85E-05	5.74E-04	6.13E-04
	1,1-DICHLOROETHENE	4.20E+01	2.20E+01	--	--	--	1.87E-03	1.95E-02	2.13E-02	--	--	--	9.82E-04	1.02E-02	1.12E-02
	1,2,3-TRICHLOROBENZENE	5.60E-01	5.60E-01	3.53E-10	--	3.53E-10	6.86E-04	9.46E-03	1.01E-02	3.53E-10	--	3.53E-10	6.86E-04	9.46E-03	1.01E-02
	1,2,4-TRICHLOROBENZENE	2.00E+02	1.07E+02	1.26E-07	--	1.26E-07	2.45E-01	3.40E+00	3.64E+00	6.77E-08	--	6.77E-08	1.32E-01	1.82E+00	1.96E+00
	1,2,4-TRIMETHYLBENZENE	9.30E+01	9.06E+01	--	--	--	5.18E-05	1.29E+00	1.29E+00	--	--	--	5.04E-05	1.26E+00	1.26E+00
	1,2-DICHLOROBENZENE	6.20E+04	1.12E+04	--	--	--	5.24E+00	2.27E+01	2.80E+01	--	--	--	9.47E-01	4.11E+00	5.06E+00
	1,2-DICHLOROETHANE	1.50E+05	2.50E+04	1.52E-04	4.83E-03	4.98E-03	5.84E+00	2.65E+03	2.66E+03	2.53E-05	8.04E-04	8.30E-04	9.74E-01	4.42E+02	4.43E+02
	1,2-DICHLOROETHENE (TOTAL)	5.70E+04	8.17E+03	--	--	--	8.14E+00	1.49E+02	1.57E+02	--	--	--	1.17E+00	2.13E+01	2.25E+01
	1,2-DICHLOROPROPANE	3.50E+02	2.18E+02	4.92E-07	8.18E-06	8.67E-06	4.60E-01	7.65E+00	8.11E+00	3.06E-07	5.09E-06	5.40E-06	2.87E-01	4.76E+00	5.05E+00
	1,3,5-TRIMETHYLBENZENE	2.20E+01	2.20E+01	--	--	--	1.22E-05	3.06E-01	3.06E-01	--	--	--	1.22E-05	3.06E-01	3.06E-01
	1,3-DICHLOROBENZENE	6.30E+02	2.69E+02	--	--	--	2.26E-01	4.44E-01	6.70E-01	--	--	--	9.66E-02	1.90E-01	2.86E-01
	1,4-DICHLOROBENZENE	1.50E+04	3.70E+03	4.01E-05	1.80E-04	2.20E-04	3.90E+00	1.37E+00	5.27E+00	9.90E-06	4.45E-05	5.44E-05	9.62E-01	3.39E-01	1.30E+00
	1,6,7-TRIMETHYLNAPHTHALENE	4.00E-01	4.00E-01	--	--	--	8.72E-04	1.98E-03	2.85E-03	--	--	--	8.72E-04	1.98E-03	2.85E-03
	1-METHYLNAPHTHALENE	4.00E+00	4.00E+00	--	--	--	8.72E-03	1.98E-02	2.85E-02	--	--	--	8.72E-03	1.98E-02	2.85E-02
	1-METHYLPHENANTHRENE	5.00E-02	5.00E-02	--	--	--	4.33E-06	1.01E-06	5.33E-06	--	--	--	4.33E-06	1.01E-06	5.33E-06
	2,4-DIMETHYLPHENOL	1.60E+04	1.60E+04	--	--	--	1.63E+00	--	1.63E+00	--	--	--	1.63E+00	--	1.63E+00
	2,4-DINITROTOLUENE	4.90E+03	4.90E+03	2.74E-05	--	2.74E-05	1.41E+00	--	1.41E+00	2.74E-05	--	2.74E-05	1.41E+00	--	1.41E+00
	2,6-DIMETHYLNAPHTHALENE	2.00E+00	2.00E+00	--	--	--	4.36E-03	9.90E-03	1.43E-02	--	--	--	4.36E-03	9.90E-03	1.43E-02
	2-BUTANONE	2.90E+01	2.90E+01	--	--	--	8.61E-06	3.05E-04	3.14E-04	--	--	--	8.61E-06	3.05E-04	3.14E-04
	2-CHLORONAPHTHALENE	1.00E+00	1.00E+00	--	--	--	1.09E-04	2.19E-04	3.28E-04	--	--	--	1.09E-04	2.19E-04	3.28E-04
	2-METHYLNAPHTHALENE	9.20E+02	4.86E+02	--	--	--	2.01E+00	4.55E+00	6.56E+00	--	--	--	1.06E+00	2.41E+00	3.46E+00
	2-METHYLPHENOL	3.80E+03	3.80E+03	--	--	--	1.09E-01	--	1.09E-01	--	--	--	1.09E-01	--	1.09E-01
	4,4'-DDE	1.90E-02	1.90E-02	2.74E-09	--	2.74E-09	--	--	--	2.74E-09	--	2.74E-09	--	--	--
	4,4'-DDT	9.40E-03	9.40E-03	2.29E-09	--	2.29E-09	9.42E-04	--	9.42E-04	2.29E-09	--	2.29E-09	9.42E-04	--	9.42E-04
	4-METHYL-2-PENTANONE	9.00E+00	9.00E+00	--	--	--	5.64E-05	1.93E-04	2.49E-04	--	--	--	5.64E-05	1.93E-04	2.49E-04
	4-METHYLPHENOL	9.10E+03	9.10E+03	--	--	--	2.60E+00	--	2.60E+00	--	--	--	2.60E+00	--	2.60E+00
	ACENAPHTHENE	8.90E+01	6.80E+01	--	--	--	1.29E-02	2.32E-02	3.61E-02	--	--	--	9.88E-03	1.77E-02	2.76E-02
	ACENAPHTHYLENE	2.00E+00	2.00E+00	--	--	--	2.91E-04	4.78E-04	7.69E-04	--	--	--	2.91E-04	4.78E-04	7.69E-04
	ACETONE	2.10E+03	1.82E+03	--	--	--	6.49E-05	3.05E-02	3.06E-02	--	--	--	5.64E-05	2.65E-02	2.66E-02
	ACETOPHENONE	6.00E+00	6.00E+00	--	--	--	1.67E-06	--	1.67E-06	--	--	--	1.67E-06	--	1.67E-06
	ALPHA-CHLORDANE	7.90E-03	7.90E-03	1.03E-09	--	1.03E-09	1.11E-04	--	1.11E-04	1.03E-09	--	1.03E-09	1.11E-04	--	1.11E-04
	ALUMINUM	4.48E+03	3.79E+03	--	--	--	8.31E-04	--	8.31E-04	--	--	--	7.03E-04	--	7.03E-04
	ANTHRACENE	4.00E+00	2.50E+00	--	--	--	3.46E-04	1.44E-04	4.91E-04	--	--	--	2.16E-04	9.01E-05	3.06E-04

TABLE A3-16: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-25 PLUME, A-AQUIFER (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
8, 12	ANTIMONY	4.01E+01	2.14E+01	--	--	--	1.86E-02	--	1.86E-02	--	--	--	9.92E-03	--	9.92E-03
	AROCLOR-1260	1.10E+01	1.10E+01	8.75E-09	--	8.75E-09	--	--	--	8.75E-09	--	8.75E-09	--	--	--
	ARSENIC	1.43E+01	5.65E+00	3.58E-07	--	3.58E-07	8.84E-03	--	8.84E-03	1.42E-07	--	1.42E-07	3.49E-03	--	3.49E-03
	BARIUM	9.24E+02	2.38E+02	--	--	--	8.57E-04	--	8.57E-04	--	--	--	2.20E-04	--	2.20E-04
	BENZENE	4.00E+02	9.33E+01	1.59E-06	1.67E-05	1.83E-05	2.78E-01	1.36E+00	1.64E+00	3.71E-07	3.89E-06	4.26E-06	6.49E-02	3.17E-01	3.82E-01
	BENZO(A)ANTHRACENE	3.10E+00	3.10E+00	4.63E-06	--	4.63E-06	--	--	--	4.63E-06	--	4.63E-06	--	--	--
	BENZO(A)PYRENE	2.10E-01	2.10E-01	4.68E-06	--	4.68E-06	--	--	--	4.68E-06	--	4.68E-06	--	--	--
	BENZO(B)FLUORANTHENE	5.50E-02	5.50E-02	1.22E-07	--	1.22E-07	--	--	--	1.22E-07	--	1.22E-07	--	--	--
	BENZOIC ACID	1.50E+01	1.50E+01	--	--	--	3.97E-06	--	3.97E-06	--	--	--	3.97E-06	--	3.97E-06
	BERYLLIUM	1.10E+00	6.76E-01	--	--	--	1.02E-04	--	1.02E-04	--	--	--	6.27E-05	--	6.27E-05
	BETA-BHC	8.40E-03	8.40E-03	4.41E-10	--	4.41E-10	8.57E-05	--	8.57E-05	4.41E-10	--	4.41E-10	8.57E-05	--	8.57E-05
	BIPHENYL	1.00E+01	1.00E+01	--	--	--	5.57E-06	3.56E-03	3.57E-03	--	--	--	5.57E-06	3.56E-03	3.57E-03
	BROMODICHLOROMETHANE	1.30E+02	1.30E+02	2.06E-07	4.76E-06	4.97E-06	5.55E-03	1.28E-01	1.34E-01	2.06E-07	4.76E-06	4.97E-06	5.55E-03	1.28E-01	1.34E-01
	BUTYLBENZYLPHTHALATE	6.00E+00	6.00E+00	--	--	--	8.35E-07	--	8.35E-07	--	--	--	8.35E-07	--	8.35E-07
	CADMIUM	6.40E+00	4.21E+00	--	--	--	2.37E-03	--	2.37E-03	--	--	--	1.56E-03	--	1.56E-03
	CARBAZOLE	4.50E+00	3.88E+00	3.58E-11	--	3.58E-11	--	--	--	3.08E-11	--	3.08E-11	--	--	--
	CARBON DISULFIDE	6.55E+01	5.31E+01	--	--	--	2.07E-03	9.77E-03	1.18E-02	--	--	--	1.68E-03	7.93E-03	9.60E-03
	CHLOROBENZENE	2.30E+03	1.53E+03	--	--	--	5.97E-01	3.28E+00	3.87E+00	--	--	--	3.97E-01	2.18E+00	2.57E+00
	CHLOROETHANE	8.10E+01	5.06E+01	3.80E-09	1.08E-07	1.12E-07	2.29E-04	9.00E-04	1.13E-03	2.37E-09	6.76E-08	6.99E-08	1.43E-04	5.62E-04	7.05E-04
	CHLOROFORM	3.90E+01	1.34E+01	2.18E-08	1.06E-06	1.08E-06	4.92E-03	6.55E-02	7.04E-02	7.49E-09	3.65E-07	3.72E-07	1.69E-03	2.25E-02	2.42E-02
	CHLOROMETHANE	4.00E-01	4.00E-01	--	--	--	9.42E-06	5.60E-04	5.70E-04	--	--	--	9.42E-06	5.60E-04	5.70E-04
	CHROMIUM	9.85E+01	9.85E+01	--	--	--	1.22E-05	--	1.22E-05	--	--	--	1.22E-05	--	1.22E-05
	CHROMIUM VI	1.15E+02	1.15E+02	--	--	--	1.42E-05	--	1.42E-05	--	--	--	1.42E-05	--	1.42E-05
	CHRYSENE	2.00E+02	2.00E+02	2.99E-05	--	2.99E-05	--	--	--	2.99E-05	--	2.99E-05	--	--	--
	CIS-1,2-DICHLOROETHENE	5.80E+04	1.48E+04	--	--	--	8.29E+00	1.51E+02	1.60E+02	--	--	--	2.12E+00	3.88E+01	4.09E+01
	COBALT	8.88E+01	1.87E+01	--	--	--	3.29E-04	--	3.29E-04	--	--	--	6.94E-05	--	6.94E-05
	COPPER	5.82E+01	1.73E+01	--	--	--	2.92E-04	--	2.92E-04	--	--	--	8.69E-05	--	8.69E-05
	CYANIDE	7.60E-01	7.60E-01	--	--	--	7.05E-06	--	7.05E-06	--	--	--	7.05E-06	--	7.05E-06
	CYCLOHEXANE	5.10E-01	5.10E-01	--	--	--	8.35E-09	8.52E-06	8.53E-06	--	--	--	8.35E-09	8.52E-06	8.53E-06
	DELTA-BHC	9.70E-03	9.70E-03	--	--	--	9.90E-05	--	9.90E-05	--	--	--	9.90E-05	--	9.90E-05
	DIBENZOFURAN	3.20E+01	1.45E+01	--	--	--	4.45E-04	6.21E-02	6.26E-02	--	--	--	2.01E-04	2.81E-02	2.83E-02
	DIBENZOTHIOPHENE	1.00E-01	1.00E-01	--	--	--	6.96E-08	2.76E-05	2.77E-05	--	--	--	6.96E-08	2.76E-05	2.77E-05
	DICHLORODIFLUOROMETHANE	4.20E+00	4.20E+00	--	--	--	3.51E-05	1.75E-03	1.78E-03	--	--	--	3.51E-05	1.75E-03	1.78E-03
	DIELDRIN	6.00E-02	6.00E-02	3.05E-08	--	3.05E-08	2.67E-03	--	2.67E-03	3.05E-08	--	3.05E-08	2.67E-03	--	2.67E-03
	DIETHYLPHTHALATE	1.00E+01	1.00E+01	--	--	--	9.04E-06	--	9.04E-06	--	--	--	9.04E-06	--	9.04E-06

TABLE A3-16: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-25 PLUME, A-AQUIFER (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
8, 12	ENDOSULFAN SULFATE	7.50E-02	7.50E-02	--	--	--	3.48E-07	--	3.48E-07	--	--	--	3.48E-07	--	3.48E-07
	ENDRIN KETONE	1.00E-01	1.00E-01	--	--	--	7.42E-04	--	7.42E-04	--	--	--	7.42E-04	--	7.42E-04
	ETHYLBENZENE	1.50E+01	6.42E+00	--	--	--	1.36E-03	1.30E-03	2.66E-03	--	--	--	5.84E-04	5.56E-04	1.14E-03
	FLUORANTHENE	1.70E+01	7.35E+00	--	--	--	1.73E-02	--	1.73E-02	--	--	--	7.50E-03	--	7.50E-03
	FLUORENE	1.30E+02	2.33E+01	--	--	--	9.04E-05	3.59E-02	3.60E-02	--	--	--	1.62E-05	6.43E-03	6.45E-03
	GAMMA-CHLORDANE	1.10E-02	1.10E-02	1.44E-09	--	1.44E-09	1.55E-04	--	1.55E-04	1.44E-09	--	1.44E-09	1.55E-04	--	1.55E-04
	HEPTACHLOR	1.30E-02	1.30E-02	1.33E-09	--	1.33E-09	4.15E-05	--	4.15E-05	1.33E-09	--	1.33E-09	4.15E-05	--	4.15E-05
	HEPTACHLOR EPOXIDE	3.00E-02	3.00E-02	6.22E-09	--	6.22E-09	3.68E-03	--	3.68E-03	6.22E-09	--	6.22E-09	3.68E-03	--	3.68E-03
	HEPTACHLOR EPOXIDE A	5.50E-02	5.50E-02	1.14E-08	--	1.14E-08	6.75E-03	--	6.75E-03	1.14E-08	--	1.14E-08	6.75E-03	--	6.75E-03
	HEXACHLOROETHANE	7.00E+00	7.00E+00	2.17E-08	--	2.17E-08	3.90E-02	--	3.90E-02	2.17E-08	--	2.17E-08	3.90E-02	--	3.90E-02
	IRON	5.50E+05	2.45E+04	--	--	--	3.40E-01	--	3.40E-01	--	--	--	1.52E-02	--	1.52E-02
	ISOPROPYLBENZENE	4.40E+00	1.93E+00	--	--	--	1.22E-06	9.51E-04	9.53E-04	--	--	--	5.38E-07	4.18E-04	4.19E-04
	LEAD	1.70E+01	8.68E+00	--	--	--	--	--	--	--	--	--	--	--	--
	M,P-XYLENES	2.80E+01	2.80E+01	--	--	--	1.38E-03	2.42E-02	2.55E-02	--	--	--	1.38E-03	2.42E-02	2.55E-02
	MANGANESE	1.21E+04	3.16E+03	--	--	--	9.35E-02	--	9.35E-02	--	--	--	2.44E-02	--	2.44E-02
	MERCURY	8.00E+00	3.56E+00	--	--	--	4.95E-03	1.70E+00	1.71E+00	--	--	--	2.20E-03	7.58E-01	7.61E-01
	METHYLCYCLOHEXANE	7.20E-01	7.20E-01	--	--	--	2.33E-08	2.20E-05	2.20E-05	--	--	--	2.33E-08	2.20E-05	2.20E-05
	METHYLENE CHLORIDE	2.00E+02	2.00E+02	2.60E-08	2.76E-07	3.01E-07	2.16E-03	6.41E-03	8.57E-03	2.60E-08	2.76E-07	3.01E-07	2.16E-03	6.41E-03	8.57E-03
	MOLYBDENUM	3.56E+01	1.78E+01	--	--	--	1.32E-03	--	1.32E-03	--	--	--	6.62E-04	--	6.62E-04
	NAPHTHALENE	3.70E+02	2.04E+02	5.53E-06	1.31E-05	1.86E-05	1.61E-01	8.89E+00	9.06E+00	3.05E-06	7.23E-06	1.03E-05	8.90E-02	4.91E+00	4.99E+00
	NICKEL	2.60E+02	5.62E+01	--	--	--	4.82E-04	--	4.82E-04	--	--	--	1.04E-04	--	1.04E-04
	O-XYLENE	1.60E+01	1.60E+01	--	--	--	7.87E-04	1.38E-02	1.46E-02	--	--	--	7.87E-04	1.38E-02	1.46E-02
	PARA-ISOPROPYL TOLUENE	3.40E+01	3.40E+01	--	--	--	9.46E-06	6.92E-03	6.93E-03	--	--	--	9.46E-06	6.92E-03	6.93E-03
	PENTACHLOROPHENOL	6.10E+03	6.10E+03	7.57E-04	--	7.57E-04	1.47E+01	--	1.47E+01	7.57E-04	--	7.57E-04	1.47E+01	--	1.47E+01
	PHENANTHRENE	5.90E+02	2.01E+02	--	--	--	5.11E-02	1.19E-02	6.29E-02	--	--	--	1.74E-02	4.04E-03	2.14E-02
	PHENOL	2.30E+03	2.30E+03	--	--	--	6.12E-03	--	6.12E-03	--	--	--	6.12E-03	--	6.12E-03
	PYRENE	9.00E+00	4.68E+00	--	--	--	2.62E-03	9.75E-04	3.59E-03	--	--	--	1.36E-03	5.07E-04	1.87E-03
	SELENIUM	6.42E+01	3.19E+01	--	--	--	2.38E-03	--	2.38E-03	--	--	--	1.18E-03	--	1.18E-03
	SILVER	1.26E+01	1.26E+01	--	--	--	2.81E-04	--	2.81E-04	--	--	--	2.81E-04	--	2.81E-04
	STYRENE	7.90E+00	7.90E+00	--	--	--	2.71E-04	6.82E-04	9.53E-04	--	--	--	2.71E-04	6.82E-04	9.53E-04
	TERT-BUTYL METHYL ETHER	7.10E+00	3.66E+00	5.08E-12	2.33E-09	2.34E-09	2.30E-07	2.08E-04	2.09E-04	2.62E-12	1.20E-09	1.20E-09	1.18E-07	1.07E-04	1.08E-04
	TETRACHLOROETHENE	7.20E+04	1.39E+04	3.40E-03	4.36E-04	3.84E-03	4.41E+01	1.45E+02	1.89E+02	6.58E-04	8.44E-05	7.43E-04	8.53E+00	2.81E+01	3.67E+01
	THALLIUM	5.27E+01	1.53E+01	--	--	--	1.48E-01	--	1.48E-01	--	--	--	4.31E-02	--	4.31E-02
	TOLUENE	6.60E+01	3.56E+01	--	--	--	1.90E-03	1.62E-02	1.81E-02	--	--	--	1.02E-03	8.72E-03	9.74E-03
	TRANS-1,2-DICHLOROETHENE	2.40E+03	8.27E+02	--	--	--	1.71E-01	3.16E+00	3.33E+00	--	--	--	5.91E-02	1.09E+00	1.15E+00

TABLE A3-16: SUMMARY OF CANCER RISKS AND NONCANCER HAZARD INDICES FOR CONSTRUCTION WORKER TRENCH EXPOSURE, IR-25 PLUME, A-AQUIFER (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Analyte	EPC		Cancer Risk (Based on MAX)			Noncancer Hazard (Based on MAX)			Cancer Risk (Based on RME)			Noncancer Hazard (Based on RME)		
		MAX (µg/L)	RME [a] (µg/L)	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total	Dermal	Inhalation	Total
8, 12	TRICHLOROETHENE	1.80E+04	3.57E+03	7.44E-06	4.07E-05	4.82E-05	--	2.38E+00	2.38E+00	1.48E-06	8.08E-06	9.56E-06	--	4.72E-01	4.72E-01
	TRICHLOROFLUOROMETHANE	5.90E+03	3.04E+03	--	--	--	4.74E-02	6.56E-01	7.03E-01	--	--	--	2.45E-02	3.38E-01	3.63E-01
	VANADIUM	5.67E+01	1.14E+01	--	--	--	1.05E-02	--	1.05E-02	--	--	--	2.12E-03	--	2.12E-03
	VINYL CHLORIDE	6.60E+03	1.66E+03	7.35E-05	8.38E-04	9.11E-04	2.29E+00	7.59E+00	9.88E+00	1.85E-05	2.11E-04	2.30E-04	5.76E-01	1.92E+00	2.49E+00
	XYLENE (TOTAL)	1.50E+02	1.07E+02	--	--	--	7.37E-03	1.29E-01	1.37E-01	--	--	--	5.27E-03	9.26E-02	9.78E-02
	ZINC	2.58E+03	7.36E+02	--	--	--	9.57E-04	--	9.57E-04	--	--	--	2.73E-04	--	2.73E-04
			TOTAL	**4.5E-03**	**6.4E-03**	**1.1E-02**	**1.0E+02**	**3.2E+03**	**3.3E+03**	**1.5E-03**	**1.2E-03**	**2.7E-03**	**3.8E+01**	**5.6E+02**	**6.0E+02**

Notes:

a The 95 UCL is used as the RME EPC. If the 95 UCL exceeds the MAX, then the MAX is used as the RME EPC.

µg/L Microgram per liter
-- Not applicable
95 UCL 95 percent upper confidence level
EPC Exposure point concentration
MAX Maximum detected concentration
RME Reasonable maximum exposure

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
3	B0931	1,1-DICHLOROETHANE	3.60E-01	6.48E+00	2.13E+03	5.55E-08	1.69E-04
		MERCURY	2.30E-01	--	6.80E-01	--	3.38E-01
		TRICHLOROETHENE	2.00E-01	2.88E+00	1.41E+03	6.94E-08	1.42E-04
					TOTAL	1.25E-07	3.39E-01
5	B1527	2-METHYLNAPHTHALENE	2.70E+00	--	7.07E+02	--	3.82E-03
		ACENAPHTHENE	2.65E+00	--	3.30E+04	--	8.02E-05
		CARBON DISULFIDE	2.00E-01	--	5.63E+02	--	3.55E-04
		MERCURY	2.50E-01	--	6.80E-01	--	3.68E-01
					TOTAL	--	3.72E-01
5	B1528	TETRACHLOROETHENE	1.00E+00	5.38E-01	4.64E+01	1.86E-06	2.16E-02
					TOTAL	1.86E-06	2.16E-02
5	B2031	2-METHYLNAPHTHALENE	1.10E+01	--	7.07E+02	--	1.56E-02
		FLUORENE	6.00E+00	--	4.43E+04	--	1.35E-04
		MERCURY	9.75E-02	--	6.80E-01	--	1.43E-01
					TOTAL	--	1.59E-01
5	B2531	MERCURY	1.50E-01	--	6.80E-01	--	2.21E-01
					TOTAL	--	2.21E-01

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
6	B2420	BROMOMETHANE	2.75E-01	--	1.92E+01	--	1.44E-02
		CIS-1,2-DICHLOROETHENE	2.50E-01	--	2.09E+02	--	1.19E-03
		MERCURY	7.50E-02	--	6.80E-01	--	1.10E-01
		TOLUENE	3.00E-01	--	1.41E+03	--	2.12E-04
					TOTAL	--	1.26E-01
9	B2818	1,2-DICHLOROETHANE	3.60E-01	2.33E+00	1.22E+02	1.54E-07	2.95E-03
		CARBON DISULFIDE	2.90E-01	--	5.63E+02	--	5.15E-04
		MERCURY	3.70E-01	--	6.80E-01	--	5.44E-01
		TRICHLOROETHENE	2.25E-01	2.88E+00	1.41E+03	7.81E-08	1.60E-04
					TOTAL	2.32E-07	5.48E-01
9	B3021	CIS-1,2-DICHLOROETHENE	1.90E-01	--	2.09E+02	--	9.08E-04
		TOLUENE	2.70E-01	--	1.41E+03	--	1.91E-04
		XYLENE (TOTAL)	2.00E-01	--	3.37E+02	--	5.93E-04
					TOTAL	--	1.69E-03
9	B3418	CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
					TOTAL	--	5.32E-03
12	B3718	M,P-XYLENES	7.00E-01	--	3.37E+02	--	2.08E-03
		MERCURY	1.30E-01	--	6.80E-01	--	1.91E-01
		TOLUENE	4.00E-01	--	1.41E+03	--	2.83E-04
					TOTAL	--	1.94E-01

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
12	B4219	MERCURY	2.00E+00	--	6.80E-01	--	2.94E+00
					TOTAL	--	2.94E+00
12	B4419	MERCURY	3.20E-01	--	6.80E-01	--	4.71E-01
					TOTAL	--	4.71E-01
12	B4516	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	6.60E+01	--	1.27E+03	--	5.20E-02
		1,2-DICHLOROBENZENE	1.00E+00	--	2.56E+03	--	3.90E-04
		CARBON DISULFIDE	1.80E+00	--	5.63E+02	--	3.19E-03
		CIS-1,2-DICHLOROETHENE	2.90E-01	--	2.09E+02	--	1.39E-03
		DICHLORODIFLUOROMETHANE	5.90E+01	--	1.43E+01	--	4.14E+00
		MERCURY	2.90E-02	--	6.80E-01	--	4.26E-02
		TRICHLOROFLUOROMETHANE	1.40E+01	--	1.76E+02	--	7.95E-02
					TOTAL	--	4.32E+00
15	B4819	CARBON DISULFIDE	4.00E-01	--	5.63E+02	--	7.10E-04
		MERCURY	1.30E-01	--	6.80E-01	--	1.91E-01
					TOTAL	--	1.92E-01
15	B5117	CARBON DISULFIDE	7.00E+00	--	5.63E+02	--	1.24E-02
		MERCURY	9.10E-01	--	6.80E-01	--	1.34E+00
					TOTAL	--	1.35E+00

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
16	B5708	ACENAPHTHENE	3.50E+00	--	3.30E+04	--	1.06E-04
		FLUORENE	3.00E+00	--	4.43E+04	--	6.77E-05
		MERCURY	2.10E-01	--	6.80E-01	--	3.09E-01
		PHENANTHRENE	3.00E+00	--	1.90E+05	--	1.58E-05
		PYRENE	2.95E+00	--	2.33E+05	--	1.27E-05
					TOTAL	--	3.09E-01
16	B5810	CHLOROFORM	4.00E+00	6.99E-01	3.26E+02	5.72E-06	1.23E-02
		MERCURY	2.50E-01	--	6.80E-01	--	3.68E-01
					TOTAL	5.72E-06	3.80E-01
16	B5910	MERCURY	1.70E-01	--	6.80E-01	--	2.50E-01
					TOTAL	--	2.50E-01
BOS-1	B0128	XYLENE (TOTAL)	1.00E+00	--	3.37E+02	--	2.96E-03
					TOTAL	--	2.96E-03

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	B0139	1,4-DICHLOROBENZENE	4.10E-01	2.14E+00	8.08E+03	1.92E-07	5.07E-05
		ACETONE	3.00E+00	--	1.98E+06	--	1.52E-06
		ACETOPHENONE	3.00E+00	--	7.54E+05	--	3.98E-06
		BENZENE	1.00E+00	3.74E-01	1.32E+02	2.67E-06	7.56E-03
		CARBON DISULFIDE	9.00E+00	--	5.63E+02	--	1.60E-02
		CHLOROBENZENE	4.00E+00	--	3.92E+02	--	1.02E-02
		CHLOROETHANE	1.30E+01	6.51E+00	2.25E+04	2.00E-06	5.78E-04
		CIS-1,2-DICHLOROETHENE	3.40E-01	--	2.09E+02	--	1.63E-03
		MERCURY	2.75E-02	--	6.80E-01	--	4.04E-02
		TERT-BUTYL METHYL ETHER	8.30E-01	3.89E+02	1.25E+05	2.13E-09	6.64E-06
		TOLUENE	2.00E+00	--	1.41E+03	--	1.41E-03
		TRICHLOROETHENE	2.00E+00	2.88E+00	1.41E+03	6.94E-07	1.42E-03
					TOTAL	5.56E-06	7.93E-02
BOS-1	B0228	ETHYLBENZENE	3.80E-01	--	3.14E+03	--	1.21E-04
					TOTAL	--	1.21E-04
BOS-1	B0328	1,2-DICHLOROETHANE	1.40E-01	2.33E+00	1.22E+02	6.00E-08	1.15E-03
		TOLUENE	9.00E-01	--	1.41E+03	--	6.36E-04
					TOTAL	6.00E-08	1.78E-03
BOS-1	B0335	1,2-DICHLOROETHENE (TOTAL)	3.00E-01	--	2.09E+02	--	1.43E-03
		CHLOROBENZENE	1.00E+00	--	3.92E+02	--	2.55E-03
		CIS-1,2-DICHLOROETHENE	1.00E+01	--	2.09E+02	--	4.78E-02
		TERT-BUTYL METHYL ETHER	2.40E-01	3.89E+02	1.25E+05	6.17E-10	1.92E-06
		TRICHLOROETHENE	1.00E+00	2.88E+00	1.41E+03	3.47E-07	7.10E-04
					TOTAL	3.48E-07	5.25E-02

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	B0528	1,1,2,2-TETRACHLOROETHANE	1.00E+00	3.01E+00	1.48E+04	3.32E-07	6.74E-05
		2-HEXANONE	4.00E+00	--	4.36E+06	--	9.17E-07
		VINYL ACETATE	2.00E+00	--	9.52E+03	--	2.10E-04
					TOTAL	3.32E-07	2.78E-04
BOS-1	B0529	CIS-1,2-DICHLOROETHENE	2.10E-01	--	2.09E+02	--	1.00E-03
		TERT-BUTYL METHYL ETHER	2.00E-01	3.89E+02	1.25E+05	5.14E-10	1.60E-06
					TOTAL	5.14E-10	1.01E-03
BOS-1	B0827	1,2,4-TRICHLOROBENZENE	2.00E+00	--	6.61E+01	--	3.02E-02
		BENZENE	2.25E+00	3.74E-01	1.32E+02	6.01E-06	1.70E-02
		CHLOROBENZENE	2.25E+00	--	3.92E+02	--	5.74E-03
		MERCURY	1.60E-01	--	6.80E-01	--	2.35E-01
		TOLUENE	2.75E+00	--	1.41E+03	--	1.94E-03
					TOTAL	6.01E-06	2.90E-01
BOS-1	B0828	TRICHLOROETHENE	2.50E-01	2.88E+00	1.41E+03	8.68E-08	1.77E-04
					TOTAL	8.68E-08	1.77E-04
BOS-1	B0923	MERCURY	1.50E-01	--	6.80E-01	--	2.21E-01
					TOTAL	--	2.21E-01

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	B1420	1,2-DICHLOROETHANE	1.95E-01	2.33E+00	1.22E+02	8.36E-08	1.60E-03
		TETRACHLOROETHENE	2.25E+00	5.38E-01	4.64E+01	4.19E-06	4.85E-02
		TOLUENE	5.90E-01	--	1.41E+03	--	4.17E-04
		XYLENE (TOTAL)	5.10E-01	--	3.37E+02	--	1.51E-03
					TOTAL	4.27E-06	5.20E-02
BOS-1	B1422	CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
		MERCURY	3.50E-01	--	6.80E-01	--	5.15E-01
					TOTAL	--	5.20E-01
BOS-1	B1423	CARBON DISULFIDE	2.00E+00	--	5.63E+02	--	3.55E-03
		MERCURY	1.40E-01	--	6.80E-01	--	2.06E-01
					TOTAL	--	2.09E-01
BOS-2	B1720	CHLOROFORM	5.25E-01	6.99E-01	3.26E+02	7.51E-07	1.61E-03
		TOLUENE	2.15E-01	--	1.41E+03	--	1.52E-04
					TOTAL	7.51E-07	1.76E-03
BOS-2	B2117	MERCURY	1.00E-01	--	6.80E-01	--	1.47E-01
					TOTAL	--	1.47E-01
BOS-2	B2517	MERCURY	8.50E-02	--	6.80E-01	--	1.25E-01
		NAPHTHALENE	3.00E+00	3.58E+00	1.52E+02	8.37E-07	1.97E-02
					TOTAL	8.37E-07	1.45E-01

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
BOS-2	B3314	CARBON DISULFIDE	1.10E+01	--	5.63E+02	--	1.95E-02
		TERT-BUTYL METHYL ETHER	4.10E+00	3.89E+02	1.25E+05	1.05E-08	3.28E-05
					TOTAL	1.05E-08	1.96E-02
BOS-2	B3613	1,1-DICHLOROETHANE	6.00E-01	6.48E+00	2.13E+03	9.25E-08	2.82E-04
		CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
		M,P-XYLENES	6.00E-01	--	3.37E+02	--	1.78E-03
					TOTAL	9.25E-08	7.39E-03
BOS-2	B3614	1,1-DICHLOROETHANE	2.00E+00	6.48E+00	2.13E+03	3.08E-07	9.40E-04
					TOTAL	3.08E-07	9.40E-04
BOS-2	B3714	1,1-DICHLOROETHANE	3.50E+00	6.48E+00	2.13E+03	5.40E-07	1.65E-03
		CARBON DISULFIDE	1.45E+01	--	5.63E+02	--	2.57E-02
					TOTAL	5.40E-07	2.74E-02
BOS-2	B3814	ETHYLBENZENE	5.75E-01	--	3.14E+03	--	1.83E-04
		M,P-XYLENES	9.00E-01	--	3.37E+02	--	2.67E-03
		TOLUENE	4.50E-01	--	1.41E+03	--	3.18E-04
					TOTAL	--	3.17E-03

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-R [b] (µg/L)	Noncancer Inhalation RBSL-VI-R [b] (µg/L)	Cancer Risk	Hazard Index
BOS-2	B3914	CARBON DISULFIDE	2.10E+01	--	5.63E+02	--	3.73E-02
		M,P-XYLENES	7.00E-01	--	3.37E+02	--	2.08E-03
		PYRENE	3.00E+00	--	2.33E+05	--	1.29E-05
		TOLUENE	3.00E-01	--	1.41E+03	--	2.12E-04
					TOTAL	--	3.96E-02
BOS-2	B4014	M,P-XYLENES	9.00E-01	--	3.37E+02	--	2.67E-03
					TOTAL	--	2.67E-03
BOS-2	B4314	CARBON DISULFIDE	5.00E+00	--	5.63E+02	--	8.87E-03
					TOTAL	--	8.87E-03
BOS-3	B4614	MERCURY	5.90E-01	--	6.80E-01	--	8.68E-01
					TOTAL	--	8.68E-01
BOS-3	B4814	MERCURY	1.90E-01	--	6.80E-01	--	2.79E-01
		TOLUENE	5.00E-01	--	1.41E+03	--	3.54E-04
					TOTAL	--	2.80E-01
BOS-3	B4915	1,2-DICHLOROETHENE (TOTAL)	9.00E+00	--	2.09E+02	--	4.30E-02
					TOTAL	--	4.30E-02
BOS-3	B6006	MERCURY	2.80E+00	--	6.80E-01	--	4.12E+00
					TOTAL	--	4.12E+00

Table A3-17: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a MAX EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air. Max EPCs were the only EPCs for non-plume wells.

b Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

Definitions:

--	Not applicable
µg/L	Microgram per liter
EPA	U.S. Environmental Protection Agency
MAX	Maximum detected concentration
RB	Redevelopment block
RBSL-VI-R	Risk-based screening level for vapor intrusion, residential exposure scenario

Source:

EPA. 2002a. "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." Draft. Federal Register. November 29, 2002. Volume 67, Number 230. Pages 71169-71172.

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
3	AH10	TRICHLOROETHENE	2.50E-01	4.84E+00	1.41E+03	5.17E-08	1.77E-04
					TOTAL	5.17E-08	1.77E-04
3	AH11	1,1-DICHLOROETHANE	3.60E-01	1.09E+01	2.13E+03	3.30E-08	1.69E-04
		MERCURY	2.30E-01	--	6.80E-01	--	3.38E-01
		TRICHLOROETHENE	2.00E-01	4.84E+00	1.41E+03	4.13E-08	1.42E-04
					TOTAL	7.44E-08	3.39E-01
5	AJ10	TETRACHLOROETHENE	1.00E+00	9.03E-01	4.64E+01	1.11E-06	2.16E-02
					TOTAL	1.11E-06	2.16E-02
5	AL11	2-METHYLNAPHTHALENE	1.10E+01	--	7.07E+02	--	1.56E-02
		FLUORENE	6.00E+00	--	4.43E+04	--	1.35E-04
		MERCURY	9.75E-02	--	6.80E-01	--	1.43E-01
					TOTAL	--	1.59E-01
6	AJ09	2-METHYLNAPHTHALENE	2.70E+00	--	7.07E+02	--	3.82E-03
		ACENAPHTHENE	2.65E+00	--	3.30E+04	--	8.02E-05
		CARBON DISULFIDE	2.00E-01	--	5.63E+02	--	3.55E-04
		MERCURY	2.50E-01	--	6.80E-01	--	3.68E-01
					TOTAL	--	3.72E-01

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
6	AM07	BROMOMETHANE	2.75E-01	--	1.92E+01	--	1.44E-02
		CIS-1,2-DICHLOROETHENE	2.50E-01	--	2.09E+02	--	1.19E-03
		MERCURY	7.50E-02	--	6.80E-01	--	1.10E-01
		TOLUENE	3.00E-01	--	1.41E+03	--	2.12E-04
					TOTAL	--	1.26E-01
7	AN11	MERCURY	1.50E-01	--	6.80E-01	--	2.21E-01
					TOTAL	--	2.21E-01
9	AO06	1,2-DICHLOROETHANE	3.60E-01	3.92E+00	1.22E+02	9.19E-08	2.95E-03
		CARBON DISULFIDE	2.90E-01	--	5.63E+02	--	5.15E-04
		MERCURY	3.70E-01	--	6.80E-01	--	5.44E-01
		TRICHLOROETHENE	2.25E-01	4.84E+00	1.41E+03	4.65E-08	1.60E-04
					TOTAL	1.38E-07	5.48E-01
9	AO07	CIS-1,2-DICHLOROETHENE	1.90E-01	--	2.09E+02	--	9.08E-04
		TOLUENE	2.70E-01	--	1.41E+03	--	1.91E-04
		XYLENE (TOTAL)	2.00E-01	--	3.37E+02	--	5.93E-04
					TOTAL	--	1.69E-03
9	AQ06	CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
					TOTAL	--	5.32E-03

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
12	AR06	M,P-XYLENES	7.00E-01	--	3.37E+02	--	2.08E-03
		MERCURY	1.30E-01	--	6.80E-01	--	1.91E-01
		TOLUENE	4.00E-01	--	1.41E+03	--	2.83E-04
					TOTAL	--	1.94E-01
12	AS07	MERCURY	2.00E+00	--	6.80E-01	--	2.94E+00
					TOTAL	--	2.94E+00
12	AT06	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	6.60E+01	--	1.27E+03	--	5.20E-02
		1,2-DICHLOROBENZENE	1.00E+00	--	2.56E+03	--	3.90E-04
		CARBON DISULFIDE	1.80E+00	--	5.63E+02	--	3.19E-03
		CIS-1,2-DICHLOROETHENE	2.90E-01	--	2.09E+02	--	1.39E-03
		DICHLORODIFLUOROMETHANE	5.90E+01	--	1.43E+01	--	4.14E+00
		MERCURY	2.90E-02	--	6.80E-01	--	4.26E-02
		TRICHLOROFLUOROMETHANE	1.40E+01	--	1.76E+02	--	7.95E-02
					TOTAL	--	4.32E+00
12	AT07	MERCURY	3.20E-01	--	6.80E-01	--	4.71E-01
					TOTAL	--	4.71E-01
15	AU07	CARBON DISULFIDE	4.00E-01	--	5.63E+02	--	7.10E-04
		MERCURY	1.30E-01	--	6.80E-01	--	1.91E-01
					TOTAL	--	1.92E-01

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
15	AV06	CARBON DISULFIDE	7.00E+00	--	5.63E+02	--	1.24E-02
		MERCURY	9.10E-01	--	6.80E-01	--	1.34E+00
					TOTAL	--	1.35E+00
16	AX03	ACENAPHTHENE	3.50E+00	--	3.30E+04	--	1.06E-04
		FLUORENE	3.00E+00	--	4.43E+04	--	6.77E-05
		MERCURY	2.10E-01	--	6.80E-01	--	3.09E-01
		PHENANTHRENE	3.00E+00	--	1.90E+05	--	1.58E-05
		PYRENE	2.95E+00	--	2.33E+05	--	1.27E-05
					TOTAL	--	3.09E-01
16	AY04	CHLOROFORM	4.00E+00	1.17E+00	3.26E+02	3.41E-06	1.23E-02
		MERCURY	2.50E-01	--	6.80E-01	--	3.68E-01
					TOTAL	3.41E-06	3.80E-01
BOS-1	AF10	1,2-DICHLOROETHANE	1.40E-01	3.92E+00	1.22E+02	3.57E-08	1.15E-03
		ETHYLBENZENE	3.80E-01	--	3.14E+03	--	1.21E-04
		TOLUENE	9.00E-01	--	1.41E+03	--	6.36E-04
		XYLENE (TOTAL)	1.00E+00	--	3.37E+02	--	2.96E-03
					TOTAL	3.57E-08	4.87E-03

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	AF12	1,2-DICHLOROETHENE (TOTAL)	3.00E-01	--	2.09E+02	--	1.43E-03
		CHLOROBENZENE	1.00E+00	--	3.92E+02	--	2.55E-03
		CIS-1,2-DICHLOROETHENE	1.00E+01	--	2.09E+02	--	4.78E-02
		TERT-BUTYL METHYL ETHER	2.40E-01	6.53E+02	1.25E+05	3.67E-10	1.92E-06
		TRICHLOROETHENE	1.00E+00	4.84E+00	1.41E+03	2.07E-07	7.10E-04
					TOTAL	2.07E-07	5.25E-02
BOS-1	AF13	1,4-DICHLOROBENZENE	4.10E-01	3.59E+00	8.08E+03	1.14E-07	5.07E-05
		ACETONE	3.00E+00	--	1.98E+06	--	1.52E-06
		ACETOPHENONE	3.00E+00	--	7.54E+05	--	3.98E-06
		BENZENE	1.00E+00	6.29E-01	1.32E+02	1.59E-06	7.56E-03
		CARBON DISULFIDE	9.00E+00	--	5.63E+02	--	1.60E-02
		CHLOROBENZENE	4.00E+00	--	3.92E+02	--	1.02E-02
		CHLOROETHANE	1.30E+01	1.09E+01	2.25E+04	1.19E-06	5.78E-04
		CIS-1,2-DICHLOROETHENE	3.40E-01	--	2.09E+02	--	1.63E-03
		MERCURY	2.75E-02	--	6.80E-01	--	4.04E-02
		TERT-BUTYL METHYL ETHER	8.30E-01	6.53E+02	1.25E+05	1.27E-09	6.64E-06
		TOLUENE	2.00E+00	--	1.41E+03	--	1.41E-03
		TRICHLOROETHENE	2.00E+00	4.84E+00	1.41E+03	4.13E-07	1.42E-03
					TOTAL	3.31E-06	7.93E-02
BOS-1	AG10	1,1,2,2-TETRACHLOROETHANE	1.00E+00	5.06E+00	1.48E+04	1.98E-07	6.74E-05
		2-HEXANONE	4.00E+00	--	4.36E+06	--	9.17E-07
		CIS-1,2-DICHLOROETHENE	2.10E-01	--	2.09E+02	--	1.00E-03
		TERT-BUTYL METHYL ETHER	2.00E-01	6.53E+02	1.25E+05	3.06E-10	1.60E-06
		VINYL ACETATE	2.00E+00	--	9.52E+03	--	2.10E-04
					TOTAL	1.98E-07	1.28E-03

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	AH08	MERCURY	1.50E-01	--	6.80E-01	--	2.21E-01
					TOTAL	--	2.21E-01
BOS-1	AH09	1,2,4-TRICHLOROBENZENE	2.00E+00	--	6.61E+01	--	3.02E-02
		BENZENE	2.25E+00	6.29E-01	1.32E+02	3.58E-06	1.70E-02
		CHLOROBENZENE	2.25E+00	--	3.92E+02	--	5.74E-03
		MERCURY	1.60E-01	--	6.80E-01	--	2.35E-01
		TOLUENE	2.75E+00	--	1.41E+03	--	1.94E-03
					TOTAL	3.58E-06	2.90E-01
BOS-1	AJ07	1,2-DICHLOROETHANE	1.95E-01	3.92E+00	1.22E+02	4.98E-08	1.60E-03
		TETRACHLOROETHENE	2.25E+00	9.03E-01	4.64E+01	2.49E-06	4.85E-02
		TOLUENE	5.90E-01	--	1.41E+03	--	4.17E-04
		XYLENE (TOTAL)	5.10E-01	--	3.37E+02	--	1.51E-03
					TOTAL	2.54E-06	5.20E-02
BOS-1	AJ08	CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
		MERCURY	3.50E-01	--	6.80E-01	--	5.15E-01
					TOTAL	--	5.20E-01
BOS-2	AK07	CHLOROFORM	5.25E-01	1.17E+00	3.26E+02	4.47E-07	1.61E-03
		TOLUENE	2.15E-01	--	1.41E+03	--	1.52E-04
					TOTAL	4.47E-07	1.76E-03

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
BOS-2	AL06	MERCURY	1.00E-01	--	6.80E-01	--	1.47E-01
					TOTAL	--	1.47E-01
BOS-2	AN06	MERCURY	8.50E-02	--	6.80E-01	--	1.25E-01
		NAPHTHALENE	3.00E+00	6.02E+00	1.52E+02	4.98E-07	1.97E-02
					TOTAL	4.98E-07	1.45E-01
BOS-2	AP05	CARBON DISULFIDE	1.10E+01	--	5.63E+02	--	1.95E-02
		TERT-BUTYL METHYL ETHER	4.10E+00	6.53E+02	1.25E+05	6.28E-09	3.28E-05
					TOTAL	6.28E-09	1.96E-02
BOS-2	AQ05	1,1-DICHLOROETHANE	2.00E+00	1.09E+01	2.13E+03	1.84E-07	9.40E-04
		CARBON DISULFIDE	3.00E+00	--	5.63E+02	--	5.32E-03
		M,P-XYLENES	6.00E-01	--	3.37E+02	--	1.78E-03
					TOTAL	1.84E-07	8.04E-03
BOS-2	AR05	1,1-DICHLOROETHANE	3.50E+00	1.09E+01	2.13E+03	3.21E-07	1.65E-03
		CARBON DISULFIDE	2.10E+01	--	5.63E+02	--	3.73E-02
		ETHYLBENZENE	5.75E-01	--	3.14E+03	--	1.83E-04
		M,P-XYLENES	9.00E-01	--	3.37E+02	--	2.67E-03
		PYRENE	3.00E+00	--	2.33E+05	--	1.29E-05
		TOLUENE	4.50E-01	--	1.41E+03	--	3.18E-04
					TOTAL	3.21E-07	4.21E-02

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Inhalation RBSL-VI-IW [b] (µg/L)	Noncancer Inhalation RBSL-VI-IW [b] (µg/L)	Cancer Risk	Hazard Index
BOS-2	AS05	M,P-XYLENES	9.00E-01	--	3.37E+02	--	2.67E-03
					TOTAL	--	2.67E-03
BOS-2	AT05	CARBON DISULFIDE	5.00E+00	--	5.63E+02	--	8.87E-03
					TOTAL	--	8.87E-03
BOS-3	AU05	MERCURY	5.90E-01	--	6.80E-01	--	8.68E-01
		TOLUENE	5.00E-01	--	1.41E+03	--	3.54E-04
					TOTAL	--	8.68E-01
BOS-3	AV05	1,2-DICHLOROETHENE (TOTAL)	9.00E+00	--	2.09E+02	--	4.30E-02
					TOTAL	--	4.30E-02
BOS-3	AY02	MERCURY	2.80E+00	--	6.80E-01	--	4.12E+00
					TOTAL	--	4.12E+00

Table A3-18: Summary of Cancer Risks and Noncancer Hazard Indices for Industrial Exposure via Vapor Intrusion, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a Max EPCs are groundwater source concentrations (i.e., concentration of the analyte at the source) and not the inhalation concentration in air. Max EPCs were the only EPCs for non-plume wells.

b Risk-based screening levels for vapor intrusion (EPA 2002a) were adjusted to incorporate California toxicity criteria.

Definitions:

--	Not applicable
µg/L	Microgram per liter
MAX	Maximum detected concentration
RB	Redevelopment block
RBSL-VI-IW	Risk-based screening level for vapor intrusion, industrial exposure scenario

Source:

EPA. 2002a. "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." Draft. Federal Register. November 29, 2002. Volume 67, Number 230. Pages 71169-71172.

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
2	AG12	BARIUM	5.72E+01	--	--	--	5.31E-05	--	5.31E-05
		MANGANESE	1.98E+02	--	--	--	1.53E-03	--	1.53E-03
		THALLIUM	3.07E+01	--	--	--	8.63E-02	--	8.63E-02
		VANADIUM	1.00E+01	--	--	--	1.86E-03	--	1.86E-03
			TOTAL	--	--	--	8.97E-02	--	8.97E-02
3	AH10	ALUMINUM	1.63E+02	--	--	--	3.02E-05	--	3.02E-05
		ANTIMONY	3.56E+01	--	--	--	1.65E-02	--	1.65E-02
		ARSENIC	7.60E+00	1.90E-07	--	1.90E-07	4.70E-03	--	4.70E-03
		BARIUM	2.55E+02	--	--	--	2.37E-04	--	2.37E-04
		BERYLLIUM	5.20E-01	--	--	--	4.82E-05	--	4.82E-05
		CADMIUM	1.10E+00	--	--	--	4.08E-04	--	4.08E-04
		COBALT	1.84E+01	--	--	--	6.83E-05	--	6.83E-05
		COPPER	2.40E+00	--	--	--	1.20E-05	--	1.20E-05
		IRON	1.04E+03	--	--	--	6.43E-04	--	6.43E-04
		LEAD	1.56E+01	--	--	--	--	--	--
		MANGANESE	8.34E+03	--	--	--	6.45E-02	--	6.45E-02
		NICKEL	1.22E+01	--	--	--	2.26E-05	--	2.26E-05
		THALLIUM	5.30E+00	--	--	--	1.49E-02	--	1.49E-02
		TRICHLOROETHENE	2.50E-01	1.03E-10	5.66E-10	6.69E-10	--	3.30E-05	3.30E-05
		VANADIUM	1.10E+00	--	--	--	2.04E-04	--	2.04E-04
			TOTAL	1.90E-07	5.66E-10	1.91E-07	1.02E-01	3.30E-05	1.02E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
3	AH11	1,1-DICHLOROETHANE	3.60E-01	3.64E-11	7.61E-10	7.97E-10	4.47E-06	6.67E-05	7.12E-05
		ALUMINUM	3.16E+01	--	--	--	5.86E-06	--	5.86E-06
		ANTIMONY	1.34E+01	--	--	--	6.21E-03	--	6.21E-03
		ARSENIC	5.11E+01	1.28E-06	--	1.28E-06	3.16E-02	--	3.16E-02
		BARIUM	6.34E+02	--	--	--	5.88E-04	--	5.88E-04
		BUTYLBENZYLPHTHALATE	1.00E+01	--	--	--	1.39E-06	--	1.39E-06
		CAPROLACTAM	4.70E+00	--	--	--	2.62E-07	--	2.62E-07
		CHROMIUM	1.50E+00	--	--	--	1.86E-07	--	1.86E-07
		COBALT	5.90E+00	--	--	--	2.19E-05	--	2.19E-05
		COPPER	8.60E+00	--	--	--	4.31E-05	--	4.31E-05
		DIETHYLPHTHALATE	1.00E+01	--	--	--	9.04E-06	--	9.04E-06
		IRON	3.69E+03	--	--	--	2.28E-03	--	2.28E-03
		MANGANESE	6.69E+03	--	--	--	5.17E-02	--	5.17E-02
		MERCURY	2.30E-01	--	--	--	1.42E-04	4.90E-02	4.92E-02
		MOLYBDENUM	3.20E+00	--	--	--	1.19E-04	--	1.19E-04
		NICKEL	7.04E+01	--	--	--	1.31E-04	--	1.31E-04
		TRICHLOROETHENE	2.00E-01	8.27E-11	4.53E-10	5.35E-10	--	2.64E-05	2.64E-05
		VANADIUM	1.76E+01	--	--	--	3.27E-03	--	3.27E-03
		ZINC	1.16E+02	--	--	--	4.30E-05	--	4.30E-05
			TOTAL	1.28E-06	1.21E-09	1.28E-06	9.62E-02	4.91E-02	1.45E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
5	AJ10	ARSENIC	1.50E+00	3.76E-08	--	3.76E-08	9.28E-04	--	9.28E-04
		BARIUM	3.95E+02	--	--	--	3.66E-04	--	3.66E-04
		COBALT	1.96E+01	--	--	--	7.27E-05	--	7.27E-05
		IRON	2.79E+02	--	--	--	1.73E-04	--	1.73E-04
		LEAD	2.10E+00	--	--	--	--	--	--
		MANGANESE	2.52E+03	--	--	--	1.95E-02	--	1.95E-02
		NICKEL	3.22E+02	--	--	--	5.97E-04	--	5.97E-04
		TETRACHLOROETHENE	1.00E+00	4.72E-08	6.06E-09	5.33E-08	6.12E-04	2.02E-03	2.63E-03
			TOTAL	8.48E-08	6.06E-09	9.09E-08	2.22E-02	2.02E-03	2.42E-02
5	AK10	ARSENIC	8.60E+00	2.15E-07	--	2.15E-07	5.32E-03	--	5.32E-03
		BARIUM	6.67E+01	--	--	--	6.19E-05	--	6.19E-05
		CHROMIUM	5.30E+00	--	--	--	6.55E-07	--	6.55E-07
		COBALT	1.60E+00	--	--	--	5.94E-06	--	5.94E-06
		IRON	1.03E+03	--	--	--	6.37E-04	--	6.37E-04
		MANGANESE	1.88E+02	--	--	--	1.45E-03	--	1.45E-03
		MOLYBDENUM	2.90E+01	--	--	--	1.08E-03	--	1.08E-03
		NICKEL	7.90E+00	--	--	--	1.47E-05	--	1.47E-05
		SELENIUM	2.40E+00	--	--	--	8.90E-05	--	8.90E-05
		SILVER	7.40E-01	--	--	--	1.65E-05	--	1.65E-05
		VANADIUM	4.90E+00	--	--	--	9.09E-04	--	9.09E-04
			TOTAL	2.15E-07	--	2.15E-07	9.58E-03	--	9.58E-03

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
5	AL11	2-METHYLNAPHTHALENE	1.10E+01	--	--	--	2.40E-02	5.44E-02	7.84E-02
		ALPHA-BHC	4.00E-02	7.35E-09	--	7.35E-09	1.63E-04	--	1.63E-04
		ALUMINUM	3.49E+01	--	--	--	6.47E-06	--	6.47E-06
		ARSENIC	2.50E+00	6.26E-08	--	6.26E-08	1.55E-03	--	1.55E-03
		BARIUM	1.16E+02	--	--	--	1.07E-04	--	1.07E-04
		BETA-BHC	8.00E-02	4.20E-09	--	4.20E-09	8.16E-04	--	8.16E-04
		COBALT	7.50E+00	--	--	--	2.78E-05	--	2.78E-05
		COPPER	6.85E+00	--	--	--	3.43E-05	--	3.43E-05
		DELTA-BHC	2.75E-02	--	--	--	2.81E-04	--	2.81E-04
		FLUORENE	6.00E+00	--	--	--	4.17E-06	1.66E-03	1.66E-03
		HEXACHLOROETHANE	5.00E+00	1.55E-08	--	1.55E-08	2.78E-02	--	2.78E-02
		IRON	5.63E+02	--	--	--	3.48E-04	--	3.48E-04
		MANGANESE	1.55E+03	--	--	--	1.19E-02	--	1.19E-02
		MERCURY	9.75E-02	--	--	--	6.03E-05	2.08E-02	2.08E-02
		NICKEL	3.59E+01	--	--	--	6.66E-05	--	6.66E-05
		SELENIUM	2.67E+00	--	--	--	9.93E-05	--	9.93E-05
		THALLIUM	2.40E+00	--	--	--	6.75E-03	--	6.75E-03
		VANADIUM	3.10E+00	--	--	--	5.75E-04	--	5.75E-04
			TOTAL	8.97E-08	--	8.97E-08	7.46E-02	7.69E-02	1.52E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
5	AM10	BARIUM	8.88E+02	--	--	--	8.24E-04	--	8.24E-04
		CADMIUM	3.80E+00	--	--	--	1.41E-03	--	1.41E-03
		COBALT	1.20E+01	--	--	--	4.45E-05	--	4.45E-05
		MANGANESE	2.14E+03	--	--	--	1.65E-02	--	1.65E-02
		MOLYBDENUM	2.80E+00	--	--	--	1.04E-04	--	1.04E-04
		NICKEL	6.65E+01	--	--	--	1.23E-04	--	1.23E-04
		THALLIUM	9.30E+00	--	--	--	2.61E-02	--	2.61E-02
		VANADIUM	2.60E+00	--	--	--	4.82E-04	--	4.82E-04
			TOTAL	--	--	--	4.57E-02	--	4.57E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
6	AJ09	2-METHYLNAPHTHALENE	2.70E+00	--	--	--	5.89E-03	1.34E-02	1.92E-02
		ACENAPHTHENE	2.65E+00	--	--	--	3.85E-04	6.90E-04	1.07E-03
		ANTIMONY	1.70E+00	--	--	--	7.88E-04	--	7.88E-04
		ARSENIC	1.75E+00	4.38E-08	--	4.38E-08	1.08E-03	--	1.08E-03
		BARIUM	1.60E+02	--	--	--	1.48E-04	--	1.48E-04
		CARBON DISULFIDE	2.00E-01	--	--	--	6.31E-06	2.98E-05	3.61E-05
		CHROMIUM	1.04E+01	--	--	--	1.29E-06	--	1.29E-06
		COBALT	2.15E+00	--	--	--	7.98E-06	--	7.98E-06
		COPPER	1.67E+01	--	--	--	8.37E-05	--	8.37E-05
		IRON	3.48E+02	--	--	--	2.15E-04	--	2.15E-04
		LEAD	1.36E+01	--	--	--	--	--	--
		MANGANESE	5.06E+02	--	--	--	3.91E-03	--	3.91E-03
		MERCURY	2.50E-01	--	--	--	1.55E-04	5.33E-02	5.34E-02
		MOLYBDENUM	2.10E+00	--	--	--	7.79E-05	--	7.79E-05
		NICKEL	2.22E+01	--	--	--	4.12E-05	--	4.12E-05
		SELENIUM	7.45E+00	--	--	--	2.76E-04	--	2.76E-04
		THALLIUM	1.63E+01	--	--	--	4.58E-02	--	4.58E-02
		VANADIUM	3.40E+00	--	--	--	6.31E-04	--	6.31E-04
		ZINC	3.21E+01	--	--	--	1.19E-05	--	1.19E-05
		TOTAL		4.38E-08	--	4.38E-08	5.95E-02	6.74E-02	1.27E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
6	AK08	ALUMINUM	1.29E+02	--	--	--	2.39E-05	--	2.39E-05
		ARSENIC	4.65E+00	1.16E-07	--	1.16E-07	2.88E-03	--	2.88E-03
		BARIUM	7.01E+01	--	--	--	6.50E-05	--	6.50E-05
		CADMIUM	3.25E+00	--	--	--	1.21E-03	--	1.21E-03
		CHROMIUM	1.26E+03	--	--	--	1.56E-04	--	1.56E-04
		COBALT	1.61E+02	--	--	--	5.97E-04	--	5.97E-04
		COPPER	1.63E+01	--	--	--	8.17E-05	--	8.17E-05
		IRON	5.05E+04	--	--	--	3.12E-02	--	3.12E-02
		MANGANESE	2.59E+03	--	--	--	2.00E-02	--	2.00E-02
		MOLYBDENUM	3.21E+01	--	--	--	1.19E-03	--	1.19E-03
		NICKEL	7.12E+03	--	--	--	1.32E-02	--	1.32E-02
		SILVER	3.40E+00	--	--	--	7.57E-05	--	7.57E-05
		VANADIUM	1.10E+00	--	--	--	2.04E-04	--	2.04E-04
		ZINC	2.93E+01	--	--	--	1.09E-05	--	1.09E-05
		TOTAL		1.16E-07	--	1.16E-07	7.09E-02	--	7.09E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
6	AK09	ALUMINUM	2.00E+02	--	--	--	3.71E-05	--	3.71E-05
		ANTIMONY	6.30E+00	--	--	--	2.92E-03	--	2.92E-03
		ARSENIC	2.00E+00	5.01E-08	--	5.01E-08	1.24E-03	--	1.24E-03
		BARIUM	3.50E+02	--	--	--	3.25E-04	--	3.25E-04
		CADMIUM	5.70E-01	--	--	--	2.11E-04	--	2.11E-04
		COBALT	4.00E+00	--	--	--	1.48E-05	--	1.48E-05
		COPPER	6.20E+00	--	--	--	3.11E-05	--	3.11E-05
		IRON	3.13E+02	--	--	--	1.94E-04	--	1.94E-04
		MANGANESE	8.10E+02	--	--	--	6.26E-03	--	6.26E-03
		NICKEL	3.33E+01	--	--	--	6.18E-05	--	6.18E-05
		THALLIUM	2.70E+00	--	--	--	7.59E-03	--	7.59E-03
		VANADIUM	1.20E+00	--	--	--	2.23E-04	--	2.23E-04
		ZINC	1.66E+01	--	--	--	6.16E-06	--	6.16E-06
			TOTAL	5.01E-08	--	5.01E-08	1.91E-02	--	1.91E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
6	AM07	ALUMINUM	3.44E+01	--	--	--	6.38E-06	--	6.38E-06
		ANTIMONY	2.98E+01	--	--	--	1.38E-02	--	1.38E-02
		ARSENIC	8.90E+00	2.23E-07	--	2.23E-07	5.50E-03	--	5.50E-03
		BARIUM	5.85E+02	--	--	--	5.43E-04	--	5.43E-04
		BERYLLIUM	3.30E-01	--	--	--	3.06E-05	--	3.06E-05
		BROMOMETHANE	2.75E-01	--	--	--	1.02E-04	5.21E-03	5.31E-03
		CHROMIUM	7.70E+00	--	--	--	9.52E-07	--	9.52E-07
		CIS-1,2-DICHLOROETHENE	2.50E-01	--	--	--	3.57E-05	6.53E-04	6.89E-04
		COBALT	4.80E+00	--	--	--	1.78E-05	--	1.78E-05
		COPPER	3.62E+02	--	--	--	1.82E-03	--	1.82E-03
		IRON	1.49E+02	--	--	--	9.21E-05	--	9.21E-05
		MANGANESE	7.04E+02	--	--	--	5.44E-03	--	5.44E-03
		MERCURY	7.50E-02	--	--	--	4.64E-05	1.60E-02	1.60E-02
		MOLYBDENUM	4.00E+00	--	--	--	1.48E-04	--	1.48E-04
		NICKEL	1.20E+01	--	--	--	2.23E-05	--	2.23E-05
		SILVER	5.80E-01	--	--	--	1.29E-05	--	1.29E-05
		THALLIUM	8.90E+00	--	--	--	2.50E-02	--	2.50E-02
		TOLUENE	3.00E-01	--	--	--	8.63E-06	7.34E-05	8.21E-05
		VANADIUM	4.40E+00	--	--	--	8.16E-04	--	8.16E-04
		ZINC	1.72E+02	--	--	--	6.39E-05	--	6.39E-05
			TOTAL	2.23E-07	--	2.23E-07	5.35E-02	2.19E-02	7.55E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
6	AM09	BARIUM	4.38E+02	--	--	--	4.06E-04	--	4.06E-04
		COBALT	9.00E+00	--	--	--	3.34E-05	--	3.34E-05
		IRON	3.72E+01	--	--	--	2.30E-05	--	2.30E-05
		MANGANESE	2.03E+03	--	--	--	1.57E-02	--	1.57E-02
		MOLYBDENUM	1.50E+00	--	--	--	5.57E-05	--	5.57E-05
		NICKEL	3.36E+01	--	--	--	6.23E-05	--	6.23E-05
		THALLIUM	7.00E+00	--	--	--	1.97E-02	--	1.97E-02
		VANADIUM	1.60E+00	--	--	--	2.97E-04	--	2.97E-04
			TOTAL	--	--	--	3.62E-02	--	3.62E-02
7	AN11	ARSENIC	3.60E+00	9.02E-08	--	9.02E-08	2.23E-03	--	2.23E-03
		BARIUM	4.02E+01	--	--	--	3.73E-05	--	3.73E-05
		CADMIUM	5.00E+00	--	--	--	1.86E-03	--	1.86E-03
		COBALT	1.90E+00	--	--	--	7.05E-06	--	7.05E-06
		IRON	3.96E+01	--	--	--	2.45E-05	--	2.45E-05
		MANGANESE	3.29E+02	--	--	--	2.54E-03	--	2.54E-03
		MERCURY	1.50E-01	--	--	--	9.28E-05	3.20E-02	3.21E-02
		MOLYBDENUM	3.70E+00	--	--	--	1.37E-04	--	1.37E-04
		NICKEL	1.16E+01	--	--	--	2.15E-05	--	2.15E-05
		THALLIUM	3.00E+00	--	--	--	8.43E-03	--	8.43E-03
		VANADIUM	2.80E+00	--	--	--	5.19E-04	--	5.19E-04
			TOTAL	9.02E-08	--	9.02E-08	1.59E-02	3.20E-02	4.79E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
7	AP10	ANTIMONY	3.28E+01	--	--	--	1.52E-02	--	1.52E-02
		ARSENIC	1.70E+00	4.26E-08	--	4.26E-08	1.05E-03	--	1.05E-03
		BARIUM	3.70E+02	--	--	--	3.43E-04	--	3.43E-04
		BERYLLIUM	1.40E+00	--	--	--	1.30E-04	--	1.30E-04
		COBALT	2.10E+00	--	--	--	7.79E-06	--	7.79E-06
		COPPER	3.90E+00	--	--	--	1.96E-05	--	1.96E-05
		IRON	1.14E+01	--	--	--	7.05E-06	--	7.05E-06
		MANGANESE	3.74E+02	--	--	--	2.89E-03	--	2.89E-03
		NICKEL	3.86E+01	--	--	--	7.16E-05	--	7.16E-05
		SILVER	1.85E+01	--	--	--	4.12E-04	--	4.12E-04
		VANADIUM	8.31E+01	--	--	--	1.54E-02	--	1.54E-02
		TOTAL		4.26E-08	--	4.26E-08	3.56E-02	--	3.56E-02
7	AQ10	ANTIMONY	2.84E+01	--	--	--	1.32E-02	--	1.32E-02
		ARSENIC	3.65E+00	9.14E-08	--	9.14E-08	2.26E-03	--	2.26E-03
		BARIUM	5.91E+01	--	--	--	5.48E-05	--	5.48E-05
		CHROMIUM	1.30E+00	--	--	--	1.61E-07	--	1.61E-07
		COPPER	1.30E+00	--	--	--	6.52E-06	--	6.52E-06
		MANGANESE	1.87E+02	--	--	--	1.45E-03	--	1.45E-03
		MOLYBDENUM	2.18E+01	--	--	--	8.09E-04	--	8.09E-04
		NICKEL	4.24E+01	--	--	--	7.87E-05	--	7.87E-05
		TOTAL		9.14E-08	--	9.14E-08	1.78E-02	--	1.78E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
9	AO06	1,2-DICHLOROETHANE	3.60E-01	3.65E-10	1.16E-08	1.20E-08	1.40E-05	6.37E-03	6.38E-03
		2,6-DINITROTOLUENE	5.80E+01	2.20E-07	--	2.20E-07	2.26E-02	--	2.26E-02
		ALUMINUM	2.43E+02	--	--	--	4.51E-05	--	4.51E-05
		ANTIMONY	2.76E+01	--	--	--	1.28E-02	--	1.28E-02
		ARSENIC	7.50E+00	1.88E-07	--	1.88E-07	4.64E-03	--	4.64E-03
		BARIUM	1.10E+02	--	--	--	1.02E-04	--	1.02E-04
		BERYLLIUM	1.50E+00	--	--	--	1.39E-04	--	1.39E-04
		CARBON DISULFIDE	2.90E-01	--	--	--	9.15E-06	4.32E-05	5.24E-05
		CHROMIUM	6.00E+00	--	--	--	7.42E-07	--	7.42E-07
		COBALT	3.20E+00	--	--	--	1.19E-05	--	1.19E-05
		COPPER	9.50E+00	--	--	--	4.76E-05	--	4.76E-05
		MANGANESE	4.71E+03	--	--	--	3.64E-02	--	3.64E-02
		MERCURY	3.70E-01	--	--	--	2.29E-04	7.89E-02	7.91E-02
		MOLYBDENUM	1.28E+01	--	--	--	4.75E-04	--	4.75E-04
		NICKEL	4.68E+01	--	--	--	8.67E-05	--	8.67E-05
		SELENIUM	1.96E+01	--	--	--	7.27E-04	--	7.27E-04
		THALLIUM	8.52E+01	--	--	--	2.39E-01	--	2.39E-01
		TRICHLOROETHENE	2.25E-01	9.30E-11	5.09E-10	6.02E-10	--	2.97E-05	2.97E-05
		VANADIUM	7.05E+00	--	--	--	1.31E-03	--	1.31E-03
		ZINC	1.70E+01	--	--	--	6.31E-06	--	6.31E-06
			TOTAL	4.08E-07	1.21E-08	4.20E-07	3.19E-01	8.53E-02	4.04E-01
9	AO07	CIS-1,2-DICHLOROETHENE	1.90E-01	--	--	--	2.71E-05	4.96E-04	5.23E-04
		TOLUENE	2.70E-01	--	--	--	7.76E-06	6.61E-05	7.39E-05
		XYLENE (TOTAL)	2.00E-01	--	--	--	9.83E-06	1.73E-04	1.82E-04
			TOTAL	--	--	--	4.47E-05	7.35E-04	7.80E-04

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
9	AP07	ARSENIC	9.90E+00	2.48E-07	--	2.48E-07	6.12E-03	--	6.12E-03
		BARIUM	1.26E+02	--	--	--	1.16E-04	--	1.16E-04
		BERYLLIUM	1.40E+00	--	--	--	1.30E-04	--	1.30E-04
		CADMIUM	4.60E+00	--	--	--	1.71E-03	--	1.71E-03
		COBALT	1.83E+01	--	--	--	6.79E-05	--	6.79E-05
		COPPER	5.80E+00	--	--	--	2.91E-05	--	2.91E-05
		IRON	3.56E+01	--	--	--	2.20E-05	--	2.20E-05
		LEAD	3.00E+00	--	--	--	--	--	--
		MANGANESE	4.89E+02	--	--	--	3.78E-03	--	3.78E-03
		MOLYBDENUM	6.30E+01	--	--	--	2.34E-03	--	2.34E-03
		NICKEL	4.80E+01	--	--	--	8.91E-05	--	8.91E-05
		SELENIUM	1.93E+00	--	--	--	7.14E-05	--	7.14E-05
		VANADIUM	1.19E+01	--	--	--	2.20E-03	--	2.20E-03
			TOTAL	2.48E-07	--	2.48E-07	1.67E-02	--	1.67E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
9	AQ06	ANTIMONY	1.03E+01	--	--	--	4.78E-03	--	4.78E-03
		ARSENIC	1.39E+01	3.47E-07	--	3.47E-07	8.56E-03	--	8.56E-03
		BARIUM	1.15E+02	--	--	--	1.07E-04	--	1.07E-04
		CARBON DISULFIDE	3.00E+00	--	--	--	9.46E-05	4.47E-04	5.42E-04
		CHROMIUM	4.35E+00	--	--	--	5.38E-07	--	5.38E-07
		COBALT	2.08E+00	--	--	--	7.70E-06	--	7.70E-06
		COPPER	1.94E+01	--	--	--	9.73E-05	--	9.73E-05
		IRON	2.21E+01	--	--	--	1.37E-05	--	1.37E-05
		LEAD	1.10E+00	--	--	--	--	--	--
		MANGANESE	6.57E+02	--	--	--	5.07E-03	--	5.07E-03
		MOLYBDENUM	1.48E+01	--	--	--	5.47E-04	--	5.47E-04
		NICKEL	1.06E+01	--	--	--	1.97E-05	--	1.97E-05
		VANADIUM	5.45E-01	--	--	--	1.01E-04	--	1.01E-04
			TOTAL	3.47E-07	--	3.47E-07	1.94E-02	4.47E-04	1.99E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
12	AR06	ALUMINUM	4.28E+02	--	--	--	7.94E-05	--	7.94E-05
		ARSENIC	4.10E+00	1.03E-07	--	1.03E-07	2.54E-03	--	2.54E-03
		BARIUM	6.77E+01	--	--	--	6.28E-05	--	6.28E-05
		BERYLLIUM	5.20E-01	--	--	--	4.82E-05	--	4.82E-05
		CADMIUM	2.30E+00	--	--	--	8.53E-04	--	8.53E-04
		CHROMIUM	1.17E+01	--	--	--	1.45E-06	--	1.45E-06
		COBALT	2.50E+00	--	--	--	9.28E-06	--	9.28E-06
		IRON	9.41E+02	--	--	--	5.82E-04	--	5.82E-04
		LEAD	4.20E+00	--	--	--	--	--	--
		M,P-XYLENES	7.00E-01	--	--	--	3.44E-05	6.06E-04	6.41E-04
		MANGANESE	4.96E+01	--	--	--	3.83E-04	--	3.83E-04
		MERCURY	1.30E-01	--	--	--	8.04E-05	2.77E-02	2.78E-02
		MOLYBDENUM	3.60E+00	--	--	--	1.34E-04	--	1.34E-04
		NICKEL	3.18E+01	--	--	--	5.90E-05	--	5.90E-05
		SELENIUM	2.63E+00	--	--	--	9.74E-05	--	9.74E-05
		THALLIUM	1.08E+01	--	--	--	3.04E-02	--	3.04E-02
		TOLUENE	4.00E-01	--	--	--	1.15E-05	9.79E-05	1.09E-04
		VANADIUM	3.40E+00	--	--	--	6.31E-04	--	6.31E-04
		ZINC	3.27E+01	--	--	--	1.21E-05	--	1.21E-05
		TOTAL		1.03E-07	--	1.03E-07	3.60E-02	2.84E-02	6.44E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
12	AS06	ARSENIC	7.60E+00	1.90E-07	--	1.90E-07	4.70E-03	--	4.70E-03
		BARIUM	1.02E+03	--	--	--	9.46E-04	--	9.46E-04
		COBALT	2.66E+01	--	--	--	9.89E-05	--	9.89E-05
		LEAD	6.72E+01	--	--	--	--	--	--
		MANGANESE	1.71E+04	--	--	--	1.32E-01	--	1.32E-01
		NICKEL	1.22E+02	--	--	--	2.26E-04	--	2.26E-04
		ZINC	3.61E+01	--	--	--	1.34E-05	--	1.34E-05
			TOTAL	1.90E-07	--	1.90E-07	1.38E-01	--	1.38E-01
12	AS07	BARIUM	8.66E+02	--	--	--	8.03E-04	--	8.03E-04
		CHROMIUM	5.70E+00	--	--	--	7.05E-07	--	7.05E-07
		COBALT	1.20E+01	--	--	--	4.45E-05	--	4.45E-05
		IRON	1.55E+04	--	--	--	9.59E-03	--	9.59E-03
		MANGANESE	7.18E+03	--	--	--	5.55E-02	--	5.55E-02
		MERCURY	2.00E+00	--	--	--	1.24E-03	4.26E-01	4.27E-01
		NICKEL	4.94E+01	--	--	--	9.16E-05	--	9.16E-05
		ZINC	2.17E+01	--	--	--	8.05E-06	--	8.05E-06
			TOTAL	--	--	--	6.73E-02	4.26E-01	4.93E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
12	AT06	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	6.60E+01	--	--	--	6.12E-08	1.46E-04	1.46E-04
		1,2-DICHLOROBENZENE	1.00E+00	--	--	--	8.45E-05	3.67E-04	4.51E-04
		ALUMINUM	2.91E+01	--	--	--	5.40E-06	--	5.40E-06
		ANTIMONY	2.90E+00	--	--	--	1.35E-03	--	1.35E-03
		ARSENIC	4.80E+00	1.20E-07	--	1.20E-07	2.97E-03	--	2.97E-03
		BARIUM	6.93E+01	--	--	--	6.43E-05	--	6.43E-05
		BERYLLIUM	3.50E-01	--	--	--	3.25E-05	--	3.25E-05
		CARBON DISULFIDE	1.80E+00	--	--	--	5.68E-05	2.68E-04	3.25E-04
		CHROMIUM	1.10E+00	--	--	--	1.36E-07	--	1.36E-07
		CIS-1,2-DICHLOROETHENE	2.90E-01	--	--	--	4.14E-05	7.57E-04	7.99E-04
		COBALT	2.70E+00	--	--	--	1.00E-05	--	1.00E-05
		COPPER	1.68E+01	--	--	--	8.42E-05	--	8.42E-05
		DICHLORODIFLUOROMETHANE	5.90E+01	--	--	--	4.93E-04	2.45E-02	2.50E-02
		IRON	1.31E+03	--	--	--	8.10E-04	--	8.10E-04
		MANGANESE	2.15E+03	--	--	--	1.66E-02	--	1.66E-02
		MERCURY	2.90E-02	--	--	--	1.79E-05	6.18E-03	6.20E-03
		MOLYBDENUM	3.80E+00	--	--	--	1.41E-04	--	1.41E-04
		NICKEL	7.21E+01	--	--	--	1.34E-04	--	1.34E-04
		SILVER	1.10E+00	--	--	--	2.45E-05	--	2.45E-05
		THALLIUM	1.90E+00	--	--	--	5.34E-03	--	5.34E-03
		TRICHLOROFLUOROMETHANE	1.40E+01	--	--	--	1.13E-04	1.56E-03	1.67E-03
		VANADIUM	8.30E+00	--	--	--	1.54E-03	--	1.54E-03
		ZINC	7.59E+01	--	--	--	2.82E-05	--	2.82E-05
			TOTAL	1.20E-07	--	1.20E-07	3.00E-02	3.38E-02	6.38E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
12	AT07	ANTIMONY	1.44E+01	--	--	--	6.66E-03	--	6.66E-03
		ARSENIC	1.07E+01	2.68E-07	--	2.68E-07	6.62E-03	--	6.62E-03
		BARIUM	1.04E+02	--	--	--	9.63E-05	--	9.63E-05
		COPPER	3.52E+00	--	--	--	1.77E-05	--	1.77E-05
		LEAD	1.68E+00	--	--	--	--	--	--
		MANGANESE	3.09E+02	--	--	--	2.38E-03	--	2.38E-03
		MERCURY	3.20E-01	--	--	--	1.98E-04	6.82E-02	6.84E-02
		MOLYBDENUM	5.95E+00	--	--	--	2.21E-04	--	2.21E-04
		VANADIUM	6.40E+00	--	--	--	1.19E-03	--	1.19E-03
		ZINC	2.96E+01	--	--	--	1.10E-05	--	1.10E-05
			TOTAL	2.68E-07	--	2.68E-07	1.74E-02	6.82E-02	8.56E-02
15	AU06	BARIUM	2.92E+02	--	--	--	2.71E-04	--	2.71E-04
		CADMIUM	4.10E+00	--	--	--	1.52E-03	--	1.52E-03
		COBALT	6.50E+00	--	--	--	2.41E-05	--	2.41E-05
		MANGANESE	1.40E+03	--	--	--	1.08E-02	--	1.08E-02
		NICKEL	3.65E+01	--	--	--	6.76E-05	--	6.76E-05
		SELENIUM	3.70E+00	--	--	--	1.37E-04	--	1.37E-04
		THALLIUM	3.10E+00	--	--	--	8.71E-03	--	8.71E-03
		VANADIUM	1.07E+01	--	--	--	1.99E-03	--	1.99E-03
		ZINC	7.59E+01	--	--	--	2.82E-05	--	2.82E-05
			TOTAL	--	--	--	2.36E-02	--	2.36E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
15	AU07	ARSENIC	5.50E+00	1.38E-07	--	1.38E-07	3.40E-03	--	3.40E-03
		BARIUM	8.40E+02	--	--	--	7.79E-04	--	7.79E-04
		CADMIUM	6.40E-01	--	--	--	2.37E-04	--	2.37E-04
		CARBON DISULFIDE	4.00E-01	--	--	--	1.26E-05	5.96E-05	7.23E-05
		COBALT	5.00E+00	--	--	--	1.86E-05	--	1.86E-05
		IRON	2.70E+03	--	--	--	1.67E-03	--	1.67E-03
		MANGANESE	2.72E+03	--	--	--	2.10E-02	--	2.10E-02
		MERCURY	1.30E-01	--	--	--	8.04E-05	2.77E-02	2.78E-02
		NICKEL	1.62E+01	--	--	--	3.01E-05	--	3.01E-05
		SILVER	3.90E-01	--	--	--	8.68E-06	--	8.68E-06
		THALLIUM	4.63E+01	--	--	--	1.30E-01	--	1.30E-01
		ZINC	1.50E+01	--	--	--	5.57E-06	--	5.57E-06
		TOTAL		1.38E-07	--	1.38E-07	1.57E-01	2.78E-02	1.85E-01
15	AV06	ALUMINUM	2.56E+01	--	--	--	4.74E-06	--	4.74E-06
		ANTIMONY	1.92E+01	--	--	--	8.90E-03	--	8.90E-03
		ARSENIC	6.70E+00	1.68E-07	--	1.68E-07	4.14E-03	--	4.14E-03
		BARIUM	8.70E+01	--	--	--	8.07E-05	--	8.07E-05
		CADMIUM	2.40E+00	--	--	--	8.90E-04	--	8.90E-04
		CARBON DISULFIDE	7.00E+00	--	--	--	2.21E-04	1.04E-03	1.26E-03
		CHROMIUM	3.79E+01	--	--	--	4.69E-06	--	4.69E-06
		MANGANESE	1.54E+01	--	--	--	1.19E-04	--	1.19E-04
		MERCURY	9.10E-01	--	--	--	5.63E-04	1.94E-01	1.94E-01
		MOLYBDENUM	8.00E+00	--	--	--	2.97E-04	--	2.97E-04
		NICKEL	2.81E+01	--	--	--	5.22E-05	--	5.22E-05
		THALLIUM	7.91E+01	--	--	--	2.22E-01	--	2.22E-01
		VANADIUM	3.30E+00	--	--	--	6.12E-04	--	6.12E-04
		TOTAL		1.68E-07	--	1.68E-07	2.38E-01	1.95E-01	4.33E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
16	AX03	ACENAPHTHENE	3.50E+00	--	--	--	5.09E-04	9.11E-04	1.42E-03
		ALDRIN	1.45E-02	9.15E-10	--	9.15E-10	1.26E-04	--	1.26E-04
		ALPHA-CHLORDANE	1.33E-02	1.73E-09	--	1.73E-09	1.87E-04	--	1.87E-04
		ALUMINUM	5.15E+03	--	--	--	9.55E-04	--	9.55E-04
		ARSENIC	1.22E+01	3.06E-07	--	3.06E-07	7.54E-03	--	7.54E-03
		BARIUM	4.01E+02	--	--	--	3.72E-04	--	3.72E-04
		CHROMIUM	3.11E+01	--	--	--	3.85E-06	--	3.85E-06
		CHROMIUM VI	8.00E+00	--	--	--	9.89E-07	--	9.89E-07
		COBALT	3.40E+00	--	--	--	1.26E-05	--	1.26E-05
		COPPER	9.00E+00	--	--	--	4.51E-05	--	4.51E-05
		FLUORANTHENE	2.80E+00	--	--	--	2.86E-03	--	2.86E-03
		FLUORENE	3.00E+00	--	--	--	2.09E-06	8.29E-04	8.31E-04
		GAMMA-CHLORDANE	1.37E-02	1.79E-09	--	1.79E-09	1.92E-04	--	1.92E-04
		IRON	8.10E+03	--	--	--	5.01E-03	--	5.01E-03
		LEAD	2.10E+00	--	--	--	--	--	--
		MANGANESE	3.04E+03	--	--	--	2.35E-02	--	2.35E-02
		MERCURY	2.10E-01	--	--	--	1.30E-04	4.48E-02	4.49E-02
		MOLYBDENUM	4.50E+00	--	--	--	1.67E-04	--	1.67E-04
		NICKEL	4.13E+01	--	--	--	7.66E-05	--	7.66E-05
		PHENANTHRENE	3.00E+00	--	--	--	2.60E-04	6.03E-05	3.20E-04
		PYRENE	2.95E+00	--	--	--	8.57E-04	3.19E-04	1.18E-03
		SELENIUM	1.21E+01	--	--	--	4.49E-04	--	4.49E-04
		SILVER	1.40E+00	--	--	--	3.12E-05	--	3.12E-05
		VANADIUM	1.65E+01	--	--	--	3.06E-03	--	3.06E-03
		ZINC	1.64E+01	--	--	--	6.09E-06	--	6.09E-06
			TOTAL	3.10E-07	--	3.10E-07	4.64E-02	4.69E-02	9.32E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
16	AY04	ANTIMONY	7.20E+00	--	--	--	3.34E-03	--	3.34E-03
		ARSENIC	1.61E+01	4.03E-07	--	4.03E-07	9.96E-03	--	9.96E-03
		BARIUM	7.44E+02	--	--	--	6.90E-04	--	6.90E-04
		BERYLLIUM	3.80E-01	--	--	--	3.52E-05	--	3.52E-05
		CHLOROFORM	4.00E+00	2.23E-09	1.09E-07	1.11E-07	5.05E-04	6.72E-03	7.22E-03
		CHROMIUM	6.08E+01	--	--	--	7.52E-06	--	7.52E-06
		CHROMIUM VI	8.00E+00	--	--	--	9.89E-07	--	9.89E-07
		COBALT	1.02E+01	--	--	--	3.78E-05	--	3.78E-05
		COPPER	2.26E+01	--	--	--	1.13E-04	--	1.13E-04
		HEPTACHLOR	2.80E-02	2.87E-09	--	2.87E-09	8.93E-05	--	8.93E-05
		IRON	6.02E+02	--	--	--	3.72E-04	--	3.72E-04
		LEAD	7.15E+01	--	--	--	--	--	--
		MANGANESE	1.82E+03	--	--	--	1.41E-02	--	1.41E-02
		MERCURY	2.50E-01	--	--	--	1.55E-04	5.33E-02	5.34E-02
		MOLYBDENUM	7.20E+00	--	--	--	2.67E-04	--	2.67E-04
		NICKEL	7.91E+01	--	--	--	1.47E-04	--	1.47E-04
		SELENIUM	1.14E+01	--	--	--	4.23E-04	--	4.23E-04
		SILVER	2.10E+00	--	--	--	4.68E-05	--	4.68E-05
		THALLIUM	6.20E+00	--	--	--	1.74E-02	--	1.74E-02
		VANADIUM	7.00E+00	--	--	--	1.30E-03	--	1.30E-03
		ZINC	2.00E+02	--	--	--	7.42E-05	--	7.42E-05
			TOTAL	4.08E-07	1.09E-07	5.17E-07	4.91E-02	6.00E-02	1.09E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AF10	1,2-DICHLOROETHANE	1.40E-01	1.42E-10	4.51E-09	4.65E-09	5.45E-06	2.48E-03	2.48E-03
		ANTIMONY	1.96E+01	--	--	--	9.09E-03	--	9.09E-03
		ARSENIC	3.80E+01	9.52E-07	--	9.52E-07	2.35E-02	--	2.35E-02
		BARIUM	6.79E+02	--	--	--	6.30E-04	--	6.30E-04
		CHROMIUM	5.60E+00	--	--	--	6.93E-07	--	6.93E-07
		COBALT	1.16E+01	--	--	--	4.30E-05	--	4.30E-05
		COPPER	3.20E+00	--	--	--	1.60E-05	--	1.60E-05
		ETHYLBENZENE	3.80E-01	--	--	--	3.45E-05	3.29E-05	6.75E-05
		IRON	1.23E+03	--	--	--	7.61E-04	--	7.61E-04
		LEAD	2.84E+01	--	--	--	--	--	--
		MANGANESE	6.29E+03	--	--	--	4.86E-02	--	4.86E-02
		MOLYBDENUM	2.80E+00	--	--	--	1.04E-04	--	1.04E-04
		NICKEL	4.28E+01	--	--	--	7.94E-05	--	7.94E-05
		SELENIUM	3.60E+00	--	--	--	1.34E-04	--	1.34E-04
		TOLUENE	9.00E-01	--	--	--	2.59E-05	2.20E-04	2.46E-04
		VANADIUM	4.50E+00	--	--	--	8.35E-04	--	8.35E-04
		XYLENE (TOTAL)	1.00E+00	--	--	--	4.92E-05	8.63E-04	9.12E-04
		ZINC	1.56E+02	--	--	--	5.79E-05	--	5.79E-05
		TOTAL		9.52E-07	4.51E-09	9.56E-07	8.40E-02	3.59E-03	8.76E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AF12	1,2-DICHLOROETHENE (TOTAL)	3.00E-01	--	--	--	4.29E-05	7.84E-04	8.27E-04
		ALUMINUM	3.85E+01	--	--	--	7.14E-06	--	7.14E-06
		ANTIMONY	3.40E+00	--	--	--	1.58E-03	--	1.58E-03
		ARSENIC	5.50E+00	1.38E-07	--	1.38E-07	3.40E-03	--	3.40E-03
		BARIUM	6.93E+02	--	--	--	6.43E-04	--	6.43E-04
		CHLOROBENZENE	1.00E+00	--	--	--	2.60E-04	1.42E-03	1.68E-03
		CHROMIUM	9.20E+00	--	--	--	1.14E-06	--	1.14E-06
		CIS-1,2-DICHLOROETHENE	1.00E+01	--	--	--	1.43E-03	2.61E-02	2.75E-02
		COBALT	1.05E+01	--	--	--	3.90E-05	--	3.90E-05
		IRON	7.37E+02	--	--	--	4.56E-04	--	4.56E-04
		MANGANESE	2.52E+03	--	--	--	1.95E-02	--	1.95E-02
		MOLYBDENUM	1.60E+00	--	--	--	5.94E-05	--	5.94E-05
		NICKEL	4.03E+01	--	--	--	7.48E-05	--	7.48E-05
		SELENIUM	5.30E+00	--	--	--	1.97E-04	--	1.97E-04
		TERT-BUTYL METHYL ETHER	2.40E-01	1.72E-13	7.88E-11	7.90E-11	7.77E-09	7.05E-06	7.05E-06
		THALLIUM	2.81E+01	--	--	--	7.90E-02	--	7.90E-02
		TRICHLOROETHENE	1.00E+00	4.13E-10	2.26E-09	2.68E-09	--	1.32E-04	1.32E-04
		ZINC	2.03E+02	--	--	--	7.53E-05	--	7.53E-05
			TOTAL	1.38E-07	2.34E-09	1.41E-07	1.07E-01	2.85E-02	1.35E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AF13	1,4-DICHLOROBENZENE	4.10E-01	1.10E-09	4.93E-09	6.02E-09	1.06E-04	3.75E-05	1.44E-04
		ACETONE	3.00E+00	--	--	--	9.28E-08	4.36E-05	4.37E-05
		ACETOPHENONE	3.00E+00	--	--	--	8.35E-07	--	8.35E-07
		ALPHA-CHLORDANE	2.10E-03	2.75E-10	--	2.75E-10	2.96E-05	--	2.96E-05
		ALUMINUM	3.05E+01	--	--	--	5.66E-06	--	5.66E-06
		ANTIMONY	2.11E+01	--	--	--	9.79E-03	--	9.79E-03
		ARSENIC	9.50E+00	2.38E-07	--	2.38E-07	5.87E-03	--	5.87E-03
		BARIUM	2.31E+02	--	--	--	2.14E-04	--	2.14E-04
		BENZENE	1.00E+00	3.98E-09	4.17E-08	4.57E-08	6.96E-04	3.39E-03	4.09E-03
		BERYLLIUM	2.80E-01	--	--	--	2.60E-05	--	2.60E-05
		CAPROLACTAM	9.00E-01	--	--	--	5.01E-08	--	5.01E-08
		CARBON DISULFIDE	9.00E+00	--	--	--	2.84E-04	1.34E-03	1.63E-03
		CHLOROBENZENE	4.00E+00	--	--	--	1.04E-03	5.70E-03	6.73E-03
		CHLOROETHANE	1.30E+01	6.09E-10	1.74E-08	1.80E-08	3.68E-05	1.45E-04	1.81E-04
		CHROMIUM	1.80E+00	--	--	--	2.23E-07	--	2.23E-07
		CIS-1,2-DICHLOROETHENE	3.40E-01	--	--	--	4.86E-05	8.88E-04	9.36E-04
		COBALT	1.67E+01	--	--	--	6.20E-05	--	6.20E-05
		COPPER	1.40E+00	--	--	--	7.02E-06	--	7.02E-06
		GAMMA-CHLORDANE	8.30E-03	1.09E-09	--	1.09E-09	1.17E-04	--	1.17E-04
		HEPTACHLOR	1.10E-02	1.13E-09	--	1.13E-09	3.51E-05	--	3.51E-05
		IRON	1.73E+03	--	--	--	1.07E-03	--	1.07E-03
		LEAD	2.30E+00	--	--	--	--	--	--
		MANGANESE	2.41E+03	--	--	--	1.86E-02	--	1.86E-02
		MERCURY	2.75E-02	--	--	--	1.70E-05	5.86E-03	5.88E-03
		MOLYBDENUM	2.80E+00	--	--	--	1.04E-04	--	1.04E-04
		NICKEL	2.66E+01	--	--	--	4.93E-05	--	4.93E-05
		PENTACHLOROPHENOL	2.40E+01	2.98E-06	--	2.98E-06	5.79E-02	--	5.79E-02
		SILVER	8.82E+00	--	--	--	1.96E-04	--	1.96E-04
		TERT-BUTYL METHYL ETHER	8.30E-01	5.94E-13	2.72E-10	2.73E-10	2.69E-08	2.44E-05	2.44E-05
		THALLIUM	8.35E+00	--	--	--	2.35E-02	--	2.35E-02
		TOLUENE	2.00E+00	--	--	--	5.75E-05	4.90E-04	5.47E-04
		TRICHLOROETHENE	2.00E+00	8.27E-10	4.53E-09	5.35E-09	--	2.64E-04	2.64E-04

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AF13	VANADIUM	1.30E+00	--	--	--	2.41E-04	--	2.41E-04
		TOTAL		3.22E-06	6.88E-08	3.29E-06	1.20E-01	1.82E-02	1.38E-01
BOS-1	AG10	1,1,2,2-TETRACHLOROETHANE	1.00E+00	4.94E-09	4.99E-08	5.48E-08	2.13E-05	2.91E-04	3.12E-04
		2-HEXANONE	4.00E+00	--	--	--	1.19E-06	4.61E-05	4.73E-05
		ALUMINUM	5.64E+02	--	--	--	1.05E-04	--	1.05E-04
		ANTIMONY	2.71E+01	--	--	--	1.26E-02	--	1.26E-02
		ARSENIC	8.00E+00	2.00E-07	--	2.00E-07	4.95E-03	--	4.95E-03
		BARIUM	1.18E+03	--	--	--	1.09E-03	--	1.09E-03
		CADMIUM	2.08E+00	--	--	--	7.70E-04	--	7.70E-04
		CHROMIUM	9.70E+00	--	--	--	1.20E-06	--	1.20E-06
		CIS-1,2-DICHLOROETHENE	2.10E-01	--	--	--	3.00E-05	5.48E-04	5.78E-04
		COBALT	2.18E+01	--	--	--	8.09E-05	--	8.09E-05
		COPPER	1.95E+00	--	--	--	9.78E-06	--	9.78E-06
		IRON	1.03E+03	--	--	--	6.37E-04	--	6.37E-04
		MANGANESE	6.26E+03	--	--	--	4.84E-02	--	4.84E-02
		MOLYBDENUM	4.60E+00	--	--	--	1.71E-04	--	1.71E-04
		NICKEL	7.18E+01	--	--	--	1.33E-04	--	1.33E-04
		SELENIUM	5.20E+00	--	--	--	1.93E-04	--	1.93E-04
		TERT-BUTYL METHYL ETHER	2.00E-01	1.43E-13	6.57E-11	6.58E-11	6.47E-09	5.87E-06	5.88E-06
		VANADIUM	3.10E+00	--	--	--	5.75E-04	--	5.75E-04
		VINYL ACETATE	2.00E+00	--	--	--	2.08E-06	8.85E-04	8.85E-04
		ZINC	1.84E+02	--	--	--	6.83E-05	--	6.83E-05
		TOTAL		2.05E-07	5.00E-08	2.55E-07	6.98E-02	1.78E-03	7.16E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AH08	ALUMINUM	1.80E+02	--	--	--	3.34E-05	--	3.34E-05
		ANTIMONY	8.30E+00	--	--	--	3.85E-03	--	3.85E-03
		ARSENIC	5.10E+00	1.28E-07	--	1.28E-07	3.15E-03	--	3.15E-03
		BARIUM	1.32E+03	--	--	--	1.22E-03	--	1.22E-03
		BERYLLIUM	1.30E+00	--	--	--	1.21E-04	--	1.21E-04
		CADMIUM	3.10E+00	--	--	--	1.15E-03	--	1.15E-03
		CHROMIUM	2.35E+01	--	--	--	2.91E-06	--	2.91E-06
		COBALT	2.27E+01	--	--	--	8.42E-05	--	8.42E-05
		IRON	1.51E+03	--	--	--	9.34E-04	--	9.34E-04
		MANGANESE	7.68E+03	--	--	--	5.94E-02	--	5.94E-02
		MERCURY	1.50E-01	--	--	--	9.28E-05	3.20E-02	3.21E-02
		MOLYBDENUM	4.27E+01	--	--	--	1.58E-03	--	1.58E-03
		NICKEL	2.85E+02	--	--	--	5.29E-04	--	5.29E-04
		THALLIUM	5.30E+00	--	--	--	1.49E-02	--	1.49E-02
		VANADIUM	6.10E+00	--	--	--	1.13E-03	--	1.13E-03
		ZINC	1.98E+02	--	--	--	7.35E-05	--	7.35E-05
			TOTAL	1.28E-07	--	1.28E-07	8.82E-02	3.20E-02	1.20E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AH09	1,2,4-TRICHLOROBENZENE	2.00E+00	1.26E-09	--	1.26E-09	2.45E-03	3.40E-02	3.64E-02
		ANTIMONY	2.31E+01	--	--	--	1.07E-02	--	1.07E-02
		ARSENIC	2.40E+00	6.01E-08	--	6.01E-08	1.48E-03	--	1.48E-03
		BARIUM	7.16E+02	--	--	--	6.64E-04	--	6.64E-04
		BENZENE	2.25E+00	8.94E-09	9.38E-08	1.03E-07	1.57E-03	7.64E-03	9.20E-03
		BERYLLIUM	1.00E+00	--	--	--	9.28E-05	--	9.28E-05
		CADMIUM	2.10E+00	--	--	--	7.79E-04	--	7.79E-04
		CHLOROBENZENE	2.25E+00	--	--	--	5.84E-04	3.20E-03	3.79E-03
		CHROMIUM	2.45E+01	--	--	--	3.03E-06	--	3.03E-06
		CHROMIUM VI	2.00E+01	--	--	--	2.47E-06	--	2.47E-06
		COBALT	1.99E+01	--	--	--	7.40E-05	--	7.40E-05
		COPPER	6.10E+00	--	--	--	3.06E-05	--	3.06E-05
		IRON	7.38E+02	--	--	--	4.56E-04	--	4.56E-04
		MANGANESE	9.82E+02	--	--	--	7.59E-03	--	7.59E-03
		MERCURY	1.60E-01	--	--	--	9.89E-05	3.41E-02	3.42E-02
		MOLYBDENUM	2.57E+01	--	--	--	9.54E-04	--	9.54E-04
		NICKEL	3.61E+02	--	--	--	6.70E-04	--	6.70E-04
		THALLIUM	2.40E+00	--	--	--	6.75E-03	--	6.75E-03
		TOLUENE	2.75E+00	--	--	--	7.91E-05	6.73E-04	7.52E-04
		VANADIUM	4.40E+00	--	--	--	8.16E-04	--	8.16E-04
		ZINC	2.27E+02	--	--	--	8.42E-05	--	8.42E-05
			TOTAL	7.03E-08	9.38E-08	1.64E-07	3.59E-02	7.96E-02	1.15E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AI08	ALUMINUM	8.06E+02	--	--	--	1.50E-04	--	1.50E-04
		ANTIMONY	8.22E+01	--	--	--	3.81E-02	--	3.81E-02
		ARSENIC	2.92E+01	7.31E-07	--	7.31E-07	1.81E-02	--	1.81E-02
		BARIUM	2.00E+02	--	--	--	1.85E-04	--	1.85E-04
		BERYLLIUM	1.70E+00	--	--	--	1.58E-04	--	1.58E-04
		COBALT	1.06E+01	--	--	--	3.91E-05	--	3.91E-05
		COPPER	4.34E+01	--	--	--	2.18E-04	--	2.18E-04
		IRON	6.35E+01	--	--	--	3.93E-05	--	3.93E-05
		LEAD	9.82E+01	--	--	--	--	--	--
		MANGANESE	2.25E+03	--	--	--	1.74E-02	--	1.74E-02
		NICKEL	6.00E+00	--	--	--	1.11E-05	--	1.11E-05
		SELENIUM	7.37E+01	--	--	--	2.73E-03	--	2.73E-03
		THALLIUM	1.63E+02	--	--	--	4.58E-01	--	4.58E-01
		VANADIUM	3.40E+00	--	--	--	6.31E-04	--	6.31E-04
		TOTAL		7.31E-07	--	7.31E-07	5.36E-01	--	5.36E-01
BOS-1	AJ06	ARSENIC	2.23E+01	5.59E-07	--	5.59E-07	1.38E-02	--	1.38E-02
		BARIUM	2.11E+02	--	--	--	1.96E-04	--	1.96E-04
		CADMIUM	2.30E+00	--	--	--	8.53E-04	--	8.53E-04
		COBALT	2.50E+00	--	--	--	9.28E-06	--	9.28E-06
		IRON	4.49E+01	--	--	--	2.78E-05	--	2.78E-05
		MANGANESE	1.30E+03	--	--	--	1.00E-02	--	1.00E-02
		MOLYBDENUM	2.40E+00	--	--	--	8.90E-05	--	8.90E-05
		NICKEL	4.09E+01	--	--	--	7.59E-05	--	7.59E-05
		THALLIUM	4.00E+00	--	--	--	1.12E-02	--	1.12E-02
		TOTAL		5.59E-07	--	5.59E-07	3.63E-02	--	3.63E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AJ07	1,2-DICHLOROETHANE	1.95E-01	1.98E-10	6.28E-09	6.47E-09	7.60E-06	3.45E-03	3.46E-03
		ANTIMONY	5.36E+01	--	--	--	2.49E-02	--	2.49E-02
		ARSENIC	4.78E+00	1.20E-07	--	1.20E-07	2.95E-03	--	2.95E-03
		BARIUM	7.06E+02	--	--	--	6.54E-04	--	6.54E-04
		BERYLLIUM	3.75E+00	--	--	--	3.48E-04	--	3.48E-04
		CADMIUM	4.40E+00	--	--	--	1.63E-03	--	1.63E-03
		CHROMIUM	1.88E+01	--	--	--	2.33E-06	--	2.33E-06
		CHROMIUM VI	1.00E+01	--	--	--	1.24E-06	--	1.24E-06
		COBALT	3.38E+01	--	--	--	1.25E-04	--	1.25E-04
		COPPER	4.06E+01	--	--	--	2.04E-04	--	2.04E-04
		DI-N-OCTYLPHTHALATE	4.50E+00	--	--	--	3.13E-06	--	3.13E-06
		IRON	1.98E+02	--	--	--	1.22E-04	--	1.22E-04
		LEAD	4.20E+00	--	--	--	--	--	--
		MANGANESE	4.45E+03	--	--	--	3.44E-02	--	3.44E-02
		MOLYBDENUM	1.67E+01	--	--	--	6.20E-04	--	6.20E-04
		NICKEL	6.51E+02	--	--	--	1.21E-03	--	1.21E-03
		SELENIUM	4.35E+01	--	--	--	1.62E-03	--	1.62E-03
		SILVER	2.05E+00	--	--	--	4.56E-05	--	4.56E-05
		TETRACHLOROETHENE	2.25E+00	1.06E-07	1.36E-08	1.20E-07	1.38E-03	4.54E-03	5.92E-03
		THALLIUM	8.00E+00	--	--	--	2.25E-02	--	2.25E-02
		TOLUENE	5.90E-01	--	--	--	1.70E-05	1.44E-04	1.61E-04
		VANADIUM	6.05E+00	--	--	--	1.12E-03	--	1.12E-03
		XYLENE (TOTAL)	5.10E-01	--	--	--	2.51E-05	4.40E-04	4.65E-04
		ZINC	1.53E+01	--	--	--	5.68E-06	--	5.68E-06
		TOTAL		2.26E-07	1.99E-08	2.46E-07	9.39E-02	8.58E-03	1.02E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-1	AJ08	ALUMINUM	2.34E+01	--	--	--	4.34E-06	--	4.34E-06
		ANTIMONY	3.01E+01	--	--	--	1.40E-02	--	1.40E-02
		ARSENIC	4.60E+00	1.15E-07	--	1.15E-07	2.84E-03	--	2.84E-03
		BARIUM	9.96E+02	--	--	--	9.24E-04	--	9.24E-04
		BERYLLIUM	3.00E+00	--	--	--	2.78E-04	--	2.78E-04
		CARBON DISULFIDE	3.00E+00	--	--	--	9.46E-05	4.47E-04	5.42E-04
		CHROMIUM	1.30E+00	--	--	--	1.61E-07	--	1.61E-07
		COBALT	1.80E+01	--	--	--	6.68E-05	--	6.68E-05
		COPPER	8.40E+00	--	--	--	4.21E-05	--	4.21E-05
		IRON	1.81E+03	--	--	--	1.12E-03	--	1.12E-03
		LEAD	1.14E+02	--	--	--	--	--	--
		MANGANESE	4.05E+03	--	--	--	3.13E-02	--	3.13E-02
		MERCURY	3.50E-01	--	--	--	2.16E-04	7.46E-02	7.48E-02
		MOLYBDENUM	4.28E+01	--	--	--	1.59E-03	--	1.59E-03
		NICKEL	1.53E+02	--	--	--	2.84E-04	--	2.84E-04
		SELENIUM	3.02E+01	--	--	--	1.12E-03	--	1.12E-03
		THALLIUM	1.58E+02	--	--	--	4.44E-01	--	4.44E-01
		VANADIUM	3.60E+00	--	--	--	6.68E-04	--	6.68E-04
		ZINC	2.23E+01	--	--	--	8.27E-06	--	8.27E-06
		TOTAL		1.15E-07	--	1.15E-07	4.99E-01	7.50E-02	5.74E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AK06	ANTIMONY	1.25E+01	--	--	--	5.80E-03	--	5.80E-03
		ARSENIC	2.25E+00	5.64E-08	--	5.64E-08	1.39E-03	--	1.39E-03
		BARIUM	1.17E+02	--	--	--	1.09E-04	--	1.09E-04
		CADMIUM	1.74E+00	--	--	--	6.46E-04	--	6.46E-04
		COBALT	7.80E+00	--	--	--	2.89E-05	--	2.89E-05
		MANGANESE	7.52E+02	--	--	--	5.81E-03	--	5.81E-03
		MOLYBDENUM	8.10E+00	--	--	--	3.01E-04	--	3.01E-04
		NICKEL	4.22E+01	--	--	--	7.83E-05	--	7.83E-05
		THALLIUM	5.70E+00	--	--	--	1.60E-02	--	1.60E-02
		VANADIUM	9.50E-01	--	--	--	1.76E-04	--	1.76E-04
		TOTAL		5.64E-08	--	5.64E-08	3.04E-02	--	3.04E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AK07	ALUMINUM	3.32E+02	--	--	--	6.16E-05	--	6.16E-05
		ANTIMONY	4.16E+01	--	--	--	1.93E-02	--	1.93E-02
		ARSENIC	4.10E+00	1.03E-07	--	1.03E-07	2.54E-03	--	2.54E-03
		BARIUM	9.62E+01	--	--	--	8.92E-05	--	8.92E-05
		BERYLLIUM	2.90E+00	--	--	--	2.69E-04	--	2.69E-04
		CADMIUM	3.40E+00	--	--	--	1.26E-03	--	1.26E-03
		CHLOROFORM	5.25E-01	2.93E-10	1.43E-08	1.46E-08	6.62E-05	8.82E-04	9.48E-04
		CHROMIUM	1.08E+01	--	--	--	1.34E-06	--	1.34E-06
		COBALT	8.75E+00	--	--	--	3.25E-05	--	3.25E-05
		COPPER	5.70E+00	--	--	--	2.86E-05	--	2.86E-05
		IRON	4.48E+02	--	--	--	2.77E-04	--	2.77E-04
		LEAD	6.40E+00	--	--	--	--	--	--
		MANGANESE	2.82E+01	--	--	--	2.18E-04	--	2.18E-04
		MOLYBDENUM	7.10E+00	--	--	--	2.63E-04	--	2.63E-04
		NICKEL	2.83E+01	--	--	--	5.25E-05	--	5.25E-05
		SELENIUM	2.76E+01	--	--	--	1.02E-03	--	1.02E-03
		SILVER	1.40E+00	--	--	--	3.12E-05	--	3.12E-05
		THALLIUM	9.78E+01	--	--	--	2.75E-01	--	2.75E-01
		TOLUENE	2.15E-01	--	--	--	6.18E-06	5.26E-05	5.88E-05
		VANADIUM	1.57E+01	--	--	--	2.91E-03	--	2.91E-03
		ZINC	2.50E+00	--	--	--	9.28E-07	--	9.28E-07
		TOTAL		1.03E-07	1.43E-08	1.17E-07	3.03E-01	9.34E-04	3.04E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AL06	BARIUM	1.02E+02	--	--	--	9.46E-05	--	9.46E-05
		CADMIUM	3.17E+01	--	--	--	1.18E-02	--	1.18E-02
		COBALT	5.60E-01	--	--	--	2.08E-06	--	2.08E-06
		IRON	5.01E+01	--	--	--	3.10E-05	--	3.10E-05
		MANGANESE	1.56E+01	--	--	--	1.21E-04	--	1.21E-04
		MERCURY	1.00E-01	--	--	--	6.18E-05	2.13E-02	2.14E-02
		MOLYBDENUM	7.70E+00	--	--	--	2.86E-04	--	2.86E-04
		NICKEL	7.70E+00	--	--	--	1.43E-05	--	1.43E-05
		SILVER	4.70E+00	--	--	--	1.05E-04	--	1.05E-04
		THALLIUM	1.15E+02	--	--	--	3.23E-01	--	3.23E-01
		VANADIUM	4.50E+00	--	--	--	8.35E-04	--	8.35E-04
		TOTAL		--	--	--	3.37E-01	2.13E-02	3.58E-01
BOS-2	AL07	ARSENIC	2.35E+00	5.89E-08	--	5.89E-08	1.45E-03	--	1.45E-03
		BARIUM	6.94E+01	--	--	--	6.44E-05	--	6.44E-05
		CADMIUM	2.10E+00	--	--	--	7.79E-04	--	7.79E-04
		COBALT	8.90E-01	--	--	--	3.30E-06	--	3.30E-06
		MANGANESE	3.41E+02	--	--	--	2.63E-03	--	2.63E-03
		MOLYBDENUM	3.50E+00	--	--	--	1.30E-04	--	1.30E-04
		NICKEL	2.56E+01	--	--	--	4.76E-05	--	4.76E-05
		SELENIUM	4.70E+00	--	--	--	1.74E-04	--	1.74E-04
		THALLIUM	8.10E+00	--	--	--	2.28E-02	--	2.28E-02
		ZINC	2.94E+01	--	--	--	1.09E-05	--	1.09E-05
		TOTAL		5.89E-08	--	5.89E-08	2.81E-02	--	2.81E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AM06	ANTIMONY	2.70E+00	--	--	--	1.25E-03	--	1.25E-03
		BARIUM	4.51E+01	--	--	--	4.18E-05	--	4.18E-05
		CADMIUM	3.60E-01	--	--	--	1.34E-04	--	1.34E-04
		SELENIUM	3.10E+00	--	--	--	1.15E-04	--	1.15E-04
		THALLIUM	2.15E+00	--	--	--	6.04E-03	--	6.04E-03
		TOTAL		--	--	--	7.59E-03	--	7.59E-03
BOS-2	AN05	BARIUM	6.60E+01	--	--	--	6.12E-05	--	6.12E-05
		CADMIUM	5.80E+00	--	--	--	2.15E-03	--	2.15E-03
		COBALT	3.60E+00	--	--	--	1.34E-05	--	1.34E-05
		COPPER	9.30E+00	--	--	--	4.66E-05	--	4.66E-05
		MANGANESE	1.84E+03	--	--	--	1.42E-02	--	1.42E-02
		NICKEL	3.42E+01	--	--	--	6.34E-05	--	6.34E-05
		THALLIUM	6.60E+00	--	--	--	1.86E-02	--	1.86E-02
		VANADIUM	1.80E+00	--	--	--	3.34E-04	--	3.34E-04
		TOTAL		--	--	--	3.54E-02	--	3.54E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AN06	ANTIMONY	2.10E+00	--	--	--	9.74E-04	--	9.74E-04
		ARSENIC	2.90E+00	7.26E-08	--	7.26E-08	1.79E-03	--	1.79E-03
		BARIUM	1.53E+02	--	--	--	1.42E-04	--	1.42E-04
		CADMIUM	1.35E+01	--	--	--	5.01E-03	--	5.01E-03
		COBALT	1.75E+00	--	--	--	6.49E-06	--	6.49E-06
		MANGANESE	3.04E+03	--	--	--	2.35E-02	--	2.35E-02
		MERCURY	8.50E-02	--	--	--	5.26E-05	1.81E-02	1.82E-02
		MOLYBDENUM	9.10E+00	--	--	--	3.38E-04	--	3.38E-04
		NAPHTHALENE	3.00E+00	4.48E-08	1.06E-07	1.51E-07	1.31E-03	7.21E-02	7.34E-02
		NICKEL	4.96E+01	--	--	--	9.20E-05	--	9.20E-05
		SELENIUM	2.17E+00	--	--	--	8.07E-05	--	8.07E-05
		THALLIUM	2.30E+00	--	--	--	6.47E-03	--	6.47E-03
		VANADIUM	1.20E+00	--	--	--	2.23E-04	--	2.23E-04
			TOTAL	1.17E-07	1.06E-07	2.24E-07	3.99E-02	9.02E-02	1.30E-01

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AO05	2,6-DINITROTOLUENE	1.00E+02	3.78E-07	--	3.78E-07	3.90E-02	--	3.90E-02
		ANTIMONY	6.92E+00	--	--	--	3.21E-03	--	3.21E-03
		BARIUM	7.91E+02	--	--	--	7.34E-04	--	7.34E-04
		CADMIUM	4.00E-01	--	--	--	1.48E-04	--	1.48E-04
		CHROMIUM	2.32E+01	--	--	--	2.87E-06	--	2.87E-06
		COBALT	1.83E+00	--	--	--	6.77E-06	--	6.77E-06
		IRON	1.70E+02	--	--	--	1.05E-04	--	1.05E-04
		MANGANESE	1.11E+03	--	--	--	8.58E-03	--	8.58E-03
		MOLYBDENUM	8.90E+00	--	--	--	3.30E-04	--	3.30E-04
		NICKEL	3.04E+01	--	--	--	5.64E-05	--	5.64E-05
		SELENIUM	4.67E+00	--	--	--	1.73E-04	--	1.73E-04
		THALLIUM	5.55E+00	--	--	--	1.56E-02	--	1.56E-02
		VANADIUM	9.30E+00	--	--	--	1.73E-03	--	1.73E-03
		ZINC	2.08E+01	--	--	--	7.72E-06	--	7.72E-06
			TOTAL	3.78E-07	--	3.78E-07	6.96E-02	--	6.96E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AP05	ANTIMONY	7.50E+00	--	--	--	3.48E-03	--	3.48E-03
		ARSENIC	1.60E+00	4.01E-08	--	4.01E-08	9.89E-04	--	9.89E-04
		BARIUM	9.18E+01	--	--	--	8.52E-05	--	8.52E-05
		BERYLLIUM	1.10E-01	--	--	--	1.02E-05	--	1.02E-05
		CADMIUM	1.63E+00	--	--	--	6.03E-04	--	6.03E-04
		CARBON DISULFIDE	1.10E+01	--	--	--	3.47E-04	1.64E-03	1.99E-03
		COBALT	6.50E-01	--	--	--	2.41E-06	--	2.41E-06
		COPPER	2.87E+01	--	--	--	1.44E-04	--	1.44E-04
		IRON	3.71E+02	--	--	--	2.29E-04	--	2.29E-04
		LEAD	1.52E+01	--	--	--	--	--	--
		MANGANESE	1.07E+03	--	--	--	8.27E-03	--	8.27E-03
		TERT-BUTYL METHYL ETHER	4.10E+00	2.93E-12	1.35E-09	1.35E-09	1.33E-07	1.20E-04	1.21E-04
		THALLIUM	2.70E+00	--	--	--	7.59E-03	--	7.59E-03
		TOTAL		4.01E-08	1.35E-09	4.14E-08	2.17E-02	1.76E-03	2.35E-02
BOS-2	AQ05	1,1-DICHLOROETHANE	2.00E+00	2.02E-10	4.23E-09	4.43E-09	2.49E-05	3.71E-04	3.96E-04
		BARIUM	8.17E+01	--	--	--	7.57E-05	--	7.57E-05
		CADMIUM	1.65E+01	--	--	--	6.12E-03	--	6.12E-03
		CARBON DISULFIDE	3.00E+00	--	--	--	9.46E-05	4.47E-04	5.42E-04
		M,P-XYLENES	6.00E-01	--	--	--	2.95E-05	5.20E-04	5.49E-04
		MANGANESE	1.74E+03	--	--	--	1.35E-02	--	1.35E-02
		SELENIUM	3.50E+00	--	--	--	1.30E-04	--	1.30E-04
		THALLIUM	1.36E+01	--	--	--	3.82E-02	--	3.82E-02
		TOTAL		2.02E-10	4.23E-09	4.43E-09	5.82E-02	1.34E-03	5.95E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AR05	1,1-DICHLOROETHANE	3.50E+00	3.54E-10	7.39E-09	7.75E-09	4.35E-05	6.49E-04	6.92E-04
		ANTIMONY	7.50E+00	--	--	--	3.48E-03	--	3.48E-03
		ARSENIC	2.55E+00	6.39E-08	--	6.39E-08	1.58E-03	--	1.58E-03
		BARIUM	4.17E+01	--	--	--	3.87E-05	--	3.87E-05
		CADMIUM	7.65E+00	--	--	--	2.84E-03	--	2.84E-03
		CARBON DISULFIDE	2.10E+01	--	--	--	6.62E-04	3.13E-03	3.79E-03
		CHROMIUM	9.00E-01	--	--	--	1.11E-07	--	1.11E-07
		COBALT	1.37E+00	--	--	--	5.06E-06	--	5.06E-06
		COPPER	1.82E+01	--	--	--	9.14E-05	--	9.14E-05
		ENDRIN KETONE	2.00E-03	--	--	--	1.48E-05	--	1.48E-05
		ETHYLBENZENE	5.75E-01	--	--	--	5.23E-05	4.98E-05	1.02E-04
		IRON	6.90E+02	--	--	--	4.27E-04	--	4.27E-04
		M,P-XYLENES	9.00E-01	--	--	--	4.42E-05	7.79E-04	8.24E-04
		MANGANESE	1.26E+03	--	--	--	9.70E-03	--	9.70E-03
		NICKEL	2.00E+00	--	--	--	3.71E-06	--	3.71E-06
		PYRENE	3.00E+00	--	--	--	8.72E-04	3.25E-04	1.20E-03
		SELENIUM	4.83E+00	--	--	--	1.79E-04	--	1.79E-04
		SILVER	8.10E-01	--	--	--	1.80E-05	--	1.80E-05
		THALLIUM	5.15E+00	--	--	--	1.45E-02	--	1.45E-02
		TOLUENE	4.50E-01	--	--	--	1.29E-05	1.10E-04	1.23E-04
		VANADIUM	2.30E+00	--	--	--	4.27E-04	--	4.27E-04
		ZINC	1.34E+01	--	--	--	4.99E-06	--	4.99E-06
			TOTAL	6.42E-08	7.39E-09	7.16E-08	3.50E-02	5.04E-03	4.00E-02
BOS-2	AS05	M,P-XYLENES	9.00E-01	--	--	--	4.42E-05	7.79E-04	8.24E-04
			TOTAL	--	--	--	4.42E-05	7.79E-04	8.24E-04

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-2	AT05	ARSENIC	2.10E+00	5.26E-08	--	5.26E-08	1.30E-03	--	1.30E-03
		BARIUM	2.15E+02	--	--	--	1.99E-04	--	1.99E-04
		CARBON DISULFIDE	5.00E+00	--	--	--	1.58E-04	7.46E-04	9.03E-04
		CHROMIUM	6.10E-01	--	--	--	7.54E-08	--	7.54E-08
		COBALT	1.20E+00	--	--	--	4.45E-06	--	4.45E-06
		MANGANESE	5.35E+02	--	--	--	4.14E-03	--	4.14E-03
		MOLYBDENUM	1.07E+01	--	--	--	3.97E-04	--	3.97E-04
		NICKEL	2.84E+01	--	--	--	5.27E-05	--	5.27E-05
		VANADIUM	3.00E+00	--	--	--	5.57E-04	--	5.57E-04
			TOTAL	5.26E-08	--	5.26E-08	6.80E-03	7.46E-04	7.55E-03
BOS-3	AU05	2,4,6-TRICHLOROPHENOL	2.40E+01	1.56E-07	--	1.56E-07	1.56E+00	--	1.56E+00
		ALUMINUM	1.23E+02	--	--	--	2.28E-05	--	2.28E-05
		ARSENIC	2.80E+00	7.01E-08	--	7.01E-08	1.73E-03	--	1.73E-03
		BARIUM	6.56E+02	--	--	--	6.09E-04	--	6.09E-04
		CHROMIUM	8.40E+00	--	--	--	1.04E-06	--	1.04E-06
		COBALT	7.20E+00	--	--	--	2.67E-05	--	2.67E-05
		COPPER	5.00E+00	--	--	--	2.51E-05	--	2.51E-05
		IRON	1.16E+02	--	--	--	7.17E-05	--	7.17E-05
		MANGANESE	4.92E+03	--	--	--	3.80E-02	--	3.80E-02
		MERCURY	5.90E-01	--	--	--	3.65E-04	1.26E-01	1.26E-01
		MOLYBDENUM	1.35E+01	--	--	--	5.01E-04	--	5.01E-04
		NICKEL	1.16E+02	--	--	--	2.15E-04	--	2.15E-04
		THALLIUM	4.80E+00	--	--	--	1.35E-02	--	1.35E-02
		TOLUENE	5.00E-01	--	--	--	1.44E-05	1.22E-04	1.37E-04
		VANADIUM	4.90E+00	--	--	--	9.09E-04	--	9.09E-04
		ZINC	1.45E+02	--	--	--	5.38E-05	--	5.38E-05
			TOTAL	2.26E-07	--	2.26E-07	1.61E+00	1.26E-01	1.74E+00

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-3	AV05	1,2-DICHLOROETHENE (TOTAL)	9.00E+00	--	--	--	1.29E-03	2.35E-02	2.48E-02
		ARSENIC	2.20E+00	5.51E-08	--	5.51E-08	1.36E-03	--	1.36E-03
		BARIUM	3.60E+02	--	--	--	3.34E-04	--	3.34E-04
		CADMIUM	6.20E+00	--	--	--	2.30E-03	--	2.30E-03
		COBALT	3.50E+00	--	--	--	1.30E-05	--	1.30E-05
		COPPER	8.40E-01	--	--	--	4.21E-06	--	4.21E-06
		HEPTACHLOR EPOXIDE	1.00E-02	2.07E-09	--	2.07E-09	1.23E-03	--	1.23E-03
		IRON	7.12E+02	--	--	--	4.40E-04	--	4.40E-04
		MANGANESE	2.08E+03	--	--	--	1.61E-02	--	1.61E-02
		NICKEL	1.20E+01	--	--	--	2.23E-05	--	2.23E-05
		SELENIUM	2.50E+00	--	--	--	9.28E-05	--	9.28E-05
		THALLIUM	6.40E+00	--	--	--	1.80E-02	--	1.80E-02
		VANADIUM	1.10E+00	--	--	--	2.04E-04	--	2.04E-04
		ZINC	1.30E+01	--	--	--	4.82E-06	--	4.82E-06
			TOTAL	5.72E-08	--	5.72E-08	4.14E-02	2.35E-02	6.49E-02

Table A3-19: Summary of Cancer Risks and Noncancer Hazard Indices for Construction Worker Trench Exposure, Non-Plume Wells, A-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Risk			Noncancer Hazard		
				Dermal	Inhalation	Total	Dermal	Inhalation	Total
BOS-3	AY02	ALPHA-CHLORDANE	5.10E-03	6.68E-10	--	6.68E-10	7.19E-05	--	7.19E-05
		ARSENIC	1.94E+01	4.86E-07	--	4.86E-07	1.20E-02	--	1.20E-02
		BARIUM	6.73E+01	--	--	--	6.24E-05	--	6.24E-05
		BERYLLIUM	4.30E-01	--	--	--	3.99E-05	--	3.99E-05
		CHROMIUM	1.20E+01	--	--	--	1.48E-06	--	1.48E-06
		CHROMIUM VI	9.00E+00	--	--	--	1.11E-06	--	1.11E-06
		COBALT	8.00E-01	--	--	--	2.97E-06	--	2.97E-06
		COPPER	2.48E+02	--	--	--	1.24E-03	--	1.24E-03
		HEPTACHLOR	2.80E-02	2.87E-09	--	2.87E-09	8.93E-05	--	8.93E-05
		MANGANESE	1.42E+01	--	--	--	1.10E-04	--	1.10E-04
		MERCURY	2.80E+00	--	--	--	1.73E-03	5.97E-01	5.98E-01
		MOLYBDENUM	8.30E+00	--	--	--	3.08E-04	--	3.08E-04
		NICKEL	2.13E+01	--	--	--	3.95E-05	--	3.95E-05
		SELENIUM	8.15E+00	--	--	--	3.02E-04	--	3.02E-04
		SILVER	1.60E+00	--	--	--	3.56E-05	--	3.56E-05
		THALLIUM	5.50E+00	--	--	--	1.55E-02	--	1.55E-02
		VANADIUM	5.00E+00	--	--	--	9.28E-04	--	9.28E-04
		ZINC	2.81E+01	--	--	--	1.04E-05	--	1.04E-05
		TOTAL		4.89E-07	--	4.89E-07	3.24E-02	5.97E-01	6.29E-01

Notes:

a MAX EPCs were the only EPCs for non-plume wells.

Definitions:

-- Not applicable
µg/L Microgram per liter
EPC Exposure point concentration
MAX Maximum detected concentration
RB Redevelopment block

Table A3-20: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Domestic Use RBSL [b] (µg/L)	Noncancer Domestic Use RBSL [b] (µg/L)	Cancer Risk	Hazard Index
2	B0238	ARSENIC	6.30E+00	7.08E-03	1.09E+01	8.90E-04	5.75E-01
		BARIUM	4.52E+01	--	7.30E+03	--	6.19E-03
		CHROMIUM	1.46E+01	--	5.47E+04	--	2.67E-04
		CHROMIUM VI	2.00E+01	--	1.09E+02	--	1.83E-01
		COBALT	4.10E+00	--	7.30E+02	--	5.62E-03
		IRON	5.06E+02	--	1.09E+04	--	4.62E-02
		MANGANESE	3.59E+02	--	8.76E+02	--	4.10E-01
		MOLYBDENUM	2.30E+00	--	1.82E+02	--	1.26E-02
		NICKEL	1.64E+01	--	7.30E+02	--	2.25E-02
		VANADIUM	6.10E+00	--	3.65E+01	--	1.67E-01
		ZINC	4.48E+01	--	1.09E+04	--	4.09E-03
					TOTAL	8.90E-04	1.43E+00
2	B0337	ACETOPHENONE	6.00E-01	--	1.34E+03	--	4.48E-04
		BARIUM	1.43E+02	--	7.30E+03	--	1.96E-02
		CHROMIUM	3.59E+01	--	5.47E+04	--	6.56E-04
		CHROMIUM VI	3.00E+01	--	1.09E+02	--	2.74E-01
		IRON	4.03E+02	--	1.09E+04	--	3.68E-02
		MANGANESE	8.23E+01	--	8.76E+02	--	9.40E-02
		NICKEL	1.28E+01	--	7.30E+02	--	1.75E-02
		VANADIUM	7.95E+00	--	3.65E+01	--	2.18E-01
		ZINC	4.40E+00	--	1.09E+04	--	4.02E-04
					TOTAL	--	6.61E-01

Table A3-20: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Domestic Use RBSL [b] (µg/L)	Noncancer Domestic Use RBSL [b] (µg/L)	Cancer Risk	Hazard Index
BOS-1	B0139	1,4-DICHLOROBENZENE	4.10E-01	2.96E-01	6.63E+02	1.38E-06	6.19E-04
		ACETONE	3.00E+00	--	5.48E+03	--	5.48E-04
		ACETOPHENONE	3.00E+00	--	1.34E+03	--	2.24E-03
		ALPHA-CHLORDANE	2.10E-03	5.10E-02	1.82E+01	4.11E-08	1.15E-04
		ALUMINUM	3.05E+01	--	3.65E+04	--	8.36E-04
		ANTIMONY	2.11E+01	--	1.46E+01	--	1.45E+00
		ARSENIC	9.50E+00	7.08E-03	1.09E+01	1.34E-03	8.68E-01
		BARIUM	2.31E+02	--	7.30E+03	--	3.16E-02
		BENZENE	1.00E+00	1.11E-01	4.39E+01	9.04E-06	2.28E-02
		BERYLLIUM	2.80E-01	--	7.30E+01	--	3.84E-03
		CAPROLACTAM	9.00E-01	--	1.82E+04	--	4.93E-05
		CARBON DISULFIDE	9.00E+00	--	1.04E+03	--	8.63E-03
		CHLOROBENZENE	4.00E+00	--	1.06E+02	--	3.77E-02
		CHLOROETHANE	1.30E+01	4.64E+00	8.59E+03	2.80E-06	1.51E-03
		CHROMIUM	1.80E+00	--	5.47E+04	--	3.29E-05
		CIS-1,2-DICHLOROETHENE	3.40E-01	--	6.08E+01	--	5.59E-03
		COBALT	1.67E+01	--	7.30E+02	--	2.29E-02
		COPPER	1.40E+00	--	1.46E+03	--	9.59E-04
		GAMMA-CHLORDANE	8.30E-03	5.10E-02	1.82E+01	1.63E-07	4.55E-04
		HEPTACHLOR	1.10E-02	1.49E-02	1.82E+01	7.36E-07	6.03E-04
		IRON	1.73E+03	--	1.09E+04	--	1.58E-01
		LEAD	2.30E+00	--	1.50E+01	--	1.53E-01
		MANGANESE	1.36E+03	--	8.76E+02	--	1.55E+00
		MERCURY	2.75E-02	--	1.09E+01	--	2.51E-03
		MOLYBDENUM	2.80E+00	--	1.82E+02	--	1.53E-02
		NICKEL	5.50E+00	--	7.30E+02	--	7.53E-03
		PENTACHLOROPHENOL	2.40E+01	5.60E-01	1.09E+03	4.28E-05	2.19E-02
		SILVER	8.82E+00	--	1.82E+02	--	4.84E-02
		TERT-BUTYL METHYL ETHER	8.30E-01	1.05E+01	5.21E+03	7.94E-08	1.59E-04
		THALLIUM	8.35E+00	--	2.41E+00	--	3.47E+00
		TOLUENE	2.00E+00	--	7.23E+02	--	2.76E-03
		TRICHLOROETHENE	2.00E+00	1.40E+00	9.52E+00	1.43E-06	2.10E-01
		VANADIUM	1.30E+00	--	3.65E+01	--	3.56E-02

Table A3-20: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer with Potential Hydraulic Communication (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX [a] (µg/L)	Cancer Domestic Use RBSL [b] (µg/L)	Noncancer Domestic Use RBSL [b] (µg/L)	Cancer Risk	Hazard Index
					TOTAL	1.40E-03	8.13E+00
BOS-1	B0237	ANTIMONY	1.41E+01	--	1.46E+01	--	9.66E-01
		BARIUM	1.16E+02	--	7.30E+03	--	1.59E-02
		COBALT	6.20E+00	--	7.30E+02	--	8.49E-03
		IRON	6.90E+01	--	1.09E+04	--	6.30E-03
		MANGANESE	2.41E+03	--	8.76E+02	--	2.75E+00
		NICKEL	2.66E+01	--	7.30E+02	--	3.64E-02
					TOTAL	--	3.78E+00

Notes:

a MAX EPCs were the only EPCs for non-plume wells.

b Values shown are adjusted EPA Region IX residential tap water PRGs (EPA 2004a). See Section A7.2 in Appendix A.

Definitions:

-- Not applicable
µg/L Microgram per liter
EPA U.S. Environmental Protection Agency
EPC Exposure point concentration
MAX Maximum detected concentration
PRG Preliminary remediation goal
RB Redevelopment block
RBSL Risk-based screening level

Source:

EPA. 2004a. "EPA Region IX Preliminary Remediation Goals (PRG) 2004." Region IX PRGs Table 2002 Update, Including Memorandum. From Stanford Smucker, EPA Region IX Regional Toxicologist. To PRG Table Users. October 1.

Table A3-21: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

RB	Exposure Point	Analyte	MAX[a] (µg/L)	Cancer Domestic Use RBSL[b] (µg/L)	Noncancer Domestic Use RBSL[b] (µg/L)	Cancer Risk	Hazard Index
2	B0238	ARSENIC	6.30E+00	7.08E-03	1.09E+01	8.90E-04	5.75E-01
		BARIUM	4.52E+01	--	7.30E+03	--	6.19E-03
		CHROMIUM	1.46E+01	--	5.47E+04	--	2.67E-04
		CHROMIUM VI	2.00E+01	--	1.09E+02	--	1.83E-01
		COBALT	4.10E+00	--	7.30E+02	--	5.62E-03
		IRON	5.06E+02	--	1.09E+04	--	4.62E-02
		MANGANESE	3.59E+02	--	8.76E+02	--	4.10E-01
		MOLYBDENUM	2.30E+00	--	1.82E+02	--	1.26E-02
		NICKEL	1.64E+01	--	7.30E+02	--	2.25E-02
		VANADIUM	6.10E+00	--	3.65E+01	--	1.67E-01
		ZINC	4.48E+01	--	1.09E+04	--	4.09E-03
					TOTAL	8.90E-04	1.43E+00
2	B0337	ACETOPHENONE	6.00E-01	--	1.34E+03	--	4.48E-04
		BARIUM	1.43E+02	--	7.30E+03	--	1.96E-02
		CHROMIUM	3.59E+01	--	5.47E+04	--	6.56E-04
		CHROMIUM VI	3.00E+01	--	1.09E+02	--	2.74E-01
		IRON	4.03E+02	--	1.09E+04	--	3.68E-02
		MANGANESE	8.23E+01	--	8.76E+02	--	9.40E-02
		NICKEL	1.28E+01	--	7.30E+02	--	1.75E-02
		VANADIUM	7.95E+00	--	3.65E+01	--	2.18E-01
		ZINC	4.40E+00	--	1.09E+04	--	4.02E-04
					TOTAL	--	6.61E-01

Table A3-21: Summary of Cancer Risks and Noncancer Hazard Indices for Residential Exposure via Domestic Use, Non-Plume Wells, B-Aquifer (Cont.)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a MAX EPCs were the only EPCs for non-plume wells.

b Values shown are adjusted EPA Region IX residential tap water PRGs (EPA 2004a). See Section A7.2 in Appendix A.

Definitions:

--	Not applicable
µg/L	Micrograms per liter
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
MAX	Maximum detected concentration
PRG	Preliminary remediation goal
RB	Redevelopment block
RBSL	Risk-based screening level

Source:

EPA. 2004a. "EPA Region IX Preliminary Remediation Goals (PRG) 2004." Region IX PRGs Table 2002 Update, Including Memorandum. From Stanford Smucker, EPA Region IX Regional Toxicologist. To PRG Table Users. October 1.

ATTACHMENT A4
GROUNDWATER PLUME DELINEATION METHODOLOGY

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS A4-ii

A4.1 INTRODUCTION A4-1

A4.2 METHODOLOGY A4-1

A4.3 RESULTS A4-3

A4.4 REFERENCES A4-5

Figure

A4-1 IR-25 and IR-10A Risk Plume Delineation for Human Health Risk Assessment

A4-2 IR-25 and IR-10A Risk Plume Delineation (Inset) for Human Health Risk Assessment

A4-3 IR-10B Risk Plume Delineation for Human Health Risk Assessment

Table

A4-1 Groundwater Data Associated with Treatability Studies at Parcel B

A4-2 Groundwater Plume Designations

ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
IR	Installation Restoration
RBSL	Risk-based screening level
Tetra Tech	Tetra Tech EM Inc.
TMSRA	Technical Memorandum in Support of Record of Decision Amendment
VOC	Volatile organic compound

A4.1 INTRODUCTION

Groundwater plumes in the A-aquifer were delineated to evaluate the areal extent for the assessment of risks from exposure to groundwater for the human health risk assessment (HHRA) for Hunters Point Shipyard (HPS) Parcel B. Parcel B consists of four hydrogeologic zones: an unconfined A-aquifer zone, an aquitard zone, a discontinuous B-aquifer zone, and a deep bedrock water-bearing zone (Tetra Tech EM Inc. [Tetra Tech] 2001b). The A- and B-aquifers are considered in hydraulic communication in localized areas of Parcel B, but are not in hydraulic communication site wide (see Section 2.2.4 of the Technical Memorandum in Support of a Record of Decision Amendment [TMSRA]). Potentially complete pathways for exposure to groundwater from the A- and B-aquifers are detailed in Section A3.5 of Appendix A.

Several documents served as a foundation to identify groundwater plumes at Parcel B. They include:

- Parcel B Remedial Investigation, Draft Final Report (PRC Environmental Management, Inc. and others 1996)
- Draft Field Sampling Plan for Parcel B Remedial Action Monitoring Plan, Parcel B (Tetra Tech 2000)
- Distribution of the Bay Mud Aquitard and Characterization of the B-aquifer in Parcel B, Technical Memorandum (Tetra Tech 2001a)
- Draft Technical Memorandum, Parcel B Groundwater Evaluation (Tetra Tech 2001b)

Three plumes were delineated as part of the HHRA based on A-aquifer data at Parcel B. Installation Restoration (IR)-10B plume was delineated based on the presence of chromium VI in the A-aquifer. IR-10A and IR-25 plumes were delineated based on the presence of volatile organic compounds (VOC) in the A-aquifer. The boundaries of the plumes were based on delineation to nondetectable levels. Because the IR-25 plume transgresses into Parcel C, groundwater data from Parcel B and Parcel C within the boundary of the plume were included in the data set for IR-25. Information on delineation of the three plumes is provided in the methodology section below.

A4.2 METHODOLOGY

Based on the methodology established by the Base Realignment and Closure Cleanup Team for the groundwater HHRA at HPS, plumes in the A-aquifer were delineated to nondetectable concentrations (that is, the reporting limit) for use in the HHRA. These plumes were used in the HHRA to evaluate potential risks from exposure to groundwater in the A-aquifer via vapor intrusion for residents and industrial workers and exposure to groundwater in the A-aquifer via inhalation and dermal contact for the construction worker. The plume boundaries delineated for the A-aquifer were also extrapolated vertically to the B-aquifer for purposes of evaluating potential residential risks from domestic use of groundwater in the B-aquifer.

To evaluate risks, data from the last 12 rounds of monitoring for each chemical at each monitoring well were used to calculate exposure point concentrations for chemicals of potential concern in groundwater. For Parcel B, this data set consists of all groundwater monitoring well data collected at Parcel B through quarter 20 (December 2004) of monitoring. Groundwater data were not collected consistently at Parcel B for all chemicals during all quarters, so data for an individual chemical may span more than the last 12 quarters of sampling. Using the data for VOCs from this data set, groundwater plumes in the A-aquifer were delineated to the reporting limit (nondetectable) with the following systematic approach. Three plumes were delineated: IR-10A, IR-10B, and IR-25. The delineated plumes are presented in Figures A4-1, A4-2, and A4-3.

- The target VOCs used to delineate the plumes of VOCs in groundwater at IR-10A and IR-25 are listed below. These VOCs were selected because maximum concentrations measured at HPS (installation-wide) exceeded residential risk-based screening levels (RBSL) for groundwater vapor intrusion (see Section A7.2 of Appendix A). The RBSLs levels are based on a cancer risk level of 1×10^{-6} and a noncancer hazard of 1.

Target VOCs Used to Delineate IR-10A and IR-25 Groundwater Plumes
1,1,2-Trichloroethane
1,1-Dichloroethane
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloroethene (total)
1,4-Dichlorobenzene
2-Methylnaphthalene
Benzene
Carbon tetrachloride
Chloroform
cis-1,2-Dichlorothene
Isopropylbenzene
Methylene chloride
Naphthalene
Tetrachloroethene
trans-1,2-Dichloroethene
Trichloroethene
Vinyl chloride
Xylene

- The IR-10B plume was delineated based on measured concentrations of chromium VI. VOCs were also detected in the area of the IR-10B plume, but this plume was not delineated for VOC concentrations because none of the VOC concentrations detected in the area of this plume exceeded RBSLs for groundwater vapor intrusion. Although the exposure pathway for vapor intrusion is incomplete for chromium VI because chromium is not volatile, the chromium VI plume at IR-10B was delineated for evaluation in the HHRA because exposure to chromium is potentially complete for the construction worker exposure scenario (see Section A4.3).

- Only groundwater data from monitoring wells were used to delineate risk plumes; data from piezometers were not used for plume delineation.

- Results for more than one volatile chemical were used to delineate each plume. (That is, the plumes delineated for the HHRA are not chemical-specific.)

- The plumes were not delineated based on a temporal component, but instead on the maximum concentration detected in samples collected at a monitoring location within the last 12 quarters of sampling, ending in quarter 20.

- Plumes were delineated to nondetectable concentrations (that is, the reporting limit), which is typically 0.5 micrograms per liter (µg/L) for most VOCs (see Figures A4-1 and A4-2) and 10 µg/L for chromium VI (see Figure A4-3). Detected concentrations below the reporting limit (that is, J-qualified estimated concentrations below the reporting limit) were not used to delineate plumes for the HHRA. These J-qualified data were used in the HHRA to estimate exposure point concentrations for groundwater.

- Data collected from monitoring wells associated with treatability studies at Parcel B were excluded from the data set used for plume delineation, beginning with data collected from the initiation of the treatability study, and including data collected following completion of the treatability studies. The monitoring well locations and sample dates associated with data excluded from the plume delineation data set are summarized in Table A4-1. The excluded data are associated with the zero-valent iron and chemical oxidation treatability studies for the IR-10A and IR-25 plumes, respectively. These data were excluded from the plume delineation data set because plume concentrations have not yet stabilized following treatability studies, and temporal fluctuations associated with nonstabilized plume concentrations may contribute to uncertainties with the delineated plume boundaries. Data collected from the monitoring wells associated with treatability studies before initiation of the studies were retained in the data set used for plume delineation.

A4.3 RESULTS

Three plumes were delineated for the HHRA for Parcel B: IR-10A, IR-10B, and IR-25. The plumes are shown in Figures A4-1, A4-2, and A4-3. The plume at IR-10A is located in the center of Parcel B and the plume at IR-25 is located in the southern portion of Parcel B (see Figure A4-1). The primary target VOCs that comprise these plumes are chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, dichloroethene, trichloroethene, and vinyl chloride (see Figure A4-2).

The plume at IR-10B is located centrally within Parcel B and covers a smaller area in comparison with the IR-10A plume (see Figure A4-3). Two monitoring wells comprise the IR-10B plume. The highest concentration of chromium VI measured in this plume was 550 µg/L at monitoring well IR10MW12A. One VOC (carbon disulfide) was detected within this plume; however, data for this VOC are not shown on Figure A4-3 because concentrations of carbon

disulfide do not exceed the RBSL for carbon disulfide. As described in Section A4.3.2 of Appendix A, no complete exposure pathways have been identified for residential, industrial, and recreational exposure to chromium VI in the A-aquifer. However, a complete exposure pathway exists for chromium VI in the A-aquifer for construction workers (dermal contact with groundwater). Inhalation of VOCs in the A-aquifer in the IR-10B plume is also a complete pathway for construction workers, as well as for residential and industrial receptors.

Table A4-2 lists each groundwater monitoring well at Parcel B and the associated plume and corresponding aquifer for each monitoring well. The analytical data for the monitoring wells associated with each plume were combined to form the groundwater data set for that plume for the HHRA (see Section A4.3.2 of Appendix A). Monitoring wells not associated with the delineated plumes are also listed in Table A4-2. Analytical data collected from the non-plume wells were grouped by associated residential and industrial grid for evaluation in the HHRA (see Section A4.3.2 of Appendix A).

Table A4-2 also indicates for each groundwater monitoring location if communication occurs between the A- and B-aquifers. The potential for hydraulic communication between the A- and B-aquifers is limited to small areas in the western portion of Parcel B (see Section 2.2.4 of the TMSRA). The B-aquifer is predominantly absent from other areas of Parcel B.

None of the three A-aquifer plumes identified for the HHRA was assumed to be in communication with the B-aquifer. For exposure areas where communication between aquifers is identified, the HHRA evaluated potential residential risks for domestic use under two cases: first using solely B-aquifer data, and second using a combination of A- and B-aquifer data. The following four exposure areas (residential grids) at Parcel B have groundwater monitoring data in an area where hydraulic communication may occur between the A- and B-aquifers: B0238 (IR18MW100B), B0337 (IR18MW101B), B0139 (IR18MW21A and IR18MW21AD), and B0237 (PA18MW09A). Each of these grids was evaluated for potential risks from domestic use of groundwater. Grids B0238 and B0337 were evaluated for potential risks from domestic use with B-aquifer data only because no corresponding A-aquifer data were available for these grids. Grids B0139 and B0237 were evaluated for potential risks from domestic use with A-aquifer data only because B-aquifer data were not available for these grids.

A4.4 REFERENCES

PRC Environmental Management, Inc., Harding Lawson Associates, Levine-Fricke-Recon, and Uribe & Associates. 1996. "Parcel B Remedial Investigation, Draft Final Report, Hunters Point Shipyard, San Francisco, California." June 6.

Tetra Tech EM Inc. [Tetra Tech]. 2000. "Draft Field Sampling Plan for Parcel B Remedial Action Monitoring Plan, Parcel B, Hunters Point Shipyard, San Francisco, California." April 2000.

Tetra Tech. 2001a. Distribution of the Bay Mud Aquitard and Characterization of the B-aquifer in Parcel B, Technical Memorandum, Hunters Point Shipyard, San Francisco, California." February 19.

Tetra Tech. 2001b. "Draft Technical Memorandum, Parcel B Groundwater Evaluation, Hunters Point Shipyard, San Francisco, California." November 30.

FIGURES

Notes:
Plume contours are based upon A-aquifer well data only. B-aquifer and bedrock wells are shown for point of reference only.

Plume contours are based upon groundwaler sample analytical data selected according to the following criteria:

1) Analytical data from monitoring wells and piezometers only (no hydropunch or grab groundwater samples)

2) Analytical data from the last 12 quarters of monitoring through Q20 (December 2004)

3) The highest concentration of any one analyte for each monitoring point during this time period

San Francisco Bay

IR07MW19A
CHLOROFORM 0.8 µg/L

IR07MW20A2
TETRACHLOROETHENE 2.25 µg/L

IR07MWS-3 (ND)

IR07MW20A1
XYLENE (TOTAL) 0.51 µg/L

IR07MWS-4DD
1,2,4-TRICHLOROBENZENE 2 µg/L J

IR07MWS-4D
BENZENE 2.25 µg/L

IR07P20A (NA)

IR23MW14A (ND)

IR07MW24AD (ND)

IR07MW25AD
XYLENE (TOTAL) 1 µg/L J

IR07MW25A (ND)

IR07MW21A1
1,2-DICHLOROETHANE 0.14 µg/L J

IR07MW21A2 (ND)

IR07MW21A1D (ND)

IR07MW24A
CIS-1,2-DICHLOROETHENE 0.21 µg/L J

IR07MW23A
CIS-1,2-DICHLOROETHENE 10 µg/L J

IR07MW26AD (ND)

IR07MWP-1 (ND)

IR07MW26A (ND)

IR07MWS-4
TRICHLOROETHENE 0.25 µg/L J3

IR07MWS-2 (ND)

IR07MWS-2D (ND)

IR07MWP-2 (ND)

IR60MW08A (ND)

IR60MW04A (ND)

IR46MW43A (ND)

PA24MW01A
NAPHTHALENE 3 µg/L

IR46MW42A (ND)

IR60MW10A (ND)

IR07MW94A (NA)

UT03MW11A
2-METHYLNAPHTHALENE 2.7 µg/L

IR46MW39A2 (ND)

IR46MW46A (ND)

IR46MW39A (ND)

IR46MW39A3 (ND)

PA18MW09A (ND)

IR18MW21A
TRICHLOROETHENE 2 µg/L J

UT03MW16A (ND)

IR18MW101B

IR18P21A1 (NA)

IR18MW22A (ND)

IR18MW91A (NA)

IR18MW100B

UT03MW12A (ND)

UT03MW10A (ND)

UT02MW17A (ND)

IR07MW93A (NA)

IR18MW92A (NA)

IR18P21A2 (NA)

IR07MW27A
1,1-DICHLOROETHANE 0.36 µg/L J

IR07MWS-1
TETRACHLOROETHENE 1 µg/L J

UT02MW16A (ND)

IR62MW07A (ND)

UT02MW15A
2-METHYLNAPHTHALENE 11 µg/L

IR62MW08A (ND)

SEE FIGURE A4-2 FOR DETAIL OF THIS AREA

SEE INSET FOR EASTERN PORTION OF PARCEL B

Parcel C

IR06MW54F (ND)

IR06MW57F (ND)

IR58MW24F (ND)

EASTERN PORTION OF PARCEL B

IR26MW41A (ND)

IR26MW40A (ND)

IR26MW42A (ND)

IR26MW43A (ND)
1,2-DICHLOROETHENE (TOTAL) 9 µg/L J5

IR26MW46A (ND)

IR26MW47A (ND)

IR26MW36A (ND)

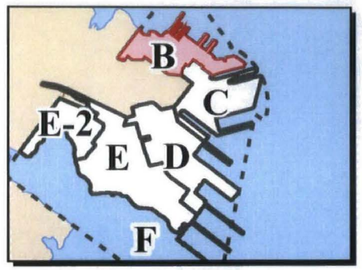
IR26MW45A (ND)
CHLOROFORM 4 µg/L J

IR26MW41A (ND)
1,2-DICHLOROETHENE (TOTAL) 1 µg/L J

IR26MW48A (ND)
NAPHTHALENE 10 µg/L J

PA50MW02 (ND)

IR26MW44A (ND)



Location Map

- A-Aquifer Well
- B-Aquifer Well
- Bedrock Water-Bearing Zone Well
- Piezometer
- Road
- IR-10A Plume
- IR-25 Plume
- Parcel B Boundary
- Non-Navy Property
- Demolished Building
- Existing Building
- San Francisco Bay

Abbreviations:
µg/L - Microgram per liter
IR - Installation Restoration
J - Estimated concentration
NA - Not analyzed
ND - Not detected

N

125 0 125 250 375
Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A4-1
IR-25 AND IR-10A RISK PLUME DELINEATION FOR HUMAN HEALTH RISK ASSESSMENT

TMSRA for Parcel B

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PA50MW01A
CIS-1,2-DICHLOROETHENE 0.25 µg/L J

IR10MW32A
1,2-DICHLOROETHENE (TOTAL) 7 µg/L J

IR10MW64A (NA)

IR10BHG08 (NA)

IR10BHG07 (NA)

IR10MW33A
TRICHLOROETHENE 23 µg/L

IR10MW78A (NA)

IR10BHG06 (NA)

IR61MW05A (ND)

IR10BHG05 (NA)

IR10MW75A
CHLOROFORM 0.53 µg/L

IR61MW04A (ND)

IR10MW12A (ND)

IR10MW76A
TRICHLOROETHENE 2.55 µg/L

IR10BHG02 (NA)

IR10MW77A (NA)

IR10BHG01 (NA)

IR10BHG09 (NA)

IR10BHG03 (NA)

IR10MW72A (NA)

IR10MW73A (NA)

IR10MW67A (NA)

IR10BHG10 (NA)

IR10MW68A (NA)

IR10MW69A
TRICHLOROETHENE 5.1 µg/L

IR10P15A (NA)

IR10MW15A (ND)

IR06MW46A (ND)

IR06MW40A
VINYL CHLORIDE 14 µg/L

IR06MW47F
CHLOROFORM 1 µg/L J

IR06MW41A
CHLOROFORM 2 µg/L J3

IR06MW35A
CIS-1,2-DICHLOROETHENE 31 µg/L

IR06MW52F (ND)

IR06MW59A1
VINYL CHLORIDE 350 µg/L

IR06MW59A2
CIS-1,2-DICHLOROETHENE 8.1 µg/L

IR06MW53F (ND)

IR06MW48F
VINYL CHLORIDE 12 µg/L

IR06MW22A
CIS-1,2-DICHLOROETHENE 270 µg/L

IR06MW22AD
BENZENE 72 µg/L

IR06MW23A
BENZENE 15 µg/L

IR06MW30A
CIS-1,2-DICHLOROETHENE 340 µg/L

IR06MW54F

IR06P54FB

IR06P54FA

IR06MW32A
1,4-DICHLOROBENZENE 1.1 µg/L

IR10MW31A1
1,2-DICHLOROETHANE 0.36 µg/L J

IR10MW31A2 (ND)

IR10MW31A1D (ND)

IR10MW60A (NA)

IR10MW62A
CIS-1,2-DICHLOROETHENE 1.4 µg/L

IR10MW13A2
1,2-DICHLOROETHENE (TOTAL) 8 µg/L

IR10MW13A1
1,2-DICHLOROETHENE (TOTAL) 66 µg/L

IR10P13A (ND)

IR10P13AA (NA)

IR10MW80A (ND)

IR10MW63A (NA)

IR10MW61A
VINYL CHLORIDE 240 µg/L

IR10MW79A
XYLENE (TOTAL) 0.2 µg/L J

IR10MW74A (NA)

IR10MW59A
TRICHLOROETHENE 410 µg/L

IR10MW29A2 (ND)

IR10MW29A1 (ND)

IR10MW71A
TRICHLOROETHENE 650 µg/L

IR10MW70A (NA)

IR10MW28A
TRICHLOROETHENE 21 µg/L

IR10MW66A (NA)

IR10MW65A (NA)

IR25MW60A1
TRICHLOROETHENE 1.2 µg/L

IR25MW57A (NA)

IR25MW18A
1,2-DICHLOROETHANE 43000 µg/L J3

IR25MW903B
1,2-DICHLOROBENZENE 3000 µg/L

IR25MW19A
1,2-DICHLOROETHANE 91000 µg/L J3

IR25MW15F
1,2-DICHLOROBENZENE 0.4 µg/L J

IR25MW42B
1,2-DICHLOROBENZENE 0.7 µg/L

IR06MW44A
1,2-DICHLOROBENZENE 9 µg/L

IR25MW51A
1,2-DICHLOROBENZENE 0.84 µg/L

IR25MW20A
TETRACHLOROETHENE 12 µg/L

IR06P30A (NA)

IR06MW51F (ND)

IR25MW37B (ND)

IR46MW38A (ND)

IR46P38AB (NA)

IR46P38AA (NA)

IR10MW14A
1,2-DICHLOROETHENE (TOTAL) 4 µg/L

IR25MW37A
CIS-1,2-DICHLOROETHENE 7 µg/L
TRICHLOROETHENE 7 µg/L

IR25MW17A
1,2-DICHLOROETHANE 2.7 µg/L

IR46MW37A (ND)

IR25MW38B
1,2-DICHLOROBENZENE 2.9 µg/L

IR25MW61A1
CHLOROFORM 0.5 µg/L

IR25MW61A2
CHLOROFORM 0.59 µg/L

IR25MW60A2
CHLOROFORM 1.1 µg/L

IR25MW56A (NA)

IR25MW39B (ND)

IR25MW39A
1,4-DICHLOROBENZENE 0.81 µg/L

IR25MW900B
1,2-DICHLOROBENZENE 6800 µg/L

IR25MW11A
2-METHYLNAPHTHALENE 920 µg/L J

IR06MW50F (ND)

IR25MW22A
1,2-DICHLOROBENZENE 0.91 µg/L

IR06MW49F
TRICHLOROETHENE 4 µg/L

IR06MW27A
CHLOROFORM 0.3 µg/L J

IR06MW55F

IR06MW56F

IR06MW32AD
BENZENE 11 µg/L

IR25MW40A
1,4-DICHLOROBENZENE 1.1 µg/L

San Francisco Bay

IR46MW47A (ND)

PA24MW02A (ND)

IR46MW48A
1,1-DICHLOROETHANE 0.6 µg/L

IR46MW40A2
1,1-DICHLOROETHANE 2 µg/L J

IR46MW40A (ND)

IR46MW40A3
1,1-DICHLOROETHANE 3.5 µg/L

IR24MW07A (ND)

PA24MW03AD (ND)

PA24MW03AD1 (ND)

IR24MW05A (ND)

IR24MW06A (ND)

IR24MW04A
TRICHLOROETHENE 1.5 µg/L

IR46MW41A (ND)

IR26MW41A
1,2-DICHLOROBENZENE 1 µg/L J

IR20MW06A (ND)

IR25MW904B
CIS-1,2-DICHLOROETHENE 2.2 µg/L

IR20MW17A
1,2-DICHLOROETHENE (TOTAL) 11 µg/L

IR25MW52A
1,2-DICHLOROBENZENE 45 µg/L

IR20MW01A (ND)

IR25MW15A1
1,2-DICHLOROETHANE 150000 µg/L

IR20MW11A (ND)

IR25MW15A2
1,2-DICHLOROETHANE 6500 µg/L

IR25MW41A
1,4-DICHLOROBENZENE 1.1 µg/L

IR06MW45A
CIS-1,2-DICHLOROETHENE 0.9 µg/L

IR25MW905B
1,2-DICHLOROETHANE 280 µg/L

IR25MW902B
1,2-DICHLOROETHANE 36000 µg/L

IR25MW901B
1,2-DICHLOROBENZENE 6800 µg/L

IR25MW50A
1,4-DICHLOROBENZENE 0.55 µg/L

IR25MW16A
TRICHLOROETHENE 510 µg/L J3

IR06MW34A
NAPHTHALENE 15 µg/L

IR06MW42A
NAPHTHALENE 275 µg/L

Parcel C

125 128 131 121 122 119 115 120 123 113 124 114 134 130 133 156 112 111 109 135

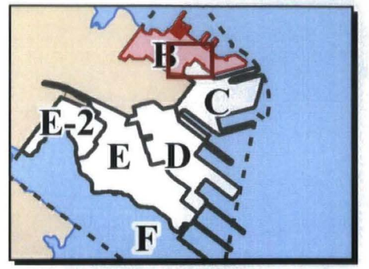
Notes:
Plume contours are based upon A-aquifer well data only. Bedrock wells are shown for point of reference only.

Plume contours are based upon groundwater sample analytical data selected according to the following criteria:

1) Analytical data from monitoring wells and piezometers only (no hydropunch or grab groundwater samples)

2) Analytical data from the last 12 quarters of monitoring through Q20 (December 2004)

3) The highest concentration of any one analyte for each monitoring point during this time period



Location Map

- A-Aquifer Well
- Bedrock Water-Bearing Zone Well
- Piezometer
- Road
- IR-10A Plume
- IR-25 Plume
- PARCEL B BOUNDARY
- Non-Navy Property
- Demolished Building
- Existing Building
- San Francisco Bay

Abbreviations:
µg/L - Microgram per liter
IR - Installation Restoration
J - Estimated concentration
NA - Not analyzed
ND - Not detected

N

50 0 50 100 150
Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A4-2
IR-25 AND IR-10A RISK PLUME DELINEATION (INSET) FOR HUMAN HEALTH RISK ASSESSMENT

TMSRA for Parcel B

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Notes:
Plume contours are based upon A-aquifer well data only. B-aquifer and bedrock wells are shown for point of reference only.

Plume contours are based upon groundwater sample analytical data selected according to the following criteria:

1) Analytical data from monitoring wells and piezometers only (no hydropunch or grab groundwater samples)

2) Analytical data from the last 12 quarters of monitoring through Q20 (December 2004)

3) The highest concentration of any one analyte for each monitoring point during this time period

San Francisco Bay

PARCEL B

PARCEL C

SEE INSET FOR DETAIL OF THIS AREA

IR07MW20A1
CHROMIUM VI 10 µg/L

IR07MWS-4DD
CHROMIUM VI 20 µg/L

IR10MW12A
CHROMIUM VI 550 µg/L

IR61MW05A
CHROMIUM VI 19 µg/L J

IR26MW47A
CHROMIUM VI 11 µg/L J

IR26MW46A
CHROMIUM VI 6 µg/L J

IR26MW48A
CHROMIUM VI 8 µg/L J5

INSET

Scale in Feet: 30 0 30 60

Location Map

- A-Aquifer Well
- A/B-Aquifer Well
- B-Aquifer Well
- Bedrock Water-Bearing Zone Well
- Piezometer
- Road
- IR-10B Plume
- Parcel B Boundary
- Non-Navy Property
- Demolished Building
- Existing Building
- San Francisco Bay

Abbreviations:
µg/L - Microgram per liter
IR - Installation Restoration
J - Estimated concentration
NA - Not analyzed
ND - Not detected

Scale in Feet: 150 0 150 300 450

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE A4-3
IR-10B RISK PLUME DELINEATION FOR HUMAN HEALTH RISK ASSESSMENT

TMSRA for Parcel B

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TABLES

TABLE A4-1: GROUNDWATER DATA ASSOCIATED WITH TREATABILITY STUDIES AT PARCEL B

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parcel	Groundwater Monitoring Location	Aquifer Designation	Groundwater Grouping	Communication Between the A- and B-Aquifer	Treatability Study Description	Dates of Study[a]
B	IR10MW28A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW33A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW59A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW60A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW61A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW63A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW71A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
B	IR10MW74A	A	IR-10A Plume	No	Building 123 ZVI Study	Sept - Oct., 2003
C	IR06MW44A	A	IR-25 Plume	No	ChemOx study	April - July, 2001
C	IR25MW11A	A	IR-25 Plume	No	ChemOx study	April - July, 2001
C	IR25MW15A1	A	IR-25 Plume	No	ChemOx study	April - July, 2001
C	IR25MW15A2	A	IR-25 Plume	No	ChemOx study	April - July, 2001
C	IR25MW18A	A	IR-25 Plume	No	ChemOx study	April - July, 2001
C	IR25MW19A	A	IR-25 Plume	No	ChemOx study	April - July, 2001
B	IR10MW69A	A	Non-plume	No	Building 123 ZVI Study	Sept - Oct., 2003

Notes:

a Data collected from monitoring wells locations associated with treatability studies were excluded from the risk plume delineation data set, beginning with data collected from the initiation of the treatability study. Data collected from these well locations following completion of the treatability study were also excluded, because plume concentrations have not yet stabilized.

ChemOx Chemical Oxidation
IR Installation Restoration
Oct October
Sept September
ZVI Zero-valent iron

TABLE A4-2: GROUNDWATER PLUME DESIGNATIONS

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parcel	Groundwater Monitoring Location [a]	Aquifer Designation	Groundwater Grouping	Communication Between the A- and B-Aquifer
B	IR10MW13A1	A	IR-10A Plume	No
B	IR10MW13A2	A	IR-10A Plume	No
B	IR10MW28A	A	IR-10A Plume	No
B	IR10MW32A	A	IR-10A Plume	No
B	IR10MW33A	A	IR-10A Plume	No
B	IR10MW59A	A	IR-10A Plume	No
B	IR10MW61A	A	IR-10A Plume	No
B	IR10MW62A	A	IR-10A Plume	No
B	IR10MW69A	A	IR-10A Plume	No
B	IR10MW71A	A	IR-10A Plume	No
B	IR10MW75A	A	IR-10A Plume	No
B	IR10MW76A	A	IR-10A Plume	No
B	IR10MW12A	A	IR-10B Plume	No
B	IR61MW05A	A	IR-10B Plume	No
B	IR10MW14A	A	IR-25 Plume	No
B	IR20MW17A	A	IR-25 Plume	No
B	IR24MW04A	A	IR-25 Plume	No
B	IR25MW61A1	A	IR-25 Plume	No
B	IR25MW61A2	A	IR-25 Plume	No
C	IR06MW22A	A	IR-25 Plume	No
C	IR06MW22AD	A	IR-25 Plume	No
C	IR06MW23A	A	IR-25 Plume	No
C	IR06MW30A	A	IR-25 Plume	No
C	IR06MW32A	A	IR-25 Plume	No
C	IR06MW32AD	A	IR-25 Plume	No
C	IR06MW34A	A	IR-25 Plume	No
C	IR06MW35A	A	IR-25 Plume	No
C	IR06MW40A	A	IR-25 Plume	No
C	IR06MW41A	A	IR-25 Plume	No
C	IR06MW42A	A	IR-25 Plume	No
C	IR06MW44A	A	IR-25 Plume	No
C	IR06MW45A	A	IR-25 Plume	No
C	IR06MW47F	A	IR-25 Plume	No
C	IR06MW48F	A	IR-25 Plume	No
C	IR06MW49F	A	IR-25 Plume	No
C	IR06MW51F	A	IR-25 Plume	No
C	IR06MW52F	A	IR-25 Plume	No
C	IR06MW59A1	A	IR-25 Plume	No
C	IR06MW59A2	A	IR-25 Plume	No
C	IR25MW11A	A	IR-25 Plume	No
C	IR25MW15A1	A	IR-25 Plume	No
C	IR25MW15A2	A	IR-25 Plume	No
C	IR25MW15F	A	IR-25 Plume	No
C	IR25MW16A	A	IR-25 Plume	No
C	IR25MW17A	A	IR-25 Plume	No

TABLE A4-2: GROUNDWATER PLUME DESIGNATIONS (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parcel	Groundwater Monitoring Location [a]	Aquifer Designation	Groundwater Grouping	Communication Between the A- and B-Aquifer
C	IR25MW18A	A	IR-25 Plume	No
C	IR25MW19A	A	IR-25 Plume	No
C	IR25MW20A	A	IR-25 Plume	No
C	IR25MW22A	A	IR-25 Plume	No
C	IR25MW37A	A	IR-25 Plume	No
C	IR25MW37B	A	IR-25 Plume	No
C	IR25MW38B	A	IR-25 Plume	No
C	IR25MW39A	A	IR-25 Plume	No
C	IR25MW39B	A	IR-25 Plume	No
C	IR25MW40A	A	IR-25 Plume	No
C	IR25MW41A	A	IR-25 Plume	No
C	IR25MW42B	A	IR-25 Plume	No
C	IR25MW50A	A	IR-25 Plume	No
C	IR25MW51A	A	IR-25 Plume	No
C	IR25MW52A	A	IR-25 Plume	No
C	IR25MW60A1	A	IR-25 Plume	No
C	IR25MW60A2	A	IR-25 Plume	No
C	IR25MW900B	A	IR-25 Plume	No
C	IR25MW901B	A	IR-25 Plume	No
C	IR25MW902B	A	IR-25 Plume	No
C	IR25MW903B	A	IR-25 Plume	No
C	IR25MW904B	A	IR-25 Plume	No
C	IR25MW905B	A	IR-25 Plume	No
B	IR06MW46A	A	Non-plume	No
B	IR07MW19A	A	Non-plume	No
B	IR07MW20A1	A	Non-plume	No
B	IR07MW20A2	A	Non-plume	No
B	IR07MW21A1	A	Non-plume	No
B	IR07MW21A1D	A	Non-plume	No
B	IR07MW21A2	A	Non-plume	No
B	IR07MW23A	A	Non-plume	Yes
B	IR07MW24A	A	Non-plume	No
B	IR07MW24AD	A	Non-plume	No
B	IR07MW25A	A	Non-plume	No
B	IR07MW25AD	A	Non-plume	No
B	IR07MW26A	A	Non-plume	No
B	IR07MW26AD	A	Non-plume	No
B	IR07MW27A	A	Non-plume	No
B	IR07MWP-1	A	Non-plume	No
B	IR07MWP-2	A	Non-plume	No
B	IR07MWS-1	A	Non-plume	No
B	IR07MWS-2	A	Non-plume	No
B	IR07MWS-2D	A	Non-plume	No
B	IR07MWS-3	A	Non-plume	No
B	IR07MWS-4	A	Non-plume	No

TABLE A4-2: GROUNDWATER PLUME DESIGNATIONS (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parcel	Groundwater Monitoring Location [a]	Aquifer Designation	Groundwater Grouping	Communication Between the A- and B-Aquifer
B	IR07MWS-4D	A	Non-plume	No
B	IR07MWS-4DD	A	Non-plume	No
B	IR10MW15A	A	Non-plume	No
B	IR10MW29A1	A	Non-plume	No
B	IR10MW29A2	A	Non-plume	No
B	IR10MW31A1	A	Non-plume	No
B	IR10MW31A1D	A	Non-plume	No
B	IR10MW31A2	A	Non-plume	No
B	IR10MW64A	A	Non-plume	Yes
B	IR10MW65A	A	Non-plume	Yes
B	IR10MW66A	A	Non-plume	Yes
B	IR10MW67A	A	Non-plume	Yes
B	IR10MW68A	A	Non-plume	Yes
B	IR10MW70A	A	Non-plume	Yes
B	IR10MW73A	A	Non-plume	Yes
B	IR10MW77A	A	Non-plume	Yes
B	IR10MW78A	A	Non-plume	Yes
B	IR10MW79A	A	Non-plume	No
B	IR10MW80A	A	Non-plume	No
B	IR18MW21A	A	Non-plume	Yes
B	IR18MW21AD	A	Non-plume	Yes
B	IR18MW22A	A	Non-plume	Yes
B	IR20MW01A	A	Non-plume	No
B	IR20MW06A	A	Non-plume	No
B	IR20MW11A	A	Non-plume	No
B	IR23MW14A	A	Non-plume	No
B	IR24MW05A	A	Non-plume	No
B	IR24MW06A	A	Non-plume	No
B	IR24MW07A	A	Non-plume	No
B	IR26MW36A	A	Non-plume	No
B	IR26MW40A	A	Non-plume	No
B	IR26MW41A	A	Non-plume	No
B	IR26MW42A	A	Non-plume	No
B	IR26MW43A	A	Non-plume	No
B	IR26MW44A	A	Non-plume	No
B	IR26MW45A	A	Non-plume	No
B	IR26MW46A	A	Non-plume	No
B	IR26MW47A	A	Non-plume	No
B	IR26MW48A	A	Non-plume	No
B	IR46MW37A	A	Non-plume	No
B	IR46MW38A	A	Non-plume	No
B	IR46MW39A	A	Non-plume	No
B	IR46MW39A2	A	Non-plume	No
B	IR46MW39A3	A	Non-plume	No
B	IR46MW40A	A	Non-plume	No

TABLE A4-2: GROUNDWATER PLUME DESIGNATIONS (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parcel	Groundwater Monitoring Location [a]	Aquifer Designation	Groundwater Grouping	Communication Between the A- and B-Aquifer
B	IR46MW40A2	A	Non-plume	No
B	IR46MW40A3	A	Non-plume	No
B	IR46MW41A	A	Non-plume	No
B	IR46MW42A	A	Non-plume	No
B	IR46MW43A	A	Non-plume	No
B	IR46MW46A	A	Non-plume	No
B	IR46MW47A	A	Non-plume	No
B	IR46MW48A	A	Non-plume	No
B	IR60MW04A	A	Non-plume	No
B	IR60MW08A	A	Non-plume	No
B	IR60MW10A	A	Non-plume	No
B	IR61MW04A	A	Non-plume	No
B	IR62MW07A	A	Non-plume	No
B	IR62MW08A	A	Non-plume	Yes
B	PA18MW09A	A	Non-plume	Yes
B	PA24MW01A	A	Non-plume	No
B	PA24MW02A	A	Non-plume	No
B	PA24MW03AD	A	Non-plume	No
B	PA24MW03AD1	A	Non-plume	No
B	PA50MW01A	A	Non-plume	No
B	PA50MW02A	A	Non-plume	No
B	UT02MW15A	A	Non-plume	No
B	UT02MW16A	A	Non-plume	No
B	UT02MW17A	A	Non-plume	No
B	UT03MW10A	A	Non-plume	No
B	UT03MW11A	A	Non-plume	No
B	UT03MW12A	A	Non-plume	No
B	UT03MW16A	A	Non-plume	No
B	IR18MW100B	B	Non-plume	Yes
B	IR18MW101B	B	Non-plume	Yes

Notes:

a Groundwater monitoring locations without data or that were not analyzed for individual chemicals considered in the risk assessment were not included.

IR Installation Restoration

ATTACHMENT A5
GROUNDWATER-TO-OUTDOOR AIR MODEL FOR CONSTRUCTION WORKER TRENCH EXPOSURE

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS A5-ii

A5.1 INTRODUCTION A5-1

EQUATION A5-1 ..... A5-1
EQUATION A5-2 ..... A5-1
EQUATION A5-3 ..... A5-2
EQUATION A5-4 ..... A5-2
EQUATION A5-5 ..... A5-3

A5.2 REFERENCES A5-4

Table

A5-1 Trench Model Input Parameters

A5-2 Trench Model Chemical-Specific Values

ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	Microgram per cubic meter
µg/L	Microgram per liter
atm-m^3/mol	Atmosphere – cubic meter per mole
atm-m^3/mole-°K	Atmosphere – cubic meter per mole – degrees Kelvin
cm/s	Centimeter per second
cm^2/m^2	Square centimeter per square meter
COPC	Chemical of potential concern
g/mol	Gram per mole
hr^{-1}	Event per hour
°K	Degrees Kelvin
L/cm^3	Liter per cubic centimeter
L/m^3	Liter per cubic meter
m^2	Square meter
m^3	Cubic meter
s/hr	Second per hour
TMSRA	Technical memorandum in support of a record of decision amendment
VDEQ	Virginia Department of Environmental Quality
VF	Volatilization factor

A5.1 INTRODUCTION

As discussed in Section A5.1.3.5 of Appendix A, chemical-specific volatilization factors (VF) were used to estimate exposure point concentrations from volatile chemicals of potential concern (COPC) in groundwater for the human health risk assessment at Parcel B at Hunters Point Shipyard. Chemical-specific VFs were used to relate concentrations of volatile chemicals in groundwater that accumulate in a construction trench to airborne concentrations that may be inhaled by construction workers. The VF for this scenario was calculated based on Virginia Department of Environmental Quality (VDEQ) guidance (VDEQ 2005), which provides a combination of a vadose zone model to estimate volatilization of gaseous COPCs from groundwater in a trench, and a box model to estimate dispersion of the COPCs from the air inside the trench into aboveground air. These models, which can be described by five equations, are detailed below.

Equation A5-1

$$C_{trench} = CGW \times VF$$

Where:

C_{trench}	=	Concentration of contaminant in the trench (microgram per cubic meter [$\mu g/m^3$])
CGW	=	Concentration of contaminant in groundwater (microgram per liter [$\mu g/L$])
VF	=	Volatilization factor (see Equations A5-2 through A5-5) (liter per cubic meter [L/m^3])

Equation A5-2

$$VF = (K_i \times A \times F \times 10^{-3} \times 10^4 \times 3{,}600) / (ACH \times V)$$

where:

K_i	=	Mass transfer coefficient of contaminant *i* (see Equation A5-3) (centimeter per second [cm/s])
A	=	Area of the trench (square meter [m^2])
F	=	Fraction of floor through which contaminant can enter (unitless)
ACH	=	Air changes per hour (hr^{-1})
V	=	Volume of trench (m^3)
10^{-3}	=	Conversion factor (liter per cubic centimeter [L/cm^3])
10^4	=	Conversion factor (square centimeter per square meter [cm^2/m^2])
3,600	=	Conversion factor (second per hour)

If the aspect ratio of trench (that is, the ratio of trench width to trench depth) is less than or equal to 1, VDEQ (2005) recommends air changes of 2 per hour (ACH) to calculate the VF. If the aspect ratio is greater than one, VDEQ (2005) recommends an ACH of 360 per hour to calculate the VF. Trench dimensions from excavations at Parcel B were reviewed to estimate trench aspect ratios for Parcel B. Data for these excavations show the following: for trenches less than 4 feet deep, the aspect ratio was approximately 1; for trenches between 4 and 6 feet deep, the aspect ratio was approximately 1.3; and for trenches greater than 6 feet deep, the aspect ratio was approximately 1.5 (Navy 2006). If these data are averaged, then the average trench aspect ratio is 1.27. For purposes of the HHRA, an ACH of 100 was assumed as the VF for construction trenches. This ACH is more conservative than the VDEQ-recommended ACH of 360 for trenches with an aspect ratio greater than 1.

Input parameters for the trench model are summarized in Table A5-1.

Equation A5-3

$$K_i = 1 / \{(1/k_{iL}) + [(R\ T) / (H_i\ k_{iG})]\}$$

where:

k_{iL}	=	Liquid-phase mass transfer coefficient of contaminant *i* (see Equation A5-4) (cm/s)
R	=	Ideal gas constant (atmosphere – cubic meter per mole – degrees Kelvin [atm-m^3/mol-°K])
T	=	Average system temperature (°K)
H_i	=	Henry's Law constant of I (atmosphere – cubic meter per mole [atm-m^3/mol])
K_{iG}	=	Gas-phase mass transfer coefficient of i (see Equation A5-5) (cm/s)

The value for R is 8.2×10^{-5} atm-m^3/mole-°K. A default value of 298°K was used for T in Equation A5-3.

Equation A5-4

$$k_{iL} = (MW_{O2}/MW_i)^{0.5} \times (T/298) \times k_L,O_2$$

where:

k_{iL}	=	Liquid-phase mass transfer coefficient of contaminant *i* (cm/s)
MW_{O2}	=	Molecular weight of oxygen (gram per mole [g/mol])
MW_i	=	Molecular weight of contaminant *i* (g/mol)

T	=	Average system absolute temperature (°K)
k_L,O_2	=	Liquid-phase mass transfer coefficient of oxygen at 25 °C (cm/s)

The value of k_L, O_2 in Equation A5-4 is 0.002 cm/s.

Equation A5-5

$$k_{iG} = (MW_{H2O}/MW_i)^{0.335} \times (T/298)^{1.005} \times k_G, H_2O$$

where:

k_{iG}	=	Gas-phase mass transfer coefficient of contaminant *i* (cm/s)
MW_{H2O}	=	Molecular weight of water (g/mol)
T	=	Average system absolute temperature (°K)
k_G,H_2O	=	Gas-phase mass transfer coefficient of water vapor at 25°C (cm/s)

The value of k_G, H_2O in Equation A5-5 is 0.833 cm/s.

Chemical-specific modeling parameters are summarized in Table A5-2.

A5.2 REFERENCES

U.S. Department of the Navy (Navy). 2006. E-Mail Message Regarding Trench Aspect Ratio's [*sic*]. From George Patrick Brooks, Remedial Project Manager. To Shirley Fu, Risk Assessor, Tetra Tech EM Inc. November 17.

Virginia Department of Environmental Quality. 2005. "Voluntary Remediation Program Risk Assessment Guidance." Available online at: http://www.deq.virginia.gov/vrprisk/raguide.html. Accessed January 30.

TABLES

TABLE A5-1: TRENCH MODEL INPUT PARAMETERS

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

For Mass-Transfer Coefficients			
Variable	**Value**	**Units**	**Source**
Gas-phase mass transfer coefficient of water vapor at 25°C (K_G,H_2O)	0.833	cm/s	Not applicable
Molecular weight of water (MW_{H2O})	18	unitless	Not applicable
Liquid-phase mass transfer coefficient of oxygen at 25°C (k_L,O_2)	0.002	cm/s	Not applicable
Molecular weight of oxygen (MW_{O2})	32	unitless	Not applicable
Average system temperature (T)	290	K	Site specific
Ideal gas constant (R)	0.000082	atm-m^3/mol-°K	Not applicable

For Emission Flux and Concentration in Trench			
Variable	**Value**	**Units**	**Source**
Volume conversion factor (CF1)	0.001	L/cm^3	Not applicable
Area conversion factor (CF)	10,000	cm^2/m^2	Not applicable
Time conversion factor (CF3)	3,600	s/hr	Not applicable
Fraction of floor through which contaminant can enter (F)	1	unitless	Site specific
Air changes per hour (ACH)	100	hr^{-1}	Professional judgement (a)

Trench dimensions			
Variable	**Value**	**Units**	**Source**
Length of trench (in feet)	10	feet	Site specific
Width of trench (in feet)	8	feet	Site specific
Depth of trench (in feet)	9.76	feet	Site specific
Ratio of width/depth	0.82	unitless	Site specific

Notes:

a	See main text of Attachment A5.
atm-m^3/mol-°K	Atmosphere - cubic meter per mole - degrees Kelvin
cm/s	Centimeter per second
cm^2/m^2	Square centimeter per square meter
F	Fahrenheit
hr^{-1}	Event per hour
K	Kelvin
L/cm^3	Liter per cubic centimeter
s/hr	Second per hour
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

TABLE A5-2: TRENCH MODEL CHEMICAL-SPECIFIC VALUES

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Molecular Weight (MW_i) g/mol	Henry's Law Constant (H_i) atm-m^3/mol	Gas-Phase Mass Transfer Coefficient (K_{IG}) cm/s	Liquid-Phase Mass Transfer Coefficient (K_{IL}) cm/s	Overall Mass Transfer Coefficient (K_i) cm/s	Volatilization Factor (VF) L/m^3	Concentration of Contaminant in Trench (C_{trench}) $\mu g/m^3$	Concentration of Contaminant in Trench (C_{trench}) mg/m^3
Volatile Organic Compounds								
1,1,1-Trichloroethane	133.40	1.72E-02	4.14E-01	9.53E-04	9.50E-04	1.15E-01	1.15E-01	1.15E-04
1,1,2-Trichloro-1,2,2-trifluoroethane	187.37	4.81E-01	3.70E-01	8.04E-04	8.04E-04	9.73E-02	9.73E-02	9.73E-05
1,1-Dichloroethane	98.96	5.62E-03	4.58E-01	1.11E-03	1.10E-03	1.33E-01	1.33E-01	1.33E-04
1,1-Dichloroethene	96.94	2.61E-02	4.61E-01	1.12E-03	1.12E-03	1.35E-01	1.35E-01	1.35E-04
1,2,3-Trichlorobenzene	181.45	1.25E-03	3.74E-01	8.17E-04	7.85E-04	9.50E-02	9.50E-02	9.50E-05
1,2,4-Trichlorobenzene	181.45	1.42E-03	3.74E-01	8.17E-04	7.88E-04	9.54E-02	9.54E-02	9.54E-05
1,2,4-Trimethylbenzene	120.19	6.16E-03	4.29E-01	1.00E-03	9.95E-04	1.20E-01	1.20E-01	1.20E-04
1,2-Dichlorobenzene	147.00	1.90E-03	4.01E-01	9.08E-04	8.83E-04	1.07E-01	1.07E-01	1.07E-04
1,2-Dichloroethane	98.96	9.79E-04	4.58E-01	1.11E-03	1.05E-03	1.27E-01	1.27E-01	1.27E-04
1,2-Dichloroethene (Total)	96.94	4.51E-03	4.61E-01	1.12E-03	1.10E-03	1.34E-01	1.34E-01	1.34E-04
1,2-Dichloropropane	112.99	2.80E-03	4.38E-01	1.04E-03	1.02E-03	1.23E-01	1.23E-01	1.23E-04
1,3,5-Trimethylbenzene	120.19	8.77E-03	4.29E-01	1.00E-03	9.98E-04	1.21E-01	1.21E-01	1.21E-04
1,3-Dichlorobenzene	147.00	3.10E-03	4.01E-01	9.08E-04	8.93E-04	1.08E-01	1.08E-01	1.08E-04
1,4-Dichlorobenzene	147.00	2.43E-03	4.01E-01	9.08E-04	8.88E-04	1.08E-01	1.08E-01	1.08E-04
2-Butanone	72.11	5.59E-05	5.09E-01	1.30E-03	6.22E-04	7.53E-02	7.53E-02	7.53E-05
4-Methyl-2-pentanone	100.16	1.38E-04	4.56E-01	1.10E-03	7.77E-04	9.40E-02	9.40E-02	9.40E-05
Acetone	58.08	3.88E-05	5.47E-01	1.44E-03	5.52E-04	6.68E-02	6.68E-02	6.68E-05
Benzene	78.11	5.55E-03	4.96E-01	1.25E-03	1.23E-03	1.49E-01	1.49E-01	1.49E-04
Bromodichloromethane	163.83	1.60E-03	3.87E-01	8.60E-04	8.33E-04	1.01E-01	1.01E-01	1.01E-04
Bromomethane	94.94	6.24E-03	4.64E-01	1.13E-03	1.12E-03	1.35E-01	1.35E-01	1.35E-04
Carbon disulfide	76.14	3.03E-02	5.00E-01	1.26E-03	1.26E-03	1.52E-01	1.52E-01	1.52E-04
Chlorobenzene	112.56	3.70E-03	4.39E-01	1.04E-03	1.02E-03	1.24E-01	1.24E-01	1.24E-04
Chloroethane	64.51	8.82E-03	5.29E-01	1.37E-03	1.36E-03	1.65E-01	1.65E-01	1.65E-04
Chloroform	119.38	3.67E-03	4.30E-01	1.01E-03	9.93E-04	1.20E-01	1.20E-01	1.20E-04
Chloromethane	50.49	8.82E-03	5.74E-01	1.55E-03	1.54E-03	1.86E-01	1.86E-01	1.86E-04
cis-1,2-Dichloroethene	96.94	4.08E-03	4.61E-01	1.12E-03	1.10E-03	1.33E-01	1.33E-01	1.33E-04
Cyclohexane	84.16	1.95E-01	4.83E-01	1.20E-03	1.20E-03	1.45E-01	1.45E-01	1.45E-04
Dibenzofuran	168.19	1.26E-05	3.83E-01	8.49E-04	1.64E-04	1.98E-02	1.98E-02	1.98E-05
Dichlorodifluoromethane	120.91	3.43E-01	4.28E-01	1.00E-03	1.00E-03	1.21E-01	1.21E-01	1.21E-04
Ethylbenzene	106.17	7.88E-03	4.47E-01	1.07E-03	1.06E-03	1.28E-01	1.28E-01	1.28E-04
Isopropylbenzene	120.19	1.16E+00	4.29E-01	1.00E-03	1.00E-03	1.22E-01	1.22E-01	1.22E-04
m,p-Xylenes	106.17	7.34E-03	4.47E-01	1.07E-03	1.06E-03	1.28E-01	1.28E-01	1.28E-04
Methylcyclohexane	98.19	4.30E-01	4.59E-01	1.11E-03	1.11E-03	1.34E-01	1.34E-01	1.34E-04
Methylene chloride	84.93	2.19E-03	4.82E-01	1.19E-03	1.16E-03	1.41E-01	1.41E-01	1.41E-04

TABLE A5-2: TRENCH MODEL CHEMICAL-SPECIFIC VALUES (CONTINUED)

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Molecular Weight (MW_I) g/mol	Henry's Law Constant (H_I) atm-m^3/mol	Gas-Phase Mass Transfer Coefficient (K_{IG}) cm/s	Liquid-Phase Mass Transfer Coefficient (K_{IL}) cm/s	Overall Mass Transfer Coefficient (K_I) cm/s	Volatilization Factor (VF) L/m^3	Concentration of Contaminant in Trench (C_{trench}) $\mu g/m^3$	Concentration of Contaminant in Trench (C_{trench}) mg/m^3
Volatile Organic Compounds (Continued)								
o-Xylene	106.17	5.19E-03	4.47E-01	1.07E-03	1.06E-03	1.28E-01	1.28E-01	1.28E-04
para-Isopropyl toluene	134.22	1.10E-02	4.13E-01	9.50E-04	9.46E-04	1.14E-01	1.14E-01	1.14E-04
Styrene	104.15	2.75E-03	4.50E-01	1.08E-03	1.06E-03	1.28E-01	1.28E-01	1.28E-04
tert-Butyl methyl ether	88.15	5.87E-04	4.76E-01	1.17E-03	1.07E-03	1.29E-01	1.29E-01	1.29E-04
Tetrachloroethene	165.83	1.84E-02	3.85E-01	8.55E-04	8.53E-04	1.03E-01	1.03E-01	1.03E-04
Toluene	92.14	6.64E-03	4.69E-01	1.15E-03	1.14E-03	1.38E-01	1.38E-01	1.38E-04
trans-1,2-Dichloroethene	96.94	9.38E-03	4.61E-01	1.12E-03	1.11E-03	1.34E-01	1.34E-01	1.34E-04
Trichloroethene	131.39	1.03E-02	4.16E-01	9.61E-04	9.55E-04	1.16E-01	1.16E-01	1.16E-04
Trichlorofluoromethane	137.37	9.70E-02	4.10E-01	9.39E-04	9.39E-04	1.14E-01	1.14E-01	1.14E-04
Vinyl chloride	62.50	2.70E-02	5.34E-01	1.39E-03	1.39E-03	1.68E-01	1.68E-01	1.68E-04
Xylene (Total)	106.16	5.18E-03	4.47E-01	1.07E-03	1.06E-03	1.28E-01	1.28E-01	1.28E-04
Semivolatile Organic Compounds								
1-Methylnaphthalene [a]	142.20	5.18E-04	4.06E-01	9.23E-04	8.36E-04	1.01E-01	1.01E-01	1.01E-04
1-Methylphenanthrene [b]	178.23	6.50E-05	3.76E-01	8.25E-04	4.58E-04	5.54E-02	5.54E-02	5.54E-05
1,6,7-Trimethylnaphthalene [a]	142.20	5.18E-04	4.06E-01	9.23E-04	8.36E-04	1.01E-01	1.01E-01	1.01E-04
2,6-Dimethylnaphthalene [a]	142.20	5.18E-04	4.06E-01	9.23E-04	8.36E-04	1.01E-01	1.01E-01	1.01E-04
2-Chloronaphthalene	162.62	3.14E-04	3.88E-01	8.63E-04	7.39E-04	8.94E-02	8.94E-02	8.94E-05
2-Methylnaphthalene	142.20	5.18E-04	4.06E-01	9.23E-04	8.36E-04	1.01E-01	1.01E-01	1.01E-04
Acenaphthene	154.21	1.55E-04	3.95E-01	8.87E-04	6.59E-04	7.98E-02	7.98E-02	7.98E-05
Acenaphthylene	152.19	1.13E-04	3.96E-01	8.92E-04	6.06E-04	7.33E-02	7.33E-02	7.33E-05
Anthracene	178.23	6.50E-05	3.76E-01	8.25E-04	4.58E-04	5.54E-02	5.54E-02	5.54E-05
Fluorene	166.22	6.36E-05	3.85E-01	8.54E-04	4.67E-04	5.65E-02	5.65E-02	5.65E-05
Naphthalene	128.17	4.83E-04	4.20E-01	9.73E-04	8.73E-04	1.06E-01	1.06E-01	1.06E-04
Phenanthrene	178.23	2.33E-05	3.76E-01	8.25E-04	2.55E-04	3.08E-02	3.08E-02	3.08E-05
Pyrene	202.25	1.10E-05	3.60E-01	7.74E-04	1.37E-04	1.66E-02	1.66E-02	1.66E-05

Notes:

a 2-Methylnaphthalene used as a surrogate.
b Anthracene used as a surrogate.

$\mu g/m^3$	Microgram per cubic meter	g/mol	Gram per mole
µg/L	Microgram per liter	L/m^3	Liter per cubic meter
atm-m^3/mol	Atmosphere - cubic meter per mole	mg/m^3	Milligram per cubic meter
cm/s	Centimeter per second	TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

Sources:

EPA. 2004. "Region 9 Preliminary Remediation Goals (PRG) Table." October 1. Available Online at: http://www.epa.gov/region09/waste/sfund/prg/index.htm

ATTACHMENT A6
DERIVATION OF HUNTERS POINT SHIPYARD RISK-BASED CONCENTRATION FOR LEAD

DERIVATION OF HUNTERS POINT SHIPYARD RISK-BASED CONCENTRATION FOR LEAD

The risk-based concentration for lead for residential receptors at Hunters Point Shipyard was developed as part of the human health risk assessment to evaluate health effects from lead exposure. Each exposure area with a concentration of lead in soil above the risk-based concentration was identified as posing the potential to result in blood-lead concentrations that would exceed the target in future child residents of 10 micrograms per deciliter. The target of 10 micrograms per deciliter is the low end of the range for adverse health effects in children (Centers for Disease Control 1991).

In the original human health risk assessment presented in the remedial investigation report for Parcel B (PRC Environmental Management, Inc. and others 1996), soil lead concentrations corresponding to 10 micrograms per deciliter were calculated using the blood-lead model from the Department of Toxic Substances Control (California Environmental Protection Agency 1992) and the Integrated Exposure Uptake Biokinetic model (version 0.99d) for children developed by the U.S. Environmental Protection Agency (1994). Using site-specific modeling assumptions, the Integrated Exposure Uptake Biokinetic model predicted a blood-lead concentration of 10 micrograms per deciliter or less in 99 percent of exposed children at a soil concentration of 221 milligrams per kilogram, and the Department of Toxic Substances Control model predicted a soil concentration of 245 milligrams per kilogram. The original human health risk assessment used the more conservative soil lead concentration of 221 milligrams per kilogram as the lead risk-based concentration (PRC Environmental Management, Inc. and others 1996).

Since the human health risk assessment was originally conducted, the Department of Toxic Substances Control has updated the blood-lead model. The most recent version of the Department of Toxic Substances Control's blood-lead model is LeadSpread 7.0 (California Environmental Protection Agency 1999). The model was used to calculate a revised lead risk-based concentration for this human health risk assessment. The following values and assumptions were used to apply the Department of Toxic Substances Control's LeadSpread model:

- **Lead in air:** the concentration of lead in air was assumed to be 0.014 microgram per cubic meter, which is the maximum concentration of lead in air measured at Hunters Point Shipyard (PRC Environmental Management, Inc. and others 1996).

- **Lead in water:** the concentration of lead in tap water was assumed to be 13.6 micrograms per liter, which is the maximum detected concentration of lead in groundwater from the B-aquifer and bedrock water-bearing zone for all parcels at Hunters Point Shipyard, based on data for the last 12 rounds of sampling from each monitoring well. The maximum concentration was detected at Parcel E-2 at well IR01MW26B on September 10, 2004.

- **Homegrown produce:** the percentage of produce that is homegrown was assumed to be 7 percent of all produce consumed, which is the default value provided in Leadspread 7.0.

- **Respirable dust:** the value used for respirable dust was assumed to be 1.5 micrograms per cubic meter, which is the default value provided in Leadspread 7.0.

Based on the assumptions listed above, the Department of Toxic Substances Control's LeadSpread model predicts a blood-lead concentration of 10 micrograms per deciliter or less in 99 percent of exposed children at a soil lead concentration of 155 milligrams per kilogram. This concentration of 155 milligrams per kilogram is used as the residential risk-based concentration for lead at Hunters Point Shipyard.

REFERENCES

California Environmental Protection Agency. 1992. "Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities." Interim Final. July.

California Environmental Protection Agency. 1999. LeadSpread. Available Online at: http://www.dtsc.ca.gov/ScienceTechnology/ledspred.html

California Air Resources Board. 2005. Annual Toxics Summary for Lead in Air, San Francisco – Arkansas Street Monitoring Station, Year 2002. Available Online at: http://www.arb.ca.gov/adam/toxics/sitepages/pbsfo.html

Centers for Disease Control. 1991. "Preventing Lead Poisoning in Young Children." October.

PRC Environmental Management, Inc., Harding Lawson Associates, Levine-Fricke-Recon, and Uribe & Associates. 1996. "Draft Final Parcel B Remedial Investigation Report, Hunters Point Shipyard, San Francisco, California." June 3.

U.S. Environmental Protection Agency. 1994. "Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children." Document No. EPA/540/R-93/081. February.

ATTACHMENT A7
TRICHLOROETHENE UNCERTAINTY ANALYSIS

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS A7-ii

A7.1 INTRODUCTION A7-1

A7.2 TOXICITY VALUES FOR TRICHLOROETHENE A7-1

A7.2.1 CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY TOXICITY VALUES A7-1

A7.2.2 EPA NATIONAL CENTER FOR ENVIRONMENTAL ASSESSMENT PROVISIONAL TOXICITY VALUES A7-2

A7.2.3 EPA WITHDRAWN INTEGRATED RISK INFORMATION SYSTEM TOXICITY VALUES A7-2

A7.3 SENSITIVITY ANALYSIS FOR TRICHLOROETHENE A7-2

A7.3.1 EVALUATION OF GROUNDWATER A7-2

A7.3.2 EVALUATION OF SOIL A7-3

A7.4 REFERENCES A7-4

Table

A7-1 Trichloroethene Uncertainty Analysis Toxicity Values

A7-2 Trichloroethene Uncertainty Analysis for Groundwater

A7-3 Trichloroethene Uncertainty Analysis for Soil

ACRONYMS AND ABBREVIATIONS

Cal/EPA	California Environmental Protection Agency
COPC	Chemical of potential concern
EPA	U.S. Environmental Protection Agency
HHRA	Human health risk assessment
HI	Hazard index
IRIS	Integrated Risk Information System
mg/kg-day	Milligram per kilogram per day
NCEA	National Center for Environmental Assessment
OEHHA	Office of Environmental Health Hazard Assessment
REL	Reference exposure level
RfD	Reference dose
SF	Slope factor
TCE	Trichloroethene
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

A7.1 INTRODUCTION

This attachment presents an uncertainty analysis of the toxicity criteria for trichloroethene (TCE) used in the revised baseline human health risk assessment (HHRA) for Parcel B at Hunters Point Shipyard. As discussed in Section A6.3 of Appendix A, the U.S. Environmental Protection Agency (EPA) withdrew its previously published toxicity values for TCE in 1988. EPA has not published finalized toxicity values for TCE since the original values were withdrawn because of uncertainties relating to the science of TCE toxicity. In 2001, EPA's Office of Research and Development completed a preliminary draft reassessment of health risks posed by TCE (EPA 2001). This preliminary draft reassessment proposes toxicity values that are much more conservative than the values withdrawn by EPA, and these suggested toxicity values are now the subject of much debate. As such, the scientific community is divided on whether to use the withdrawn values, the new suggested values, or some other values for calculating risks.

Uncertainties specific to the provisional toxicity criteria for TCE were analyzed because the differences between the EPA provisional toxicity criteria, EPA's withdrawn toxicity criteria, and the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) toxicity criteria are significant and can affect the risk results. Therefore, toxicity values developed by Cal/EPA OEHHA for TCE, although less conservative than the EPA (2001) provisional cancer slope factors (SF) for TCE, were used for the HHRA for Parcel B. These values were used to evaluate oral and inhalation route cancer risks and inhalation route noncancer hazards from exposure to TCE.

The EPA and Cal/EPA OEHHA toxicity criteria for TCE are discussed in Section A7.2. Section A7.3 presents a sensitivity analysis of the risk results of Parcel B in comparison to the differing EPA and Cal/EPA toxicity criteria for TCE. References used in this uncertainty analysis are provided in Section A7.4.

A7.2 TOXICITY VALUES FOR TRICHLOROETHENE

This section presents the following toxicity criteria for TCE: criteria from Cal/EPA OEHHA, provisional criteria from EPA's National Center for Environmental Assessment (NCEA), and withdrawn criteria from EPA's Integrated Risk Information System (IRIS). Table A7-1 summarizes the applicable toxicity values available from these three sources.

A7.2.1 CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY TOXICITY VALUES

Cal/EPA OEHHA (Cal/EPA 2004) has established toxicity values for health effects associated with exposure to TCE (see Table A7-1). Cal/EPA has established an oral SF of 1.3×10^{-2} per milligrams per kilogram per day (mg/kg-day) and an inhalation SF of 7×10^{-3} per mg/kg-day. Cal/EPA toxicity values were used to evaluate potential cancer risks in the HHRA (see Section A6.0 of Appendix A).

Although Cal/EPA has not established a noncancer reference dose (RfD) for effects other than cancer, Cal/EPA has established an inhalation reference exposure level (REL) of 600 micrograms per cubic meter or 0.17 mg/kg-day. OEHHA adopted the Cal/EPA REL in February 2005; this value was used to evaluate potential noncancer inhalation effects in the HHRA for Parcel B (see Section A6.0 of Appendix A).

A7.2.2 EPA National Center for Environmental Assessment Provisional Toxicity Values

EPA's NCEA has endorsed use of provisional values for health effects associated with exposure to TCE that were derived using physiologically based pharmacokinetic methods and route extrapolation (EPA 2001). For effects other than cancer, NCEA recommends an oral RfD of 3×10^{-4} mg/kg-day based on critical effects to the liver, kidney, and developing fetus. NCEA further recommends an inhalation RfD of 1×10^{-2} mg/kg-day based on critical effects to the central nervous system, liver, and endocrine system observed in subchronic studies in mice and rats at doses as low as 1 mg/kg-day. The primary source of uncertainty associated with the toxicity factors for TCE is the use of data on subchronic exposure to represent chronic exposure. NCEA has recommended several SFs for TCE, with most between 2×10^{-2} and 4×10^{-1} per mg/kg-day. The range of SFs has not been reduced to a single number, but NCEA recommends that risk assessors use the upper-end of the SF range (that is, 4×10^{-1} per mg/kg-day) to emphasize the possibility that different risks may exist under different circumstances. The use of the upper end of the range of SFs is conservative and may result in an overestimation of risks. The NCEA oral RfD was used in the HHRA to evaluate noncancer hazards from exposure to TCE (see Section A6.0 of Appendix A).

A7.2.3 EPA Withdrawn Integrated Risk Information System Toxicity Values

The noncancer oral and inhalation RfDs for TCE (0.006 mg/kg-day) were withdrawn from IRIS in August 1992 (EPA 2005). The oral and inhalation SFs (0.011 and 0.006 per mg/kg-day, respectively) were withdrawn from IRIS in July 1989. These toxicity values were considered final by EPA at one time, but have been withdrawn pending further review. They were included in this uncertainty evaluation because they were once considered final and EPA IRIS has not provided alternate values for consideration.

A7.3 SENSITIVITY ANALYSIS FOR TRICHLOROETHENE

This section presents a sensitivity analysis of the risk results of Parcel B in comparison to the differing EPA and Cal/EPA toxicity criteria for TCE.

A7.3.1 Evaluation of Groundwater

Samples from several A-aquifer monitoring wells contained detectable levels of TCE. Some of the wells were within the boundaries of the IR-10A and IR-25 plumes, and a few other "non-plume wells" were within two residential exposure areas (B0931 and B2818). Data for

"non-plume wells" were evaluated using the grid-based approach described in Section A4.3.2 of Appendix A. Residential exposure areas were chosen for this evaluation because no wells in redevelopment blocks assessed for industrial exposure contained detectable levels of TCE (see Attachment A3 to Appendix A). The planned reuse of the two plumes and two residential exposure areas is mixed use and research and development; both of these planned reuses are associated with a residential exposure scenario in the HHRA.

Risks from exposure to TCE measured in groundwater were calculated in the HHRA using the Cal/EPA toxicity values described in Section A7.2 of this attachment. The differences between the Cal/EPA toxicity values and the EPA NCEA provisional toxicity values and the withdrawn EPA IRIS toxicity values are significant. As a result, an evaluation was conducted to determine if use of other available toxicity values for TCE (that is, the EPA NCEA provisional and withdrawn EPA IRIS toxicity values) would change the resulting cancer risks and noncancer hazard indices (HI) for these two residential exposure areas. The estimated cancer risks and noncancer hazards associated with the use of appropriate toxicity values from all three sources are presented in Table A7-2. Cancer risks and noncancer hazards from each of the two plumes, two residential exposure area grids, and for the entire redevelopment block are presented in the table. As shown, use of EPA NCEA provisional toxicity values and withdrawn toxicity values for EPA IRIS would increase the estimated cancer risks and noncancer HIs from exposure to TCE. The use of EPA NCEA provisional toxicity values would alter the risk characterization results for a redevelopment block. (That is, these values would change the results from a risk less than 1.0E-06 for carcinogens to a risk greater than the point of departure of 1.0E-06 for carcinogens.) The cancer risks in redevelopment blocks 3 and 9 would change from 1.2E-07 and 2.3E-07 to 4.1E-06 and 4.7E-06, which is greater than the point of departure of 1.0E-06 for carcinogens.

A7.3.2 EVALUATION OF SOIL

In the evaluation of soil risks, 27 residential exposure areas contained TCE as a chemical of potential concern (COPC). The residential exposure areas and redevelopment blocks are listed in Table A7-3. The planned reuses associated with these redevelopment blocks are research and development (residential exposure scenario) and mixed use (residential exposure scenario). Similar to the evaluation for groundwater presented above, TCE in soil was evaluated to determine if the use of other available toxicity values for TCE would change the resulting cancer risks and noncancer HI results. Table A7-3 presents the cancer risks and noncancer HI calculated for TCE in soil, based on planned reuse, for the exposure areas where TCE was identified as a COPC. Also presented in the table are the resulting cancer risks and noncancer HIs if the EPA NCEA provisional and EPA IRIS withdrawn toxicity values are used for TCE. As shown in the table, use of EPA NCEA provisional toxicity values and EPA IRIS withdrawn toxicity values for TCE would increase the estimated cancer risks and noncancer HIs from exposure to TCE. The use of EPA NCEA provisional toxicity values would also alter the risk characterization results for a redevelopment block. (For example, these values would change the results from a risk less than 1.0E-06 for carcinogens to a risk greater than the point of departure of 1.0E-06 for carcinogens.) (See Table A7-3.)

A7.4 REFERENCES

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EPA. 2005. Integrated Risk Information System (IRIS) Online Database. Office of Research and Development, National Center for Environmental Assessment. Available online at: http://www.epa.gov/iris

TABLES

TABLE A7-1: TRICHLOROETHENE UNCERTAINTY ANALYSIS TOXICITY VALUES

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Toxicity Value	Cal/EPA OEHHA Value	EPA NCEA Provisional Value	Withdrawn EPA IRIS Value
Noncancer (mg/kg-day)			
RfD_{oral}	NA	0.0003	0.006
$RfD_{inhalation}$	NA	0.01	0.006
$REL_{inhalation}$	0.17	NA	NA
Cancer $(mg/kg\text{-}day)^{-1}$			
SF_{oral}	0.013	0.4	0.011
$SF_{inhalation}$	0.007	0.4	0.006

Notes:

	Shaded values indicate toxicity values used in the risk evaluation.
Cal/EPA	California Environmental Protection Agency
EPA	U.S. Environmental Protection Agency
IRIS	Integrated Risk Information System
mg/kg-day	Milligram per kilogram per day
mg/kg-day-1	Per milligram per kilogram per day
NA	Not applicable
NCEA	National Center for Environmental Assessment
OEHHA	Office of Environmental Health Hazard Assessment
RfD	Reference dose
REL	Reference exposure level
SF	Slope factor
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

TABLE A7-2: TRICHLOROETHENE UNCERTAINTY ANALYSIS FOR GROUNDWATER

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Redevelopment Block	Exposure Area	Planned Reuse	Reuse Type	Maximum Concentration of TCE (µg/L)	Trichloroethene Vapor Intrusion Cancer Risk			Trichloroethene Vapor Intrusion Hazard Quotient		
					Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS	Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS
8, 9	IR-10A PLUME	Mixed Use	Residential	185	6.4E-05	3.7E-03	5.5E-05	0.13	2.2	3.9
8, 12	IR-25 PLUME	Mixed Use	Residential	3570	1.2E-03	7.1E-02	1.1E-03	2.5	43	75
3	B0931	Research and Development	Residential	0.2	6.9E-08	4.0E-06	6.0E-08	0.00014	0.0024	0.0042
9	B2818	Mixed Use	Residential	0.225	7.8E-08	4.5E-06	6.7E-08	0.00016	0.0027	0.0047

Redevelopment Block	Exposure Area	Planned Reuse	Reuse Type	Maximum Concentration of TCE (µg/L)	Redevelopment Block Vapor Intrusion Cancer Risk			Redevelopment Block Vapor Intrusion Hazard Quotient		
					Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS	Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS
8, 9	IR-10A PLUME	Mixed Use	Residential	185	6.0E-03	9.7E-03	6.0E-03	2.6	4.7	6.3
8, 12	IR-25 PLUME	Mixed Use	Residential	3570	9.9E-02	1.7E-01	9.9E-02	684	725	756
3	B0931	Research and Development	Residential	0.2	1.2E-07	4.1E-06	1.2E-07	0.00031	0.0026	0.0044
9	B2818	Mixed Use	Residential	0.225	2.3E-07	4.7E-06	2.2E-07	0.0036	0.0062	0.0082

Notes:

µg/L	Microgram per liter
Cal/EPA OEHHA	California Environmental Protection Agency Office of Environmental Health Hazard Assessment
EPA	U.S. Environmental Protection Agency
IRIS	Integrated Risk Information System
J	Estimated concentration
NCEA	National Center for Environmental Assessment
TCE	Trichloroethene
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

TABLE A7-3: TRICHLOROETHENE UNCERTAINTY ANALYSIS FOR SOIL

Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Grid Number	Redevelopment Block	Planned Reuse	Reuse Type	Exposure Point Concentration for TCE (mg/kg)	Trichloroethene Ingestion Cancer Risk			Trichloroethene Inhalation Cancer Risk			Trichloroethene Total Cancer Risk			Redevelopment Block Total Cancer Risk		
					Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS	Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS	Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS	Cal/EPA OEHHA	Provisional NCEA	Withdrawn EPA IRIS
B0632	3	Research and Development	Residential	2.0E-03	4.1E-11	1.3E-09	3.4E-11	6.4E-10	3.6E-08	5.5E-10	6.8E-10	3.8E-08	5.8E-10	4.8E-09	4.2E-08	4.7E-09
B1626	6	Research and Development	Residential	3.1E-03	6.3E-11	1.9E-09	5.3E-11	9.9E-10	5.7E-08	8.5E-10	1.1E-09	5.9E-08	9.0E-10	7.2E-06	7.3E-06	7.2E-06
B1826	6	Research and Development	Residential	1.3E-03	2.6E-11	8.1E-10	2.2E-11	4.2E-10	2.4E-08	3.6E-10	4.4E-10	2.5E-08	3.8E-10	1.0E-08	3.5E-08	1.0E-08
B2526	6	Research and Development	Residential	6.1E-03	1.2E-10	3.8E-09	1.1E-10	1.9E-09	1.1E-07	1.7E-09	2.1E-09	1.2E-07	1.8E-09	1.1E-08	1.2E-07	1.1E-08
B2623	8	Mixed Use	Residential	1.4E+00	2.9E-08	8.8E-07	2.4E-08	4.5E-07	2.6E-05	3.8E-07	4.8E-07	2.6E-05	4.1E-07	4.8E-07	2.6E-05	4.1E-07
B2624	8	Mixed Use	Residential	4.4E+00	9.0E-08	2.8E-06	7.6E-08	1.4E-06	8.0E-05	1.2E-06	1.5E-06	8.3E-05	1.3E-06	1.5E-06	8.3E-05	1.3E-06
B2722	8	Mixed Use	Residential	4.2E-02	8.5E-10	2.6E-08	7.2E-10	1.3E-08	7.7E-07	1.1E-08	1.4E-08	7.9E-07	1.2E-08	1.4E-08	7.9E-07	1.2E-08
B2723	8	Mixed Use	Residential	2.9E+01	5.8E-07	1.8E-05	4.9E-07	9.1E-06	5.2E-04	7.8E-06	9.7E-06	5.4E-04	8.3E-06	9.9E-06	5.4E-04	8.5E-06
B2724	8	Mixed Use	Residential	1.0E+02	2.0E-06	6.3E-05	1.7E-06	3.2E-05	1.8E-03	2.7E-05	3.4E-05	1.9E-03	2.9E-05	3.4E-05	1.9E-03	2.9E-05
B2725	8	Mixed Use	Residential	1.1E+00	2.3E-08	7.0E-07	1.9E-08	3.6E-07	2.0E-05	3.1E-07	3.8E-07	2.1E-05	3.2E-07	3.8E-07	2.1E-05	3.2E-07
B2726	8	Mixed Use	Residential	8.2E-02	1.7E-09	5.1E-08	1.4E-09	2.6E-08	1.5E-06	2.2E-08	2.8E-08	1.5E-06	2.4E-08	2.8E-08	1.5E-06	2.4E-08
B2823	8	Mixed Use	Residential	1.6E+02	3.3E-06	1.0E-04	2.8E-06	5.2E-05	3.0E-03	4.4E-05	5.5E-05	3.1E-03	4.7E-05	5.5E-05	3.1E-03	4.7E-05
B2824	8	Mixed Use	Residential	3.7E+01	7.5E-07	2.3E-05	6.3E-07	1.2E-05	6.7E-04	1.0E-05	1.3E-05	7.0E-04	1.1E-05	1.3E-05	7.0E-04	1.1E-05
B2922	8	Mixed Use	Residential	3.3E-02	6.7E-10	2.1E-08	5.7E-10	1.1E-08	6.0E-07	9.0E-09	1.1E-08	6.2E-07	9.6E-09	2.5E-08	6.4E-07	2.3E-08
B2923	8	Mixed Use	Residential	6.4E+01	1.3E-06	4.0E-05	1.1E-06	2.0E-05	1.2E-03	1.7E-05	2.2E-05	1.2E-03	1.8E-05	1.5E-04	1.3E-03	1.5E-04
B2924	8	Mixed Use	Residential	2.1E+01	4.3E-07	1.3E-05	3.6E-07	6.7E-06	3.8E-04	5.8E-06	7.1E-06	4.0E-04	6.1E-06	7.2E-06	4.0E-04	6.2E-06
B2926	8	Mixed Use	Residential	5.0E-03	1.0E-10	3.1E-09	8.6E-11	1.6E-09	9.1E-08	1.4E-09	1.7E-09	9.4E-08	1.5E-09	1.5E-06	1.5E-06	1.5E-06
B3023	8	Mixed Use	Residential	2.6E-02	5.3E-10	1.6E-08	4.5E-10	8.3E-09	4.7E-07	7.1E-09	8.8E-09	4.9E-07	7.6E-09	8.8E-09	4.9E-07	7.6E-09
B3024	8	Mixed Use	Residential	6.2E-02	1.3E-09	3.9E-08	1.1E-09	2.0E-08	1.1E-06	1.7E-08	2.1E-08	1.2E-06	1.8E-08	2.1E-08	1.2E-06	1.8E-08
B3126	8	Mixed Use	Residential	2.0E-03	4.1E-11	1.3E-09	3.4E-11	6.4E-10	3.6E-08	5.5E-10	6.8E-10	3.8E-08	5.8E-10	1.3E-07	1.7E-07	1.3E-07
B3326	8	Mixed Use	Residential	1.2E-02	2.4E-10	7.5E-09	2.1E-10	3.8E-09	2.2E-07	3.3E-09	4.1E-09	2.3E-07	3.5E-09	9.7E-09	2.3E-07	9.1E-09
B3426	8	Mixed Use	Residential	1.5E-02	3.1E-10	9.4E-09	2.6E-10	4.8E-09	2.7E-07	4.1E-09	5.1E-09	2.8E-07	4.4E-09	1.4E-07	4.2E-07	1.4E-07
B3421	9	Mixed Use	Residential	1.0E-03	2.0E-11	6.3E-10	1.7E-11	3.2E-10	1.8E-08	2.7E-10	3.4E-10	1.9E-08	2.9E-10	1.6E-07	1.8E-07	1.6E-07
B3816	12	Mixed Use	Residential	1.0E-02	2.1E-10	6.4E-09	1.8E-10	3.3E-09	1.9E-07	2.8E-09	3.5E-09	1.9E-07	3.0E-09	3.5E-09	1.9E-07	3.0E-09
B3916	12	Mixed Use	Residential	1.0E-03	2.0E-11	6.3E-10	1.7E-11	3.2E-10	1.8E-08	2.7E-10	3.4E-10	1.9E-08	2.9E-10	3.4E-10	1.9E-08	2.9E-10
B4716	15	Mixed Use	Residential	2.6E-01	5.4E-09	1.7E-07	4.5E-09	8.4E-08	4.8E-06	7.2E-08	9.0E-08	5.0E-06	7.7E-08	4.3E-05	4.8E-05	4.3E-05
B4816	15	Mixed Use	Residential	1.0E-01	2.0E-09	6.3E-08	1.7E-09	3.2E-08	1.8E-06	2.7E-08	3.4E-08	1.9E-06	2.9E-08	5.5E-08	1.9E-06	5.0E-08
B0632	3	Research and Development	Residential	2.0E-03	NA	0.000085	0.0000043	0.0000023	0.000039	0.000065	0.0000023	0.00012	0.000070	2.8	2.8	2.8
B1626	6	Research and Development	Residential	3.1E-03	NA	0.00013	0.0000066	0.0000036	0.000061	0.00010	0.0000036	0.00019	0.00011	1.8	1.8	1.8
B1826	6	Research and Development	Residential	1.3E-03	NA	0.000055	0.0000028	0.0000015	0.000025	0.000042	0.0000015	0.000081	0.000045	1.4	1.4	1.4
B2526	6	Research and Development	Residential	6.1E-03	NA	0.00026	0.000013	0.0000070	0.00012	0.00020	0.0000070	0.00038	0.00021	0.10	0.10	0.10
B2623	8	Mixed Use	Residential	1.4E+00	NA	0.060	0.0030	0.0016	0.027	0.046	0.0016	0.087	0.049	0.0016	0.087	0.049
B2624	8	Mixed Use	Residential	4.4E+00	NA	0.19	0.0094	0.0051	0.086	0.14	0.0051	0.27	0.15	0.22	0.49	0.37
B2722	8	Mixed Use	Residential	4.2E-02	NA	0.0018	0.000089	0.000048	0.00082	0.0014	0.000048	0.0026	0.0015	2.8	2.8	2.8
B2723	8	Mixed Use	Residential	2.9E+01	NA	1.2	0.062	0.033	0.56	0.94	0.033	1.8	1.0	0.035	1.8	1.0
B2724	8	Mixed Use	Residential	1.0E+02	NA	4.3	0.21	0.12	2.0	3.3	0.12	6.2	3.5	0.12	6.2	3.5
B2725	8	Mixed Use	Residential	1.1E+00	NA	0.047	0.0023	0.0013	0.022	0.036	0.0013	0.069	0.039	0.31	0.38	0.35
B2726	8	Mixed Use	Residential	8.2E-02	NA	0.0035	0.00017	0.000095	0.0016	0.0027	0.000095	0.0051	0.0029	0.14	0.14	0.14
B2823	8	Mixed Use	Residential	1.6E+02	NA	6.8	0.34	0.19	3.2	5.3	0.19	10	5.6	2.0	12	7.5
B2824	8	Mixed Use	Residential	3.7E+01	NA	1.6	0.079	0.043	0.72	1.2	0.043	2.3	1.3	0.044	2.3	1.3
B2922	8	Mixed Use	Residential	3.3E-02	NA	0.0014	0.000070	0.000038	0.00065	0.0011	0.000038	0.0021	0.0011	0.42	0.42	0.42
B2923	8	Mixed Use	Residential	6.4E+01	NA	2.7	0.14	0.073	1.2	2.1	0.073	4.0	2.2	14	18	16
B2924	8	Mixed Use	Residential	2.1E+01	NA	0.89	0.045	0.024	0.41	0.69	0.024	1.3	0.73	0.028	1.3	0.74
B2926	8	Mixed Use	Residential	5.0E-03	NA	0.00021	0.000011	0.0000058	0.00010	0.00016	0.0000058	0.00031	0.00017	2.6	2.6	2.6
B3023	8	Mixed Use	Residential	2.6E-02	NA	0.0011	0.000055	0.000030	0.00051	0.00085	0.000030	0.0016	0.00091	0.000030	0.0016	0.00091
B3024	8	Mixed Use	Residential	6.2E-02	NA	0.0026	0.00013	0.000072	0.0012	0.0020	0.000072	0.0039	0.0022	0.000072	0.0039	0.0022
B3126	8	Mixed Use	Residential	2.0E-03	NA	0.000085	0.0000043	0.0000023	0.000039	0.000065	0.0000023	0.00012	0.000070	1.7	1.7	1.7
B3326	8	Mixed Use	Residential	1.2E-02	NA	0.00051	0.000026	0.000014	0.00024	0.00039	0.000014	0.00075	0.00042	0.078	0.079	0.079
B3426	8	Mixed Use	Residential	1.5E-02	NA	0.00064	0.000032	0.000017	0.00029	0.00049	0.000017	0.00093	0.00052	1.0	1.0	1.0
B3421	9	Mixed Use	Residential	1.0E-03	NA	0.000043	0.0000021	0.0000012	0.000020	0.000033	0.0000012	0.000062	0.000035	2.4	2.4	2.4
B3816	12	Mixed Use	Residential	1.0E-02	NA	0.00043	0.000021	0.000012	0.00020	0.00033	0.000012	0.00063	0.00036	1.9	1.9	1.9
B3916	12	Mixed Use	Residential	1.0E-03	NA	0.000043	0.0000021	0.0000012	0.000020	0.000033	0.0000012	0.000062	0.000035	0.0000012	0.000062	0.000035
B4716	15	Mixed Use	Residential	2.6E-01	NA	0.011	0.00055	0.00030	0.0052	0.0086	0.00030	0.016	0.0092	5.3	5.3	5.3
B4816	15	Mixed Use	Residential	1.0E-01	NA	0.0043	0.00021	0.00012	0.0020	0.0033	0.00012	0.0062	0.0035	0.59	0.60	0.59

TABLE A7-3: TRICHLOROETHENE UNCERTAINTY ANALYSIS FOR SOIL (CONTINUED)
Appendix A, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

Cal/EPA OEHHA	California Environmental Protection Agency Office of Environmental Health Hazard Assessment
EPA	U.S. Environmental Protection Agency
IRIS	Integrated Risk Information System
mg/kg	Milligram per kilogram
NA	Not applicable
NCEA	National Center for Environmental Assessment
TCE	Trichloroethene
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

ATTACHMENT A8
SOIL AND GROUNDWATER ANALYTICAL DATA USED FOR HUMAN HEALTH RISK ASSESSMENT (PROVIDED ON COMPACT DISC ONLY)

APPENDIX B
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT OF THE PARCEL B SHORELINE, SITES IR-07 AND IR-26

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... B-v

B1.0 INTRODUCTION B-1

B1.1 OVERVIEW OF THE ECOLOGICAL RISK ASSESSMENT PROCESS B-1

B1.2 ECOLOGY OF THE PARCEL B SHORELINE SITES IR-07 AND IR-26 ..... B-2

B2.0 SCREENING-LEVEL PROBLEM FORMULATION AND ECOLOGICAL EFFECTS CHARACTERIZATION (STEP 1) B-3

B2.1 CONCEPTUAL SITE MODEL B-3

B2.1.1 Stressors B-4

B2.1.2 Fate and Transport Pathways B-4

B2.1.3 Exposure Pathways B-4

B2.1.4 Assessment and Measurement Endpoints B-5

B2.2 GENERAL APPROACH TO SCREENING-LEVEL AND REFINEMENT EVALUATION B-7

B2.2.1 Screening-Level and Refinement Evaluation for Sediment B-7

B2.2.2 Screening-Level and Refinement Evaluation for Groundwater B-9

B2.3 SELECTION OF SCREENING ECOTOXICITY VALUES B-10

B2.3.1 Toxicological Benchmarks for Benthic Invertebrates in Sediment B-10

B2.3.2 Toxicological Benchmarks for Aquatic Receptors Exposed to Groundwater via Surface Water B-10

B2.3.3 TRVs for Birds and Mammals B-11

B2.4 CHEMICALS WITH NO SCREENING VALUES B-12

B3.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT FOR BENTHIC INVERTEBRATES (STEP 2) B-12

B3.1 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN SURFACE SEDIMENT B-13

B3.2 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN SUBSURFACE SEDIMENT B-13

B3.3 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN GROUNDWATER B-14

B3.4 SUMMARY OF RISK CHARACTERIZATION FOR BENTHIC INVERTEBRATES ALONG THE PARCEL B SHORELINE B-15

B4.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT FOR BIRDS AND MAMMALS (STEP 2) B-15

B4.1 EXPOSURE ASSESSMENT FOR BIRDS AND MAMMALS USING FOOD-CHAIN MODEL B-16

B4.1.1 Exposure Assessment B-16

B4.1.2 Food Chain Model Dose Equation B-17

B4.1.3 Exposure Parameters for Dose Model B-17
B4.1.4 Chemical Concentrations in Sediment and Tissue Samples B-18
B4.2 DOSE PARAMETERS FOR FOOD CHAIN MODEL B-18
B4.2.1 Surf Scoter Dose Parameters B-19
B4.2.2 Willet Dose Parameters B-21
B4.2.3 Red-Tailed Hawk Dose Parameters B-22
B4.2.4 House Mouse Dose Parameters B-24
B4.3 TOXICITY REFERENCE VALUES AND HAZARD QUOTIENT INTERPRETATION B-27
B4.3.1 TRVs B-27
B4.3.2 Hazard Quotient Approach B-28
B4.4 RISK ESTIMATES B-29
B4.4.1 Risk to Birds B-29
B4.4.2 Risk to Mammals B-30

B5.0 RISK CHARACTERIZATION B-30
B5.1 REFINEMENT OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN B-31
B5.1.1 Comparison of Site Sediment and Groundwater Concentrations with Regional Ambient Concentrations B-32
B5.1.2 Refinement of COPECs for Benthic Invertebrates B-34
B5.1.3 Refinement of COPECs for Birds and Mammals B-38
B5.2 UNCERTAINTY IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT B-50
B5.2.1 Sample Data B-50
B5.2.2 Ambient Screening Concentrations B-51
B5.2.3 Toxicological Benchmarks B-51
B5.2.4 Uncertainties Associated with Food Chain Modeling B-51
B5.3 CONCLUSIONS B-55

B6.0 REFERENCES B-56

Attachment

B1 Groundwater Data Supporting the Screening-Level Ecological Risk Assessment of the Parcel B Shoreline

FIGURES

B-1 IR-07 SLERA and Shoreline Sampling Locations

B-2 IR-26 SLERA and Shoreline Sampling Locations

B-3 Conceptual Site Model

TABLES

B-1 Summary of Shoreline Sediment Samples

B-2 Summary of Descriptive Statistics for Shoreline Sediments (0 to 2 feet bgs)

B-3 Summary of Descriptive Statistics for Shoreline Sediment (2.5 to 4 feet bgs)

B-4 Sediment Screening Concentrations (Effects Range-Median) for Benthic Invertebrates

B-5 Surface Water Criteria for the San Francisco Bay

B-6 Unadjusted Bird and Mammal Toxicity Reference Values

B-7 Hazard Quotients for Invertebrate Receptors Based on the Ratio of the Maximum Concentration in Surface and Subsurface Sediments to Effects Range-Median

B-8 Hazard Quotients for Invertebrate Receptors Based on the Ratio of the Detected Concentration in Groundwater to Screening Criteria

B-9 Bioaccumulation Factors

B-10 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Surf Scoter Using the Maximum Concentration

B-11 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Willet (*Macoma* Tissue) Using the Maximum Concentration

B-12 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Willet (Soft-Bodied Invertebrate Tissue) Using the Maximum Concentration

B-13 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Red-Tailed Hawk Using the Maximum Concentration

B-14 Risk Calculations for Shoreline Surface and Subsurface Sediments for the House Mouse Using the Maximum Concentration

B-15 Shoreline Sediments (0 to 2 feet bgs) Hazard Quotient by Measurement Endpoint Using the Maximum Concentration

B-16 Shoreline Sediments (2.5 to 4 feet bgs) Hazard Quotient by Measurement Endpoint Using the Maximum Concentration

B-17 Comparison of Exposure Point Concentrations with Regional Ambient Concentrations (0 to 2 feet bgs)

B-18 Comparison of Exposure Point Concentrations with Regional Ambient Concentrations (2.5 to 4 feet bgs)

B-19 Hazard Quotients for Invertebrate Receptors Based on the Ratio of Exposure Point Concentrations in Surface and Subsurface Sediments to Effects Range-Median

B-20 Hazard Quotients for Invertebrate Receptors Based on the Ratio of Detected Concentrations in Groundwater to Screening Criteria

B-21 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Surf Scoter Using the Exposure Point Concentration

B-22 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Willet (*Macoma* Tissue) Using the Exposure Point Concentration

B-23 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Willet (Soft-Bodied Invertebrate Tissue) Using the Exposure Point Concentration

B-24 Risk Calculations for Shoreline Surface and Subsurface Sediments for the Red-Tailed Hawk Using the Exposure Point Concentration

B-25 Risk Calculations for Shoreline Surface and Subsurface Sediments for the House Mouse Using the Exposure Point Concentration

B-26 Shoreline Sediments (0 to 2 feet bgs) Hazard Quotient by Measurement Endpoint Using the Exposure Point Concentration

B-27 Shoreline Sediments (2.5 to 4 feet bgs) Hazard Quotient by Measurement Endpoint Using the Exposure Point Concentration

ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation factor
BERA	Baseline ecological risk assessment
bgs	Below ground surface
BHC	Benzene hexachloride, also known as hexachlorocyclohexane
BSAF	Biota-sediment accumulation factor
BTAG	Biological Technical Advisory Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPEC	Chemical of potential ecological concern
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
ER-M	Effects range-median
g/g/day	Gram per gram per day
HGAL	Hunters Point groundwater ambient level
HMW	High molecular weight
HPAL	Hunters Point ambient level
HPS	Hunters Point Shipyard
HQ	Hazard quotient
IR	Installation Restoration
kg/day	Kilogram per day
LD_{50}	Dietary lethal concentrations that result in a 50 percent mortality rate
LFR	Levine-Fricke-Recon
LMW	Low molecular weight
LOAEL	Lowest-observed-adverse-effect level

mg/kg	Milligram per kilogram
mg/kg-day	Milligram per kilogram per day
NAS	National Academy of Sciences
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No-observed-adverse-effect level
ORNL	Oak Ridge National Laboratory
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRC	PRC Environmental Management, Inc.
SLERA	Screening-level ecological risk assessment
SUF	Site use factor
SVOC	Semivolatile organic compound
Tetra Tech	Tetra Tech EM Inc.
TMSRA	Technical memorandum in support of a record of decision amendment
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit
VOC	Volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board

B1.0 INTRODUCTION

Appendix B evaluates risk to ecological receptors exposed to chemicals in sediment and surface water via the groundwater pathway in the shoreline areas of Parcel B at Installation Restoration (IR) Sites IR-07 and IR-26 at Hunters Point Shipyard (HPS) in San Francisco, California. This appendix follows ecological risk assessment (ERA) guidance from the U.S. Environmental Protection Agency (EPA) (1997) and the Department of the Navy (Navy) (1999). This appendix is an integral part of the technical memorandum in support a record of decision amendment (TMSRA) and is not intended to be stand-alone. Therefore, the history, previous investigations, and data collection and analysis sections of the TMSRA are not repeated in this appendix.

This section provides an overview of the ERA process and the ecology at the Parcel B shoreline. Section B2.0 presents the problem formulation and approach to the screening-level ecological risk assessment (SLERA). Section B3.0 summarizes risk to benthic invertebrates, and Section B4.0 summarizes risk to birds and mammals. Section B5.0 presents the risk characterization. Section B6.0 provides the references used to prepare this appendix. Figures and tables are included after Section B6.0. Attachment B1 provides the groundwater data supporting the SLERA of the Parcel B shoreline.

B1.1 OVERVIEW OF THE ECOLOGICAL RISK ASSESSMENT PROCESS

ERAs are intended to fulfill three basic functions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1. Document whether actual or potential ecological risks exist at a site
2. Identify chemicals posing potential ecological risk at the site
3. Generate data to be used to evaluate cleanup options, if necessary

EPA separates the ERA process into the following eight steps (EPA 1997):

Step 1: Screening-level problem formulation and evaluation of ecological effects

Step 2: Screening-level preliminary exposure estimate and risk calculation

Step 3: Baseline risk assessment problem formulation

Step 4: Study design and data quality objectives

Step 5: Field verification of sampling design

Step 6: Site investigation and analysis of exposure and effects

Step 7: Risk characterization

Step 8: Risk management

Steps 1 and 2 make up the SLERA. This appendix extends the SLERA into the initial phase of EPA's Step 3, which corresponds to Step 3a, "Refinement of Conservative Exposure Assumptions," of the Navy's ERA process (Navy 1999). Step 3 focuses on refining the list of chemicals of potential ecological concern (COPEC) based on more realistic exposure assumptions and comparison with ambient concentrations (EPA 2001).

This SLERA characterizes risk to ecological receptors in the "intertidal zone" of Parcel B and in adjacent offshore zones associated with groundwater-surface water interaction (that is, interaction with San Francisco Bay). The intertidal zone is located between the low- and high-water lines, and offshore areas are located below the low-water line. Ecological receptors in these areas include benthic invertebrates, birds, and mammals.

Section 2.0 of the TMSRA summarizes previous investigations conducted along the Parcel B shoreline.

B1.2 ECOLOGY OF THE PARCEL B SHORELINE SITES IR-07 AND IR-26

The focus of this SLERA is the intertidal zone of the Parcel B shoreline and the adjacent offshore area associated with groundwater-surface water interaction. The shoreline of IR-07 consists of 1.5 acres adjacent to the southern portion of the India Basin. Approximately 1,300 square feet of tidal marsh wetlands are located within the IR-07 shoreline (see Figure B-1). These wetlands are bordered by India Basin to the north and by riprap to the south. Riprap was placed along the shoreline at four locations to control erosion in IR-07. The shoreline of IR-26 consists of about 0.3 acre on the peninsula known as Point Avisadero (see Figure B-2). The shoreline of IR-26 is nearly completely covered by riprap for erosion control, with little or no interstitial soil between individual rocks.

Very little native vegetation was observed along the Parcel B shoreline; ice plant (*Carpobrotis edulis*) is the dominant plant species (Tetra Tech EM Inc. [Tetra Tech] 2002). Common pickleweed (*Salicornia virginica*) and salt grass (*Distichlis spicata*) were also observed in the tidal marsh.

Invertebrates, birds, and mammals were observed using the shoreline habitat during sampling. Invertebrates observed along the Parcel B shoreline included crabs, isopods, mussels (mainly *Mytilus edulis*), and barnacles. Crabs and isopods typically hide under rocks and feed on other small invertebrates. Mussels and barnacles attach to rocks and other solid substrates and feed by filtering organic matter from water.

Bird species reported or expected to forage along the shoreline or in adjacent offshore areas include the black-bellied plover (*Pluvialis squatarola*), black turnstone (*Arenaria melanocephala*), sanderling (*Calidris alba*), long-billed curlew (*Numenius americanus*), dunlin (*Calidris alpine*), double-crested cormorant (*Phalacrocorax auritus*), surf scoter (*Melanitta perspicillata*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), and peregrine falcon (*Falco peregrinus*) (Tetra Tech and Levine-Fricke-Recon [LFR] 2000). In

addition, the tidal wetlands may be used by shorebirds and wading birds, such as the willet (*Catoptrophorus semipalmatus*), killdeer (*Charadrius vociferous*), and great blue heron (*Ardea herodias*).

Mammals observed along the Parcel B shoreline include the California ground squirrel (*Spermophilus beecheyi*), which uses the riprap areas for shelter. In addition, the house mouse (*Mus musculus*) is expected to forage and seek refuge in the shoreline area (Tetra Tech and LFR 2000).

B2.0 SCREENING-LEVEL PROBLEM FORMULATION AND ECOLOGICAL EFFECTS CHARACTERIZATION (STEP 1)

The SLERA described in steps 1 and 2 of EPA's eight-step process results in a list of "preliminary contaminants of concern for the baseline risk assessment" (EPA 1997). This section describes the screening methods used to identify COPECs in shoreline sediment and groundwater based on comparison with toxicological benchmarks for ecological receptors.

B2.1 CONCEPTUAL SITE MODEL

The conceptual site model is an important part of problem formulation because it defines the exposure pathways to be evaluated in the risk assessment. The model also provides other key information, such as contaminant sources, release and transport mechanisms, and the relative importance of each to specific measurement and assessment endpoints. The conceptual site model establishes whether a complete exposure pathway to an ecological receptor exists. The conceptual model also aids in identifying (1) missing information, and (2) areas of uncertainty in understanding how chemical stressors may pose a risk to selected ecological receptors. The conceptual site model includes the following components:

1. Stressors
2. Fate and transport
3. Exposure pathways
4. Assessment and measurement endpoints

A conceptual site model for the Parcel B shoreline is presented on Figure B-3. Sources of contamination are discussed in Section 2.3 (Updated Characterization of Soil and Groundwater) in the main TMSRA text. The following sections review the components of the conceptual site model.

B2.1.1 Stressors

Stressors can be defined as any factor that causes adverse ecological impacts at the site. All chemicals detected in sediment and groundwater samples from the Parcel B shoreline were considered potential stressors except for essential mineral nutrients such as sodium, chloride, potassium, phosphorus, magnesium, and calcium. Stressors identified in the sediments at Parcel B shoreline included metals, pesticides, polychlorinated biphenyls (PCB), semivolatile organic compounds (SVOC), and organotins.

B2.1.2 Fate and Transport Pathways

Physical fate and transport processes at the Parcel B shoreline include movement of contaminated sediment suspended in surface water; transport of chemicals in groundwater to surface water; and transport of chemicals in plant and animal tissues (biotic transport).

Chemicals associated with sediment in Parcel B are primarily transported to the shoreline through sediment suspended in water flowing over the land. Metals beneath the soil surface in Parcel B are effectively immobile because they are not transported overland as dry particulate materials. Tidal water from surrounding areas in the San Francisco Bay also carries sediment into the Parcel B shoreline when it inundates the shoreline twice daily. The amount of sediment carried on incoming tides varies with tidal height, storm energy, and other dynamic factors. Therefore, total concentrations of chemicals in sediment at the shoreline reflect both regional ambient and site-specific components. The relevance of the potential exchange of sediment between the Parcel B shoreline and surrounding areas in San Francisco Bay is discussed in Section B5.1 of this appendix for identifying site-related risk.

Groundwater is not of ecological concern at Parcel B until it meets or becomes surface water, at which point it can transport dissolved chemicals into the offshore environment. The Parcel B SLERA focuses on chemicals in groundwater that migrate to the ecological point of exposure and are potentially bioavailable to aquatic receptors. The ecological point of exposure for groundwater at Parcel B includes the areas within the shoreline sediment pore space and the areas where groundwater surfaces and mixes with surface water of the bay.

B2.1.3 Exposure Pathways

Potentially complete exposure pathways at the Parcel B shoreline were evaluated based on fate and transport processes. A chemical must be able to travel from a source to a representative receptor and must be taken up through one or more routes for an exposure pathway to be considered complete. Thus, these pathways present the greatest potential risk of adverse effects for receptors of concern at a site. Potential exposure pathways that result in receptor contact include exposure to sediments, groundwater via surface water, and food-chain transfer.

Potentially complete exposure routes for animals that live in or migrate through the Parcel B shoreline include ingestion and dermal contact. Each exposure route is summarized below and is illustrated on Figure B-3.

Ingestion

Animal receptors could be exposed through ingestion of chemicals in surface water, sediment, or food. Ingestion of contaminated media occurs directly when an animal eats contaminated food or drinks contaminated water. Incidental ingestion of contaminated sediment or surface water also occurs when animals are feeding, preening, or grooming (Beyer, Connor, and Gerould 1994). Ingestion of contaminated food and incidental ingestion of sediment are the primary exposure pathways for birds and mammals evaluated in the SLERA for the Parcel B shoreline. Ingestion of surface water is typically excluded from SLERAs because of the relatively limited data available to evaluate this pathway for most receptors (EPA 1997).

Direct Contact

Direct contact is considered the principal exposure pathway for benthic invertebrates that are in continuous contact with sediments and water. Direct contact is considered a relatively insignificant route of exposure for birds and mammals when compared with ingestion and is not considered in this SLERA (EPA 1997).

Inhalation

Inhalation is also considered a relatively insignificant route of exposure to birds and mammals because dispersion in air of volatile organic compounds (VOC) is likely to reduce exposure. The exclusion of the inhalation route could potentially result in an underestimate of the exposure dose; however, the ingestion exposure route typically dominates other exposure routes. The magnitude of the potential underestimate is anticipated to be low relative to the magnitude of exposure through ingestion of contaminated food items and incidental ingestion of sediment. Therefore, the inhalation exposure route will not be evaluated further.

B2.1.4 Assessment and Measurement Endpoints

EPA guidance requires selection of assessment and measurement endpoints to focus the risk assessment process and to characterize risk at a site (EPA 1997, 1999b). EPA defines assessment endpoints as "explicit expressions of the actual environmental values (e.g. ecological resources) that are to be protected" (EPA 1997). Assessment endpoints are environmental characteristics or values that, if found to be significantly affected, would indicate a need for action by risk managers. Various definitions of valuable ecological resources include those without which ecosystem function would be significantly impaired; those providing critical resources, such as habitat or fisheries; and those perceived by humans as being valuable, such as endangered species and other issues addressed by legislation. Useful assessment endpoints

define both the valuable ecological entities at a site and a characteristic of the entity to protect, such as reproductive success or production per unit area.

Assessment endpoints are usually not amenable to direct measurement; therefore, measurement endpoints related to assessment endpoints were identified. EPA defines a measurement endpoint as "a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint and is a measure of biological effects (such as mortality, reproduction, or growth)" (EPA 1997). Measurement endpoints more closely reflect technical considerations in the risk assessment process and include measures of exposure or effects that are often expressed as statistical or arithmetic summaries of observations. Measurement endpoints focus on both direct measures of ecological effects (such as toxicity tests) and indirect measures (such as food-chain modeling) that allow evaluation of risk to representative receptors. Assessment and measurement endpoints for invertebrates, birds, and mammals are summarized below.

Benthic Invertebrates

The assessment endpoint for benthic invertebrates is maintenance of adequate rates of survival, growth, and reproduction to sustain populations of benthic invertebrates. Invertebrates are expected to be a food source for higher-trophic-level consumers; therefore, the health of the invertebrate community is considered an ecological value to be protected.

The measurement endpoints for benthic invertebrates are the comparison of exposure point concentrations (EPC) in sediment and surface water with toxicity-based benchmarks for evaluating risk to benthic marine invertebrates and aquatic receptors.

Birds and Mammals

The assessment endpoints for birds and mammals are adequate rates of survival, growth, and reproduction to protect populations of diving ducks, carnivorous shorebirds, carnivorous birds, and omnivorous mammals. Diving ducks, carnivorous shorebirds, and omnivorous mammals are secondary consumers that are expected to be a food source for upper-trophic-level consumers, such as raptors, and are an important ecological resource for a healthy ecosystem. Carnivorous birds, such as raptors, are tertiary consumers and are susceptible to the effects of bioaccumulative chemicals. Reductions in the tertiary consumer populations at the Parcel B shoreline could have undesirable effects on lower-trophic levels through the loss of predation. Therefore, maintenance of populations of secondary and tertiary consumers at the Parcel B shoreline were considered ecological values to be protected.

The following measurement endpoints were selected for birds and mammals based on information available from bird and mammal surveys and natural history assessments conducted along the Parcel B shoreline:

- Diving ducks (represented by the surf scoter): Estimate doses based on EPCs to compare with toxicity reference values (TRV)
- Carnivorous shorebirds (represented by the willet): Estimate doses based on EPCs to compare with TRVs
- Carnivorous birds (represented by the red-tailed hawk): Estimate doses based on EPCs to compare with TRVs
- Omnivorous small mammals (represented by the house mouse): Estimate doses based on EPCs to compare with TRVs

Representative receptors were selected based on (1) observed or expected occurrence of species at the Parcel B shoreline, (2) susceptibility of the receptor to chemical effects, and (3) the potential for exposure based on feeding behavior and site use.

B2.2 GENERAL APPROACH TO SCREENING-LEVEL AND REFINEMENT EVALUATION

All chemicals detected in sediment and groundwater samples from the Parcel B shoreline were screened to identify COPECs, except for essential mineral nutrients such as sodium, chloride, potassium, phosphorus, magnesium, and calcium. A toxicity-based approach was used to identify site-related chemicals that may pose risks to sensitive ecological receptors in the intertidal zone, including benthic invertebrates, birds, and mammals. Inorganic and organic chemicals were screened against toxicity benchmarks for each ecological receptor, as recommended by EPA (1997).

B2.2.1 Screening-Level and Refinement Evaluation for Sediment

Sediment samples were evaluated in two spatial groups.

1. *Surface shoreline samples: 0 to 2 feet below ground surface (bgs)* – This interval range was selected because receptors selected as measurement endpoints are not expected to burrow below 2.0 feet bgs.
2. *Subsurface shoreline samples: 2.5 to 4 feet bgs* – This interval was evaluated because of the potential for erosional processes and disturbance to expose deeper sediments at the surface.

The process and rationale for identifying COPECs are similar for all areas and ecological receptors. COPECs for benthic invertebrates were identified as chemicals with EPCs that exceed the effects range-median (ER-M) (see Section B3.0). Chemicals were screened in the evaluation of birds and mammals using food chain modeling against TRVs (see Section B4.0). COPECs were refined in the risk characterization step by comparing site concentrations with ambient concentrations and revising risk calculations to reflect more realistic exposure assumptions (see Section B5.0).

The site-specific data set used in this SLERA included laboratory analysis of chemicals in sediment samples. Table B-1 lists the sediment samples collected from all locations along the Parcel B shoreline. All surface sediment samples and all but three subsurface samples were analyzed for metals, PCBs, pesticides, SVOCs, VOCs, total petroleum hydrocarbons, and organotins. In addition, three other subsurface samples were analyzed for organotins only. Additionally, the evaluation of risk to birds and mammals used the following data to develop exposure models and compare site concentrations with ambient concentrations:

- Wildlife surveys conducted within Parcel E at HPS
- Bioaccumulation factors (BAF) derived from prey tissue collected in Parcels E, E-2, and F at HPS
- Natural history data for representative birds and mammals
- Hunters Point ambient levels (HPAL) (PRC Environmental Management, Inc. [PRC] 1995)
- San Francisco Bay ambient sediment data (San Francisco Bay Regional Water Quality Control Board [Water Board] 1998a)

The SLERA considered the entire Parcel B shoreline as intertidal habitat, and the solid medium was defined as sediment. The rationale for choosing sampling locations and analytical methods is provided in the Parcel B field sampling and analysis plan (Tetra Tech 2003) and shoreline characterization technical memorandum (Tetra Tech 2004). Complete analytical data are provided in Appendix A of the technical memorandum (Tetra Tech 2004).

Tables B-2 and B-3 present the summary of descriptive statistics for chemicals analyzed in surface and subsurface sediment samples. Values in the tables were calculated using a distribution-dependent formula. One-half the reporting limit was substituted for censored data for samples with at least 85 percent detected data (such as nondetected data qualified as "U"). Unbiased estimates of the mean and standard deviations were calculated using equations 13.3 and 13.5 in Gilbert (1987) for samples confirmed or assumed to follow a lognormal distribution. The 95 percent upper confidence limit (UCL_{95}) for lognormal distributions was calculated using Land's method, as discussed in Gilbert (1987) and EPA (1992c).

Population parameters for samples with more than 15 percent censored data were calculated using stochastic modeling, following the "bounding" approach described in EPA (2002a). This approach treats each censored datum as a random, uniform variable that can assume any value between zero and its reporting limit. Monte Carlo simulation is used to develop a distribution of the range of possible estimates for a UCL based on a particular mathematical form selected for the UCL. Random surrogate values between zero and the reporting limit are used for individual censored measurements in each calculation (the default is 2,000 calculations) of the UCL. As a result, the distribution reflects the entire range of possible values that could be calculated for the UCL. Because random surrogate values are substituted for each censored measurement, this technique reflects the uncertainty contributed by varying levels of censored data and is appropriate for samples with either single or multiple censoring limits. The

maximum estimated value (from the distribution of all 2,000 estimates of the UCL_{95}) was used as a plausible upper bound for the UCL_{95} of the mean. The mean and standard deviation were calculated based on the median values of the means and standard deviations used to calculate the 2,000 estimates of the UCL_{95}.

The median (50th percentile) and 95th percentile were calculated for all samples, regardless of detection frequency, based on nonparametric assumptions (that is, based strictly on a rank ordering of the combined detected and censored measurements). Descriptive statistics were not used for Steps 1 and 2 of this SLERA; however, they were calculated to refine the COPECs, as described in Section B5.0. EPCs selected for the SLERA were the maximum detected concentration for each chemical; for the refinement step, EPCs were the lesser of the maximum detected concentration or the UCL_{95}.

B2.2.2 Screening-Level and Refinement Evaluation for Groundwater

The process and rationale for identifying COPECs in groundwater are similar to those for sediment. COPECs for benthic invertebrates were identified as chemicals with EPCs that exceed screening values developed from water quality criteria (see Sections B2.3.2 and B3.3). COPECs were refined in the risk characterization step by comparing site concentrations with regional ambient concentrations and evaluating trends in the frequency and magnitude of detections (see Section B5.0).

Concentrations in groundwater from the 12 most recent sampling events were used to evaluate risk to aquatic receptors in San Francisco Bay. The maximum concentrations of each chemical detected in samples from the 16 Parcel B groundwater point of compliance, post-remedial action, and supplemental characterization monitoring wells listed below were used as EPCs in the San Francisco Bay. The SLERA used the maximum concentrations in the data set as conservative estimates, in keeping with guidance from EPA (1997). The 16 wells used in the SLERA to evaluate groundwater are listed below.

West:

- IR07MW25A (post-remedial action)
- IR07MW24A (post-remedial action)
- IR07MW21A1 (post-remedial action)
- IR07MWS-4 (point of compliance)
- IR07MW26A (post-remedial action)
- IR07MWS-2 (point of compliance)
- IR07MW20A1 (post-remedial action)
- IR07MW19A (point of compliance)

Central:

- PA50MW01A (point of compliance)
- IR10MW31A1 (point of compliance)
- IR46MW37A (point of compliance)

East:

- IR26MW41A (point of compliance)
- IR26MW45A (point of compliance)
- IR26MW46A (supplemental characterization)
- IR26MW47A (supplemental characterization)
- IR26MW48A (supplemental characterization)

B2.3 SELECTION OF SCREENING ECOTOXICITY VALUES

EPCs based on the sediment and groundwater data from the Parcel B shoreline were evaluated using toxicological benchmarks derived from the published scientific literature and available for benthic invertebrates exposed to sediment, aquatic receptors exposed to surface water, and birds and mammals exposed to chemicals through ingestion.

B2.3.1 Toxicological Benchmarks for Benthic Invertebrates in Sediment

Estuarine sediment guidelines are based on chemical and toxicological effects data from numerous studies of invertebrates in marine and estuarine sediments. ER-M values are widely used as guidelines to interpret and assess potential effects of chemicals on benthic invertebrates in coastal sediments (Long and others 1995; National Oceanic and Atmospheric Administration [NOAA] 1991). When the EPC (maximum concentration) in sediment exceeded the ER-M, site-related chemicals were considered COPECs for benthic invertebrates. Table B-4 lists the ER-M values.

No ER-M for tributyltin is available. However, EPA has provided recommended sediment screening values for tributyltin for Superfund sites in Puget Sound, Washington (EPA 1996). The EPA recommendations do not include calculations of apparent effects thresholds or effects range values, but provide a sediment screening value for tributyltin that is considered protective of most marine organisms and life stages from most acute and chronic effects. Using sediment-water partitioning models and water quality criteria, EPA established this sediment screening value at 1,255 milligrams of tributyltin per kilogram (mg/kg) of organic carbon, assuming 2 percent total organic carbon. This value is equivalent to 25.1 mg/kg of tributyltin (dry weight) (EPA 1996); it is included in Table B-4 and is applied to each of the organotin compounds.

B2.3.2 Toxicological Benchmarks for Aquatic Receptors Exposed to Groundwater via Surface Water

It is unlikely that aquatic receptors will be directly exposed to chemical concentrations in groundwater. However, groundwater concentrations were used for the comparison to surface water for this pathway based on agreement with the Base Realignment and Closure Cleanup Team. Screening values were compiled through a review of published regulatory standards, goals, and guidance, including those established in "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 2006), "A Compilation of Water Quality Goals" (Marshack 2007), the California Toxics Rule (EPA 2000a), National Recommended Water Quality Criteria (EPA 2002b); and other sources, as appropriate (Water Board 1998a).

Individual toxicity criteria were selected using a methodology that sorts and selects criteria according to the applicability and quality of data. First, criteria were sorted by applicability and quality of data into one of four tiers (see Table B-5). Chronic exposure toxicity criteria were identified as most applicable for the exposure scenario at Parcel B and as more protective (lower concentration values) than short-duration acute or instantaneous exposure toxicity criteria (higher

concentration values). As a result, applicable chronic exposure toxicity criteria were assigned to the first tier of applicability. The most protective (lowest) value was selected for screening where more than one applicable toxicity value was available in the same tier.

If no first-tier criterion was available for a specific analyte, an acute value was selected as a second-tier criterion. Each acute criterion was made more protective, and thus conservative, by lowering the value by 80 percent to make acute criteria more appropriate for use in chronic exposure scenarios (EPA 1986). Where no first- or second-tier criteria were available, instantaneous criteria were used as third-tier criteria. Each instantaneous criterion was made more protective by lowering the value by 90 percent to make instantaneous criteria more appropriate for use in chronic exposure scenarios (EPA 1986). In those cases where no first-, second-, or third-tier criteria were available, published EPA lowest-observable-effects criteria were included for screening. The selected screening criteria for the evaluation of Parcel B groundwater are shown in Table B-5 along with the basis for the selection.

B2.3.3 TRVs for Birds and Mammals

The evaluation of risk to birds and mammals focused on ingestion of chemicals in sediment and prey by selected receptors (see Section B4.0). TRVs are daily doses consistent with no-observed-adverse-effects levels (NOAEL) and lowest-observed-adverse-effects levels (LOAEL) reported in laboratory toxicological studies on birds or mammals. TRVs are based on evaluation of published toxicological data derived from laboratory studies and are not specific to any geographical region. Risks to representative birds and mammals were evaluated quantitatively based on a hazard quotient (HQ) approach, where the site-specific estimated dose was divided by the TRV.

TRVs selected for this technical memorandum were compiled from two sources: (1) Navy and EPA Region 9 TRVs (Navy 1998), and (2) Oak Ridge National Laboratory (ORNL) toxicological benchmarks for wildlife (Sample and others 1996). TRVs were derived for selected Navy installation-specific chemicals and receptors in a collaborative effort with the Navy, its contractors, and the EPA Region 9 Biological Technical Advisory Group (BTAG), which includes federal, state, and local regulatory agencies and resource trustees. The derivation of TRVs and the use of food chain analysis in the HQ approach were described in detail in "Development of Toxicity Reference Values for Conducting Ecological Risk Assessments at Naval Facilities in California, Interim Final Technical Memorandum" (Navy 1998).

High TRVs (LOAELs) and low TRVs (NOAELs) were derived for each chemical to reflect the variability of parameters in an ecological risk context. Specifically, the low TRV was considered a conservative value consistent with a chronic no-effect level. The high TRV was a less conservative value consistent with a LOAEL. Therefore, adverse effects have been demonstrated at the high TRV. When compared with site-specific doses ingested by receptors of concern, the high TRV (LOAEL) can be used to identify sites that may pose potential risk to birds or mammals. Conversely, no adverse effects are expected at a dose below the low TRV.

ORNL toxicological benchmarks are similar to Navy and EPA TRVs in that they are ingestion-based NOAELs and LOAELs derived from published scientific literature. Both sets of TRVs carry the same sources of uncertainty, as detailed in Section B5.0. ORNL benchmarks carry an additional liability because their derivation is not fully documented. Primary literature citations are included in Section B6.0 but are not linked directly to any specific benchmark. Instead, values from the primary literature were incorporated into complex models, which resulted in separate TRVs for 9 mammal and 11 bird species. Table B-6 presents the unadjusted TRVs reported for test species (Navy 1998; Sample and others 1996). These TRVs were allometrically adjusted to reflect effect levels for the representative receptors.

BTAG TRVs available for both mammal and bird receptors included arsenic, cadmium, copper, lead, manganese, mercury, nickel, selenium, zinc, organotins, PCBs, and dichlorodiphenyltrichloroethane (DDT). Additionally, the following BTAG TRVs were available for mammals only: cobalt, thallium, heptachlor, lindane (gamma-benzene hexachloride [BHC]), methoxychlor, and high molecular weight (HMW) and low molecular weight (LMW) polynuclear aromatic hydrocarbons (PAH) (Navy 1998). Sample and others (1996) provided bird and mammal toxicological benchmarks for aluminum, barium, chromium, molybdenum, and vanadium. In Sample and others (1996), only mammal TRVs were available for antimony, beryllium, and pentachlorophenol; bird TRVs were available for BHC, chlordane, dieldrin, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, and endrin ketone.

B2.4 CHEMICALS WITH NO SCREENING VALUES

Chemicals cannot be eliminated during the early stages of the risk assessment simply because no benchmarks are available (EPA 1997). In most cases, the lack of a toxicological benchmark is caused by inadequate data on exposure and effects in the literature, as evaluated by the authors of published benchmarks (Long and others 1995; Efroymson and others 1997). Therefore, chemicals detected at the site were retained by default if no toxicological benchmark was available (EPA 1997). However, experience suggests that chemicals without benchmarks do not typically drive cleanup decisions. Therefore, chemicals without valid toxicological benchmarks were not considered primary COPECs, and further consideration of these chemicals is limited to the uncertainty discussion (see Section B5.2). Primary COPECs are those that exceed available toxicological benchmarks, which are discussed in Sections B3.0 and B4.0.

B3.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT FOR BENTHIC INVERTEBRATES (STEP 2)

Risk to populations of benthic invertebrates in the Parcel B shoreline was evaluated in Step 2 of this SLERA by comparing site-specific EPCs with toxicological benchmarks using an HQ approach. HQs are calculated by dividing the EPCs by the most appropriate toxicological benchmarks. Detected chemicals with HQs above 1.0 were retained as COPECs for further evaluation in the refinement step (see Section B5.0). Sections B3.1, B3.2, and B3.3 present screening-level exposure and risk estimates for benthic invertebrates exposed to surface and subsurface sediments and groundwater via surface water along the Parcel B shoreline.

B3.1 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN SURFACE SEDIMENT

The SLERA assumes that exposure pathways are complete for benthic invertebrates exposed to surface sediment along the Parcel B shoreline.

Risk to benthic invertebrates from exposure to surface sediment in the intertidal zone was evaluated in the SLERA using ER-M values, as described in Section B2.3.1. ER-M values represent the cumulative exposure of benthic invertebrates to chemicals in sediment through dermal contact and ingestion. Table B-7 presents HQs based on the ratio of EPCs (equal to the maximum concentration) in surface sediment to ER-M values. The HQs for the following chemicals exceeded 1.0 for Parcel B sediments; these chemicals were retained as COPECs for benthic invertebrates:

- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Total Aroclors (Aroclor-1254 and -1260)
- 4,4-DDT
- Total DDT
- Dieldrin
- Phenanthrene
- Zinc

HQs that exceeded 1.0 for inorganic chemicals ranged from 1.20 (chromium) to 32.9 (nickel). No ER-M values were available for aluminum, antimony, barium, beryllium, cobalt, manganese, molybdenum, thallium, or vanadium, so these chemicals were considered COPECs by default. The HQs for arsenic, cadmium, selenium, and silver were less than 1.0; therefore, these chemicals were eliminated as COPECs for benthic invertebrates.

HQs that exceeded 1.0 for pesticides and PCBs ranged from 2.81 (total DDT, which is the sum of DDT, dichlorodiphenyldichloroethane [DDD], and dichlorodiphenyldichloroethene [DDE]) to 26.1 (total Aroclors). Phenanthrene was the only SVOC that exceeded its ER-M value, with an HQ of 1.20.

Detected organic chemicals for which no ER-M values were available were considered COPECs by default. Organic chemicals with HQs less than 1.0 were not considered COPECs for benthic invertebrates in the shoreline area (see Table B-7).

B3.2 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN SUBSURFACE SEDIMENT

Risk to benthic invertebrates from subsurface sediment was evaluated as described for surface sediment. Benthic invertebrates could be exposed to sediment that is at or below 2.5 feet bgs because the shoreline at Parcel B is susceptible to erosional processes that could expose deeper sediments.

Chemicals with HQs greater than 1.0 were considered COPECs for benthic invertebrates. Table B-7 presents HQs based on the ratio of EPCs in subsurface sediment to ER-M values. All of the COPECs identified above for surface sediment were retained as COPECs for subsurface sediment. In addition, the following HQs exceeded 1.0 in subsurface but not surface sediments, and these chemicals were retained as COPECs:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Chrysene
- Dibenz(a,h)anthracene
- 4,4'-DDE
- Total HMW PAHs
- Pyrene

HQs that exceeded 1.0 for inorganic chemicals ranged from 1.38 (chromium) to 31 (nickel). No ER-M values were available for aluminum, antimony, barium, beryllium, cobalt, manganese, molybdenum, thallium, or vanadium, so they were considered as COPECs by default. The HQs for arsenic, cadmium, and silver were less than 1.0 and selenium was not detected in subsurface sediment; therefore, these chemicals were eliminated as COPECs for benthic invertebrates.

HQs that exceeded 1.0 for pesticides and PCBs ranged from 1.11 (DDE) to 35.3 (total Aroclors). The HQs that exceeded 1.0 for the SVOCs ranged from 1.07 (chrysene) to 1.75 (benzo[a]pyrene). The HQ for total HMW PAHs was 2.33.

If no ER-M values were available, detected organic chemicals were considered COPECs by default. Chemicals with HQs less than 1.0 were not considered COPECs for benthic invertebrates in the shoreline area (see Table B-7).

B3.3 RISK ESTIMATES FOR BENTHIC INVERTEBRATES IN GROUNDWATER

Although benthic invertebrates are not likely to be directly exposed to groundwater, the SLERA assumes that exposure pathways are complete via surface water along the Parcel B shoreline. The SLERA evaluated risk to benthic invertebrates from exposure to surface water via groundwater in the offshore area adjacent to Parcel B using water quality criteria for protection of aquatic life, as described in Section B2.3.2. Chemicals with HQs greater than 1.0 were considered COPECs in groundwater for benthic invertebrates. Table B-8 presents HQs based on the ratio of EPCs (equal to the maximum concentration) in groundwater to selected water quality screening criteria. The following HQs exceeded 1.0 for Parcel B groundwater and were retained as COPECs in groundwater for benthic invertebrates:

- Arsenic
- Alpha-chlordane
- Copper
- Endrin aldehyde
- Gamma-chlordane
- Heptachlor
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Zinc

Any chemical for which the HQ was less than 1.0, based on the maximum concentration, was eliminated as a COPEC in groundwater for benthic invertebrates (see Table B-8). Detected organic chemicals for which water quality criteria were not available were considered COPECs by default and are discussed further in the uncertainty section (see Section B5.2).

B3.4 SUMMARY OF RISK CHARACTERIZATION FOR BENTHIC INVERTEBRATES ALONG THE PARCEL B SHORELINE

Sediment in the intertidal area of the shoreline is perennially wet and is assumed to provide year-round habitat to benthic invertebrates. Any HQ greater than 1.0 was considered to warrant further evaluation because the ER-M represents a probable effects concentration.

Benthic invertebrates were assumed in this SLERA to be exposed to the same concentrations in surface water as in groundwater. Any HQ greater than 1.0 was considered to warrant further evaluation because the selected water quality criteria represent chronic effects concentrations.

By design, the SLERA overestimates risk because its objective is to identify whether further evaluation is necessary (EPA 1997, 2001). The data presented in Sections B2.0 and B3.0 of this appendix and in the TMSRA indicated that potential risk to benthic invertebrates in the Parcel B shoreline sediment cannot be ruled out. Some potentially toxic chemicals were detected at concentrations that exceeded toxicological benchmarks, and exposure pathways to receptors are complete. As a result, chemicals identified in the SLERA as COPECs for benthic invertebrates are further evaluated in Section B5.1, Refinement of COPECs.

B4.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT FOR BIRDS AND MAMMALS (STEP 2)

The evaluation of risk to birds and mammals is based on the selected assessment and measurement endpoints identified in Section B2.1. Ingestion of chemicals in sediment and prey was considered the most important exposure pathway for birds and mammals; therefore, food chain models were used to assess the exposure of birds and mammals to chemicals in their diet. Food chain models are one method of integrating ecological and chemical information into the risk assessment process, especially for chemicals that tend to bioconcentrate or bioaccumulate (Pascoe and others 1996). The food chain model is a conceptually simple method of developing site-specific estimated doses to representative receptors.

Site-specific estimated doses were then compared with TRVs derived from peer-reviewed literature in an HQ approach. A TRV is a daily dose derived from reported biological effects on laboratory animals (see Section B2.3.3). Risk to representative birds and mammals at the Parcel B shoreline was evaluated quantitatively by dividing the dose by the TRV.

B4.1 EXPOSURE ASSESSMENT FOR BIRDS AND MAMMALS USING FOOD-CHAIN MODEL

Exposure estimates for higher-trophic-level vertebrates are usually based on estimating exposure through the ingestion pathway using food chain modeling. Values for important life history parameters are available in the literature for surrogate species, and TRVs can be derived from laboratory-based studies. However, calculating HQs based on food chain modeling still requires the following assumptions: (1) targeted vertebrate receptors forage at the site on the types of prey for which tissue concentrations are available, (2) chemicals in environmental media and prey are 100 percent assimilated, and (3) toxicological benchmarks represent effects that have relevance at the population level.

Although measurements of chemical concentrations in abiotic media represent potential exposure to ecological receptors, exposure of resident consumers is mediated in part by uptake of chemicals from the abiotic media by prey organisms. Food chain models address the transfer of chemicals from abiotic media to higher-trophic-level predators through diet and provide a more realistic estimate of exposure to and uptake of chemicals for ecological receptors such as birds and mammals.

Section B4.1.1 describes the approach to the exposure assessment. Section B4.1.2 presents the dose equation used in the food chain model to estimate exposure, and Section B4.1.3 lists some exposure parameters of the food chain model. Section B4.1.4 describes the chemical concentrations used in the dose estimate.

B4.1.1 Exposure Assessment

The evaluation of risk to birds and mammals focused on ingestion of chemicals in sediment and prey by the selected receptors. Site-specific estimated doses were compared with TRVs derived from peer-reviewed literature in an HQ approach. A TRV is a daily dose derived from reported biological effects on laboratory animals. Risk to representative birds and mammals at the Parcel B shoreline was evaluated quantitatively based on an HQ approach, where the dose was divided by the TRV. The derivation of TRVs and the use of food chain analysis in the HQ approach were described in detail in a technical memorandum (Navy 1998), and their previous use at HPS was documented in the Parcel E validation study (Tetra Tech and LFR 2000). Section B4.3.1 summarizes the derivation and use of TRVs. Section B4.3.2 further describes the interpretation of TRVs and HQs.

Food chain analysis was conducted for all detected inorganic and organic chemicals where TRVs were available. Ingestion of chemicals in sediment and prey was considered the most important exposure pathway for birds and mammals.

B4.1.2 Food Chain Model Dose Equation

The exposure assessment for the SLERA evaluates potential effects to selected birds and mammals from chemicals in sediment at the Parcel B shoreline. Receptor-specific information on natural history, including diet composition, ingestion rates, body weights, and foraging ranges for each receptor, was used to evaluate the potential for exposure of receptors to chemicals at the shoreline.

The following basic dose equation was used to characterize exposure.

$$Dose_{total} = \frac{\left(\left[IR_{prey} \times C_{prey}\right] + \left[IR_{sediment} \times C_{sediment}\right]\right) \times SUF}{BW} \quad (4\text{-}1)$$

where:

$Dose_{total}$	=	Estimated dose from ingestion (mg/kg body weight per day)
IR_{prey}	=	Ingestion rate of prey (kilogram per day [kg/day])
C_{prey}	=	Concentration of chemical in prey (mg/kg)
$IR_{sediment}$	=	Ingestion rate of sediment (kg/day)
$C_{sediment}$	=	Concentration of chemical in sediment (mg/kg)
SUF	=	Site use factor (unitless), which is a ratio of site-specific area to receptor's foraging range (unitless)
BW	=	Body weight (kilogram) of receptor

Exposure assumptions were adapted for conditions at Parcel B to reduce uncertainty. However, sources of uncertainty may result from assumptions on bioavailability, diet proportions of receptors, food chain transfer, and other biological and physical factors and processes that influence exposure and toxicity at the shoreline. Estimated doses were obtained from relevant literature based on habitat, taxa, exposure route, and other ecological factors.

B4.1.3 Exposure Parameters for Dose Model

Exposure models for birds and mammals assume that exposure to chemicals is primarily through direct ingestion of prey and incidental ingestion of sediment during grooming, feeding, or burrowing (Beyer and others 1994). Exposure models estimate the mass of a chemical ingested daily by a receptor per kilogram of body weight (the daily chemical dose). Estimates of exposure are generally based on knowledge of the spatial and temporal distribution of both

chemicals and receptors and on specific natural and life history characteristics that influence exposure to chemicals. All doses calculated in this SLERA were based on a typical receptor and incorporated the life history parameters listed below.

- The *average* adult body weight found in the literature
- The *average* ingestion rate or the *average* adult body weight found in the literature to calculate the ingestion rate, using the appropriate equation from Nagy (2001)
- A conservative site use factor (SUF) of 1

Average values for exposure parameters, such as body weight and ingestion rate, were used to develop dose estimates because the assessment endpoint is the protection of populations rather than the individual. The exposure parameters used in modeling each of ecological receptor are presented in Section B4.2.

B4.1.4 Chemical Concentrations in Sediment and Tissue Samples

Exposure point calculations of chemicals in sediment surface and subsurface samples collected at the Parcel B shoreline were used in the dose calculations. One-half the detection limit was used when a chemical was not detected. No samples of prey tissue were collected from the shoreline. Instead, information on biotransfer factors from the terrestrial portion of Parcels E and E-2 documented in the Parcel E validation study was applied to the Parcel B shoreline (Tetra Tech and LFR 2000). This section focuses on estimates of tissue concentrations.

Organisms were targeted for tissue collection for the following reasons during the Parcel E validation study: (1) known occurrence in areas of interest, (2) diet and other life history parameters that would indicate likely exposure to soil, and (3) importance in diet of the selected bird or mammal. Tissue samples included plant stems and leaves, invertebrates in soil, lizards, and rodents. Tissue concentrations were converted from wet weight to dry weight using EPA's conversion factors (EPA 1993). BAFs were calculated based on site-specific soil and tissue concentrations. Those BAFs, as well as BAFs derived from the Parcel F (offshore) validation study using collocated data for *Macoma* tissue and sediment (Battelle and others 2002), were used to estimate tissue concentrations in prey used in the dose estimates for birds and mammals of interest in the shoreline habitat. BAFs are provided in Table B-9.

B4.2 Dose Parameters for Food Chain Model

Significant adverse effects on growth, survival, and reproduction or other endpoints that are critical to maintaining populations for each bird and mammal were the focus of this SLERA. The sections below discuss the information on natural history and exposure parameters used to develop dose estimates in the screening assessment for birds and mammals along the Parcel B shoreline. Tables B-10 through B-14 summarize the parameters used to calculate a dose for each bird and mammal under various exposure scenarios. Literature citations and the rationale used to select each value are provided below.

B4.2.1 Surf Scoter Dose Parameters

The surf scoter is a common winter resident of the San Francisco Bay from October through April. The surf scoter is common on large bays and marine waters along the entire California coast from late September to early May (Harvey and others 1992). They are 17 to 21 inches long and can usually be found resting in flocks on open ocean beyond the surf or in large bays (Udvardy 1977).

Surf scoters are omnivorous. Their main foods include bivalve and gastropod mollusks, crustaceans, and miscellaneous invertebrates. Fish, aquatic insects, and plant material are also eaten at times. Surf scoters feed by diving and taking food from the bottom of large bays or oceans just beyond breaking waves. Dives can be as shallow as 1.8 meters or as deep as 12 meters. Scoters primarily forage early and late in the day; however, some night foraging may occur (Zeiner and others 1990).

Surf scoters nest on dry land near quiet or slow-moving water in the northern lakes and tundra of Canada and Alaska (Palmer 1976). Brush or trees usually conceal nests. Scoters produce a single brood, with a clutch size ranging from five to nine eggs. Scoters can breed after 2 years (Zeiner and others 1990). The table below summarizes the parameters used in the dose calculations for the surf scoter.

Parameter	Average Adult	Unit	References and Comments
IR_{total}	0.0909	kg/day	Calculated using an average adult body weight of 1.150 kg using the equation for intake of dry matter as food by marine birds of a= 0.880; b= 0.658 (Nagy 2001)
$IR_{sediment}$	0.00273	kg/day	3 percent of IR_{total} based on maximum grit for white-winged scoters from Vermeer and Bourne (1984)
$C_{sediment}$	Shoreline analytical data	mg/kg	Sediment data collected from Parcel B shoreline; EPC equals maximum concentration or UCL_{95}
IR_{macoma}	0.0909	kg/day	100 percent of IR_{total} because diet was assumed to consist entirely of *Macoma* tissue
C_{macoma}	$C_{sediment}$ x BAF	mg/kg	Estimated using *Macoma* BAFs calculated for the Parcel F validation study using collocated data for *Macoma* tissue and sediment (Battelle and others 2002) (see Table B-16)
SUF	1	unitless	Conservative estimate based on 100 percent site use (EPA 1997).
Body Weight	1.15	kilogram	Average adult body weight from Ohlendorf and others (1985)

Total Ingestion Rate (IR_{total})

The total ingestion rate (IR_{total}) for the surf scoter was calculated using an average adult body weight of 1.15 kg using the equation for intake of dry matter as food by marine birds of a = 0.880; b = 0.658 (Nagy 2001). The IR_{total} was 0.0909 kg/day.

Sediment Ingestion Rate ($IR_{sediment}$)

Species-specific information on the rate of incidental sediment ingestion was not available for the surf scoter; however, a field study on the closely related white-winged scoter (*Melanitta fusca deglandi*) measured grit in the stomach contents of birds from four locations in British Columbia (Vermeer and Bourne 1984). In this study, birds at three of the four stations had between 1.5 and 3.2 grams of grit in their guts, with a mean of 2.3 grams. At the fourth station, scientists measured 20.8 grams of grit, made up mostly of gravel, in the guts. The station (Cumshewa Inlet) where scoters contained the most grit also was the station with a gravel substrate. An incidental $IR_{sediment}$ for the scoter of 0.00273 kg/day was used in the exposure model. The sediment ingestion rate represents 3 percent of the prey ingestion rate (0.0909 kg/day) and is based on similar sediment ingestion rates for diving ducks (Beyer and others 1994).

Sediment Concentrations ($C_{sediment}$)

EPCs were the maximum concentrations detected in the sediments for the appropriate depth range, 0 to 2 feet bgs or 2.5 to 4 feet bgs.

Macoma Ingestion Rate (IR_{macoma})

The average adult IR_{macoma} was equal to the IR_{total} because the diet of the surf scoter was assumed to consist of 100 percent *Macoma* tissue.

Macoma Concentrations (C_{macoma})

Macoma concentrations (prey) were estimated for each COPEC by multiplying concentrations in sediment by site-specific and literature-based BAFs (see Table B-9). Site-specific BAFs were calculated using data for *Macoma* tissue and collocated sediment collected for the Parcel F validation study (Battelle and others 2002). Literature BAFs were used where site-specific BAFs were not available.

Foraging Range and SUF

Based on ERA protocol from EPA (1997), a conservative estimate of 100 percent site use was applied in risk calculations for the surf scoter.

Body Weight

Male surf scoters are generally slightly heavier than females (Savard and others 1998). Data from wintering birds measured between 1986 and 1990 were evaluated to develop a reasonable average body weight (Savard and others 1998). The average body weight of adult males was 1.148 kilograms, and the average body weight of adult females was 1.047 kilograms, resulting in

an average of 1.15 kilograms. This average is the same as was measured in scoters from British Columbia (Vermeer 1981).

B4.2.2 Willet Dose Parameters

Shorebirds such as the willet feed on invertebrates by probing or plucking prey from shallow waters and sifting small crustaceans out of sandy sediments. Shorebirds may ingest chemicals in prey tissue as well as in sediment ingested incidentally while foraging because they feed on prey that is in close contact with sediments.

Willets are common winter residents along the California coast in intertidal mudflat habitats; they are less common on sandy marine shores and inland habitats. They are most common in estuarine habitats, salt emergent wetlands, and salt ponds in July through April. They are found from April to August (during the breeding season) on wet meadows in Modoc, Lassen, and Plumas Counties in California. Some willets stay in coastal habitats during the breeding season but do not nest (Zeiner and others 1990).

Willets feed day or night during ebb, low, and flood tides in coastal estuaries with intertidal mudflats during the nonbreeding season (September to March). Willets feed by a peck-probe method, eating mainly small crustaceans and mollusks. Some fish, polychaete worms, larval and pupal dipteran insects, and fish eggs are also sometimes eaten (Zeiner and others 1990). The table below summarizes the parameters used in the dose calculations for the willet.

Parameter	Average Adult	Unit	References and Comments
IR_{total}	0.0301	kg/day	Calculated using average adult body weight of 0.215 kg using the equation for intake of dry matter as food by marine birds (a= 0.880; b= 0.658) (Nagy 2001)
$IR_{sediment}$	0.0009	kg/day	3 percent of IR_{total} (Hui and Beyer 1998)
$C_{sediment}$	Shoreline analytical data	mg/kg	Sediment data collected from Parcel B shoreline; EPC equals maximum or UCL_{95}
IR_{prey} (equal to either IR_{macoma} or IR_{sbi})	0.0301	kg/day	100 percent of IR_{total} because diet was assumed to consist entirely of either *Macoma* or soft-bodied invertebrate tissue.
C_{prey} (equal to either C_{macoma} or C_{sbi}	$C_{sediment}$ x BAF	mg/kg	Concentrations estimated using site-specific invertebrate tissue BAFs from Table B-16 multiplied by the concentration in sediment ($C_{sediment}$)
SUF	1	unitless	Conservative estimate based on 100 percent site use (EPA 1997).
Body Weight	0.215	kilogram	Mean adult body weight from Dunning (1984)

Total Ingestion Rate (IR_{total})

The IR_{total} for the willet was calculated using an average adult body weight of 0.215 kilogram using the equation for intake of dry matter as food by marine birds of a = 0.880; b = 0.658 from Nagy (2001). The IR_{total} was 0.0301 kg/day.

Sediment Ingestion Rate ($IR_{sediment}$)

A literature review conducted in September 1999 by the Navy's Sediment Work Group identified a study by Hui and Beyer (1998) that estimated an incidental $IR_{sediment}$ for the willet of 3 percent. This value was multiplied by the daily ingestion rate to calculate a species-specific incidental $IR_{sediment}$ of 0.0009 kg/day.

Sediment Concentrations ($C_{sediment}$)

EPCs were estimated as the lesser of the maximum detected concentration and the UCL_{95} for each chemical.

Prey Ingestion Rate ($IR_{prey} = IR_{macoma}$ or IR_{sbi})

The average adult ingestion rate for prey (*Macoma* or soft-bodied invertebrates) was equal to the IR_{total} because the diet of the willet was assumed to consist of either 100 percent *Macoma* or 100 percent soft-bodied invertebrate tissue.

Prey Concentrations ($C_{prey} = C_{macoma}$ or C_{sbi})

Prey (*Macoma* or soft-bodied invertebrates) concentrations were estimated for each COPEC by multiplying concentrations in sediment by site-specific and literature-based BAFs (see Tables B-11 and B-12). Site-specific BAFs were calculated using data for *Macoma* or soft-bodied invertebrate tissue and collocated sediment collected for the Parcel F validation study (Battelle and others 2002). Literature BAFs were used where site-specific BAFs were not available. Separate doses were calculated for each prey item.

Foraging Range and SUF

Based on ERA protocol from EPA (1997), a conservative estimate of 100 percent site use was applied in risk calculations for the willet.

Body Weight

The dose model for the willet used a body weight of 0.215 kilogram and was based on a study of 41 adult willets of both sexes (Dunning 1984). Both male and female body weights fall within the range considered a realistic representation for the willet.

B4.2.3 Red-Tailed Hawk Dose Parameters

Raptors may be exposed to chemicals in sediment in Parcel B shoreline while foraging on small mammal prey. The red-tailed hawk is known to occur in the area. It was selected as the representative raptor because it is the most common large raptor in the area and a substantial body of natural history and toxicological literature is available.

The red-tailed hawk is the most common hawk in North America, preferentially inhabiting open grasslands, woodlands, wetlands, and pastures with scattered trees and woods. Red-tailed hawks are swooping, pouncing carnivores with a diet that consists of small mammals, insects, earthworms, reptiles, and amphibians (Ehrlich and others 1988; Zeiner and others 1990). The table below summarizes the parameters used in the dose calculations for the red-tailed hawk.

Parameter	Average Adult	Unit	References and Comments
IR_{total}	0.119	kg/day	Derived from EPA's "Wildlife Exposure Factors Handbook" (EPA 1993)
$IR_{sediment}$	0.00047	kg/day	0.4 percent of IR_{total} based on the rate for the American kestrel (Pascoe and others 1996)
$C_{Sediment}$	Shoreline analytical data	mg/kg	Sediment data collected from Parcel B shoreline; EPC equals UCL_{95}
IR_{mouse}	0.119	kg/day	100 percent of IR_{total} because diet was assumed to consist entirely of mice
C_{mouse}	$C_{sediment}$ x BAF	mg/kg	Concentrations estimated using site-specific mouse tissue BAFs from Table B-16 multiplied by $C_{sediment}$.
Tissue Moisture	68	per cent	Mouse tissue moisture intake from EPA (1993)
SUF	1	unitless	Conservative estimate based on 100 percent site use (EPA 1997).
Body Weight	1.204	kilogram	Average body weight from EPA (1993)

Total Ingestion Rate (IR_{total})

The IR_{total} for the red-tailed hawk was derived from data in EPA's "Wildlife Exposure Factors Handbook" (EPA 1993). These values were used to calculate a mean IR of 0.099 gram per gram per day (g/g/day). The ingestion rate was converted to kg/day (IR_{total} [g/g/day] times body weight [grams]/1,000) using the mean female body weight (as discussed below). The IR_{total} for the red-tailed hawk is 0.119 kg/day.

Sediment Ingestion Rate ($IR_{sediment}$)

The incidental $IR_{sediment}$ for the red-tailed hawk was based on the value for the American kestrel as a percentage of the IR_{total}. The incidental soil ingestion rate for the American kestrel represents about 0.4 percent of its IR_{total}. The same percentage was used for the red-tailed hawk to derive an incidental $IR_{sediment}$ of 0.00047 kg/day.

Sediment Concentrations ($C_{sediment}$)

EPCs were estimated as the lesser of the maximum detected concentration and the UCL_{95} for each chemical.

Mouse Ingestion Rate (IR_{mouse})

The IR_{mouse} was equal to the IR_{total} because the diet of the red-tailed hawk was assumed to consist of 100 percent small mammals.

Mouse Concentrations (C_{mouse})

C_{mouse} values were estimated for each COPEC by multiplying concentrations in sediment by site-specific and literature-based BAFs (see Table B-9). Site-specific BAFs were calculated using data for mouse tissue and collocated sediment collected for the Parcel E validation study (Tetra Tech and LFR 2000). Literature BAFs were used where site-specific BAFs were not available.

Foraging Range and SUF

Based on ERA protocol from EPA (1997), a conservative estimate of 100 percent site use was applied in risk calculations for the red-tailed hawk.

Body Weight

A single value for the body weight of the red-tailed hawk was selected from the range of female body weight values presented in EPA's "Wildlife Exposure Factors Handbook" (EPA 1993). The mean female body weight used in the dose model was 1.204 kilograms.

B4.2.4 House Mouse Dose Parameters

The house mouse is an omnivorous rodent that may be exposed to chemicals in sediment and food items in the Parcel B shoreline. It is expected to occur in Parcel B.

The house mouse was selected as a representative receptor because it was the most common small mammal trapped during the surveys. The relevant natural history parameters of this species are well characterized in the literature, and adequate toxicological data are available.

The house mouse is a small-bodied omnivore common throughout California, preferentially inhabiting buildings but also found in fields (Burt and Grossenheider 1980). The house mouse was selected for evaluating risks to mammals from ingestion of contaminated plants (seeds, leaves, and stems), invertebrates, and sediment. The table below summarizes the parameters used in the dose calculations for the house mouse.

Parameter	Average Adult	Unit	References and Comments
IR_{total}	0.0045	kg/day	Calculated based on mean adult deer mouse ingestion rate of 0.268 g/g/day (EPA 1993); IR converted to kg/day using the following equation: IR_{total} (g/g/day) * BW (grams) / 1,000
$IR_{sediment}$	0.00009	kg/day	2.0 percent of IR_{total} (EPA 1999b)
$C_{sediment}$	Shoreline analytical data	mg/kg	Sediment data collected from site; EPC equals UCL_{95}
IR_{seed}	0.0036	kg/day	IR_{seed} was estimated as 80 percent of IR_{total} based on the fraction of the diet assumed to be composed of seeds (EPA 1999b).
IR_{stem}	0.00033	kg/day	IR_{stem} was estimated as 7.4 percent of IR_{total} based on the fraction of the diet assumed to be composed of stems (EPA 1999b).
IR_{invert}	0.00057	kg/day	IR_{invert} was estimated as 12.7 percent of IR_{total} based on the fraction of the diet assumed to be composed of invertebrates (EPA 1999b).
C_{prey} (C_{seed} and C_{stem} and C_{invert})	$C_{sediment}$ x BAF	mg/kg	Concentrations estimated using site-specific plant and invertebrate tissue BAFs from Table B-16 multiplied by $C_{sediment}$
Tissue Moisture	37.5	percent	Site-specific seed tissue moisture from Tetra Tech and LFR (2000)
	72.3	percent	Site specific stem and leaf moisture from Tetra Tech and LFR (2000)
	69	percent	Invertebrate tissue moisture from EPA (1993)
SUF	1.0	unitless	Based on home range information compared with size of Parcel E shoreline; home range = 0.435 acre (California Environmental Protection Agency 1999). Also, conservative estimate based on 100 percent site use (EPA 1997).
Body Weight	0.01693	kilogram	Mean adult body weight from site-specific data (Tetra Tech and LFR 2000)

Total Ingestion Rate (IR_{total})

The IR_{total} for the house mouse was calculated based on ingestion data for the deer mouse (EPA 1993). These ingestion rates are for breeding and nonbreeding males and females. The mean available ingestion rate for the deer mouse is 0.268 g/g/day. The IR_{total} was converted to kg/day by applying the following equation.

$$\frac{IR_{total}\ (g/g/day) \times BW\ (grams)}{1{,}000} \qquad (4\text{-}2)$$

Body weight was obtained from field data. The resulting IR_{total} was 0.0045 kg/day for the adult house mouse.

Sediment Ingestion Rate ($IR_{sediment}$)

Incidental $IR_{sediment}$ was based on one study that measured the proportion of insoluble ash in the gastrointestinal tract and feces of rodents (EPA 1993). The incidental $IR_{sediment}$ was estimated at

2 percent of the IR_{total} for white-footed mice. This percentage was used to derive an incidental $IR_{sediment}$ of 0.00009 kg/day.

Sediment Concentrations ($C_{sediment}$)

EPCs were estimated as the lesser of the maximum detected concentration and the UCL_{95} for each chemical.

Prey Ingestion Rate ($IR_{prey} = IR_{seed} + IR_{stem} + IR_{invert}$)

The dose estimate model was refined so that the term "prey" specifically refers to seeds, stems, and leaves, and invertebrates to estimate the potential exposure of house mice to chemicals. Ingestion rates for these food types were calculated using data on dietary composition for the deer mouse from a study conducted in a Colorado grassland prairie (EPA 1993). The deer mouse study expressed dietary composition as percent volume of stomach contents. This SLERA assumed percent volume equaled percent mass; therefore, the percent volume from the deer mouse study was used to calculate ingestion rates for prey items.

Seeds are estimated to represent 42.65 percent of stomach contents by volume for the adult house mouse (averaged across four seasons). Based on this value and the IR_{total} of 0.0045 kg/day for adult house mice, the IR_{seed} is 0.0019 kg/day. Stems and leaves are estimated to represent 3.95 percent of stomach contents by volume (averaged across four seasons). Based on this value, IR_{stem} (including leaves) is 0.00018 kg/day. Invertebrates were estimated to represent 6.875 percent of the stomach contents by volume, resulting in a daily IR_{invert} of 0.00031 kg/day. The sum of ingestion rates of the various prey items (0.0024 kg/day) is less than the IR_{total} for the house mice (0.0045 kg/day). The unclassified portion of the ingestion rate (0.0045 kg/day minus 0.0024 kg/day equals 0.0021 kg/day) was prorated proportionately as a function of the relative percentage of stomach contents. Using this prorating method, the daily IR_{seed} is 0.0019 kg/day plus 0.0017 kg/day, or 0.0036 kg/day. The daily IR_{stem} (including leaves) is 0.00018 kg/day plus 0.00015 kg/day, or 0.00033 kg/day. The daily IR_{invert} is 0.00031 kg/day plus 0.00026 kg/day, or 0.00057 kg/day.

Prey Concentrations ($C_{prey} = C_{seed}$ and C_{stem} and C_{invert})

The house mouse is primarily omnivorous, with a diet that consists of terrestrial insects, fruits, and berries (California Environmental Protection Agency 1999). Concentrations of chemicals in tissues of plants and invertebrates were estimated by multiplying concentrations in soil by site-specific and literature-based BAFs (see Table B-9). Site-specific BAFs were calculated using data for plants and invertebrate tissue and collocated soil collected for the Parcel E ERA validation study (Tetra Tech and LFR 2000). Literature BAFs were used where site-specific BAFs were not available.

Foraging Range and SUF

The SUF accounts for the size of the area of concern compared with the foraging range used by the receptor species. If the area of the habitat used in the area of concern is larger than the foraging range of the species, it is likely that individuals may spend 100 percent of their time there. The SUF is calculated by dividing the habitat in the area of concern by the estimated home range. The home range of the house mouse, as reported by California Environmental Protection Agency (1999), is about 0.435 acre; therefore, the SUF for the house mouse was set at 1.0 for the dose calculation, meaning that the mouse spends 100 percent of its foraging time at Parcel B.

Body Weight

Mean weight calculations for the house mouse were derived from field data (Tetra Tech and LFR 2000). House mice were identified as adults based on visual observations in the field, including general size and the presence or absence of external genitalia in captured individuals. The body weight of each adult mouse collected in the field was used to calculate a mean adult body weight of 0.01693 kilogram.

B4.3 TOXICITY REFERENCE VALUES AND HAZARD QUOTIENT INTERPRETATION

Site-specific daily dose estimates were compared with high and low TRVs to estimate the potential adverse biological effects on each receptor. The risk to representative receptors was characterized based on this comparison; this comparison was carried out in a manner consistent with EPA's HQ methodology (EPA 1998), as follows:

$$HQ = \frac{Dose}{TRV} = \frac{(mg / kg - day)}{(mg / kg - day)} \qquad (4\text{-}3)$$

where:

HQ	=	Hazard quotient (unitless)
Dose	=	Chemical-, receptor-, and site-specific daily dose estimate (mg/kg per day [mg/kg-day])
TRV	=	Chemical- and receptor-specific toxicity reference value (mg/kg-day)

B4.3.1 TRVs

TRVs used in the SLERA were derived primarily from the Navy-BTAG working group (Navy 1998); when a TRV was not available from this source, TRVs from Sample and others (1996) were used. Each TRV represents a critical exposure level from a toxicological study and is supported by a data set of toxicological exposures and effects. A low TRV is a conservative value consistent with a chronic no-effects level. A high TRV represents a mid-range of LOAELs for a chemical, where the endpoint of toxicity was ecologically relevant.

Raw TRVs derived for mammals and birds were adjusted for each site-specific receptor of concern based on body scaling (allometric conversion). The underlying assumption of allometric conversion is that physiological processes such as metabolism are a function of body size (Opresko and others 1993). Allometric conversions assume that smaller animals have higher metabolic rates and are typically able to detoxify or eliminate ingested chemicals more quickly than can larger animals (Opresko and others 1993; Sample and others 1996). The following allometric conversion equations by Sample and Arenal (1999) were used for this food chain model.

$$Birds \quad TRV_{receptor} = TRV_{test\ organism}\ (Body\ Weight_{test\ organism} / Body\ Weight_{receptor})^{1 - 1.2} \qquad (4\text{-}4)$$

$$Mammals \quad TRV_{receptor} = TRV_{test\ organism}\ (Body\ Weight_{test\ organism} / Body\ Weight_{receptor})^{1 - 0.94} \qquad (4\text{-}5)$$

TRVs for each chemical (presented in Table B-6) were allometrically converted for each of the representative receptors using the appropriate equation for birds or mammals. Adjusted TRVs are shown in each dose calculation table (see Tables B-10 through B-14).

B4.3.2 Hazard Quotient Approach

As discussed in the guidance (EPA 1998), receptors may be at risk if the HQ exceeds 1.0. Because of differences in the degree of conservatism in selecting TRVs for various chemicals and receptors, resulting HQ values should not be compared between chemicals or receptors or summed in a hazard index; instead, HQs should be considered individually.

Risk posed by typical site-specific dose estimates lower than the low TRV is not considered significant because the typical dose is designed to reflect risk to the average receptor at the site. Dose estimates greater than the high TRV indicate potential significant risk to the average receptor. Dose estimates between the low and high TRVs cannot be easily characterized and represent some potential for risk to the average receptor.

The interpretation of each HQ is summarized in the table below.

HQ = Dose/TRV	Low TRV	High TRV	Between Low and High TRV
Average Dose	$HQ_{(dose/low\ TRV)}$ <1.0 indicates little or no risk to average receptor	$HQ_{(dose/high\ TRV)}$ > 1.0 indicates potential significant risk to average receptor	$HQ_{(dose/high\ TRV)}$ < 1.0 and $HQ_{(dose/low\ TRV)}$ > 1.0 indicates potential for risk to average receptor

Tables B-10 through B-14 present the complete dose calculations for birds and mammals. Tables B-15 and B-16 summarize the HQ information and identify HQs greater than 1.0 calculated for specific chemical-receptor pairs.

B4.4 RISK ESTIMATES

This section presents the calculation of estimated risk to birds (see Section B4.4.1) and mammals (see Section B4.4.2).

B4.4.1 Risk to Birds

Daily chemical doses were estimated for the surf scoter, willet, and red-tailed hawk for the Parcel B shoreline based on life history and foraging habits. Daily dose estimates for the average receptor for each chemical were then compared with low and high TRVs to calculate HQs. Tables B-10 through B-13 provide dose calculations for birds under specific exposure scenarios. Tables B-15 and B-16 summarize the bird HQs for surface (0 to 2 feet bgs) and subsurface (2.5 to 4.0 feet bgs) sediment.

Of the chemicals evaluated, the following were retained as COPECs based on HQs greater than 1.0 using the high or low TRV for at least one of the bird receptors.

For surface (0 to 2 feet bgs) and subsurface (2.5 to 4 feet bgs) sediments:

- Aluminum
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Thallium
- Zinc
- Total Aroclors
- Total DDT
- Dieldrin
- Methoxychlor

For surface sediment only:

- Arsenic
- Barium
- Manganese
- Heptachlor epoxide
- Tetrabutyltin
- Tributyltin

For subsurface sediment only:

- Molybdenum

Additionally, the following COPECs were retained by default based on the absence of TRVs: antimony, beryllium, cobalt, silver, 4-methylphenol, 4-nitrophenol, azobenzene, benzoic acid, benzyl alcohol, dibenzofuran, HMW PAHs, LMW PAHs, pentachlorophenol, and phenol. These COPECs are discussed further in Section B5.1, Refinement of COPECs.

B4.4.2 Risk to Mammals

Daily dose estimates were calculated for the house mouse for the Parcel B shoreline based on life history and foraging habits. Daily dose estimates for the average receptor for each chemical were then compared with low and high TRVs to calculate HQs (see Table B-14). Tables B-15 and B-16 summarize the mammal HQs.

Of the chemicals evaluated, the following were retained as COPECs based on HQs greater than 1.0 using the high or low TRV for the house mouse.

For surface (0 to 2 feet bgs) and subsurface (2.5 to 4 feet bgs) sediments:

- Aluminum
- Antimony
- Barium
- Cadmium
- Copper
- Lead
- Manganese
- Molybdenum
- Nickel
- Vanadium
- Zinc
- Total Aroclors

For surface sediment only:

- Arsenic
- Cobalt

For subsurface sediment only:

- Total HMW PAHs

The following chemicals were retained by default based on the absence of TRVs: silver, 4-methylphenol, 4-nitrophenol, azobenzene, benzoic acid, benzyl alcohol, dibenzofuran, and phenol.

These COPECs are further evaluated in Section B5.1, Refinement of COPECs.

B5.0 RISK CHARACTERIZATION

EPA's "Risk Characterization Handbook" describes risk characterization as "a conscious and deliberate process to bring all important considerations about risk, both the likelihood of the risk but also the strengths and limitations of the assessment and a description of how others have assessed the risk into an integrated picture," (EPA 2000b). Risk characterization must summarize strengths and limitations and results of the risk assessment in a social, legal, and economic context to support discussions with other stakeholders, including the public (EPA 2000b). The risk characterization "conveys the risk assessor's judgment as to the nature and existence of (or lack of) ecological risks" (EPA 2000b). In addition, risk characterization must adhere to principles of transparency, clarity, consistency, and reasonableness.

Risk characterization integrates information from the exposure and effects assessments to evaluate relationships between chemical exposure and the expression of ecological effects (EPA 1997). This integration relies primarily on weight-of-evidence arguments that evaluate all lines of evidence introduced into the risk assessment. Discussion of uncertainties at each level of the risk assessment is another key aspect of risk characterization.

The two components of risk characterization are risk estimation and risk description. Risk estimation integrates exposure profiles for each receptor group with information on effects and summarizes the associated uncertainties. Risk description presents the information necessary for interpreting risk results and identifies thresholds for defining adverse effects for each assessment endpoint.

The risk characterization considers the science of risk assessment as well as the policy and other decisions that were made by the risk assessment team (EPA 2000b). Decisions about what media to sample and where to collect samples along the Parcel B shoreline were based in part on policy considerations, including limitations of time and budget. Likewise, some decisions were deferred to standard practice in EPA Region 9, including development of HPALs, use of San Francisco Bay ambient concentrations, and the TRVs used in this risk assessment. However, most decisions were made specifically to achieve the highest level of confidence in the conclusions of the SLERA in the context of previous and ongoing remedial work at HPS.

This section characterizes risk to all assessment endpoints at the Parcel B shoreline. The key findings, assumptions, strengths, and limitations of the risk assessment attributable to exposure to chemical stressors at a site are discussed in the context of the ecological significance of predicted effects. Ecological significance is a measure of the degree to which eliminating an estimated risk will make a difference, given the other dynamic factors operating in the environment (EPA 2000b). Section B5.1 discusses the refinement of COPECs for the Parcel B shoreline. Section B5.2 discusses uncertainty in the SLERA. Section B5.3 summarizes the risk assessment conclusions based on ecological relevance and implications for risk management.

B5.1 REFINEMENT OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

EPA guidance on conducting ERAs recommends that the list of COPECs be reevaluated in the problem formulation step of the baseline ecological risk assessment (BERA) to account for site-specific and regional conditions (EPA 2001). In addition, Navy guidance indicates that an intermediate refinement step may be conducted (Step 3a) if the SLERA indicates unacceptable or uncertain risk (Navy 1999). Step 3a reevaluates the conservative exposure assumptions of the SLERA to identify potential risks and includes a comparison of site concentrations with regional ambient concentrations of chemicals, as required under Navy policy during problem formulation of the BERA (Navy 2000).

The steps to refining the COPECs in sediment are provided below.

1. Revise EPCs from maximum concentrations to the lesser of the UCL_{95} or maximum concentration to reflect exposure assumptions that are more realistic for the Parcel B shoreline as described in Section B2.2.1.

2. Compare EPCs with regional ambient concentrations – COPECs with EPCs above regional ambient concentrations or without regional ambient concentrations were retained as COPECs (see Section B5.1.1).

3. Calculate refined HQs for remaining COPECs using revised EPCs – COPECs with refined HQs greater than 1 were retained (see Sections B5.1.2.3 and B5.1.3).

The steps to refining the COPECs in water are provided below.

1. Compare detected concentrations of COPECs in groundwater with regional ambient concentrations – COPECs with detected concentrations above regional ambient concentrations were retained (see Section B5.1.1).

2. Calculate refined HQs for remaining COPECs in groundwater using the screening value and evaluate the magnitude and frequency of detection – COPECs with refined HQs greater than 1 were retained (see Section B5.1.2.3).

This section discusses the refinement of COPECs based on a comparison of revised EPCs with regional ambient concentrations and recalculated HQs using the revised EPCs. This refinement of COPECs represents the initial step of the BERA problem formulation (Step 3a), described in Section B1.0.

B5.1.1 Comparison of Site Sediment and Groundwater Concentrations with Regional Ambient Concentrations

Concentrations of chemicals in sediment and groundwater were compared with ambient concentrations from three data sets to refine COPECs at the Parcel B shoreline. These data sets are presented below.

- Hunters Point ambient levels (HPAL) (PRC 1995) – EPCs for inorganic COPECs in sediment were compared with HPALs to identify COPECs with concentrations greater than ambient concentrations.

- San Francisco Bay ambient sediment data (Water Board 1998a; Eco Analysis 1998) – EPCs for organic COPECs in sediment were compared with regional ambient concentrations of chemicals in San Francisco Bay.

- Hunters Point groundwater ambient levels (HGAL) (PRC 1996) – Concentrations of COPECs in groundwater were compared to HGALs to identify COPECs with concentrations greater than ambient concentrations.

The following sections describe all the comparisons of sediment and groundwater data with the three ambient data sets.

B5.1.1.1 Comparison of Inorganic Chemical Concentrations in Sediment with HPALs

The objective of the comparison of concentrations in sediment with HPALs was to identify the inorganic chemicals at the Parcel B shoreline that could be considered sources of contamination and so would require investigation under CERCLA. Concentrations in sediment were compared with HPALs for inorganic chemicals in accordance with Navy guidance (Navy 2000).

Inorganic chemicals were retained as a COPEC if the EPC exceeded the HPAL. Inorganic chemicals were dropped from further consideration when the EPC was less than the HPAL. Chemicals were retained by default when no ambient concentrations were available. Tables B-17 and B-18 present the comparison of the refined EPCs for surface and subsurface soils with HPAL.

Concentrations of copper, lead, thallium, and zinc exceeded HPALs in surface sediments at the Parcel B shoreline. Concentrations of cadmium, copper, lead, molybdenum, thallium, and zinc exceeded HPALs in subsurface sediments. These chemicals were retained as COPECs along with aluminum that does not have an HPAL. Concentrations of antimony, arsenic, barium, beryllium, chromium, cobalt, manganese, mercury, nickel, selenium, silver, and vanadium in surface and subsurface sediments were less than the HPALs; therefore, these chemicals were dropped from further consideration. In addition, concentrations of cadmium and molybdenum in surface sediments were less than HPALs; therefore, these chemicals were not retained as COPECs in surface sediment.

B5.1.1.2 Comparison of Chemical Concentrations in Sediment with San Francisco Bay Ambient Sediment Concentrations

Sediment in the Parcel B shoreline is in direct contact with surface water and sediment of San Francisco Bay through twice-daily tidal exchange. Therefore, EPCs in sediment at Parcel B sediment were compared with ambient concentrations in fine-grained sediments of San Francisco Bay to focus the risk assessment on chemicals that likely originated at the shoreline (Water Board 1998a). Ambient concentrations from the Water Board are available for 10 inorganic chemicals, total PAHs, PCBs, and selected chlorinated pesticides. Tables B-17 and B-18 present the comparison of the refined EPCs for surface and subsurface soils to ambient fine-grain sediment concentration.

Concentrations for all COPECs in sediment were higher in samples from the Parcel B shoreline than the San Francisco Bay ambient concentrations (Water Board 1998a), except for several individual PAH congeners. However, the total HMW and LMW PAH concentrations exceeded the San Francisco Bay ambient concentrations; therefore, no chemicals were eliminated as COPECs based on the ambient screen.

B5.1.1.3 Comparison of Chemical Concentrations in Groundwater with HGALs

The objective of the comparison of concentrations in groundwater with HGALs was to identify the inorganic chemicals at the Parcel B shoreline that could be considered sources of contamination. Concentrations in groundwater were compared with HGALs for inorganic chemicals in accordance with Navy guidance (Navy 2000). HGALs were available for eight COPECs identified for groundwater. Results of the comparison of HGALs with EPCs established for groundwater are summarized below.

Detected concentrations of arsenic in two groundwater samples exceeded the HGAL for arsenic of 27.3 micrograms per liter (µg/L). Detected concentrations of copper in four groundwater samples exceeded the HGAL for copper of 28.0 µg/L. Detected concentrations of lead in five groundwater samples exceeded the HGAL for lead of 14.4 µg/L. Detected concentrations of mercury in 10 groundwater samples exceeded the HGAL for mercury of 0.60 µg/L. Detected concentrations of selenium in six groundwater samples exceeded the HGAL for selenium of 14.5 µg/L. Detected concentrations of zinc in eight groundwater samples exceeded the HGAL for zinc of 75.7 µg/L. As a result, arsenic, copper, lead, mercury, selenium, and zinc were retained as COPECs for aquatic receptors.

The detected concentrations of nickel and silver in groundwater samples did not exceed HGALs of 96.5 µg/L (nickel) and 7.4 (silver). As a result, nickel and silver were not retained as COPECs for aquatic receptors.

B5.1.2 Refinement of COPECs for Benthic Invertebrates

Risks to benthic invertebrates exposed to sediment and groundwater via surface water at the Parcel B shoreline were further refined for COPECs retained after comparison of site concentrations with regional ambient concentrations. Risks from COPECs in sediment were evaluated quantitatively by comparing EPCs (equal to the lesser of the UCL_{95} or the maximum concentration) in surface and subsurface sediment with ER-M values. Chemicals that exceeded the ER-M were considered COPECs for benthic invertebrates. Table B-19 presents refined HQs for benthic invertebrates.

Risks to aquatic receptors from COPECs in groundwater were evaluated quantitatively by calculating refined HQs using screening criteria. Additional lines of evidence used in refining COPECs in groundwater included the frequency and magnitude of detections in samples collected from the 16 Parcel B shoreline wells over the 12 sampling events.

B5.1.2.1 Surface Sediment

Refined EPCs for copper, lead, total Aroclors, 4,4'-DDT, total DDT, and dieldrin in surface sediment exceeded ER-M values (see Table B-19). As shown in the table below, HQs for these chemicals ranged from 1.03 (lead) to 10.5 (DDT).

Hazard Quotients Greater than 1.0 for Invertebrates in Surface Sediment	
Chemical of Potential Ecological Concern	**Hazard Quotient based on Exposure Point Concentration[a]**
Copper	1.14
Lead	1.03
Total Aroclors	6.14
DDT	10.5
Total DDT	2.02
Dieldrin	1.94

Notes:

a Exposure point concentration is the lesser of the maximum concentration detected or the calculated UCL_{95}.

Total Aroclors Sum of Aroclors

Total DDT Sum of DDT and its metabolites (DDD and DDE)

EPCs for zinc and phenanthrene did not exceed ER-M values. As a result, copper, lead, total Aroclors, DDT, total DDT, and dieldrin were retained as primary COPECs for benthic invertebrates.

B5.1.2.2 Subsurface Sediment

EPCs for copper, lead, zinc, total Aroclors, 4,4-DDT, total DDT, dieldrin, and dibenz(a,h)anthracene in subsurface sediment exceeded ER-M values (see Table B-19). As shown in the table below, HQs for these chemicals ranged from 1.10 (zinc) to 16.7 (total Aroclors).

Hazard Quotients Greater than 1.0 for Invertebrates in Subsurface Sediment	
Chemical of Potential Ecological Concern	**Hazard Quotient based on Exposure Point Concentration[a]**
Copper	15.4
Lead	2.22
Zinc	1.10
Total Aroclors	16.7
4,4-DDT	15.4
Total DDT	2.86
Dieldrin	3.36
Dibenz(a,h)anthracene	1.42

Notes:

a Exposure point concentration is the lesser of the maximum concentration detected or the calculated UCL_{95}.

Total Aroclors Sum of Aroclors

Total DDT Sum of DDT and its metabolites (DDD and DDE)

EPCs for DDE, benzo(a)anthracene, benzo(a)pyrene, chrysene, phenanthrene, pyrene, and total HMW PAHs did not exceed ER-M values. As a result, copper, lead, zinc, total Aroclors, DDT, total DDT, dieldrin, and dibenz(a,h)anthracene were retained as primary COPECs for benthic invertebrates.

B5.1.2.3 Groundwater

HQs for chemicals in groundwater were greater than 1.0 for arsenic, copper, lead, mercury, selenium, zinc, alpha-chlordane, endrin aldehyde, gamma-chlordane and heptachlor (see Table B-20). The paragraphs below provide a detailed discussion of the risk evaluation for COPECs with refined HQs greater than 1.0. Figures B-1 and B-2 show the locations of the groundwater monitoring wells used in the analysis of groundwater chemical concentrations that is discussed below. Attachment B1 contains tables and figures that support the following discussion.

COPECs with HQs Greater than 1.0

Arsenic was detected in at least one sample collected from each well. However, the detected concentration of arsenic (estimated at 38 µg/L) exceeded the water screening value for protection of aquatic life (36 µg/L) in only one sample (collected in September 2004 from well IR07MW21A1) and resulted in a refined HQ only slightly greater than 1. The result for this sample was more than six times higher than the next highest concentration from this well, suggesting that this single detection was an anomaly. The arsenic concentration in the subsequent sample collected in November 2004 from well IR07MW21A1 was less than the screening value. Figure B1-1 illustrates the range of arsenic concentrations in groundwater. Table B1-1 presents data for arsenic concentrations in groundwater. Arsenic was not retained as a COPEC for aquatic receptors because of the low frequency of detection and the low magnitude of the refined HQ.

Copper was detected in 24 samples collected from 14 wells. Copper concentrations are compared to the HGAL (28 µg/L) because it is greater than the water screening value for protection of aquatic life. Detected concentrations of copper in four samples from four different wells (PA50MW01A, IR07MW26A, IR10MW31A1, and IR26MW47A) resulted in HQs greater than 1. The two greatest HQs resulted from detected concentrations in samples collected in June 2002 at wells IR26MW47A and PA50MW01A. However, subsequent samples collected from both wells over the next 2 years resulted in much lower concentrations (refined HQs less than 1). The concentration of copper measured at well IR07MW26A (collected in September 2004) resulted in an HQ only slightly greater than 1; copper was not detected in the sample collected at well IR07MW26A in November 2004. The concentration of copper measured at well IR10MW31A1 (collected in August 1990) resulted in an HQ only slightly greater than 1; copper was not detected in the subsequent samples collected at well IR10MW31A1 in 1991 and 1992. Figures B1-2a and B1-2b illustrate the range of copper concentrations in groundwater. Table B1-2 presents data for copper concentrations in groundwater. Copper was not retained as a COPEC for aquatic receptors because detected concentrations that resulted in refined HQs greater than 1 were infrequent and sporadic.

Lead was detected in 10 samples collected from nine wells. Lead concentrations are compared to the HGAL (14.4 µg/L) because it is greater than the water screening value for protection of aquatic life. The detected concentrations in five samples from five different wells (IR07MWS-2, IR07MWS-4, IR07MW25A, IR07MW26A, and IR26MW48A) resulted in refined HQs slightly greater than 1. All of these samples were collected in September 2004. However, subsequent samples collected from all wells resulted in lower concentrations (so that refined HQs were less than 1). Figures B1-3a and B1-3b illustrate the range of lead concentrations in groundwater. Table B1-3 presents data for lead concentrations in groundwater. Lead was not retained as a COPEC for aquatic receptors because detected concentrations that resulted in refined HQs above 1 were infrequent and sporadic.

Mercury was detected in 30 samples from 11 wells. Mercury concentrations are compared to the HGAL (0.6 µg/L) because it is greater than the water screening value for protection of aquatic life. The 11 samples with the greatest detected concentrations were collected from well IR26MW47A. Detected concentrations in 10 samples resulted in a HQ greater than 1. Figure B1-4 illustrates the range of mercury concentrations in groundwater. Table B1-4 presents data for mercury concentrations in groundwater. As a result of consistent detections above the HGAL, mercury was retained as a COPEC for aquatic receptors.

Selenium was detected in 19 samples collected from 12 wells. Selenium concentrations are compared with the HGAL (14.5 µg/L) because it is greater than the water screening value for protection of aquatic life. The detected concentrations in six samples from five different wells (IR07MWS-2, IR07MW19A, IR07MW20A1, IR07MW26A, and IR10MW31A1) resulted in refined HQs greater than 1. Selenium was not detected in subsequent samples collected from all five wells. Figure B1-5 illustrates the range of selenium concentrations in groundwater. Table B1-5 presents data for selenium concentrations in groundwater. Selenium was not retained as a COPEC for aquatic receptors because detected concentrations that resulted in refined HQs above 1 were infrequent and sporadic.

Zinc was detected in 31 samples collected from 15 wells. However, the detected concentrations of zinc exceeded the water screening value for protection of aquatic life (81 µg/L) in seven samples collected from six wells (IR07MW21A1D, IR07MW24AD, IR07MW26AD, IR07MWS-4DD, IR26MW45A, and PA50MW01A). In all cases, subsequent samples collected from the same wells were less than the screening value. Figures B1-6a and B1-6b illustrate the range of zinc concentrations in groundwater. Table B1-6 presents data for zinc concentrations in groundwater. Zinc was not retained as a COPEC for aquatic receptors because of the low frequency of detection.

Alpha-chlordane was detected in only 3 samples collected from the 16 shoreline wells (IR26MW46A and IR26MW47A). Subsequent samples collected from both wells resulted in no detections of alpha-chlordane. Table B1-7 presents data for alpha-chlordane concentrations in groundwater. Alpha-chlordane was not retained as a COPEC for aquatic receptors because of the low frequency of detection.

Endrin aldehyde was detected in only 1 sample collected from the 16 shoreline wells (IR26MW48A). Subsequent samples collected from this well resulted in no detections of endrin aldehyde. In addition, the concentration of endrin aldehyde based on this single sample resulted in a refined HQ (1.1) only slightly greater than 1. Table B1-8 presents data for endrin aldehyde

concentrations in groundwater. Endrin aldehyde was not retained as a COPEC for aquatic receptors because of the low frequency of detection and the low magnitude of the refined HQ.

Gamma-chlordane was detected in only 1 sample collected from the 16 shoreline wells (IR26MW46A). Subsequent samples collected from this well resulted in no detections of gamma-chlordane. Table B1-9 presents data for gamma-chlordane concentrations in groundwater. Gamma-chlordane was not retained as a COPEC for aquatic receptors because of the low frequency of detection.

Heptachlor was detected in only 2 samples collected from the 16 shoreline wells (IR26MW47A and IR26MW48A). Subsequent samples collected from both wells resulted in no detections of heptachlor. Table B1-10 presents data for heptachlor concentrations in groundwater. Heptachlor was not retained as a COPEC for aquatic receptors because of the low frequency of detection.

B5.1.2.4 Summary of Risk Characterization for Benthic Invertebrates along the Parcel B Shoreline

Sediment in the intertidal area of the shoreline is perennially wet and is assumed to provide year-round habitat to benthic invertebrates. Any HQ greater than 1.0 is considered to warrant further evaluation because the ER-M represents a probable effects concentration.

Copper, lead, zinc, total Aroclors, 4,4-DDT, total DDT, dieldrin, and dibenz(a,h)anthracene were measured at concentrations that pose a potential risk to benthic invertebrates in surface or subsurface sediments at the Parcel B shoreline. Exposure point concentrations for all of these chemicals were higher in the subsurface than in surface samples. These chemicals in sediment present potential risk to benthic invertebrate receptors.

Mercury was detected at concentrations that pose risk to benthic invertebrate aquatic receptors exposed to groundwater via surface water. Concentrations for mercury in groundwater exceeded both HGALs and ambient water quality criteria, and showed a consistent trend of detections above the screening value. As a result, mercury in groundwater presents a potential risk to benthic invertebrate receptors.

B5.1.3 Refinement of COPECs for Birds and Mammals

Estimates of risk to birds (willet, surf scoter, and red-tailed hawk) and mammals (house mouse) from COPECs retained after concentrations in surface and subsurface sediment at the Parcel B shoreline were compared with HPALs and San Francisco Bay ambient concentrations were further refined using the food chain modeling techniques described in Sections B4.1 and B4.3. However, the EPC used in the risk calculations was revised from the maximum site concentration to the UCL_{95} to reflect a more realistic exposure assumption. The COPECs retained for further refinement included the following:

- *For Birds (0 to 2 feet bgs):* aluminum, copper, lead, thallium, zinc, total Aroclors, total DDT, dieldrin, heptachlor epoxide, methoxychlor, tetrabutyltin, and tributyltin.

- *For Birds (2.5 to 4 feet bgs):* aluminum, cadmium, copper, lead, molybdenum, thallium, zinc, total Aroclors, total DDT, dieldrin, and methoxychlor.

Additionally, 4-methylphenol, 4-nitrophenol, azobenzene, benzoic acid, benzyl alcohol, dibenzofuran, HMW PAHs, LMW PAHs, pentachlorophenol, and phenol were retained as COPECs by default because no bird TRVs were available. These chemicals are discussed in Section B5.2.

- *For Mammals (0 to 2 feet bgs):* aluminum, copper, lead, zinc, and total Aroclors.

- *For Mammals (2.5 to 4 feet bgs):* aluminum, cadmium, copper, lead, molybdenum, zinc, total Aroclors, and HMW PAHs.

Additionally, 4-methylphenol, 4-nitrophenol, benzoic acid, benzyl alcohol, dibenzofuran, and phenol were retained as COPECs by default because no mammalian TRVs were available. These chemicals are discussed in Section B5.2.

The refined risk calculations are presented on Tables B-21 through B-25. Tables B-26 and B-27 summarize the HQs by receptor.

B5.1.3.1 Refinement of Risk Calculations for Birds

As discussed above, daily dose estimates for the average receptor for each chemical were revised using the UCL_{95} as the EPC to estimate more appropriately exposure of birds to COPECs at the Parcel B shoreline. These dose estimates were compared with low and high TRVs to calculate HQs. Tables B-21 through B-24 provide dose calculations for bird receptors under specific exposure scenarios. Tables B-26 and B-27 summarize the refined HQs for surface and subsurface sediments at the Parcel B shoreline.

Significant risk may be indicated by HQs greater than 1.0 based on the high TRVs [$HQs_{(dose/high\ TRV)}$]. As shown in the table below, HQs for lead, total Aroclors, and methoxychlor in surface sediments indicated significant risk to the willet. HQs for copper in subsurface sediments indicated significant risk for the willet and surf scoter and HQs for lead and total Aroclors indicated significant risk for the willet. No HQs for COPECs in surface or subsurface sediments indicated a significant risk to the red-tailed hawk.

Hazard Quotients Greater than 1.0 Based on the High Toxicity Reference Value for Birds			
Chemical of Potential Ecological Concern	**Willet (*Macoma* Tissue)**	**Willet (Soft-Bodied Invertebrate Tissue)**	**Surf Scoter**
Surface Sediment			
Lead	NA	1.97	NA
Total Aroclors	NA	1.14	NA
Methoxychlor	2.06	2.06	NA
Subsurface Sediment			
Copper	3.16	8.84	1.28
Lead	1.11	4.23	NA
Total Aroclors	NA	3.09	NA

Notes:
NA Not applicable because the hazard quotient based on the high toxicity reference value was less than 1
Total Aroclors Sum of Aroclors

Potential risk may be indicated by HQs greater than 1.0 based on the low TRVs [$HQ_{(dose/low\ TRV)}$], as shown in the table below.

Hazard Quotients Greater than 1.0 Based on the Low Toxicity Reference Value for Birds				
Chemical of Potential Ecological Concern	**Willet (*Macoma* Tissue)**	**Willet (Soft-Bodied Invertebrate Tissue)**	**Surf Scoter**	**Red-Tailed Hawk**
Surface Sediment				
Copper	5.83	16.3	2.35	NA
Lead	213	815	86.3	14.2
Thallium	3.33	3.33	1.34	NA
Zinc	2.90	3.32	1.17	NA
Total Aroclors	4.02	13.8	1.62	NA
Total DDT	6.93	28.2	2.80	NA
Heptachlor epoxide	2.97	2.97	1.20	NA
Methoxychlor	343	343	139	NA
Subsurface Sediment				
Aluminum	NA	4.24	NA	NA
Cadmium	8.11	28.4	3.27	NA
Copper	78.5	220	31.7	4.42
Lead	459	1,750	186	30.6
Thallium	2.93	2.93	1.18	NA
Zinc	3.77	4.31	1.52	NA
Total Aroclors	10.9	37.5	4.41	NA
Total DDT	9.48	39.8	3.95	NA
Dieldrin	NA	1.24	NA	NA
Methoxychlor	19.9	19.9	8.02	NA

Notes:
NA Not applicable because the hazard quotient based on the low toxicity reference value was less than 1
Total DDT Sum of DDT and its metabolites (DDD and DDE)

The paragraphs below provide a detailed discussion of the chemicals posing significant risk and the chemicals that pose potential risk to birds.

Chemicals Posing Significant Risk

Copper

Copper in subsurface sediment poses significant risk to the willet and surf scoter. Copper in surface sediment poses potential risk to the willet and surf scoter. Potential risk was also indicated for the red-tailed hawk from copper in subsurface sediment. HQs are summarized in the preceding tables.

Copper can be toxic to birds. Mallards and adult chickens tolerated a daily dietary copper concentration of 29 mg/kg of body weight, and adult chickens tolerated a daily dietary copper concentration of 60 mg/kg of body weight. In adult chickens, pigeons, and ducks, minimum lethal doses of copper ranged from 300 to 1,500 mg/kg of body weight (Demayo and others 1982). Diets that contain elevated levels of copper can slow growth rate, diminish egg production, and cause developmental abnormalities in various bird species. For example, chicks showed a slight reduction in weight gain at dietary copper concentrations of 350 mg/kg or higher; turkeys tolerated a diet with 676 mg/kg copper (Owen 1981).

Lead

The willet is at significant risk from exposure to lead in both surface and subsurface sediment. Lead in both surface and subsurface sediment poses potential risk to the surf scoter and red-tailed hawk.

Lead at the Parcel B shoreline is likely present as a mixture of inorganic salts, such as lead chloride, lead sulfate, lead carbonate, and various lead oxides. These forms are generally less bioavailable and, thus, less toxic than is lead acetate, the form of lead used as the basis for the low TRV. Thus, risks to birds from lead based on the low TRV may be overestimated by an order of magnitude or more. Uncertainty regarding the TRVs is discussed in more detail in Section B5.2.

Lead produces a variety of toxic effects in birds, including damage to the nervous system, muscular paralysis, inhibition of heme synthesis, damage to kidneys, damage to the liver, and death (Eisler 1988). Sub-lethal exposure to lead may also have adverse systemic and reproductive effects in some species by decreasing plasma calcium, inhibiting growth, and reducing the hatchability of chicks. Organic forms of lead are more toxic to birds than are inorganic forms (Eisler 1988).

The TRV for lead was derived from a study that used a very soluble form of lead (lead acetate) fed to Japanese quail (Edens and others 1976). Reproductive effects were measured, including plasma calcium levels, eggshell thickness, and number of hatchlings. The Japanese quail is one

of the most sensitive species to reproductive effects. A comparable study was also used where the same form of lead was administered to American kestrels with similar endpoints to account for differences in the sensitivity of receptors to lead. In the study using kestrels, a raptor species, a dose of up to 50 mg/kg did not cause significant adverse reproductive effects on egg production, incubation, fertility, or eggshell thickness (Pattee 1984). A dose as small as 10 mg/kg was sufficient to cause significant reduction in egg production in the Japanese quail (Edens and Garlich 1983). Considerable uncertainty is associated with the TRV.

Total Aroclors

Significant risk to the willet from exposure to PCBs (as Aroclors) was indicated in surface and subsurface sediment. The surf scoter is potentially at risk from PCBs in surface and subsurface sediment. No risk to the red-tailed hawk was indicated in either sediment layer.

Birds are less susceptible to the acute toxic effects of PCBs than are mammals. For example, dietary lethal concentrations that result in a 50 percent mortality rate (LD_{50}) for various bird species for total Aroclors ranged from 604 to 6,000 mg/kg of diet (Eisler 1986). Sublethal effects associated with exposure to PCBs include disruptions in normal patterns of growth and reproduction, metabolism, and behavior in birds. Dietary PCB concentrations of 10 mg/kg have resulted in lower hatchability and erratic incubation behavior in ringdoves, and concentrations of 40 mg/kg have inhibited nest building and reproduction in mourning doves and fewer intact eggs from mallard ducks (Eisler 1986).

Methoxychlor

Significant risk to the willet was indicated from exposure to methoxychlor. Potential risk was predicted for the willet from exposure to methoxychlor in subsurface sediment. Potential risk was predicted for the surf scoter from exposure to methoxychlor in surface and subsurface sediment. No risk to the red-tailed hawk was indicated in either sediment layer.

Birds metabolize methoxychlor relatively easily and as a result, methoxychlor is not accumulated to elevated levels (Gardner and Bailey 1975, as cited in Beyer and others 1996). No evidence has been found regarding methoxychlor residues in relation to increased mortality rates (Beyer and others 1996). Methoxychlor has caused feminization in male gull chick embryos. Methoxychlor was injected into developing gull eggs, which resulted in abnormal development of ovarian tissue in male hatchlings (Fry and Toone 1981, as cited in Peterle 1991).

Chemicals Indicating Potential Risk

$HQ_{(dose/high\ TRV)}$ values for the following chemicals were less than 1.0 for all three bird species, indicating potential risk to birds: aluminum, cadmium, thallium, zinc, total DDT, dieldrin, and heptachlor epoxide. Potential risk from these chemicals to the willet or surf scoter was indicated by $HQs_{(dose/low\ TRV)}$ greater than 1.0 in surface or subsurface sediment, as summarized below. No potential risk to the red-tailed hawk was predicted for any of these chemicals.

Aluminum

Potential risk was predicted only for the willet from exposure to aluminum in subsurface sediments.

Birds are most likely to be exposed to aluminum through their diets. Fortunately, only a fraction of the ingested metal is assimilated, and fecal excretion is relatively efficient. Thus, birds are at less risk than fish, amphibians, or aquatic invertebrates. Although aluminum has not been identified as a required mineral, indirect evidence suggests that low dietary levels may be necessary to maintain calcium and phosphorus metabolism (National Academy of Sciences [NAS] 1980).

In general, diets with less than 1,000 mg/kg aluminum are not considered harmful, although some effects, such as reduced food consumption and eggshell breaking strength, appear in diets containing 1,500 mg/kg (Hussein and others 1988). Bones, particularly in growing chicks and reproductive females, appear to be the most efficient tissues for storing metal, followed by the brains, liver, and kidneys. Levels in feathers of raptor chicks may also reflect dietary exposure (Bortolotti and Barlow 1988). Effects of aluminum include depressed food consumption, reduced egg production, alterations in plasma phosphorus and calcium metabolism, interferences with ATPase activity, reduced eggshell breaking strength, lowered tibial breaking strength and shortened limbs, malformations, microphthalamia, decreased body weight, ectopic viscera, and hemorrhages (NAS 1980; Giliani and Chatzinoff 1981; Lundholm and Mathson 1986; Hussein and others 1988; Wisser and others 1990). Scheuhammer (1991) and Scanlon (1990) have reviewed the toxicology of aluminum in birds.

Insectivorous birds may be at risk in acidified environments because insects contain aluminum levels up to 5,000 mg/kg aluminum, and some estuarine invertebrates have levels exceeding 17,000 mg/kg (Havas and Hutchinson 1983; Sadler and Lynam 1985, both as cited in Sparling and Lowe 1996). Carnivorous and herbivorous birds may also be at risk from aluminum consumption. Many insectivorous birds, especially those that probe or dabble in the soil, may also consume substantial amounts of aluminum-rich soil with their foods. Much of this metal may be biologically active in acidified environments.

Cadmium

Potential risk was predicted for the willet and surf scoter from exposure to cadmium in subsurface sediments.

Sub-lethal effects of cadmium on birds include growth retardation, nephrotoxicity, anemia, damage to the testicles, absorptive epithelium of the duodenum, reduced egg production, and effects on calcium absorption (Scheuhammer 1987). Cadmium ingestion by mallards (*Anas platyrhynchos*) enhances alterations induced by food restriction, such as reduced plasma triiodothyronine and thyroxine concentrations and increased concentration of plasma nonesterified fatty acids and corticosterone. Cadmium ingestion by mallards also increases

concentrations of copper and zinc in the kidney (Di Giulio and Scanlon 1985). Three-week-old chicks fed 75 mg/kg of cadmium showed a decrease in hematocrit, hemoglobin, liver iron, and intestinal iron-59 absorption, pointing to a defect in iron metabolism (Freeland and Cousins 1973). Cadmium fed to young Japanese quails (*Coturnix coturnix*) at a level of 75 mg/kg of diet from hatching to 4 weeks of age produced gross, microscopic, and ultrastructural lesions in the proximal small intestine (Richardson and Spivey Fox 1974).

Thallium

Potential risk was predicted for the willet and the surf scoter from exposure to thallium in surface and subsurface sediments.

Very little information was available on the effects of thallium on birds. Thallium has been used as a poison to control predators and rodents. Birds, such as eagles, hawks, magpies, and turkey vultures, were poisoned accidentally by these baits (Robinson 1948). In one acute toxicity test, eagles were given a single LD_{50} dose. Effects included loss of muscular coordination, loss of balance, reluctance to move, loss of appetite, belligerence, fear-threat displays, falling, debilitation, loss of righting reflex, distress, breathing complications, and immobility (Bean and Hudson 1976).

Zinc

Potential risk was predicted for the willet and the surf scoter from exposure to zinc in surface and subsurface sediments.

Different species of birds have varying sensitivities to zinc exposure. Acute effects of zinc in ducks caused mortality and pancreatic degradation (Eisler 1993). Reduced growth and death were observed in poultry chicks fed diets containing elevated zinc levels. Younger stages of life appear to be more sensitive to zinc exposure. The pancreas and bone are primary target organs of zinc in birds (Eisler 1993). Decreased weight gain was observed in Japanese quail, chickens, and turkeys fed diets containing zinc (NAS 1980).

Total DDT

Potential risk was predicted for the willet and surf scoter from exposure to total DDT in surface and subsurface sediments.

Effects of DDT and its metabolites on bird reproduction have been well characterized. DDT and its metabolites can mimic estrogen by binding to specific estrogen receptors inside cells. Because of this mode of action, the toxicity of DDT primarily affects reproduction. Organochlorines, including DDT, have been implicated in the thinning of eggshells of at least 54 species and 10 orders of birds (Peterle 1991). DDT reduces the transport and transfer of calcium from females into the eggs, resulting in thin eggshells. Mallard hens fed 50 mg/kg of DDT produced eggshells weighing 12 percent less than control eggshells; their thickness was reduced by 18 percent. Two days after treatment, mallards exposed to a single dose of DDT

(1,000 mg/kg) produced eggs with shells that were 28 percent thinner than the control eggs. Birds treated with DDE showed delayed egg laying, reduced nesting success, reduced hatchability, and abnormal egg size and weight (Peterle 1991; U.S. Department of the Interior [DOI] 1998).

Mean DDE residues in double-crested cormorant eggs collected in the early 1970s varied from 6.4 micrograms per gram in Lake Erie to 14.5 micrograms per gram in Lake Huron. Elevated concentrations of DDE in double-crested cormorant eggs caused severe shell thinning, leading in some cases to breakage during incubation. Custer and others (1999) measured the nesting success of double-crested cormorants more recently. Of 1,570 eggs laid, 32 percent did not hatch and 0.4 percent had deformed embryos. Of 632 chicks monitored from hatching to 12 days of age, 9 percent were missing or found dead; no deformities were observed in the chicks (Custer and others 1999).

Dieldrin

Potential risk was predicted for the willet and the surf scoter from exposure to dieldrin in subsurface sediments only.

Dieldrin adversely affects reproduction in birds. Japanese quail given dieldrin at a dose of 20 mg/kg of feed (approximately 2.5 mg/kg-day) for 9 weeks exhibited reduced parental and chick survival rates and laid fewer eggs. Exposure of birds to dieldrin has been associated with eggshell thinning (Winn 1972 and Walker and others 1969, as cited in Beyer and others 1996).

Heptachlor Epoxide

Potential risk was predicted for the willet and the surf scoter from exposure to heptachlor epoxide in surface sediments.

Heptachlor has been known to decrease reproductive success in birds and decrease chick survival rates (Blus and others 1984, Henny and others 1983, and Grolleau and Froux 1973, as cited in Beyer and others 1996).

Summary of Risk to Birds

Significant risk ($HQ_{[dose/high\ TRV]}$) was indicated for copper, lead, total Aroclors, and methoxychlor ingested by the willet and for copper ingested by the surf scoter under a conservative exposure scenario that assumed birds acquired 100 percent of their food from sediment at the Parcel B shoreline. No significant risk to the red-tailed hawk was indicated for any chemical.

B5.1.3.2 Refinement of Risk Calculations for Mammals

As discussed in Section B5.1.3, daily dose estimates for the average receptor for each chemical using the UCL_{95} rather than the maximum concentration as the EPC. These dose estimates were compared with low and high TRVs to calculate HQs. Table B-25 provides dose calculations for the house mouse under specific exposure scenarios. Tables B-26 and B-27 summarize the refined HQs for surface and subsurface sediments at the Parcel B shoreline.

Significant risk may be indicated by HQs greater than 1.0 based on the high TRVs [$HQs_{(dose/high\ TRV)}$]. Total Aroclors indicated a significant risk to the house mouse in surface sediments; only aluminum and molybdenum indicated a significant risk in subsurface sediments.

Potential risk may be indicated by HQs greater than 1.0 based on the low TRVs [$HQ_{(dose/low\ TRV)}$]. Doses for the house mouse exceeded the low TRV for aluminum, copper, lead, and zinc for surface and subsurface sediments. Potential risk for subsurface sediments was also indicated by cadmium and total Aroclors.

The paragraphs below discuss the chemicals considered to pose significant risk and potential risk to the house mouse.

Chemical that Pose Significant Risk

No chemical in surface sediment posed a significant risk to the house mouse. Aluminum indicated a significant risk in subsurface sediment.

Aluminum

The dose to the house mouse exceeded the high TRV for aluminum for subsurface sediments, which indicates significant risk. Potential risk was predicted from exposure to surface sediment.

The toxicity of aluminum is mediated by pH. Aluminum is generally not bioavailable at a pH above 5.0, which is typical of the Parcel B shoreline.

Relatively little information is available on exposure pathways or effects of aluminum on wildlife. The principal effects of elevated concentrations of aluminum on mammals include depressed food intake and decreased weight gain in young animals. In general, mammals appear to be at moderate to minimal risk from aluminum toxicity. Aluminum is not accumulated at sufficient levels in soft animal tissues to produce secondary toxicity in carnivores. Unless the soil is acidic, aluminum ingested with soil is probably insoluble and has low biological availability; gut pH and retention time are important in determining how much of this metal is assimilated. Soluble aluminum in acidic forest soils may pose a risk, but problems would largely be manifested as reduced feeding and weight gain (Sparling and Lowe 1996). Mulder, van Grinsven, and van Breemen (1987) established the relationship between soil solution pH and demonstrated that soluble aluminum does not occur above a pH of 5.0. Thus, toxicity associated with aluminum in soils is not expected.

Molybdenum

The HQ for the house mouse using the high TRV in subsurface sediment indicated potential risk.

Few studies describe the toxicity of molybdenum to wild mammals. Signs of molybdenosis in cattle include weight loss, reduced feeding, inhibited growth, hair loss, leg deformities, anemia, anorexia, lesions in connective tissue, diarrhea and other intestinal disturbances, brittle bones prone to fracture, and milk reduction (DOI 1998). Younger animals and lactating cows appear to be the most susceptible. Because of the unique environment of the rumen, cattle and other ruminants are far more susceptible to the toxic effects of molybdenum than are other species (Eisler 1989). Toxicity generally occurs when cattle graze pastures where the forage contains 20 to 100 mg/kg molybdenum dry weight. Concentrations of molybdenum in cattle tissues are generally highest in the liver, followed by the kidneys, spleen, lungs, brain, and muscles. The ultimate sink for molybdenum in the body is bone (DOI 1998).

Total Aroclors

HQs using the high TRV for the house mouse indicated potential risk from surface sediments.

PCB exposures in mammals are associated with adverse effects, including reproductive impairment and failure, physiological, altered behavior, and mutagenic, carcinogenic, and teratogenic (Eisler 1986; Beyer and others 1996). In mammals, the most consistent, pathological changes occur in the liver. In females, however, PCBs are transferred through lactation and placenta from adult to offspring; therefore, in utero effects and fetotoxicity may be expressed.

Chemicals Indicating Potential Risk

Potential risk, indicated by a dose greater than the low TRV, was indicated for copper, lead, zinc, and total Aroclors for surface and subsurface sediments. In addition, cadmium and molybdenum posed a potential risk to the house mouse exposed to subsurface sediment. Toxic effects associated with these chemicals are summarized below.

Cadmium

The HQ using the low TRV indicated potential risk to the house mouse.

Cadmium is a known developmental toxin, causing teratogenic and mutagenic effects. Parental doses of cadmium decrease testosterone and produce adverse effects on the testes and prostates of test animals. Prenatal exposure to cadmium has fetotoxic effects, such as reduced fetal weight (Agency for Toxic Substances and Disease Registry [ATSDR] 1993) and can cause adverse effects during development of the lungs, brain, testes, eyes, and palate (Domingo 1994). Small amounts of cadmium could affect embryonic deoxyribonucleic acid and protein synthesis (Domingo 1994).

Chronic exposure of mice to 300 milligrams per liter of cadmium chloride in drinking water for 10 weeks resulted in a decrease of antibody synthesis. This immunosuppression persists and is more pronounced several weeks after exposure is discontinued (Koller and others 1975). Effects are produced at relatively low cadmium exposures (up to 50 micrograms per milliliter of cadmium for 3 weeks), suggesting that the immune system is vulnerable to the toxic effects of cadmium (Blakley 1984). Metabolic changes, histopathologic alterations, and liver necrosis have been observed in rats, mice, and rabbits after oral exposure to concentrations of cadmium ranging from 0.05 to 138 mg/kg-day (ATSDR 1993). The estimated wildlife LOAELs for cadmium for mammals, presented in Sample, Opresko, and Suter (1996), ranged from 4.2 to 15.8 mg/kg-day. The daily dose calculated for the house mouse for the Parcel B shoreline was 0.513 mg/kg-day.

Copper

Potential risk was indicated by HQs for copper in surface and subsurface sediment.

Mammals are relatively tolerant to copper. The accumulation of copper in animal tissues is influenced by several factors, including the genetic make-up of the animal, the levels of dietary iron and zinc, the intake of molybdenum and sulfate or sulfide, the availability of pantothenic acid and vitamin E, the quantity and source of protein, and other factors that remain unidentified (Hill 1977). Copper is primarily stored in the liver, kidney, bone marrow, and hair (Talmage and Walton 1991). The toxic effects of copper on many animals have been studied, including cats, dogs, cattle, sheep, rats, mice, horses, guinea pigs, pigs, and monkeys. Different species of animals display varying levels of sensitivity to copper. The principal organ affected by exposure to copper is the liver, where copper primarily accumulates in subcellular organelles, ultimately causing liver cirrhosis in all mammals. Copper can also cause necrotic kidney tubules and brain damage (Owen 1981). The primary toxic effects of an acute copper dose given orally are gastrointestinal irritation, vomiting (including blood), low blood pressure, jaundice caused by liver necrosis, and coma. Other chronic signs include inhibition of growth, muscular dystrophy, anemia, impaired reproduction, and decreased longevity (DOI 1998; Demayo and others 1982; Talmage and Walton 1991). Chronic exposure to copper causes accumulation of copper in the body, which in turn causes hemolytic anemia and lesions in the liver, brain, and eyes. Rat studies show liver, kidney, and stomach damage to be both short- and long-term effects caused by ingestion of copper (ATSDR 1990).

Copper is an essential nutrient required for normal enzymatic function. At high concentrations, copper may act as a catalyst for the production of free radicals (DOI 1998). Serum copper concentrations increase with age in both mice and humans, but renal and hepatic concentrations decline. Dietary copper influences the life span of mice. Aging in mice was accelerated when mice were fed copper (administered as copper gluconate in drinking water) at a concentration of 317 mg/kg (Massie and Aiello 1984).

The magnitude of copper toxicity varies with the ratio of copper to molybdenum in the diet for most animals. Low concentrations of molybdenum cause copper to accumulate at a faster rate and cause toxicity at lower concentrations (DOI 1998). Whole-body concentrations of copper in small mammals collected from various uncontaminated sites ranged from 8.3 to 13.4 mg/kg dry weight (Talmage and Walton 1991).

Lead

HQs using the low TRV for the house mouse indicated potential risk from surface and subsurface sediments.

Lead can have multiple toxic effects in mammalian species. Lead may cause damage to the nervous system, hematological effects, kidney dysfunction, sterility, abortion, neonatal mortality, growth retardation, delays in maturation, and reduced body weight (Amdur and others 1991; Eisler 1988). Younger mammals may have greater sensitivity to lead toxicity from their developing blood-brain barrier. In these cases, developing capillaries in the brain allow lead in the blood to be transported to newly formed components of the brain. Organic forms of lead are more toxic to mammals than are inorganic forms (Amdur and others 1991).

Zinc

HQs using the low TRV for surface and subsurface sediments indicated a potential risk to the house mouse.

Excessive zinc intake adversely affects survival of all mammals tested and causes a wide variety of neurological, hematological, immunological, hepatic, renal, cardiovascular, developmental, and genotoxic effects (Eisler 1993). The adverse effects include growth retardation, testicular atrophy, changes in skin, and poor appetite (Eisler 1993; Prasad 1995). The pancreas and bone are primary areas of zinc deposition in mammals. Toxic effects of zinc after ingestion of objects that contain zinc has been observed in many domestic animals, including dogs, cats, ferrets, cattle, sheep, and horses (Eisler 1993). Elevated concentrations of zinc in the diet of pregnant rats and sheep caused an increased incidence of hypocuprosis, still births, and fetal resorptions (Domingo 1994).

Acute oral toxicity in rodents exposed to zinc is low, with lethal doses resulting in a 50 percent mortality rate ranging from 30 to 600 mg/kg body weight, depending on the zinc salt administered. Acute effects in rodents after inhalation or intratracheal instillation of zinc compounds include respiratory distress, pulmonary edema, and infiltration of the lung by leucocytes. Effects of zinc toxicity following short-term oral exposure to rodents include weakness, anorexia, anemia, diminished growth, loss of hair, and lowered food utilization. Zinc produced no adverse symptoms in rodents at about 160 mg/kg of body weight in rats (International Programme on Chemical Safety 1996).

Summary of Risk to Mammals

Significant risk ($HQ_{[dose/high\ TRV]}$) was indicated for total Aroclors ingested by the house mouse in surface sediment. Significant risk was also indicated for aluminum and molybdenum ingested by the house mouse in subsurface sediments.

B5.2 UNCERTAINTY IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

Uncertainty plays an important role in risk-based decision-making; therefore, uncertainty is incorporated explicitly in the risk characterization in a SLERA. Although identifying known sources of uncertainty is more useful than using conservative default assumptions, many site-specific parameters cannot be determined easily, and the SLERA must rely on estimates. Uncertainty is generally defined as a component of risk or degree of hazard resulting from imperfect knowledge of the present or future state of the system considered (Suter 1993).

The following three sources of uncertainty in ERAs are described in Suter (1993).

1. Mistakes in execution of the assessment, including incorrect measurements, data recording errors, and computational errors

2. Imperfect knowledge of factors that could be known, such as lack of knowledge about some aspect of the ecosystem that may be relevant, including assumptions used in dose models; practical constraints on the ability to measure everything; and lack of knowledge on the toxicological effects of all chemicals on all species

3. Inherent randomness of the world such as stochasticity in physical or biological processes that may affect assumptions or actual risk, including variation in population parameters or rainfall patterns

The complexity of ecological systems tends to increase the level of uncertainty involved in ERAs compared with human health risk assessments. Using realistic assumptions and multiple lines of evidence is the best approach to reducing uncertainty associated with conclusions in an ERA. The sections below briefly review some sources of uncertainty identified for this SLERA.

B5.2.1 Sample Data

Data were collected from discrete locations based on the small areas of the Parcel B shoreline. Data were validated and determined to be of high usability, and data computations and summary tables were double-checked. Data quality is not considered an important source of uncertainty, as identified and defined in the field sampling and analysis plan (Tetra Tech 2003).

Waterfowl and benthic invertebrates will be primarily exposed to the most surficial sediments. However, the shoreline at Parcel B is susceptible to erosional processes that could expose deeper sediments. Wind-driven waves and other disturbances of surface sediments could expose the deeper sediments, as well. The list of COPECs for benthic invertebrates is much the same for the surface and subsurface layers; there is no reason to expect that concentrations in the top 6 inches of sediment would differ greatly from the samples used in the SLERA.

B5.2.2 Ambient Screening Concentrations

The data set used to develop ambient screening concentrations for 145 inorganic chemicals at HPS is considered of high quality and usable for risk assessment. However, HPALs for cobalt, chromium, and nickel were calculated using a regression equation based on concentrations of magnesium, as described in PRC 1995. Uncertainty in the actual ambient concentration is greater for these chemicals.

B5.2.3 Toxicological Benchmarks

Screening values (such as ER-M values and TRVs) used to identify COPECs and levels of risk to ecological receptors include multiple sources of uncertainty. Although these values were based on numerous studies, the relevance of any benchmark to a particular site is unknown. Effects on receptors at a site may be underestimated or overestimated based on this approach; however, the practice of using these values for screening chemicals in environmental media is widespread and is currently the best method available for preliminary screening. Screening values were not available for all chemicals detected in sediment from the Parcel B shoreline; as a result, some COPECs could not be adequately evaluated given current knowledge. Most of the screening values are based on single chemical exposures or on single chemicals analyzed in the context of effects observed in complex chemical mixture exposures. The effect of multiple chemical stressors operating synergistically or antagonistically was not incorporated into this risk assessment.

Screening values are based on total concentrations and do not address uncertainty associated with individual chemical species (some forms are more toxic than others) or potential for bioavailability. In some cases, screening benchmarks were used where they are not strictly appropriate. ER-M values are most appropriate for assessing risk to some groups of benthic receptors. However, these benchmarks were used to evaluate risk to all benthic invertebrates in the area. The lack of suitable screening values for some chemicals and groups of receptors is considered an important source of uncertainty in this SLERA.

B5.2.4 Uncertainties Associated with Food Chain Modeling

This discussion highlights uncertainties associated with the food chain modeling used to evaluate risk to birds and mammals in Section B4.0. The overall effect of these uncertainties and conservative assumptions cannot be quantitatively calculated without site-specific information.

B5.2.4.1 Tissue Residue Data

This source of uncertainty relates to the representativeness of BAFs developed from field-collected data. BAFs were developed for plants, mice, and soft- and hard-bodied invertebrates. BAFs for plants and mice were developed from data collected for the Parcel E ERA validation study report (Tetra Tech and LFR 2000). BAFs for soft- and hard-bodied invertebrates were developed for the Parcel F validation study (Battelle and others 2002).

Uncertainty associated with tissue analysis reflects the assumption that samples collected at one time adequately reflect exposure of receptors to COPECs.

Two main sources of uncertainty are associated with development of BAFs for soft- and hard-bodied invertebrates. The first source of uncertainty relates to BAFs developed from laboratory data for *Macoma nasuta* and whether they may underestimate uptake if steady-state conditions are not reached during the 28-day exposure period. Field-collected bivalves were shown to have concentrations in tissue similar to laboratory-reared *Macoma nasuta,* supporting the contention that a 28-day exposure time is sufficient to reach steady state (Battelle and others 2002).

Second, it was unclear whether the soft-bodied invertebrate tissues collected in the field are a fair representation of the tissue burdens in polychaetes in the field. A preliminary evaluation suggests that the data collected in the field may overestimate concentrations in polychaete tissue (Battelle and others 2002). The Parcel F validation study suggested that body burdens measured in the field-collected polychaetes were greater than body burdens measured in laboratory exposed *Macoma nasuta*. The validation study stated that field-collected bivalves were likely the result of COPECs sorbed to sediment in the guts and not a higher uptake rate into tissue. To support this hypothesis, the Parcel F validation study cited a study conducted in South Basin in 2001 and 2002 (U.S. Army Corps of Engineers 2002). This study developed biota-sediment accumulation factors (BSAFs) for polychaetes and amphipods based on laboratory-controlled studies using South Basin sediments and depurated test organisms. BSAFs for PCBs based on depurated *Neanthes* ranged from 0.155 to 0.181, which were lower than BSAFs developed using *Leptocheirus* (an amphipod) (BSAFs ranging from 0.386 to 1.334). The BSAFs for *Neanthes* were also lower than BSAFs developed using the depurated *M. nasuta* data collected in South Basin for the validation study (0.418 for stations with sediment concentrations less than 2,000 parts per billion PCBs). Therefore, in South Basin sediments, depurated polychaete tissue reflected lower uptake on a normalized lipid basis than either amphipods or bivalve.

BAFs for some inorganic elements were slightly higher in field-collected polychaete tissue than for laboratory-derived BAFs. Although the field-collected BAFs for inorganic elements may be slightly more protective, the correlation of laboratory-derived BAFs to sediment concentration is much higher, and therefore provides more reliable identification of the sediment areas requiring consideration for remediation.

Additionally, only one composite sample was collected per area (five total), and these samples may not be representative of the entire offshore area. Furthermore, the composite sample in each area was collected over a large area and could not be collocated with specific locations where sediment samples were collected during the Parcel F validation study. This situation resulted in uncertainty associated with the concentrations in sediment that caused exposure to soft-bodied invertebrates in the field, potentially under- or over-estimating uptake.

Site-specific tissue residue data were not available for some chemicals and receptors, and prey concentrations were estimated based on literature BAFs and other parameters. This approach is generally associated with much more uncertainty than is one based on site-specific prey tissue concentrations. In particular, estimates of prey concentration do not include

accurate predictors of assimilation and depuration of contaminants in the same way as time-averaged tissue concentrations. Additionally, a BAF of zero was used for chemicals where literature-based BAFs were not available.

B5.2.4.2 Estimated Doses, Site Use Factors, and other Parameters

Assumptions used in estimating ingested doses and model parameters are based mostly on scientific literature and may not accurately represent species or conditions at the site. Sources of uncertainty in dose estimates include inaccuracy in model parameters based on poor literature-derived data, population and individual variation in life history, and variation in dietary patterns of animals in the Parcel B shoreline. In addition, the lack of empirical data for each receptor necessitated using simple scaling equations to estimate receptor-specific ingestion rates. These estimates may not accurately represent actual ingestion rates and are a source of uncertainty in dose calculation.

An additional source of uncertainty is introduced by the estimation of food ingestion rates. Allometric regression models were used to estimate food consumption based on metabolic rates derived by Nagy (2001) for various groups of birds and mammals. Food ingestion rates estimated using the allometric equations are expressed as kilograms of dry weight per day. Wildlife does not generally consume dry food (unless maintained in the laboratory); therefore, some investigators suggest converting food consumption rates to kilograms of fresh weight by adding the water content of the food. It was necessary to convert the tissue results to dry weight for mathematical consistency in the allometric equations used to estimate doses because both HPS tissue residue results from the analytical laboratories and recommended literature-derived BAFs are reported in wet weight (Sample and others 1996; EPA 1999a). Further reasoning behind the conversion from wet to dry weight is that the TRVs, which were used to calculate HQs and compare estimated doses to evaluate whether risk exists to higher-trophic-level receptors, are also reported on the basis of dry weight. This conversion from wet to dry weight may overestimate chemical concentrations in tissue, potentially resulting in higher calculated risk.

The use of dose models as estimates of exposure assumes that exposure of the animal through other routes (such as dermal exposure or drinking surface water) is minimal. In general, it is common practice in ERAs to focus on ingestion of contaminated prey and soil (Pascoe and others 1996; EPA 1997), although ignoring other sources may lead to an underestimation of risk.

Bird SUFs were set equal to 1.0, and were not adjusted to reflect receptor foraging areas at the Parcel B shoreline, because a SLERA is designed to be a conservative evaluation of potential risk. In fact, potential foraging and exposure area of the Parcel B shoreline is substantially less than the foraging range of the bird receptors considered. No significant risk to birds would be indicated were the SUF adjusted to reflect actual exposure to sediment at Parcel B. An SUF of 1.0 is considered appropriate for the house mouse, which has a smaller foraging range than the bird receptors.

Risk calculations used average exposure parameters reported for each ecological receptor. The ranges of reported body weights and ingestion rates vary significantly in the literature (EPA 1993; Dunning 1993; Nagy 1987). These values may not reflect the true attributes of receptors living at the Parcel B shoreline.

B5.2.4.3 Bioavailability

All COPECs were conservatively assumed to be 100 percent bioavailable to all receptors. However, bioavailability may be significantly less than 100 percent, depending on the COPEC and receptor. For example, aluminum is bioavailable only at pH values less than about 5.0 (EPA 2000c); therefore, potential effects caused by exposure to aluminum may be significantly overestimated.

B5.2.4.4 Development of TRVs

TRVs used in risk calculations were derived from literature studies. These studies were not conducted on the ecological receptors assessed in this SLERA. TRVs were extrapolated using uncertainty factors to account for differences between species. The effect of this uncertainty cannot be estimated. The use of assessment endpoint species as surrogates for other related or ecologically similar taxa is supported by current guidance (EPA 1992a, 1992b, 1992c). However, this type of analysis does not account for differences among taxa and that uncertainty exists with regard to assessments of risk to whole communities based on detailed analysis of relatively few taxa.

TRVs for antimony, beryllium, cobalt, silver, and HMW and LMW PAHs were unavailable for birds, and a TRV for silver was unavailable for mammals; therefore, risks to these receptors from exposure to these COPECs could not be evaluated. Additionally, TRVs for birds or mammals were not available for many of the SVOCs detected in sediments. The bird TRVs for lead were derived from a study that used a very soluble form of lead for the laboratory tests (Edens and Garlich 1983). Consequently, the overly conservative assumptions summarized below are associated with the TRVs for lead.

- The form of lead ingested by birds at the Parcel B shoreline is the very soluble and bioavailable lead acetate.
- Birds ingest lead at the shoreline as lead acetate in drinking water.
- Site-specific soil and chemical conditions at the Parcel B shoreline that would affect the bioavailability of the form of lead in sediment are the same as in the controlled laboratory conditions used to generate the TRVs.

Similarly, TRVs for methylmercury were used in the initial risk estimation, but it is unlikely that much, if any, on-site mercury is present in the methylated form.

B5.2.4.5 Individual and Population Variation

Individuals within a population vary in several life history and behavioral traits. The dose models incorporated some of this variability by estimating typical values for most model parameters. However, these models focus on adult individuals and may not accurately represent ingestion of chemicals by juvenile stages that feed in a different manner or on different prey. Even among adults of the same population, considerable individual variation in exposure may occur.

B5.2.4.6 Hazard Quotients

HQs resulting from comparison of site chemicals with screening values and ingested doses with TRVs are common in ERAs. An HQ greater than 1.0 is generally considered to indicate a potential for risk (EPA 1997). However, the HQ cannot be used to determine either the probability or the magnitude of effects, and caution should be exercised in interpreting HQs. HQs for different chemicals cannot be summed to assess cumulative risk because of the different modes of chemical action and different levels of confidence in the underlying TRVs.

B5.2.4.7 Interspecies Extrapolation

The use of allometric conversions in interspecies extrapolations is discussed in Section B4.3.1. The use of assessment endpoint species as surrogates for other related or ecologically similar taxa is supported by current guidance (EPA 1997, 1999a). However, this type of analysis does not account for differences among taxa, and uncertainty exists about risk assessments of whole communities based on detailed analysis of only a few species.

B5.3 CONCLUSIONS

The SLERA focuses on a determination of whether further assessment or remedial action is necessary (EPA 1997, 2001). The data presented in this appendix and in the entire TMSRA indicate that risk to benthic invertebrates, birds, and mammals from several metals and organic compounds in sediment and groundwater along the Parcel B shoreline cannot be ruled out. Specific chemicals in sediments that pose risk to one or more ecological receptors include: metals — aluminum, copper, lead, molybdenum and zinc; pesticides — dieldrin, methoxychlor, 4,4-DDT and total DDT; total Aroclors; and dibenz(a,h)anthracene. Mercury is the only chemical in groundwater that poses a risk to ecological receptors.

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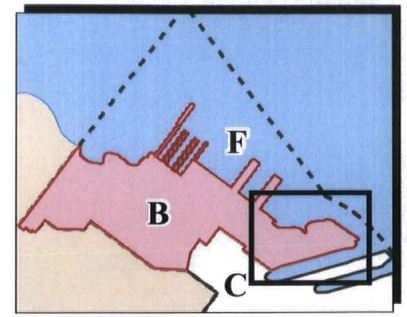
FIGURES

SAN FRANCISCO BAY

IR-26

IR26IT001
IR26IT004
IR26IT007
IR26MW41A
IR26MW46A
IR26MW47A
IR26MW48A

133
157
140
135
206
207
208
205
204



Location Map

- Groundwater monitoring well used in SLERA
- Shoreline Sampling Location
- Road
- Historical or Actual Rail Line
- SLERA and Shoreline Sampling Area
- Previous Excavation
- 140 Building
- Parcel B Boundary
- Other Parcel Boundary
- San Francisco Bay

Notes:
IR Installation Restoration
SLERA Screening-level ecological risk assessment

N

0 100 200

Scale in Feet

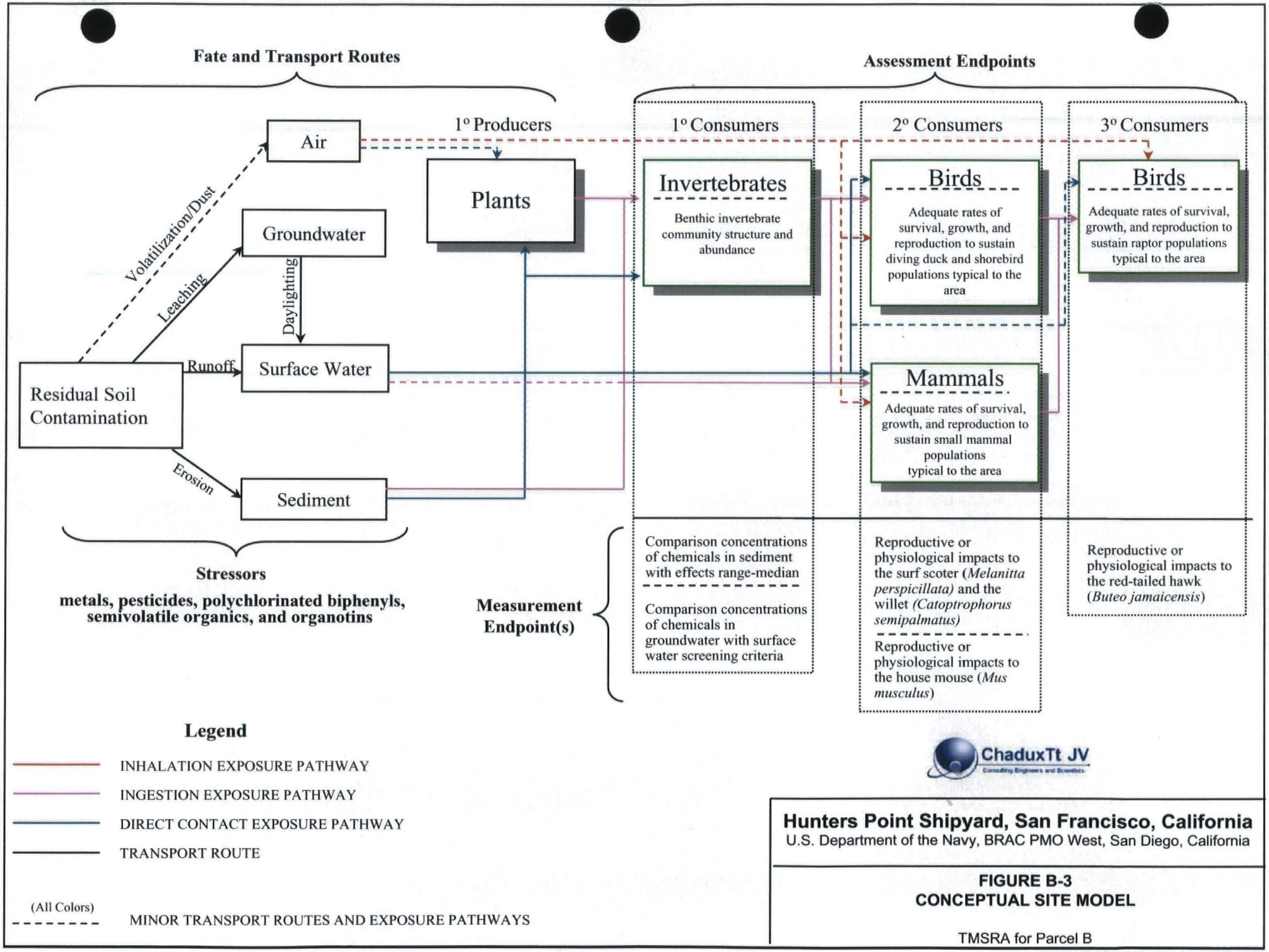
ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE B-2
IR-26 SLERA AND SHORELINE SAMPLING LOCATIONS

TMSRA for Parcel B

11/30/2007 O:\Hunters Point\Projects\Parcel B\Parcel B FS\TMSRA\FigureB-2ShorelineIR-26.mxd TtEMI-DN Kurt.Cholak


Fate and Transport Routes
Assessment Endpoints
Air
Plants
Groundwater
Surface Water
Sediment
Residual Soil Contamination
Volatilization/Dust
Leaching
Daylighting
Runoff
Erosion
1° Producers
1° Consumers
2° Consumers
3° Consumers
Invertebrates
Benthic invertebrate community structure and abundance
Birds
Adequate rates of survival, growth, and reproduction to sustain diving duck and shorebird populations typical to the area
Birds
Adequate rates of survival, growth, and reproduction to sustain raptor populations typical to the area
Mammals
Adequate rates of survival, growth, and reproduction to sustain small mammal populations typical to the area
Stressors
metals, pesticides, polychlorinated biphenyls, semivolatile organics, and organotins
Measurement Endpoint(s)
Comparison concentrations of chemicals in sediment with effects range-median
Comparison concentrations of chemicals in groundwater with surface water screening criteria
Reproductive or physiological impacts to the surf scoter (Melanitta perspicillata) and the willet (Catoptrophorus semipalmatus)
Reproductive or physiological impacts to the house mouse (Mus musculus)
Reproductive or physiological impacts to the red-tailed hawk (Buteo jamaicensis)
Legend
INHALATION EXPOSURE PATHWAY
INGESTION EXPOSURE PATHWAY
DIRECT CONTACT EXPOSURE PATHWAY
TRANSPORT ROUTE
(All Colors)
MINOR TRANSPORT ROUTES AND EXPOSURE PATHWAYS
ChaduxTt JV
Consulting Engineers and Scientists
Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California
FIGURE B-3
CONCEPTUAL SITE MODEL
TMSRA for Parcel B

TABLES

TABLE B-1: SUMMARY OF SHORELINE SEDIMENT SAMPLES

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Sample Location	Depth Interval (feet bgs)
Surface Samples (0.0 - 2.0 feet bgs) [a]	
IR07IT001	0.0 - 0.5
	1.5 - 2.0
IR07IT002	0.0 - 0.5
	1.5 - 2.0
IR07IT004	0.0 - 0.5
	1.5 - 2.0
IR07IT005	0.0 - 0.5
	1.5 - 2.0
IR07IT005D	0.0 - 0.5
IR07IT006	0.0 - 0.5
	1.5 - 2.0
IR07IT006D	0.0 - 0.5
IR07IT007	0.0 - 0.5
	1.5 - 2.0
IR07IT008	0.0 - 0.5
	1.5 - 2.0
IR07IT009	0.0 - 0.5
	1.5 - 2.0
IR07IT010	0.0 - 0.5
	1.5 - 2.0
IR07IT011	0.0 - 0.5
	1.5 - 2.0
IR07IT011D	1.5 - 2.0
IR07IT012	0.0 - 0.5
	1.5 - 2.0
IR07IT013	0.0 - 0.5
	1.5 - 2.0

Sample Location	Depth Interval (feet bgs)
Surface Samples (0.0 - 2.0 feet bgs) [a]	
IR07IT014	0.0 - 0.5
	1.5 - 2.0
IR07IT015	0.0 - 0.5
	1.5 - 2.0
IR07IT016	0.0 - 0.5
	1.5 - 2.0
IR07IT016D	0.0 - 0.5
IR07IT017	0.0 - 0.5
	1.5 - 2.0
IR07IT018	0.0 - 0.5
	1.5 - 2.0
IR07IT019	0.0 - 0.5
	1.5 - 2.0
IR07IT020	0.0 - 0.5
	1.5 - 2.0
IR07IT020D	0.0 - 0.5
	1.5 - 2.0
IR07IT021	0.0 - 0.5
	1.5 - 2.0
IR26IT001	0.0 - 0.5
	1.5 - 2.0
IR26IT004	0.0 - 0.5
	1.5 - 2.0
IR26IT007	0.0 - 0.5
	1.5 - 2.0

Sample Location	Depth Interval (feet bgs)
Subsurface Samples (2.5 - 4.0 feet bgs) [a]	
IR07IT004	2.5 - 3.0
	3.5 - 4.0
IR07IT009	2.5 - 3.0
	3.5 - 4.0
IR07IT010	2.5 - 3.0
IR07IT013	2.5 - 3.0
	3.5 - 4.0
IR07IT014	3.5 - 4.0
IR07IT015	2.5 - 3.0
	3.5 - 4.0
IR07IT016	2.5 - 3.0
	3.5 - 4.0
IR07IT016D	3.5 - 4.0
IR07IT017	2.5 - 3.0
IR07IT019	2.5 - 3.0
	3.5 - 4.0
IR07IT020	2.5 - 3.0
	3.5 - 4.0
IR07IT021	2.5 - 3.0
	3.5 - 4.0

Notes: "D" suffix on sample location name indicates a field duplicate sample

a Samples from the 2.5 to 3.0 feet bgs depth interval at locations IR07IT009, IR07IT017, and IR07IT020 were analyzed for organotins only. All other samples were analyzed for metals, organotins, polychlorinated biphenyls, pesticides, semivolatile organic compounds, total petroleum hydrocarbons, and volatile organic compounds.

bgs Below ground surface

TABLE B-5: SURFACE WATER CRITERIA FOR THE SAN FRANCISCO BAY
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Pseudonym	San Francisco Bay Basin Plan[a] (µg/L)		California Toxics Rule Criteria for Enclosed Bays and Estuaries[e] (µg/L)									National Recommended Water Quality Criteria[k] (µg/L) Saltwater Aquatic Life					National Ambient Water Quality Criteria (AWQC) for Protection of Saltwater Aquatic Life[l] (µg/L) Lowest Observed Effect Level (LOEL)								Other Criteria (footnotes indicate source) (µg/L)				Selected Water Quality Criteria (µg/L)
				Chronic[g]		Acute[g]			Instantaneous Maximum				Chronic[g]		Acute[g]			Chronic[h]		Acute[l]			Other[j]			Other		
		Concentration	Footnotes	Concentration	Footnotes	Concentration	20% of	Concentration[f]	Footnotes	Concentration	10% of	Concentration[f]	Footnotes	Concentration	Footnotes	Concentration	20% of	Concentration[f]	Footnotes	Concentration	Footnotes	Concentration	20% of	Concentration[f]	Footnotes	Concentration	Footnotes			
1,1,1-Trichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	31,200	6,240	--	--	--	--	--	--	6,240
1,1,2,2-Tetrachloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9,020	1,804	--	--	--	--	--	--	1804
1,1-Dichloroethene	1,1-Dichloroethylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	--	--	--	44,800
1,2,4,5-Tetrachlorobenzene		--	--	--	--	--	--	--	--	--	--	--						129	(22)							--	--	129
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	129	(22)	160	--	(22)	--	--	--	--	--	129
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)	--	--	--	--	--	129
1,2-Dichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	113,000	22,600	--	--	--	--	--	--	22,600
1,2-Dichloroethene (total)	1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	--	--	--	44,800
1,2-Dichloropropane	Propylene dichloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3,040	(28)	10,300	--	(28)				--	--	3,040
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)				--	--	129
1,3-Dichloropropene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	790	158	(29)	--	--	--	--	--	158
1,4-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)	--	--	--	--	--	129
2,4-Dinitrophenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,850	970	(88)				--	--	970
2,4-Dinitrotoluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	590	118	(53)	370	(53, 82)		--	--	118
2,6-Dinitrotoluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	590	118	(53)	370	(53, 82)		--	--	118
2-Chloronaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	1.5	(48)	--	--	--	--	--	1.5
2-Nitrophenol	Nitrophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	--	--	--	970
4,4'-DDD	2,4-DDD; DDD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.6	0.72	--	--	--	--	--	--	.72
4,4'-DDE	2,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	2.8	--	--	--	--	--	--	2.8
4,4'-DDT		--	--	0.001	(114)	0.13	--	--	--	--	--	--	0.001	G,aa,ii	0.13	--	G,ii	--	--	--	--	--	--	--	--	--	--	0.001
4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cresol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	--	--	--	970
4-Amino-2,6-dinitrotoluene	Dinitrotoluenes; 4-Methyl-3,5-dinitroaniline	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	590	118	--	370	(82)		--	--	118
4-Nitrophenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	--	--	--	970
Acenaphthene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	710	--	970	--	--	500	(38)		--	--	710
Acenaphthylene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Aldrin		--	--	--	--	--	--	--	1.3	--	II	--	--	--	1.3	0.26	G	--	--	--	--	--	--	--	--	--	--	0.26
Alpha-chlordane	Chlordane	--	--	0.004	(114)	--	--	--	0.09	--	--	0.004	G,aa,o	0.09	--	G,o	--	--	--	--	--	--	--	--	--	--	--	0.004
Anthracene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Aroclor-1016	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1221	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1232	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1242	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1248	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1254	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Aroclor-1260	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	--	--	--	--	0.03	N,aa	--	--	--	--	--	--	10	--	--	--	--	--	--	--	0.03
Arsenic		36	b	36	mm, oo	69	--	mm, oo	--	--	--	36	A,D,bb	69	--	A,D,bb	--	--	--	--	--	--	--	--	--	--	--	36
Atrazine		--	--	--	--	--	--	--	--	--	--	11	r,(68)	310	--	r,(68)	--	--	--	--	--	--	--	--	--	--	--	11
Benzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5,100	--	--	700	(83)		--	--	700
Benzo(a)anthracene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Benzo(a)pyrene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Benzo(b)fluoranthene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Benzo(g,h,i)perylene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Benzo(k)fluoranthene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	--	60
Bromochloromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Bromodichloromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Bromoform		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Bromomethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Butylbenzylphthalate	n-Butyl benzyl phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,944	588.8	(45)	3.4	(38, 45)		--	--	588.8
Cadmium		9.3	b	9.3	(1, 142)	42	--	(1, 142)	--	--	--	8.8	D,bb,gg	40	--	D,bb,gg	--	--	--	--	--	--	--	--	--	--	--	8.8
Carbon tetrachloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	50,000	--	--	11,500	(20, 82)		--	--	6,400
Chlordane				0.004	(114)	--	--	--	0.09	0.009	--	0.004	G,aa	0.09	0.009	G	--	--	--	--	--	--	--	--	--	--	--	0.004
Chlorobenzene	Monochlorobenzene	--	--	--	--	--		--				--	--	--	--	--	--	129	(22)	160	--	(22)	--	--	--	--	--	129
Chloroform		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Chloromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)		--	--	6,400
Chromium (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	400	s	400
Chromium VI		50 (VI)	b	50 (VI)	--	1,100 (VI)	--	--	--	--	--	50 (VI)	D,bb	1,100 (VI)	--	D,bb	--	--	--	--	--	--	--	--	--	--	--	50

TABLE B-5: SURFACE WATER CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Pseudonym	San Francisco Bay Basin Plan[a] (µg/L)		California Toxics Rule Criteria for Enclosed Bays and Estuaries[e] (µg/L)							National Recommended Water Quality Criteria[k] (µg/L)					National Ambient Water Quality Criteria (AWQC) for Protection of Saltwater Aquatic Life[l] (µg/L)							Other Criteria (footnotes indicate source) (µg/L)		Selected Water Quality Criteria (µg/L)
											Saltwater Aquatic Life					Lowest Observed Effect Level (LOEL)									
				Chronic[g]		Acute[g]			Instantaneous Maximum		Chronic[g]		Acute[g]			Chronic[h]		Acute[i]			Other[j]				
		Concentration	Footnotes	Concentration	Footnotes	Concentration	20% of Concentration[f]	Footnotes	Concentration	10% of Concentration[f]	Footnotes	Concentration	Footnotes	Concentration	20% of Concentration[f]	Footnotes	Concentration	Footnotes	Concentration	20% of Concentration[f]	Footnotes	Concentration	Footnotes	Other	Footnotes	
Chrysene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Cis-1,2-dichloroethene	Cis-1,2-dichloroethylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	--	--	44,800
Copper		--	--	3.1	nn, oo	4.8	--	oo	--	--	--	3.1	D,cc,ff	4.8	--	D,cc,ff	--	--	--	--	--	--	--	--	3.1
Cyanide		--	--	1	pp	1	--	pp	--	--	--	1	Q,bb	1	--	Q,bb	--	--	--	--	--	--	--			1
Dibenz(a,h)anthracene	1,2:5,6-Dibenzanthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Dibromochloromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	--	--	6,400
Dieldrin		--	--	0.0019	(114), ll	--	--	--	0.71	--	ll	0.0019	G,aa	0.71	0.142	G	--	--	--	--	--	--	--	--	--	0.142
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,944	588.8	(45)	3.4	(38, 45)	--	--	588.8
Dimethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,944	--	(45)	3.4	(38, 45)	--	--	3.4
Di-n-butylphthalate	Dibutyl phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,944	588.8	(45)	3.4	(38, 45)	--	--	588.8
Di-n-octylphthalate	Bis-n-octyl phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,944	588.8	(45)	3.4	(38, 45)	--	--	588.8
Endosulfan I	Endosulfan (alpha)	--	--	0.0087	ll	--	--	--	0.034	--	(115), ll	0.0087	G,Y,o	0.034	--	G,Y,o	--	--	--	--	--	--	--	--	--	0.0087
Endosulfan II	Endosulfan (beta)	--	--	0.0087	ll	--	--	--	0.034	--	(115), ll	0.0087	G,Y,o	0.034	--	G,Y,o	--	--	--	--	--	--	--	--	--	0.0087
Endrin		--	--	0.0023	(114), ll	--	--	--	0.037	--	ll	0.0023	G,aa	0.037	--	G	--	--	--	--	--	--	--	--	--	0.0023
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	430	86	--	--	--	--	--	86
Fluoranthene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16	--	40	--	--	--	--	--	--	16
Fluorene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Gamma-BHC (lindane)	Gamma-Benzene hexachloride	--	--	--	--	--	--	--	0.16	--	ll	--	--	0.16	0.032	G	--	--	--	--	--	--	--	--	--	0.032
Gamma-chlordane	Chlordane	--	--	0.004	(114)	--	--	--	0.09	--	--	0.004	G,aa,o	0.09	--	G,o	--	--	--	--	--	--	--	--	--	0.004
Heptachlor		--	--	0.0036	(114)	ll	--	--	0.053	--	ll	0.0036	G,aa	0.053	--	G	--	--	--	--	--	--	--	--	--	0.0036
Heptachlor epoxide		--	--	0.0036	(114)	ll		--	0.053	--	ll	0.0036	G,V,aa	0.053	--	G,V	--	--	--	--	--	--	--	--	--	0.0036
Hexachlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	129	(22)	160	--	(22)	--	--	--	--	129
Hexachlorobutadiene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	32	6.4	--	--	--	--	--	6.4
Hexachlorocyclopentadiene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	1.4	--	--	--	--	--	1.4
Hexachloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	940	188	--	--	--	--	--	188
Indeno(1,2,3-cd)pyrene	Ideno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Isophorone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12,900	2,580	--	--	--	--	--	2,580
Lead		8.1	b	8.1	(1, 142), m	210	--	(1, 142), m	--	--	--	8.1	D,bb	210	--	D,bb	--	--	--	--	--	--	--	--	--	5.6
Mercury	Mercury, inorganic	0.025	b	--	--	--	--	--	--	--	--	0.94	D,ee,hh	1.8	--	D,ee,hh	--	--	--	--	--	--	--	--	--	0.025
Methoxychlor		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.003	(51),f	0.003
Methyl-tert-butyl-ether	Methyl t-butyl ether (MTBE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8,000	p	8,000
Methylene chloride	Dichloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	--	--	6,400
Mirex		--	--	--	--	--	--	--	--	--	--	0.001	F	--	--	--	--	--	--	--	--	--	--	--	--	0.001
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,350	470	--	--	--	--	--	470
Nickel		8.2	b	8.2	(2, 142), oo	74	--	(1, 142), oo	--	--	--	8.2	D,bb	74	--	D,bb	--	--	--	--	--	--	--	--	--	8.2
Nitrobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,680	1,336	--	--	--	--	--	1,336
N-Nitroso-di-n-propylamine	N-Nitrosodi-n-propylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3,300,000	660,000	(56)	--	--	--	--	660,000
N-nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3,300,000	660,000	(56)	--	--	--	--	660,000
Pentachlorophenol		--	--	7.9	--	13	--	--	--	--	--	7.9	bb	13	--	bb	--	--	--	--	--	--	--	--	--	7.9
Phenanthrene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5,800	1,160	--	--	--	--	--	1,160
Pyrene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	--	--	60
Selenium		5.0	b	71	(1, 142)	290	--	(1, 142)	--	--	--	71	D,bb,dd	290	--	D,bb,dd	--	--	--	--	--	--	--	--	--	5
Silver		1.9	c	--	--	1.9	0.38	(1, 142)	--	--	--	--	--	1.9	0.38	D,G	--	--	--	--	--	--	--	--	--	0.38
Sulfide	Sulfide-Hydrogen Sulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2	(51),f	0.2
Tetrachloroethene	Tetrachloroethylene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	450	--	10,200	--	--	--	--	--	--	450
Thallium		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,130	426	--	--	--	--	--	426
Toluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5,000	--	6,300	--	--	--	--	--	--	5,000
Toxaphene		--	--	0.002	--	0.21	--	--	--	--	--	0.002	aa	0.21	--	--	--	--	--	--	--	--	--	--	--	0.002
TPH-Diesel	Diesel range organics; Diesel Fuel; Diesel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,400	q	1,400
TPH-Gasoline	Gasoline range organics; Gasoline	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,400	q	1,400
TPH-Motor Oil	Motor oil; motor oil range organics	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,400	q	1,400
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	--	--	44,800
Trichloroethene	Trichloroethylene (TCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,000	400	--	--	--	--	--	400
Zinc		81	b	81	mm, oo	90	--	oo	--	--	--	81	D,bb	90	--	D,bb	--	--	--	--	--	--	--	--	--	81

TABLE B-5: SURFACE WATER CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes: **Values shaded are selected as screening criteria.**
Footnotes and references are detailed below.

-- No criterion available
ug/L Microgram per liter
BHC Benzene Hexachloride (Lindane)
DDD Dichlorodiphenyldichloroethane
DDE 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene
DDT 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
TPH Total petroleum hydrocarbons

Footnotes:

a California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region (Water Board). "Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin." Table 3-3 Marine Water Quality Objectives for Toxic Pollutants for Surface Waters. Available online at http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm
b From Water Board "Basin Plan" 4-Day Average (Chronic)
c From Water Board "Basin Plan" 24-Hour and 1-Hour Average (Acute)
d From Water Board "Basin Plan" Instantaneous Maximum
e From "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (CTR) (EPA 2000) and "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 1995). The most appropriate criteria were used.
f Criterion made more suitably protective by means of standard convention of lowering acute values by 80 percent and instantaneous values by 90 percent to make them more appropriate for use under chronic exposure scenarios.
g An acute criterion (EPA identified as Criteria Maximum Concentration [CMC]) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The chronic concentration (EPA identified as Criterion Continuous Concentration [CCC]) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC are just two of the six parts of an aquatic life criterion; the other four parts are the acute averaging period, chronic averaging period, acute frequency of elevated level allowed, and chronic frequency of elevated level allowed. Because Clean Water Act 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States (EPA 2002a).
h EPA National "AWQC Lowest Observed Effect Level (Chronic)" (Water Board 2007)
i EPA National "AWQC Lowest Observed Effect Level (Acute)" (Water Board 2007)
j EPA National "AWQC Lowest Observed Effect Level (Other)" (Water Board 2007)
k From "National Recommended Water Quality Criteria: 2002" (EPA 2002a) and "Revision of National Recommended Water Quality Criteria." (EPA 2002b), unless otherwise noted.
l From "Final Technical Memorandum Estimation of Ambient Concentrations of Metals in Groundwater" (Tetra Tech 2001)
m In instances where criteria from "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (EPA 2000) refer to the "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 1995), Water Board 1995 criteria were used. The Water Board 1995 criteria are distinguished by an "m" in the footnote column.
o Detailed application of this toxicity criterion may require the review or summation of analyte isomer, congener, or speciation results, as applicable. Please see applicable regulatory agency source document for additional detail.
p Water Board 1998
q Tetra Tech EM Inc. 1999
r Water Board 2007
s Value derived in Appendix I; based on EPA "Ambient Water Quality Criteria for Chromium" EPA 440/5-80-035 with adjustment for chronic from acute criterion

The following lettered footnotes are derived from EPA "National Recommended Water Quality Criteria: 2002" (EPA 2002a), Table 1 - Priority Toxic Pollutants:

A This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EAP 440/5-84-033, January 1985), Species Mean Acute Values (SMAVs) are given for both arsenic (III) and arsenic (V) for five species, and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available on whether the toxicities of the forms of arsenic to aquatic organisms are additive.
D Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and mulitplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are currently unavailable. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs). See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington DC 20460; and 40CFR 131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble - Conversion Factors for Dissolved Metals.
F The deviation of this value is presented in the Red Book (EPA 440/9-76-023, July 1976).
G The criterion is based on Clean Water Act 304(a) aquatic life criterion issued in 1980 and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), Dichlorodiphenyltrichloroethane (DDT) (EPA 440/5-80-38), Endosulfan (EPA 440/5-80-046), Endrin (EPA 440/5-80-047), Heptachlor (EPA 440/5-80-052), Hexachlorocyclohexane (EPA 440/5-80-054), Silver (EPA 440/5-80-071), The minimum data requirements and derivation procedures were different in the 1980 guidelines than in the 1985 guidelines. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 guidelines.
N This criterion applies to total polychlorinated biphenyls (the sum of all congener or all isomer or homolog or Aroclor analyses.)
Q This recommended water quality criterion is expressed as mg free cyanide (as CN)/L.
V This value was derived from data for heptachlor, and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.
Y This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
aa This criterion is based on a Clean Water Act 304(a) aquatic life criterion issued in 1980 or 1986, and was issued in one of the following documents : Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80-038), Endrin (EPA 4405-80-047), Heptachlor (EPA 440/5-80-052), Polychlorinated biphenyls (EPA 440/5-80-068), Toxaphene (EPA 440/5-86-006). This CCC is currently based on the Final Residue Value (FRV) procedure. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393-15399, March 23, 1995), the EPA no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria. Therefore, the EPA anticipates that future revisions of this CCC will not be based on FRV procedure.
bb This water quality criterion is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* , PB85-227046, January 1985) and was issued in one of the following criteria documents: Arsenic (EPA 440/5-84-033), Cadmium (EPA 882-R-01-001), Chromium (EPA 440/5-84-029), Copper (EPA 440/5-84-031), Cyanide (EPA 440/5-84-028), Lead (EPA 440/5-84-027), Nickel (EPA 440/5-86-004), Pentachlorophenol (EPA 440/5-86-009), Toxaphene (EPA 440/5-86-006), Zinc (EPA 440/5-87-003).
cc When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic, and use of Water-Effect Ratios might be appropriate.
dd The selenium criteria document (EPA 440/5-87-006, September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fish in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 milligrams per liter (mg/L) in salt water because the saltwater CCC does not take into account uptake via the food chain.
ee This recommended water quality criterion was derived on page 43 of the mercury document (EPA 440/5-84-026, January1985). The saltwater CCC of 0.025 µg/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised Clean Water Act 304(a) aquatic life criteria.
ff This recommended water quality criterion was derived in Ambient Water Quality Criteria Saltwater Copper Addendum (draft, April 14, 1995) and was promulgated in the interim final National Toxics Rule (60 FR 22228-222237, May 4, 1995).
gg EPA is working on this criterion, and so this recommended water quality criterion may change substantially in the near future.
hh This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury, and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criterion was derived.
ii This criterion applies to DDT and its metabolites (that is, the total concentration of DDT and its metabolites should not exceed this value.)

TABLE B-5: SURFACE WATER CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

The following lettered footnotes are derived from EPA "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (EPA 2000).

ll This criterion is based on Clean Water Act 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/ Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80-038), Endosulfan (EPA 440/5-80-046), Endrin (EPA 440/5-80-047), Heptochlor (440/5-80-025), Hexachlorocyclohexane (EPA 440/5/80/054), Silver (EPA 440/5-80-071) (originally footnote g in CTR).

mm Criteria for these metals are expressed as a function of the water-effect ratio (WER) (originally footnote I in the CTR).

nn No criterion for protection of human health from consumption of aquatic organisms (excluding water) was presented in the 1980 criteria document or in the 1986 Quality Criteria for Water. Nevertheless, sufficient information was presented in the 1980 document to allow a calculation of a criterion, even though the results of the calculations were not shown in the document.

oo These freshwater and saltwater criteria for metals are expressed in terms of dissolved fraction of the metal in the water column. Criterion values were calculated by using EPA's Clean Water Act 304(a) guidance values (described in the total recoverable fraction) and then applying the conversion factors in 131.36(b)() and (2).

pp These criteria were promulgated for specific waters in California in the National Toxics Rule (NTR). The specific waters to which the NTR criteria apply include Waters of the State defined as bays or estuaries, including the San Francisco Bay upstream to and including Suisun Bay and the Sacramento-San Joaquin Delta. This section does not apply instead of the NTR for these criteria.

rr PCBs are a class of chemicals that include Aroclors 1242,1254,1221,1232,1248,1260, and 1016. The aquatic life criteria apply to the sum of this set of seven Aroclors.

The following numbered footnotes are derived from "A Compilation of Water Quality Goals" (Water Board 2007). These footnotes directly correlate with the source document.

1 Expressed as dissolved
2 Expressed as total recoverable
6 Pentavalent arsenic [As(V)] effects on plants.
20 For halomethanes
22 For chlorinated benzenes
23 Toxicity to a fish species exposed for 7.5 days
24 For dichlorobenzenes
27 For dichloroethylenes
28 For dichloropropanes
29 For dichloropropenes
38 Toxicity to algae occurs
45 For phthalate esters
48 For chlorinated naphthalenes
51 From U.S. Environmental Protection Agency, *Quality Criteria for Water* (1976) "The Red Book."
52 For polycyclic aromatic hydrocarbons
53 For dinitrotoluenes
56 For nitrosamines
68 Draft/tentative/provisional; applies only to second value if more than one value is listed.
82 A decrease in the number of algal cells occurs.
83 Adverse effects on a fish species exposed for 168 days.
88 For nitrophenols
95 For the pentavalent form
114 Developed as 24-hour average using 1980 EPA guidelines, but applied as 4-day average in the National Toxics Rule or Proposed California Toxics Rule.
115 Criterion most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
116 Applies separately to Aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016; based on carcinogenicity at 1-in-a-million risk level.
142 Criteria do not apply to waters subject to water quality objectives in Tables III-2A and III-2B of the San Francisco Bay Regional Water Quality Control Board's 1986 Basin Plan.
143 These criteria were promulgated for specific California waters in the National Toxics Rule.
144 The ambient level was set at or below the minimum reported detection limit.
145 The ambient concentraton represents the 95th percentile of the distribution. Additionally, the 95th percentile of the distribution was calculated using distribution-dependent formulae. For normal and lognormal distributions, the 95th percentile calculation used the parameters of the best-fitted regression line drawn through the detected values on the probability plot. For nonparametric distribution, the analytical formula was used (Gilbert 1987).

References:

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EPA. 2002a. "National Recommended Water Quality Criteria: 2002." EPA-822-R-02-047. November.
EPA. 2002b. "Revision of National Recommended Water Quality Criteria." FRL-OW-7431-3. December 27.

TABLE B-6: UNADJUSTED BIRD AND MAMMAL TOXICITY REFERENCE VALUES

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	MAMMAL UNADJUSTED TRVs		BIRD UNADJUSTED TRVs	
	Literature-Based High TRV (mg/kg-day)	Literature-Based Low TRV (mg/kg-day)	Literature-Based High TRV (mg/kg-day)	Literature-Based Low TRV (mg/kg-day)
Metals				
Aluminum	1.93E+01	1.93E+00	1.10E+03	1.10E+02
Antimony	1.25E+00	1.25E-01	NV	NV
Arsenic	4.70E+00	3.20E-01	2.20E+01	5.50E+00
Barium	1.98E+01	5.10E+00	4.17E+01	2.08E+01
Beryllium	6.60E+00	6.60E-01	NV	NV
Cadmium	2.64E+00	6.00E-02	1.04E+01	8.00E-02
Chromium[a]	2.74E+04	2.74E+03	5.00E+00	1.00E+00
Cobalt	2.00E+01	1.20E+00	NV	NV
Copper	6.32E+02	2.67E+00	5.23E+01	2.30E+00
Lead	2.41E+02	1.00E+00	8.75E+00	1.40E-02
Manganese	1.59E+02	1.37E+01	7.76E+02	7.76E+01
Mercury	4.00E+00	2.50E-01	1.80E-01	3.90E-02
Molybdenum	2.60E+00	2.60E-01	3.53E+01	3.50E+00
Nickel	3.16E+01	1.33E-01	5.52E+01	1.38E+00
Selenium	1.21E+00	5.00E-02	9.30E-01	2.30E-01
Thallium	1.43E+00	4.80E-01	3.50E-01	3.50E-02
Vanadium	2.10E+00	2.10E-01	1.14E+02	1.14E+01
Zinc	4.11E+02	9.61E+00	1.72E+02	1.72E+01
Pesticides				
BHC	3.75E+00[b]	5.00E-02[b]	2.25E+00	5.63E-01
Chlordane	6.80E+00[c]	1.29E-01[c]	1.07E+01	2.14E+00
Total DDT[d]	1.60E+01	8.00E-01	7.70E-01	7.70E-02
Dieldrin	1.00E+00[e]	1.00E-01[e]	1.50E+00	9.00E-03
Endosulfan II	6.80E+00[c]	1.29E-01[c]	1.00E+02[f]	1.00E+01[f]
Endosulfan sulfate	6.80E+00[c]	1.29E-01[c]	1.00E+02[f]	1.00E+01[f]
Endrin	6.80E+00[c]	1.29E-01[c]	3.00E+01	3.00E-01
Endrin aldehyde	6.80E+00[c]	1.29E-01[c]	3.00E+01[g]	3.00E-01[g]
Endrin ketone	6.80E+00[c]	1.29E-01[c]	3.00E+01[g]	3.00E-01[g]
Heptachlor	6.80E+00	1.29E-01	1.50E+00	9.00E-03
Heptachlor epoxide	6.80E+00[c]	1.29E-01[c]	1.50E+00[c]	9.00E-03[c]
Methoxychlor	5.00E+01	2.50E+00	1.50E+00[c]	9.00E-03[c]

TABLE B-6: UNADJUSTED BIRD AND MAMMAL TOXICITY REFERENCE VALUES (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	MAMMAL UNADJUSTED TRVs		BIRD UNADJUSTED TRVs	
	Literature-Based High TRV (mg/kg-day)	Literature-Based Low TRV (mg/kg-day)	Literature-Based High TRV (mg/kg-day)	Literature-Based Low TRV (mg/kg-day)
Polychlorinated Biphenyls[h]				
Total Aroclors	1.28E+00	3.60E-01	1.27E+00	9.00E-02
Polynuclear Aromatic Hydrocarbons				
HMW PAHs[i]	3.28E+01	1.31E+00	NV	NV
LMW PAHs[j]	1.50E+02	5.00E+01	NV	NV
Semivolatile Organic Compounds				
Pentachlorophenol	2.40E+00	2.40E-01	NV	NV
Organotins[k]				
Dibutyltin	1.50E+01	2.50E-01	4.59E+01	7.30E-01
Monobutyltin	1.50E+01	2.50E-01	4.59E+01	7.30E-01
Tetrabutyltin	1.50E+01	2.50E-01	4.59E+01	7.30E-01
Tributyltin	1.50E+01	2.50E-01	4.59E+01	7.30E-01

Notes:

a Based on trivalent chromium.

b TRV based on similar compound, lindane (gamma-BHC); individual TRV not developed.

c TRV based on similar compound, heptachlor; individual TRV not developed.

d Total DDT TRV based on 4,4'-DDT.

e TRV based on similar compound, aldrin; individual TRV not developed.

f TRV based on similar compound, endosulfan; individual TRV not developed.

g TRV based on similar compound, endrin; individual TRV not developed.

h Total Aroclor TRV based on Aroclor-1254.

i HMW PAHs are defined as measured PAHs with a molecular weight greater than 200 atomic units and include benzo(a)fluorene, fluoranthene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(b)fluorene, benzo(g,h,i)perylene, chrysene, benzo(a)anthracene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, and benzo(a)pyrene. TRV based on benzo(a)pyrene.

j LMW PAHs are defined as measured PAHs with a molecular weight below 200 atomic units, including naphthalene, fluorene, anthracene, phenanthrene, acenaphthene, and 2-methylnaphthalene. TRV based on naphthalene.

k TRV based on similar compound, butyltin; individual TRV not developed.

BHC	Benzene hexachloride	mg/kg-day	Milligram per kilogram per day
DDD	Dichlorodiphenyldichloroethane	NV	No value available
DDE	Dichlorodiphenyldichloroethene	PAH	Polynuclear aromatic hydrocarbon
DDT	Dichlorodiphenyltrichloroethane	Total Aroclors	Summed concentration of Aroclors
HMW	High molecular weight	Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
LMW	Low molecular weight	TRV	Toxicity reference value

TABLE B-7: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE MAXIMUM CONCENTRATION IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS RANGE-MEDIAN

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	0 - 2 feet bgs		
	EPC[a] (mg/kg)	Screening Criteria (mg/kg)	HQ Based on the Maximum Concentration
Metals			
Aluminum	19000	NA	NA
Antimony	24	NA	NA
Arsenic	28	70	0.4
Barium	630	NA	NA
Beryllium	0.62	NA	NA
Cadmium	5	9.6	0.52
Chromium	450	370	**1.2**
Cobalt	75	NA	NA
Copper	1950	270	**7.2**
Lead	800	218	**3.67**
Manganese	4900	NA	NA
Mercury	1.9	0.71	**2.68**
Molybdenum	2.5	NA	NA
Nickel	1700	51.6	**32.9**
Selenium	0.133	1.4	0.095
Silver	0.92	3.7	0.24
Thallium	5.8	NA	NA
Vanadium	64	NA	NA
Zinc	1100	410	**2.68**
Pesticides and PCBs			
Aroclor-1248	0.11	NA	NA
Aroclor-1254	1.1	NA	NA
Aroclor-1260	3.5	NA	NA
Total Aroclors	4.71	0.18	**26.1**
4,4-DDD	0.0023	0.02	0.12
4,4-DDE	0.017	0.027	0.63
4,4-DDT	0.11	0.007	**15.7**
Total DDT	0.1293	0.046	**2.81**
alpha-BHC	0.0064	NA	NA
alpha-Chlordane	0.0022	0.006	0.37
gamma-Chlordane	0.0021	0.006	0.35
Dieldrin	0.0265	0.008	**3.31**
Endosulfan II	0.0027	NA	NA
Endrin	0.023	0.045	0.51
Endrin aldehyde	0.0031	NA	NA
Endrin ketone	0.0097	NA	NA
Heptachlor	0.0016	NA	NA
Heptachlor epoxide	0.0053	NA	NA
Methoxychlor	0.017	NA	NA
SVOCs			
2-Methylnaphthalene	0.0194	0.67	0.17
4-Methylphenol	NA	NA	NA
4-Nitrophenol	NA	NA	NA
Acenaphthene	0.0266	0.5	0.42

TABLE B-7: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE MAXIMUM CONCENTRATION IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS RANGE-MEDIAN (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	0 - 2 feet bgs		
	EPC[a] (mg/kg)	Screening Criteria (mg/kg)	HQ Based on the Maximum Concentration
SVOCs (Continued)			
Acenaphthylene	0.0317	0.64	0.18
Anthracene	0.088	1.1	0.4
Azobenzene	NA	NA	NA
Benzo(a)anthracene	0.244	1.6	0.41
Benzo(a)pyrene	0.51	1.6	0.32
Benzo(b)fluoranthene	1.1	NA	NA
Benzo(g,h,i)perylene	0.13	NA	NA
Benzo(k)fluoranthene	0.77	NA	NA
Benzoic acid	0.685	NA	NA
Chrysene	0.69	2.8	0.25
Dibenz(a,h)anthracene	0.14	0.26	0.54
Dibenzofuran	0.14	NA	NA
Fluoranthene	2.3	5.1	0.45
Fluorene	0.28	0.54	0.52
Indeno(1,2,3-cd)pyrene	0.27	NA	NA
Naphthalene	0.124	2.1	0.059
Pentachlorophenol	0.037	NA	NA
Phenanthrene	1.8	1.5	**1.2**
Phenol	0.29	NA	NA
Pyrene	1.1	2.6	0.42
Total HMW PAHs	7.66	9.6	0.79
Total LMW PAHs	3.085	3.2	0.97
Organotins			
Dibutyltin	0.366	25.1	0.014
Monobutyltin	0.102	25.1	0.004
Tetrabutyltin	0.0484	25.1	0.0019
Tributyltin	0.99	25.1	0.04

TABLE B-7: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE MAXIMUM CONCENTRATION IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS RANGE-MEDIAN (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	2.5 - 4 feet bgs		
	EPC[a] (mg/kg)	Screening Criteria (mg/kg) ER-M	HQ Based on the Maximum Concentration
Metals			
Aluminum	22000	NA	NA
Antimony	5.9	NA	NA
Arsenic	6.6	70	0.4
Barium	170	NA	NA
Beryllium	0.52	NA	NA
Cadmium	5.9	9.6	0.62
Chromium	510	370	**1.38**
Cobalt	72	NA	NA
Copper	5400	270	**20**
Lead	1200	218	**5.51**
Manganese	600	NA	NA
Mercury	1.3	0.71	**1.83**
Molybdenum	11	NA	NA
Nickel	1600	51.6	**31**
Silver	0.5	3.7	0.14
Thallium	0.97	NA	NA
Vanadium	51	NA	NA
Zinc	1300	410	**3.17**
Pesticides and PCBs			
Aroclor-1254	0.45	NA	NA
Aroclor-1260	5.9	NA	NA
Total Aroclors	6.35	0.18	**35.3**
4,4-DDD	0.0055	0.02	0.28
4,4-DDE	0.03	0.027	**1.11**
4,4-DDT	0.12	0.007	**17.1**
Total DDT	0.156	0.046	**3.4**
alpha-Chlordane	0.0019	0.006	0.32
Dieldrin	0.045	0.008	**5.63**
Endosulfan sulfate	0.0096	NA	NA
Endrin	0.0076	0.045	0.17
Endrin aldehyde	0.0088	NA	NA
Heptachlor	0.0012	NA	NA
Methoxychlor	0.046	NA	NA
SVOCs			
2-Methylnaphthalene	0.04	0.67	0.6
4-Methylphenol	0.31	NA	NA
Acenaphthene	0.17	0.5	0.34
Acenaphthylene	0.16	0.64	0.25
Anthracene	0.46	1.1	0.42
Benzo(a)anthracene	2.6	1.6	**1.63**
Benzo(a)pyrene	2.8	1.6	**1.75**
Benzo(b)fluoranthene	2.9	NA	NA
Benzo(g,h,i)perylene	0.079	NA	NA
Benzo(k)fluoranthene	0.692	NA	NA

TABLE B-7: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE MAXIMUM CONCENTRATION IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS RANGE-MEDIAN (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	2.5 - 4 feet bgs		
	EPC[a] (mg/kg)	Screening Criteria (mg/kg) ER-M	HQ Based on the Maximum Concentration
SVOCs (Continued)			
Benzoic Acid	0.7	NA	NA
Benzyl Alcohol	0.19	NA	NA
Chrysene	3	2.8	**1.07**
Dibenz(a,h)anthracene	0.43	0.26	**1.65**
Dibenzofuran	0.059	NA	NA
Fluoranthene	4.1	5.1	0.8
Fluorene	0.1	0.54	0.19
Indeno(1,2,3-cd)pyrene	0.83	NA	NA
Naphthalene	0.141	2.1	0.067
Pentachlorophenol	0.16	NA	NA
Phenanthrene	1.8	1.5	**1.2**
Phenol	0.09	NA	NA
Pyrene	3.9	2.6	**1.5**
Total HMW PAHs	22.34	9.6	**2.33**
Total LMW PAHs	2.871	3.2	0.91
Organotins			
Dibutyltin	0.189	25.1	0.00753
Monobutyltin	0.0676	25.1	0.0027
Tributyltin	0.335	25.1	0.0134

Notes:

a	EPC is the maximum detected concentration
Bold	HQ above 1.0
bgs	Below ground surface
BHC	Benzene Hexachloride
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HMW	High molecular weight
HQ	Hazard quotient
LMW	Low molecular weight
NA	Effects range-median not available
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
SVOC	Semivolatile organic compound
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)

TABLE B-8: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE DETECTED CONCENTRATION IN GROUNDWATER TO SCREENING CRITERIA

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well	Chemical	Maximum Detected Concentration	Screening Criterion[a]	Unit	Sample Date	Hazard Quotient
Metals						
IR26MW46A	Aluminum	5,150		µg/L	22-May-03	
IR07MW26A	Antimony	82.15		µg/L	16-Nov-04	
IR07MW21A1	Arsenic	38	36	µg/L	01-Sep-04	**1.06**
IR26MW45A	Barium	744		µg/L	12-Jan-00	
IR26MW48A	Chromium	60.8		µg/L	29-Mar-04	
IR07MW20A1	Chromium VI	10		µg/L	14-Nov-02	
IR07MWS-4	Cobalt	18.4		µg/L	17-Nov-04	
PA50MW01A	Copper	362	3.1	µg/L	04-Jun-02	**117**
IR07MW19A	Cadmium	3.4	8.8	µg/L	16-Nov-04	0.39
IR26MW46A	Iron	8,100		µg/L	22-May-03	
IR07MWS-2	Lead	114	5.6	µg/L	01-Sep-04	**20.4**
IR07MWS-2	Molybdenum	42.8		µg/L	10-Oct-00	
IR07MWS-2	Magnesium	1,260,000		µg/L	04-Nov-03	
IR07MWS-4	Manganese	8,340		µg/L	17-Nov-04	
IR26MW47A	Mercury	2.8	0.025	µg/L	17-Nov-04	**112**
IR26MW48A	Nickel	79.1	8.2	µg/L	23-May-03	**9.65**
IR07MW26A	Selenium	73.7	5	µg/L	01-Sep-04	**14.7**
IR26MW48A	Silver	2.1	0.38	µg/L	07-Jun-04	**5.53**
IR07MW26A	Thallium	163	426	µg/L	29-Mar-04	0.38
IR26MW46A	Vanadium	16.5		µg/L	22-May-03	
IR26MW45A	Zinc	200	81	µg/L	12-Jan-00	**2.47**
Volatile Organic Chemicals						
IR26MW41A	1,1,2-Trichloro-1,2,2-trifluoroethane	66		µg/L	05-Mar-03	
IR26MW41A	1,2-Dichlorobenzene	1	129	µg/L	14-Jun-02	0.01
IR26MW41A	Cis-1,2-Dichloroethene[b]	0.29	44,800	µg/L	29-Mar-04	6.47E-06
PA50MW01A	Bromomethane	0.275	6,400	µg/L	04-Jun-02	4.30E-05
IR07MWS-2	Carbon disulfide	2		µg/L	13-Mar-02	
IR26MW45A	Chloroform	4	6,400	µg/L	02-May-00	0.0006
IR26MW41A	Dichlorodifluoromethane	59		µg/L	05-Nov-03	
IR07MW25A	Ethylbenzene	0.38	86	µg/L	02-Jun-04	0.0044
IR26MW41A	Methane	180		µg/L	26-Sep-02	
IR07MW24A	Methyl tert-butyl ether	0.2	8,000	µg/L	03-Jun-04	2.50E-05
IR07MW21A1	Toluene	0.74	5,000	µg/L	25-Mar-04	0.0001
IR07MWS-4	Trichloroethene	0.25	400	µg/L	17-Nov-04	0.0006
IR26MW41A	Trichlorofluoromenthane	14		µg/L	05-Mar-03	
IR46MW37A	m,p-Xylenes	0.7		µg/L	26-Sep-02	
IR07MW20A1	Xylene(total)	0.51		µg/L	16-Nov-04	
Pesticides						
IR26MW48A	DDE	0.02635	2.8	µg/L	23-May-03	0.01
IR26MW46A	Aldrin	0.0145	0.26	µg/L	13-Aug-03	0.06
IR26MW46A	Alpha-chlordane	0.01325	0.004	µg/L	10-Nov-03	**3.31**
IR26MW48A	Endosulfan sulfate[c]	0.0008	0.0087	µg/L	23-May-03	0.09
IR26MW48A	Endrin aldehyde[d]	0.026	0.0023	µg/L	23-May-03	**11.30**
IR26MW46A	Gamma-chlordane	0.01365	0.004	µg/L	10-Nov-03	**3.41**
IR26MW47A	Heptachlor	0.028	0.0036	µg/L	11-Mar-03	**7.78**

TABLE B-8: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF THE DETECTED CONCENTRATION IN GROUNDWATER TO SCREENING CRITERIA (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well	Chemical	Maximum Detected Concentration	Screening Criterion[a]	Unit	Sample Date	Hazard Quotient
Semivolatile Organic Compounds						
IR26MW46A	Acenapthene	3.5	710	µg/L	13-Aug-03	0.0049
IR26MW48A	Acenapthylene	3	60	µg/L	23-May-03	0.05
IR26MW48A	Anthracene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Benzo(a)anthracene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Benzo(a)pyrene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Benzo(b)fluoranthene	3	60	µg/L	23-May-03	0.05
IR26MW48A	Chrysene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Dibenz(a,h)anthracene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Fluoranthene	3.5	16	µg/L	23-May-03	0.22
IR26MW46A	Fluorene	3	60	µg/L	13-Aug-03	0.05
IR26MW48A	Indeno(1,2,3-cd)pyrene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Naphthalene	7.5	470	µg/L	23-May-03	0.02
IR26MW48A	Phenanthrene	3.5	60	µg/L	23-May-03	0.06
IR26MW48A	Pyrene	3	60	µg/L	23-May-03	0.05
Total Petroleum Hydrocarbons						
IR10MW31A1	Diesel Range Organics	78.5	1,400	µg/L	29-Aug-02	0.06
IR07MW20A1	Gasoline Range Organics	87	1,400	µg/L	04-Jun-02	0.06
IR07MW25A	Motor Oil Range Organics	360	1,400	µg/L	16-Nov-04	0.26

Notes:

Bold	Hazard quotient above 1.0
a	Table B-5 provides basis for screening criteria.
b	Criterion for total 1,2-dichloroethene
c	Criterion for endosulfan I
d	Criterion for endrin
µg/L	Microgram per liter
DDE	Dichlorodiphenyldichloroethene

TABLE B-9: BIOACCUMULATION FACTORS
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	*Macoma* BAF (concentration [mg\kg] dry tissue/concentration [mg\kg] dry sediment)[a]	Soft-Bodied Aquatic Invertebrate BAF (concentration [mg\kg] dry tissue/ concentration [mg\kg] dry sediment)[a,b]	Terrestrial Invertebrate BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil)[c,d]	Soil-to-Seed BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil[c,e]	Soil-to-Stem/Leaf BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil)[c,e]	Mouse BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil or sediment) [c,f]
Aluminum	0.02	0.33	0.22 [g]	0.004 [g]	0.004 [g]	0.000065 [g]
Antimony	0.1	0.33	0.927	0.288	0.667	0.013033
Arsenic	1.92	1.53	0.297	0.095	0.228	0.3108
Barium	0.03	0.28	0.22 [g]	0.15 [g]	0.15 [g]	0.000065 [g]
Beryllium	0.9 [g]	0.9 [g]	0.22 [g]	0.01 [g]	0.01 [g]	0.000065 [g]
Cadmium	1.08	3.86	0.501	0.791	0.745	0.008886
Chromium	0.06	0.22	0.01 [g]	0.008 [g]	0.008 [g]	0.000065 [g]
Cobalt	0.13	0.39	0.07 [g]	0.026 [g]	0.026 [g]	0.000065 [g]
Copper	0.22	0.67	0.796	0.165	0.182	0.075521
Lead	0.08	0.39	0.074	0.017	0.032	0.033436
Manganese	0.07	0.41	0.064	0.099	0.107	0.018157
Mercury	0.29	0.61	0.624	0.117	0.137	0.008631
Molybdenum	2.86	1.75	2.386	4.044	4.258	0.834834
Nickel	0.08	0.29	0.018	0.025	0.026	0.00034
Selenium	14.0	20.0	9.17	1.54	1.50	1.063830
Silver	0.45	1.11	1.89	2.34	4.96	0.022436
Thallium	0.9 [g]	0.9 [g]	0.22 [g]	0.004 [g]	0.004 [g]	0.000065 [g]
Vanadium	0.06	0.29	0.22 [g]	0.12 [g]	0.12 [g]	0.000065 [g]
Zinc	0.73	0.84	0.821	0.285	0.548	0.127101
alpha-Chlordane	3.62	5.82	21.716	4.052	10.099	0.094912
alpha-BHC	7.144 [g]	7.144 [g]	7.14 [g]	0.54 [g]	0.54 [g]	0.0000202 [g]
beta-BHC	7.027 [g]	7.027 [g]	7.03 [g]	0.55 [g]	0.55 [g]	0.0000197 [g]
delta-BHC	9.437 [g]	9.437 [g]	9.44 [g]	0.45 [g]	0.45 [g]	0.0000283 [g]
Total DDT	3.49	14.28	13.084	3.781	9.964	0.01877
Dieldrin	4.97	21.7	26.5 [g]	0.22 [g]	0.22 [g]	0.0000997 [g]
Endosulfan II	7.32 [g]	7.32 [g]	7.32 [g]	0.54 [g]	0.54 [g]	0.0000208 [g]
Endosufan sulfate	6.37 [g]	6.37 [g]	6.37 [g]	0.61 [g]	0.61 [g]	0.0000176 [g]
Endrin	28.48 [g]	28.48 [g]	22.5 [g]	0.24 [g]	0.24 [g]	0.0000816 [g]
Endrin aldehyde	31.2 [g]	31.2 [g]	31.2 [g]	0.19 [g]	0.19 [g]	0.000122 [g]
Endrin ketone	31.2 [g]	31.2 [g]	31.2 [g]	0.19 [g]	0.19 [g]	0.000122 [g]
gamma-Chlordane	3.16	4.16	21.716	4.052	10.099	0.094912
Heptachlor	26.49 [g]	26.49 [g]	1.4 [g]	0.0489 [g]	0.0489 [g]	0.0000997 [g]
Heptachlor epoxide	26.49 [g]	26.49 [g]	1.4 [g]	0.0489 [g]	0.0489 [g]	0.0000997 [g]

TABLE B-9: BIOACCUMULATION FACTORS (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	*Macoma* BAF (concentration [mg\kg] dry tissue/concentration [mg\kg] dry sediment)[a]	Soft-Bodied Aquatic Invertebrate BAF (concentration [mg\kg] dry tissue/ concentration [mg\kg] dry sediment)[a,b]	Terrestrial Invertebrate BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil)[c,d]	Soil-to-Seed BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil[c,e]	Soil-to-Stem/Leaf BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil)[c,e]	Mouse BAF (concentration [mg\kg] wet tissue/ concentration [mg\kg] dry soil or sediment) [c,f]
Methoxychlor	20.38 [g]	20.38 [g]	20.4 [g]	0.26 [g]	0.26 [g]	0.0000725 [g]
Total Aroclors	1.77	6.15	16.203	2.586	7.541	0.059934
4-Methylphenol	1.557 [g]	1.557 [g]	1.56 [g]	1.6 [g]	1.6 [g]	0.00000313 [g]
4-Nitrophenol	1.519 [g]	1.519 [g]	1.52 [g]	1.62 [g]	1.62 [g]	0.00000304 [g]
Azobenzene	7.261 [g]	7.261 [g]	7.261 [g]	0.534 [g]	0.534 [g]	0.0000205 [g]
Benzoic Acid	1.47 [g]	1.47 [g]	1.47 [g]	1.66 [g]	1.66 [g]	0.00000293 [g]
Benzyl Alcohol	0.783 [g]	0.783 [g]	0.78 [g]	2.59 [g]	2.59 [g]	0.00000135 [g]
Dibenzofuran	9.284 [g]	9.284 [g]	9.28 [g]	0.45 [g]	0.45 [g]	0.0000277 [g]
HMW PAH	0.21	0.63	0.441 [g]	0.346 [g]	0.534 [g]	0.000122 [g]
LMW PAH	0.11	0.69	1.892 [g]	1.38 [g]	2.307 [g]	0.000122 [g]
Pentachlorophenol	21.058[g]	21.058 [g]	1,034 [g]	0.0449 [g]	0.0449 [g]	0.0000754 [g]
Phenol	1.051 [g]	1.051 [g]	1.05 [g]	2.11 [g]	2.11 [g]	0.00000194 [g]
Dibutyltin	1.91	14.08	1.077 [g]	2.068 [g]	2.068 [g]	0.000002 [g]
Monobutyltin	4.78 [g]	4.78 [g]	4.782 [g]	0.722 [g]	0.722 [g]	0.0000123 [g]
Tetrabutyltin	651.25 [g]	651.25 [g]	651.25 [g]	0.0225 [g]	0.0225 [g]	0.00498 [g]
Tributyltin	4.92	10.13	130.8 [g]	0.0699 [g]	0.0699 [g]	0.000701 [g]

Notes:

a Site-specific BAFs from Parcel F VS report (Battelle and others 2002), unless otherwise noted.
b Point Avisadero tissue and sediment data excluded from BAF calculation of mercury and total PCBs.
c Site-specific BAFs from Parcel E ERA VS report (Tetra Tech and LFR 2000), unless otherwise noted
d For invertebrates, wet weight was converted to dry weight using 69 percent moisture from EPA 1993.
e For plants, wet weight was converted to dry weight using site specific percent moisture data (37.75 percent for seeds and 72.31 for leaves and stems). Site-specific percent moisture for seeds and stems was taken from HPS Parcel E VS. BAFs obtained from EPA 1999 were already in dry weight; thus, no conversion was necessary.
f For mammals, wet weight was converted to dry weight using percent moisture from EPA 1999 (68 percent).
g BAFs from EPA 1999 were used for these chemicals; site-specific BAFs were not available for these chemicals.

BAF	Bioaccumulation factor	LFR	Levine-Fricke-Recon
BHC	Benzene hexachloride	LMW	Low molecular weight
DDD	Dichlorodiphenyldichloroethane	mg/kg	Milligram per kilogram
DDE	Dichlorodiphenyldichloroethene	PAH	Polynuclear aromatic hydrocarbon
DDT	Dichlorodiphenyltrichloroethane	PCB	Polychlorinated biphenyl
EPA	U.S. Environmental Protection Agency	Tetra Tech	Tetra Tech EM Inc.
ERA	Ecological risk assessment	Total Aroclors	Summed concentrations of of Aroclors
HMW	High molecular weight	Total DDT	Summed concentrations of DDT and its metabolites DDD and DDE
HPS	Hunters Point Shipyard	VS	Validation study

Sources:

Battelle, Entrix, Inc., and Neptune and Company. 2002. "Draft Hunters Point Shipyard Parcel F Validation Study Report, San Francisco, California." April 25.
Tetra Tech and LFR. 2000. "Ecological Risk Assessment Validation Study Report, Parcel E, Hunters Point Shipyard, San Francisco, California, Draft Final." March 14.
EPA. 1993. "Wildlife Exposure Factors Handbook; Volumes I and II." EPA 600/R-93/187a. December.
EPA. 1999. "Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites." EPA, Office of Solid Waste and Emergency Response. Washington, DC. Directive 9285.7-28P. October.

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)											
Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.90E+04	2.73E-03	2.00E-02	3.80E+02	9.09E-02	1.15E+00	7.51E+01	1.64E+03	4.58E-02
	Low TRV	1.00E+00	1.90E+04	2.73E-03	2.00E-02	3.80E+02	9.09E-02	1.15E+00	7.51E+01	1.64E+02	4.58E-01
Antimony											
	High TRV	1.00E+00	2.40E+01	2.73E-03	1.00E-01	2.40E+00	9.09E-02	1.15E+00	2.47E-01	NV	NC
	Low TRV	1.00E+00	2.40E+01	2.73E-03	1.00E-01	2.40E+00	9.09E-02	1.15E+00	2.47E-01	NV	NC
Arsenic											
	High TRV	1.00E+00	2.80E+01	2.73E-03	1.92E+00	5.38E+01	9.09E-02	1.15E+00	4.32E+00	2.19E+01	1.97E-01
	Low TRV	1.00E+00	2.80E+01	2.73E-03	1.92E+00	5.38E+01	9.09E-02	1.15E+00	4.32E+00	5.48E+00	7.88E-01
Barium											
	High TRV	1.00E+00	6.30E+02	2.73E-03	3.00E-02	1.89E+01	9.09E-02	1.15E+00	2.99E+00	6.54E+01	4.57E-02
	Low TRV	1.00E+00	6.30E+02	2.73E-03	3.00E-02	1.89E+01	9.09E-02	1.15E+00	2.99E+00	3.26E+01	9.16E-02
Beryllium											
	High TRV	1.00E+00	6.20E-01	2.73E-03	9.00E-01	5.58E-01	9.09E-02	1.15E+00	4.56E-02	NV	NC
	Low TRV	1.00E+00	6.20E-01	2.73E-03	9.00E-01	5.58E-01	9.09E-02	1.15E+00	4.56E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.00E+00	2.73E-03	1.08E+00	5.40E+00	9.09E-02	1.15E+00	4.39E-01	1.76E+01	2.50E-02
	Low TRV	1.00E+00	5.00E+00	2.73E-03	1.08E+00	5.40E+00	9.09E-02	1.15E+00	4.39E-01	8.61E-02	5.10E+00
Chromium											
	High TRV	1.00E+00	4.50E+02	2.73E-03	6.00E-02	2.70E+01	9.09E-02	1.15E+00	3.20E+00	4.92E+00	6.51E-01
	Low TRV	1.00E+00	4.50E+02	2.73E-03	6.00E-02	2.70E+01	9.09E-02	1.15E+00	3.20E+00	9.83E-01	3.26E+00
Cobalt											
	High TRV	1.00E+00	7.50E+01	2.73E-03	1.30E-01	9.75E+00	9.09E-02	1.15E+00	9.49E-01	NV	NC
	Low TRV	1.00E+00	7.50E+01	2.73E-03	1.30E-01	9.75E+00	9.09E-02	1.15E+00	9.49E-01	NV	NC
Copper											
	High TRV	1.00E+00	1.95E+03	2.73E-03	2.20E-01	4.29E+02	9.09E-02	1.15E+00	3.85E+01	6.43E+01	5.99E-01
	Low TRV	1.00E+00	1.95E+03	2.73E-03	2.20E-01	4.29E+02	9.09E-02	1.15E+00	3.85E+01	2.59E+00	1.49E+01
Lead											
	High TRV	1.00E+00	8.00E+02	2.73E-03	8.00E-02	6.40E+01	9.09E-02	1.15E+00	6.96E+00	9.41E+00	7.40E-01
	Low TRV	1.00E+00	8.00E+02	2.73E-03	8.00E-02	6.40E+01	9.09E-02	1.15E+00	6.96E+00	2.27E-02	3.07E+02
Manganese											
	High TRV	1.00E+00	4.90E+03	2.73E-03	7.00E-02	3.43E+02	9.09E-02	1.15E+00	3.87E+01	1.10E+03	3.51E-02
	Low TRV	1.00E+00	4.90E+03	2.73E-03	7.00E-02	3.43E+02	9.09E-02	1.15E+00	3.87E+01	1.10E+02	3.51E-01
Mercury											
	High TRV	1.00E+00	1.90E+00	2.73E-03	2.90E-01	5.51E-01	9.09E-02	1.15E+00	4.81E-02	1.85E-01	2.60E-01
	Low TRV	1.00E+00	1.90E+00	2.73E-03	2.90E-01	5.51E-01	9.09E-02	1.15E+00	4.81E-02	4.01E-02	1.20E+00
Molybdenum											
	High TRV	1.00E+00	2.50E+00	2.73E-03	2.86E+00	7.15E+00	9.09E-02	1.15E+00	5.71E-01	3.35E+01	1.71E-02
	Low TRV	1.00E+00	2.50E+00	2.73E-03	2.86E+00	7.15E+00	9.09E-02	1.15E+00	5.71E-01	3.32E+00	1.72E-01
Nickel											
	High TRV	1.00E+00	1.70E+03	2.73E-03	8.00E-02	1.36E+02	9.09E-02	1.15E+00	1.48E+01	6.33E+01	2.34E-01
	Low TRV	1.00E+00	1.70E+03	2.73E-03	8.00E-02	1.36E+02	9.09E-02	1.15E+00	1.48E+01	1.56E+00	9.45E+00
Selenium											
	High TRV	1.00E+00	1.33E-01	2.73E-03	1.40E+01	1.86E+00	9.09E-02	1.15E+00	1.47E-01	9.37E-01	1.57E-01
	Low TRV	1.00E+00	1.33E-01	2.73E-03	1.40E+01	1.86E+00	9.09E-02	1.15E+00	1.47E-01	2.32E-01	6.36E-01
Silver											
	High TRV	1.00E+00	9.20E-01	2.73E-03	4.50E-01	4.14E-01	9.09E-02	1.15E+00	3.49E-02	NV	NC
	Low TRV	1.00E+00	9.20E-01	2.73E-03	4.50E-01	4.14E-01	9.09E-02	1.15E+00	3.49E-02	NV	NC

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Thallium											
	High TRV	1.00E+00	5.80E+00	2.73E-03	9.00E-01	5.22E+00	9.09E-02	1.15E+00	4.26E-01	6.02E-01	7.08E-01
	Low TRV	1.00E+00	5.80E+00	2.73E-03	9.00E-01	5.22E+00	9.09E-02	1.15E+00	4.26E-01	6.02E-02	7.08E+00
Vanadium											
	High TRV	1.00E+00	6.40E+01	2.73E-03	6.00E-02	3.84E+00	9.09E-02	1.15E+00	4.55E-01	1.14E+02	4.01E-03
	Low TRV	1.00E+00	6.40E+01	2.73E-03	6.00E-02	3.84E+00	9.09E-02	1.15E+00	4.55E-01	1.14E+01	4.01E-02
Zinc											
	High TRV	1.00E+00	1.10E+03	2.73E-03	7.30E-01	8.03E+02	9.09E-02	1.15E+00	6.61E+01	1.79E+02	3.70E-01
	Low TRV	1.00E+00	1.10E+03	2.73E-03	7.30E-01	8.03E+02	9.09E-02	1.15E+00	6.61E+01	1.79E+01	3.70E+00
Total Aroclors											
	High TRV	1.00E+00	4.70E+00	2.73E-03	1.77E+00	8.32E+00	9.09E-02	1.15E+00	6.69E-01	1.17E+00	5.70E-01
	Low TRV	1.00E+00	4.70E+00	2.73E-03	1.77E+00	8.32E+00	9.09E-02	1.15E+00	6.69E-01	9.68E-02	6.91E+00
Total DDT											
	High TRV	1.00E+00	1.29E-01	2.73E-03	3.49E+00	4.51E-01	9.09E-02	1.15E+00	3.60E-02	1.54E+00	2.33E-02
	Low TRV	1.00E+00	1.29E-01	2.73E-03	3.49E+00	4.51E-01	9.09E-02	1.15E+00	3.60E-02	9.26E-03	3.89E+00
alpha-BHC											
	High TRV	1.00E+00	6.40E-03	2.73E-03	7.14E+00	4.57E-02	9.09E-02	1.15E+00	3.63E-03	3.38E+00	1.07E-03
	Low TRV	1.00E+00	6.40E-03	2.73E-03	7.14E+00	4.57E-02	9.09E-02	1.15E+00	3.63E-03	8.46E-01	4.29E-03
alpha-Chlordane											
	High TRV	1.00E+00	2.20E-03	2.73E-03	3.62E+00	7.96E-03	9.09E-02	1.15E+00	6.35E-04	1.91E+01	3.33E-05
	Low TRV	1.00E+00	2.20E-03	2.73E-03	3.62E+00	7.96E-03	9.09E-02	1.15E+00	6.35E-04	3.81E+00	1.66E-04
gamma-Chlordane											
	High TRV	1.00E+00	2.10E-03	2.73E-03	3.16E+00	6.64E-03	9.09E-02	1.15E+00	5.30E-04	1.91E+01	2.78E-05
	Low TRV	1.00E+00	2.10E-03	2.73E-03	3.16E+00	6.64E-03	9.09E-02	1.15E+00	5.30E-04	3.81E+00	1.39E-04
Dieldrin											
	High TRV	1.00E+00	2.65E-02	2.73E-03	4.97E+00	1.32E-01	9.09E-02	1.15E+00	1.05E-02	9.22E-01	1.14E-02
	Low TRV	1.00E+00	2.65E-02	2.73E-03	4.97E+00	1.32E-01	9.09E-02	1.15E+00	1.05E-02	9.22E-02	1.14E-01
Endosulfan II											
	High TRV	1.00E+00	2.70E-03	2.73E-03	7.32E+00	1.98E-02	9.09E-02	1.15E+00	1.57E-03	1.24E+02	1.27E-05
	Low TRV	1.00E+00	2.70E-03	2.73E-03	7.32E+00	1.98E-02	9.09E-02	1.15E+00	1.57E-03	1.24E+01	1.27E-04
Endrin											
	High TRV	1.00E+00	2.30E-02	2.73E-03	2.85E+01	6.55E-01	9.09E-02	1.15E+00	5.18E-02	3.00E+01	1.73E-03
	Low TRV	1.00E+00	2.30E-02	2.73E-03	2.85E+01	6.55E-01	9.09E-02	1.15E+00	5.18E-02	3.00E-01	1.73E-01
Endrin aldehyde											
	High TRV	1.00E+00	3.10E-03	2.73E-03	3.12E+01	9.67E-02	9.09E-02	1.15E+00	7.65E-03	3.00E+01	2.55E-04
	Low TRV	1.00E+00	3.10E-03	2.73E-03	3.12E+01	9.67E-02	9.09E-02	1.15E+00	7.65E-03	3.00E-01	2.55E-02
Endrin ketone											
	High TRV	1.00E+00	9.70E-03	2.73E-03	3.12E+01	3.03E-01	9.09E-02	1.15E+00	2.39E-02	3.00E+01	7.98E-04
	Low TRV	1.00E+00	9.70E-03	2.73E-03	3.12E+01	3.03E-01	9.09E-02	1.15E+00	2.39E-02	3.00E-01	7.98E-02
Heptachlor											
	High TRV	1.00E+00	1.60E-03	2.73E-03	2.65E+01	4.23E-02	9.09E-02	1.15E+00	3.35E-03	1.54E+00	2.17E-03
	Low TRV	1.00E+00	1.60E-03	2.73E-03	2.65E+01	4.23E-02	9.09E-02	1.15E+00	3.35E-03	9.26E-03	3.62E-01
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	2.73E-03	2.65E+01	1.40E-01	9.09E-02	1.15E+00	1.11E-02	1.54E+00	7.20E-03
	Low TRV	1.00E+00	5.30E-03	2.73E-03	2.65E+01	1.40E-01	9.09E-02	1.15E+00	1.11E-02	9.26E-03	1.20E+00
Methoxychlor											
	High TRV	1.00E+00	1.70E-02	2.73E-03	2.04E+01	3.46E-01	9.09E-02	1.15E+00	2.74E-02	1.54E+00	1.78E-02
	Low TRV	1.00E+00	1.70E-02	2.73E-03	2.04E+01	3.46E-01	9.09E-02	1.15E+00	2.74E-02	9.26E-03	2.96E+00

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
4-Methylphenol											
	High TRV	1.00E+00	1.40E-01	2.73E-03	1.56E+00	2.18E-01	9.09E-02	1.15E+00	1.76E-02	NV	NC
	Low TRV	1.00E+00	1.40E-01	2.73E-03	1.56E+00	2.18E-01	9.09E-02	1.15E+00	1.76E-02	NV	NC
4-Nitrophenol											
	High TRV	1.00E+00	7.20E-02	2.73E-03	1.52E+00	1.09E-01	9.09E-02	1.15E+00	8.82E-03	NV	NC
	Low TRV	1.00E+00	7.20E-02	2.73E-03	1.52E+00	1.09E-01	9.09E-02	1.15E+00	8.82E-03	NV	NC
Azobenzene											
	High TRV	1.00E+00	4.30E-02	2.73E-03	7.26E+00	3.12E-01	9.09E-02	1.15E+00	2.48E-02	NV	NC
	Low TRV	1.00E+00	4.30E-02	2.73E-03	7.26E+00	3.12E-01	9.09E-02	1.15E+00	2.48E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	6.90E-01	2.73E-03	1.47E+00	1.01E+00	9.09E-02	1.15E+00	8.18E-02	NV	NC
	Low TRV	1.00E+00	6.90E-01	2.73E-03	1.47E+00	1.01E+00	9.09E-02	1.15E+00	8.18E-02	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	4.10E-02	2.73E-03	7.83E-01	3.21E-02	9.09E-02	1.15E+00	2.63E-03	NV	NC
	Low TRV	1.00E+00	4.10E-02	2.73E-03	7.83E-01	3.21E-02	9.09E-02	1.15E+00	2.63E-03	NV	NC
Dibenzofuran											
	High TRV	1.00E+00	1.40E-01	2.73E-03	9.28E+00	1.30E+00	9.09E-02	1.15E+00	1.03E-01	NV	NC
	Low TRV	1.00E+00	1.40E-01	2.73E-03	9.28E+00	1.30E+00	9.09E-02	1.15E+00	1.03E-01	NV	NC
HMW PAHs											
	High TRV	1.00E+00	7.66E+00	2.73E-03	2.10E-01	1.61E+00	9.09E-02	1.15E+00	1.45E-01	NV	NC
	Low TRV	1.00E+00	7.66E+00	2.73E-03	2.10E-01	1.61E+00	9.09E-02	1.15E+00	1.45E-01	NV	NC
LMW PAHs											
	High TRV	1.00E+00	3.09E+00	2.73E-03	1.10E-01	3.39E-01	9.09E-02	1.15E+00	3.41E-02	NV	NC
	Low TRV	1.00E+00	3.09E+00	2.73E-03	1.10E-01	3.39E-01	9.09E-02	1.15E+00	3.41E-02	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	3.70E-02	2.73E-03	2.11E+01	7.79E-01	9.09E-02	1.15E+00	6.17E-02	NV	NC
	Low TRV	1.00E+00	3.70E-02	2.73E-03	2.11E+01	7.79E-01	9.09E-02	1.15E+00	6.17E-02	NV	NC
Phenol											
	High TRV	1.00E+00	2.90E-01	2.73E-03	1.05E+00	3.05E-01	9.09E-02	1.15E+00	2.48E-02	NV	NC
	Low TRV	1.00E+00	2.90E-01	2.73E-03	1.05E+00	3.05E-01	9.09E-02	1.15E+00	2.48E-02	NV	NC
Dibutyltin											
	High TRV	1.00E+00	3.66E-01	2.73E-03	1.91E+00	6.99E-01	9.09E-02	1.15E+00	5.61E-02	7.53E+01	7.45E-04
	Low TRV	1.00E+00	3.66E-01	2.73E-03	1.91E+00	6.99E-01	9.09E-02	1.15E+00	5.61E-02	1.20E+00	4.68E-02
Monobutyltin											
	High TRV	1.00E+00	1.02E-01	2.73E-03	4.78E+00	4.88E-01	9.09E-02	1.15E+00	3.88E-02	7.53E+01	5.15E-04
	Low TRV	1.00E+00	1.02E-01	2.73E-03	4.78E+00	4.88E-01	9.09E-02	1.15E+00	3.88E-02	1.20E+00	3.24E-02
Tetrabutyltin											
	High TRV	1.00E+00	4.84E-02	2.73E-03	6.51E+02	3.15E+01	9.09E-02	1.15E+00	2.49E+00	7.53E+01	3.31E-02
	Low TRV	1.00E+00	4.84E-02	2.73E-03	6.51E+02	3.15E+01	9.09E-02	1.15E+00	2.49E+00	1.20E+00	2.08E+00
Tributyltin											
	High TRV	1.00E+00	9.90E-01	2.73E-03	4.92E+00	4.87E+00	9.09E-02	1.15E+00	3.87E-01	7.53E+01	5.14E-03
	Low TRV	1.00E+00	9.90E-01	2.73E-03	4.92E+00	4.87E+00	9.09E-02	1.15E+00	3.87E-01	1.20E+00	3.23E-01

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	2.20E+04	2.73E-03	2.00E-02	4.40E+02	9.09E-02	1.15E+00	8.70E+01	1.64E+03	5.30E-02
	Low TRV	1.00E+00	2.20E+04	2.73E-03	2.00E-02	4.40E+02	9.09E-02	1.15E+00	8.70E+01	1.64E+02	5.30E-01
Antimony											
	High TRV	1.00E+00	5.90E+00	2.73E-03	1.00E-01	5.90E-01	9.09E-02	1.15E+00	6.06E-02	NV	NC
	Low TRV	1.00E+00	5.90E+00	2.73E-03	1.00E-01	5.90E-01	9.09E-02	1.15E+00	6.06E-02	NV	NC
Arsenic											
	High TRV	1.00E+00	6.60E+00	2.73E-03	1.92E+00	1.27E+01	9.09E-02	1.15E+00	1.02E+00	2.19E+01	4.64E-02
	Low TRV	1.00E+00	6.60E+00	2.73E-03	1.92E+00	1.27E+01	9.09E-02	1.15E+00	1.02E+00	5.48E+00	1.86E-01
Barium											
	High TRV	1.00E+00	1.70E+02	2.73E-03	3.00E-02	5.10E+00	9.09E-02	1.15E+00	8.07E-01	6.54E+01	1.23E-02
	Low TRV	1.00E+00	1.70E+02	2.73E-03	3.00E-02	5.10E+00	9.09E-02	1.15E+00	8.07E-01	3.26E+01	2.47E-02
Beryllium											
	High TRV	1.00E+00	5.20E-01	2.73E-03	9.00E-01	4.68E-01	9.09E-02	1.15E+00	3.82E-02	NV	NC
	Low TRV	1.00E+00	5.20E-01	2.73E-03	9.00E-01	4.68E-01	9.09E-02	1.15E+00	3.82E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.90E+00	2.73E-03	1.08E+00	6.37E+00	9.09E-02	1.15E+00	5.18E-01	1.76E+01	2.95E-02
	Low TRV	1.00E+00	5.90E+00	2.73E-03	1.08E+00	6.37E+00	9.09E-02	1.15E+00	5.18E-01	8.61E-02	6.02E+00
Chromium											
	High TRV	1.00E+00	5.10E+02	2.73E-03	6.00E-02	3.06E+01	9.09E-02	1.15E+00	3.63E+00	4.92E+00	7.38E-01
	Low TRV	1.00E+00	5.10E+02	2.73E-03	6.00E-02	3.06E+01	9.09E-02	1.15E+00	3.63E+00	9.83E-01	3.69E+00
Cobalt											
	High TRV	1.00E+00	7.20E+01	2.73E-03	1.30E-01	9.36E+00	9.09E-02	1.15E+00	9.11E-01	NV	NC
	Low TRV	1.00E+00	7.20E+01	2.73E-03	1.30E-01	9.36E+00	9.09E-02	1.15E+00	9.11E-01	NV	NC
Copper											
	High TRV	1.00E+00	5.40E+03	2.73E-03	2.20E-01	1.19E+03	9.09E-02	1.15E+00	1.07E+02	6.43E+01	1.66E+00
	Low TRV	1.00E+00	5.40E+03	2.73E-03	2.20E-01	1.19E+03	9.09E-02	1.15E+00	1.07E+02	2.59E+00	4.13E+01
Lead											
	High TRV	1.00E+00	1.20E+03	2.73E-03	8.00E-02	9.60E+01	9.09E-02	1.15E+00	1.04E+01	9.41E+00	1.11E+00
	Low TRV	1.00E+00	1.20E+03	2.73E-03	8.00E-02	9.60E+01	9.09E-02	1.15E+00	1.04E+01	2.27E-02	4.60E+02
Manganese											
	High TRV	1.00E+00	6.00E+02	2.73E-03	7.00E-02	4.20E+01	9.09E-02	1.15E+00	4.74E+00	1.10E+03	4.29E-03
	Low TRV	1.00E+00	6.00E+02	2.73E-03	7.00E-02	4.20E+01	9.09E-02	1.15E+00	4.74E+00	1.10E+02	4.29E-02
Mercury											
	High TRV	1.00E+00	1.30E+00	2.73E-03	2.90E-01	3.77E-01	9.09E-02	1.15E+00	3.29E-02	1.85E-01	1.78E-01
	Low TRV	1.00E+00	1.30E+00	2.73E-03	2.90E-01	3.77E-01	9.09E-02	1.15E+00	3.29E-02	4.01E-02	8.20E-01
Molybdenum											
	High TRV	1.00E+00	1.10E+01	2.73E-03	2.86E+00	3.15E+01	9.09E-02	1.15E+00	2.51E+00	3.35E+01	7.51E-02
	Low TRV	1.00E+00	1.10E+01	2.73E-03	2.86E+00	3.15E+01	9.09E-02	1.15E+00	2.51E+00	3.32E+00	7.57E-01
Nickel											
	High TRV	1.00E+00	1.60E+03	2.73E-03	8.00E-02	1.28E+02	9.09E-02	1.15E+00	1.39E+01	6.33E+01	2.20E-01
	Low TRV	1.00E+00	1.60E+03	2.73E-03	8.00E-02	1.28E+02	9.09E-02	1.15E+00	1.39E+01	1.56E+00	8.89E+00
Silver											
	High TRV	1.00E+00	5.00E-01	2.73E-03	4.50E-01	2.25E-01	9.09E-02	1.15E+00	1.90E-02	NV	NC
	Low TRV	1.00E+00	5.00E-01	2.73E-03	4.50E-01	2.25E-01	9.09E-02	1.15E+00	1.90E-02	NV	NC
Thallium											
	High TRV	1.00E+00	9.70E-01	2.73E-03	9.00E-01	8.73E-01	9.09E-02	1.15E+00	7.13E-02	6.02E-01	1.18E-01
	Low TRV	1.00E+00	9.70E-01	2.73E-03	9.00E-01	8.73E-01	9.09E-02	1.15E+00	7.13E-02	6.02E-02	1.18E+00

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Vanadium											
	High TRV	1.00E+00	5.10E+01	2.73E-03	6.00E-02	3.06E+00	9.09E-02	1.15E+00	3.63E-01	1.14E+02	3.19E-03
	Low TRV	1.00E+00	5.10E+01	2.73E-03	6.00E-02	3.06E+00	9.09E-02	1.15E+00	3.63E-01	1.14E+01	3.19E-02
Zinc											
	High TRV	1.00E+00	1.30E+03	2.73E-03	7.30E-01	9.49E+02	9.09E-02	1.15E+00	7.81E+01	1.79E+02	4.37E-01
	Low TRV	1.00E+00	1.30E+03	2.73E-03	7.30E-01	9.49E+02	9.09E-02	1.15E+00	7.81E+01	1.79E+01	4.37E+00
Total Aroclors											
	High TRV	1.00E+00	6.35E+00	2.73E-03	1.77E+00	1.12E+01	9.09E-02	1.15E+00	9.03E-01	1.17E+00	7.71E-01
	Low TRV	1.00E+00	6.35E+00	2.73E-03	1.77E+00	1.12E+01	9.09E-02	1.15E+00	9.03E-01	9.68E-02	9.34E+00
Total DDT											
	High TRV	1.00E+00	1.56E-01	2.73E-03	3.49E+00	5.43E-01	9.09E-02	1.15E+00	4.33E-02	1.54E+00	2.80E-02
	Low TRV	1.00E+00	1.56E-01	2.73E-03	3.49E+00	5.43E-01	9.09E-02	1.15E+00	4.33E-02	9.26E-03	4.67E+00
beta-BHC											
	High TRV	1.00E+00	5.10E-03	2.73E-03	7.03E+00	3.58E-02	9.09E-02	1.15E+00	2.84E-03	3.38E+00	8.41E-04
	Low TRV	1.00E+00	5.10E-03	2.73E-03	7.03E+00	3.58E-02	9.09E-02	1.15E+00	2.84E-03	8.46E-01	3.36E-03
delta-BHC											
	High TRV	1.00E+00	1.70E-03	2.73E-03	9.44E+00	1.60E-02	9.09E-02	1.15E+00	1.27E-03	3.38E+00	3.76E-04
	Low TRV	1.00E+00	1.70E-03	2.73E-03	9.44E+00	1.60E-02	9.09E-02	1.15E+00	1.27E-03	8.46E-01	1.50E-03
alpha-Chlordane											
	High TRV	1.00E+00	1.90E-03	2.73E-03	3.62E+00	6.88E-03	9.09E-02	1.15E+00	5.48E-04	1.91E+01	2.87E-05
	Low TRV	1.00E+00	1.90E-03	2.73E-03	3.62E+00	6.88E-03	9.09E-02	1.15E+00	5.48E-04	3.81E+00	1.44E-04
Dieldrin											
	High TRV	1.00E+00	4.50E-02	2.73E-03	4.97E+00	2.24E-01	9.09E-02	1.15E+00	1.78E-02	9.22E-01	1.93E-02
	Low TRV	1.00E+00	4.50E-02	2.73E-03	4.97E+00	2.24E-01	9.09E-02	1.15E+00	1.78E-02	9.22E-02	1.93E-01
Endosulfan sulfate											
	High TRV	1.00E+00	9.60E-03	2.73E-03	6.37E+00	6.12E-02	9.09E-02	1.15E+00	4.86E-03	1.24E+02	3.93E-05
	Low TRV	1.00E+00	9.60E-03	2.73E-03	6.37E+00	6.12E-02	9.09E-02	1.15E+00	4.86E-03	1.24E+01	3.93E-04
Endrin											
	High TRV	1.00E+00	7.60E-03	2.73E-03	2.85E+01	2.16E-01	9.09E-02	1.15E+00	1.71E-02	3.00E+01	5.71E-04
	Low TRV	1.00E+00	7.60E-03	2.73E-03	2.85E+01	2.16E-01	9.09E-02	1.15E+00	1.71E-02	3.00E-01	5.71E-02
Endrin aldehyde											
	High TRV	1.00E+00	8.80E-03	2.73E-03	3.12E+01	2.75E-01	9.09E-02	1.15E+00	2.17E-02	3.00E+01	7.24E-04
	Low TRV	1.00E+00	8.80E-03	2.73E-03	3.12E+01	2.75E-01	9.09E-02	1.15E+00	2.17E-02	3.00E-01	7.24E-02
Heptachlor											
	High TRV	1.00E+00	1.20E-03	2.73E-03	2.65E+01	3.18E-02	9.09E-02	1.15E+00	2.52E-03	1.54E+00	1.63E-03
	Low TRV	1.00E+00	1.20E-03	2.73E-03	2.65E+01	3.18E-02	9.09E-02	1.15E+00	2.52E-03	9.26E-03	2.72E-01
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	2.73E-03	2.04E+01	9.37E-01	9.09E-02	1.15E+00	7.42E-02	1.54E+00	4.81E-02
	Low TRV	1.00E+00	4.60E-02	2.73E-03	2.04E+01	9.37E-01	9.09E-02	1.15E+00	7.42E-02	9.26E-03	8.02E+00
4-Methylphenol											
	High TRV	1.00E+00	3.10E-01	2.73E-03	1.56E+00	4.83E-01	9.09E-02	1.15E+00	3.89E-02	NV	NC
	Low TRV	1.00E+00	3.10E-01	2.73E-03	1.56E+00	4.83E-01	9.09E-02	1.15E+00	3.89E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	7.00E-01	2.73E-03	1.47E+00	1.03E+00	9.09E-02	1.15E+00	8.30E-02	NV	NC
	Low TRV	1.00E+00	7.00E-01	2.73E-03	1.47E+00	1.03E+00	9.09E-02	1.15E+00	8.30E-02	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	1.90E-01	2.73E-03	7.83E-01	1.49E-01	9.09E-02	1.15E+00	1.22E-02	NV	NC
	Low TRV	1.00E+00	1.90E-01	2.73E-03	7.83E-01	1.49E-01	9.09E-02	1.15E+00	1.22E-02	NV	NC

TABLE B-10: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (2.5 TO 4 FEET BGS)											
Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Dibenzofuran											
	High TRV	1.00E+00	5.90E-02	2.73E-03	9.28E+00	5.48E-01	9.09E-02	1.15E+00	4.34E-02	NV	NC
	Low TRV	1.00E+00	5.90E-02	2.73E-03	9.28E+00	5.48E-01	9.09E-02	1.15E+00	4.34E-02	NV	NC
HMW PAHs											
	High TRV	1.00E+00	2.23E+01	2.73E-03	2.10E-01	4.69E+00	9.09E-02	1.15E+00	4.24E-01	NV	NC
	Low TRV	1.00E+00	2.23E+01	2.73E-03	2.10E-01	4.69E+00	9.09E-02	1.15E+00	4.24E-01	NV	NC
LMW PAHs											
	High TRV	1.00E+00	2.87E+00	2.73E-03	1.10E-01	3.16E-01	9.09E-02	1.15E+00	3.18E-02	NV	NC
	Low TRV	1.00E+00	2.87E+00	2.73E-03	1.10E-01	3.16E-01	9.09E-02	1.15E+00	3.18E-02	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	1.60E-01	2.73E-03	2.11E+01	3.37E+00	9.09E-02	1.15E+00	2.67E-01	NV	NC
	Low TRV	1.00E+00	1.60E-01	2.73E-03	2.11E+01	3.37E+00	9.09E-02	1.15E+00	2.67E-01	NV	NC
Phenol											
	High TRV	1.00E+00	9.00E-02	2.73E-03	1.05E+00	9.46E-02	9.09E-02	1.15E+00	7.69E-03	NV	NC
	Low TRV	1.00E+00	9.00E-02	2.73E-03	1.05E+00	9.46E-02	9.09E-02	1.15E+00	7.69E-03	NV	NC
Dibutyltin											
	High TRV	1.00E+00	1.89E-01	2.73E-03	1.91E+00	3.61E-01	9.09E-02	1.15E+00	2.90E-02	7.53E+01	3.85E-04
	Low TRV	1.00E+00	1.89E-01	2.73E-03	1.91E+00	3.61E-01	9.09E-02	1.15E+00	2.90E-02	1.20E+00	2.42E-02
Monobutyltin											
	High TRV	1.00E+00	6.76E-02	2.73E-03	4.78E+00	3.23E-01	9.09E-02	1.15E+00	2.57E-02	7.53E+01	3.41E-04
	Low TRV	1.00E+00	6.76E-02	2.73E-03	4.78E+00	3.23E-01	9.09E-02	1.15E+00	2.57E-02	1.20E+00	2.14E-02
Tributyltin											
	High TRV	1.00E+00	3.35E-01	2.73E-03	4.92E+00	1.65E+00	9.09E-02	1.15E+00	1.31E-01	7.53E+01	1.74E-03
	Low TRV	1.00E+00	3.35E-01	2.73E-03	4.92E+00	1.65E+00	9.09E-02	1.15E+00	1.31E-01	1.20E+00	1.09E-01

Notes:

BAF	Bioaccumulation factor from sediment concentrations to Macoma tissue concentrations	kg/day	Kilogram per day
bgs	Below ground surface	LMW	Low molecular weight
BHC	Benzene hexachloride	NC	Not calculated
BW	Body weight	NV	No TRV available
DDD	Dichlorodiphenyldichloroethane	mg/kg	Milligram per kilogram
DDE	Dichlorodiphenyldichloroethene	mg/kg/day	Milligram per kilogram-day
DDT	Dichlorodiphenyltrichloroethane	PAH	Polynuclear aromatic hydrocarbon
HMW	High molecular weight	SUF	Site use factor
HQ	Hazard quotient	Total Aroclors	Summed concentration of Aroclors
IR	Ingestion rate of *Macoma* tissue	Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
kg	Kilogram	TRV	Toxicity reference value

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.90E+04	9.00E-04	2.00E-02	3.80E+02	3.01E-02	2.15E-01	1.33E+02	1.17E+03	1.13E-01
	Low TRV	1.00E+00	1.90E+04	9.00E-04	2.00E-02	3.80E+02	3.01E-02	2.15E-01	1.33E+02	1.17E+02	1.13E+00
Antimony											
	High TRV	1.00E+00	2.40E+01	9.00E-04	1.00E-01	2.40E+00	3.01E-02	2.15E-01	4.36E-01	NV	NC
	Low TRV	1.00E+00	2.40E+01	9.00E-04	1.00E-01	2.40E+00	3.01E-02	2.15E-01	4.36E-01	NV	NC
Arsenic											
	High TRV	1.00E+00	2.80E+01	9.00E-04	1.92E+00	5.38E+01	3.01E-02	2.15E-01	7.64E+00	1.57E+01	4.88E-01
	Low TRV	1.00E+00	2.80E+01	9.00E-04	1.92E+00	5.38E+01	3.01E-02	2.15E-01	7.64E+00	3.92E+00	1.95E+00
Barium											
	High TRV	1.00E+00	6.30E+02	9.00E-04	3.00E-02	1.89E+01	3.01E-02	2.15E-01	5.28E+00	4.68E+01	1.13E-01
	Low TRV	1.00E+00	6.30E+02	9.00E-04	3.00E-02	1.89E+01	3.01E-02	2.15E-01	5.28E+00	2.33E+01	2.26E-01
Beryllium											
	High TRV	1.00E+00	6.20E-01	9.00E-04	9.00E-01	5.58E-01	3.01E-02	2.15E-01	8.07E-02	NV	NC
	Low TRV	1.00E+00	6.20E-01	9.00E-04	9.00E-01	5.58E-01	3.01E-02	2.15E-01	8.07E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.00E+00	9.00E-04	1.08E+00	5.40E+00	3.01E-02	2.15E-01	7.77E-01	1.26E+01	6.19E-02
	Low TRV	1.00E+00	5.00E+00	9.00E-04	1.08E+00	5.40E+00	3.01E-02	2.15E-01	7.77E-01	6.15E-02	1.26E+01
Chromium											
	High TRV	1.00E+00	4.50E+02	9.00E-04	6.00E-02	2.70E+01	3.01E-02	2.15E-01	5.66E+00	3.52E+00	1.61E+00
	Low TRV	1.00E+00	4.50E+02	9.00E-04	6.00E-02	2.70E+01	3.01E-02	2.15E-01	5.66E+00	7.03E-01	8.05E+00
Cobalt											
	High TRV	1.00E+00	7.50E+01	9.00E-04	1.30E-01	9.75E+00	3.01E-02	2.15E-01	1.68E+00	NV	NC
	Low TRV	1.00E+00	7.50E+01	9.00E-04	1.30E-01	9.75E+00	3.01E-02	2.15E-01	1.68E+00	NV	NC
Copper											
	High TRV	1.00E+00	1.95E+03	9.00E-04	2.20E-01	4.29E+02	3.01E-02	2.15E-01	6.82E+01	4.60E+01	1.48E+00
	Low TRV	1.00E+00	1.95E+03	9.00E-04	2.20E-01	4.29E+02	3.01E-02	2.15E-01	6.82E+01	1.85E+00	3.69E+01
Lead											
	High TRV	1.00E+00	8.00E+02	9.00E-04	8.00E-02	6.40E+01	3.01E-02	2.15E-01	1.23E+01	6.73E+00	1.83E+00
	Low TRV	1.00E+00	8.00E+02	9.00E-04	8.00E-02	6.40E+01	3.01E-02	2.15E-01	1.23E+01	1.62E-02	7.59E+02
Manganese											
	High TRV	1.00E+00	4.90E+03	9.00E-04	7.00E-02	3.43E+02	3.01E-02	2.15E-01	6.85E+01	7.90E+02	8.67E-02
	Low TRV	1.00E+00	4.90E+03	9.00E-04	7.00E-02	3.43E+02	3.01E-02	2.15E-01	6.85E+01	7.90E+01	8.67E-01
Mercury											
	High TRV	1.00E+00	1.90E+00	9.00E-04	2.90E-01	5.51E-01	3.01E-02	2.15E-01	8.51E-02	1.32E-01	6.43E-01
	Low TRV	1.00E+00	1.90E+00	9.00E-04	2.90E-01	5.51E-01	3.01E-02	2.15E-01	8.51E-02	2.87E-02	2.97E+00
Molybdenum											
	High TRV	1.00E+00	2.50E+00	9.00E-04	2.86E+00	7.15E+00	3.01E-02	2.15E-01	1.01E+00	2.39E+01	4.23E-02
	Low TRV	1.00E+00	2.50E+00	9.00E-04	2.86E+00	7.15E+00	3.01E-02	2.15E-01	1.01E+00	2.37E+00	4.26E-01
Nickel											
	High TRV	1.00E+00	1.70E+03	9.00E-04	8.00E-02	1.36E+02	3.01E-02	2.15E-01	2.62E+01	4.53E+01	5.78E-01
	Low TRV	1.00E+00	1.70E+03	9.00E-04	8.00E-02	1.36E+02	3.01E-02	2.15E-01	2.62E+01	1.12E+00	2.34E+01
Selenium											
	High TRV	1.00E+00	1.33E-01	9.00E-04	1.40E+01	1.86E+00	3.01E-02	2.15E-01	2.61E-01	6.70E-01	3.90E-01
	Low TRV	1.00E+00	1.33E-01	9.00E-04	1.40E+01	1.86E+00	3.01E-02	2.15E-01	2.61E-01	1.66E-01	1.58E+00
Silver											
	High TRV	1.00E+00	9.20E-01	9.00E-04	4.50E-01	4.14E-01	3.01E-02	2.15E-01	6.18E-02	NV	NC
	Low TRV	1.00E+00	9.20E-01	9.00E-04	4.50E-01	4.14E-01	3.01E-02	2.15E-01	6.18E-02	NV	NC

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQS FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Thallium											
	High TRV	1.00E+00	5.80E+00	9.00E-04	9.00E-01	5.22E+00	3.01E-02	2.15E-01	7.55E-01	4.31E-01	1.75E+00
	Low TRV	1.00E+00	5.80E+00	9.00E-04	9.00E-01	5.22E+00	3.01E-02	2.15E-01	7.55E-01	4.31E-02	1.75E+01
Vanadium											
	High TRV	1.00E+00	6.40E+01	9.00E-04	6.00E-02	3.84E+00	3.01E-02	2.15E-01	8.06E-01	8.12E+01	9.92E-03
	Low TRV	1.00E+00	6.40E+01	9.00E-04	6.00E-02	3.84E+00	3.01E-02	2.15E-01	8.06E-01	8.12E+00	9.92E-02
Zinc											
	High TRV	1.00E+00	1.10E+03	9.00E-04	7.30E-01	8.03E+02	3.01E-02	2.15E-01	1.17E+02	1.28E+02	9.17E-01
	Low TRV	1.00E+00	1.10E+03	9.00E-04	7.30E-01	8.03E+02	3.01E-02	2.15E-01	1.17E+02	1.28E+01	9.17E+00
Total Aroclors											
	High TRV	1.00E+00	4.70E+00	9.00E-04	1.77E+00	8.32E+00	3.01E-02	2.15E-01	1.18E+00	8.38E-01	1.41E+00
	Low TRV	1.00E+00	4.70E+00	9.00E-04	1.77E+00	8.32E+00	3.01E-02	2.15E-01	1.18E+00	6.92E-02	1.71E+01
Total DDT											
	High TRV	1.00E+00	1.29E-01	9.00E-04	3.49E+00	4.51E-01	3.01E-02	2.15E-01	6.37E-02	1.10E+00	5.78E-02
	Low TRV	1.00E+00	1.29E-01	9.00E-04	3.49E+00	4.51E-01	3.01E-02	2.15E-01	6.37E-02	6.62E-03	9.63E+00
alpha-BHC											
	High TRV	1.00E+00	6.40E-03	9.00E-04	7.14E+00	4.57E-02	3.01E-02	2.15E-01	6.43E-03	2.42E+00	2.66E-03
	Low TRV	1.00E+00	6.40E-03	9.00E-04	7.14E+00	4.57E-02	3.01E-02	2.15E-01	6.43E-03	6.05E-01	1.06E-02
alpha-Chlordane											
	High TRV	1.00E+00	2.20E-03	9.00E-04	3.62E+00	7.96E-03	3.01E-02	2.15E-01	1.12E-03	1.36E+01	8.25E-05
	Low TRV	1.00E+00	2.20E-03	9.00E-04	3.62E+00	7.96E-03	3.01E-02	2.15E-01	1.12E-03	2.73E+00	4.12E-04
gamma-Chlordane											
	High TRV	1.00E+00	2.10E-03	9.00E-04	3.16E+00	6.64E-03	3.01E-02	2.15E-01	9.38E-04	1.36E+01	6.88E-05
	Low TRV	1.00E+00	2.10E-03	9.00E-04	3.16E+00	6.64E-03	3.01E-02	2.15E-01	9.38E-04	2.73E+00	3.44E-04
Dieldrin											
	High TRV	1.00E+00	2.65E-02	9.00E-04	4.97E+00	1.32E-01	3.01E-02	2.15E-01	1.85E-02	6.60E-01	2.81E-02
	Low TRV	1.00E+00	2.65E-02	9.00E-04	4.97E+00	1.32E-01	3.01E-02	2.15E-01	1.85E-02	6.60E-02	2.81E-01
Endosulfan II											
	High TRV	1.00E+00	2.70E-03	9.00E-04	7.32E+00	1.98E-02	3.01E-02	2.15E-01	2.78E-03	8.83E+01	3.15E-05
	Low TRV	1.00E+00	2.70E-03	9.00E-04	7.32E+00	1.98E-02	3.01E-02	2.15E-01	2.78E-03	8.83E+00	3.15E-04
Endrin											
	High TRV	1.00E+00	2.30E-02	9.00E-04	2.85E+01	6.55E-01	3.01E-02	2.15E-01	9.18E-02	2.15E+01	4.28E-03
	Low TRV	1.00E+00	2.30E-02	9.00E-04	2.85E+01	6.55E-01	3.01E-02	2.15E-01	9.18E-02	2.15E-01	4.28E-01
Endrin aldehyde											
	High TRV	1.00E+00	3.10E-03	9.00E-04	3.12E+01	9.67E-02	3.01E-02	2.15E-01	1.36E-02	2.15E+01	6.32E-04
	Low TRV	1.00E+00	3.10E-03	9.00E-04	3.12E+01	9.67E-02	3.01E-02	2.15E-01	1.36E-02	2.15E-01	6.32E-02
Endrin ketone											
	High TRV	1.00E+00	9.70E-03	9.00E-04	3.12E+01	3.03E-01	3.01E-02	2.15E-01	4.24E-02	2.15E+01	1.98E-03
	Low TRV	1.00E+00	9.70E-03	9.00E-04	3.12E+01	3.03E-01	3.01E-02	2.15E-01	4.24E-02	2.15E-01	1.98E-01
Heptachlor											
	High TRV	1.00E+00	1.60E-03	9.00E-04	2.65E+01	4.24E-02	3.01E-02	2.15E-01	5.94E-03	1.10E+00	5.39E-03
	Low TRV	1.00E+00	1.60E-03	9.00E-04	2.65E+01	4.24E-02	3.01E-02	2.15E-01	5.94E-03	6.62E-03	8.98E-01
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	1.10E+00	1.78E-02
	Low TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	6.62E-03	2.97E+00
Methoxychlor											
	High TRV	1.00E+00	1.70E-02	9.00E-04	2.04E+01	3.46E-01	3.01E-02	2.15E-01	4.86E-02	1.10E+00	4.40E-02
	Low TRV	1.00E+00	1.70E-02	9.00E-04	2.04E+01	3.46E-01	3.01E-02	2.15E-01	4.86E-02	6.62E-03	7.34E+00

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
4-Methylphenol											
	High TRV	1.00E+00	1.40E-01	9.00E-04	1.56E+00	2.18E-01	3.01E-02	2.15E-01	3.11E-02	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-04	1.56E+00	2.18E-01	3.01E-02	2.15E-01	3.11E-02	NV	NC
4-Nitrophenol											
	High TRV	1.00E+00	7.20E-02	9.00E-04	1.52E+00	1.09E-01	3.01E-02	2.15E-01	1.56E-02	NV	NC
	Low TRV	1.00E+00	7.20E-02	9.00E-04	1.52E+00	1.09E-01	3.01E-02	2.15E-01	1.56E-02	NV	NC
Azobenzene											
	High TRV	1.00E+00	4.30E-02	9.00E-04	7.26E+00	3.12E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
	Low TRV	1.00E+00	4.30E-02	9.00E-04	7.26E+00	3.12E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	6.90E-01	9.00E-04	1.47E+00	1.01E+00	3.01E-02	2.15E-01	1.45E-01	NV	NC
	Low TRV	1.00E+00	6.90E-01	9.00E-04	1.47E+00	1.01E+00	3.01E-02	2.15E-01	1.45E-01	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	4.10E-02	9.00E-04	7.83E-01	3.21E-02	3.01E-02	2.15E-01	4.67E-03	NV	NC
	Low TRV	1.00E+00	4.10E-02	9.00E-04	7.83E-01	3.21E-02	3.01E-02	2.15E-01	4.67E-03	NV	NC
Dibenzofuran											
	High TRV	1.00E+00	1.40E-01	9.00E-04	9.28E+00	1.30E+00	3.01E-02	2.15E-01	1.83E-01	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-04	9.28E+00	1.30E+00	3.01E-02	2.15E-01	1.83E-01	NV	NC
HMW PAHs											
	High TRV	1.00E+00	7.66E+00	9.00E-04	2.10E-01	1.61E+00	3.01E-02	2.15E-01	2.57E-01	NV	NC
	Low TRV	1.00E+00	7.66E+00	9.00E-04	2.10E-01	1.61E+00	3.01E-02	2.15E-01	2.57E-01	NV	NC
LMW PAHs											
	High TRV	1.00E+00	3.09E+00	9.00E-04	1.10E-01	3.39E-01	3.01E-02	2.15E-01	6.04E-02	NV	NC
	Low TRV	1.00E+00	3.09E+00	9.00E-04	1.10E-01	3.39E-01	3.01E-02	2.15E-01	6.04E-02	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	3.70E-02	9.00E-04	2.11E+01	7.79E-01	3.01E-02	2.15E-01	1.09E-01	NV	NC
	Low TRV	1.00E+00	3.70E-02	9.00E-04	2.11E+01	7.79E-01	3.01E-02	2.15E-01	1.09E-01	NV	NC
Phenol											
	High TRV	1.00E+00	2.90E-01	9.00E-04	1.05E+00	3.05E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
	Low TRV	1.00E+00	2.90E-01	9.00E-04	1.05E+00	3.05E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
Dibutyltin											
	High TRV	1.00E+00	3.66E-01	9.00E-04	1.91E+00	6.99E-01	3.01E-02	2.15E-01	9.94E-02	5.39E+01	1.84E-03
	Low TRV	1.00E+00	3.66E-01	9.00E-04	1.91E+00	6.99E-01	3.01E-02	2.15E-01	9.94E-02	8.57E-01	1.16E-01
Monobutyltin											
	High TRV	1.00E+00	1.02E-01	9.00E-04	4.78E+00	4.88E-01	3.01E-02	2.15E-01	6.87E-02	5.39E+01	1.27E-03
	Low TRV	1.00E+00	1.02E-01	9.00E-04	4.78E+00	4.88E-01	3.01E-02	2.15E-01	6.87E-02	8.57E-01	8.02E-02
Tetrabutyltin											
	High TRV	1.00E+00	4.84E-02	9.00E-04	6.51E+02	3.15E+01	3.01E-02	2.15E-01	4.41E+00	5.39E+01	8.19E-02
	Low TRV	1.00E+00	4.84E-02	9.00E-04	6.51E+02	3.15E+01	3.01E-02	2.15E-01	4.41E+00	8.57E-01	5.15E+00
Tributyltin											
	High TRV	1.00E+00	9.90E-01	9.00E-04	4.92E+00	4.87E+00	3.01E-02	2.15E-01	6.86E-01	5.39E+01	1.27E-02
	Low TRV	1.00E+00	9.90E-01	9.00E-04	4.92E+00	4.87E+00	3.01E-02	2.15E-01	6.86E-01	8.57E-01	8.01E-01

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	2.20E+04	9.00E-04	2.00E-02	4.40E+02	3.01E-02	2.15E-01	1.54E+02	1.17E+03	1.31E-01
	Low TRV	1.00E+00	2.20E+04	9.00E-04	2.00E-02	4.40E+02	3.01E-02	2.15E-01	1.54E+02	1.17E+02	1.31E+00
Antimony											
	High TRV	1.00E+00	5.90E+00	9.00E-04	1.00E-01	5.90E-01	3.01E-02	2.15E-01	1.07E-01	NV	NC
	Low TRV	1.00E+00	5.90E+00	9.00E-04	1.00E-01	5.90E-01	3.01E-02	2.15E-01	1.07E-01	NV	NC
Arsenic											
	High TRV	1.00E+00	6.60E+00	9.00E-04	1.92E+00	1.27E+01	3.01E-02	2.15E-01	1.80E+00	1.57E+01	1.15E-01
	Low TRV	1.00E+00	6.60E+00	9.00E-04	1.92E+00	1.27E+01	3.01E-02	2.15E-01	1.80E+00	3.92E+00	4.60E-01
Barium											
	High TRV	1.00E+00	1.70E+02	9.00E-04	3.00E-02	5.10E+00	3.01E-02	2.15E-01	1.43E+00	4.68E+01	3.05E-02
	Low TRV	1.00E+00	1.70E+02	9.00E-04	3.00E-02	5.10E+00	3.01E-02	2.15E-01	1.43E+00	2.33E+01	6.11E-02
Beryllium											
	High TRV	1.00E+00	5.20E-01	9.00E-04	9.00E-01	4.68E-01	3.01E-02	2.15E-01	6.77E-02	NV	NC
	Low TRV	1.00E+00	5.20E-01	9.00E-04	9.00E-01	4.68E-01	3.01E-02	2.15E-01	6.77E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.90E+00	9.00E-04	1.08E+00	6.37E+00	3.01E-02	2.15E-01	9.17E-01	1.26E+01	7.30E-02
	Low TRV	1.00E+00	5.90E+00	9.00E-04	1.08E+00	6.37E+00	3.01E-02	2.15E-01	9.17E-01	6.15E-02	1.49E+01
Chromium											
	High TRV	1.00E+00	5.10E+02	9.00E-04	6.00E-02	3.06E+01	3.01E-02	2.15E-01	6.42E+00	3.52E+00	1.83E+00
	Low TRV	1.00E+00	5.10E+02	9.00E-04	6.00E-02	3.06E+01	3.01E-02	2.15E-01	6.42E+00	7.03E-01	9.13E+00
Cobalt											
	High TRV	1.00E+00	7.20E+01	9.00E-04	1.30E-01	9.36E+00	3.01E-02	2.15E-01	1.61E+00	NV	NC
	Low TRV	1.00E+00	7.20E+01	9.00E-04	1.30E-01	9.36E+00	3.01E-02	2.15E-01	1.61E+00	NV	NC
Copper											
	High TRV	1.00E+00	5.40E+03	9.00E-04	2.20E-01	1.19E+03	3.01E-02	2.15E-01	1.89E+02	4.60E+01	4.11E+00
	Low TRV	1.00E+00	5.40E+03	9.00E-04	2.20E-01	1.19E+03	3.01E-02	2.15E-01	1.89E+02	1.85E+00	1.02E+02
Lead											
	High TRV	1.00E+00	1.20E+03	9.00E-04	8.00E-02	9.60E+01	3.01E-02	2.15E-01	1.85E+01	6.73E+00	2.74E+00
	Low TRV	1.00E+00	1.20E+03	9.00E-04	8.00E-02	9.60E+01	3.01E-02	2.15E-01	1.85E+01	1.62E-02	1.14E+03
Manganese											
	High TRV	1.00E+00	6.00E+02	9.00E-04	7.00E-02	4.20E+01	3.01E-02	2.15E-01	8.39E+00	7.90E+02	1.06E-02
	Low TRV	1.00E+00	6.00E+02	9.00E-04	7.00E-02	4.20E+01	3.01E-02	2.15E-01	8.39E+00	7.90E+01	1.06E-01
Mercury											
	High TRV	1.00E+00	1.30E+00	9.00E-04	2.90E-01	3.77E-01	3.01E-02	2.15E-01	5.82E-02	1.32E-01	4.40E-01
	Low TRV	1.00E+00	1.30E+00	9.00E-04	2.90E-01	3.77E-01	3.01E-02	2.15E-01	5.82E-02	2.87E-02	2.03E+00
Molybdenum											
	High TRV	1.00E+00	1.10E+01	9.00E-04	2.86E+00	3.15E+01	3.01E-02	2.15E-01	4.45E+00	2.39E+01	1.86E-01
	Low TRV	1.00E+00	1.10E+01	9.00E-04	2.86E+00	3.15E+01	3.01E-02	2.15E-01	4.45E+00	2.37E+00	1.88E+00
Nickel											
	High TRV	1.00E+00	1.60E+03	9.00E-04	8.00E-02	1.28E+02	3.01E-02	2.15E-01	2.46E+01	4.53E+01	5.44E-01
	Low TRV	1.00E+00	1.60E+03	9.00E-04	8.00E-02	1.28E+02	3.01E-02	2.15E-01	2.46E+01	1.12E+00	2.20E+01
Silver											
	High TRV	1.00E+00	5.00E-01	9.00E-04	4.50E-01	2.25E-01	3.01E-02	2.15E-01	3.36E-02	NV	NC
	Low TRV	1.00E+00	5.00E-01	9.00E-04	4.50E-01	2.25E-01	3.01E-02	2.15E-01	3.36E-02	NV	NC
Thallium											
	High TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-01	2.93E-01
	Low TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-02	2.93E+00

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQS FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Vanadium											
	High TRV	1.00E+00	5.10E+01	9.00E-04	6.00E-02	3.06E+00	3.01E-02	2.15E-01	6.42E-01	8.12E+01	7.90E-03
	Low TRV	1.00E+00	5.10E+01	9.00E-04	6.00E-02	3.06E+00	3.01E-02	2.15E-01	6.42E-01	8.12E+00	7.90E-02
Zinc											
	High TRV	1.00E+00	1.30E+03	9.00E-04	7.30E-01	9.49E+02	3.01E-02	2.15E-01	1.38E+02	1.28E+02	1.08E+00
	Low TRV	1.00E+00	1.30E+03	9.00E-04	7.30E-01	9.49E+02	3.01E-02	2.15E-01	1.38E+02	1.28E+01	1.08E+01
Total Aroclors											
	High TRV	1.00E+00	6.35E+00	9.00E-04	1.77E+00	1.12E+01	3.01E-02	2.15E-01	1.60E+00	8.38E-01	1.91E+00
	Low TRV	1.00E+00	6.35E+00	9.00E-04	1.77E+00	1.12E+01	3.01E-02	2.15E-01	1.60E+00	6.92E-02	2.31E+01
Total DDT											
	High TRV	1.00E+00	1.56E-01	9.00E-04	3.49E+00	5.43E-01	3.01E-02	2.15E-01	7.66E-02	1.10E+00	6.95E-02
	Low TRV	1.00E+00	1.56E-01	9.00E-04	3.49E+00	5.43E-01	3.01E-02	2.15E-01	7.66E-02	6.62E-03	1.16E+01
beta-BHC											
	High TRV	1.00E+00	5.10E-03	9.00E-04	7.03E+00	3.58E-02	3.01E-02	2.15E-01	5.04E-03	2.42E+00	2.08E-03
	Low TRV	1.00E+00	5.10E-03	9.00E-04	7.03E+00	3.58E-02	3.01E-02	2.15E-01	5.04E-03	6.05E-01	8.33E-03
delta-BHC											
	High TRV	1.00E+00	1.70E-03	9.00E-04	9.44E+00	1.60E-02	3.01E-02	2.15E-01	2.25E-03	2.42E+00	9.32E-04
	Low TRV	1.00E+00	1.70E-03	9.00E-04	9.44E+00	1.60E-02	3.01E-02	2.15E-01	2.25E-03	6.05E-01	3.72E-03
alpha-Chlordane											
	High TRV	1.00E+00	1.90E-03	9.00E-04	3.62E+00	6.88E-03	3.01E-02	2.15E-01	9.71E-04	1.36E+01	7.12E-05
	Low TRV	1.00E+00	1.90E-03	9.00E-04	3.62E+00	6.88E-03	3.01E-02	2.15E-01	9.71E-04	2.73E+00	3.56E-04
Dieldrin											
	High TRV	1.00E+00	4.50E-02	9.00E-04	4.97E+00	2.24E-01	3.01E-02	2.15E-01	3.15E-02	6.60E-01	4.78E-02
	Low TRV	1.00E+00	4.50E-02	9.00E-04	4.97E+00	2.24E-01	3.01E-02	2.15E-01	3.15E-02	6.60E-02	4.78E-01
Endosulfan sulfate											
	High TRV	1.00E+00	9.60E-03	9.00E-04	6.37E+00	6.12E-02	3.01E-02	2.15E-01	8.60E-03	8.83E+01	9.74E-05
	Low TRV	1.00E+00	9.60E-03	9.00E-04	6.37E+00	6.12E-02	3.01E-02	2.15E-01	8.60E-03	8.83E+00	9.74E-04
Endrin											
	High TRV	1.00E+00	7.60E-03	9.00E-04	2.85E+01	2.16E-01	3.01E-02	2.15E-01	3.03E-02	2.15E+01	1.41E-03
	Low TRV	1.00E+00	7.60E-03	9.00E-04	2.85E+01	2.16E-01	3.01E-02	2.15E-01	3.03E-02	2.15E-01	1.41E-01
Endrin aldehyde											
	High TRV	1.00E+00	8.80E-03	9.00E-04	3.12E+01	2.75E-01	3.01E-02	2.15E-01	3.85E-02	2.15E+01	1.79E-03
	Low TRV	1.00E+00	8.80E-03	9.00E-04	3.12E+01	2.75E-01	3.01E-02	2.15E-01	3.85E-02	2.15E-01	1.79E-01
Heptachlor											
	High TRV	1.00E+00	1.20E-03	9.00E-04	2.65E+01	3.18E-02	3.01E-02	2.15E-01	4.46E-03	1.10E+00	4.04E-03
	Low TRV	1.00E+00	1.20E-03	9.00E-04	2.65E+01	3.18E-02	3.01E-02	2.15E-01	4.46E-03	6.62E-03	6.73E-01
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	1.10E+00	1.19E-01
	Low TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	6.62E-03	1.99E+01
4-Methylphenol											
	High TRV	1.00E+00	3.10E-01	9.00E-04	1.56E+00	4.83E-01	3.01E-02	2.15E-01	6.89E-02	NV	NC
	Low TRV	1.00E+00	3.10E-01	9.00E-04	1.56E+00	4.83E-01	3.01E-02	2.15E-01	6.89E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	7.00E-01	9.00E-04	1.47E+00	1.03E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC
	Low TRV	1.00E+00	7.00E-01	9.00E-04	1.47E+00	1.03E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	1.90E-01	9.00E-04	7.83E-01	1.49E-01	3.01E-02	2.15E-01	2.16E-02	NV	NC
	Low TRV	1.00E+00	1.90E-01	9.00E-04	7.83E-01	1.49E-01	3.01E-02	2.15E-01	2.16E-02	NV	NC

TABLE B-11: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQS FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Dibenzofuran											
	High TRV	1.00E+00	5.90E-02	9.00E-04	9.28E+00	5.48E-01	3.01E-02	2.15E-01	7.69E-02	NV	NC
	Low TRV	1.00E+00	5.90E-02	9.00E-04	9.28E+00	5.48E-01	3.01E-02	2.15E-01	7.69E-02	NV	NC
HMW PAHs											
	High TRV	1.00E+00	2.23E+01	9.00E-04	2.10E-01	4.69E+00	3.01E-02	2.15E-01	7.50E-01	NV	NC
	Low TRV	1.00E+00	2.23E+01	9.00E-04	2.10E-01	4.69E+00	3.01E-02	2.15E-01	7.50E-01	NV	NC
LMW PAHs											
	High TRV	1.00E+00	2.87E+00	9.00E-04	1.10E-01	3.16E-01	3.01E-02	2.15E-01	5.62E-02	NV	NC
	Low TRV	1.00E+00	2.87E+00	9.00E-04	1.10E-01	3.16E-01	3.01E-02	2.15E-01	5.62E-02	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	1.60E-01	9.00E-04	2.11E+01	3.37E+00	3.01E-02	2.15E-01	4.72E-01	NV	NC
	Low TRV	1.00E+00	1.60E-01	9.00E-04	2.11E+01	3.37E+00	3.01E-02	2.15E-01	4.72E-01	NV	NC
Phenol											
	High TRV	1.00E+00	9.00E-02	9.00E-04	1.05E+00	9.46E-02	3.01E-02	2.15E-01	1.36E-02	NV	NC
	Low TRV	1.00E+00	9.00E-02	9.00E-04	1.05E+00	9.46E-02	3.01E-02	2.15E-01	1.36E-02	NV	NC
Dibutyltin											
	High TRV	1.00E+00	1.89E-01	9.00E-04	1.91E+00	3.61E-01	3.01E-02	2.15E-01	5.13E-02	5.39E+01	9.53E-04
	Low TRV	1.00E+00	1.89E-01	9.00E-04	1.91E+00	3.61E-01	3.01E-02	2.15E-01	5.13E-02	8.57E-01	5.99E-02
Monobutyltin											
	High TRV	1.00E+00	6.76E-02	9.00E-04	4.78E+00	3.23E-01	3.01E-02	2.15E-01	4.55E-02	5.39E+01	8.45E-04
	Low TRV	1.00E+00	6.76E-02	9.00E-04	4.78E+00	3.23E-01	3.01E-02	2.15E-01	4.55E-02	8.57E-01	5.31E-02
Tributyltin											
	High TRV	1.00E+00	3.35E-01	9.00E-04	4.92E+00	1.65E+00	3.01E-02	2.15E-01	2.32E-01	5.39E+01	4.31E-03
	Low TRV	1.00E+00	3.35E-01	9.00E-04	4.92E+00	1.65E+00	3.01E-02	2.15E-01	2.32E-01	8.57E-01	2.71E-01

Notes:

BAF	Bioaccumulation factor from sediment concentrations to *Macoma* tissue concentrations
bgs	Below ground surface
BHC	Benzene hexachloride
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
HQ	Hazard quotient
IR	Ingestion rate of *Macoma* tissue
kg	Kilogram
kg/day	Kilogram per day
LMW	Low molecular weight
NC	Not calculated
NV	No TRV available
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Zinc		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.90E+04	9.00E-04	3.30E-01	6.27E+03	3.01E-02	2.15E-01	9.57E+02	1.17E+03	8.15E-01
	Low TRV	1.00E+00	1.90E+04	9.00E-04	3.30E-01	6.27E+03	3.01E-02	2.15E-01	9.57E+02	1.17E+02	8.15E+00
Antimony											
	High TRV	1.00E+00	2.40E+01	9.00E-04	3.30E-01	7.92E+00	3.01E-02	2.15E-01	1.21E+00	NV	NC
	Low TRV	1.00E+00	2.40E+01	9.00E-04	3.30E-01	7.92E+00	3.01E-02	2.15E-01	1.21E+00	NV	NC
Arsenic											
	High TRV	1.00E+00	2.80E+01	9.00E-04	1.53E+00	4.28E+01	3.01E-02	2.15E-01	6.11E+00	1.57E+01	3.90E-01
	Low TRV	1.00E+00	2.80E+01	9.00E-04	1.53E+00	4.28E+01	3.01E-02	2.15E-01	6.11E+00	3.92E+00	1.56E+00
Barium											
	High TRV	1.00E+00	6.30E+02	9.00E-04	2.80E-01	1.76E+02	3.01E-02	2.15E-01	2.73E+01	4.68E+01	5.84E-01
	Low TRV	1.00E+00	6.30E+02	9.00E-04	2.80E-01	1.76E+02	3.01E-02	2.15E-01	2.73E+01	2.33E+01	1.17E+00
Beryllium											
	High TRV	1.00E+00	6.20E-01	9.00E-04	9.00E-01	5.58E-01	3.01E-02	2.15E-01	8.07E-02	NV	NC
	Low TRV	1.00E+00	6.20E-01	9.00E-04	9.00E-01	5.58E-01	3.01E-02	2.15E-01	8.07E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.00E+00	9.00E-04	3.86E+00	1.93E+01	3.01E-02	2.15E-01	2.72E+00	1.26E+01	2.17E-01
	Low TRV	1.00E+00	5.00E+00	9.00E-04	3.86E+00	1.93E+01	3.01E-02	2.15E-01	2.72E+00	6.15E-02	4.43E+01
Chromium											
	High TRV	1.00E+00	4.50E+02	9.00E-04	2.20E-01	9.90E+01	3.01E-02	2.15E-01	1.57E+01	3.52E+00	4.48E+00
	Low TRV	1.00E+00	4.50E+02	9.00E-04	2.20E-01	9.90E+01	3.01E-02	2.15E-01	1.57E+01	7.03E-01	2.24E+01
Cobalt											
	High TRV	1.00E+00	7.50E+01	9.00E-04	3.90E-01	2.93E+01	3.01E-02	2.15E-01	4.41E+00	NV	NC
	Low TRV	1.00E+00	7.50E+01	9.00E-04	3.90E-01	2.93E+01	3.01E-02	2.15E-01	4.41E+00	NV	NC
Copper											
	High TRV	1.00E+00	1.95E+03	9.00E-04	6.70E-01	1.31E+03	3.01E-02	2.15E-01	1.91E+02	4.60E+01	4.15E+00
	Low TRV	1.00E+00	1.95E+03	9.00E-04	6.70E-01	1.31E+03	3.01E-02	2.15E-01	1.91E+02	1.85E+00	1.03E+02
Lead											
	High TRV	1.00E+00	8.00E+02	9.00E-04	3.90E-01	3.12E+02	3.01E-02	2.15E-01	4.70E+01	6.73E+00	6.99E+00
	Low TRV	1.00E+00	8.00E+02	9.00E-04	3.90E-01	3.12E+02	3.01E-02	2.15E-01	4.70E+01	1.62E-02	2.90E+03
Manganese											
	High TRV	1.00E+00	4.90E+03	9.00E-04	4.10E-01	2.01E+03	3.01E-02	2.15E-01	3.02E+02	7.90E+02	3.82E-01
	Low TRV	1.00E+00	4.90E+03	9.00E-04	4.10E-01	2.01E+03	3.01E-02	2.15E-01	3.02E+02	7.90E+01	3.82E+00
Mercury											
	High TRV	1.00E+00	1.90E+00	9.00E-04	6.10E-01	1.16E+00	3.01E-02	2.15E-01	1.70E-01	1.32E-01	1.29E+00
	Low TRV	1.00E+00	1.90E+00	9.00E-04	6.10E-01	1.16E+00	3.01E-02	2.15E-01	1.70E-01	2.87E-02	5.94E+00
Molybdenum											
	High TRV	1.00E+00	2.50E+00	9.00E-04	1.75E+00	4.38E+00	3.01E-02	2.15E-01	6.23E-01	2.39E+01	2.60E-02
	Low TRV	1.00E+00	2.50E+00	9.00E-04	1.75E+00	4.38E+00	3.01E-02	2.15E-01	6.23E-01	2.37E+00	2.62E-01
Nickel											
	High TRV	1.00E+00	1.70E+03	9.00E-04	2.90E-01	4.93E+02	3.01E-02	2.15E-01	7.61E+01	4.53E+01	1.68E+00
	Low TRV	1.00E+00	1.70E+03	9.00E-04	2.90E-01	4.93E+02	3.01E-02	2.15E-01	7.61E+01	1.12E+00	6.80E+01
Selenium											
	High TRV	1.00E+00	1.33E-01	9.00E-04	2.00E+01	2.66E+00	3.01E-02	2.15E-01	3.73E-01	6.70E-01	5.57E-01
	Low TRV	1.00E+00	1.33E-01	9.00E-04	2.00E+01	2.66E+00	3.01E-02	2.15E-01	3.73E-01	1.66E-01	2.25E+00
Silver											
	High TRV	1.00E+00	9.20E-01	9.00E-04	1.11E+00	1.02E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC
	Low TRV	1.00E+00	9.20E-01	9.00E-04	1.11E+00	1.02E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

		Maximum Sediment			Soft-bodied Invertebrate					Allometrically	
		Concentration	$IR_{Sediment}$	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Concentration	$IR_{Soft\text{-}bodied\ Invertebrate}$	BW	Dose	Converted TRV	
Chemical	SUF	(mg/kg)	(kg/day)		(mg/kg)	(kg/day)	(kg)	(mg/kg/day)	(mg/kg/day)	HQ
Thallium										
High TRV	1.00E+00	5.80E+00	9.00E-04	9.00E-01	5.22E+00	3.01E-02	2.15E-01	7.55E-01	4.31E-01	1.75E+00
Low TRV	1.00E+00	5.80E+00	9.00E-04	9.00E-01	5.22E+00	3.01E-02	2.15E-01	7.55E-01	4.31E-02	1.75E+01
Vanadium										
High TRV	1.00E+00	6.40E+01	9.00E-04	2.90E-01	1.86E+01	3.01E-02	2.15E-01	2.87E+00	8.12E+01	3.53E-02
Low TRV	1.00E+00	6.40E+01	9.00E-04	2.90E-01	1.86E+01	3.01E-02	2.15E-01	2.87E+00	8.12E+00	3.53E-01
Zinc										
High TRV	1.00E+00	1.10E+03	9.00E-04	8.40E-01	9.24E+02	3.01E-02	2.15E-01	1.34E+02	1.28E+02	1.05E+00
Low TRV	1.00E+00	1.10E+03	9.00E-04	8.40E-01	9.24E+02	3.01E-02	2.15E-01	1.34E+02	1.28E+01	1.05E+01
Total Aroclors										
High TRV	1.00E+00	4.70E+00	9.00E-04	6.15E+00	2.89E+01	3.01E-02	2.15E-01	4.07E+00	8.38E-01	4.85E+00
Low TRV	1.00E+00	4.70E+00	9.00E-04	6.15E+00	2.89E+01	3.01E-02	2.15E-01	4.07E+00	6.92E-02	5.88E+01
Total DDT										
High TRV	1.00E+00	1.29E-01	9.00E-04	1.43E+01	1.85E+00	3.01E-02	2.15E-01	2.59E-01	1.10E+00	2.35E-01
Low TRV	1.00E+00	1.29E-01	9.00E-04	1.43E+01	1.85E+00	3.01E-02	2.15E-01	2.59E-01	6.62E-03	3.91E+01
alpha-BHC										
High TRV	1.00E+00	6.40E-03	9.00E-04	7.14E+00	4.57E-02	3.01E-02	2.15E-01	6.43E-03	2.42E+00	2.66E-03
Low TRV	1.00E+00	6.40E-03	9.00E-04	7.14E+00	4.57E-02	3.01E-02	2.15E-01	6.43E-03	6.05E-01	1.06E-02
alpha-Chlordane										
High TRV	1.00E+00	2.20E-03	9.00E-04	5.82E+00	1.28E-02	3.01E-02	2.15E-01	1.80E-03	1.36E+01	1.32E-04
Low TRV	1.00E+00	2.20E-03	9.00E-04	5.82E+00	1.28E-02	3.01E-02	2.15E-01	1.80E-03	2.73E+00	6.61E-04
gamma-Chlordane										
High TRV	1.00E+00	2.10E-03	9.00E-04	4.16E+00	8.74E-03	3.01E-02	2.15E-01	1.23E-03	1.36E+01	9.03E-05
Low TRV	1.00E+00	2.10E-03	9.00E-04	4.16E+00	8.74E-03	3.01E-02	2.15E-01	1.23E-03	2.73E+00	4.52E-04
Dieldrin										
High TRV	1.00E+00	2.65E-02	9.00E-04	2.17E+01	5.75E-01	3.01E-02	2.15E-01	8.06E-02	6.60E-01	1.22E-01
Low TRV	1.00E+00	2.65E-02	9.00E-04	2.17E+01	5.75E-01	3.01E-02	2.15E-01	8.06E-02	6.60E-02	1.22E+00
Endosulfan II										
High TRV	1.00E+00	2.70E-03	9.00E-04	7.32E+00	1.98E-02	3.01E-02	2.15E-01	2.78E-03	8.83E+01	3.15E-05
Low TRV	1.00E+00	2.70E-03	9.00E-04	7.32E+00	1.98E-02	3.01E-02	2.15E-01	2.78E-03	8.83E+00	3.15E-04
Endrin										
High TRV	1.00E+00	2.30E-02	9.00E-04	2.85E+01	6.55E-01	3.01E-02	2.15E-01	9.18E-02	2.15E+01	4.28E-03
Low TRV	1.00E+00	2.30E-02	9.00E-04	2.85E+01	6.55E-01	3.01E-02	2.15E-01	9.18E-02	2.15E-01	4.28E-01
Endrin aldehyde										
High TRV	1.00E+00	3.10E-03	9.00E-04	3.12E+01	9.67E-02	3.01E-02	2.15E-01	1.36E-02	2.15E+01	6.32E-04
Low TRV	1.00E+00	3.10E-03	9.00E-04	3.12E+01	9.67E-02	3.01E-02	2.15E-01	1.36E-02	2.15E-01	6.32E-02
Endrin ketone										
High TRV	1.00E+00	9.70E-03	9.00E-04	3.12E+01	3.03E-01	3.01E-02	2.15E-01	4.24E-02	2.15E+01	1.98E-03
Low TRV	1.00E+00	9.70E-03	9.00E-04	3.12E+01	3.03E-01	3.01E-02	2.15E-01	4.24E-02	2.15E-01	1.98E-01
Heptachlor										
High TRV	1.00E+00	1.60E-03	9.00E-04	2.65E+01	4.24E-02	3.01E-02	2.15E-01	5.94E-03	1.10E+00	5.39E-03
Low TRV	1.00E+00	1.60E-03	9.00E-04	2.65E+01	4.24E-02	3.01E-02	2.15E-01	5.94E-03	6.62E-03	8.98E-01
Heptachlor epoxide										
High TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	1.10E+00	1.78E-02
Low TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	6.62E-03	2.97E+00
Methoxychlor										
High TRV	1.00E+00	1.70E-02	9.00E-04	2.04E+01	3.46E-01	3.01E-02	2.15E-01	4.86E-02	1.10E+00	4.40E-02
Low TRV	1.00E+00	1.70E-02	9.00E-04	2.04E+01	3.46E-01	3.01E-02	2.15E-01	4.86E-02	6.62E-03	7.34E+00

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
4-Methylphenol											
	High TRV	1.00E+00	1.40E-01	9.00E-04	1.56E+00	2.18E-01	3.01E-02	2.15E-01	3.11E-02	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-04	1.56E+00	2.18E-01	3.01E-02	2.15E-01	3.11E-02	NV	NC
4-Nitrophenol											
	High TRV	1.00E+00	7.20E-02	9.00E-04	1.52E+00	1.09E-01	3.01E-02	2.15E-01	1.56E-02	NV	NC
	Low TRV	1.00E+00	7.20E-02	9.00E-04	1.52E+00	1.09E-01	3.01E-02	2.15E-01	1.56E-02	NV	NC
Azobenzene											
	High TRV	1.00E+00	4.30E-02	9.00E-04	7.26E+00	3.12E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
	Low TRV	1.00E+00	4.30E-02	9.00E-04	7.26E+00	3.12E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	6.90E-01	9.00E-04	1.47E+00	1.01E+00	3.01E-02	2.15E-01	1.45E-01	NV	NC
	Low TRV	1.00E+00	6.90E-01	9.00E-04	1.47E+00	1.01E+00	3.01E-02	2.15E-01	1.45E-01	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	4.10E-02	9.00E-04	7.83E-01	3.21E-02	3.01E-02	2.15E-01	4.67E-03	NV	NC
	Low TRV	1.00E+00	4.10E-02	9.00E-04	7.83E-01	3.21E-02	3.01E-02	2.15E-01	4.67E-03	NV	NC
Dibenzofuran											
	High TRV	1.00E+00	1.40E-01	9.00E-04	9.28E+00	1.30E+00	3.01E-02	2.15E-01	1.83E-01	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-04	9.28E+00	1.30E+00	3.01E-02	2.15E-01	1.83E-01	NV	NC
HMW PAHs											
	High TRV	1.00E+00	7.66E+00	9.00E-04	6.30E-01	4.83E+00	3.01E-02	2.15E-01	7.08E-01	NV	NC
	Low TRV	1.00E+00	7.66E+00	9.00E-04	6.30E-01	4.83E+00	3.01E-02	2.15E-01	7.08E-01	NV	NC
LMW PAHs											
	High TRV	1.00E+00	3.09E+00	9.00E-04	6.90E-01	2.13E+00	3.01E-02	2.15E-01	3.11E-01	NV	NC
	Low TRV	1.00E+00	3.09E+00	9.00E-04	6.90E-01	2.13E+00	3.01E-02	2.15E-01	3.11E-01	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	3.70E-02	9.00E-04	2.11E+01	7.79E-01	3.01E-02	2.15E-01	1.09E-01	NV	NC
	Low TRV	1.00E+00	3.70E-02	9.00E-04	2.11E+01	7.79E-01	3.01E-02	2.15E-01	1.09E-01	NV	NC
Phenol											
	High TRV	1.00E+00	2.90E-01	9.00E-04	1.05E+00	3.05E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
	Low TRV	1.00E+00	2.90E-01	9.00E-04	1.05E+00	3.05E-01	3.01E-02	2.15E-01	4.39E-02	NV	NC
Dibutyltin											
	High TRV	1.00E+00	3.66E-01	9.00E-04	1.41E+01	5.15E+00	3.01E-02	2.15E-01	7.23E-01	5.39E+01	1.34E-02
	Low TRV	1.00E+00	3.66E-01	9.00E-04	1.41E+01	5.15E+00	3.01E-02	2.15E-01	7.23E-01	8.57E-01	8.44E-01
Monobutyltin											
	High TRV	1.00E+00	1.02E-01	9.00E-04	4.78E+00	4.88E-01	3.01E-02	2.15E-01	6.87E-02	5.39E+01	1.27E-03
	Low TRV	1.00E+00	1.02E-01	9.00E-04	4.78E+00	4.88E-01	3.01E-02	2.15E-01	6.87E-02	8.57E-01	8.02E-02
Tetrabutyltin											
	High TRV	1.00E+00	4.84E-02	9.00E-04	6.51E+02	3.15E+01	3.01E-02	2.15E-01	4.41E+00	5.39E+01	8.19E-02
	Low TRV	1.00E+00	4.84E-02	9.00E-04	6.51E+02	3.15E+01	3.01E-02	2.15E-01	4.41E+00	8.57E-01	5.15E+00
Tributyltin											
	High TRV	1.00E+00	9.90E-01	9.00E-04	1.01E+01	1.00E+01	3.01E-02	2.15E-01	1.41E+00	5.39E+01	2.61E-02
	Low TRV	1.00E+00	9.90E-01	9.00E-04	1.01E+01	1.00E+01	3.01E-02	2.15E-01	1.41E+00	8.57E-01	1.64E+00

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	2.20E+04	9.00E-04	3.30E-01	7.26E+03	3.01E-02	2.15E-01	1.11E+03	1.17E+03	9.44E-01
	Low TRV	1.00E+00	2.20E+04	9.00E-04	3.30E-01	7.26E+03	3.01E-02	2.15E-01	1.11E+03	1.17E+02	9.44E+00
Antimony											
	High TRV	1.00E+00	5.90E+00	9.00E-04	3.30E-01	1.95E+00	3.01E-02	2.15E-01	2.97E-01	NV	NC
	Low TRV	1.00E+00	5.90E+00	9.00E-04	3.30E-01	1.95E+00	3.01E-02	2.15E-01	2.97E-01	NV	NC
Arsenic											
	High TRV	1.00E+00	6.60E+00	9.00E-04	1.53E+00	1.01E+01	3.01E-02	2.15E-01	1.44E+00	1.57E+01	9.20E-02
	Low TRV	1.00E+00	6.60E+00	9.00E-04	1.53E+00	1.01E+01	3.01E-02	2.15E-01	1.44E+00	3.92E+00	3.68E-01
Barium											
	High TRV	1.00E+00	1.70E+02	9.00E-04	2.80E-01	4.76E+01	3.01E-02	2.15E-01	7.38E+00	4.68E+01	1.58E-01
	Low TRV	1.00E+00	1.70E+02	9.00E-04	2.80E-01	4.76E+01	3.01E-02	2.15E-01	7.38E+00	2.33E+01	3.16E-01
Beryllium											
	High TRV	1.00E+00	5.20E-01	9.00E-04	9.00E-01	4.68E-01	3.01E-02	2.15E-01	6.77E-02	NV	NC
	Low TRV	1.00E+00	5.20E-01	9.00E-04	9.00E-01	4.68E-01	3.01E-02	2.15E-01	6.77E-02	NV	NC
Cadmium											
	High TRV	1.00E+00	5.90E+00	9.00E-04	3.86E+00	2.28E+01	3.01E-02	2.15E-01	3.21E+00	1.26E+01	2.56E-01
	Low TRV	1.00E+00	5.90E+00	9.00E-04	3.86E+00	2.28E+01	3.01E-02	2.15E-01	3.21E+00	6.15E-02	5.22E+01
Chromium											
	High TRV	1.00E+00	5.10E+02	9.00E-04	2.20E-01	1.12E+02	3.01E-02	2.15E-01	1.78E+01	3.52E+00	5.07E+00
	Low TRV	1.00E+00	5.10E+02	9.00E-04	2.20E-01	1.12E+02	3.01E-02	2.15E-01	1.78E+01	7.03E-01	2.54E+01
Cobalt											
	High TRV	1.00E+00	7.20E+01	9.00E-04	3.90E-01	2.81E+01	3.01E-02	2.15E-01	4.23E+00	NV	NC
	Low TRV	1.00E+00	7.20E+01	9.00E-04	3.90E-01	2.81E+01	3.01E-02	2.15E-01	4.23E+00	NV	NC
Copper											
	High TRV	1.00E+00	5.40E+03	9.00E-04	6.70E-01	3.62E+03	3.01E-02	2.15E-01	5.29E+02	4.60E+01	1.15E+01
	Low TRV	1.00E+00	5.40E+03	9.00E-04	6.70E-01	3.62E+03	3.01E-02	2.15E-01	5.29E+02	1.85E+00	2.86E+02
Lead											
	High TRV	1.00E+00	1.20E+03	9.00E-04	3.90E-01	4.68E+02	3.01E-02	2.15E-01	7.05E+01	6.73E+00	1.05E+01
	Low TRV	1.00E+00	1.20E+03	9.00E-04	3.90E-01	4.68E+02	3.01E-02	2.15E-01	7.05E+01	1.62E-02	4.35E+03
Manganese											
	High TRV	1.00E+00	6.00E+02	9.00E-04	4.10E-01	2.46E+02	3.01E-02	2.15E-01	3.70E+01	7.90E+02	4.68E-02
	Low TRV	1.00E+00	6.00E+02	9.00E-04	4.10E-01	2.46E+02	3.01E-02	2.15E-01	3.70E+01	7.90E+01	4.68E-01
Mercury											
	High TRV	1.00E+00	1.30E+00	9.00E-04	6.10E-01	7.93E-01	3.01E-02	2.15E-01	1.16E-01	1.32E-01	8.80E-01
	Low TRV	1.00E+00	1.30E+00	9.00E-04	6.10E-01	7.93E-01	3.01E-02	2.15E-01	1.16E-01	2.87E-02	4.06E+00
Molybdenum											
	High TRV	1.00E+00	1.10E+01	9.00E-04	1.75E+00	1.93E+01	3.01E-02	2.15E-01	2.74E+00	2.39E+01	1.15E-01
	Low TRV	1.00E+00	1.10E+01	9.00E-04	1.75E+00	1.93E+01	3.01E-02	2.15E-01	2.74E+00	2.37E+00	1.15E+00
Nickel											
	High TRV	1.00E+00	1.60E+03	9.00E-04	2.90E-01	4.64E+02	3.01E-02	2.15E-01	7.17E+01	4.53E+01	1.58E+00
	Low TRV	1.00E+00	1.60E+03	9.00E-04	2.90E-01	4.64E+02	3.01E-02	2.15E-01	7.17E+01	1.12E+00	6.40E+01
Silver											
	High TRV	1.00E+00	5.00E-01	9.00E-04	1.11E+00	5.55E-01	3.01E-02	2.15E-01	7.98E-02	NV	NC
	Low TRV	1.00E+00	5.00E-01	9.00E-04	1.11E+00	5.55E-01	3.01E-02	2.15E-01	7.98E-02	NV	NC
Thallium											
	High TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-01	2.93E-01
	Low TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-02	2.93E+00

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Vanadium											
	High TRV	1.00E+00	5.10E+01	9.00E-04	2.90E-01	1.48E+01	3.01E-02	2.15E-01	2.28E+00	8.12E+01	2.81E-02
	Low TRV	1.00E+00	5.10E+01	9.00E-04	2.90E-01	1.48E+01	3.01E-02	2.15E-01	2.28E+00	8.12E+00	2.81E-01
Zinc											
	High TRV	1.00E+00	1.30E+03	9.00E-04	8.40E-01	1.09E+03	3.01E-02	2.15E-01	1.58E+02	1.28E+02	1.24E+00
	Low TRV	1.00E+00	1.30E+03	9.00E-04	8.40E-01	1.09E+03	3.01E-02	2.15E-01	1.58E+02	1.28E+01	1.24E+01
Total Aroclors											
	High TRV	1.00E+00	6.35E+00	9.00E-04	6.15E+00	3.91E+01	3.01E-02	2.15E-01	5.49E+00	8.38E-01	6.55E+00
	Low TRV	1.00E+00	6.35E+00	9.00E-04	6.15E+00	3.91E+01	3.01E-02	2.15E-01	5.49E+00	6.92E-02	7.94E+01
Total DDT											
	High TRV	1.00E+00	1.56E-01	9.00E-04	1.43E+01	2.22E+00	3.01E-02	2.15E-01	3.12E-01	1.10E+00	2.82E-01
	Low TRV	1.00E+00	1.56E-01	9.00E-04	1.43E+01	2.22E+00	3.01E-02	2.15E-01	3.12E-01	6.62E-03	4.71E+01
beta-BHC											
	High TRV	1.00E+00	5.10E-03	9.00E-04	7.03E+00	3.58E-02	3.01E-02	2.15E-01	5.04E-03	2.42E+00	2.08E-03
	Low TRV	1.00E+00	5.10E-03	9.00E-04	7.03E+00	3.58E-02	3.01E-02	2.15E-01	5.04E-03	6.05E-01	8.33E-03
delta-BHC											
	High TRV	1.00E+00	1.70E-03	9.00E-04	9.44E+00	1.60E-02	3.01E-02	2.15E-01	2.25E-03	2.42E+00	9.32E-04
	Low TRV	1.00E+00	1.70E-03	9.00E-04	9.44E+00	1.60E-02	3.01E-02	2.15E-01	2.25E-03	6.05E-01	3.72E-03
alpha-Chlordane											
	High TRV	1.00E+00	1.90E-03	9.00E-04	5.82E+00	1.11E-02	3.01E-02	2.15E-01	1.56E-03	1.36E+01	1.14E-04
	Low TRV	1.00E+00	1.90E-03	9.00E-04	5.82E+00	1.11E-02	3.01E-02	2.15E-01	1.56E-03	2.73E+00	5.71E-04
Dieldrin											
	High TRV	1.00E+00	4.50E-02	9.00E-04	2.17E+01	9.77E-01	3.01E-02	2.15E-01	1.37E-01	6.60E-01	2.08E-01
	Low TRV	1.00E+00	4.50E-02	9.00E-04	2.17E+01	9.77E-01	3.01E-02	2.15E-01	1.37E-01	6.60E-02	2.08E+00
Endosulfan sulfate											
	High TRV	1.00E+00	9.60E-03	9.00E-04	6.37E+00	6.12E-02	3.01E-02	2.15E-01	8.60E-03	8.83E+01	9.74E-05
	Low TRV	1.00E+00	9.60E-03	9.00E-04	6.37E+00	6.12E-02	3.01E-02	2.15E-01	8.60E-03	8.83E+00	9.74E-04
Endrin											
	High TRV	1.00E+00	7.60E-03	9.00E-04	2.85E+01	2.16E-01	3.01E-02	2.15E-01	3.03E-02	2.15E+01	1.41E-03
	Low TRV	1.00E+00	7.60E-03	9.00E-04	2.85E+01	2.16E-01	3.01E-02	2.15E-01	3.03E-02	2.15E-01	1.41E-01
Endrin aldehyde											
	High TRV	1.00E+00	8.80E-03	9.00E-04	3.12E+01	2.75E-01	3.01E-02	2.15E-01	3.85E-02	2.15E+01	1.79E-03
	Low TRV	1.00E+00	8.80E-03	9.00E-04	3.12E+01	2.75E-01	3.01E-02	2.15E-01	3.85E-02	2.15E-01	1.79E-01
Heptachlor											
	High TRV	1.00E+00	1.20E-03	9.00E-04	2.65E+01	3.18E-02	3.01E-02	2.15E-01	4.46E-03	1.10E+00	4.04E-03
	Low TRV	1.00E+00	1.20E-03	9.00E-04	2.65E+01	3.18E-02	3.01E-02	2.15E-01	4.46E-03	6.62E-03	6.73E-01
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	1.10E+00	1.19E-01
	Low TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	6.62E-03	1.99E+01
4-Methylphenol											
	High TRV	1.00E+00	3.10E-01	9.00E-04	1.56E+00	4.83E-01	3.01E-02	2.15E-01	6.89E-02	NV	NC
	Low TRV	1.00E+00	3.10E-01	9.00E-04	1.56E+00	4.83E-01	3.01E-02	2.15E-01	6.89E-02	NV	NC
Benzoic acid											
	High TRV	1.00E+00	7.00E-01	9.00E-04	1.47E+00	1.03E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC
	Low TRV	1.00E+00	7.00E-01	9.00E-04	1.47E+00	1.03E+00	3.01E-02	2.15E-01	1.47E-01	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	1.90E-01	9.00E-04	7.83E-01	1.49E-01	3.01E-02	2.15E-01	2.16E-02	NV	NC
	Low TRV	1.00E+00	1.90E-01	9.00E-04	7.83E-01	1.49E-01	3.01E-02	2.15E-01	2.16E-02	NV	NC

TABLE B-12: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Dibenzofuran											
	High TRV	1.00E+00	5.90E-02	9.00E-04	9.28E+00	5.48E-01	3.01E-02	2.15E-01	7.69E-02	NV	NC
	Low TRV	1.00E+00	5.90E-02	9.00E-04	9.28E+00	5.48E-01	3.01E-02	2.15E-01	7.69E-02	NV	NC
HMW PAHs											
	High TRV	1.00E+00	2.23E+01	9.00E-04	6.30E-01	1.41E+01	3.01E-02	2.15E-01	2.06E+00	NV	NC
	Low TRV	1.00E+00	2.23E+01	9.00E-04	6.30E-01	1.41E+01	3.01E-02	2.15E-01	2.06E+00	NV	NC
LMW PAHs											
	High TRV	1.00E+00	2.87E+00	9.00E-04	6.90E-01	1.98E+00	3.01E-02	2.15E-01	2.89E-01	NV	NC
	Low TRV	1.00E+00	2.87E+00	9.00E-04	6.90E-01	1.98E+00	3.01E-02	2.15E-01	2.89E-01	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	1.60E-01	9.00E-04	2.11E+01	3.37E+00	3.01E-02	2.15E-01	4.72E-01	NV	NC
	Low TRV	1.00E+00	1.60E-01	9.00E-04	2.11E+01	3.37E+00	3.01E-02	2.15E-01	4.72E-01	NV	NC
Phenol											
	High TRV	1.00E+00	9.00E-02	9.00E-04	1.05E+00	9.46E-02	3.01E-02	2.15E-01	1.36E-02	NV	NC
	Low TRV	1.00E+00	9.00E-02	9.00E-04	1.05E+00	9.46E-02	3.01E-02	2.15E-01	1.36E-02	NV	NC
Dibutyltin											
	High TRV	1.00E+00	1.89E-01	9.00E-04	1.41E+01	2.66E+00	3.01E-02	2.15E-01	3.73E-01	5.39E+01	6.93E-03
	Low TRV	1.00E+00	1.89E-01	9.00E-04	1.41E+01	2.66E+00	3.01E-02	2.15E-01	3.73E-01	8.57E-01	4.36E-01
Monobutyltin											
	High TRV	1.00E+00	6.76E-02	9.00E-04	4.78E+00	3.23E-01	3.01E-02	2.15E-01	4.55E-02	5.39E+01	8.45E-04
	Low TRV	1.00E+00	6.76E-02	9.00E-04	4.78E+00	3.23E-01	3.01E-02	2.15E-01	4.55E-02	8.57E-01	5.31E-02
Tributyltin											
	High TRV	1.00E+00	3.35E-01	9.00E-04	1.01E+01	3.39E+00	3.01E-02	2.15E-01	4.76E-01	5.39E+01	8.84E-03
	Low TRV	1.00E+00	3.35E-01	9.00E-04	1.01E+01	3.39E+00	3.01E-02	2.15E-01	4.76E-01	8.57E-01	5.56E-01

Notes:

BAF	Bioaccumulation factor from sediment concentrations to soft-bodied invertebrate concentrations
bgs	Below ground surface
BHC	Benzene hexachloride
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
HQ	Toxicity reference value
IR	Ingestion rate of soft bodied invertebrate tissue
kg	Kilogram
kg/day	Kilogram per day
LMW	Low molecular weight
NC	Not calculated
NV	No TRV available
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.90E+04	4.70E-04	6.50E-05	3.95E-01	1.19E-01	1.20E+00	7.46E+00	1.66E+03	4.50E-03
	Low TRV	1.00E+00	1.90E+04	4.70E-04	6.50E-05	3.95E-01	1.19E-01	1.20E+00	7.46E+00	1.66E+02	4.50E-02
Antimony											
	High TRV	1.00E+00	2.40E+01	4.70E-04	1.30E-02	1.00E-01	1.19E-01	1.20E+00	1.93E-02	NV	NC
	Low TRV	1.00E+00	2.40E+01	4.70E-04	1.30E-02	1.00E-01	1.19E-01	1.20E+00	1.93E-02	NV	NC
Arsenic											
	High TRV	1.00E+00	2.80E+01	4.70E-04	3.11E-01	2.78E+00	1.19E-01	1.20E+00	2.86E-01	2.21E+01	1.29E-02
	Low TRV	1.00E+00	2.80E+01	4.70E-04	3.11E-01	2.78E+00	1.19E-01	1.20E+00	2.86E-01	5.53E+00	5.18E-02
Barium											
	High TRV	1.00E+00	6.30E+02	4.70E-04	6.50E-05	1.31E-02	1.19E-01	1.20E+00	2.47E-01	6.60E+01	3.74E-03
	Low TRV	1.00E+00	6.30E+02	4.70E-04	6.50E-05	1.31E-02	1.19E-01	1.20E+00	2.47E-01	3.29E+01	7.51E-03
Beryllium											
	High TRV	1.00E+00	6.20E-01	4.70E-04	6.50E-05	1.29E-05	1.19E-01	1.20E+00	2.43E-04	NV	NC
	Low TRV	1.00E+00	6.20E-01	4.70E-04	6.50E-05	1.29E-05	1.19E-01	1.20E+00	2.43E-04	NV	NC
Cadmium											
	High TRV	1.00E+00	5.00E+00	4.70E-04	8.89E-03	1.42E-02	1.19E-01	1.20E+00	3.36E-03	1.77E+01	1.90E-04
	Low TRV	1.00E+00	5.00E+00	4.70E-04	8.89E-03	1.42E-02	1.19E-01	1.20E+00	3.36E-03	8.68E-02	3.87E-02
Chromium											
	High TRV	1.00E+00	4.50E+02	4.70E-04	6.50E-05	9.36E-03	1.19E-01	1.20E+00	1.77E-01	4.96E+00	3.56E-02
	Low TRV	1.00E+00	4.50E+02	4.70E-04	6.50E-05	9.36E-03	1.19E-01	1.20E+00	1.77E-01	9.93E-01	1.78E-01
Cobalt											
	High TRV	1.00E+00	7.50E+01	4.70E-04	6.50E-05	1.56E-03	1.19E-01	1.20E+00	2.94E-02	NV	NC
	Low TRV	1.00E+00	7.50E+01	4.70E-04	6.50E-05	1.56E-03	1.19E-01	1.20E+00	2.94E-02	NV	NC
Copper											
	High TRV	1.00E+00	1.95E+03	4.70E-04	7.55E-02	4.71E+01	1.19E-01	1.20E+00	5.42E+00	6.49E+01	8.35E-02
	Low TRV	1.00E+00	1.95E+03	4.70E-04	7.55E-02	4.71E+01	1.19E-01	1.20E+00	5.42E+00	2.61E+00	2.08E+00
Lead											
	High TRV	1.00E+00	8.00E+02	4.70E-04	3.34E-02	8.56E+00	1.19E-01	1.20E+00	1.16E+00	9.50E+00	1.22E-01
	Low TRV	1.00E+00	8.00E+02	4.70E-04	3.34E-02	8.56E+00	1.19E-01	1.20E+00	1.16E+00	2.29E-02	5.06E+01
Manganese											
	High TRV	1.00E+00	4.90E+03	4.70E-04	1.82E-02	2.85E+01	1.19E-01	1.20E+00	4.73E+00	1.12E+03	4.24E-03
	Low TRV	1.00E+00	4.90E+03	4.70E-04	1.82E-02	2.85E+01	1.19E-01	1.20E+00	4.73E+00	1.12E+02	4.24E-02
Mercury											
	High TRV	1.00E+00	1.90E+00	4.70E-04	8.63E-03	5.25E-03	1.19E-01	1.20E+00	1.26E-03	1.87E-01	6.75E-03
	Low TRV	1.00E+00	1.90E+00	4.70E-04	8.63E-03	5.25E-03	1.19E-01	1.20E+00	1.26E-03	4.05E-02	3.11E-02
Molybdenum											
	High TRV	1.00E+00	2.50E+00	4.70E-04	8.35E-01	6.68E-01	1.19E-01	1.20E+00	6.70E-02	3.38E+01	1.98E-03
	Low TRV	1.00E+00	2.50E+00	4.70E-04	8.35E-01	6.68E-01	1.19E-01	1.20E+00	6.70E-02	3.35E+00	2.00E-02
Nickel											
	High TRV	1.00E+00	1.70E+03	4.70E-04	3.40E-04	1.85E-01	1.19E-01	1.20E+00	6.82E-01	6.39E+01	1.07E-02
	Low TRV	1.00E+00	1.70E+03	4.70E-04	3.40E-04	1.85E-01	1.19E-01	1.20E+00	6.82E-01	1.58E+00	4.32E-01
Selenium											
	High TRV	1.00E+00	1.33E-01	4.70E-04	1.06E+00	4.53E-02	1.19E-01	1.20E+00	4.53E-03	9.46E-01	4.79E-03
	Low TRV	1.00E+00	1.33E-01	4.70E-04	1.06E+00	4.53E-02	1.19E-01	1.20E+00	4.53E-03	2.34E-01	1.94E-02
Silver											
	High TRV	1.00E+00	9.20E-01	4.70E-04	2.24E-02	6.61E-03	1.19E-01	1.20E+00	1.01E-03	NV	NC
	Low TRV	1.00E+00	9.20E-01	4.70E-04	2.24E-02	6.61E-03	1.19E-01	1.20E+00	1.01E-03	NV	NC

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Thallium											
	High TRV	1.00E+00	5.80E+00	4.70E-04	6.50E-05	1.21E-04	1.19E-01	1.20E+00	2.28E-03	6.08E-01	3.75E-03
	Low TRV	1.00E+00	5.80E+00	4.70E-04	6.50E-05	1.21E-04	1.19E-01	1.20E+00	2.28E-03	6.08E-02	3.75E-02
Vanadium											
	High TRV	1.00E+00	6.40E+01	4.70E-04	6.50E-05	1.33E-03	1.19E-01	1.20E+00	2.51E-02	1.15E+02	2.19E-04
	Low TRV	1.00E+00	6.40E+01	4.70E-04	6.50E-05	1.33E-03	1.19E-01	1.20E+00	2.51E-02	1.15E+01	2.19E-03
Zinc											
	High TRV	1.00E+00	1.10E+03	4.70E-04	1.27E-01	4.47E+01	1.19E-01	1.20E+00	4.85E+00	1.80E+02	2.69E-02
	Low TRV	1.00E+00	1.10E+03	4.70E-04	1.27E-01	4.47E+01	1.19E-01	1.20E+00	4.85E+00	1.80E+01	2.69E-01
Total Aroclors											
	High TRV	1.00E+00	4.70E+00	4.70E-04	5.99E-02	9.01E-02	1.19E-01	1.20E+00	1.07E-02	1.18E+00	9.08E-03
	Low TRV	1.00E+00	4.70E+00	4.70E-04	5.99E-02	9.01E-02	1.19E-01	1.20E+00	1.07E-02	9.77E-02	1.10E-01
Total DDT											
	High TRV	1.00E+00	1.29E-01	4.70E-04	1.88E-02	7.77E-04	1.19E-01	1.20E+00	1.27E-04	1.56E+00	8.17E-05
	Low TRV	1.00E+00	1.29E-01	4.70E-04	1.88E-02	7.77E-04	1.19E-01	1.20E+00	1.27E-04	9.34E-03	1.36E-02
alpha-BHC											
	High TRV	1.00E+00	6.40E-03	4.70E-04	2.02E-05	4.14E-08	1.19E-01	1.20E+00	2.50E-06	3.41E+00	7.33E-07
	Low TRV	1.00E+00	6.40E-03	4.70E-04	2.02E-05	4.14E-08	1.19E-01	1.20E+00	2.50E-06	8.54E-01	2.93E-06
alpha-Chlordane											
	High TRV	1.00E+00	2.20E-03	4.70E-04	9.49E-02	6.68E-05	1.19E-01	1.20E+00	7.46E-06	1.92E+01	3.88E-07
	Low TRV	1.00E+00	2.20E-03	4.70E-04	9.49E-02	6.68E-05	1.19E-01	1.20E+00	7.46E-06	3.85E+00	1.94E-06
gamma-Chlordane											
	High TRV	1.00E+00	2.10E-03	4.70E-04	9.49E-02	6.38E-05	1.19E-01	1.20E+00	7.12E-06	1.92E+01	3.70E-07
	Low TRV	1.00E+00	2.10E-03	4.70E-04	9.49E-02	6.38E-05	1.19E-01	1.20E+00	7.12E-06	3.85E+00	1.85E-06
Dieldrin											
	High TRV	1.00E+00	2.65E-02	4.70E-04	9.97E-05	8.45E-07	1.19E-01	1.20E+00	1.04E-05	9.31E-01	1.12E-05
	Low TRV	1.00E+00	2.65E-02	4.70E-04	9.97E-05	8.45E-07	1.19E-01	1.20E+00	1.04E-05	9.31E-02	1.12E-04
Endosulfan II											
	High TRV	1.00E+00	2.70E-03	4.70E-04	2.08E-05	1.80E-08	1.19E-01	1.20E+00	1.06E-06	1.25E+02	8.47E-09
	Low TRV	1.00E+00	2.70E-03	4.70E-04	2.08E-05	1.80E-08	1.19E-01	1.20E+00	1.06E-06	1.25E+01	8.47E-08
Endrin											
	High TRV	1.00E+00	2.30E-02	4.70E-04	8.16E-05	6.01E-07	1.19E-01	1.20E+00	9.04E-06	3.03E+01	2.99E-07
	Low TRV	1.00E+00	2.30E-02	4.70E-04	8.16E-05	6.01E-07	1.19E-01	1.20E+00	9.04E-06	3.03E-01	2.99E-05
Endrin aldehyde											
	High TRV	1.00E+00	3.10E-03	4.70E-04	1.22E-04	1.21E-07	1.19E-01	1.20E+00	1.22E-06	3.03E+01	4.04E-08
	Low TRV	1.00E+00	3.10E-03	4.70E-04	1.22E-04	1.21E-07	1.19E-01	1.20E+00	1.22E-06	3.03E-01	4.04E-06
Endrin ketone											
	High TRV	1.00E+00	9.70E-03	4.70E-04	1.22E-04	3.79E-07	1.19E-01	1.20E+00	3.82E-06	3.03E+01	1.26E-07
	Low TRV	1.00E+00	9.70E-03	4.70E-04	1.22E-04	3.79E-07	1.19E-01	1.20E+00	3.82E-06	3.03E-01	1.26E-05
Heptachlor											
	High TRV	1.00E+00	1.60E-03	4.70E-04	9.97E-05	5.10E-08	1.19E-01	1.20E+00	6.30E-07	1.56E+00	4.04E-07
	Low TRV	1.00E+00	1.60E-03	4.70E-04	9.97E-05	5.10E-08	1.19E-01	1.20E+00	6.30E-07	9.34E-03	6.74E-05
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	4.70E-04	9.97E-05	1.69E-07	1.19E-01	1.20E+00	2.09E-06	1.56E+00	1.34E-06
	Low TRV	1.00E+00	5.30E-03	4.70E-04	9.97E-05	1.69E-07	1.19E-01	1.20E+00	2.09E-06	9.34E-03	2.23E-04
Methoxychlor											
	High TRV	1.00E+00	1.70E-02	4.70E-04	7.25E-05	3.94E-07	1.19E-01	1.20E+00	6.68E-06	1.56E+00	4.29E-06
	Low TRV	1.00E+00	1.70E-02	4.70E-04	7.25E-05	3.94E-07	1.19E-01	1.20E+00	6.68E-06	9.34E-03	7.15E-04

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
4-Methylphenol											
	High TRV	1.00E+00	1.40E-01	4.70E-04	3.13E-06	1.40E-07	1.19E-01	1.20E+00	5.47E-05	NV	NC
	Low TRV	1.00E+00	1.40E-01	4.70E-04	3.13E-06	1.40E-07	1.19E-01	1.20E+00	5.47E-05	NV	NC
4-Nitrophenol											
	High TRV	1.00E+00	7.20E-02	4.70E-04	3.04E-06	7.00E-08	1.19E-01	1.20E+00	2.81E-05	NV	NC
	Low TRV	1.00E+00	7.20E-02	4.70E-04	3.04E-06	7.00E-08	1.19E-01	1.20E+00	2.81E-05	NV	NC
Azobenzene											
	High TRV	1.00E+00	4.30E-02	4.70E-04	2.05E-05	2.82E-07	1.19E-01	1.20E+00	1.68E-05	NV	NC
	Low TRV	1.00E+00	4.30E-02	4.70E-04	2.05E-05	2.82E-07	1.19E-01	1.20E+00	1.68E-05	NV	NC
Benzoic acid											
	High TRV	1.00E+00	6.90E-01	4.70E-04	2.93E-06	6.47E-07	1.19E-01	1.20E+00	2.69E-04	NV	NC
	Low TRV	1.00E+00	6.90E-01	4.70E-04	2.93E-06	6.47E-07	1.19E-01	1.20E+00	2.69E-04	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	4.10E-02	4.70E-04	1.35E-06	1.77E-08	1.19E-01	1.20E+00	1.60E-05	NV	NC
	Low TRV	1.00E+00	4.10E-02	4.70E-04	1.35E-06	1.77E-08	1.19E-01	1.20E+00	1.60E-05	NV	NC
Dibenzofuran											
	High TRV	1.00E+00	1.40E-01	4.70E-04	2.77E-05	1.24E-06	1.19E-01	1.20E+00	5.48E-05	NV	NC
	Low TRV	1.00E+00	1.40E-01	4.70E-04	2.77E-05	1.24E-06	1.19E-01	1.20E+00	5.48E-05	NV	NC
HMW PAHs											
	High TRV	1.00E+00	7.66E+00	4.70E-04	1.22E-04	2.99E-04	1.19E-01	1.20E+00	3.02E-03	NV	NC
	Low TRV	1.00E+00	7.66E+00	4.70E-04	1.22E-04	2.99E-04	1.19E-01	1.20E+00	3.02E-03	NV	NC
LMW PAHs											
	High TRV	1.00E+00	3.09E+00	4.70E-04	1.22E-04	1.20E-04	1.19E-01	1.20E+00	1.22E-03	NV	NC
	Low TRV	1.00E+00	3.09E+00	4.70E-04	1.22E-04	1.20E-04	1.19E-01	1.20E+00	1.22E-03	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	3.70E-02	4.70E-04	7.54E-05	8.93E-07	1.19E-01	1.20E+00	1.45E-05	NV	NC
	Low TRV	1.00E+00	3.70E-02	4.70E-04	7.54E-05	8.93E-07	1.19E-01	1.20E+00	1.45E-05	NV	NC
Phenol											
	High TRV	1.00E+00	2.90E-01	4.70E-04	1.94E-06	1.80E-07	1.19E-01	1.20E+00	1.13E-04	NV	NC
	Low TRV	1.00E+00	2.90E-01	4.70E-04	1.94E-06	1.80E-07	1.19E-01	1.20E+00	1.13E-04	NV	NC
Dibutyltin											
	High TRV	1.00E+00	3.66E-01	4.70E-04	2.00E-06	2.34E-07	1.19E-01	1.20E+00	1.43E-04	7.60E+01	1.88E-06
	Low TRV	1.00E+00	3.66E-01	4.70E-04	2.00E-06	2.34E-07	1.19E-01	1.20E+00	1.43E-04	1.21E+00	1.18E-04
Monobutyltin											
	High TRV	1.00E+00	1.02E-01	4.70E-04	1.23E-05	4.01E-07	1.19E-01	1.20E+00	3.99E-05	7.60E+01	5.24E-07
	Low TRV	1.00E+00	1.02E-01	4.70E-04	1.23E-05	4.01E-07	1.19E-01	1.20E+00	3.99E-05	1.21E+00	3.30E-05
Tetrabutyltin											
	High TRV	1.00E+00	4.84E-02	4.70E-04	4.98E-03	7.71E-05	1.19E-01	1.20E+00	2.65E-05	7.60E+01	3.49E-07
	Low TRV	1.00E+00	4.84E-02	4.70E-04	4.98E-03	7.71E-05	1.19E-01	1.20E+00	2.65E-05	1.21E+00	2.19E-05
Tributyltin											
	High TRV	1.00E+00	9.90E-01	4.70E-04	7.01E-04	2.22E-04	1.19E-01	1.20E+00	4.08E-04	7.60E+01	5.37E-06
	Low TRV	1.00E+00	9.90E-01	4.70E-04	7.01E-04	2.22E-04	1.19E-01	1.20E+00	4.08E-04	1.21E+00	3.38E-04

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUB\SURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	2.20E+04	4.70E-04	6.50E-05	4.58E-01	1.19E-01	1.20E+00	8.63E+00	1.66E+03	5.21E-03
	Low TRV	1.00E+00	2.20E+04	4.70E-04	6.50E-05	4.58E-01	1.19E-01	1.20E+00	8.63E+00	1.66E+02	5.21E-02
Antimony											
	High TRV	1.00E+00	5.90E+00	4.70E-04	1.30E-02	2.46E-02	1.19E-01	1.20E+00	4.73E-03	NV	NC
	Low TRV	1.00E+00	5.90E+00	4.70E-04	1.30E-02	2.46E-02	1.19E-01	1.20E+00	4.73E-03	NV	NC
Arsenic											
	High TRV	1.00E+00	6.60E+00	4.70E-04	3.11E-01	6.56E-01	1.19E-01	1.20E+00	6.75E-02	2.21E+01	3.05E-03
	Low TRV	1.00E+00	6.60E+00	4.70E-04	3.11E-01	6.56E-01	1.19E-01	1.20E+00	6.75E-02	5.53E+00	1.22E-02
Barium											
	High TRV	1.00E+00	1.70E+02	4.70E-04	6.50E-05	3.54E-03	1.19E-01	1.20E+00	6.67E-02	6.60E+01	1.01E-03
	Low TRV	1.00E+00	1.70E+02	4.70E-04	6.50E-05	3.54E-03	1.19E-01	1.20E+00	6.67E-02	3.29E+01	2.03E-03
Beryllium											
	High TRV	1.00E+00	5.20E-01	4.70E-04	6.50E-05	1.08E-05	1.19E-01	1.20E+00	2.04E-04	NV	NC
	Low TRV	1.00E+00	5.20E-01	4.70E-04	6.50E-05	1.08E-05	1.19E-01	1.20E+00	2.04E-04	NV	NC
Cadmium											
	High TRV	1.00E+00	5.90E+00	4.70E-04	8.89E-03	1.68E-02	1.19E-01	1.20E+00	3.96E-03	1.77E+01	2.24E-04
	Low TRV	1.00E+00	5.90E+00	4.70E-04	8.89E-03	1.68E-02	1.19E-01	1.20E+00	3.96E-03	8.68E-02	4.56E-02
Chromium											
	High TRV	1.00E+00	5.10E+02	4.70E-04	6.50E-05	1.06E-02	1.19E-01	1.20E+00	2.00E-01	4.96E+00	4.03E-02
	Low TRV	1.00E+00	5.10E+02	4.70E-04	6.50E-05	1.06E-02	1.19E-01	1.20E+00	2.00E-01	9.93E-01	2.02E-01
Cobalt											
	High TRV	1.00E+00	7.20E+01	4.70E-04	6.50E-05	1.50E-03	1.19E-01	1.20E+00	2.83E-02	NV	NC
	Low TRV	1.00E+00	7.20E+01	4.70E-04	6.50E-05	1.50E-03	1.19E-01	1.20E+00	2.83E-02	NV	NC
Copper											
	High TRV	1.00E+00	5.40E+03	4.70E-04	7.55E-02	1.31E+02	1.19E-01	1.20E+00	1.50E+01	6.49E+01	2.31E-01
	Low TRV	1.00E+00	5.40E+03	4.70E-04	7.55E-02	1.31E+02	1.19E-01	1.20E+00	1.50E+01	2.61E+00	5.75E+00
Lead											
	High TRV	1.00E+00	1.20E+03	4.70E-04	3.34E-02	1.28E+01	1.19E-01	1.20E+00	1.74E+00	9.50E+00	1.83E-01
	Low TRV	1.00E+00	1.20E+03	4.70E-04	3.34E-02	1.28E+01	1.19E-01	1.20E+00	1.74E+00	2.29E-02	7.59E+01
Manganese											
	High TRV	1.00E+00	6.00E+02	4.70E-04	1.82E-02	3.49E+00	1.19E-01	1.20E+00	5.79E-01	1.12E+03	5.19E-04
	Low TRV	1.00E+00	6.00E+02	4.70E-04	1.82E-02	3.49E+00	1.19E-01	1.20E+00	5.79E-01	1.12E+02	5.19E-03
Mercury											
	High TRV	1.00E+00	1.30E+00	4.70E-04	8.63E-03	3.59E-03	1.19E-01	1.20E+00	8.62E-04	1.87E-01	4.62E-03
	Low TRV	1.00E+00	1.30E+00	4.70E-04	8.63E-03	3.59E-03	1.19E-01	1.20E+00	8.62E-04	4.05E-02	2.13E-02
Molybdenum											
	High TRV	1.00E+00	1.10E+01	4.70E-04	8.35E-01	2.94E+00	1.19E-01	1.20E+00	2.95E-01	3.38E+01	8.72E-03
	Low TRV	1.00E+00	1.10E+01	4.70E-04	8.35E-01	2.94E+00	1.19E-01	1.20E+00	2.95E-01	3.35E+00	8.80E-02
Nickel											
	High TRV	1.00E+00	1.60E+03	4.70E-04	3.40E-04	1.74E-01	1.19E-01	1.20E+00	6.42E-01	6.39E+01	1.00E-02
	Low TRV	1.00E+00	1.60E+03	4.70E-04	3.40E-04	1.74E-01	1.19E-01	1.20E+00	6.42E-01	1.58E+00	4.06E-01
Silver											
	High TRV	1.00E+00	5.00E-01	4.70E-04	2.24E-02	3.59E-03	1.19E-01	1.20E+00	5.50E-04	NV	NC
	Low TRV	1.00E+00	5.00E-01	4.70E-04	2.24E-02	3.59E-03	1.19E-01	1.20E+00	5.50E-04	NV	NC
Thallium											
	High TRV	1.00E+00	9.70E-01	4.70E-04	6.50E-05	2.02E-05	1.19E-01	1.20E+00	3.81E-04	6.08E-01	6.26E-04
	Low TRV	1.00E+00	9.70E-01	4.70E-04	6.50E-05	2.02E-05	1.19E-01	1.20E+00	3.81E-04	6.08E-02	6.26E-03

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Vanadium											
	High TRV	1.00E+00	5.10E+01	4.70E-04	6.50E-05	1.06E-03	1.19E-01	1.20E+00	2.00E-02	1.15E+02	1.75E-04
	Low TRV	1.00E+00	5.10E+01	4.70E-04	6.50E-05	1.06E-03	1.19E-01	1.20E+00	2.00E-02	1.15E+01	1.75E-03
Zinc											
	High TRV	1.00E+00	1.30E+03	4.70E-04	1.27E-01	5.29E+01	1.19E-01	1.20E+00	5.73E+00	1.80E+02	3.18E-02
	Low TRV	1.00E+00	1.30E+03	4.70E-04	1.27E-01	5.29E+01	1.19E-01	1.20E+00	5.73E+00	1.80E+01	3.18E-01
Total Aroclors											
	High TRV	1.00E+00	6.35E+00	4.70E-04	5.99E-02	1.22E-01	1.19E-01	1.20E+00	1.45E-02	1.18E+00	1.23E-02
	Low TRV	1.00E+00	6.35E+00	4.70E-04	5.99E-02	1.22E-01	1.19E-01	1.20E+00	1.45E-02	9.77E-02	1.49E-01
Total DDT											
	High TRV	1.00E+00	1.56E-01	4.70E-04	1.88E-02	9.34E-04	1.19E-01	1.20E+00	1.53E-04	1.56E+00	9.83E-05
	Low TRV	1.00E+00	1.56E-01	4.70E-04	1.89E-02	9.39E-04	1.19E-01	1.20E+00	1.54E-04	9.34E-03	1.64E-02
beta-BHC											
	High TRV	1.00E+00	5.10E-03	4.70E-04	1.97E-05	3.22E-08	1.19E-01	1.20E+00	1.99E-06	3.41E+00	5.84E-07
	Low TRV	1.00E+00	5.10E-03	4.70E-04	1.97E-05	3.22E-08	1.19E-01	1.20E+00	1.99E-06	8.54E-01	2.34E-06
delta-BHC											
	High TRV	1.00E+00	1.70E-03	4.70E-04	2.83E-05	1.54E-08	1.19E-01	1.20E+00	6.65E-07	3.41E+00	1.95E-07
	Low TRV	1.00E+00	1.70E-03	4.70E-04	2.83E-05	1.54E-08	1.19E-01	1.20E+00	6.65E-07	8.54E-01	7.79E-07
alpha-Chlordane											
	High TRV	1.00E+00	1.90E-03	4.70E-04	9.49E-02	5.77E-05	1.19E-01	1.20E+00	6.45E-06	1.92E+01	3.35E-07
	Low TRV	1.00E+00	1.90E-03	4.70E-04	9.49E-02	5.77E-05	1.19E-01	1.20E+00	6.45E-06	3.85E+00	1.67E-06
Dieldrin											
	High TRV	1.00E+00	4.50E-02	4.70E-04	9.97E-05	1.44E-06	1.19E-01	1.20E+00	1.77E-05	9.31E-01	1.90E-05
	Low TRV	1.00E+00	4.50E-02	4.70E-04	9.97E-05	1.44E-06	1.19E-01	1.20E+00	1.77E-05	9.31E-02	1.90E-04
Endosulfan sulfate											
	High TRV	1.00E+00	9.60E-03	4.70E-04	1.76E-05	5.41E-08	1.19E-01	1.20E+00	3.75E-06	1.25E+02	3.01E-08
	Low TRV	1.00E+00	9.60E-03	4.70E-04	1.76E-05	5.41E-08	1.19E-01	1.20E+00	3.75E-06	1.25E+01	3.01E-07
Endrin											
	High TRV	1.00E+00	7.60E-03	4.70E-04	8.16E-05	1.98E-07	1.19E-01	1.20E+00	2.99E-06	3.03E+01	9.86E-08
	Low TRV	1.00E+00	7.60E-03	4.70E-04	8.16E-05	1.98E-07	1.19E-01	1.20E+00	2.99E-06	3.03E-01	9.86E-06
Endrin aldehyde											
	High TRV	1.00E+00	8.80E-03	4.70E-04	1.22E-04	3.44E-07	1.19E-01	1.20E+00	3.47E-06	3.03E+01	1.15E-07
	Low TRV	1.00E+00	8.80E-03	4.70E-04	1.22E-04	3.44E-07	1.19E-01	1.20E+00	3.47E-06	3.03E-01	1.15E-05
Heptachlor											
	High TRV	1.00E+00	1.20E-03	4.70E-04	9.97E-05	3.83E-08	1.19E-01	1.20E+00	4.72E-07	1.56E+00	3.03E-07
	Low TRV	1.00E+00	1.20E-03	4.70E-04	9.97E-05	3.83E-08	1.19E-01	1.20E+00	4.72E-07	9.34E-03	5.06E-05
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	4.70E-04	7.25E-05	1.07E-06	1.19E-01	1.20E+00	1.81E-05	1.56E+00	1.16E-05
	Low TRV	1.00E+00	4.60E-02	4.70E-04	7.25E-05	1.07E-06	1.19E-01	1.20E+00	1.81E-05	9.34E-03	1.93E-03
4-Methylphenol											
	High TRV	1.00E+00	3.10E-01	4.70E-04	3.13E-06	3.10E-07	1.19E-01	1.20E+00	1.21E-04	NV	NC
	Low TRV	1.00E+00	3.10E-01	4.70E-04	3.13E-06	3.10E-07	1.19E-01	1.20E+00	1.21E-04	NV	NC
Benzoic acid											
	High TRV	1.00E+00	7.00E-01	4.70E-04	2.93E-06	6.56E-07	1.19E-01	1.20E+00	2.73E-04	NV	NC
	Low TRV	1.00E+00	7.00E-01	4.70E-04	2.93E-06	6.56E-07	1.19E-01	1.20E+00	2.73E-04	NV	NC
Benzyl alcohol											
	High TRV	1.00E+00	1.90E-01	4.70E-04	1.35E-06	8.21E-08	1.19E-01	1.20E+00	7.42E-05	NV	NC
	Low TRV	1.00E+00	1.90E-01	4.70E-04	1.35E-06	8.21E-08	1.19E-01	1.20E+00	7.42E-05	NV	NC

TABLE B-13: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Dibenzofuran											
	High TRV	1.00E+00	5.90E-02	4.70E-04	2.77E-05	5.23E-07	1.19E-01	1.20E+00	2.31E-05	NV	NC
	Low TRV	1.00E+00	5.90E-02	4.70E-04	2.77E-05	5.23E-07	1.19E-01	1.20E+00	2.31E-05	NV	NC
HMW PAHs											
	High TRV	1.00E+00	2.23E+01	4.70E-04	1.22E-04	8.72E-04	1.19E-01	1.20E+00	8.80E-03	NV	NC
	Low TRV	1.00E+00	2.23E+01	4.70E-04	1.22E-04	8.72E-04	1.19E-01	1.20E+00	8.80E-03	NV	NC
LMW PAHs											
	High TRV	1.00E+00	2.87E+00	4.70E-04	1.22E-04	1.12E-04	1.19E-01	1.20E+00	1.13E-03	NV	NC
	Low TRV	1.00E+00	2.87E+00	4.70E-04	1.22E-04	1.12E-04	1.19E-01	1.20E+00	1.13E-03	NV	NC
Pentachlorophenol											
	High TRV	1.00E+00	1.60E-01	4.70E-04	7.54E-05	3.86E-06	1.19E-01	1.20E+00	6.28E-05	NV	NC
	Low TRV	1.00E+00	1.60E-01	4.70E-04	7.54E-05	3.86E-06	1.19E-01	1.20E+00	6.28E-05	NV	NC
Phenol											
	High TRV	1.00E+00	9.00E-02	4.70E-04	1.94E-06	5.59E-08	1.19E-01	1.20E+00	3.51E-05	NV	NC
	Low TRV	1.00E+00	9.00E-02	4.70E-04	1.94E-06	5.59E-08	1.19E-01	1.20E+00	3.51E-05	NV	NC
Dibutyltin											
	High TRV	1.00E+00	1.89E-01	4.70E-04	2.00E-06	1.21E-07	1.19E-01	1.20E+00	7.38E-05	7.60E+01	9.70E-07
	Low TRV	1.00E+00	1.89E-01	4.70E-04	2.00E-06	1.21E-07	1.19E-01	1.20E+00	7.38E-05	1.21E+00	6.10E-05
Monobutyltin											
	High TRV	1.00E+00	6.76E-02	4.70E-04	1.23E-05	2.66E-07	1.19E-01	1.20E+00	2.64E-05	7.60E+01	3.47E-07
	Low TRV	1.00E+00	6.76E-02	4.70E-04	1.23E-05	2.66E-07	1.19E-01	1.20E+00	2.64E-05	1.21E+00	2.18E-05
Tributyltin											
	High TRV	1.00E+00	3.35E-01	4.70E-04	7.01E-04	7.51E-05	1.19E-01	1.20E+00	1.38E-04	7.60E+01	1.82E-06
	Low TRV	1.00E+00	3.35E-01	4.70E-04	7.01E-04	7.51E-05	1.19E-01	1.20E+00	1.38E-04	1.21E+00	1.14E-04

Notes:

BAF	Bioaccumulation factor from sediment concentrations to mouse tissue concentrations
bgs	Below ground surface
BHC	Benzene hexachloride
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
HQ	Hazard quotient
IR	Ingestion rate of mouse tissue
kg	Kilogram
kg/day	Kilogram per day
LMW	Low molecular weight
NC	Not calculated
NV	No TRV available
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
Aluminum																	
	High TRV	1.00E+00	1.90E+04	9.00E-05	4.00E-03	4.73E+01	3.60E-03	4.00E-03	2.10E+01	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.11E+02	2.00E+01	5.58E+00
	Low TRV	1.00E+00	1.90E+04	9.00E-05	4.00E-03	4.73E+01	3.60E-03	4.00E-03	2.10E+01	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.11E+02	2.00E+00	5.58E+01
Antimony																	
	High TRV	1.00E+00	2.40E+01	9.00E-05	2.88E-01	4.30E+00	3.60E-03	6.67E-01	4.43E+00	3.30E-04	9.27E-01	2.69E-04	5.70E-04	1.69E-02	1.13E+00	1.29E+00	8.73E-01
	Low TRV	1.00E+00	2.40E+01	9.00E-05	2.88E-01	4.30E+00	3.60E-03	6.67E-01	4.43E+00	3.30E-04	9.27E-01	2.69E-04	5.70E-04	1.69E-02	1.13E+00	1.29E-01	8.73E+00
Arsenic																	
	High TRV	1.00E+00	2.80E+01	9.00E-05	9.50E-02	1.66E+00	3.60E-03	2.28E-01	1.77E+00	3.30E-04	2.97E-01	8.62E-05	5.70E-04	1.69E-02	5.35E-01	5.26E+00	1.02E-01
	Low TRV	1.00E+00	2.80E+01	9.00E-05	9.50E-02	1.66E+00	3.60E-03	2.28E-01	1.77E+00	3.30E-04	2.97E-01	8.62E-05	5.70E-04	1.69E-02	5.35E-01	3.83E-01	1.40E+00
Barium																	
	High TRV	1.00E+00	6.30E+02	9.00E-05	1.50E-01	5.88E+01	3.60E-03	1.50E-01	2.62E+01	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.64E+01	2.37E+01	6.89E-01
	Low TRV	1.00E+00	6.30E+02	9.00E-05	1.50E-01	5.88E+01	3.60E-03	1.50E-01	2.62E+01	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.64E+01	6.20E+00	2.64E+00
Beryllium																	
	High TRV	1.00E+00	6.20E-01	9.00E-05	1.00E-02	3.86E-03	3.60E-03	1.00E-02	1.72E-03	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	4.15E-03	7.92E+00	5.25E-04
	Low TRV	1.00E+00	6.20E-01	9.00E-05	1.00E-02	3.86E-03	3.60E-03	1.00E-02	1.72E-03	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	4.15E-03	7.92E-01	5.25E-03
Cadmium																	
	High TRV	1.00E+00	5.00E+00	9.00E-05	7.91E-01	2.46E+00	3.60E-03	7.45E-01	1.03E+00	3.30E-04	5.01E-01	1.45E-04	5.70E-04	1.69E-02	5.70E-01	2.74E+00	2.08E-01
	Low TRV	1.00E+00	5.00E+00	9.00E-05	7.91E-01	2.46E+00	3.60E-03	7.45E-01	1.03E+00	3.30E-04	5.01E-01	1.45E-04	5.70E-04	1.69E-02	5.70E-01	6.24E-02	9.14E+00
Chromium																	
	High TRV	1.00E+00	4.50E+02	9.00E-05	8.00E-03	2.24E+00	3.60E-03	8.00E-03	9.97E-01	3.30E-04	1.00E-02	2.90E-06	5.70E-04	1.69E-02	2.89E+00	3.24E+04	8.92E-05
	Low TRV	1.00E+00	4.50E+02	9.00E-05	8.00E-03	2.24E+00	3.60E-03	8.00E-03	9.97E-01	3.30E-04	1.00E-02	2.90E-06	5.70E-04	1.69E-02	2.89E+00	3.24E+03	8.92E-04
Cobalt																	
	High TRV	1.00E+00	7.50E+01	9.00E-05	2.60E-02	1.21E+00	3.60E-03	2.60E-02	5.40E-01	3.30E-04	7.00E-02	2.03E-05	5.70E-04	1.69E-02	6.67E-01	2.32E+01	2.88E-02
	Low TRV	1.00E+00	7.50E+01	9.00E-05	2.60E-02	1.21E+00	3.60E-03	2.60E-02	5.40E-01	3.30E-04	7.00E-02	2.03E-05	5.70E-04	1.69E-02	6.67E-01	1.40E+00	4.75E-01
Copper																	
	High TRV	1.00E+00	1.95E+03	9.00E-05	1.65E-01	2.00E+02	3.60E-03	1.82E-01	9.83E+01	3.30E-04	7.96E-01	2.31E-04	5.70E-04	1.69E-02	5.49E+01	6.46E+02	8.49E-02
	Low TRV	1.00E+00	1.95E+03	9.00E-05	1.65E-01	2.00E+02	3.60E-03	1.82E-01	9.83E+01	3.30E-04	7.96E-01	2.31E-04	5.70E-04	1.69E-02	5.49E+01	2.76E+00	1.99E+01
Lead																	
	High TRV	1.00E+00	8.00E+02	9.00E-05	1.70E-02	8.47E+00	3.60E-03	3.20E-02	7.09E+00	3.30E-04	7.40E-02	2.15E-05	5.70E-04	1.69E-02	6.19E+00	2.42E+02	2.55E-02
	Low TRV	1.00E+00	8.00E+02	9.00E-05	1.70E-02	8.47E+00	3.60E-03	3.20E-02	7.09E+00	3.30E-04	7.40E-02	2.15E-05	5.70E-04	1.69E-02	6.19E+00	1.16E+00	5.33E+00
Manganese																	
	High TRV	1.00E+00	4.90E+03	9.00E-05	9.90E-02	3.02E+02	3.60E-03	1.07E-01	1.45E+02	3.30E-04	6.40E-02	1.86E-05	5.70E-04	1.69E-02	9.31E+01	1.64E+02	5.66E-01
	Low TRV	1.00E+00	4.90E+03	9.00E-05	9.90E-02	3.02E+02	3.60E-03	1.07E-01	1.45E+02	3.30E-04	6.40E-02	1.86E-05	5.70E-04	1.69E-02	9.31E+01	1.42E+01	6.57E+00
Mercury																	
	High TRV	1.00E+00	1.90E+00	9.00E-05	1.17E-01	1.38E-01	3.60E-03	1.37E-01	7.21E-02	3.30E-04	6.24E-01	1.81E-04	5.70E-04	1.69E-02	4.09E-02	4.62E+00	8.86E-03
	Low TRV	1.00E+00	1.90E+00	9.00E-05	1.17E-01	1.38E-01	3.60E-03	1.37E-01	7.21E-02	3.30E-04	6.24E-01	1.81E-04	5.70E-04	1.69E-02	4.09E-02	2.89E-01	1.42E-01
Molybdenum																	
	High TRV	1.00E+00	2.50E+00	9.00E-05	4.04E+00	6.29E+00	3.60E-03	4.26E+00	2.95E+00	3.30E-04	2.39E+00	6.93E-04	5.70E-04	1.69E-02	1.41E+00	2.69E+00	5.24E-01
	Low TRV	1.00E+00	2.50E+00	9.00E-05	4.04E+00	6.29E+00	3.60E-03	4.26E+00	2.95E+00	3.30E-04	2.39E+00	6.93E-04	5.70E-04	1.69E-02	1.41E+00	2.69E-01	5.24E+00
Nickel																	
	High TRV	1.00E+00	1.70E+03	9.00E-05	2.50E-02	2.65E+01	3.60E-03	2.60E-02	1.22E+01	3.30E-04	1.80E-02	5.23E-06	5.70E-04	1.69E-02	1.49E+01	3.71E+01	4.01E-01
	Low TRV	1.00E+00	1.70E+03	9.00E-05	2.50E-02	2.65E+01	3.60E-03	2.60E-02	1.22E+01	3.30E-04	1.80E-02	5.23E-06	5.70E-04	1.69E-02	1.49E+01	1.56E-01	9.54E+01
Selenium																	
	High TRV	1.00E+00	1.33E-01	9.00E-05	1.54E+00	1.28E-01	3.60E-03	1.50E+00	5.52E-02	3.30E-04	9.17E+00	2.66E-03	5.70E-04	1.69E-02	2.90E-02	1.24E+00	2.34E-02
	Low TRV	1.00E+00	1.33E-01	9.00E-05	1.54E+00	1.28E-01	3.60E-03	1.50E+00	5.52E-02	3.30E-04	9.17E+00	2.66E-03	5.70E-04	1.69E-02	2.90E-02	5.77E-02	5.02E-01
Silver																	
	High TRV	1.00E+00	9.20E-01	9.00E-05	2.34E+00	1.34E+00	3.60E-03	4.96E+00	1.26E+00	3.30E-04	1.89E+00	5.49E-04	5.70E-04	1.69E-02	3.15E-01	NV	NC
	Low TRV	1.00E+00	9.20E-01	9.00E-05	2.34E+00	1.34E+00	3.60E-03	4.96E+00	1.26E+00	3.30E-04	1.89E+00	5.49E-04	5.70E-04	1.69E-02	3.15E-01	NV	NC
Thallium																	
	High TRV	1.00E+00	5.80E+00	9.00E-05	4.00E-03	1.44E-02	3.60E-03	4.00E-03	6.42E-03	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	3.40E-02	1.55E+00	2.20E-02
	Low TRV	1.00E+00	5.80E+00	9.00E-05	4.00E-03	1.44E-02	3.60E-03	4.00E-03	6.42E-03	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	3.40E-02	5.20E-01	6.54E-02

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
Vanadium																	
	High TRV	1.00E+00	6.40E+01	9.00E-05	1.20E-01	4.78E+00	3.60E-03	1.20E-01	2.13E+00	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.40E+00	2.47E+00	5.65E-01
	Low TRV	1.00E+00	6.40E+01	9.00E-05	1.20E-01	4.78E+00	3.60E-03	1.20E-01	2.13E+00	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	1.40E+00	2.47E-01	5.65E+00
Zinc																	
	High TRV	1.00E+00	1.10E+03	9.00E-05	2.85E-01	1.95E+02	3.60E-03	5.48E-01	1.67E+02	3.30E-04	8.21E-01	2.38E-04	5.70E-04	1.69E-02	5.06E+01	4.73E+02	1.07E-01
	Low TRV	1.00E+00	1.10E+03	9.00E-05	2.85E-01	1.95E+02	3.60E-03	5.48E-01	1.67E+02	3.30E-04	8.21E-01	2.38E-04	5.70E-04	1.69E-02	5.06E+01	9.85E+00	5.14E+00
Total Aroclors																	
	High TRV	1.00E+00	4.70E+00	9.00E-05	2.59E+00	7.57E+00	3.60E-03	7.54E+00	9.81E+00	3.30E-04	1.62E+01	4.70E-03	5.70E-04	1.69E-02	1.83E+00	1.30E+00	1.40E+00
	Low TRV	1.00E+00	4.70E+00	9.00E-05	2.59E+00	7.57E+00	3.60E-03	7.54E+00	9.81E+00	3.30E-04	1.62E+01	4.70E-03	5.70E-04	1.69E-02	1.83E+00	3.64E-01	5.01E+00
Total DDT																	
	High TRV	1.00E+00	1.29E-01	9.00E-05	3.78E+00	3.04E-01	3.60E-03	9.96E+00	3.57E-01	3.30E-04	1.31E+01	3.80E-03	5.70E-04	1.69E-02	7.25E-02	1.91E+01	3.80E-03
	Low TRV	1.00E+00	1.29E-01	9.00E-05	3.78E+00	3.04E-01	3.60E-03	9.96E+00	3.57E-01	3.30E-04	1.31E+01	3.80E-03	5.70E-04	1.69E-02	7.25E-02	9.54E-01	7.60E-02
alpha-BHC																	
	High TRV	1.00E+00	6.40E-03	9.00E-05	5.40E-01	2.15E-03	3.60E-03	5.40E-01	9.57E-04	3.30E-04	7.14E+00	2.07E-03	5.70E-04	1.69E-02	5.80E-04	3.83E+00	1.51E-04
	Low TRV	1.00E+00	6.40E-03	9.00E-05	5.40E-01	2.15E-03	3.60E-03	5.40E-01	9.57E-04	3.30E-04	7.14E+00	2.07E-03	5.70E-04	1.69E-02	5.80E-04	5.75E-02	1.01E-02
alpha-Chlordane																	
	High TRV	1.00E+00	2.20E-03	9.00E-05	4.05E+00	5.55E-03	3.60E-03	1.01E+01	6.15E-03	3.30E-04	2.17E+01	6.30E-03	5.70E-04	1.69E-02	1.52E-03	7.90E+00	1.93E-04
	Low TRV	1.00E+00	2.20E-03	9.00E-05	4.05E+00	5.55E-03	3.60E-03	1.01E+01	6.15E-03	3.30E-04	2.17E+01	6.30E-03	5.70E-04	1.69E-02	1.52E-03	1.44E-01	1.06E-02
gamma-Chlordane																	
	High TRV	1.00E+00	2.10E-03	9.00E-05	4.05E+00	5.30E-03	3.60E-03	1.01E+01	5.87E-03	3.30E-04	2.17E+01	6.30E-03	5.70E-04	1.69E-02	1.46E-03	7.90E+00	1.85E-04
	Low TRV	1.00E+00	2.10E-03	9.00E-05	4.05E+00	5.30E-03	3.60E-03	1.01E+01	5.87E-03	3.30E-04	2.17E+01	6.30E-03	5.70E-04	1.69E-02	1.46E-03	1.44E-01	1.02E-02
Dieldrin																	
	High TRV	1.00E+00	2.65E-02	9.00E-05	2.20E-01	3.63E-03	3.60E-03	2.20E-01	1.61E-03	3.30E-04	2.65E+01	7.69E-03	5.70E-04	1.69E-02	1.20E-03	1.08E+00	1.11E-03
	Low TRV	1.00E+00	2.65E-02	9.00E-05	2.20E-01	3.63E-03	3.60E-03	2.20E-01	1.61E-03	3.30E-04	2.65E+01	7.69E-03	5.70E-04	1.69E-02	1.20E-03	1.08E-01	1.11E-02
Endosulfan II																	
	High TRV	1.00E+00	2.70E-03	9.00E-05	5.40E-01	9.08E-04	3.60E-03	5.40E-01	4.04E-04	3.30E-04	7.32E+00	2.13E-03	5.70E-04	1.69E-02	2.87E-04	7.90E+00	3.63E-05
	Low TRV	1.00E+00	2.70E-03	9.00E-05	5.40E-01	9.08E-04	3.60E-03	5.40E-01	4.04E-04	3.30E-04	7.32E+00	2.13E-03	5.70E-04	1.69E-02	2.87E-04	1.44E-01	2.00E-03
Endrin																	
	High TRV	1.00E+00	2.30E-02	9.00E-05	2.40E-01	3.44E-03	3.60E-03	2.40E-01	1.53E-03	3.30E-04	2.25E+01	6.53E-03	5.70E-04	1.69E-02	1.10E-03	7.90E+00	1.40E-04
	Low TRV	1.00E+00	2.30E-02	9.00E-05	2.40E-01	3.44E-03	3.60E-03	2.40E-01	1.53E-03	3.30E-04	2.25E+01	6.53E-03	5.70E-04	1.69E-02	1.10E-03	1.44E-01	7.68E-03
Endrin aldehyde																	
	High TRV	1.00E+00	3.10E-03	9.00E-05	1.90E-01	3.67E-04	3.60E-03	1.90E-01	1.63E-04	3.30E-04	3.12E+01	9.06E-03	5.70E-04	1.69E-02	4.03E-04	7.90E+00	5.10E-05
	Low TRV	1.00E+00	3.10E-03	9.00E-05	1.90E-01	3.67E-04	3.60E-03	1.90E-01	1.63E-04	3.30E-04	3.12E+01	9.06E-03	5.70E-04	1.69E-02	4.03E-04	1.44E-01	2.81E-03
Endrin ketone																	
	High TRV	1.00E+00	9.70E-03	9.00E-05	1.90E-01	1.15E-03	3.60E-03	1.90E-01	5.10E-04	3.30E-04	3.12E+01	9.06E-03	5.70E-04	1.69E-02	6.10E-04	7.90E+00	7.73E-05
	Low TRV	1.00E+00	9.70E-03	9.00E-05	1.90E-01	1.15E-03	3.60E-03	1.90E-01	5.10E-04	3.30E-04	3.12E+01	9.06E-03	5.70E-04	1.69E-02	6.10E-04	1.44E-01	4.25E-03
Heptachlor																	
	High TRV	1.00E+00	1.60E-03	9.00E-05	4.89E-02	4.87E-05	3.60E-03	4.89E-02	2.17E-05	3.30E-04	1.40E+00	4.06E-04	5.70E-04	1.69E-02	3.30E-05	7.90E+00	4.18E-06
	Low TRV	1.00E+00	1.60E-03	9.00E-05	4.89E-02	4.87E-05	3.60E-03	4.89E-02	2.17E-05	3.30E-04	1.40E+00	4.06E-04	5.70E-04	1.69E-02	3.30E-05	1.44E-01	2.30E-04
Heptachlor epoxide																	
	High TRV	1.00E+00	5.30E-03	9.00E-05	4.89E-02	1.61E-04	3.60E-03	4.89E-02	7.18E-05	3.30E-04	1.40E+00	4.06E-04	5.70E-04	1.69E-02	7.76E-05	7.90E+00	9.82E-06
	Low TRV	1.00E+00	5.30E-03	9.00E-05	4.89E-02	1.61E-04	3.60E-03	4.89E-02	7.18E-05	3.30E-04	1.40E+00	4.06E-04	5.70E-04	1.69E-02	7.76E-05	1.44E-01	5.40E-04
Methoxychlor																	
	High TRV	1.00E+00	1.70E-02	9.00E-05	2.60E-01	2.75E-03	3.60E-03	2.60E-01	1.22E-03	3.30E-04	2.04E+01	5.92E-03	5.70E-04	1.69E-02	8.99E-04	5.98E+01	1.50E-05
	Low TRV	1.00E+00	1.70E-02	9.00E-05	2.60E-01	2.75E-03	3.60E-03	2.60E-01	1.22E-03	3.30E-04	2.04E+01	5.92E-03	5.70E-04	1.69E-02	8.99E-04	2.99E+00	3.01E-04
4-Methylphenol																	
	High TRV	1.00E+00	1.40E-01	9.00E-05	1.60E+00	1.39E-01	3.60E-03	1.60E+00	6.20E-02	3.30E-04	1.56E+00	4.53E-04	5.70E-04	1.69E-02	3.16E-02	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-05	1.60E+00	1.39E-01	3.60E-03	1.60E+00	6.20E-02	3.30E-04	1.56E+00	4.53E-04	5.70E-04	1.69E-02	3.16E-02	NV	NC

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
4-Nitrophenol																	
	High TRV	1.00E+00	7.20E-02	9.00E-05	1.62E+00	7.26E-02	3.60E-03	1.62E+00	3.23E-02	3.30E-04	1.52E+00	4.41E-04	5.70E-04	1.69E-02	1.65E-02	NV	NC
	Low TRV	1.00E+00	7.20E-02	9.00E-05	1.62E+00	7.26E-02	3.60E-03	1.62E+00	3.23E-02	3.30E-04	1.52E+00	4.41E-04	5.70E-04	1.69E-02	1.65E-02	NV	NC
Azobenzene																	
	High TRV	1.00E+00	4.30E-02	9.00E-05	5.34E-01	1.43E-02	3.60E-03	5.34E-01	6.36E-03	3.30E-04	7.26E+00	2.11E-03	5.70E-04	1.69E-02	3.46E-03	NV	NC
	Low TRV	1.00E+00	4.30E-02	9.00E-05	5.34E-01	1.43E-02	3.60E-03	5.34E-01	6.36E-03	3.30E-04	7.26E+00	2.11E-03	5.70E-04	1.69E-02	3.46E-03	NV	NC
Benzoic acid																	
	High TRV	1.00E+00	6.90E-01	9.00E-05	1.66E+00	7.13E-01	3.60E-03	1.66E+00	3.17E-01	3.30E-04	1.47E+00	4.27E-04	5.70E-04	1.69E-02	1.61E-01	NV	NC
	Low TRV	1.00E+00	6.90E-01	9.00E-05	1.66E+00	7.13E-01	3.60E-03	1.66E+00	3.17E-01	3.30E-04	1.47E+00	4.27E-04	5.70E-04	1.69E-02	1.61E-01	NV	NC
Benzyl alcohol																	
	High TRV	1.00E+00	4.10E-02	9.00E-05	2.59E+00	6.61E-02	3.60E-03	2.59E+00	2.94E-02	3.30E-04	7.80E-01	2.26E-04	5.70E-04	1.69E-02	1.49E-02	NV	NC
	Low TRV	1.00E+00	4.10E-02	9.00E-05	2.59E+00	6.61E-02	3.60E-03	2.59E+00	2.94E-02	3.30E-04	7.80E-01	2.26E-04	5.70E-04	1.69E-02	1.49E-02	NV	NC
Dibenzofuran																	
	High TRV	1.00E+00	1.40E-01	9.00E-05	4.50E-01	3.92E-02	3.60E-03	4.50E-01	1.74E-02	3.30E-04	9.28E+00	2.69E-03	5.70E-04	1.69E-02	9.51E-03	NV	NC
	Low TRV	1.00E+00	1.40E-01	9.00E-05	4.50E-01	3.92E-02	3.60E-03	4.50E-01	1.74E-02	3.30E-04	9.28E+00	2.69E-03	5.70E-04	1.69E-02	9.51E-03	NV	NC
HMW PAHs																	
	High TRV	1.00E+00	7.66E+00	9.00E-05	3.46E-01	1.65E+00	3.60E-03	5.34E-01	1.13E+00	3.30E-04	4.41E-01	1.28E-04	5.70E-04	1.69E-02	4.14E-01	3.40E+01	1.22E-02
	Low TRV	1.00E+00	7.66E+00	9.00E-05	3.46E-01	1.65E+00	3.60E-03	5.34E-01	1.13E+00	3.30E-04	4.41E-01	1.28E-04	5.70E-04	1.69E-02	4.14E-01	1.36E+00	3.05E-01
LMW PAHs																	
	High TRV	1.00E+00	3.09E+00	9.00E-05	1.38E+00	2.65E+00	3.60E-03	2.31E+00	1.97E+00	3.30E-04	1.89E+00	5.49E-04	5.70E-04	1.69E-02	6.18E-01	1.77E+02	3.49E-03
	Low TRV	1.00E+00	3.09E+00	9.00E-05	1.38E+00	2.65E+00	3.60E-03	2.31E+00	1.97E+00	3.30E-04	1.89E+00	5.49E-04	5.70E-04	1.69E-02	6.18E-01	5.91E+01	1.05E-02
Pentachlorophenol																	
	High TRV	1.00E+00	3.70E-02	9.00E-05	4.49E-02	1.03E-03	3.60E-03	4.49E-02	4.60E-04	3.30E-04	1.03E+03	3.00E-01	5.70E-04	1.69E-02	1.05E-02	2.88E+00	3.66E-03
	Low TRV	1.00E+00	3.70E-02	9.00E-05	4.49E-02	1.03E-03	3.60E-03	4.49E-02	4.60E-04	3.30E-04	1.03E+03	3.00E-01	5.70E-04	1.69E-02	1.05E-02	2.88E-01	3.66E-02
Phenol																	
	High TRV	1.00E+00	2.90E-01	9.00E-05	2.11E+00	3.81E-01	3.60E-03	2.11E+00	1.69E-01	3.30E-04	1.05E+00	3.05E-04	5.70E-04	1.69E-02	8.59E-02	NV	NC
	Low TRV	1.00E+00	2.90E-01	9.00E-05	2.11E+00	3.81E-01	3.60E-03	2.11E+00	1.69E-01	3.30E-04	1.05E+00	3.05E-04	5.70E-04	1.69E-02	8.59E-02	NV	NC
Dibutyltin																	
	High TRV	1.00E+00	3.66E-01	9.00E-05	2.07E+00	4.71E-01	3.60E-03	2.07E+00	2.10E-01	3.30E-04	1.08E+00	3.13E-04	5.70E-04	1.69E-02	1.06E-01	1.67E+01	6.38E-03
	Low TRV	1.00E+00	3.66E-01	9.00E-05	2.07E+00	4.71E-01	3.60E-03	2.07E+00	2.10E-01	3.30E-04	1.08E+00	3.13E-04	5.70E-04	1.69E-02	1.06E-01	2.78E-01	3.83E-01
Monobutyltin																	
	High TRV	1.00E+00	1.02E-01	9.00E-05	7.22E-01	4.58E-02	3.60E-03	7.22E-01	2.04E-02	3.30E-04	4.78E+00	1.39E-03	5.70E-04	1.69E-02	1.07E-02	1.67E+01	6.45E-04
	Low TRV	1.00E+00	1.02E-01	9.00E-05	7.22E-01	4.58E-02	3.60E-03	7.22E-01	2.04E-02	3.30E-04	4.78E+00	1.39E-03	5.70E-04	1.69E-02	1.07E-02	2.78E-01	3.87E-02
Tetrabutyltin																	
	High TRV	1.00E+00	4.84E-02	9.00E-05	2.25E-02	6.78E-04	3.60E-03	2.25E-02	3.02E-04	3.30E-04	6.51E+02	1.89E-01	5.70E-04	1.69E-02	6.77E-03	1.67E+01	4.07E-04
	Low TRV	1.00E+00	4.84E-02	9.00E-05	2.25E-02	6.78E-04	3.60E-03	2.25E-02	3.02E-04	3.30E-04	6.51E+02	1.89E-01	5.70E-04	1.69E-02	6.77E-03	2.78E-01	2.44E-02
Tributyltin																	
	High TRV	1.00E+00	9.90E-01	9.00E-05	6.99E-02	4.31E-02	3.60E-03	6.99E-02	1.92E-02	3.30E-04	1.31E+02	3.80E-02	5.70E-04	1.69E-02	1.61E-02	1.67E+01	9.65E-04
	Low TRV	1.00E+00	9.90E-01	9.00E-05	6.99E-02	4.31E-02	3.60E-03	6.99E-02	1.92E-02	3.30E-04	1.31E+02	3.80E-02	5.70E-04	1.69E-02	1.61E-02	2.78E-01	5.79E-02

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
Aluminum																	
	High TRV	1.00E+00	2.20E+04	9.00E-04	4.00E-03	5.48E+01	3.60E-03	4.00E-03	2.44E+01	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	1.18E+03	2.00E+01	5.92E+01
	Low TRV	1.00E+00	2.20E+04	9.00E-04	4.00E-03	5.48E+01	3.60E-03	4.00E-03	2.44E+01	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	1.18E+03	2.00E+00	5.92E+02
Antimony																	
	High TRV	1.00E+00	5.90E+00	9.00E-04	2.88E-01	1.06E+00	3.60E-03	6.67E-01	1.09E+00	3.30E-04	9.27E-01	2.69E-03	5.70E-04	1.69E-02	5.60E-01	1.29E+00	4.33E-01
	Low TRV	1.00E+00	5.90E+00	9.00E-04	2.88E-01	1.06E+00	3.60E-03	6.67E-01	1.09E+00	3.30E-04	9.27E-01	2.69E-03	5.70E-04	1.69E-02	5.60E-01	1.29E-01	4.33E+00
Arsenic																	
	High TRV	1.00E+00	6.60E+00	9.00E-05	9.50E-02	3.90E-01	3.60E-03	2.28E-01	4.17E-01	3.30E-04	2.97E-01	8.62E-05	5.70E-04	1.69E-02	1.26E-01	5.26E+00	2.40E-02
	Low TRV	1.00E+00	6.60E+00	9.00E-05	9.50E-02	3.90E-01	3.60E-03	2.28E-01	4.17E-01	3.30E-04	2.97E-01	8.62E-05	5.70E-04	1.69E-02	1.26E-01	3.83E-01	3.30E-01
Barium																	
	High TRV	1.00E+00	1.70E+02	9.00E-04	1.50E-01	1.59E+01	3.60E-03	1.50E-01	7.06E+00	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	1.26E+01	2.37E+01	5.29E-01
	Low TRV	1.00E+00	1.70E+02	9.00E-04	1.50E-01	1.59E+01	3.60E-03	1.50E-01	7.06E+00	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	1.26E+01	6.20E+00	2.03E+00
Beryllium																	
	High TRV	1.00E+00	5.20E-01	9.00E-04	1.00E-02	3.24E-03	3.60E-03	1.00E-02	1.44E-03	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	2.84E-02	7.92E+00	3.59E-03
	Low TRV	1.00E+00	5.20E-01	9.00E-04	1.00E-02	3.24E-03	3.60E-03	1.00E-02	1.44E-03	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	2.84E-02	7.92E-01	3.59E-02
Cadmium																	
	High TRV	1.00E+00	5.90E+00	9.00E-04	7.91E-01	2.91E+00	3.60E-03	7.45E-01	1.22E+00	3.30E-04	5.01E-01	1.45E-03	5.70E-04	1.69E-02	9.55E-01	2.74E+00	3.49E-01
	Low TRV	1.00E+00	5.90E+00	9.00E-04	7.91E-01	2.91E+00	3.60E-03	7.45E-01	1.22E+00	3.30E-04	5.01E-01	1.45E-03	5.70E-04	1.69E-02	9.55E-01	6.24E-02	1.53E+01
Chromium																	
	High TRV	1.00E+00	5.10E+02	9.00E-04	8.00E-03	2.54E+00	3.60E-03	8.00E-03	1.13E+00	3.30E-04	1.00E-02	2.90E-05	5.70E-04	1.69E-02	2.77E+01	3.24E+04	8.55E-04
	Low TRV	1.00E+00	5.10E+02	9.00E-04	8.00E-03	2.54E+00	3.60E-03	8.00E-03	1.13E+00	3.30E-04	1.00E-02	2.90E-05	5.70E-04	1.69E-02	2.77E+01	3.24E+03	8.55E-03
Cobalt																	
	High TRV	1.00E+00	7.20E+01	9.00E-04	2.60E-02	1.17E+00	3.60E-03	2.60E-02	5.19E-01	3.30E-04	7.00E-02	2.03E-04	5.70E-04	1.69E-02	4.09E+00	2.32E+01	1.76E-01
	Low TRV	1.00E+00	7.20E+01	9.00E-04	2.60E-02	1.17E+00	3.60E-03	2.60E-02	5.19E-01	3.30E-04	7.00E-02	2.03E-04	5.70E-04	1.69E-02	4.09E+00	1.40E+00	2.91E+00
Copper																	
	High TRV	1.00E+00	5.40E+03	9.00E-04	1.65E-01	5.55E+02	3.60E-03	1.82E-01	2.72E+02	3.30E-04	7.96E-01	2.31E-03	5.70E-04	1.69E-02	4.10E+02	6.46E+02	6.35E-01
	Low TRV	1.00E+00	5.40E+03	9.00E-04	1.65E-01	5.55E+02	3.60E-03	1.82E-01	2.72E+02	3.30E-04	7.96E-01	2.31E-03	5.70E-04	1.69E-02	4.10E+02	2.76E+00	1.48E+02
Lead																	
	High TRV	1.00E+00	1.20E+03	9.00E-04	1.70E-02	1.27E+01	3.60E-03	3.20E-02	1.06E+01	3.30E-04	7.40E-02	2.15E-04	5.70E-04	1.69E-02	6.67E+01	2.42E+02	2.75E-01
	Low TRV	1.00E+00	1.20E+03	9.00E-04	1.70E-02	1.27E+01	3.60E-03	3.20E-02	1.06E+01	3.30E-04	7.40E-02	2.15E-04	5.70E-04	1.69E-02	6.67E+01	1.16E+00	5.74E+01
Manganese																	
	High TRV	1.00E+00	6.00E+02	9.00E-04	9.90E-02	3.70E+01	3.60E-03	1.07E-01	1.78E+01	3.30E-04	6.40E-02	1.86E-04	5.70E-04	1.69E-02	4.01E+01	1.64E+02	2.44E-01
	Low TRV	1.00E+00	6.00E+02	9.00E-04	9.90E-02	3.70E+01	3.60E-03	1.07E-01	1.78E+01	3.30E-04	6.40E-02	1.86E-04	5.70E-04	1.69E-02	4.01E+01	1.42E+01	2.83E+00
Mercury																	
	High TRV	1.00E+00	1.30E+00	9.00E-04	1.17E-01	9.47E-02	3.60E-03	1.37E-01	4.93E-02	3.30E-04	6.24E-01	1.81E-03	5.70E-04	1.69E-02	9.03E-02	4.62E+00	1.95E-02
	Low TRV	1.00E+00	1.30E+00	9.00E-04	1.17E-01	9.47E-02	3.60E-03	1.37E-01	4.93E-02	3.30E-04	6.24E-01	1.81E-03	5.70E-04	1.69E-02	9.03E-02	2.89E-01	3.13E-01
Molybdenum																	
	High TRV	1.00E+00	1.10E+01	9.00E-04	4.04E+00	2.77E+01	3.60E-03	4.26E+00	1.30E+01	3.30E-04	2.39E+00	6.93E-03	5.70E-04	1.69E-02	6.73E+00	2.69E+00	2.50E+00
	Low TRV	1.00E+00	1.10E+01	9.00E-04	4.04E+00	2.77E+01	3.60E-03	4.26E+00	1.30E+01	3.30E-04	2.39E+00	6.93E-03	5.70E-04	1.69E-02	6.73E+00	2.69E-01	2.50E+01
Nickel																	
	High TRV	1.00E+00	1.60E+03	9.00E-04	2.50E-02	2.49E+01	3.60E-03	2.60E-02	1.15E+01	3.30E-04	1.80E-02	5.23E-05	5.70E-04	1.69E-02	9.06E+01	3.71E+01	2.44E+00
	Low TRV	1.00E+00	1.60E+03	9.00E-04	2.50E-02	2.49E+01	3.60E-03	2.60E-02	1.15E+01	3.30E-04	1.80E-02	5.23E-05	5.70E-04	1.69E-02	9.06E+01	1.56E-01	5.80E+02
Silver																	
	High TRV	1.00E+00	5.00E-01	9.00E-04	2.34E+00	7.28E-01	3.60E-03	4.96E+00	6.87E-01	3.30E-04	1.89E+00	5.49E-03	5.70E-04	1.69E-02	1.95E-01	NV	NC
	Low TRV	1.00E+00	5.00E-01	9.00E-04	2.34E+00	7.28E-01	3.60E-03	4.96E+00	6.87E-01	3.30E-04	1.89E+00	5.49E-03	5.70E-04	1.69E-02	1.95E-01	NV	NC
Thallium																	
	High TRV	1.00E+00	9.70E-01	9.00E-04	4.00E-03	2.42E-03	3.60E-03	4.00E-03	1.07E-03	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	5.21E-02	1.55E+00	3.36E-02
	Low TRV	1.00E+00	9.70E-01	9.00E-04	4.00E-03	2.42E-03	3.60E-03	4.00E-03	1.07E-03	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	5.21E-02	5.20E-01	1.00E-01
Vanadium																	
	High TRV	1.00E+00	5.10E+01	9.00E-04	1.20E-01	3.81E+00	3.60E-03	1.20E-01	1.70E+00	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	3.55E+00	2.47E+00	1.44E+00
	Low TRV	1.00E+00	5.10E+01	9.00E-04	1.20E-01	3.81E+00	3.60E-03	1.20E-01	1.70E+00	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	3.55E+00	2.47E-01	1.44E+01

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
Zinc																	
	High TRV	1.00E+00	1.30E+03	9.00E-04	2.85E-01	2.31E+02	3.60E-03	5.48E-01	1.97E+02	3.30E-04	8.21E-01	2.38E-03	5.70E-04	1.69E-02	1.22E+02	4.73E+02	2.58E-01
	Low TRV	1.00E+00	1.30E+03	9.00E-04	2.85E-01	2.31E+02	3.60E-03	5.48E-01	1.97E+02	3.30E-04	8.21E-01	2.38E-03	5.70E-04	1.69E-02	1.22E+02	9.85E+00	1.24E+01
Total Aroclors																	
	High TRV	1.00E+00	6.35E+00	9.00E-04	2.59E+00	1.02E+01	3.60E-03	7.54E+00	1.33E+01	3.30E-04	1.62E+01	4.70E-02	5.70E-04	1.69E-02	2.77E+00	1.30E+00	2.13E+00
	Low TRV	1.00E+00	6.35E+00	9.00E-04	2.59E+00	1.02E+01	3.60E-03	7.54E+00	1.33E+01	3.30E-04	1.62E+01	4.70E-02	5.70E-04	1.69E-02	2.77E+00	3.64E-01	7.61E+00
Total DDT																	
	High TRV	1.00E+00	1.56E-01	9.00E-04	3.78E+00	3.66E-01	3.60E-03	9.96E+00	4.29E-01	3.30E-04	1.31E+01	3.80E-02	5.70E-04	1.69E-02	9.57E-02	1.91E+01	5.02E-03
	Low TRV	1.00E+00	1.56E-01	9.00E-04	3.78E+00	3.66E-01	3.60E-03	9.96E+00	4.29E-01	3.30E-04	1.31E+01	3.80E-02	5.70E-04	1.69E-02	9.57E-02	9.54E-01	1.00E-01
beta-BHC																	
	High TRV	1.00E+00	5.10E-03	9.00E-04	5.50E-01	1.75E-03	3.60E-03	5.50E-01	7.77E-04	3.30E-04	7.03E+00	2.04E-02	5.70E-04	1.69E-02	1.34E-03	3.83E+00	3.51E-04
	Low TRV	1.00E+00	5.10E-03	9.00E-04	5.50E-01	1.75E-03	3.60E-03	5.50E-01	7.77E-04	3.30E-04	7.03E+00	2.04E-02	5.70E-04	1.69E-02	1.34E-03	5.75E-02	2.34E-02
delta-BHC																	
	High TRV	1.00E+00	1.70E-03	9.00E-04	4.50E-01	4.76E-04	3.60E-03	4.50E-01	2.12E-04	3.30E-04	9.44E+00	2.74E-02	5.70E-04	1.69E-02	1.12E-03	3.83E+00	2.92E-04
	Low TRV	1.00E+00	1.70E-03	9.00E-04	4.50E-01	4.76E-04	3.60E-03	4.50E-01	2.12E-04	3.30E-04	9.44E+00	2.74E-02	5.70E-04	1.69E-02	1.12E-03	5.75E-02	1.94E-02
alpha-Chlordane																	
	High TRV	1.00E+00	1.90E-03	9.00E-04	4.05E+00	4.79E-03	3.60E-03	1.01E+01	5.32E-03	3.30E-04	2.17E+01	6.30E-02	5.70E-04	1.69E-02	3.35E-03	7.90E+00	4.24E-04
	Low TRV	1.00E+00	1.90E-03	9.00E-04	4.05E+00	4.79E-03	3.60E-03	1.01E+01	5.32E-03	3.30E-04	2.17E+01	6.30E-02	5.70E-04	1.69E-02	3.35E-03	1.44E-01	2.33E-02
Dieldrin																	
	High TRV	1.00E+00	4.50E-02	9.00E-04	2.20E-01	6.16E-03	3.60E-03	2.20E-01	2.74E-03	3.30E-04	2.65E+01	7.69E-02	5.70E-04	1.69E-02	6.35E-03	1.08E+00	5.85E-03
	Low TRV	1.00E+00	4.50E-02	9.00E-04	2.20E-01	6.16E-03	3.60E-03	2.20E-01	2.74E-03	3.30E-04	2.65E+01	7.69E-02	5.70E-04	1.69E-02	6.35E-03	1.08E-01	5.85E-02
Endosulfan sulfate																	
	High TRV	1.00E+00	9.60E-03	9.00E-04	6.10E-01	3.65E-03	3.60E-03	6.10E-01	1.62E-03	3.30E-04	6.37E+00	1.85E-02	5.70E-04	1.69E-02	1.94E-03	7.90E+00	2.46E-04
	Low TRV	1.00E+00	9.60E-03	9.00E-04	6.10E-01	3.65E-03	3.60E-03	6.10E-01	1.62E-03	3.30E-04	6.37E+00	1.85E-02	5.70E-04	1.69E-02	1.94E-03	1.44E-01	1.35E-02
Endrin																	
	High TRV	1.00E+00	7.60E-03	9.00E-04	2.40E-01	1.14E-03	3.60E-03	2.40E-01	5.05E-04	3.30E-04	2.25E+01	6.53E-02	5.70E-04	1.69E-02	2.85E-03	7.90E+00	3.62E-04
	Low TRV	1.00E+00	7.60E-03	9.00E-04	2.40E-01	1.14E-03	3.60E-03	2.40E-01	5.05E-04	3.30E-04	2.25E+01	6.53E-02	5.70E-04	1.69E-02	2.85E-03	1.44E-01	1.99E-02
Endrin aldehyde																	
	High TRV	1.00E+00	8.80E-03	9.00E-04	1.90E-01	1.04E-03	3.60E-03	1.90E-01	4.63E-04	3.30E-04	3.12E+01	9.06E-02	5.70E-04	1.69E-02	3.75E-03	7.90E+00	4.75E-04
	Low TRV	1.00E+00	8.80E-03	9.00E-04	1.90E-01	1.04E-03	3.60E-03	1.90E-01	4.63E-04	3.30E-04	3.12E+01	9.06E-02	5.70E-04	1.69E-02	3.75E-03	1.44E-01	2.61E-02
Heptachlor																	
	High TRV	1.00E+00	1.20E-03	9.00E-04	4.89E-02	3.65E-05	3.60E-03	4.89E-02	1.63E-05	3.30E-04	1.40E+00	4.06E-03	5.70E-04	1.69E-02	2.09E-04	7.90E+00	2.64E-05
	Low TRV	1.00E+00	1.20E-03	9.00E-04	4.89E-02	3.65E-05	3.60E-03	4.89E-02	1.63E-05	3.30E-04	1.40E+00	4.06E-03	5.70E-04	1.69E-02	2.09E-04	1.44E-01	1.45E-03
Methoxychlor																	
	High TRV	1.00E+00	4.60E-02	9.00E-04	2.60E-01	7.45E-03	3.60E-03	2.60E-01	3.31E-03	3.30E-04	2.04E+01	5.92E-02	5.70E-04	1.69E-02	6.09E-03	5.98E+01	1.02E-04
	Low TRV	1.00E+00	4.60E-02	9.00E-04	2.60E-01	7.45E-03	3.60E-03	2.60E-01	3.31E-03	3.30E-04	2.04E+01	5.92E-02	5.70E-04	1.69E-02	6.09E-03	2.99E+00	2.04E-03
4-Methylphenol																	
	High TRV	1.00E+00	3.10E-01	9.00E-04	1.60E+00	3.09E-01	3.60E-03	1.60E+00	1.37E-01	3.30E-04	1.56E+00	4.53E-03	5.70E-04	1.69E-02	8.50E-02	NV	NC
	Low TRV	1.00E+00	3.10E-01	9.00E-04	1.60E+00	3.09E-01	3.60E-03	1.60E+00	1.37E-01	3.30E-04	1.56E+00	4.53E-03	5.70E-04	1.69E-02	8.50E-02	NV	NC
Benzoic acid																	
	High TRV	1.00E+00	7.00E-01	9.00E-04	1.66E+00	7.23E-01	3.60E-03	1.66E+00	3.22E-01	3.30E-04	1.47E+00	4.27E-03	5.70E-04	1.69E-02	1.97E-01	NV	NC
	Low TRV	1.00E+00	7.00E-01	9.00E-04	1.66E+00	7.23E-01	3.60E-03	1.66E+00	3.22E-01	3.30E-04	1.47E+00	4.27E-03	5.70E-04	1.69E-02	1.97E-01	NV	NC
Benzyl alcohol																	
	High TRV	1.00E+00	1.90E-01	9.00E-04	2.59E+00	3.06E-01	3.60E-03	2.59E+00	1.36E-01	3.30E-04	7.80E-01	2.26E-03	5.70E-04	1.69E-02	7.80E-02	NV	NC
	Low TRV	1.00E+00	1.90E-01	9.00E-04	2.59E+00	3.06E-01	3.60E-03	2.59E+00	1.36E-01	3.30E-04	7.80E-01	2.26E-03	5.70E-04	1.69E-02	7.80E-02	NV	NC
Dibenzofuran																	
	High TRV	1.00E+00	5.90E-02	9.00E-04	4.50E-01	1.65E-02	3.60E-03	4.50E-01	7.35E-03	3.30E-04	9.28E+00	2.69E-02	5.70E-04	1.69E-02	7.70E-03	NV	NC
	Low TRV	1.00E+00	5.90E-02	9.00E-04	4.50E-01	1.65E-02	3.60E-03	4.50E-01	7.35E-03	3.30E-04	9.28E+00	2.69E-02	5.70E-04	1.69E-02	7.70E-03	NV	NC

TABLE B-14: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE MAXIMUM CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	Maximum Sediment Concentration (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	House Mouse Dose (mg/kg/day)	Allometrically Converted High TRV (mg/kg/day)	Hazard Quotient
HMW PAHs																	
	High TRV	1.00E+00	2.23E+01	9.00E-04	3.46E-01	4.81E+00	3.60E-03	5.34E-01	3.30E+00	3.30E-04	4.41E-01	1.28E-03	5.70E-04	1.69E-02	2.27E+00	3.40E+01	6.69E-02
	Low TRV	1.00E+00	2.23E+01	9.00E-04	3.46E-01	4.81E+00	3.60E-03	5.34E-01	3.30E+00	3.30E-04	4.41E-01	1.28E-03	5.70E-04	1.69E-02	2.27E+00	1.36E+00	1.68E+00
LMW PAHs																	
	High TRV	1.00E+00	2.87E+00	9.00E-04	1.38E+00	2.47E+00	3.60E-03	2.31E+00	1.83E+00	3.30E-04	1.89E+00	5.49E-03	5.70E-04	1.69E-02	7.13E-01	1.77E+02	4.03E-03
	Low TRV	1.00E+00	2.87E+00	9.00E-04	1.38E+00	2.47E+00	3.60E-03	2.31E+00	1.83E+00	3.30E-04	1.89E+00	5.49E-03	5.70E-04	1.69E-02	7.13E-01	5.91E+01	1.21E-02
Pentachlorophenol																	
	High TRV	1.00E+00	1.60E-01	9.00E-04	4.49E-02	4.47E-03	3.60E-03	4.49E-02	1.99E-03	3.30E-04	1.03E+03	3.00E+00	5.70E-04	1.69E-02	1.11E-01	2.88E+00	3.84E-02
	Low TRV	1.00E+00	1.60E-01	9.00E-04	4.49E-02	4.47E-03	3.60E-03	4.49E-02	1.99E-03	3.30E-04	1.03E+03	3.00E+00	5.70E-04	1.69E-02	1.11E-01	2.88E-01	3.84E-01
Phenol																	
	High TRV	1.00E+00	9.00E-02	9.00E-04	2.11E+00	1.18E-01	3.60E-03	2.11E+00	5.26E-02	3.30E-04	1.05E+00	3.05E-03	5.70E-04	1.69E-02	3.10E-02	NV	NC
	Low TRV	1.00E+00	9.00E-02	9.00E-04	2.11E+00	1.18E-01	3.60E-03	2.11E+00	5.26E-02	3.30E-04	1.05E+00	3.05E-03	5.70E-04	1.69E-02	3.10E-02	NV	NC
Dibutyltin																	
	High TRV	1.00E+00	1.89E-01	9.00E-04	2.07E+00	2.43E-01	3.60E-03	2.07E+00	1.08E-01	3.30E-04	1.08E+00	3.13E-03	5.70E-04	1.69E-02	6.40E-02	1.67E+01	3.84E-03
	Low TRV	1.00E+00	1.89E-01	9.00E-04	2.07E+00	2.43E-01	3.60E-03	2.07E+00	1.08E-01	3.30E-04	1.08E+00	3.13E-03	5.70E-04	1.69E-02	6.40E-02	2.78E-01	2.31E-01
Monobutyltin																	
	High TRV	1.00E+00	6.76E-02	9.00E-04	7.22E-01	3.04E-02	3.60E-03	7.22E-01	1.35E-02	3.30E-04	4.78E+00	1.39E-02	5.70E-04	1.69E-02	1.08E-02	1.67E+01	6.48E-04
	Low TRV	1.00E+00	6.76E-02	9.00E-04	7.22E-01	3.04E-02	3.60E-03	7.22E-01	1.35E-02	3.30E-04	4.78E+00	1.39E-02	5.70E-04	1.69E-02	1.08E-02	2.78E-01	3.89E-02
Tributyltin																	
	High TRV	1.00E+00	3.35E-01	9.00E-04	6.99E-02	1.46E-02	3.60E-03	6.99E-02	6.49E-03	3.30E-04	1.31E+02	3.80E-01	5.70E-04	1.69E-02	3.38E-02	1.67E+01	2.03E-03
	Low TRV	1.00E+00	3.35E-01	9.00E-04	6.99E-02	1.46E-02	3.60E-03	6.99E-02	6.49E-03	3.30E-04	1.31E+02	3.80E-01	5.70E-04	1.69E-02	3.38E-02	2.78E-01	1.22E-01

Notes:

BAF	Bioaccumulation factor
bgs	Below ground surface
BHC	Benzene hexachloride
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
HQ	Hazard quotient
IR	Ingestion rate
kg	Kilogram
kg/day	Kilogram per day
LMW	Low molecular weight
NC	Not calculated
NV	No TRV available
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-15: SHORELINE SEDIMENTS (0 TO 2 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE MAXIMUM CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet - *Macoma* Tissue		Willet - Soft-bodied Invertebrate Tissue		Surf Scoter		Red-tailed Hawk		House Mouse	
	HAZARD QUOTIENT									
Chemical	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV
Aluminum	1.13E-01	**1.13E+00**	8.15E-01	**8.15E+00**	4.58E-02	4.58E-01	4.48E-03	4.48E-02	**5.58E+00**	**5.58E+01**
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	8.73E-01	**8.73E+00**
Arsenic	4.88E-01	**1.95E+00**	3.90E-01	**1.56E+00**	1.97E-01	7.88E-01	1.29E-02	5.18E-02	1.02E-01	**1.40E+00**
Barium	1.13E-01	2.26E-01	5.84E-01	**1.17E+00**	4.57E-02	9.16E-02	3.74E-03	7.51E-03	**6.89E-01**	**2.64E+00**
Beryllium	NC	NC	NC	NC	NC	NC	NC	NC	5.25E-04	5.25E-03
Cadmium	6.19E-02	**1.26E+01**	2.17E-01	**4.43E+01**	2.50E-02	**5.10E+00**	1.90E-04	3.87E-02	2.08E-01	**9.14E+00**
Chromium	**1.61E+00**	**8.05E+00**	**4.48E+00**	**2.24E+01**	6.51E-01	**3.26E+00**	3.56E-02	1.78E-01	8.92E-05	8.92E-04
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	2.88E-02	4.75E-01
Copper	**1.48E+00**	**3.69E+01**	**4.15E+00**	**1.03E+02**	5.99E-01	**1.49E+01**	8.35E-02	**2.08E+00**	8.49E-02	**1.99E+01**
Lead	**1.83E+00**	**7.59E+02**	**6.99E+00**	**2.90E+03**	7.40E-01	**3.07E+02**	1.22E-01	**5.06E+01**	2.55E-02	**5.33E+00**
Manganese	8.67E-02	8.67E-01	3.82E-01	**3.82E+00**	3.51E-02	3.51E-01	4.24E-03	4.24E-02	5.66E-01	**6.57E+00**
Mercury	6.43E-01	**2.97E+00**	**1.29E+00**	**5.94E+00**	2.60E-01	**1.20E+00**	6.75E-03	3.11E-02	8.86E-03	1.42E-01
Molybdenum	4.23E-02	4.26E-01	2.60E-02	2.62E-01	1.71E-02	1.72E-01	1.98E-03	2.00E-02	5.24E-01	**5.24E+00**
Nickel	5.78E-01	**2.34E+01**	**1.68E+00**	**6.80E+01**	2.34E-01	**9.45E+00**	1.07E-02	4.32E-01	4.01E-01	**9.54E+01**
Selenium	3.90E-01	**1.58E+00**	5.57E-01	**2.25E+00**	1.57E-01	6.36E-01	4.79E-03	1.94E-02	2.34E-02	5.02E-01
Silver	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Thallium	**1.75E+00**	**1.75E+01**	**1.75E+00**	**1.75E+01**	7.08E-01	**7.08E+00**	3.75E-03	3.75E-02	2.20E-02	6.54E-02
Vanadium	9.92E-03	9.92E-02	3.53E-02	3.53E-01	4.01E-03	4.01E-02	2.19E-04	2.19E-03	5.65E-01	**5.65E+00**
Zinc	9.17E-01	**9.17E+00**	**1.05E+00**	**1.05E+01**	3.70E-01	**3.70E+00**	2.69E-02	2.69E-01	1.07E-01	**5.14E+00**
Total Aroclors	**1.41E+00**	**1.71E+01**	**4.85E+00**	**5.88E+01**	5.70E-01	**6.91E+00**	9.08E-03	1.10E-01	**1.40E+00**	**5.01E+00**
Total DDT	5.78E-02	**9.63E+00**	2.35E-01	**3.91E+01**	2.33E-02	**3.89E+00**	8.17E-05	1.36E-02	3.80E-03	7.60E-02
alpha-BHC	2.66E-03	1.06E-02	2.66E-03	1.06E-02	1.07E-03	4.29E-03	7.33E-07	2.93E-06	1.51E-04	1.01E-02
alpha-Chlordane	8.25E-05	4.12E-04	1.32E-04	6.61E-04	3.33E-05	1.66E-04	3.88E-07	1.94E-06	1.93E-04	1.06E-02
gamma-Chlordane	6.88E-05	3.44E-04	9.03E-05	4.52E-04	2.78E-05	1.39E-04	3.70E-07	1.85E-06	1.85E-04	1.02E-02
Dieldrin	2.81E-02	2.81E-01	1.22E-01	**1.22E+00**	1.14E-02	1.14E-01	1.12E-05	1.12E-04	1.11E-03	1.11E-02
Endosulfan II	3.15E-05	3.15E-04	3.15E-05	3.15E-04	1.27E-05	1.27E-04	8.47E-09	8.47E-08	3.63E-05	2.00E-03
Endrin	4.28E-03	4.28E-01	4.28E-03	4.28E-01	1.73E-03	1.73E-01	2.99E-07	2.99E-05	1.40E-04	7.68E-03
Endrin aldehyde	6.32E-04	6.32E-02	6.32E-04	6.32E-02	2.55E-04	2.55E-02	4.04E-08	4.04E-06	5.10E-05	2.81E-03
Endrin ketone	1.98E-03	1.98E-01	1.98E-03	1.98E-01	7.98E-04	7.98E-02	1.26E-07	1.26E-05	7.73E-05	4.25E-03
Heptachlor	5.39E-03	8.98E-01	5.39E-03	8.98E-01	2.17E-03	3.62E-01	4.04E-07	6.74E-05	4.18E-06	2.30E-04
Heptachlor epoxide	1.78E-02	**2.97E+00**	1.78E-02	**2.97E+00**	7.20E-03	**1.20E+00**	1.34E-06	2.23E-04	9.82E-06	5.40E-04
Methoxychlor	4.40E-02	**7.34E+00**	4.40E-02	**7.34E+00**	1.78E-02	**2.96E+00**	4.29E-06	7.15E-04	1.50E-05	3.01E-04
4-Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

TABLE B-15: SHORELINE SEDIMENTS (0 TO 2 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE MAXIMUM CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet - *Macoma* Tissue		Willet - Soft-bodied Invertebrate Tissue		Surf Scoter		Red-tailed Hawk		House Mouse	
	HAZARD QUOTIENT									
Chemical	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV
4-Nitrophenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzoic Acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl Acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibenzofuran	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
HMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	1.22E-02	3.05E-01
LMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	3.49E-03	1.05E-02
Pentachlorophenol	NC	NC	NC	NC	NC	NC	NC	NC	3.66E-03	3.66E-02
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibutyltin	1.84E-03	1.16E-01	1.34E-02	8.44E-01	7.45E-04	4.68E-02	1.88E-06	1.18E-04	6.38E-03	3.83E-01
Monobutyltin	1.27E-03	8.02E-02	1.27E-03	8.02E-02	5.15E-04	3.24E-02	5.24E-07	3.30E-05	6.45E-04	3.87E-02
Tetrabutyltin	8.19E-02	**5.15E+00**	8.19E-02	**5.15E+00**	3.31E-02	**2.08E+00**	3.49E-07	2.19E-05	4.07E-04	2.44E-02
Tributyltin	1.27E-02	8.01E-01	2.61E-02	**1.64E+00**	5.14E-03	3.23E-01	5.37E-06	3.38E-04	9.65E-04	5.79E-02

Notes:

Bold	Hazard quotient exceeded 1.0
a	Reproductive or physiological impacts to the representative receptors listed in the table.
BHC	Benzene hexachloride
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
LMW	Low molecular weight
NC	TRV not available, hazard quotient not calculated
PAH	Polynuclear aromatic hydrocarbon
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-16: SHORELINE SEDIMENTS (2.5 TO 4 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE MAXIMUM CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet - *Macoma* Tissue		Willet - Soft-bodied Invertebrate Tissue		Surf Scoter		Red-tailed Hawk		House Mouse	
	HAZARD QUOTIENT									
Chemical	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV
Aluminum	1.31E-01	**1.31E+00**	9.44E-01	**9.44E+00**	5.30E-02	5.30E-01	5.21E-03	5.21E-02	**5.92E+01**	**5.92E+02**
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	4.33E-01	**4.33E+00**
Arsenic	1.15E-01	4.60E-01	9.20E-02	3.68E-01	4.64E-02	1.86E-01	3.05E-03	1.22E-02	2.40E-02	3.30E-01
Barium	3.05E-02	6.11E-02	1.58E-01	3.16E-01	1.23E-02	2.47E-02	1.01E-03	2.03E-03	5.29E-01	**2.03E+00**
Beryllium	NC	NC	NC	NC	NC	NC	NC	NC	3.59E-03	3.59E-02
Cadmium	7.30E-02	**1.49E+01**	2.56E-01	**5.22E+01**	2.95E-02	**6.02E+00**	2.24E-04	4.56E-02	3.49E-01	**1.53E+01**
Chromium	**1.83E+00**	**9.13E+00**	**5.07E+00**	**2.54E+01**	7.38E-01	**3.69E+00**	4.03E-02	2.02E-01	8.55E-04	8.55E-03
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	1.76E-01	**2.91E+00**
Copper	**4.11E+00**	**1.02E+02**	**1.15E+01**	**2.86E+02**	**1.66E+00**	**4.13E+01**	2.31E-01	**5.75E+00**	6.35E-01	**1.48E+02**
Lead	**2.74E+00**	**1.14E+03**	**1.05E+01**	**4.35E+03**	**1.11E+00**	**4.60E+02**	1.83E-01	**7.59E+01**	2.75E-01	**5.74E+01**
Manganese	1.06E-02	1.06E-01	4.68E-02	4.68E-01	4.29E-03	4.29E-02	5.19E-04	5.19E-03	2.44E-01	**2.83E+00**
Mercury	4.40E-01	**2.03E+00**	8.80E-01	**4.06E+00**	1.78E-01	8.20E-01	4.62E-03	2.13E-02	1.95E-02	3.13E-01
Molybdenum	1.86E-01	**1.88E+00**	1.15E-01	**1.15E+00**	7.51E-02	7.57E-01	8.72E-03	8.80E-02	**2.50E+00**	**2.50E+01**
Nickel	5.44E-01	**2.20E+01**	**1.58E+00**	**6.40E+01**	2.20E-01	**8.89E+00**	1.00E-02	4.06E-01	**2.44E+00**	**5.80E+02**
Silver	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Thallium	2.93E-01	**2.93E+00**	2.93E-01	**2.93E+00**	1.18E-01	**1.18E+00**	6.26E-04	6.26E-03	3.36E-02	1.00E-01
Vanadium	7.90E-03	7.90E-02	2.81E-02	2.81E-01	3.19E-03	3.19E-02	1.75E-04	1.75E-03	**1.44E+00**	**1.44E+01**
Zinc	**1.08E+00**	**1.08E+01**	**1.24E+00**	**1.24E+01**	4.37E-01	**4.37E+00**	3.18E-02	3.18E-01	2.58E-01	**1.24E+01**
Total Aroclors	**1.91E+00**	**2.31E+01**	**6.55E+00**	**7.94E+01**	7.71E-01	**9.34E+00**	1.23E-02	1.49E-01	**2.13E+00**	**7.61E+00**
Total DDT	6.95E-02	**1.16E+01**	2.82E-01	**4.71E+01**	2.80E-02	**4.67E+00**	9.83E-05	1.64E-02	5.02E-03	1.00E-01
beta-BHC	2.08E-03	8.33E-03	2.08E-03	8.33E-03	8.41E-04	3.36E-03	5.84E-07	2.34E-06	3.51E-04	2.34E-02
delta-BHC	9.32E-04	3.72E-03	9.32E-04	3.72E-03	3.76E-04	1.50E-03	1.95E-07	7.79E-07	2.92E-04	1.94E-02
alpha Chlordane	7.12E-05	3.56E-04	1.14E-04	5.71E-04	2.87E-05	1.44E-04	3.35E-07	1.67E-06	4.24E-04	2.33E-02
Dieldrin	4.78E-02	4.78E-01	2.08E-01	**2.08E+00**	1.93E-02	1.93E-01	1.90E-05	1.90E-04	5.85E-03	5.85E-02
Endosulfan sulfate	9.74E-05	9.74E-04	9.74E-05	9.74E-04	3.93E-05	3.93E-04	3.01E-08	3.05E-07	2.46E-04	1.35E-02
Endrin	1.41E-03	1.41E-01	1.41E-03	1.41E-01	5.71E-04	5.71E-02	9.86E-08	9.86E-06	3.62E-04	1.99E-02
Endrin aldehyde	1.79E-03	1.79E-01	1.79E-03	1.79E-01	7.24E-04	7.24E-02	1.15E-07	1.15E-05	4.75E-04	2.61E-02
Heptachlor	4.04E-03	6.73E-01	4.04E-03	6.73E-01	1.63E-03	2.72E-01	3.03E-07	5.06E-05	2.64E-05	1.45E-03
Methoxychlor	1.19E-01	**1.99E+01**	1.19E-01	**1.99E+01**	4.81E-02	**8.02E+00**	1.16E-05	1.94E-03	1.02E-04	2.04E-03
4-Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

TABLE B-16: SHORELINE SEDIMENTS (2.5 TO 4 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE MAXIMUM CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet - *Macoma* Tissue		Willet - Soft-bodied Invertebrate Tissue		Surf Scoter		Red-tailed Hawk		House Mouse	
	HAZARD QUOTIENT									
Chemical	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV
Benzoic Acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl Alcohol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibenzofuran	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
HMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	6.69E-02	**1.68E+00**
LMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	4.03E-03	1.21E-02
Pentachlorophenol	NC	NC	NC	NC	NC	NC	NC	NC	3.84E-02	3.84E-01
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibutyltin	9.53E-04	5.99E-02	6.93E-03	4.36E-01	3.85E-04	2.42E-02	9.70E-07	6.10E-05	3.84E-03	2.31E-01
Monobutylin	8.45E-04	5.31E-02	8.45E-04	5.31E-02	3.41E-04	2.14E-02	3.47E-07	2.18E-05	6.48E-04	3.89E-02
Tributylin	4.31E-03	2.71E-01	8.84E-03	5.56E-01	1.74E-03	1.09E-01	1.82E-06	1.14E-04	2.03E-03	1.22E-01

Notes:

Bold	Hazard Quotient exceeded 1.0
a	Reproductive or physiological impacts to the representative receptors listed in the table.
BHC	Benzene hexachloride
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
LMW	Low molecular weight
NC	TRV not available, hazard quotient not calculated
PAH	Polynuclear aromatic hydrocarbon
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-17: COMPARISON OF EXPOSURE POINT CONCENTRATIONS WITH REGIONAL AMBIENT CONCENTRATIONS (0 TO 2 FEET BGS)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	Regional Ambient Concentrations			EPC[a]
	HPAL	San Francisco Bay Ambient	Water Board	
Metals (mg/kg)				
Aluminum	NA	NA	NA	***1,070***
Antimony	9.05	NA	NA	5.31
Arsenic	11.10	15.3	NA	6.5
Barium	314.4	NA	NA	102
Beryllium	0.71	NA	NA	0.62
Cadmium	3.14	0.33	NA	2.65
Chromium[b]	1,133	112	NA	203
Cobalt[b]	119	NA	NA	31.6
Copper	124.3	68.1	NA	**308**
Lead	8.99	43.2	NA	**225**
Manganese	1,431.2	NA	NA	719
Mercury	2.28	0.43	NA	0.384
Molybdenum	2.68	NA	NA	0.795
Nickel[c]	2,793	112	NA	684
Selenium	1.95	0.64	NA	0.133
Silver	1.43	0.58	NA	0.248
Thallium	0.81	NA	NA	**1.1**
Vanadium	117.2	NA	NA	31.7
Zinc	109.9	158	NA	**348**
Pesticides and PCBs (mg/kg)				
Aroclor-1248	NA	0.0148	0.0025	**0.0336**
Aroclor-1254	NA	0.0148	0.0025	**0.159**
Aroclor-1260	NA	0.0148	0.0025	**0.912**
Total Aroclors	NA	0.0148	0.0025	**1.1046**
4,4-DDD	NA	NA	NA	***0.0023***
4,4-DDE	NA	NA	NA	***0.017***
4,4-DDT	NA	NA	NA	***0.0738***
Total DDT	NA	NA	NA	***0.0931***
alpha-BHC	NA	NA	NA	NC
alpha-Chlordane	NA	NA	NA	NC
gamma-Chlordane	NA	NA	NA	NC
Dieldrin	NA	0.00044	NA	**0.0155**
Endosulfan II	NA	NA	NA	NC
Endrin	NA	NA	NA	NC
Endrin aldehyde	NA	NA	NA	NC
Endrin ketone	NA	NA	NA	NC
Heptachlor	NA	NA	NA	NC
Heptachlor epoxide	NA	NA	NA	***0.0053***
Methoxychlor	NA	NA	NA	***0.795***
SVOCs (mg/kg)	NA			
2-Methylnaphthalene	NA	0.0194	NA	**0.113**
4-Methylphenol	NA	NA	NA	***0.14***
4-Nitrophenol	NA	NA	NA	***0.072***
Acenaphthene	NA	0.0266	NA	**0.21**
Acenaphthylene	NA	0.0317	NA	**0.118**
Anthracene	NA	0.088	NA	**0.261**
Azobenzene	NA	NA	NA	***0.043***
Benzo(a)anthracene	NA	0.244	NA	**0.293**
Benzo(a)pyrene	NA	0.412	NA	**0.337**
Benzo(b)fluoranthene	NA	0.371	NA	0.361
Benzo(g,h,i)perylene	NA	0.31	NA	0.13
Benzo(k)fluoranthene	NA	0.258	NA	**0.382**

TABLE B-17: COMPARISON OF EXPOSURE POINT CONCENTRATIONS WITH REGIONAL AMBIENT CONCENTRATIONS (0 TO 2 FEET BGS) (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	Regional Ambient Concentrations			EPC[a]
	HPAL	San Francisco Bay Ambient	Water Board	
SVOCs Continued (mg/kg)				
Benzoic Acid	NA	NA	NA	***0.685***
Benzyl Alcohol	NA	NA	NA	***0.041***
Chrysene	NA	0.289	NA	**0.406**
Dibenz(a,h)anthracene	NA	0.0327	NA	**0.14**
Dibenzofuran	NA	NA	NA	***0.14***
Fluoranthene	NA	0.514	NA	**0.593**
Fluorene	NA	0.0253	NA	**0.28**
Indeno(1,2,3-cd)pyrene	NA	0.382	NA	0.227
Naphthalene	NA	0.0558	NA	**0.124**
Pentachlorophenol	NA	NA	NA	***0.037***
Phenanthrene	NA	0.237	NA	**0.485**
Phenol	NA	NA	NA	***0.287***
Pyrene	NA	0.665	NA	0.506
Total HMW PAHs	NA	0.412	NA	**3.375**
Total LMW PAHs	NA	0.0558	NA	**1.591**
Organotins (mg/kg)				
Dibutyltin	NA	NA	NA	NC
Monobutyltin	NA	NA	NA	NC
Tetrabutyltin	NA	NA	NA	***0.00831***
Tributyltin	NA	NA	NA	***0.271***

Notes:

a	EPC is the lesser of the maximum detected concentration or the calculated UCL_{95}
b	HPAL calculated by regression using the maximum concentration of magnesium (130,000)
c	HPAL calculated by regression using the maximum concentration of cobalt
bgs	Below ground surface
BHC	Benzene hexachloride
COPEC	Chemical of potential ecological concern
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HMW	High molecular weight
HPAL	Hunters Point ambient level
LMW	Low molecular weight
mg/kg	Milligram per kilogram
NA	Not available
NC	Not calculated, COPEC not retained from screening with maximum concentration
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
SVOC	Semivolatile organic compound
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
UCL_{95}	95th percentile upper confidence limit on the mean
Water Board	San Francisco Bay Regional Water Quality Control Board

TABLE B-18: COMPARISON OF EXPOSURE POINT CONCENTRATIONS WITH REGIONAL AMBIENT CONCENTRATIONS (2.5 TO 4 FEET BGS)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	Regional Ambient Concentrations			EPC[a]
	HPAL	San Francisco Bay Ambient	Water Board	
Metals (mg/kg)				
Aluminum	NA	NA	NA	***9,880***
Antimony	9.05	NA	NA	3.56
Arsenic	11.1	15.30	NA	3.88
Barium	314.4	NA	NA	76.9
Beryllium	0.71	NA	NA	0.52
Cadmium	3.14	0.33	NA	**3.21**
Chromium[b]	1,307	112	NA	300
Cobalt[b]	132	NA	NA	34
Copper	124.3	68.1	NA	**4,150**
Lead	8.99	43.2	NA	**484**
Manganese	1,431.2	NA	NA	600
Mercury	2.28	0.43	NA	1.3
Molybdenum	2.68	NA	NA	**4.44**
Nickel[c]	2,635	112	NA	692
Silver	1.43	0.58	NA	0.295
Thallium	0.81	NA	NA	**0.97**
Vanadium	117.2	NA	NA	51
Zinc	109.9	158	NA	**452**
Pesticides and PCBs (mg/kg)				
Aroclor 1254	NA	0.0148	0.0025	**0.218**
Aroclor 1260	NA	0.0148	0.0025	**2.78**
Total Aroclors	NA	0.0148	0.0025	**2.998**
4,4-DDD	NA	NA	NA	***0.0055***
4,4-DDE	NA	NA	NA	***0.0179***
4,4-DDT	NA	NA	NA	***0.108***
Total DDT	NA	NA	NA	***0.1314***
beta-BHC	NA	NA	NA	NC
delta-BHC	NA	NA	NA	NC
alpha-Chlordane	NA	NA	NA	NC
Dieldrin	NA	0.00044	NA	**0.0269**
Endosulfan sulfate	NA	NA	NA	NC
Endrin	NA	NA	NA	NC
Endrin aldehyde	NA	NA	NA	NC
Heptachlor	NA	NA	NA	NC
Methoxychlor	NA	NA	NA	***0.046***
SVOCs (mg/kg)				
2-Methylnaphthalene	NA	0.0194	NA	**0.044**
4-Methylphenol	NA	NA	NA	***0.243***
Acenaphthene	NA	0.0266	NA	**0.17**
Acenaphthylene	NA	0.0317	NA	**0.16**
Anthracene	NA	0.088	NA	**0.387**
Benzo(a)anthracene	NA	0.244	NA	**0.861**
Benzo(a)pyrene	NA	0.412	NA	**0.822**
Benzo(b)fluoranthene	NA	0.371	NA	**2.13**
Benzo(g,h,i)perylene	NA	0.31	NA	0.079
Benzo(k)fluoranthene	NA	0.258	NA	**0.692**
Benzoic Acid	NA	NA	NA	***0.7***

TABLE B-18: COMPARISON OF EXPOSURE POINT CONCENTRATIONS WITH REGIONAL AMBIENT CONCENTRATIONS (2.5 TO 4 FEET BGS) (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Chemical	Regional Ambient Concentrations			
	HPAL	San Francisco Bay Ambient	Water Board	EPC[a]
SVOCs Continued (mg/kg)				
Benzyl Alcohol	NA	NA	NA	***0.19***
Chrysene	NA	0.289	NA	**0.762**
Dibenz(a,h)anthracene	NA	0.0327	NA	**0.37**
Dibenzofuran	NA	NA	NA	***0.059***
Fluoranthene	NA	0.514	NA	**1.32**
Fluorene	NA	0.0253	NA	**0.1**
Indeno(1,2,3-cd)pyrene	NA	0.382	NA	**0.465**
Naphthalene	NA	0.0558	NA	**0.141**
Pentachlorophenol	NA	NA	NA	***0.16***
Phenanthrene	NA	0.237	NA	**0.907**
Phenol	NA	NA	NA	***0.09***
Pyrene	NA	0.665	NA	**1.19**
Total HMW PAHs	NA	0.412	NA	**8.691**
Total LMW PAHs	NA	0.0558	NA	**1.909**
Organotins (mg/kg)				
Dibutyltin	NA	NA	NA	NC
Monobutyltin	NA	NA	NA	NC
Tributyltin	NA	NA	NA	NC

Notes:

a	EPC is the lesser of the maximum concentration detected or the calucated UCL_{95}
b	HPAL calculated by regression using the maximum concentration of magnesium (160,000)
c	HPAL calculated by regression using the maximum concentration of cobalt
bgs	Below ground surface
BHC	Benzene hexachloride
COPEC	Chemical of potential ecological concern
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HMW	High molecular weight
HPAL	Hunters Point ambient level
LMW	Low molecular weight
mg/kg	Milligram per kilogram
NA	Not available
NC	Not calculated, COPEC not retained from screening with maximum concentration
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
SVOC	Semivolatile organic compound
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
UCL_{95}	95th percentile upper confidence limit on the mean
Water Board	San Francisco Bay Regional Water Quality Control Board

TABLE B-19: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF EXPOSURE POINT CONCENTRATIONS IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS-RANGE MEDIAN

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

	0 - 2 feet bgs		
Chemical	**EPC[a] (mg/kg)**	**Screening Criterion (mg/kg)**	**Hazard Quotient based on EPC[a]**
Metals			
Aluminum	1,070	NA	NA
Copper	308	270	**1.14**
Lead	225	218	**1.03**
Thallium	1.1	NA	NA
Zinc	348	410	0.85
Pesticides and PCBs			
Aroclor-1248	0.0336	NA	NA
Aroclor-1254	0.159	NA	NA
Aroclor-1260	0.912	NA	NA
Total Aroclors	1.1046	0.18	**6.14**
4,4-DDT	0.0738	0.007	**10.5**
Total DDT	0.0931	0.046	**2.02**
alpha-BHC	0.0064	NA	NA
Dieldrin	0.0155	0.008	**1.94**
Endosulfan II	0.0027	NA	NA
Endrin aldehyde	0.0031	NA	NA
Endrin ketone	0.0097	NA	NA
Heptachlor	0.0016	NA	NA
Heptachlor epoxide	0.0053	NA	NA
Methoxychlor	0.017	NA	NA
SVOCs			
4-Methylphenol	0.14	NA	NA
4-Nitrophenol	0.072	NA	NA
Azobenzene	0.043	NA	NA
Benzo(a)anthracene	0.293	1.6	NA
Benzo(a)pyrene	0.337	1.6	NA
Chrysene	0.406	2.8	NA
Dibenz(a,h)anthracene	0.14	0.26	NA
Pentachlorophenol	0.037	NA	NA
Phenanthrene	0.485	1.5	0.32
Phenol	0.287	NA	NA
Pyrene	0.506	2.6	NA
Total HMW PAHs	3.375	9.6	NA

TABLE B-19: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF EXPOSURE POINT CONCENTRATIONS IN SURFACE AND SUBSURFACE SEDIMENTS TO EFFECTS-RANGE MEDIAN (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

	2.5 - 4 feet bgs		
Chemical	EPC[a] (mg/kg)	Screening Criterion (mg/kg)	Hazard Quotient based on EPC[a]
Metals			
Aluminum	9,880	NA	NA
Copper	4,150	270	**15.4**
Lead	484	218	**2.22**
Molybdenum	11	NA	NA
Thallium	0.97	NA	NA
Zinc	452	410	**1.1**
Pesticides and PCBs			
Aroclor-1254	0.218	NA	NA
Aroclor-1260	2.78	NA	NA
Total Aroclors	2.998	0.18	**16.7**
4,4-DDE	0.0179	0.027	0.663
4,4-DDT	0.108	0.007	**15.4**
Total DDT	0.1314	0.046	**2.86**
Dieldrin	0.0269	0.008	**3.36**
Endosulfan sulfate	0.0096	NA	NA
Endrin aldehyde	0.0088	NA	NA
Heptachlor	0.0012	NA	NA
Methoxychlor	0.046	NA	NA
SVOCs			
4-Methylphenol	0.243	NA	NA
Benzo(a)anthracene	0.861	1.6	0.54
Benzo(a)pyrene	0.822	1.6	0.51
Benzo(b)fluoranthene	2.13	NA	NA
Benzo(k)fluoranthene	1.7	NA	NA
Benzoic Acid	0.7	NA	NA
Benzyl Alcohol	0.19	NA	NA
Chrysene	0.762	2.8	0.27
Dibenz(a,h)anthracene	0.37	0.26	**1.42**
Dibenzofuran	0.059	NA	NA
Indeno(1,2,3-cd)pyrene	0.465	NA	NA
Pentachlorophenol	0.16	NA	NA
Phenanthrene	0.907	1.5	0.61
Phenol	0.09	NA	NA
Pyrene	1.19	2.6	0.46
Total HMW PAHs	8.691	9.6	0.91

Notes:

Bold	Hazard quotient above 1.0
a	EPC is the lesser of the maximum detected concentration or the calculated UCL_{95}
bgs	Below ground surface
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HMW	High molecular weight
HQ	Hazard quotient
mg/kg	Milligram per kilogram
NA	Not applicable; HQ did not exceed 1.0 by using the maximum concentration; therefore, not a COPEC for surface sediment
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
SVOC	Semivolatile organic compound
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-20: HAZARD QUOTIENTS FOR INVERTEBRATE RECEPTORS BASED ON THE RATIO OF DETECTED CONCENTRATIONS IN GROUNDWATER TO SCREENING CRITERIA

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well	Chemical	Detected Concentration	Screening Value[a]	Unit	Sample Date	Hazard Quotient
Metals						
IR07MW21A1	Arsenic	38	36	µg/L	01-Sep-04	**1.06**
PA50MW01A	Copper	362	3.1	µg/L	04-Jun-02	**117**
IR07MWS-2	Lead	114	5.6	µg/L	01-Sep-04	**20.4**
IR26MW47A	Mercury	2.8	0.025	µg/L	17-Nov-04	**112**
IR07MW26A	Selenium	73.7	71	µg/L	01-Sep-04	**1.04**
IR26MW45A	Zinc	200	81	µg/L	12-Jan-00	**2.47**
Pesticides						
IR26MW46A	Alpha-chlordane	0.01325	0.004	µg/L	10-Nov-03	**3.31**
IR26MW48A	Endrin aldehyde	0.026	0.0023	µg/L	23-May-03	**11.30**
IR26MW46A	Gamma-chlordane	0.01365	0.004	µg/L	10-Nov-03	**3.41**
IR26MW47A	Heptachlor	0.028	0.0036	µg/L	11-Mar-03	**7.78**

Notes:

Bold Hazard quotient above 1.0
a Screening value from Table B-5
µg/L Microgram per liter

TABLE B-21: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE EXPOSURE POINT CONCENTRATION
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Copper											
	High TRV	1.00E+00	3.08E+02	2.73E-03	2.20E-01	6.78E+01	9.09E-02	1.15E+00	6.09E+00	6.43E+01	9.46E-02
	Low TRV	1.00E+00	3.08E+02	2.73E-03	2.20E-01	6.78E+01	9.09E-02	1.15E+00	6.09E+00	2.59E+00	2.35E+00
Lead											
	High TRV	1.00E+00	2.25E+02	2.73E-03	8.00E-02	1.80E+01	9.09E-02	1.15E+00	1.96E+00	9.41E+00	2.08E-01
	Low TRV	1.00E+00	2.25E+02	2.73E-03	8.00E-02	1.80E+01	9.09E-02	1.15E+00	1.96E+00	2.27E-02	8.63E+01
Thallium											
	High TRV	1.00E+00	1.10E+00	2.73E-03	9.00E-01	9.90E-01	9.09E-02	1.15E+00	8.09E-02	6.02E-01	1.34E-01
	Low TRV	1.00E+00	1.10E+00	2.73E-03	9.00E-01	9.90E-01	9.09E-02	1.15E+00	8.09E-02	6.02E-02	1.34E+00
Zinc											
	High TRV	1.00E+00	3.48E+02	2.73E-03	7.30E-01	2.54E+02	9.09E-02	1.15E+00	2.09E+01	1.79E+02	1.17E-01
	Low TRV	1.00E+00	3.48E+02	2.73E-03	7.30E-01	2.54E+02	9.09E-02	1.15E+00	2.09E+01	1.79E+01	1.17E+00
Total Aroclors											
	High TRV	1.00E+00	1.10E+00	2.73E-03	1.77E+00	1.96E+00	9.09E-02	1.15E+00	1.57E-01	1.17E+00	1.34E-01
	Low TRV	1.00E+00	1.10E+00	2.73E-03	1.77E+00	1.96E+00	9.09E-02	1.15E+00	1.57E-01	9.68E-02	1.62E+00
Total DDT											
	High TRV	1.00E+00	9.31E-02	2.73E-03	3.49E+00	3.25E-01	9.09E-02	1.15E+00	2.59E-02	1.54E+00	1.68E-02
	Low TRV	1.00E+00	9.31E-02	2.73E-03	3.49E+00	3.25E-01	9.09E-02	1.15E+00	2.59E-02	9.26E-03	2.80E+00
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	2.73E-03	2.65E+01	1.40E-01	9.09E-02	1.15E+00	1.11E-02	1.54E+00	7.20E-03
	Low TRV	1.00E+00	5.30E-03	2.73E-03	2.65E+01	1.40E-01	9.09E-02	1.15E+00	1.11E-02	9.26E-03	1.20E+00
Methoxychlor											
	High TRV	1.00E+00	7.95E-01	2.73E-03	2.04E+01	1.62E+01	9.09E-02	1.15E+00	1.28E+00	1.54E+00	8.31E-01
	Low TRV	1.00E+00	7.95E-01	2.73E-03	2.04E+01	1.62E+01	9.09E-02	1.15E+00	1.28E+00	9.26E-03	1.39E+02
Tetrabutyltin											
	High TRV	1.00E+00	8.31E-03	2.73E-03	6.51E+02	5.41E+00	9.09E-02	1.15E+00	4.28E-01	7.53E+01	5.68E-03
	Low TRV	1.00E+00	8.31E-03	2.73E-03	6.51E+02	5.41E+00	9.09E-02	1.15E+00	4.28E-01	1.20E+00	3.57E-01

TABLE B-21: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Cadmium											
	High TRV	1.00E+00	3.21E+00	2.73E-03	1.08E+00	3.47E+00	9.09E-02	1.15E+00	2.82E-01	1.76E+01	1.60E-02
	Low TRV	1.00E+00	3.21E+00	2.73E-03	1.08E+00	3.47E+00	9.09E-02	1.15E+00	2.82E-01	8.61E-02	3.27E+00
Copper											
	High TRV	1.00E+00	4.15E+03	2.73E-03	2.20E-01	9.13E+02	9.09E-02	1.15E+00	8.20E+01	6.43E+01	1.28E+00
	Low TRV	1.00E+00	4.15E+03	2.73E-03	2.20E-01	9.13E+02	9.09E-02	1.15E+00	8.20E+01	2.59E+00	3.17E+01
Lead											
	High TRV	1.00E+00	4.84E+02	2.73E-03	8.00E-02	3.87E+01	9.09E-02	1.15E+00	4.21E+00	9.41E+00	4.47E-01
	Low TRV	1.00E+00	4.84E+02	2.73E-03	8.00E-02	3.87E+01	9.09E-02	1.15E+00	4.21E+00	2.27E-02	1.86E+02
Thallium											
	High TRV	1.00E+00	9.70E-01	2.73E-03	9.00E-01	8.73E-01	9.09E-02	1.15E+00	7.13E-02	6.02E-01	1.18E-01
	Low TRV	1.00E+00	9.70E-01	2.73E-03	9.00E-01	8.73E-01	9.09E-02	1.15E+00	7.13E-02	6.02E-02	1.18E+00
Zinc											
	High TRV	1.00E+00	4.52E+02	2.73E-03	7.30E-01	3.30E+02	9.09E-02	1.15E+00	2.72E+01	1.79E+02	1.52E-01
	Low TRV	1.00E+00	4.52E+02	2.73E-03	7.30E-01	3.30E+02	9.09E-02	1.15E+00	2.72E+01	1.79E+01	1.52E+00
Total Aroclors											
	High TRV	1.00E+00	3.00E+00	2.73E-03	1.77E+00	5.31E+00	9.09E-02	1.15E+00	4.27E-01	1.17E+00	3.64E-01
	Low TRV	1.00E+00	3.00E+00	2.73E-03	1.77E+00	5.31E+00	9.09E-02	1.15E+00	4.27E-01	9.68E-02	4.41E+00
Total DDT											
	High TRV	1.00E+00	1.31E-01	2.73E-03	3.49E+00	4.59E-01	9.09E-02	1.15E+00	3.66E-02	1.54E+00	2.37E-02
	Low TRV	1.00E+00	1.31E-01	2.73E-03	3.49E+00	4.59E-01	9.09E-02	1.15E+00	3.66E-02	9.26E-03	3.95E+00
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	2.73E-03	2.04E+01	9.37E-01	9.09E-02	1.15E+00	7.42E-02	1.54E+00	4.81E-02
	Low TRV	1.00E+00	4.60E-02	2.73E-03	2.04E+01	9.37E-01	9.09E-02	1.15E+00	7.42E-02	9.26E-03	8.02E+00

TABLE B-21: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE SURF SCOTER USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a	EPC is the lesser of the maximum concentration detected or the calculated UCL_{95}
BAF	Bioaccumulation factor from sediment concentrations to *Macoma* tissue concentrations
bgs	Below ground surface
BW	Body weight
DDD	*Dichlorodiphenyldichloroethane*
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HQ	Hazard quotient
IR	Ingestion rate of *Macoma* tissue
kg	Kilogram
kg/day	Kilogram per day
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-22: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE EXPOSURE POINT CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.07E+03	9.00E-04	2.00E-02	2.14E+01	3.01E-02	2.15E-01	7.48E+00	1.17E+03	6.37E-03
	Low TRV	1.00E+00	1.07E+03	9.00E-04	2.00E-02	2.14E+01	3.01E-02	2.15E-01	7.48E+00	1.17E+02	6.37E-02
Copper											
	High TRV	1.00E+00	3.08E+02	9.00E-04	2.20E-01	6.78E+01	3.01E-02	2.15E-01	1.08E+01	4.60E+01	2.34E-01
	Low TRV	1.00E+00	3.08E+02	9.00E-04	2.20E-01	6.78E+01	3.01E-02	2.15E-01	1.08E+01	1.85E+00	5.83E+00
Lead											
	High TRV	1.00E+00	2.25E+02	9.00E-04	8.00E-02	1.80E+01	3.01E-02	2.15E-01	3.46E+00	6.73E+00	5.15E-01
	Low TRV	1.00E+00	2.25E+02	9.00E-04	8.00E-02	1.80E+01	3.01E-02	2.15E-01	3.46E+00	1.62E-02	2.13E+02
Thallium											
	High TRV	1.00E+00	1.10E+00	9.00E-04	9.00E-01	9.90E-01	3.01E-02	2.15E-01	1.43E-01	4.31E-01	3.33E-01
	Low TRV	1.00E+00	1.10E+00	9.00E-04	9.00E-01	9.90E-01	3.01E-02	2.15E-01	1.43E-01	4.31E-02	3.33E+00
Zinc											
	High TRV	1.00E+00	3.48E+02	9.00E-04	7.30E-01	2.54E+02	3.01E-02	2.15E-01	3.70E+01	1.28E+02	2.90E-01
	Low TRV	1.00E+00	3.48E+02	9.00E-04	7.30E-01	2.54E+02	3.01E-02	2.15E-01	3.70E+01	1.28E+01	2.90E+00
Total Aroclors											
	High TRV	1.00E+00	1.10E+00	9.00E-04	1.77E+00	1.96E+00	3.01E-02	2.15E-01	2.78E-01	8.38E-01	3.32E-01
	Low TRV	1.00E+00	1.10E+00	9.00E-04	1.77E+00	1.96E+00	3.01E-02	2.15E-01	2.78E-01	6.92E-02	4.02E+00
Total DDT											
	High TRV	1.00E+00	9.31E-02	9.00E-04	3.49E+00	3.25E-01	3.01E-02	2.15E-01	4.59E-02	1.10E+00	4.16E-02
	Low TRV	1.00E+00	9.31E-02	9.00E-04	3.49E+00	3.25E-01	3.01E-02	2.15E-01	4.59E-02	6.62E-03	6.93E+00
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	1.10E+00	1.78E-02
	Low TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	6.62E-03	2.97E+00
Methoxychlor											
	High TRV	1.00E+00	7.95E-01	9.00E-04	2.04E+01	1.62E+01	3.01E-02	2.15E-01	2.27E+00	1.10E+00	2.06E+00
	Low TRV	1.00E+00	7.95E-01	9.00E-04	2.04E+01	1.62E+01	3.01E-02	2.15E-01	2.27E+00	6.62E-03	3.43E+02
Tetrabutyltin											
	High TRV	1.00E+00	8.31E-03	9.00E-04	6.51E+02	5.41E+00	3.01E-02	2.15E-01	7.58E-01	5.39E+01	1.41E-02
	Low TRV	1.00E+00	8.31E-03	9.00E-04	6.51E+02	5.41E+00	3.01E-02	2.15E-01	7.58E-01	8.57E-01	8.84E-01

TABLE B-22: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}Macoma}$	*Macoma* Concentration (mg/kg)	IR_{Macoma} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	9.88E+03	9.00E-04	2.00E-02	1.98E+02	3.01E-02	2.15E-01	6.90E+01	1.17E+03	5.88E-02
	Low TRV	1.00E+00	9.88E+03	9.00E-04	2.00E-02	1.98E+02	3.01E-02	2.15E-01	6.90E+01	1.17E+02	5.88E-01
Cadmium											
	High TRV	1.00E+00	3.21E+00	9.00E-04	1.08E+00	3.47E+00	3.01E-02	2.15E-01	4.99E-01	1.26E+01	3.96E-02
	Low TRV	1.00E+00	3.21E+00	9.00E-04	1.08E+00	3.47E+00	3.01E-02	2.15E-01	4.99E-01	6.15E-02	8.11E+00
Copper											
	High TRV	1.00E+00	4.15E+03	9.00E-04	2.20E-01	9.13E+02	3.01E-02	2.15E-01	1.45E+02	4.60E+01	3.16E+00
	Low TRV	1.00E+00	4.15E+03	9.00E-04	2.20E-01	9.13E+02	3.01E-02	2.15E-01	1.45E+02	1.85E+00	7.85E+01
Lead											
	High TRV	1.00E+00	4.84E+02	9.00E-04	8.00E-02	3.87E+01	3.01E-02	2.15E-01	7.45E+00	6.73E+00	1.11E+00
	Low TRV	1.00E+00	4.84E+02	9.00E-04	8.00E-02	3.87E+01	3.01E-02	2.15E-01	7.45E+00	1.62E-02	4.59E+02
Molybdenum											
	High TRV	1.00E+00	4.44E+00	9.00E-04	2.86E+00	1.27E+01	3.01E-02	2.15E-01	1.80E+00	2.39E+01	7.50E-02
	Low TRV	1.00E+00	4.44E+00	9.00E-04	2.86E+00	1.27E+01	3.01E-02	2.15E-01	1.80E+00	2.37E+00	7.57E-01
Thallium											
	High TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-01	2.93E-01
	Low TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-02	2.93E+00
Zinc											
	High TRV	1.00E+00	4.52E+02	9.00E-04	7.30E-01	3.30E+02	3.01E-02	2.15E-01	4.81E+01	1.28E+02	3.77E-01
	Low TRV	1.00E+00	4.52E+02	9.00E-04	7.30E-01	3.30E+02	3.01E-02	2.15E-01	4.81E+01	1.28E+01	3.77E+00
Total Aroclors											
	High TRV	1.00E+00	3.00E+00	9.00E-04	1.77E+00	5.31E+00	3.01E-02	2.15E-01	7.55E-01	8.38E-01	9.01E-01
	Low TRV	1.00E+00	3.00E+00	9.00E-04	1.77E+00	5.31E+00	3.01E-02	2.15E-01	7.55E-01	6.92E-02	1.09E+01
Total DDT											
	High TRV	1.00E+00	1.31E-01	9.00E-04	3.49E+00	4.59E-01	3.01E-02	2.15E-01	6.48E-02	1.10E+00	5.87E-02
	Low TRV	1.00E+00	1.31E-01	9.00E-04	3.49E+00	4.59E-01	3.01E-02	2.15E-01	6.48E-02	6.62E-03	9.78E+00
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	1.10E+00	1.19E-01
	Low TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	6.62E-03	1.99E+01

TABLE B-22: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (*MACOMA* TISSUE) USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

[a]	EPC is the lesser of the maximum concentration detected or the calculated UCL_{95}
BAF	Bioaccumulation factor from sediment concentrations to *Macoma* tissue concentrations
bgs	Below ground surface
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HQ	Hazard quotient
IR	Ingestion rate of *Macoma* tissue
kg	Kilogram
kg/day	Kilogram per day
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-23: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE EXPOSURE POINT CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	1.07E+03	9.00E-04	3.30E-01	3.53E+02	3.01E-02	2.15E-01	5.39E+01	1.17E+03	4.59E-02
	Low TRV	1.00E+00	1.07E+03	9.00E-04	3.30E-01	3.53E+02	3.01E-02	2.15E-01	5.39E+01	1.17E+02	4.59E-01
Copper											
	High TRV	1.00E+00	3.08E+02	9.00E-04	6.70E-01	2.06E+02	3.01E-02	2.15E-01	3.02E+01	4.60E+01	6.56E-01
	Low TRV	1.00E+00	3.08E+02	9.00E-04	6.70E-01	2.06E+02	3.01E-02	2.15E-01	3.02E+01	1.85E+00	1.63E+01
Lead											
	High TRV	1.00E+00	2.25E+02	9.00E-04	3.90E-01	8.78E+01	3.01E-02	2.15E-01	1.32E+01	6.73E+00	1.97E+00
	Low TRV	1.00E+00	2.25E+02	9.00E-04	3.90E-01	8.78E+01	3.01E-02	2.15E-01	1.32E+01	1.62E-02	8.15E+02
Thallium											
	High TRV	1.00E+00	1.10E+00	9.00E-04	9.00E-01	9.90E-01	3.01E-02	2.15E-01	1.43E-01	4.31E-01	3.33E-01
	Low TRV	1.00E+00	1.10E+00	9.00E-04	9.00E-01	9.90E-01	3.01E-02	2.15E-01	1.43E-01	4.31E-02	3.33E+00
Zinc											
	High TRV	1.00E+00	3.48E+02	9.00E-04	8.40E-01	2.92E+02	3.01E-02	2.15E-01	4.24E+01	1.28E+02	3.32E-01
	Low TRV	1.00E+00	3.48E+02	9.00E-04	8.40E-01	2.92E+02	3.01E-02	2.15E-01	4.24E+01	1.28E+01	3.32E+00
Total Aroclors											
	High TRV	1.00E+00	1.10E+00	9.00E-04	6.15E+00	6.79E+00	3.01E-02	2.15E-01	9.56E-01	8.38E-01	1.14E+00
	Low TRV	1.00E+00	1.10E+00	9.00E-04	6.15E+00	6.79E+00	3.01E-02	2.15E-01	9.56E-01	6.92E-02	1.38E+01
Total DDT											
	High TRV	1.00E+00	9.31E-02	9.00E-04	1.43E+01	1.33E+00	3.01E-02	2.15E-01	1.87E-01	1.10E+00	1.69E-01
	Low TRV	1.00E+00	9.31E-02	9.00E-04	1.43E+01	1.33E+00	3.01E-02	2.15E-01	1.87E-01	6.62E-03	2.82E+01
Dieldrin											
	High TRV	1.00E+00	1.55E-02	9.00E-04	2.17E+01	3.36E-01	3.01E-02	2.15E-01	4.72E-02	6.60E-01	7.15E-02
	Low TRV	1.00E+00	1.55E-02	9.00E-04	2.17E+01	3.36E-01	3.01E-02	2.15E-01	4.72E-02	6.60E-02	7.15E-01
Heptachlor epoxide											
	High TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	1.10E+00	1.78E-02
	Low TRV	1.00E+00	5.30E-03	9.00E-04	2.65E+01	1.40E-01	3.01E-02	2.15E-01	1.97E-02	6.62E-03	2.97E+00
Methoxychlor											
	High TRV	1.00E+00	7.95E-01	9.00E-04	2.04E+01	1.62E+01	3.01E-02	2.15E-01	2.27E+00	1.10E+00	2.06E+00
	Low TRV	1.00E+00	7.95E-01	9.00E-04	2.04E+01	1.62E+01	3.01E-02	2.15E-01	2.27E+00	6.62E-03	3.43E+02
Tetrabutyltin											
	High TRV	1.00E+00	8.31E-03	9.00E-04	6.51E+02	5.41E+00	3.01E-02	2.15E-01	7.58E-01	5.39E+01	1.41E-02
	Low TRV	1.00E+00	8.31E-03	9.00E-04	6.51E+02	5.41E+00	3.01E-02	2.15E-01	7.58E-01	8.57E-01	8.84E-01
Tributyltin											
	High TRV	1.00E+00	2.71E-01	9.00E-04	1.01E+01	2.75E+00	3.01E-02	2.15E-01	3.85E-01	5.39E+01	7.15E-03
	Low TRV	1.00E+00	2.71E-01	9.00E-04	1.01E+01	2.75E+00	3.01E-02	2.15E-01	3.85E-01	8.57E-01	4.50E-01

TABLE B-23: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)

Chemical		SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}soft\text{-}bodied\ Invertebrate}$	Soft-bodied Invertebrate Concentration (mg/kg)	$IR_{Soft\text{-}bodied\ Invertebrate}$ (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
Aluminum											
	High TRV	1.00E+00	9.88E+03	9.00E-04	3.30E-01	3.26E+03	3.01E-02	2.15E-01	4.98E+02	1.17E+03	4.24E-01
	Low TRV	1.00E+00	9.88E+03	9.00E-04	3.30E-01	3.26E+03	3.01E-02	2.15E-01	4.98E+02	1.17E+02	4.24E+00
Cadmium											
	High TRV	1.00E+00	3.21E+00	9.00E-04	3.86E+00	1.24E+01	3.01E-02	2.15E-01	1.75E+00	1.26E+01	1.39E-01
	Low TRV	1.00E+00	3.21E+00	9.00E-04	3.86E+00	1.24E+01	3.01E-02	2.15E-01	1.75E+00	6.15E-02	2.84E+01
Copper											
	High TRV	1.00E+00	4.15E+03	9.00E-04	6.70E-01	2.78E+03	3.01E-02	2.15E-01	4.07E+02	4.60E+01	8.84E+00
	Low TRV	1.00E+00	4.15E+03	9.00E-04	6.70E-01	2.78E+03	3.01E-02	2.15E-01	4.07E+02	1.85E+00	2.20E+02
Lead											
	High TRV	1.00E+00	4.84E+02	9.00E-04	3.90E-01	1.89E+02	3.01E-02	2.15E-01	2.85E+01	6.73E+00	4.23E+00
	Low TRV	1.00E+00	4.84E+02	9.00E-04	3.90E-01	1.89E+02	3.01E-02	2.15E-01	2.85E+01	1.62E-02	1.75E+03
Molybdenum											
	High TRV	1.00E+00	4.44E+00	9.00E-04	1.75E+00	7.77E+00	3.01E-02	2.15E-01	1.11E+00	2.39E+01	4.62E-02
	Low TRV	1.00E+00	4.44E+00	9.00E-04	1.75E+00	7.77E+00	3.01E-02	2.15E-01	1.11E+00	2.37E+00	4.66E-01
Thallium											
	High TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-01	2.93E-01
	Low TRV	1.00E+00	9.70E-01	9.00E-04	9.00E-01	8.73E-01	3.01E-02	2.15E-01	1.26E-01	4.31E-02	2.93E+00
Zinc											
	High TRV	1.00E+00	4.52E+02	9.00E-04	8.40E-01	3.80E+02	3.01E-02	2.15E-01	5.50E+01	1.28E+02	4.31E-01
	Low TRV	1.00E+00	4.52E+02	9.00E-04	8.40E-01	3.80E+02	3.01E-02	2.15E-01	5.50E+01	1.28E+01	4.31E+00
Total Aroclors											
	High TRV	1.00E+00	3.00E+00	9.00E-04	6.15E+00	1.84E+01	3.01E-02	2.15E-01	2.59E+00	8.38E-01	3.09E+00
	Low TRV	1.00E+00	3.00E+00	9.00E-04	6.15E+00	1.84E+01	3.01E-02	2.15E-01	2.59E+00	6.92E-02	3.75E+01
Total DDT											
	High TRV	1.00E+00	1.31E-01	9.00E-04	1.43E+01	1.88E+00	3.01E-02	2.15E-01	2.63E-01	1.10E+00	2.39E-01
	Low TRV	1.00E+00	1.31E-01	9.00E-04	1.43E+01	1.88E+00	3.01E-02	2.15E-01	2.63E-01	6.62E-03	3.98E+01
Dieldrin											
	High TRV	1.00E+00	2.69E-02	9.00E-04	2.17E+01	5.84E-01	3.01E-02	2.15E-01	8.18E-02	6.60E-01	1.24E-01
	Low TRV	1.00E+00	2.69E-02	9.00E-04	2.17E+01	5.84E-01	3.01E-02	2.15E-01	8.18E-02	6.60E-02	1.24E+00
Methoxychlor											
	High TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	1.10E+00	1.19E-01
	Low TRV	1.00E+00	4.60E-02	9.00E-04	2.04E+01	9.37E-01	3.01E-02	2.15E-01	1.31E-01	6.62E-03	1.99E+01

TABLE B-23: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE WILLET (SOFT-BODIED INVERTEBRATE TISSUE) USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

[a]	EPC is the lesser of the maximum concentration detected or the calculated UCL_{95}
BAF	Bioaccumulation factor from sediment concentrations to soft-bodied invertebrate concentrations
bgs	Below ground surface
BW	Body weight
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
EPC	Exposure point concentration
HQ	Hazard quotient
IR	Ingestion rate of soft bodied invertebrate tissue
kg	Kilogram
kg/day	Kilogram per day
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-24: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE RED-TAILED HAWK USING THE EXPOSURE POINT CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	$BAF_{Sediment\text{-}to\text{-}mouse}$	Mouse Concentration (mg/kg)	IR_{Mouse} (kg/day)	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)										
Copper										
High TRV	1.00E+00	3.08E+02	4.70E-04	7.55E-02	7.44E+00	1.19E-01	1.20E+00	8.56E-01	6.49E+01	1.32E-02
Low TRV	1.00E+00	3.08E+02	4.70E-04	7.55E-02	7.44E+00	1.19E-01	1.20E+00	8.56E-01	2.61E+00	3.28E-01
Lead										
High TRV	1.00E+00	2.25E+02	4.70E-04	3.34E-02	2.41E+00	1.19E-01	1.20E+00	3.26E-01	9.50E+00	3.43E-02
Low TRV	1.00E+00	2.25E+02	4.70E-04	3.34E-02	2.41E+00	1.19E-01	1.20E+00	3.26E-01	2.29E-02	1.42E+01
HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)										
Copper										
High TRV	1.00E+00	4.15E+03	4.70E-04	7.55E-02	1.00E+02	1.19E-01	1.20E+00	1.15E+01	6.49E+01	1.78E-01
Low TRV	1.00E+00	4.15E+03	4.70E-04	7.55E-02	1.00E+02	1.19E-01	1.20E+00	1.15E+01	2.61E+00	4.42E+00
Lead										
High TRV	1.00E+00	4.84E+02	4.70E-04	3.34E-02	5.18E+00	1.19E-01	1.20E+00	7.01E-01	9.50E+00	7.38E-02
Low TRV	1.00E+00	4.84E+02	4.70E-04	3.34E-02	5.18E+00	1.19E-01	1.20E+00	7.01E-01	2.29E-02	3.06E+01

Notes:

a	EPC is the lesser of the maximum concentration detected or the calculated UCL_{95}.
BAF	Bioaccumulation factor from sediment concentrations to mouse tissue concentrations
bgs	Below ground surface
BW	Body weight
EPC	Exposure point concentration
HQ	Hazard quotient
IR	Ingestion rate of mouse tissue
kg	Kilogram
kg/day	Kilogram per day
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
SUF	Site use factor
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-25: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE EXPOSURE POINT CONCENTRATION
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	SUF	EPC[a] (mg/kg)	$IR_{Sediment}$ (kg/day)	BAF Seed	Seed Concentration (mg/kg)	IR_{Seed} (kg/day)	BAF Stem and Leaf	Stem and Leaf Concentration (mg/kg)	$IR_{Stem\ and\ Leaf}$ (kg/day)	BAF Invertebrate	Invertebrate Concentration (mg/kg)	$IR_{Invertebrate}$	BW (kg)	Dose (mg/kg/day)	Allometrically Converted TRV (mg/kg/day)	HQ
HIGH AND LOW TRV HQs FOR SURFACE SEDIMENT (0 TO 2 FEET BGS)																
Aluminum																
High TRV	1.00E+00	1.07E+03	9.00E-05	4.00E-03	4.28E+00	3.60E-03	4.00E-03	1.19E+00	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	6.62E+00	2.00E+01	3.31E-01
Low TRV	1.00E+00	1.07E+03	9.00E-05	4.00E-03	4.28E+00	3.60E-03	4.00E-03	1.19E+00	3.30E-04	2.20E-01	6.39E-05	5.70E-04	1.69E-02	6.62E+00	2.00E+00	3.31E+00
Copper																
High TRV	1.00E+00	3.08E+02	9.00E-05	1.65E-01	3.16E+01	3.60E-03	1.82E-01	1.55E+01	3.30E-04	7.96E-01	2.31E-04	5.70E-04	1.69E-02	8.67E+00	6.46E+02	1.34E-02
Low TRV	1.00E+00	3.08E+02	9.00E-05	1.65E-01	3.16E+01	3.60E-03	1.82E-01	1.55E+01	3.30E-04	7.96E-01	2.31E-04	5.70E-04	1.69E-02	8.67E+00	2.76E+00	3.14E+00
Lead																
High TRV	1.00E+00	2.25E+02	9.00E-05	1.70E-02	2.38E+00	3.60E-03	3.20E-02	1.99E+00	3.30E-04	7.40E-02	2.15E-05	5.70E-04	1.69E-02	1.74E+00	2.42E+02	7.18E-03
Low TRV	1.00E+00	2.25E+02	9.00E-05	1.70E-02	2.38E+00	3.60E-03	3.20E-02	1.99E+00	3.30E-04	7.40E-02	2.15E-05	5.70E-04	1.69E-02	1.74E+00	1.16E+00	1.50E+00
Zinc																
High TRV	1.00E+00	3.48E+02	9.00E-05	2.85E-01	6.17E+01	3.60E-03	5.48E-01	5.28E+01	3.30E-04	8.21E-01	2.38E-04	5.70E-04	1.69E-02	1.60E+01	4.73E+02	3.39E-02
Low TRV	1.00E+00	3.48E+02	9.00E-05	2.85E-01	6.17E+01	3.60E-03	5.48E-01	5.28E+01	3.30E-04	8.21E-01	2.38E-04	5.70E-04	1.69E-02	1.60E+01	9.85E+00	1.63E+00
Total Aroclors																
High TRV	1.00E+00	1.10E+00	9.00E-05	2.59E+00	1.78E+00	3.60E-03	7.54E+00	2.31E+00	3.30E-04	1.62E+01	4.70E-03	5.70E-04	1.69E-02	4.29E-01	1.30E+00	3.29E-01
Low TRV	1.00E+00	1.10E+00	9.00E-05	2.59E+00	1.78E+00	3.60E-03	7.54E+00	2.31E+00	3.30E-04	1.62E+01	4.70E-03	5.70E-04	1.69E-02	4.29E-01	3.64E-01	1.18E+00
HIGH AND LOW TRV HQs FOR SUBSURFACE SEDIMENT (2.5 TO 4 FEET BGS)																
Aluminum																
High TRV	1.00E+00	9.88E+03	9.00E-04	4.00E-03	3.95E+01	3.60E-03	4.00E-03	1.09E+01	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	5.34E+02	2.00E+01	2.67E+01
Low TRV	1.00E+00	9.88E+03	9.00E-04	4.00E-03	3.95E+01	3.60E-03	4.00E-03	1.09E+01	3.30E-04	2.20E-01	6.39E-04	5.70E-04	1.69E-02	5.34E+02	2.00E+00	2.67E+02
Cadmium																
High TRV	1.00E+00	3.21E+00	9.00E-04	7.91E-01	1.58E+00	3.60E-03	7.45E-01	6.62E-01	3.30E-04	5.01E-01	1.45E-03	5.70E-04	1.69E-02	5.20E-01	2.74E+00	1.90E-01
Low TRV	1.00E+00	3.21E+00	9.00E-04	7.91E-01	1.58E+00	3.60E-03	7.45E-01	6.62E-01	3.30E-04	5.01E-01	1.45E-03	5.70E-04	1.69E-02	5.20E-01	6.24E-02	8.33E+00
Copper																
High TRV	1.00E+00	4.15E+03	9.00E-04	1.65E-01	4.26E+02	3.60E-03	1.82E-01	2.09E+02	3.30E-04	7.96E-01	2.31E-03	5.70E-04	1.69E-02	3.15E+02	6.46E+02	4.88E-01
Low TRV	1.00E+00	4.15E+03	9.00E-04	1.65E-01	4.26E+02	3.60E-03	1.82E-01	2.09E+02	3.30E-04	7.96E-01	2.31E-03	5.70E-04	1.69E-02	3.15E+02	2.76E+00	1.14E+02
Lead																
High TRV	1.00E+00	4.84E+02	9.00E-04	1.70E-02	5.12E+00	3.60E-03	3.20E-02	4.29E+00	3.30E-04	7.40E-02	2.15E-04	5.70E-04	1.69E-02	2.69E+01	2.42E+02	1.11E-01
Low TRV	1.00E+00	4.84E+02	9.00E-04	1.70E-02	5.12E+00	3.60E-03	3.20E-02	4.29E+00	3.30E-04	7.40E-02	2.15E-04	5.70E-04	1.69E-02	2.69E+01	1.16E+00	2.31E+01
Molybdenum																
High TRV	1.00E+00	4.44E+00	9.00E-04	4.04E+00	1.12E+01	3.60E-03	4.26E+00	5.24E+00	3.30E-04	2.39E+00	6.93E-03	5.70E-04	1.69E-02	2.72E+00	2.69E+00	1.01E+00
Low TRV	1.00E+00	4.44E+00	9.00E-04	4.04E+00	1.12E+01	3.60E-03	4.26E+00	5.24E+00	3.30E-04	2.39E+00	6.93E-03	5.70E-04	1.69E-02	2.72E+00	2.69E-01	1.01E+01
Zinc																
High TRV	1.00E+00	4.52E+02	9.00E-04	2.85E-01	8.02E+01	3.60E-03	5.48E-02	6.86E+00	3.30E-04	8.21E-01	2.38E-03	5.70E-04	1.69E-02	4.12E+01	4.73E+02	8.72E-02
Low TRV	1.00E+00	4.52E+02	9.00E-04	2.85E-01	8.02E+01	3.60E-03	5.48E-01	6.86E+01	3.30E-04	8.21E-01	2.38E-03	5.70E-04	1.69E-02	4.24E+01	9.85E+00	4.31E+00
Total Aroclors																
High TRV	1.00E+00	3.00E+00	9.00E-04	2.59E+00	4.83E+00	3.60E-03	7.54E+00	6.26E+00	3.30E-04	1.62E+01	4.70E-02	5.70E-04	1.69E-02	1.31E+00	1.30E+00	1.00E+00
Low TRV	1.00E+00	3.00E+00	9.00E-04	2.59E+00	4.83E+00	3.60E-03	7.54E+00	6.26E+00	3.30E-04	1.62E+01	4.70E-02	5.70E-04	1.69E-02	1.31E+00	3.64E-01	3.59E+00
HMW PAHs																
High TRV	1.00E+00	8.69E+00	9.00E-04	3.46E-01	3.01E+00	3.60E-03	5.34E-01	1.29E+00	3.30E-04	4.41E-01	1.28E-03	5.70E-04	1.69E-02	1.13E+00	3.40E+01	3.32E-02
Low TRV	1.00E+00	8.69E+00	9.00E-04	3.46E-01	3.01E+00	3.60E-03	5.34E-01	1.29E+00	3.30E-04	4.41E-01	1.28E-03	5.70E-04	1.69E-02	1.13E+00	1.36E+00	8.30E-01

TABLE B-25: RISK CALCULATIONS FOR SHORELINE SURFACE AND SUBSURFACE SEDIMENTS FOR THE HOUSE MOUSE USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)
Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a	EPC is the lesser of the maximum concentration detected or the calculated UCL_{95}.
BAF	Bioaccumulation factor
bgs	Below ground surface
BW	Body weight
EPC	Exposure point concentration
HMW	High molecular weight
HQ	Hazard quotient
IR	Ingestion rate
kg	Kilogram
kg/day	Kilogram per day
mg/kg	Milligram per kilogram
mg/kg/day	Milligram per kilogram-day
PAH	Polynuclear aromatic hydrocarbon
SUF	Site use factor
Total Aroclors	Summed concentration of Aroclors
TRV	Toxicity reference value
UCL_{95}	95 percent upper confidence limit on the mean

TABLE B-26: SHORELINE SEDIMENTS (0 TO 2 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE EXPOSURE POINT CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet (*Macoma* Tissue)[b]		Willet (Soft-Bodied Invertebrate Tissue)		Surf Scoter[c]		Red-Tailed Hawk[d]		House Mouse[e]	
	HAZARD QUOTIENT									
Chemical	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV	High TRV	Low TRV
Aluminum	6.37E-03	6.37E-02	4.59E-02	4.59E-01	NA	NA	NA	NA	3.31E-01	**3.31E+00**
Copper	2.34E-01	**5.83E+00**	6.56E-01	**1.63E+01**	9.46E-02	**2.35E+00**	1.32E-02	3.28E-01	1.34E-02	**3.14E+00**
Lead	5.15E-01	**2.13E+02**	**1.97E+00**	**8.15E+02**	2.08E-01	**8.63E+01**	3.43E-02	**1.42E+01**	7.18E-03	**1.50E+00**
Thallium	3.33E-01	**3.33E+00**	3.33E-01	**3.33E+00**	1.34E-01	**1.34E+00**	NA	NA	NA	NA
Zinc	2.90E-01	**2.90E+00**	3.32E-01	**3.32E+00**	1.17E-01	**1.17E+00**	NA	NA	3.39E-02	**1.63E+00**
Total Aroclors	3.32E-01	**4.02E+00**	**1.14E+00**	**1.38E+01**	1.34E-01	**1.62E+00**	NA	NA	3.29E-01	**1.18E+00**
Total DDT	4.16E-02	**6.93E+00**	1.69E-01	**2.82E+01**	1.68E-02	**2.80E+00**	NA	NA	NA	NA
Dieldrin	NA	NA	7.15E-02	7.15E-01	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	1.78E-02	**2.97E+00**	1.78E-02	**2.97E+00**	7.20E-03	**1.20E+00**	NA	NA	NA	NA
Methoxychlor	**2.06E+00**	**3.43E+02**	**2.06E+00**	**3.43E+02**	8.31E-01	**1.39E+02**	NA	NA	NA	NA
4-Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
4-Nitrophenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzoic acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl alcohol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibenzofuran	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
HMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
LMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Pentachlorophenol	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tetrabutyltin	1.41E-02	8.84E-01	1.41E-02	8.84E-01	5.68E-03	3.57E-01	NA	NA	NA	NA
Tributyltin	NA	NA	7.15E-03	4.50E-01	NA	NA	NA	NA	NA	NA

TABLE B-26: SHORELINE SEDIMENTS (0 TO 2 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

Bold	Hazard Quotient exceeded 1.0
a	Reproductive or physiological impacts to the representative receptors listed in the table.
b	Hazard quotients were not calculated for dieldrin and tributyltin because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (see Table B-15).
c	Hazard quotients were not calculated for aluminum, dieldrin, and tributyltin because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (see Table B-15).
d	Hazard quotients were not calculated for aluminum, thallium, zinc, total aroclors, total DDT, dieldrin, heptachlor epoxide, methoxychlor, tetrabutyltin and tributyltin because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (see Table B-15).
e	Hazard quotients were not calculated for thallium, total DDT, dieldrin, heptachlor epoxide, methoxychlor, tetrabutyltin and tributyltin because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (see Table B-15).
bgs	Below ground surface
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
LMW	Low molecular weight
NA	Not applicable because hazard quotients based on maximum concentrations were less than 1
NC	TRV not available, hazard quotient not calculated
PAH	*Polynuclear aromatic hydrocarbon*
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

TABLE B-27: SHORELINE SEDIMENTS (2.5 TO 4 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE EXPOSURE POINT CONCENTRATION

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

	MEASUREMENT ENDPOINTS[a]									
	Willet (*Macoma* Tissue)[b]		Willet (Soft-Bodied Invertebrate Tissue)		Surf Scoter[c]		Red-Tailed Hawk[d]		House Mouse[e]	
	HAZARD QUOTIENT									
Chemical	**High TRV**	**Low TRV**	**High TRV**	**Low TRV**	**High TRV**	**Low TRV**	**High TRV**	**Low TRV**	**High TRV**	**Low TRV**
Aluminum	5.88E-02	5.88E-01	4.24E-01	**4.24E+00**	NA	NA	NA	NA	**2.67E+01**	**2.67E+02**
Cadmium	3.96E-02	**8.11E+00**	1.39E-01	**2.84E+01**	1.60E-02	**3.27E+00**	NA	NA	1.90E-01	**8.33E+00**
Copper	**3.16E+00**	**7.85E+01**	**8.84E+00**	**2.20E+02**	**1.28E+00**	**3.17E+01**	1.78E-01	**4.42E+00**	4.88E-01	**1.14E+02**
Lead	**1.11E+00**	**4.59E+02**	**4.23E+00**	**1.75E+03**	4.47E-01	**1.86E+02**	7.38E-02	**3.06E+01**	1.11E-01	**2.31E+01**
Molybdenum	7.50E-02	7.57E-01	4.62E-02	4.66E-01	NA	NA	NA	NA	**1.01E+00**	**1.01E+01**
Thallium	2.93E-01	**2.93E+00**	2.93E-01	**2.93E+00**	1.18E-01	**1.18E+00**	NA	NA	NA	NA
Zinc	3.77E-01	**3.77E+00**	4.31E-01	**4.31E+00**	1.52E-01	**1.52E+00**	NA	NA	8.73E-02	**4.31E+00**
Total Aroclors	9.01E-01	**1.09E+01**	**3.09E+00**	**3.75E+01**	3.64E-01	**4.41E+00**	NA	NA	1.00E+00	**3.59E+00**
Total DDT	5.87E-02	**9.48E+00**	2.39E-01	**3.98E+01**	2.37E-02	**3.95E+00**	NA	NA	NA	NA
Dieldrin	NA	NA	1.24E-01	**1.24E+00**	NA	NA	NA	NA	NA	NA
Methoxychlor	1.19E-01	**1.99E+01**	1.19E-01	**1.99E+01**	4.81E-02	**8.02E+00**	NA	NA	NA	NA
4-Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzoic acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl alcohol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dibenzofuran	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
HMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	3.32E-02	8.30E-01
LMW PAHs	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Pentachlorophenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

TABLE B-27: SHORELINE SEDIMENTS (2.5 TO 4 FEET BGS) HAZARD QUOTIENT BY MEASUREMENT ENDPOINT USING THE EXPOSURE POINT CONCENTRATION (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

Bold	Hazard quotient exceeded 1.0
a	Reproductive or physiological impacts to the representative receptors listed in the table.
b	Hazard quotients were not calculated for dieldrin because the hazard quotients based on the maximum concentrations were less than 1 (see Table B-16).
c	Hazard quotients were not calculated for aluminum, molybdenum, and dieldrin because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (see Table B-16).
d	Hazard quotients were not calculated for aluminum, cadmium, molybdenum, thallium, zinc, total Aroclors, total DDT, dieldrin, and methoxychlor because the hazard quotients based on the maximum concentrations were less than 1 for these chemicals (seeTable B-16).
e	Hazard quotients were not calculated for thallium, total DDT, dieldrin, and methoxychlor because the hazard quotiemts based on the maximum concentrations were less than 1 for these chemicals (see Table B-16).
bgs	Below ground surface
DDD	*Dichlorodiphenyldichloroethane*
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
HMW	High molecular weight
LMW	Low molecular weight
NA	Not applicable because hazard quotients based on maximum concentrations were less than 1
NC	TRV not available, hazard quotient not calculated
PAH	Polynuclear aromatic hydrocarbon
Total Aroclors	Summed concentration of Aroclors
Total DDT	Summed concentration of DDT and its metabolites (DDD and DDE)
TRV	Toxicity reference value

ATTACHMENT B1
GROUNDWATER DATA SUPPORTING THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT OF THE PARCEL B SHORELINE

Figure B1-1 Arsenic in Groundwater at 16 Shoreline Wells, Parcel B

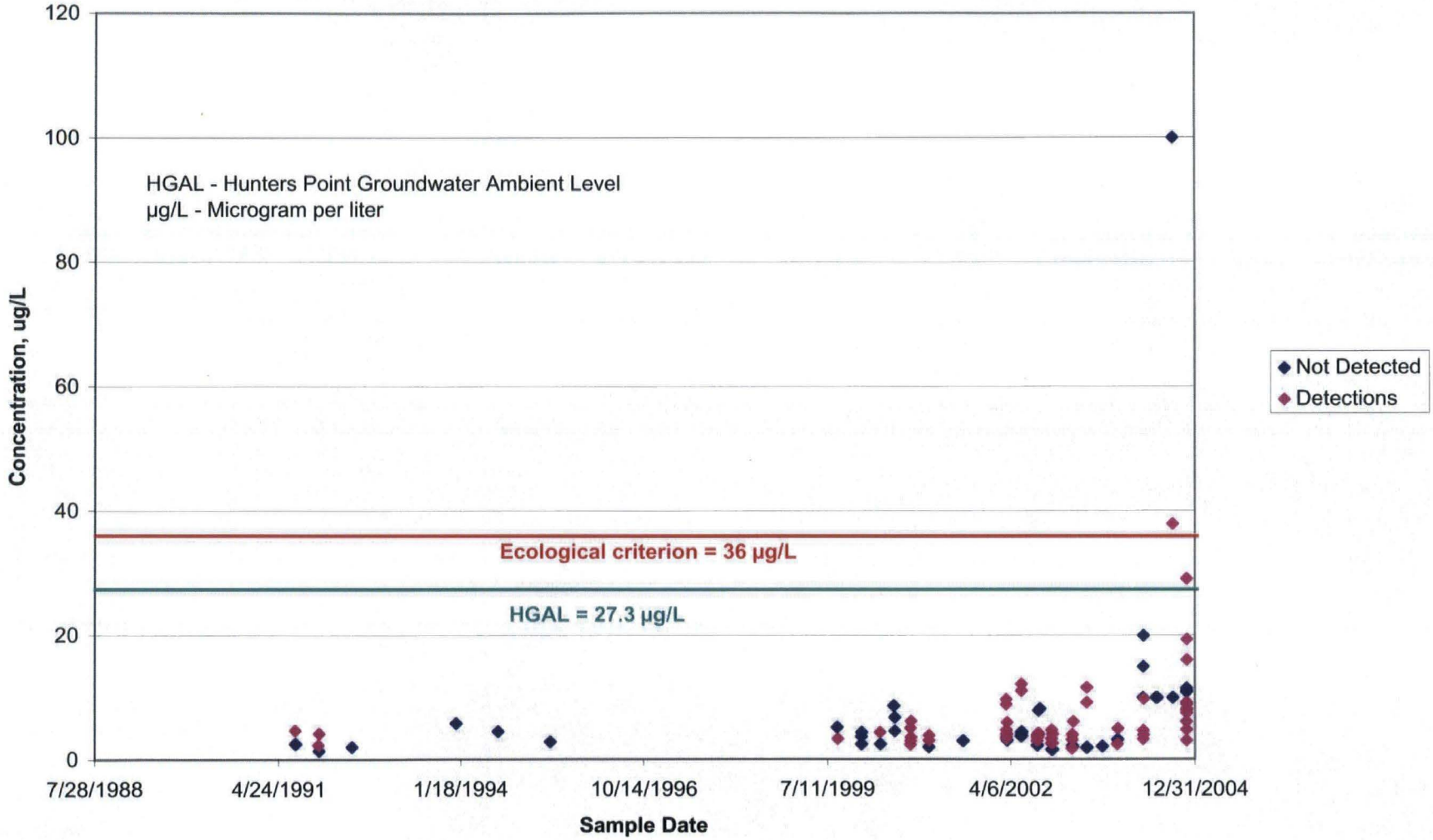

Figure B1-2a Copper in Groundwater at 16 Shoreline Wells, Parcel B

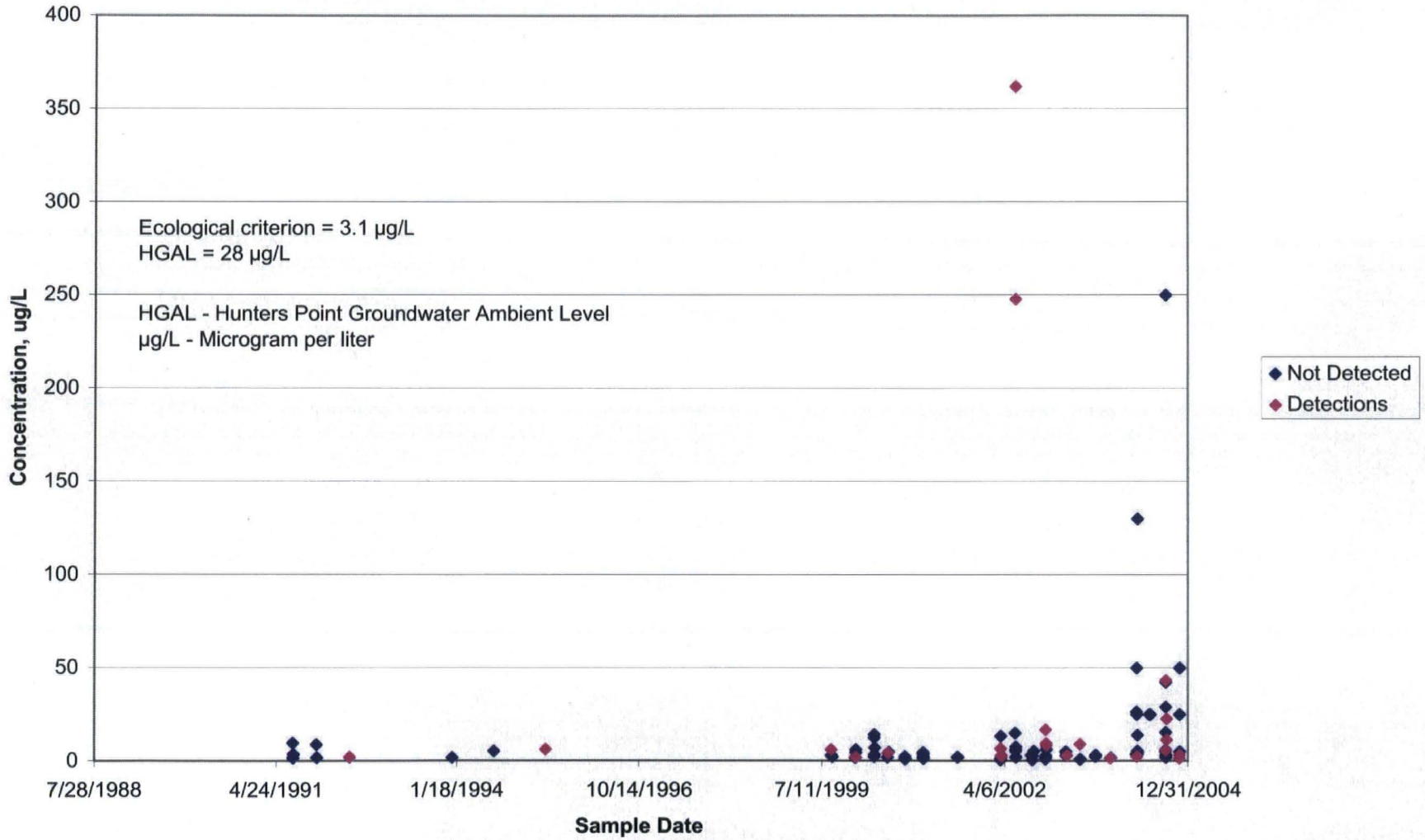

Figure B1-2b Copper in Groundwater at 16 Shoreline Wells, Parcel B (Detail View)

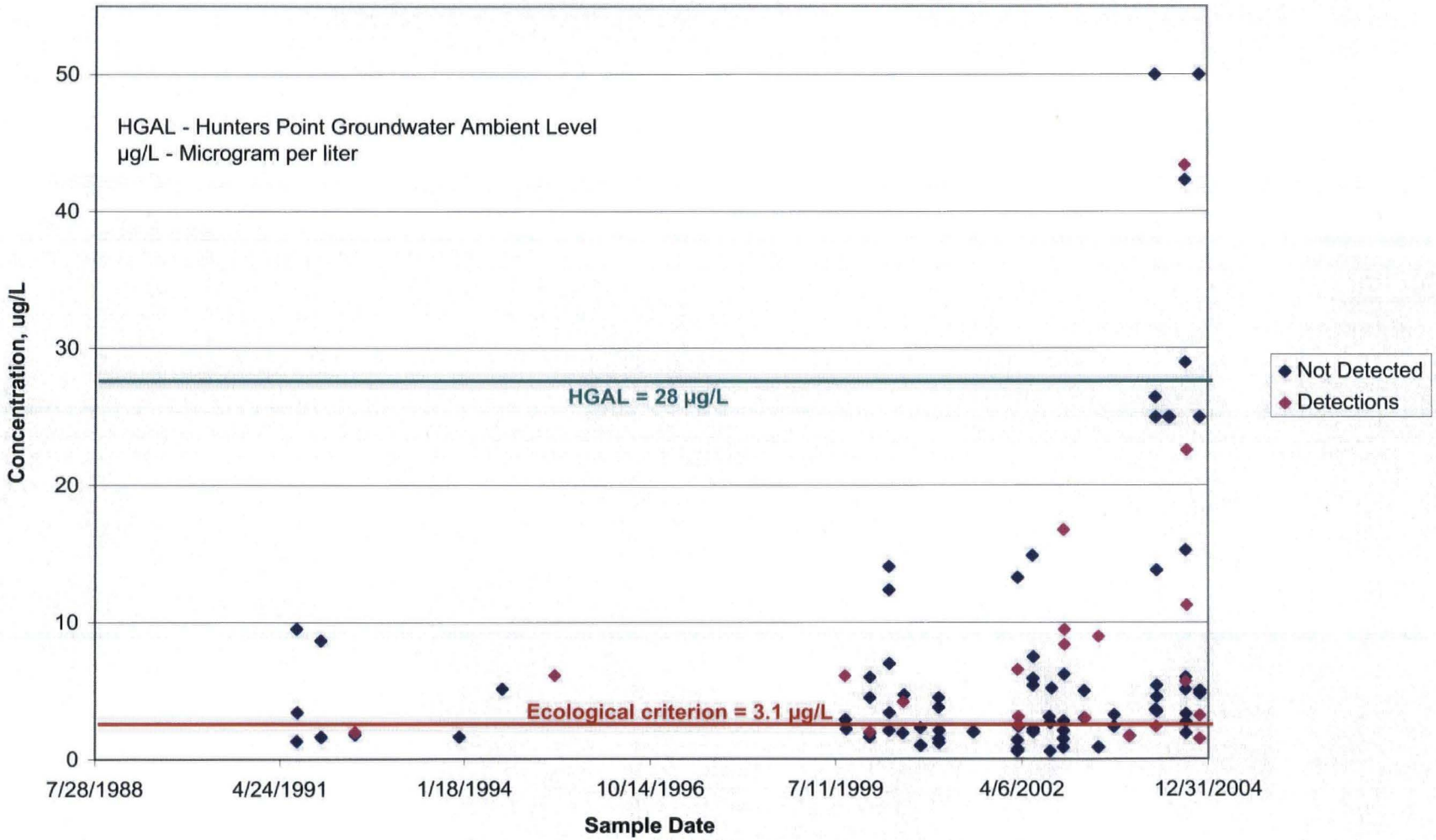

Figure B1-3a Lead in Groundwater at 16 Shoreline Wells, Parcel B

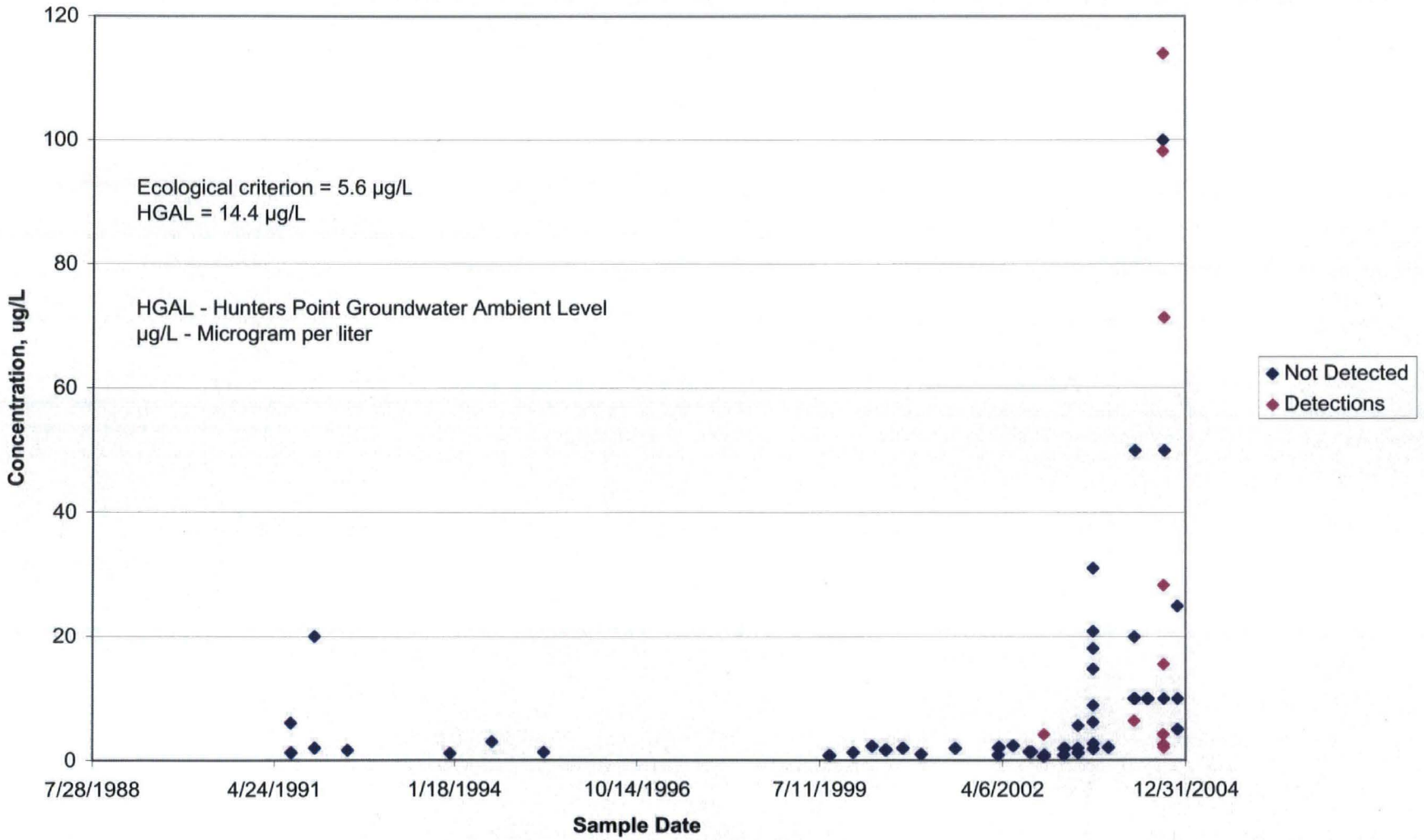

Figure B1-3b Lead in Groundwater at 16 Shoreline Wells, Parcel B (Detail View)

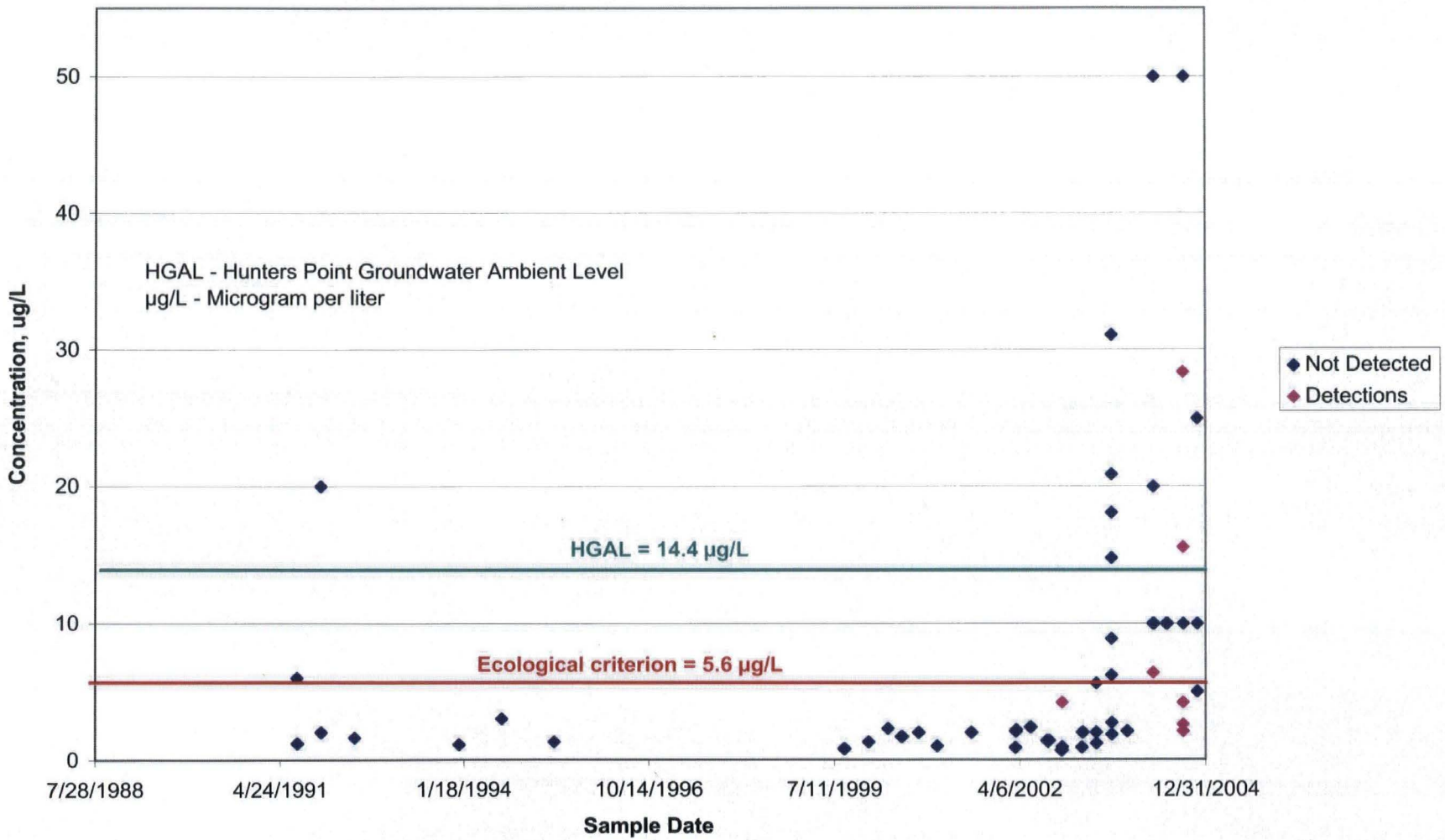

Figure B1-4 Mercury in Groundwater at 16 Shoreline Wells, Parcel B

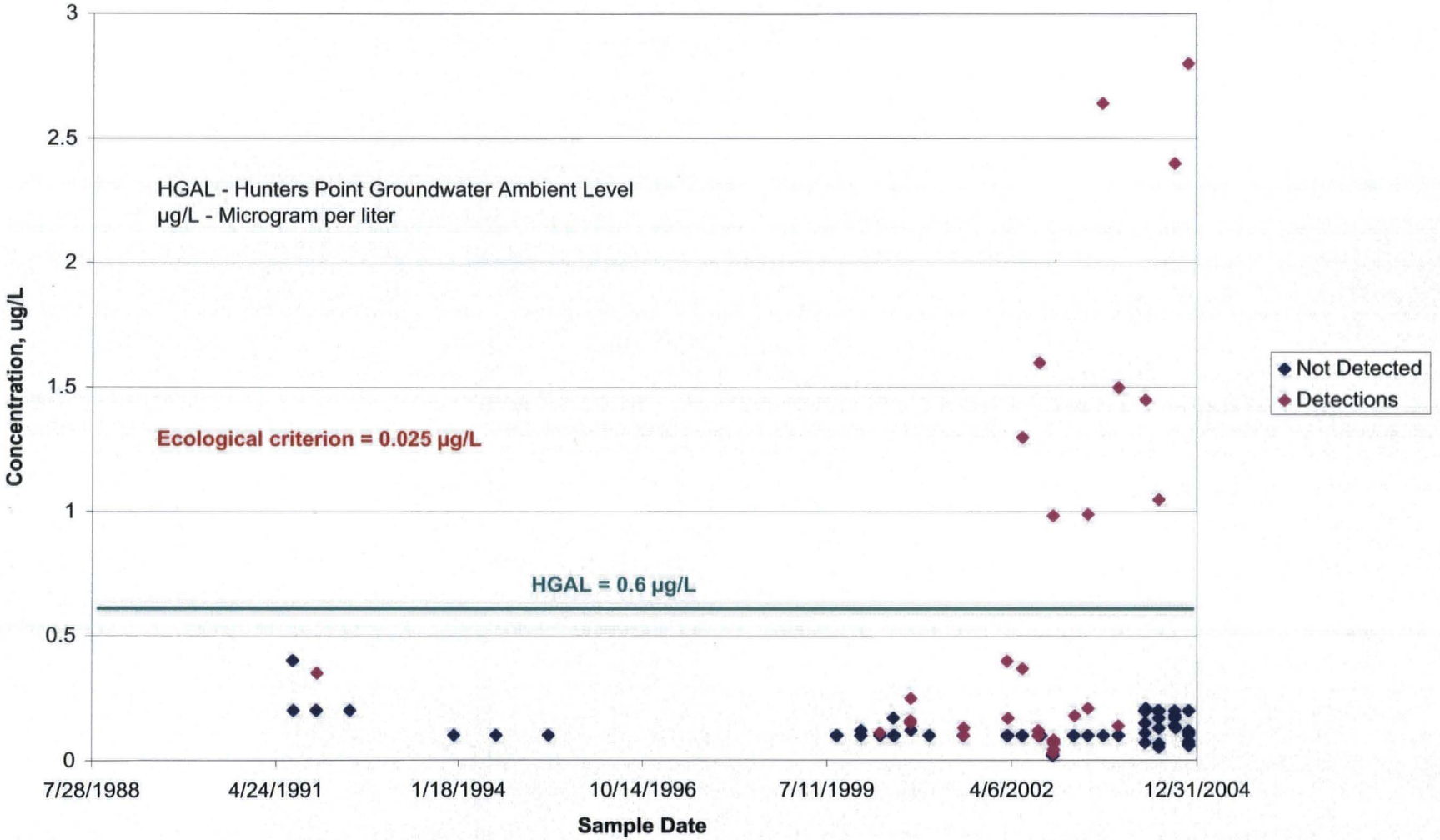

Figure B1-5 Selenium in Groundwater at 16 Shoreline Wells, Parcel B

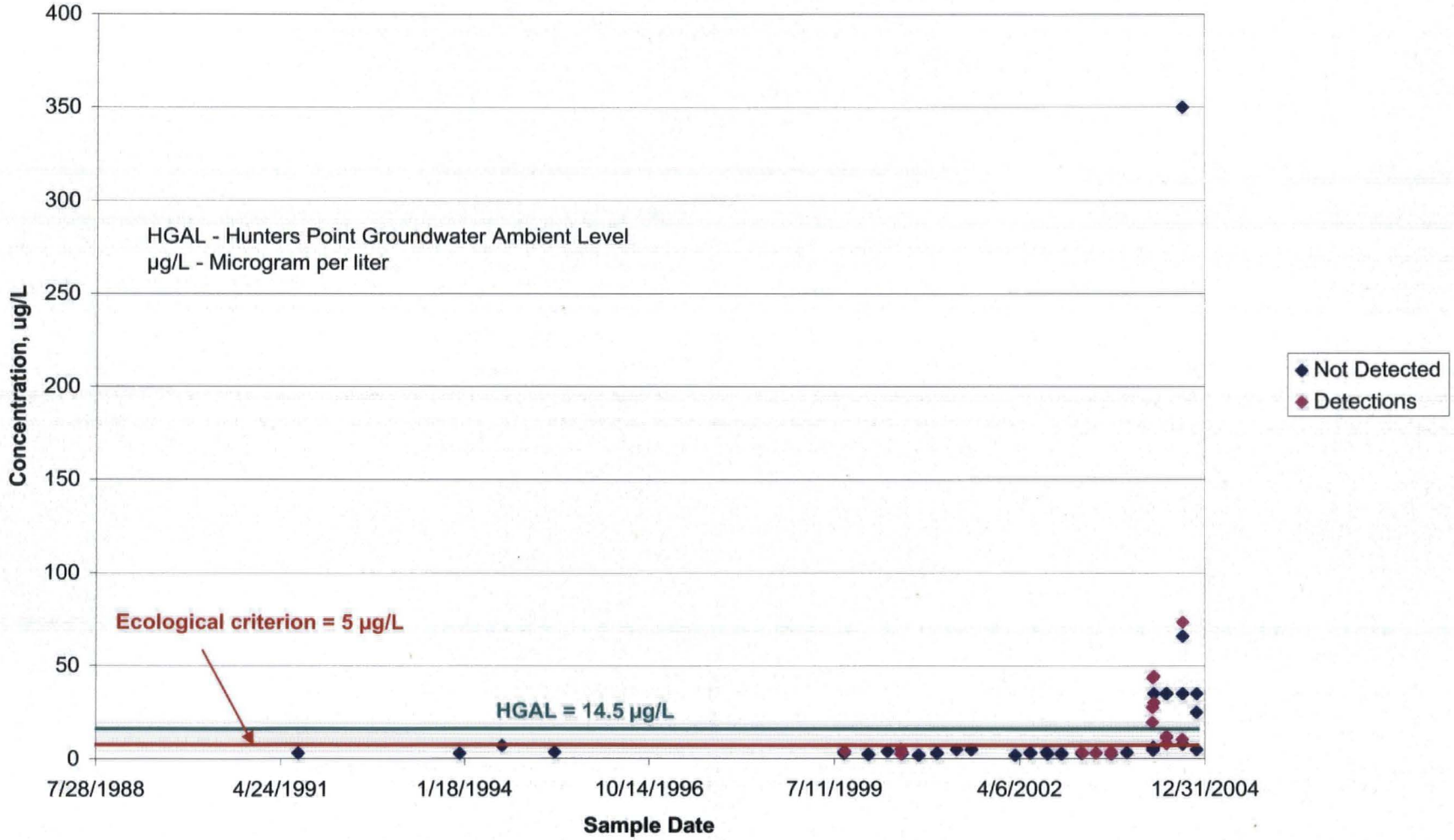

Figure B1-6a Zinc in Groundwater at 16 Shoreline Wells, Parcel B

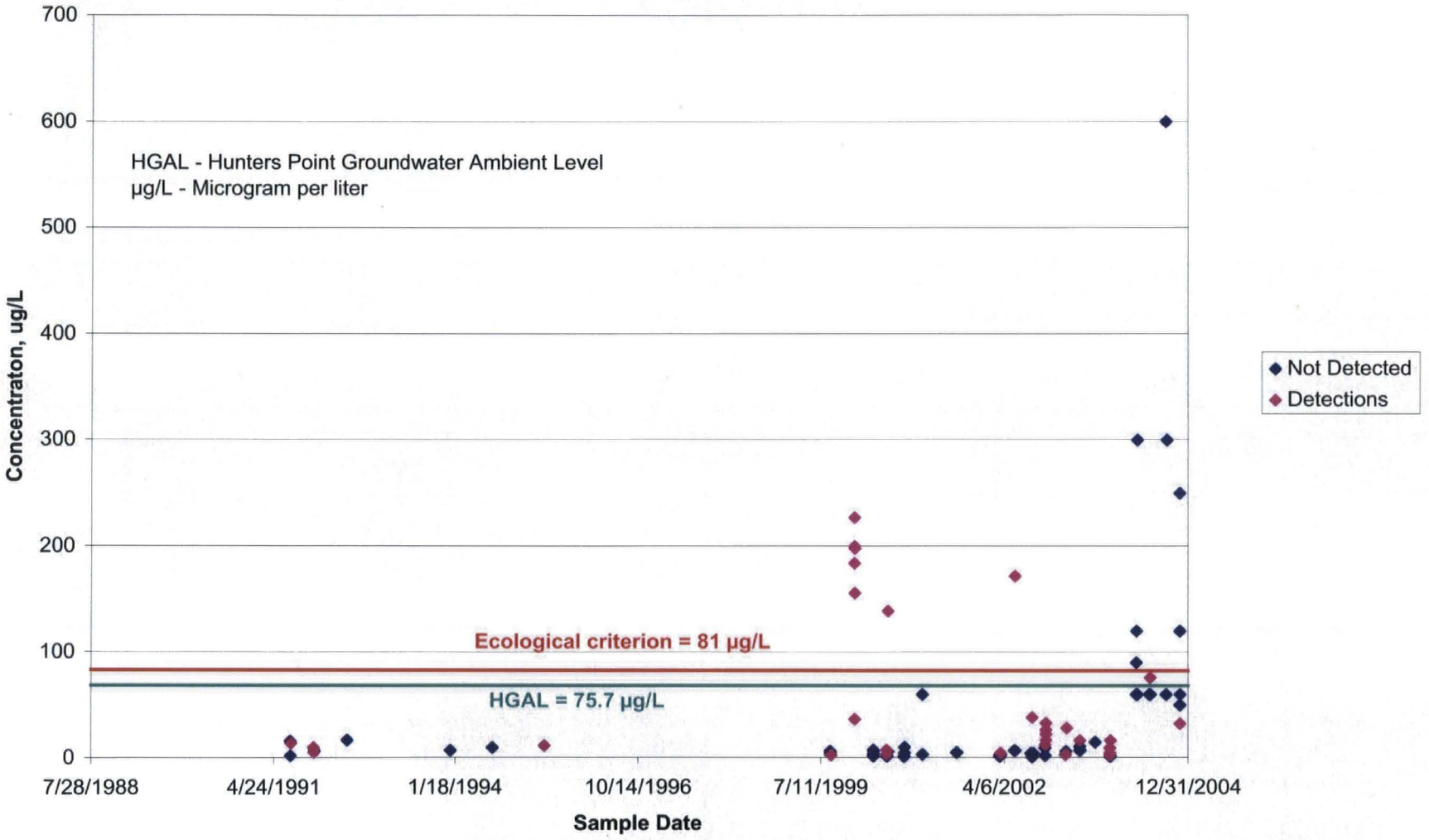

Figure B1-6b Zinc in Groundwater at 16 Shoreline Wells, Parcel B (Detail View)

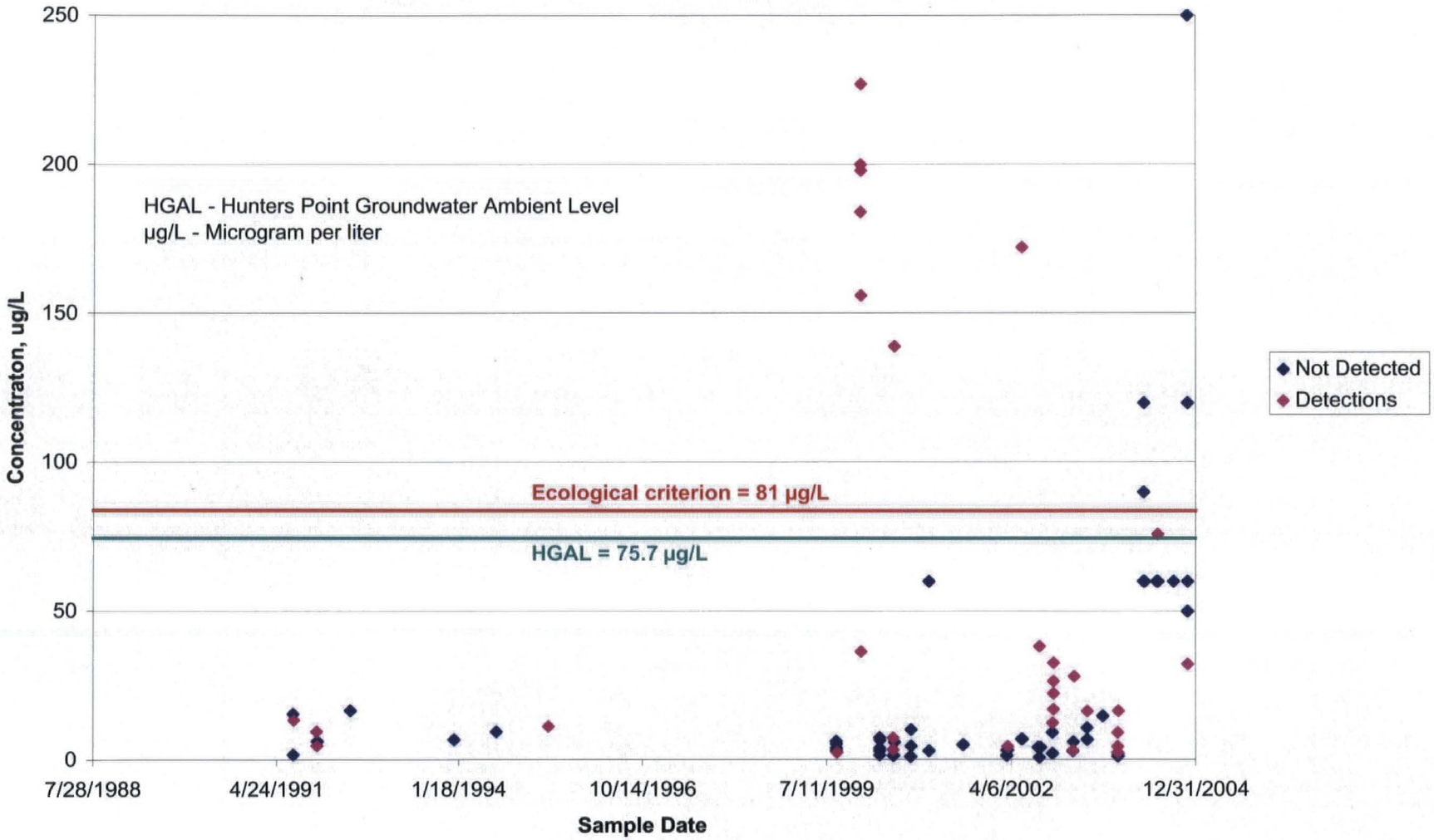

TABLE B1-1: CONCENTRATIONS OF ARSENIC IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	4.1	J	13-Mar-02
IR07MW19A	DMETAL	3.8	UJ1	31-May-02
IR07MW19A	DMETAL	2.3	UJ1	28-Aug-02
IR07MW19A	DMETAL	1.6	U	14-Nov-02
IR07MW19A	DMETAL	1.8		04-Mar-03
IR07MW19A	DMETAL	1.9	U	20-May-03
IR07MW19A	DMETAL	2.1	U	13-Aug-03
IR07MW19A	DMETAL	3.2	U	04-Nov-03
IR07MW19A	DMETAL	15	U	23-Mar-04
IR07MW19A	TMETAL	10	U	02-Jun-04
IR07MW19A	DMETAL	10	U	31-Aug-04
IR07MW19A	DMETAL	11.5	U	16-Nov-04
IR07MW20A1	DMETAL	4.775		14-Mar-02
IR07MW20A1	DMETAL	4.5	U4	04-Jun-02
IR07MW20A1	DMETAL	3.6	J1	29-Aug-02
IR07MW20A1	DMETAL	1.6	U	14-Nov-02
IR07MW20A1	DMETAL	4.05		05-Mar-03
IR07MW20A1	DMETAL	1.9	U	21-May-03
IR07MW20A1	DMETAL	2.1	U	14-Aug-03
IR07MW20A1	DMETAL	2.5		04-Nov-03
IR07MW20A1	DMETAL	20	U	24-Mar-04
IR07MW20A1	TMETAL	10	U	02-Jun-04
IR07MW20A1	DMETAL	10	U	31-Aug-04
IR07MW20A1	DMETAL	10.9	U1J3	16-Nov-04
IR07MW21A1	DMETAL	3.3	J	25-Mar-04
IR07MW21A1	TMETAL	10	U	03-Jun-04
IR07MW21A1	DMETAL	38	J	01-Sep-04
IR07MW21A1	DMETAL	6.1		16-Nov-04
IR07MW21A1D	DMETAL	2.5	U	29-Jul-91
IR07MW21A1D	DMETAL	1.4	U	04-Dec-91
IR07MW21A1D	DMETAL	2	U	03-Jun-92
IR07MW21A1D	DMETAL	5.2	U	02-Sep-99
IR07MW21A1D	DMETAL	3.7	U1	13-Jan-00
IR07MW21A1D	DMETAL	2.5	UJ1	25-Apr-00
IR07MW21A1D	DMETAL	8.7	U	07-Jul-00
IR07MW21A1D	TMETAL	8.7	U	07-Jul-00
IR07MW24A	DMETAL	4.7	J	25-Mar-04
IR07MW24A	TMETAL	10	U	03-Jun-04
IR07MW24A	DMETAL	100	U	01-Sep-04
IR07MW24A	DMETAL	8		16-Nov-04
IR07MW24AD	DMETAL	5.2	U	02-Sep-99
IR07MW24AD	DMETAL	4.4	U1	14-Jan-00
IR07MW24AD	DMETAL	4.4	J1	25-Apr-00

TABLE B1-1: CONCENTRATIONS OF ARSENIC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW24AD	DMETAL	6.8	U1	14-Jul-00
IR07MW24AD	DMETAL	6.2		13-Oct-00
IR07MW24AD	DMETAL	3.9	J1	18-Jan-01
IR07MW25A	DMETAL	9.8	J	26-Mar-04
IR07MW25A	TMETAL	10	U	02-Jun-04
IR07MW25A	DMETAL	100	U	01-Sep-04
IR07MW25A	DMETAL	9.2		16-Nov-04
IR07MW25AD	DMETAL	5.2	U	03-Sep-99
IR07MW25AD	DMETAL	2.5	U	14-Jan-00
IR07MW25AD	DMETAL	2.5	UJ1	27-Apr-00
IR07MW25AD	DMETAL	4.6	U	14-Jul-00
IR07MW25AD	DMETAL	3.6	J1	13-Oct-00
IR07MW26A	TMETAL	10	U	03-Jun-04
IR07MW26A	DMETAL	100	U	01-Sep-04
IR07MW26A	DMETAL	29.2		16-Nov-04
IR07MW26AD	DMETAL	5.2	U	02-Sep-99
IR07MW26AD	DMETAL	2.5	U	14-Jan-00
IR07MW26AD	DMETAL	2.5	UJ1	25-Apr-00
IR07MW26AD	DMETAL	8.7	U	07-Jul-00
IR07MW26AD	TMETAL	8.7	U	07-Jul-00
IR07MW26AD	DMETAL	5.1	J1	10-Oct-00
IR07MW26AD	DMETAL	2	U	17-Jan-01
IR07MWS-2	DMETAL	3.4	J	13-Mar-02
IR07MWS-2	DMETAL	3.8	U	04-Jun-02
IR07MWS-2	DMETAL	3	J1	28-Aug-02
IR07MWS-2	DMETAL	1.6	U	19-Nov-02
IR07MWS-2	DMETAL	3.2	B	04-Mar-03
IR07MWS-2	DMETAL	1.9	U	20-May-03
IR07MWS-2	DMETAL	2.1	U	12-Aug-03
IR07MWS-2	DMETAL	3.2	U	04-Nov-03
IR07MWS-2	TMETAL	10	UJ3	07-Jun-04
IR07MWS-2	DMETAL	100	U	01-Sep-04
IR07MWS-2	DMETAL	11.1	U1J3	16-Nov-04
IR07MWS-2D	DMETAL	4.6		26-Jul-91
IR07MWS-2D	DMETAL	4.1	J3	05-Dec-91
IR07MWS-2D	DMETAL	2	UJ3	03-Jun-92
IR07MWS-4	DMETAL	4	J	26-Mar-04
IR07MWS-4	TMETAL	10	UJ3	07-Jun-04
IR07MWS-4	DMETAL	10	U	01-Sep-04
IR07MWS-4	DMETAL	7.6	J9	17-Nov-04
IR07MWS-4D	DMETAL	2.5	U	25-Jul-91
IR07MWS-4D	DMETAL	2.3		02-Dec-91
IR07MWS-4DD	TMETAL	5.2	UJ9	01-Sep-99

TABLE B1-1: CONCENTRATIONS OF ARSENIC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MWS-4DD	DMETAL	2.5	U	13-Jan-00
IR07MWS-4DD	DMETAL	2.5	UJ1	25-Apr-00
IR07MWS-4DD	DMETAL	8.7	U	10-Jul-00
IR07MWS-4DD	DMETAL	2.4	J1	10-Oct-00
IR07MWS-4DD	TMETAL	2	U	17-Jan-01
IR07MWS-4DD	DMETAL	2	U	17-Jan-01
IR10MW31A1	DMETAL	3.6	U2	14-Mar-02
IR10MW31A1	DMETAL	3.8	U	03-Jun-02
IR10MW31A1	DMETAL	3.9		29-Aug-02
IR10MW31A1	DMETAL	2.6	J	19-Nov-02
IR10MW31A1	DMETAL	3.2	U	05-Nov-03
IR10MW31A1	DMETAL	10	U	22-Mar-04
IR10MW31A1	TMETAL	10	UJ3	07-Jun-04
IR10MW31A1	DMETAL	10	UJ9	02-Sep-04
IR10MW31A1	DMETAL	7.5	J39	17-Nov-04
IR10MW31A1D	DMETAL	5.8	U	23-Dec-93
IR10MW31A1D	DMETAL	4.5	U	11-Aug-94
IR10MW31A1D	DMETAL	2.8	U1	23-May-95
IR26MW41A	DMETAL	3	U	20-Jul-01
IR26MW41A	DMETAL	3.1	U	18-Mar-02
IR26MW41A	DMETAL	4.2	U4	03-Jun-02
IR26MW41A	DMETAL	3.7	J	03-Sep-02
IR26MW41A	DMETAL	1.6	U	14-Nov-02
IR26MW41A	DMETAL	2.2	U	05-Mar-03
IR26MW41A	DMETAL	1.9	U	21-May-03
IR26MW41A	DMETAL	2.1	U	13-Aug-03
IR26MW41A	DMETAL	3.2	U	05-Nov-03
IR26MW41A	TMETAL	10	U	07-Jun-04
IR26MW41A	DMETAL	4.8	J	17-Nov-04
IR26MW45A	DMETAL	3.35		07-Sep-99
IR26MW45A	DMETAL	2.5	U	12-Jan-00
IR26MW45A	DMETAL	2.5	UJ1	26-Apr-00
IR26MW45A	DMETAL	4.6	U	14-Jul-00
IR26MW45A	DMETAL	3	J1	11-Oct-00
IR26MW45A	DMETAL	3.1	J1	19-Jan-01
IR26MW46A	DMETAL	9.7	J	12-Mar-02
IR26MW46A	DMETAL	12.2		03-Jun-02
IR26MW46A	DMETAL	8.2	U1	11-Sep-02
IR26MW46A	DMETAL	3.4	J	13-Nov-02
IR26MW46A	DMETAL	2	U	06-Mar-03
IR26MW46A	DMETAL	11.6		22-May-03
IR26MW46A	TMETAL	10	U	07-Jun-04
IR26MW46A	DMETAL	10	UJ9	02-Sep-04

TABLE B1-1: CONCENTRATIONS OF ARSENIC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR26MW46A	DMETAL	8.2	J39	17-Nov-04
IR26MW47A	DMETAL	8.9	J	12-Mar-02
IR26MW47A	DMETAL	11.1		03-Jun-02
IR26MW47A	DMETAL	7.9	U1	03-Sep-02
IR26MW47A	DMETAL	4.75		14-Nov-02
IR26MW47A	DMETAL	6.1	B	11-Mar-03
IR26MW47A	DMETAL	9.2	B	22-May-03
IR26MW47A	DMETAL	2.1	U	13-Aug-03
IR26MW47A	DMETAL	5		06-Nov-03
IR26MW47A	TMETAL	10	U	07-Jun-04
IR26MW47A	DMETAL	19.4	J39	17-Nov-04
IR26MW48A	DMETAL	3.1	U	18-Mar-02
IR26MW48A	DMETAL	4.4	U4	03-Jun-02
IR26MW48A	DMETAL	4.05	U	04-Sep-02
IR26MW48A	DMETAL	2.6	J	13-Nov-02
IR26MW48A	DMETAL	1.9	U	23-May-03
IR26MW48A	DMETAL	2.1	U	13-Aug-03
IR26MW48A	DMETAL	3.2	U	05-Nov-03
IR26MW48A	TMETAL	10	U	07-Jun-04
IR26MW48A	DMETAL	16.1	J39	17-Nov-04
IR46MW37A	TMETAL	3	UJ1	23-Jul-01
IR46MW37A	DMETAL	3	UJ1	23-Jul-01
IR46MW37A	DMETAL	4.1	J	18-Mar-02
IR46MW37A	DMETAL	3.8	U	04-Jun-02
IR46MW37A	DMETAL	2.3	UJ1	29-Aug-02
IR46MW37A	DMETAL	1.6	U	18-Nov-02
IR46MW37A	DMETAL	2.2	U	05-Mar-03
IR46MW37A	DMETAL	1.9	U	20-May-03
IR46MW37A	DMETAL	2.1	U	13-Aug-03
IR46MW37A	DMETAL	3.2	U	04-Nov-03
IR46MW37A	TMETAL	10	U	08-Jun-04
IR46MW37A	DMETAL	3.1	J9	17-Nov-04
PA50MW01A	DMETAL	6	J	18-Mar-02
PA50MW01A	DMETAL	4.4	U	04-Jun-02
PA50MW01A	DMETAL	4.3	J	03-Sep-02
PA50MW01A	DMETAL	4.1	J	18-Nov-02
PA50MW01A	DMETAL	4	B	05-Mar-03
PA50MW01A	DMETAL	1.9	U	21-May-03
PA50MW01A	DMETAL	2.1	UJ	14-Aug-03
PA50MW01A	TMETAL	10	U	08-Jun-04
PA50MW01A	DMETAL	10	UJ9	02-Sep-04
PA50MW01A	DMETAL	8.9	J39	17-Nov-04

TABLE B1-1: CONCENTRATIONS OF ARSENIC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Notes: Values shown in µg/L; values in bold exceed the screening level (36 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

B	Also detected in blank
DMETAL	Dissolved metals
J	Estimated value
TMETAL	Total metals
U	Not detected
µg/L	Microgram per liter

TABLE B1-2: CONCENTRATIONS OF COPPER IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	0.74	U1	13-Mar-02
IR07MW19A	DMETAL	14.9	U1	31-May-02
IR07MW19A	DMETAL	3.1	U	28-Aug-02
IR07MW19A	DMETAL	2.8	U1	14-Nov-02
IR07MW19A	DMETAL	5	U	04-Mar-03
IR07MW19A	DMETAL	0.9	U	20-May-03
IR07MW19A	DMETAL	2.4	U	13-Aug-03
IR07MW19A	DMETAL	1.7	U	04-Nov-03
IR07MW19A	DMETAL	26.45	U	23-Mar-04
IR07MW19A	TMETAL	25	U	02-Jun-04
IR07MW19A	DMETAL	5.7	J	31-Aug-04
IR07MW19A	DMETAL	50	U	16-Nov-04
IR07MW20A1	DMETAL	6.55		14-Mar-02
IR07MW20A1	DMETAL	2	UJ23	04-Jun-02
IR07MW20A1	DMETAL	3.1	U	29-Aug-02
IR07MW20A1	DMETAL	2.1	U1	14-Nov-02
IR07MW20A1	DMETAL	5	U	05-Mar-03
IR07MW20A1	DMETAL	0.9	U	21-May-03
IR07MW20A1	DMETAL	3.25	U	14-Aug-03
IR07MW20A1	DMETAL	1.675		04-Nov-03
IR07MW20A1	DMETAL	50	U	24-Mar-04
IR07MW20A1	TMETAL	25	U	02-Jun-04
IR07MW20A1	DMETAL	5.1	U	31-Aug-04
IR07MW20A1	DMETAL	4.8	U1	16-Nov-04
IR07MW21A1	DMETAL	25	U	25-Mar-04
IR07MW21A1	TMETAL	25	U	03-Jun-04
IR07MW21A1	DMETAL	15.3	U1	01-Sep-04
IR07MW21A1	DMETAL	5	U	16-Nov-04
IR07MW21A1D	DMETAL	3.4	U1	29-Jul-91
IR07MW21A1D	DMETAL	1.6	U	04-Dec-91
IR07MW21A1D	DMETAL	1.95		03-Jun-92
IR07MW21A1D	DMETAL	2.9	U	02-Sep-99
IR07MW21A1D	DMETAL	1.9	U	13-Jan-00
IR07MW21A1D	DMETAL	2.1	U	25-Apr-00
IR07MW21A1D	DMETAL	1.9	UJ1	07-Jul-00
IR07MW21A1D	TMETAL	1.9	UJ1	07-Jul-00
IR07MW24A	DMETAL	3.6	U1	25-Mar-04
IR07MW24A	TMETAL	25	U	03-Jun-04
IR07MW24A	DMETAL	250	U	01-Sep-04
IR07MW24A	DMETAL	1.5	J	16-Nov-04
IR07MW24AD	DMETAL	2.9	U	02-Sep-99
IR07MW24AD	DMETAL	1.9	U	14-Jan-00
IR07MW24AD	DMETAL	2.1	U	25-Apr-00

TABLE B1-2: CONCENTRATIONS OF COPPER IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW24AD	DMETAL	4.7	U	14-Jul-00
IR07MW24AD	DMETAL	1	U	13-Oct-00
IR07MW24AD	DMETAL	1.2	U1	18-Jan-01
IR07MW25A	DMETAL	25	U	26-Mar-04
IR07MW25A	TMETAL	25	U	02-Jun-04
IR07MW25A	DMETAL	29	U1	01-Sep-04
IR07MW25A	DMETAL	3.2	J	16-Nov-04
IR07MW25AD	DMETAL	2.9	U	03-Sep-99
IR07MW25AD	DMETAL	4.5	U1	14-Jan-00
IR07MW25AD	DMETAL	7	U1J3	27-Apr-00
IR07MW25AD	DMETAL	4.7	U	14-Jul-00
IR07MW25AD	DMETAL	1	U	13-Oct-00
IR07MW26A	DMETAL	130	UJ3	29-Mar-04
IR07MW26A	TMETAL	25	U	03-Jun-04
IR07MW26A	DMETAL	43.4	J	01-Sep-04
IR07MW26A	DMETAL	25	U	16-Nov-04
IR07MW26AD	DMETAL	2.9	U	02-Sep-99
IR07MW26AD	DMETAL	6	U1	14-Jan-00
IR07MW26AD	DMETAL	12.4	U1J3	25-Apr-00
IR07MW26AD	DMETAL	1.9	UJ1	07-Jul-00
IR07MW26AD	TMETAL	1.9	UJ1	07-Jul-00
IR07MW26AD	DMETAL	1	U	10-Oct-00
IR07MW26AD	DMETAL	1.5	U1	17-Jan-01
IR07MWS-2	DMETAL	1.4	U1	13-Mar-02
IR07MWS-2	DMETAL	7.5	U1J23	04-Jun-02
IR07MWS-2	DMETAL	3.1	U	28-Aug-02
IR07MWS-2	DMETAL	8.4	J	19-Nov-02
IR07MWS-2	DMETAL	5	U	04-Mar-03
IR07MWS-2	DMETAL	0.9	U	20-May-03
IR07MWS-2	DMETAL	2.4	U	12-Aug-03
IR07MWS-2	DMETAL	1.7	U	04-Nov-03
IR07MWS-2	DMETAL	130	UJ3	29-Mar-04
IR07MWS-2	TMETAL	25	U	07-Jun-04
IR07MWS-2	DMETAL	42.3	U1	01-Sep-04
IR07MWS-2	DMETAL	50	U	16-Nov-04
IR07MWS-2D	DMETAL	1.3	U	26-Jul-91
IR07MWS-2D	DMETAL	1.6	UJ7	05-Dec-91
IR07MWS-2D	DMETAL	1.8	U	03-Jun-92
IR07MWS-4	DMETAL	2.4	J	26-Mar-04
IR07MWS-4	TMETAL	25	U	07-Jun-04
IR07MWS-4	DMETAL	6	U1	01-Sep-04
IR07MWS-4	DMETAL	5	UJ9	17-Nov-04
IR07MWS-4D	DMETAL	9.5	U1	25-Jul-91

TABLE B1-2: CONCENTRATIONS OF COPPER IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MWS-4D	DMETAL	8.65	U	02-Dec-91
IR07MWS-4DD	TMETAL	6.1	J	01-Sep-99
IR07MWS-4DD	DMETAL	2	J1	13-Jan-00
IR07MWS-4DD	DMETAL	14.1	U1J3	25-Apr-00
IR07MWS-4DD	DMETAL	4.2	J1	10-Jul-00
IR07MWS-4DD	DMETAL	2.3	U2	10-Oct-00
IR07MWS-4DD	TMETAL	4.5	U1	17-Jan-01
IR07MWS-4DD	DMETAL	3.8	U1	17-Jan-01
IR10MW31A1	DMETAL	13.3	U2	14-Mar-02
IR10MW31A1	DMETAL	2	UJ23	03-Jun-02
IR10MW31A1	DMETAL	3.1	U	29-Aug-02
IR10MW31A1	DMETAL	9.5	J	19-Nov-02
IR10MW31A1	DMETAL	1.7	U	05-Nov-03
IR10MW31A1	DMETAL	3.6	U1	22-Mar-04
IR10MW31A1	TMETAL	25	U	07-Jun-04
IR10MW31A1	DMETAL	2.7	U1	02-Sep-04
IR10MW31A1	DMETAL	25	UJ9	17-Nov-04
IR10MW31A1D	DMETAL	1.6	U	23-Dec-93
IR10MW31A1D	DMETAL	5.1	U	11-Aug-94
IR10MW31A1D	DMETAL	6.1		23-May-95
IR26MW41A	DMETAL	2	UJ1	20-Jul-01
IR26MW41A	DMETAL	2.5	J	18-Mar-02
IR26MW41A	DMETAL	5.4	U1J23	03-Jun-02
IR26MW41A	DMETAL	0.6	UJ1	03-Sep-02
IR26MW41A	DMETAL	16.8	J	14-Nov-02
IR26MW41A	DMETAL	5	U	05-Mar-03
IR26MW41A	DMETAL	0.9	U	21-May-03
IR26MW41A	DMETAL	2.4	U	13-Aug-03
IR26MW41A	DMETAL	1.7	U	05-Nov-03
IR26MW41A	DMETAL	4.55	U	29-Mar-04
IR26MW41A	TMETAL	25	U	07-Jun-04
IR26MW41A	DMETAL	25	U	17-Nov-04
IR26MW45A	DMETAL	2.2	U	07-Sep-99
IR26MW45A	DMETAL	1.6	UJ1	12-Jan-00
IR26MW45A	DMETAL	3.4	U1J3	26-Apr-00
IR26MW45A	DMETAL	4.7	U	14-Jul-00
IR26MW45A	DMETAL	1	U	11-Oct-00
IR26MW45A	DMETAL	2.1	U1	19-Jan-01
IR26MW46A	DMETAL	0.6	U	12-Mar-02
IR26MW46A	DMETAL	5.9	U1J23	03-Jun-02
IR26MW46A	DMETAL	5.2	U2	11-Sep-02
IR26MW46A	DMETAL	1.5	U1	13-Nov-02
IR26MW46A	DMETAL	3	UJ3	06-Mar-03

TABLE B1-2: CONCENTRATIONS OF COPPER IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR26MW46A	DMETAL	9	B	22-May-03
IR26MW46A	DMETAL	13.85	U	29-Mar-04
IR26MW46A	TMETAL	25	U	07-Jun-04
IR26MW46A	DMETAL	1.9	U1	02-Sep-04
IR26MW46A	DMETAL	25	UJ9	17-Nov-04
IR26MW47A	DMETAL	0.6	U	12-Mar-02
IR26MW47A	DMETAL	248	J23	03-Jun-02
IR26MW47A	DMETAL	0.6	UJ1	03-Sep-02
IR26MW47A	DMETAL	16.8		14-Nov-02
IR26MW47A	DMETAL	3	B	11-Mar-03
IR26MW47A	DMETAL	0.9	U	22-May-03
IR26MW47A	DMETAL	2.4	U	13-Aug-03
IR26MW47A	DMETAL	1.7	U	06-Nov-03
IR26MW47A	DMETAL	130	U	29-Mar-04
IR26MW47A	TMETAL	25	U	07-Jun-04
IR26MW47A	DMETAL	11.3	J	07-Sep-04
IR26MW47A	DMETAL	50	UJ9	17-Nov-04
IR26MW48A	DMETAL	3.1	J	18-Mar-02
IR26MW48A	DMETAL	2	UJ23	03-Jun-02
IR26MW48A	DMETAL	2.65	U	04-Sep-02
IR26MW48A	DMETAL	0.88	U1	13-Nov-02
IR26MW48A	DMETAL	0.9	U	23-May-03
IR26MW48A	DMETAL	2.4	U	13-Aug-03
IR26MW48A	DMETAL	1.7	U	05-Nov-03
IR26MW48A	DMETAL	130	UJ3	29-Mar-04
IR26MW48A	TMETAL	25	U	07-Jun-04
IR26MW48A	DMETAL	22.6	J	07-Sep-04
IR26MW48A	DMETAL	50	UJ9	17-Nov-04
IR46MW37A	DMETAL	2	U	23-Jul-01
IR46MW37A	TMETAL	2	U	23-Jul-01
IR46MW37A	DMETAL	2.4	U	18-Mar-02
IR46MW37A	DMETAL	2.2	U1J23	04-Jun-02
IR46MW37A	DMETAL	3.1	U	29-Aug-02
IR46MW37A	DMETAL	6.2	U1	18-Nov-02
IR46MW37A	DMETAL	5	U	05-Mar-03
IR46MW37A	DMETAL	0.9	U	20-May-03
IR46MW37A	DMETAL	2.4	U	13-Aug-03
IR46MW37A	DMETAL	1.7	U	04-Nov-03
IR46MW37A	DMETAL	5.4	U1J3	29-Mar-04
IR46MW37A	TMETAL	25	U	08-Jun-04
IR46MW37A	DMETAL	25	UJ9	17-Nov-04
PA50MW01A	DMETAL	2.4	U	18-Mar-02
PA50MW01A	DMETAL	362		04-Jun-02

TABLE B1-2: CONCENTRATIONS OF COPPER IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
PA50MW01A	DMETAL	0.6	UJ1	03-Sep-02
PA50MW01A	DMETAL	6.2	U1	18-Nov-02
PA50MW01A	DMETAL	5	U	05-Mar-03
PA50MW01A	DMETAL	0.9	U	21-May-03
PA50MW01A	DMETAL	2.4	U	14-Aug-03
PA50MW01A	DMETAL	3.5	U1J3	29-Mar-04
PA50MW01A	TMETAL	25	U	08-Jun-04
PA50MW01A	DMETAL	3.3	U1	02-Sep-04
PA50MW01A	DMETAL	25	UJ9	17-Nov-04

Notes: Values shown in µg/L; values in bold exceed the HGAL (28 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

B Also detected in blank
DMETAL Dissolved metals
HGAL Hunters Point groundwater ambient level
J Estimated value
TMETAL Total metals
U Not detected
µg/L Microgram per liter

TABLE B1-3: CONCENTRATIONS OF LEAD IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	0.9	U	13-Mar-02
IR07MW19A	DMETAL	2.4	U	31-May-02
IR07MW19A	DMETAL	1.4	U	28-Aug-02
IR07MW19A	DMETAL	0.7	U	14-Nov-02
IR07MW19A	DMETAL	0.9	U	04-Mar-03
IR07MW19A	DMETAL	2	U	20-May-03
IR07MW19A	DMETAL	20.9	UJ	13-Aug-03
IR07MW19A	DMETAL	2.1	U	04-Nov-03
IR07MW19A	DMETAL	6.4		23-Mar-04
IR07MW19A	TMETAL	10	U	02-Jun-04
IR07MW19A	DMETAL	2.6	J	31-Aug-04
IR07MW20A1	DMETAL	2.1	U	14-Mar-02
IR07MW20A1	DMETAL	2.4	U	04-Jun-02
IR07MW20A1	DMETAL	1.4	U	29-Aug-02
IR07MW20A1	DMETAL	0.7	U	14-Nov-02
IR07MW20A1	DMETAL	0.9	U	05-Mar-03
IR07MW20A1	DMETAL	2	U	21-May-03
IR07MW20A1	DMETAL	1.85	U	14-Aug-03
IR07MW20A1	DMETAL	2.1	U	04-Nov-03
IR07MW20A1	DMETAL	20	U	24-Mar-04
IR07MW20A1	TMETAL	10	U	02-Jun-04
IR07MW20A1	DMETAL	4.2		31-Aug-04
IR07MW21A1	DMETAL	10	U	25-Mar-04
IR07MW21A1	TMETAL	10	U	03-Jun-04
IR07MW21A1	DMETAL	100	U	01-Sep-04
IR07MW21A1	DMETAL	5	U	16-Nov-04
IR07MW21A1D	DMETAL	1.2	UJ3	29-Jul-91
IR07MW21A1D	DMETAL	2	U	04-Dec-91
IR07MW21A1D	DMETAL	1.6	U	03-Jun-92
IR07MW21A1D	DMETAL	0.8	UJ13	02-Sep-99
IR07MW21A1D	DMETAL	1.3	UJ3	13-Jan-00
IR07MW21A1D	DMETAL	2.3	U	25-Apr-00
IR07MW21A1D	DMETAL	1.7	UJ1	07-Jul-00
IR07MW21A1D	TMETAL	1.7	UJ1	07-Jul-00
IR07MW24A	DMETAL	10	U	25-Mar-04
IR07MW24A	TMETAL	10	U	03-Jun-04
IR07MW24A	DMETAL	100	U	01-Sep-04
IR07MW24A	DMETAL	5	U	16-Nov-04
IR07MW24AD	DMETAL	0.8	UJ13	02-Sep-99
IR07MW24AD	DMETAL	1.3	UJ3	14-Jan-00
IR07MW24AD	DMETAL	2.3	U	25-Apr-00
IR07MW24AD	DMETAL	1.7	U	14-Jul-00
IR07MW24AD	DMETAL	2	U	13-Oct-00

TABLE B1-3: CONCENTRATIONS OF LEAD IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW24AD	DMETAL	1	U	18-Jan-01
IR07MW25A	DMETAL	10	U	26-Mar-04
IR07MW25A	TMETAL	10	U	02-Jun-04
IR07MW25A	DMETAL	**28.4**	J	01-Sep-04
IR07MW25A	DMETAL	5	U	16-Nov-04
IR07MW25AD	DMETAL	0.8	UJ13	03-Sep-99
IR07MW25AD	DMETAL	1.3	UJ3	14-Jan-00
IR07MW25AD	DMETAL	2.3	U	27-Apr-00
IR07MW25AD	DMETAL	1.7	U	14-Jul-00
IR07MW25AD	DMETAL	2	U	13-Oct-00
IR07MW26A	DMETAL	50	U	29-Mar-04
IR07MW26A	TMETAL	10	U	03-Jun-04
IR07MW26A	DMETAL	**98.2**	J	01-Sep-04
IR07MW26A	DMETAL	25	U	16-Nov-04
IR07MW26AD	DMETAL	0.8	UJ13	02-Sep-99
IR07MW26AD	DMETAL	1.3	UJ3	14-Jan-00
IR07MW26AD	DMETAL	2.3	U	25-Apr-00
IR07MW26AD	DMETAL	1.7	UJ1	07-Jul-00
IR07MW26AD	TMETAL	1.7	UJ1	07-Jul-00
IR07MW26AD	DMETAL	1	U	17-Jan-01
IR07MWS-2	DMETAL	0.9	U	13-Mar-02
IR07MWS-2	DMETAL	2.4	U	04-Jun-02
IR07MWS-2	DMETAL	1.4	U	28-Aug-02
IR07MWS-2	DMETAL	0.7	U	19-Nov-02
IR07MWS-2	DMETAL	0.9	U	04-Mar-03
IR07MWS-2	DMETAL	2	U1	20-May-03
IR07MWS-2	DMETAL	6.2	UJ	12-Aug-03
IR07MWS-2	DMETAL	2.1	U	04-Nov-03
IR07MWS-2	DMETAL	50	U	29-Mar-04
IR07MWS-2	TMETAL	10	UJ3	07-Jun-04
IR07MWS-2	DMETAL	**114**		01-Sep-04
IR07MWS-2D	DMETAL	1.2	UJ3	26-Jul-91
IR07MWS-2D	DMETAL	2	UJ3	05-Dec-91
IR07MWS-2D	DMETAL	1.6	U	03-Jun-92
IR07MWS-4	DMETAL	10	U	26-Mar-04
IR07MWS-4	TMETAL	10	UJ3	07-Jun-04
IR07MWS-4	DMETAL	**15.6**		01-Sep-04
IR07MWS-4	DMETAL	5	U	17-Nov-04
IR07MWS-4D	DMETAL	6	UJ3	25-Jul-91
IR07MWS-4D	DMETAL	20	U	02-Dec-91
IR07MWS-4DD	TMETAL	0.8	UJ13	01-Sep-99
IR07MWS-4DD	DMETAL	1.3	U	13-Jan-00
IR07MWS-4DD	DMETAL	2.3	U	25-Apr-00

TABLE B1-3: CONCENTRATIONS OF LEAD IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MWS-4DD	DMETAL	1.7	UJ1	10-Jul-00
IR07MWS-4DD	DMETAL	2	UJ3	10-Oct-00
IR07MWS-4DD	TMETAL	1	U	17-Jan-01
IR07MWS-4DD	DMETAL	1	U	17-Jan-01
IR10MW31A1	DMETAL	2.1	U	14-Mar-02
IR10MW31A1	DMETAL	2.4	U	03-Jun-02
IR10MW31A1	DMETAL	1.4	U	29-Aug-02
IR10MW31A1	DMETAL	0.7	U	19-Nov-02
IR10MW31A1	DMETAL	2.1	U	05-Nov-03
IR10MW31A1	DMETAL	10	U	22-Mar-04
IR10MW31A1	TMETAL	10	UJ3	07-Jun-04
IR10MW31A1	DMETAL	10	U	02-Sep-04
IR10MW31A1D	DMETAL	1.1	U	23-Dec-93
IR10MW31A1D	DMETAL	3	U	11-Aug-94
IR10MW31A1D	DMETAL	1.3	U	23-May-95
IR26MW41A	DMETAL	2	U	20-Jul-01
IR26MW41A	DMETAL	2.1	U	18-Mar-02
IR26MW41A	DMETAL	2.4	U	03-Jun-02
IR26MW41A	DMETAL	1.3	U	03-Sep-02
IR26MW41A	DMETAL	0.7	U	14-Nov-02
IR26MW41A	DMETAL	0.9	U	05-Mar-03
IR26MW41A	DMETAL	2	U	21-May-03
IR26MW41A	DMETAL	18.1	UJ	13-Aug-03
IR26MW41A	DMETAL	2.1	U	05-Nov-03
IR26MW41A	DMETAL	10	U	29-Mar-04
IR26MW41A	TMETAL	10	U	07-Jun-04
IR26MW41A	DMETAL	10	U	17-Nov-04
IR26MW45A	DMETAL	0.8	U	07-Sep-99
IR26MW45A	DMETAL	1.3	U	12-Jan-00
IR26MW45A	DMETAL	2.3	U	26-Apr-00
IR26MW45A	DMETAL	1.7	U	14-Jul-00
IR26MW45A	DMETAL	2	UJ3	11-Oct-00
IR26MW45A	DMETAL	1	U	19-Jan-01
IR26MW46A	DMETAL	0.9	U	12-Mar-02
IR26MW46A	DMETAL	2.4	U	03-Jun-02
IR26MW46A	DMETAL	1.4	U	11-Sep-02
IR26MW46A	DMETAL	0.7	U	13-Nov-02
IR26MW46A	DMETAL	2	U	06-Mar-03
IR26MW46A	DMETAL	5.6	UJ3	22-May-03
IR26MW46A	DMETAL	10	U	29-Mar-04
IR26MW46A	TMETAL	10	U	07-Jun-04
IR26MW46A	DMETAL	2.1	J3	02-Sep-04
IR26MW47A	DMETAL	0.9	U	12-Mar-02

TABLE B1-3: CONCENTRATIONS OF LEAD IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR26MW47A	DMETAL	2.4	U	03-Jun-02
IR26MW47A	DMETAL	1.3	U	03-Sep-02
IR26MW47A	DMETAL	0.7	U	14-Nov-02
IR26MW47A	DMETAL	2	U	11-Mar-03
IR26MW47A	DMETAL	1.2	UJ3	22-May-03
IR26MW47A	DMETAL	8.9	UJ	13-Aug-03
IR26MW47A	DMETAL	2.1	U	06-Nov-03
IR26MW47A	DMETAL	50	U	29-Mar-04
IR26MW47A	TMETAL	10	U	07-Jun-04
IR26MW47A	DMETAL	50	U	07-Sep-04
IR26MW48A	DMETAL	2.1	U	18-Mar-02
IR26MW48A	DMETAL	2.4	U	03-Jun-02
IR26MW48A	DMETAL	1.3	U	04-Sep-02
IR26MW48A	DMETAL	0.7	U	13-Nov-02
IR26MW48A	DMETAL	1.2	U	23-May-03
IR26MW48A	DMETAL	14.8	UJ	13-Aug-03
IR26MW48A	DMETAL	2.1	U	05-Nov-03
IR26MW48A	DMETAL	50	U	29-Mar-04
IR26MW48A	TMETAL	10	U	07-Jun-04
IR26MW48A	DMETAL	71.5		07-Sep-04
IR46MW37A	DMETAL	2	UJ13	23-Jul-01
IR46MW37A	TMETAL	2	UJ13	23-Jul-01
IR46MW37A	DMETAL	2.2	U1	18-Mar-02
IR46MW37A	DMETAL	2.4	U	04-Jun-02
IR46MW37A	DMETAL	1.4	U	29-Aug-02
IR46MW37A	DMETAL	4.2		18-Nov-02
IR46MW37A	DMETAL	0.9	U	05-Mar-03
IR46MW37A	DMETAL	2	U1	20-May-03
IR46MW37A	DMETAL	31.1	U	13-Aug-03
IR46MW37A	DMETAL	2.1	U	04-Nov-03
IR46MW37A	DMETAL	10	UJ9	29-Mar-04
IR46MW37A	TMETAL	10	U	08-Jun-04
IR46MW37A	DMETAL	10	U	17-Nov-04
PA50MW01A	DMETAL	2.1	U	18-Mar-02
PA50MW01A	DMETAL	2.4	U	04-Jun-02
PA50MW01A	DMETAL	1.3	U	03-Sep-02
PA50MW01A	DMETAL	0.94	U1	18-Nov-02
PA50MW01A	DMETAL	0.9	U	05-Mar-03
PA50MW01A	DMETAL	2	U	21-May-03
PA50MW01A	DMETAL	2.7	U	14-Aug-03
PA50MW01A	DMETAL	10	U	29-Mar-04
PA50MW01A	TMETAL	10	U	08-Jun-04
PA50MW01A	DMETAL	10	U	02-Sep-04

TABLE B1-3: CONCENTRATIONS OF LEAD IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Notes: Values shown in µg/L; values in bold exceed the HGAL (14.4 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

DMETAL	Dissolved metals
HGAL	Hunters Point groundwater ambient level
J	Estimated value
TMETAL	Total metals
U	Not detected
µg/L	Microgram per liter

TABLE B1-4: CONCENTRATIONS OF MERCURY IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	0.1	U	13-Mar-02
IR07MW19A	DMETAL	0.1	U	31-May-02
IR07MW19A	DMETAL	0.1	U	28-Aug-02
IR07MW19A	DMETAL	0.019	U	14-Nov-02
IR07MW19A	DMETAL	0.1	U	04-Mar-03
IR07MW19A	DMETAL	0.1	U	20-May-03
IR07MW19A	DMETAL	0.1	U	13-Aug-03
IR07MW19A	DMETAL	0.1	U	04-Nov-03
IR07MW19A	DMETAL	0.15	U	23-Mar-04
IR07MW19A	TMETAL	0.2	U	02-Jun-04
IR07MW19A	DMETAL	0.2	U	31-Aug-04
IR07MW19A	DMETAL	0.1195	U	16-Nov-04
IR07MW20A1	DMETAL	0.1	U	14-Mar-02
IR07MW20A1	DMETAL	0.1	U	04-Jun-02
IR07MW20A1	DMETAL	0.1	U	29-Aug-02
IR07MW20A1	DMETAL	0.019	U	14-Nov-02
IR07MW20A1	DMETAL	0.1	U	05-Mar-03
IR07MW20A1	DMETAL	0.1	U	21-May-03
IR07MW20A1	DMETAL	0.1	U	14-Aug-03
IR07MW20A1	DMETAL	0.1	U	04-Nov-03
IR07MW20A1	DMETAL	0.2	U	24-Mar-04
IR07MW20A1	TMETAL	0.2	U	02-Jun-04
IR07MW20A1	DMETAL	0.2	U	31-Aug-04
IR07MW20A1	DMETAL	0.062	U1	16-Nov-04
IR07MW21A1	DMETAL	0.071	U1	25-Mar-04
IR07MW21A1	TMETAL	0.2	U	03-Jun-04
IR07MW21A1	DMETAL	0.2	U	01-Sep-04
IR07MW21A1	DMETAL	0.2	U1	16-Nov-04
IR07MW21A1D	DMETAL	0.2	U	29-Jul-91
IR07MW21A1D	DMETAL	0.2	U	04-Dec-91
IR07MW21A1D	DMETAL	0.2	U	03-Jun-92
IR07MW21A1D	DMETAL	0.1	U	02-Sep-99
IR07MW21A1D	DMETAL	0.1	U	13-Jan-00
IR07MW21A1D	DMETAL	0.1	UJ1	25-Apr-00
IR07MW21A1D	DMETAL	0.1	U	07-Jul-00
IR07MW21A1D	TMETAL	0.1	U	07-Jul-00
IR07MW24A	DMETAL	0.11	U1	25-Mar-04
IR07MW24A	TMETAL	0.2	U	03-Jun-04
IR07MW24A	DMETAL	0.2	U	01-Sep-04
IR07MW24A	DMETAL	0.076	U1	16-Nov-04
IR07MW24AD	DMETAL	0.1	U	02-Sep-99
IR07MW24AD	DMETAL	0.1	U	14-Jan-00
IR07MW24AD	DMETAL	0.1	UJ1	25-Apr-00

TABLE B1-4: CONCENTRATIONS OF MERCURY IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW24AD	DMETAL	0.1	U	14-Jul-00
IR07MW24AD	DMETAL	0.12	U	13-Oct-00
IR07MW24AD	DMETAL	0.1	U	18-Jan-01
IR07MW25A	DMETAL	0.15	U1	26-Mar-04
IR07MW25A	TMETAL	0.2	U	02-Jun-04
IR07MW25A	DMETAL	0.2	U	01-Sep-04
IR07MW25A	DMETAL	0.065	U1	16-Nov-04
IR07MW25AD	DMETAL	0.1	U	03-Sep-99
IR07MW25AD	DMETAL	0.1	U	14-Jan-00
IR07MW25AD	DMETAL	0.1	UJ1	27-Apr-00
IR07MW25AD	DMETAL	0.1	U	14-Jul-00
IR07MW25AD	DMETAL	0.12	U2	13-Oct-00
IR07MW26A	DMETAL	0.2	U	29-Mar-04
IR07MW26A	TMETAL	0.2	U	03-Jun-04
IR07MW26A	DMETAL	0.14	U1	01-Sep-04
IR07MW26A	DMETAL	0.102	U	16-Nov-04
IR07MW26AD	DMETAL	0.1	U	02-Sep-99
IR07MW26AD	DMETAL	0.12	U1	14-Jan-00
IR07MW26AD	DMETAL	0.11	J1	25-Apr-00
IR07MW26AD	DMETAL	0.1	U	07-Jul-00
IR07MW26AD	TMETAL	0.17	U1	07-Jul-00
IR07MW26AD	DMETAL	0.15	J3	10-Oct-00
IR07MW26AD	DMETAL	0.1	U	17-Jan-01
IR07MWS-2	DMETAL	0.1	U	13-Mar-02
IR07MWS-2	DMETAL	0.1	U	04-Jun-02
IR07MWS-2	DMETAL	0.1	U	28-Aug-02
IR07MWS-2	DMETAL	0.069	J	19-Nov-02
IR07MWS-2	DMETAL	0.1	U	04-Mar-03
IR07MWS-2	DMETAL	0.1	U	20-May-03
IR07MWS-2	DMETAL	0.1	U	12-Aug-03
IR07MWS-2	DMETAL	0.14		04-Nov-03
IR07MWS-2	DMETAL	0.21	U1	29-Mar-04
IR07MWS-2	TMETAL	0.2	U	07-Jun-04
IR07MWS-2	DMETAL	0.2	U	01-Sep-04
IR07MWS-2	DMETAL	0.2	U	16-Nov-04
IR07MWS-2D	DMETAL	0.4	UJ3	26-Jul-91
IR07MWS-2D	DMETAL	0.35		05-Dec-91
IR07MWS-2D	DMETAL	0.2	U	03-Jun-92
IR07MWS-4	DMETAL	0.2	U1	26-Mar-04
IR07MWS-4	TMETAL	0.2	U	07-Jun-04
IR07MWS-4	DMETAL	0.2	U	01-Sep-04
IR07MWS-4	DMETAL	0.076	U1	17-Nov-04
IR07MWS-4D	DMETAL	0.4	UJ3	25-Jul-91

TABLE B1-4: CONCENTRATIONS OF MERCURY IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MWS-4D	DMETAL	0.2	U	02-Dec-91
IR07MWS-4DD	TMETAL	0.1	U	01-Sep-99
IR07MWS-4DD	DMETAL	0.1	U	13-Jan-00
IR07MWS-4DD	DMETAL	0.1	UJ1	25-Apr-00
IR07MWS-4DD	DMETAL	0.1	U	10-Jul-00
IR07MWS-4DD	DMETAL	0.16	J	10-Oct-00
IR07MWS-4DD	TMETAL	0.1	U	17-Jan-01
IR07MWS-4DD	DMETAL	0.1	U	17-Jan-01
IR10MW31A1	DMETAL	0.1	U	14-Mar-02
IR10MW31A1	DMETAL	0.37		03-Jun-02
IR10MW31A1	DMETAL	0.1		29-Aug-02
IR10MW31A1	DMETAL	0.044	J	19-Nov-02
IR10MW31A1	DMETAL	0.1	U	05-Nov-03
IR10MW31A1	DMETAL	0.2	U	22-Mar-04
IR10MW31A1	TMETAL	0.053	U1	07-Jun-04
IR10MW31A1	DMETAL	0.17	U1	02-Sep-04
IR10MW31A1	DMETAL	0.2	U	17-Nov-04
IR10MW31A1D	DMETAL	0.1	U	23-Dec-93
IR10MW31A1D	DMETAL	0.1	U	11-Aug-94
IR10MW31A1D	DMETAL	0.1	U	23-May-95
IR26MW41A	DMETAL	0.1	U	20-Jul-01
IR26MW41A	DMETAL	0.1	U	18-Mar-02
IR26MW41A	DMETAL	0.1	U	03-Jun-02
IR26MW41A	DMETAL	0.1	U	03-Sep-02
IR26MW41A	DMETAL	0.029	J	14-Nov-02
IR26MW41A	DMETAL	0.1	U	05-Mar-03
IR26MW41A	DMETAL	0.1	U	21-May-03
IR26MW41A	DMETAL	0.1	U	13-Aug-03
IR26MW41A	DMETAL	0.1	U	05-Nov-03
IR26MW41A	DMETAL	0.2	U	29-Mar-04
IR26MW41A	TMETAL	0.17	U1	07-Jun-04
IR26MW41A	DMETAL	0.11	U1	17-Nov-04
IR26MW45A	DMETAL	0.1	U	07-Sep-99
IR26MW45A	DMETAL	0.1	U	12-Jan-00
IR26MW45A	DMETAL	0.1	UJ1	26-Apr-00
IR26MW45A	DMETAL	0.1	U	14-Jul-00
IR26MW45A	DMETAL	0.25		11-Oct-00
IR26MW45A	DMETAL	0.1	U	19-Jan-01
IR26MW46A	DMETAL	0.1	U	12-Mar-02
IR26MW46A	DMETAL	0.1	U	03-Jun-02
IR26MW46A	DMETAL	0.1	U	11-Sep-02
IR26MW46A	DMETAL	0.019	U	13-Nov-02
IR26MW46A	DMETAL	0.1	U	06-Mar-03

TABLE B1-4: CONCENTRATIONS OF MERCURY IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR26MW46A	DMETAL	0.21		22-May-03
IR26MW46A	DMETAL	0.2	U	29-Mar-04
IR26MW46A	TMETAL	0.129	U	07-Jun-04
IR26MW46A	DMETAL	0.18	U1	02-Sep-04
IR26MW46A	DMETAL	0.2	U	17-Nov-04
IR26MW47A	DMETAL	0.4		12-Mar-02
IR26MW47A	DMETAL	**1.3**		03-Jun-02
IR26MW47A	DMETAL	**1.6**		03-Sep-02
IR26MW47A	DMETAL	**0.985**		14-Nov-02
IR26MW47A	DMETAL	0.18	B	11-Mar-03
IR26MW47A	DMETAL	**0.99**		22-May-03
IR26MW47A	DMETAL	**2.64**		13-Aug-03
IR26MW47A	DMETAL	**1.5**		06-Nov-03
IR26MW47A	DMETAL	**1.45**		29-Mar-04
IR26MW47A	TMETAL	**1.05**		07-Jun-04
IR26MW47A	DMETAL	**2.4**		07-Sep-04
IR26MW47A	DMETAL	**2.8**		17-Nov-04
IR26MW48A	DMETAL	0.17	J	18-Mar-02
IR26MW48A	DMETAL	0.1	U	03-Jun-02
IR26MW48A	DMETAL	0.1	U	04-Sep-02
IR26MW48A	DMETAL	0.022	U2	13-Nov-02
IR26MW48A	DMETAL	0.1	U	23-May-03
IR26MW48A	DMETAL	0.1	U	13-Aug-03
IR26MW48A	DMETAL	0.1	U	05-Nov-03
IR26MW48A	DMETAL	0.2	U	29-Mar-04
IR26MW48A	TMETAL	0.067	U1	07-Jun-04
IR26MW48A	DMETAL	0.13	U1	07-Sep-04
IR26MW48A	DMETAL	0.2	U	17-Nov-04
IR46MW37A	DMETAL	0.1	J	23-Jul-01
IR46MW37A	TMETAL	0.13	J	23-Jul-01
IR46MW37A	DMETAL	0.1	U	18-Mar-02
IR46MW37A	DMETAL	0.1	U	04-Jun-02
IR46MW37A	DMETAL	0.12	J	29-Aug-02
IR46MW37A	DMETAL	0.083	J	18-Nov-02
IR46MW37A	DMETAL	0.1	U	05-Mar-03
IR46MW37A	DMETAL	0.1	U	20-May-03
IR46MW37A	DMETAL	0.1	U	13-Aug-03
IR46MW37A	DMETAL	0.1	U	04-Nov-03
IR46MW37A	DMETAL	0.2	U	29-Mar-04
IR46MW37A	TMETAL	0.2	U	08-Jun-04
IR46MW37A	DMETAL	0.059	U1	17-Nov-04
PA50MW01A	DMETAL	0.1	U	18-Mar-02
PA50MW01A	DMETAL	0.1	U	04-Jun-02

TABLE B1-4: CONCENTRATIONS OF MERCURY IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
PA50MW01A	DMETAL	0.1	U	03-Sep-02
PA50MW01A	DMETAL	0.075	J	18-Nov-02
PA50MW01A	DMETAL	0.1	U	05-Mar-03
PA50MW01A	DMETAL	0.1	U	21-May-03
PA50MW01A	DMETAL	0.1	U	14-Aug-03
PA50MW01A	DMETAL	0.2	U	29-Mar-04
PA50MW01A	TMETAL	0.2	U	08-Jun-04
PA50MW01A	DMETAL	0.18	U1	02-Sep-04
PA50MW01A	DMETAL	0.2	U	17-Nov-04

Notes: Values shown in µg/L; values in bold exceed the HGAL (0.6 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

B	Also detected in blank
DMETAL	Dissolved metals
HGAL	Hunters Point groundwater ambient level
J	Estimated value
TMETAL	Total metals
U	Not detected
µg/L	Microgram per liter

TABLE B1-5: CONCENTRATIONS OF SELENIUM IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	2	U	13-Mar-02
IR07MW19A	DMETAL	3.2	UJ3	31-May-02
IR07MW19A	DMETAL	3.6	U	28-Aug-02
IR07MW19A	DMETAL	2.8	U	14-Nov-02
IR07MW19A	DMETAL	2.9	U	04-Mar-03
IR07MW19A	DMETAL	3.2	U	20-May-03
IR07MW19A	DMETAL	3.9		13-Aug-03
IR07MW19A	DMETAL	3.3	U	04-Nov-03
IR07MW19A	DMETAL	27.55		23-Mar-04
IR07MW19A	TMETAL	35	U	02-Jun-04
IR07MW19A	DMETAL	35	U	31-Aug-04
IR07MW20A1	DMETAL	3.2	U	04-Jun-02
IR07MW20A1	DMETAL	3.6	U	29-Aug-02
IR07MW20A1	DMETAL	2.8	U	14-Nov-02
IR07MW20A1	DMETAL	2.9	U	05-Mar-03
IR07MW20A1	DMETAL	3.2	U	21-May-03
IR07MW20A1	DMETAL	2.5	U	14-Aug-03
IR07MW20A1	DMETAL	3.3	U	04-Nov-03
IR07MW20A1	DMETAL	43.55		24-Mar-04
IR07MW20A1	TMETAL	35	U	02-Jun-04
IR07MW20A1	DMETAL	10.5		31-Aug-04
IR07MW21A1	DMETAL	4.7	U1	25-Mar-04
IR07MW21A1	TMETAL	35	U	03-Jun-04
IR07MW21A1	DMETAL	350	U	01-Sep-04
IR07MW21A1	DMETAL	5	U	16-Nov-04
IR07MW21A1D	DMETAL	2.9	U	29-Jul-91
IR07MW21A1D	DMETAL	2.9	U	02-Sep-99
IR07MW21A1D	DMETAL	2.2	UJ1	13-Jan-00
IR07MW21A1D	DMETAL	4	U	25-Apr-00
IR07MW21A1D	DMETAL	2.8	J13	07-Jul-00
IR07MW21A1D	TMETAL	5.2	J13	07-Jul-00
IR07MW24A	DMETAL	5.5	U1	25-Mar-04
IR07MW24A	TMETAL	35	U	03-Jun-04
IR07MW24A	DMETAL	350	U	01-Sep-04
IR07MW24A	DMETAL	5	U	16-Nov-04
IR07MW24AD	DMETAL	2.9	U	02-Sep-99
IR07MW24AD	DMETAL	2.2	UJ1	14-Jan-00
IR07MW24AD	DMETAL	4	U	25-Apr-00
IR07MW24AD	DMETAL	3.6	J3	14-Jul-00
IR07MW24AD	DMETAL	2	U	13-Oct-00
IR07MW24AD	DMETAL	3	U	18-Jan-01
IR07MW25A	DMETAL	6.2	U1	26-Mar-04
IR07MW25A	TMETAL	35	U	02-Jun-04

TABLE B1-5: CONCENTRATIONS OF SELENIUM IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW25A	DMETAL	350	U	01-Sep-04
IR07MW25A	DMETAL	5	U	16-Nov-04
IR07MW25AD	DMETAL	2.9	U	03-Sep-99
IR07MW25AD	DMETAL	2.2	UJ1	14-Jan-00
IR07MW25AD	DMETAL	4	U	27-Apr-00
IR07MW25AD	DMETAL	2.7	U	14-Jul-00
IR07MW25AD	DMETAL	2	UJ1	13-Oct-00
IR07MW26A	DMETAL	44.5	J	29-Mar-04
IR07MW26A	TMETAL	35	U	03-Jun-04
IR07MW26A	DMETAL	73.7	J	01-Sep-04
IR07MW26A	DMETAL	25	U	16-Nov-04
IR07MW26AD	DMETAL	3.9	U1	02-Sep-99
IR07MW26AD	DMETAL	2.2	UJ1	14-Jan-00
IR07MW26AD	DMETAL	4	U	25-Apr-00
IR07MW26AD	DMETAL	2.7	UJ13	07-Jul-00
IR07MW26AD	TMETAL	2.7	UJ13	07-Jul-00
IR07MW26AD	DMETAL	2	U	10-Oct-00
IR07MW26AD	DMETAL	3	UJ1	17-Jan-01
IR07MWS-2	DMETAL	2	U	13-Mar-02
IR07MWS-2	DMETAL	3.2	U	04-Jun-02
IR07MWS-2	DMETAL	3.6	U	28-Aug-02
IR07MWS-2	DMETAL	2.8	U	19-Nov-02
IR07MWS-2	DMETAL	2.9	U	04-Mar-03
IR07MWS-2	DMETAL	3.2	U	20-May-03
IR07MWS-2	DMETAL	2.5	U	12-Aug-03
IR07MWS-2	DMETAL	3.3	U	04-Nov-03
IR07MWS-2	DMETAL	30.2	J9	29-Mar-04
IR07MWS-2	TMETAL	35	UJ3	07-Jun-04
IR07MWS-2	DMETAL	66.1	U1	01-Sep-04
IR07MWS-4	DMETAL	5.6	U1	26-Mar-04
IR07MWS-4	TMETAL	35	UJ3	07-Jun-04
IR07MWS-4	DMETAL	7.9	U1	01-Sep-04
IR07MWS-4	DMETAL	5	U	17-Nov-04
IR07MWS-4DD	TMETAL	3.7	U1	01-Sep-99
IR07MWS-4DD	DMETAL	2.5	UJ13	13-Jan-00
IR07MWS-4DD	DMETAL	4	U	25-Apr-00
IR07MWS-4DD	DMETAL	2.7	UJ13	10-Jul-00
IR07MWS-4DD	DMETAL	2	U	10-Oct-00
IR07MWS-4DD	TMETAL	3	UJ1	17-Jan-01
IR07MWS-4DD	DMETAL	3	UJ1	17-Jan-01
IR10MW31A1	DMETAL	3.2	U	03-Jun-02
IR10MW31A1	DMETAL	3.6	U	29-Aug-02
IR10MW31A1	DMETAL	2.8	U	19-Nov-02

TABLE B1-5: CONCENTRATIONS OF SELENIUM IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR10MW31A1	DMETAL	3.3	U	05-Nov-03
IR10MW31A1	DMETAL	19.6	J	22-Mar-04
IR10MW31A1	TMETAL	35	UJ3	07-Jun-04
IR10MW31A1	DMETAL	35	U	02-Sep-04
IR10MW31A1D	DMETAL	2.7	U	23-Dec-93
IR10MW31A1D	DMETAL	6.9	U	11-Aug-94
IR10MW31A1D	DMETAL	3.5	U	23-May-95
IR26MW41A	DMETAL	5	U	02-May-01
IR26MW41A	DMETAL	5	U	20-Jul-01
IR26MW41A	DMETAL	3.2	U	03-Jun-02
IR26MW41A	DMETAL	2.6	U	03-Sep-02
IR26MW41A	DMETAL	2.8	U	14-Nov-02
IR26MW41A	DMETAL	2.9	U	05-Mar-03
IR26MW41A	DMETAL	3.2	U	21-May-03
IR26MW41A	DMETAL	2.5	U	13-Aug-03
IR26MW41A	DMETAL	3.3	U	05-Nov-03
IR26MW41A	TMETAL	35	U	07-Jun-04
IR26MW41A	DMETAL	35	U	17-Nov-04
IR26MW45A	DMETAL	3.975		07-Sep-99
IR26MW45A	DMETAL	2.5	UJ13	12-Jan-00
IR26MW45A	DMETAL	4	U	26-Apr-00
IR26MW45A	DMETAL	2.7	U	14-Jul-00
IR26MW45A	DMETAL	2	U	11-Oct-00
IR26MW45A	DMETAL	3	U	19-Jan-01
IR26MW46A	DMETAL	3.7	BN	06-Mar-03
IR26MW46A	DMETAL	3.2	U	22-May-03
IR26MW46A	TMETAL	12.1		07-Jun-04
IR26MW47A	DMETAL	3		11-Mar-03
IR26MW47A	DMETAL	3.2	U	22-May-03
IR26MW47A	DMETAL	2.5	U	13-Aug-03
IR26MW47A	DMETAL	3.3	U	06-Nov-03
IR26MW47A	TMETAL	8.15		07-Jun-04
IR26MW48A	DMETAL	3.2	U	23-May-03
IR26MW48A	DMETAL	3		13-Aug-03
IR26MW48A	DMETAL	3.3	U	05-Nov-03
IR26MW48A	TMETAL	11.4	J	07-Jun-04
IR46MW37A	DMETAL	5	U	23-Jul-01
IR46MW37A	TMETAL	5	U	23-Jul-01
IR46MW37A	DMETAL	3.2	U	04-Jun-02
IR46MW37A	DMETAL	3.6	U	29-Aug-02
IR46MW37A	DMETAL	2.8	U	18-Nov-02
IR46MW37A	DMETAL	2.9	U	05-Mar-03
IR46MW37A	DMETAL	3.2	U	20-May-03

TABLE B1-5: CONCENTRATIONS OF SELENIUM IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR46MW37A	DMETAL	2.625		13-Aug-03
IR46MW37A	DMETAL	3.3	U	04-Nov-03
IR46MW37A	DMETAL	35	UJ9	29-Mar-04
IR46MW37A	TMETAL	35	U	08-Jun-04
IR46MW37A	DMETAL	35	U	17-Nov-04
PA50MW01A	DMETAL	3.2	U	04-Jun-02
PA50MW01A	DMETAL	2.8	U1	03-Sep-02
PA50MW01A	DMETAL	2.8	U	18-Nov-02
PA50MW01A	DMETAL	2.9	U	05-Mar-03
PA50MW01A	DMETAL	3.2	U	21-May-03
PA50MW01A	DMETAL	2.5	U	14-Aug-03
PA50MW01A	DMETAL	35	U	29-Mar-04
PA50MW01A	TMETAL	35	U	08-Jun-04
PA50MW01A	DMETAL	35	U	02-Sep-04

Notes: Values shown in bold µg/L; values in bold exceed the HGAL (14.5 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

B Also detected in blank
DMETAL Dissolved metals
HGAL Hunters Point groundwater ambient level
J Estimated value
TMETAL Total metals
U Not detected
µg/L Microgram per liter

TABLE B1-6: CONCENTRATIONS OF ZINC IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW19A	DMETAL	1.4	U	13-Mar-02
IR07MW19A	DMETAL	7	U	31-May-02
IR07MW19A	DMETAL	4.2	U	28-Aug-02
IR07MW19A	DMETAL	2.1	U	14-Nov-02
IR07MW19A	DMETAL	3	U	04-Mar-03
IR07MW19A	DMETAL	6.8	U	20-May-03
IR07MW19A	DMETAL	14.8	U	13-Aug-03
IR07MW19A	DMETAL	2.5		04-Nov-03
IR07MW19A	DMETAL	90	U	23-Mar-04
IR07MW19A	TMETAL	60	U	02-Jun-04
IR07MW19A	DMETAL	60	U	31-Aug-04
IR07MW19A	DMETAL	120	U	16-Nov-04
IR07MW20A1	DMETAL	3.2	U	14-Mar-02
IR07MW20A1	DMETAL	7	U	04-Jun-02
IR07MW20A1	DMETAL	4.2	U	29-Aug-02
IR07MW20A1	DMETAL	2.1	U	14-Nov-02
IR07MW20A1	DMETAL	3	U	05-Mar-03
IR07MW20A1	DMETAL	10.75	U	21-May-03
IR07MW20A1	DMETAL	14.8	U	14-Aug-03
IR07MW20A1	DMETAL	1.2	U	04-Nov-03
IR07MW20A1	DMETAL	120	U	24-Mar-04
IR07MW20A1	TMETAL	60	U	02-Jun-04
IR07MW20A1	DMETAL	60	U	31-Aug-04
IR07MW20A1	DMETAL	120	UJ3	16-Nov-04
IR07MW21A1	DMETAL	60	U	25-Mar-04
IR07MW21A1	TMETAL	60	U	03-Jun-04
IR07MW21A1	DMETAL	600	U	01-Sep-04
IR07MW21A1	DMETAL	50	U	16-Nov-04
IR07MW21A1D	DMETAL	13.2		29-Jul-91
IR07MW21A1D	DMETAL	4.625		04-Dec-91
IR07MW21A1D	DMETAL	16.5	U	03-Jun-92
IR07MW21A1D	DMETAL	3	U	02-Sep-99
IR07MW21A1D	DMETAL	**184**		13-Jan-00
IR07MW21A1D	DMETAL	3	U1	25-Apr-00
IR07MW21A1D	DMETAL	7.3	J	07-Jul-00
IR07MW21A1D	TMETAL	3.3	J	07-Jul-00
IR07MW24A	DMETAL	60	U	25-Mar-04
IR07MW24A	TMETAL	60	U	03-Jun-04
IR07MW24A	DMETAL	600	U	01-Sep-04
IR07MW24A	DMETAL	50	U	16-Nov-04
IR07MW24AD	DMETAL	3.8	U1	02-Sep-99
IR07MW24AD	DMETAL	**156**		14-Jan-00
IR07MW24AD	DMETAL	7.4	U1	25-Apr-00

TABLE B1-6: CONCENTRATIONS OF ZINC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MW24AD	DMETAL	5.9	U	14-Jul-00
IR07MW24AD	DMETAL	4.55	U	13-Oct-00
IR07MW24AD	DMETAL	3	U	18-Jan-01
IR07MW25A	DMETAL	60	U	26-Mar-04
IR07MW25A	TMETAL	60	U	02-Jun-04
IR07MW25A	DMETAL	600	U	01-Sep-04
IR07MW25A	DMETAL	50	U	16-Nov-04
IR07MW25AD	DMETAL	3	U	03-Sep-99
IR07MW25AD	DMETAL	36.4		14-Jan-00
IR07MW25AD	DMETAL	6.5	U1	27-Apr-00
IR07MW25AD	DMETAL	5.9	U	14-Jul-00
IR07MW25AD	DMETAL	10.1	U1	13-Oct-00
IR07MW26A	DMETAL	300	UJ3	29-Mar-04
IR07MW26A	TMETAL	60	U	03-Jun-04
IR07MW26A	DMETAL	600	U	01-Sep-04
IR07MW26A	DMETAL	250	U	16-Nov-04
IR07MW26AD	DMETAL	5.3	U1	02-Sep-99
IR07MW26AD	DMETAL	198		14-Jan-00
IR07MW26AD	DMETAL	1.5	U	25-Apr-00
IR07MW26AD	DMETAL	1.4	U	07-Jul-00
IR07MW26AD	TMETAL	1.4	U	07-Jul-00
IR07MW26AD	DMETAL	1	U	10-Oct-00
IR07MW26AD	DMETAL	60	UJ3	17-Jan-01
IR07MWS-2	DMETAL	1.4	U	13-Mar-02
IR07MWS-2	DMETAL	7	U	04-Jun-02
IR07MWS-2	DMETAL	4.2	U	28-Aug-02
IR07MWS-2	DMETAL	22.3		19-Nov-02
IR07MWS-2	DMETAL	3	U	04-Mar-03
IR07MWS-2	DMETAL	6.8	U	20-May-03
IR07MWS-2	DMETAL	14.8	U	12-Aug-03
IR07MWS-2	DMETAL	9.2		04-Nov-03
IR07MWS-2	DMETAL	300	UJ3	29-Mar-04
IR07MWS-2	TMETAL	60	UJ3	07-Jun-04
IR07MWS-2	DMETAL	600	U	01-Sep-04
IR07MWS-2	DMETAL	120	UJ3	16-Nov-04
IR07MWS-2D	DMETAL	1.6	U	26-Jul-91
IR07MWS-2D	DMETAL	6.1	U	05-Dec-91
IR07MWS-2D	DMETAL	16.5	U	03-Jun-92
IR07MWS-4	DMETAL	60	U	26-Mar-04
IR07MWS-4	TMETAL	60	UJ3	07-Jun-04
IR07MWS-4	DMETAL	60	U	01-Sep-04
IR07MWS-4	DMETAL	50	U	17-Nov-04
IR07MWS-4D	DMETAL	15.4	U2	25-Jul-91

TABLE B1-6: CONCENTRATIONS OF ZINC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR07MWS-4D	DMETAL	9.35		02-Dec-91
IR07MWS-4DD	TMETAL	6.2	U1J9	01-Sep-99
IR07MWS-4DD	DMETAL	**227**		13-Jan-00
IR07MWS-4DD	DMETAL	3.8	U1	25-Apr-00
IR07MWS-4DD	DMETAL	1.4	U	10-Jul-00
IR07MWS-4DD	DMETAL	1	U	10-Oct-00
IR07MWS-4DD	TMETAL	3	UJ3	17-Jan-01
IR07MWS-4DD	DMETAL	3	UJ3	17-Jan-01
IR10MW31A1	DMETAL	3.2	U	14-Mar-02
IR10MW31A1	DMETAL	7	U	03-Jun-02
IR10MW31A1	DMETAL	4.2	U	29-Aug-02
IR10MW31A1	DMETAL	17	J	19-Nov-02
IR10MW31A1	DMETAL	2.3	U	05-Nov-03
IR10MW31A1	DMETAL	60	U	22-Mar-04
IR10MW31A1	TMETAL	60	UJ3	07-Jun-04
IR10MW31A1	DMETAL	60	U	02-Sep-04
IR10MW31A1	DMETAL	60	UJ3	17-Nov-04
IR10MW31A1D	DMETAL	6.75	U	23-Dec-93
IR10MW31A1D	DMETAL	9.3	U	11-Aug-94
IR10MW31A1D	DMETAL	11.1		23-May-95
IR26MW41A	DMETAL	5	U	20-Jul-01
IR26MW41A	DMETAL	3.2	U	18-Mar-02
IR26MW41A	DMETAL	7	U	03-Jun-02
IR26MW41A	DMETAL	38.3		03-Sep-02
IR26MW41A	DMETAL	12.4	J	14-Nov-02
IR26MW41A	DMETAL	3.1	B	05-Mar-03
IR26MW41A	DMETAL	6.8	U	21-May-03
IR26MW41A	DMETAL	14.8	U	13-Aug-03
IR26MW41A	DMETAL	2.1	U	05-Nov-03
IR26MW41A	DMETAL	60	U	29-Mar-04
IR26MW41A	TMETAL	75.9		07-Jun-04
IR26MW41A	DMETAL	60	U	17-Nov-04
IR26MW45A	DMETAL	2.35		07-Sep-99
IR26MW45A	DMETAL	**200**		12-Jan-00
IR26MW45A	DMETAL	1.5	U	26-Apr-00
IR26MW45A	DMETAL	**139**		14-Jul-00
IR26MW45A	DMETAL	1	U	11-Oct-00
IR26MW45A	DMETAL	3	U	19-Jan-01
IR26MW46A	DMETAL	1.4	U	12-Mar-02
IR26MW46A	DMETAL	7	U	03-Jun-02
IR26MW46A	DMETAL	4.2	U	11-Sep-02
IR26MW46A	DMETAL	2.1	U	13-Nov-02
IR26MW46A	DMETAL	6	U	06-Mar-03

TABLE B1-6: CONCENTRATIONS OF ZINC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
IR26MW46A	DMETAL	16.4	B	22-May-03
IR26MW46A	DMETAL	60	U	29-Mar-04
IR26MW46A	TMETAL	60	U	07-Jun-04
IR26MW46A	DMETAL	60	U	02-Sep-04
IR26MW46A	DMETAL	60	UJ3	17-Nov-04
IR26MW47A	DMETAL	1.4	U	12-Mar-02
IR26MW47A	DMETAL	7	U	03-Jun-02
IR26MW47A	DMETAL	0.8	U	03-Sep-02
IR26MW47A	DMETAL	2.1	U	14-Nov-02
IR26MW47A	DMETAL	28.1	B	11-Mar-03
IR26MW47A	DMETAL	6.8	U	22-May-03
IR26MW47A	DMETAL	14.8	U	13-Aug-03
IR26MW47A	DMETAL	16.5		06-Nov-03
IR26MW47A	DMETAL	300	U	29-Mar-04
IR26MW47A	TMETAL	60	U	07-Jun-04
IR26MW47A	DMETAL	300	U	07-Sep-04
IR26MW47A	DMETAL	120	UJ3	17-Nov-04
IR26MW48A	DMETAL	4.4	J	18-Mar-02
IR26MW48A	DMETAL	7	U	03-Jun-02
IR26MW48A	DMETAL	0.8	U	04-Sep-02
IR26MW48A	DMETAL	9.2	U2	13-Nov-02
IR26MW48A	DMETAL	6.8	U	23-May-03
IR26MW48A	DMETAL	14.8	U	13-Aug-03
IR26MW48A	DMETAL	1.2	U	05-Nov-03
IR26MW48A	DMETAL	300	UJ3	29-Mar-04
IR26MW48A	TMETAL	60	U	07-Jun-04
IR26MW48A	DMETAL	300	U	07-Sep-04
IR26MW48A	DMETAL	120	UJ3	17-Nov-04
IR46MW37A	DMETAL	5	U	23-Jul-01
IR46MW37A	TMETAL	5	U	23-Jul-01
IR46MW37A	DMETAL	3.2	U	18-Mar-02
IR46MW37A	DMETAL	7	U	04-Jun-02
IR46MW37A	DMETAL	4.2	U	29-Aug-02
IR46MW37A	DMETAL	32.7		18-Nov-02
IR46MW37A	DMETAL	3	U	05-Mar-03
IR46MW37A	DMETAL	6.8	U	20-May-03
IR46MW37A	DMETAL	14.8	U	13-Aug-03
IR46MW37A	DMETAL	4.5		04-Nov-03
IR46MW37A	DMETAL	60	UJ3	29-Mar-04
IR46MW37A	TMETAL	60	U	08-Jun-04
IR46MW37A	DMETAL	32.3	J	17-Nov-04
PA50MW01A	DMETAL	3.2	U	18-Mar-02
PA50MW01A	DMETAL	172.25		04-Jun-02

TABLE B1-6: CONCENTRATIONS OF ZINC IN GROUNDWATER (CONTINUED)

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Analyte Group	Result	Qualifier	Sample Date
PA50MW01A	DMETAL	0.8	U	03-Sep-02
PA50MW01A	DMETAL	26.5		18-Nov-02
PA50MW01A	DMETAL	3	U	05-Mar-03
PA50MW01A	DMETAL	6.8	U	21-May-03
PA50MW01A	DMETAL	14.8	U	14-Aug-03
PA50MW01A	DMETAL	60	UJ3	29-Mar-04
PA50MW01A	TMETAL	60	U	08-Jun-04
PA50MW01A	DMETAL	60	U	02-Sep-04
PA50MW01A	DMETAL	60	UJ39	17-Nov-04

Notes: Values shown in µg/L; values in bold exceed the ecological criterion (81 µg/L)
The suffix "D" in the well name indicates an earlier well installation that was decommissioned and later reinstalled.

B	Also detected in blank
DMETAL	Dissolved metals
HGAL	Hunters Point groundwater ambient level
J	Estimated value
TMETAL	Total metals
U	Not detected
µg/L	Microgram per liter

TABLE B1-7: CONCENTRATIONS OF ALPHA-CHLORDANE IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Result	Qualifier	Sample Date
IR26MW46A	0.025	U	06-Mar-03
IR26MW46A	0.01	U	13-Aug-03
IR26MW46A	**0.01325**		10-Nov-03
IR26MW46A	0.01	U	29-Mar-04
IR26MW46A	0.01	U	07-Jun-04
IR26MW46A	0.01	U	02-Sep-04
IR26MW46A	0.01	U	17-Nov-04
IR26MW47A	0.05	U	11-Mar-03
IR26MW47A	**0.0051**	J	13-Aug-03
IR26MW47A	**0.0007**	J	06-Nov-03
IR26MW47A	0.01	U	29-Mar-04
IR26MW47A	0.01	U	07-Jun-04
IR26MW47A	0.01	U	07-Sep-04
IR26MW47A	0.01	U	17-Nov-04

Notes: Values in micrograms per liter; detected values in bold

J Estimated value
U Not detected

TABLE B1-8: CONCENTRATIONS OF ENDRIN ALDEHYDE IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Result	Qualifier	Sample Date
IR26MW48A	0.1	U	12-Mar-03
IR26MW48A	**0.002**	J	23-May-03
IR26MW48A	0.1	U	23-May-03
IR26MW48A	0.02	U	13-Aug-03
IR26MW48A	0.1	U	05-Nov-03

Notes: Values in micrograms per liter; detected values in bold

J Estimated value

U Not detected

TABLE B1-9: CONCENTRATIONS OF GAMMA-CHLORDANE IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Result	Qualifier	Sample Date
IR26MW46A	0.025	U	06-Mar-03
IR26MW46A	0.00615	U	13-Aug-03
IR26MW46A	**0.01365**		10-Nov-03
IR26MW46A	0.01	U	29-Mar-04
IR26MW46A	0.01	U	07-Jun-04
IR26MW46A	0.01	U	02-Sep-04
IR26MW46A	0.01	U	17-Nov-04

Notes: Values in micrograms per liter; detected values in bold

J Estimated value
U Not detected

TABLE B1-10: CONCENTRATIONS OF HEPTACHLOR IN GROUNDWATER

Appendix B, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Well Name	Result	Qualifier	Sample Date
IR26MW47A	**0.028**	J	11-Mar-03
IR26MW47A	0.017	U	13-Aug-03
IR26MW47A	0.0089	U	06-Nov-03
IR26MW48A	**0.028**		12-Mar-03
IR26MW48A	0.013	U	13-Aug-03
IR26MW48A	0.05	U	05-Nov-03

Notes: Values in micrograms per liter; detected values in bold

J Estimated value
U Not detected

APPENDIX C
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... C-v

C1.0 INTRODUCTION C-1

C1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS C-1
C1.2 DESCRIPTION OF METHODOLOGY C-4
C1.2.1 General C-4
C1.2.2 Identifying and Evaluating Federal ARARs C-6
C1.2.3 Identifying and Evaluating State ARARs C-7
C1.2.3.1 Solicitation of State ARARs under NCP C-7
C1.2.3.2 Chronology of Efforts to Identify State ARARs C-7
C1.3 OTHER GENERAL ISSUES C-8
C1.4 WASTE CHARACTERIZATION C-9
C1.4.1 RCRA Hazardous Waste Determination C-9
C1.4.2 California-Regulated, Non-RCRA Hazardous Waste C-12
C1.4.3 Other California Waste Classifications C-12

C2.0 CHEMICAL-SPECIFIC ARARs C-13

C2.1 SUMMARY OF ARARs CONCLUSIONS BY MEDIUM C-13
C2.1.1 ARARs Conclusions for Groundwater C-13
C2.1.2 ARARs Conclusions for Surface Water C-14
C2.1.3 ARARs Conclusions for Soil C-14
C2.1.4 ARARs Conclusions for Air C-15
C2.2 DETAILED DISCUSSION OF ARARs BY MEDIUM C-15
C2.2.1 ARARs for Groundwater C-15
C2.2.1.1 Federal ARARs C-16
C2.2.1.2 State ARARs C-21
C2.2.2 ARARs for Surface Water C-27
C2.2.2.1 Federal ARARs C-28
C2.2.2.2 State ARARs C-29
C2.2.3 ARARs for Soil C-30
C2.2.3.1 Federal ARARs C-30
C2.2.3.2 State ARARs C-31
C2.2.4 ARARs for Air C-32
C2.2.4.1 Federal ARARs C-32
C2.2.4.2 State ARARs C-32

TABLE OF CONTENTS (Continued)

C3.0 LOCATION-SPECIFIC ARARs C-33

C3.1 SUMMARY OF LOCATION-SPECIFIC ARARs C-33

C3.1.1 ARARs for Wetlands Protection C-33

C3.1.1.1 Federal ARARs C-33

C3.1.1.2 State ARARs C-33

C3.1.2 ARARs for Coastal Resources C-33

C3.1.2.1 Federal ARARs C-34

C3.1.2.2 State ARARs C-34

C3.2 DETAILED DISCUSSION OF LOCATION-SPECIFIC ARARs C-34

C3.2.1 ARARs for Wetlands Protection C-34

C3.2.1.1 Federal ARARs C-35

C3.2.1.2 State ARARs C-35

C3.2.2 ARARs for Coastal Resources C-35

C3.2.2.1 Federal ARARs C-35

C3.2.2.2 State ARARs C-36

C4.0 ACTION-SPECIFIC ARARs C-36

C4.1 REMEDIAL ALTERNATIVES FOR SOIL C-36

C4.1.1 Alternative S-1 – No Action C-37

C4.1.2 Alternative S-2 – Institutional Controls, Maintained Landscaping, and Shoreline Revetment C-37

C4.1.2.1 Federal ARARs C-37

C4.1.2.2 State ARARs C-40

C4.1.3 Alternative S-3 – Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, Maintained Landscaping, and Shoreline Revetment C-43

C4.1.3.1 Federal ARARs C-43

C4.1.3.2 State ARARs C-45

C4.1.4 Alternative S-4 – Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment C-47

C4.1.4.1 Federal ARARs C-47

C4.1.4.2 State ARARs C-48

C4.1.5 Alternative S-5 – Excavation, Methane and Mercury Source Removal, Disposal Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment C-48

C4.1.5.1 Federal ARARs C-49

C4.1.5.2 State ARARs C-50

C4.2 ARARs FOR GROUNDWATER REMEDIAL ALTERNATIVES C-51
C4.2.1 Alternative GW-1 – No Action C-51
C4.2.2 Alternative GW-2 – Long-Term Groundwater Monitoring and Institutional Controls C-51
C4.2.2.1 Federal ARARs C-51
C4.2.2.2 State ARARs C-52
C4.2.3 Alternative GW-3 – In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls C-53
C4.2.3.1 Federal ARARs C-53
C4.2.3.2 State ARARs C-54

C5.0 REFERENCES C-55

LIST OF TABLES

C-1 Potential Federal Chemical-Specific Applicable or Relevant and Appropriate Requirements

C-2 Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements

C-3 Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements

C-4 Potential State Location-Specific Applicable or Relevant and Appropriate Requirements

C-5 Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements

C-6 Potential State Action-Specific Applicable or Relevant and Appropriate Requirements

ACRONYMS AND ABBREVIATIONS

§	Section
§§	Sections
µg/L	Microgram per liter
ARAR	Applicable or relevant and appropriate requirement
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
Bay Plan	San Francisco Bay Plan
bgs	Below ground surface
Cal. Code Regs.	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
ch.	Chapter
CTR	California Toxics Rule
CWA	Clean Water Act
div.	Division
DTSC	Department of Toxic Substances Control
EP	Extraction procedure
EPA	U. S. Environmental Protection Agency
Fed. Reg.	*Federal Register*
HGAL	Hunters Point groundwater ambient level
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
NAWQC	National ambient water quality criteria
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRWQC	National recommended water quality criteria
PCB	Polychlorinated biphenyl
ppt	Parts per thousand
PRC	PRC Environmental Management, Inc.
RAO	Remedial action objective

RCRA	Resource Conservation and Recovery Act
Res.	Resolution
ROD	Record of decision
STLC	Soluble threshold limit concentration
SWRCB	State Water Resources Control Board
TBC	To be considered
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
tit.	Title
TMSRA	Technical memorandum in support of a record of decision amendment
TSCA	Toxic Substances Control Act
TTLC	Total threshold limit concentration
U.S.C.	*United States Code*
VOC	Volatile organic compound
Water Board	San Francisco Regional Water Quality Control Board
WQO	Water quality objective

C1.0 INTRODUCTION

This appendix identifies and evaluates potential federal and State of California applicable or relevant and appropriate requirements (ARAR) from the universe of regulations, requirements, and guidance and sets forth the U.S. Department of the Navy's determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in this technical memorandum in support of a record of decision (ROD) amendment (TMSRA) for Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California. This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs (no longer "potential" ARARs) will be made by the Navy in the ROD amendment, after public review, as part of the response action selection process.

The Navy selected and documented a remedial action for soil and groundwater at HPS Parcel B in a ROD signed October 9, 1997 (Navy 1997). In August 1998, the Navy completed an explanation of significant differences that revised the selected soil remedy to require cleanup of contaminated soils to a maximum depth of 10 feet (Navy 1998). In May 2000, the Navy completed another explanation of significant differences that revised the cleanup values for soil to incorporate the U.S. Environmental Protection Agency's (EPA) 1999 preliminary remediation goals (Navy 2000).

The Navy has conducted additional site characterization investigations since the ROD and explanations of significant differences were issued. These additional investigations are discussed in Section 2.0 of this TMSRA. The Navy has concluded that the site conditions differ significantly from the conditions described and considered in the feasibility study, the ROD, and the explanations of significant differences based on these additional investigations (PRC Environmental Management, Inc. [PRC] 1996). The Navy is reevaluating the implementability and cost of the selected remedy to address the information developed in these additional investigations. The overall objective of the TMSRA is to provide information to support a future proposed plan and ROD amendment that will align the final remedy for Parcel B with its planned reuse. Based on the Navy's updated knowledge of Parcel B, the Navy is now reevaluating its waste management approach for HPS Parcel B.

C1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 *United States Code* [U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the

jurisdictional prerequisites of the standard show a direct correspondence when objectively compared with the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than the federal ARAR.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (EPA 1988a). A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in Title 40 *Code of Federal Regulations* (CFR) § 300.400(g)(2) and include the following:

- The purpose of both the requirement and the purpose of the CERCLA action;
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;
- The substances regulated by the requirement and the substances found at the CERCLA site;
- The actions or activities regulated by the requirement and the response action contemplated at the CERCLA site;
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;
- The type of place regulated and the type of place affected by the release or CERCLA action;
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action; and
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site.

According to CERCLA ARARs guidance (EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. ARARs must be identified on a site-specific basis and involves a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is both relevant and appropriate. Some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988a).

Tables included in this appendix present each potential ARAR with a determination of its status (that is, "applicable," "relevant and appropriate," or "not an ARAR"). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- A state law or regulation,
- An environmental or facility siting law,
- Promulgated (of general applicability and legally enforceable),
- Substantive (not procedural or administrative),
- More stringent than the federal requirement,
- Identified in a timely manner, and
- Consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered ARARs. Permits are considered procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered ARARs. CERCLA 121(e)(1), 42 U.S.C. § 9621(e)(1), states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "on site" is defined for this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 CFR § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC requirements complement ARARs but do not override them (40 CFR § 300.400[g][3]). They are useful for guiding decisions regarding cleanup goals or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in identifying ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site-specific basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs at HPS Parcel B. Potential federal ARARs are discussed in Section C1.2.2. Pursuant to the definition of the term *on site* in 40 CFR § 300.5, the on-site areas that are part of this action include all of HPS Parcel B.

Identification of potential state ARARs was initiated through Navy requests that the Department of Toxic Substances Control (DTSC), the San Francisco Bay Regional Water Quality Control Board (Water Board), and the San Francisco Bay Conservation and Development Commission identify potential state ARARs, an action described in more detail in Section C1.2.3. Potential state ARARs that have been identified for HPS Parcel B are discussed below.

Only the substantive provisions of the specific citations discussed in the following sections are considered potential ARARs.

C1.2 DESCRIPTION OF METHODOLOGY

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

C1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for HPS Parcel B. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP:

- Identified potential federal ARARs for each response action alternative in the TMSRA, taking into account site-specific information for HPS Parcel B;
- Reviewed potential ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met to constitute state ARARs;
- Evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions; and
- Reached a conclusion as to which federal and state ARARs are the most stringent or "controlling" for each alternative.

Section 4.0 of the TMSRA discusses and presents the remedial action objectives (RAO) for the remedial actions at HPS Parcel B. The RAOs for soil, groundwater, soil gas, and sediment are identified below.

The RAOs for soil are:

- Prevent exposure to organic and inorganic chemicals in soil above remediation goals developed in the human health risk assessment (HHRA) for carcinogens or noncarcinogens for the following exposure pathways:
  - Ingestion of, outdoor inhalation of, and dermal exposure to soil from 0 to 10 feet below ground surface (bgs) by residents in areas zoned for research and development or mixed-use reuse
  - Ingestion of homegrown produce by residents in areas zoned for research and development or mixed-use reuse
  - Ingestion of, outdoor inhalation of, and dermal exposure to soil from 0 to 10 feet bgs by industrial workers in areas zoned for educational/cultural reuse
  - Ingestion of, outdoor inhalation of, and dermal exposure to soil from 0 to 2 feet bgs by recreational users in areas zoned for open space reuse
  - Soil ingestion, outdoor air inhalation, and dermal exposure to soil from 0 to 10 feet bgs by construction workers in all areas
- Prevent exposure to VOCs in soil gas at concentrations that would pose unacceptable risk via indoor inhalation of vapors. Remediation goals for soil gas will be established during the remedial design.
- Prevent presence of methane in soil gas above a concentration of 1.25 percent (by volume in air).
- Prevent exposure of ecological receptors to organic and inorganic compounds in soil and shoreline sediment in shoreline areas above remediation goals established for sediment.

The RAOs for the A-aquifer are:

- Prevent exposure to volatile organic compounds (VOC) and mercury in A-aquifer groundwater above remediation goals via indoor inhalation of vapors from groundwater.
- Prevent or minimize exposure to metals, VOCs, and semivolatile organic compounds in the A-aquifer groundwater from dermal exposure and inhalation of vapors from groundwater by construction workers above remediation goals.

- Prevent or minimize migration of chromium VI, copper, lead, and mercury in A-aquifer groundwater that would result in concentrations of chromium VI above 50 micrograms per liter (µg/L), copper above 28.04 µg/L, lead above 14.44 µg/L, and mercury above 0.6 µg/L in the surface water of the San Francisco Bay. This RAO is intended to provide protection of the beneficial uses of the bay, including protection of ecological receptors.

The RAO for the B-aquifer is:

- Prevent direct exposure to the groundwater that may contain chemicals of concern through the domestic use pathway.

The alternatives for soil that are evaluated in this TMSRA are:

- Alternative S-1 – No action
- Alternative S-2 – Institutional controls, maintained landscaping, and shoreline revetment
- Alternative S-3 – Excavation, methane and mercury source removal, disposal, maintained landscaping, institutional controls, and shoreline revetment
- Alternative S-4 – Covers, methane and mercury source removal, institutional controls, and shoreline revetment
- Alternative S-5 – Excavation, methane and mercury source removal, disposal, covers, soil vapor extraction, institutional controls, and shoreline revetment

The alternatives for groundwater that are evaluated in this TMSRA are:

- Alternative GW-1 – No action
- Alternative GW-2 – Long-term groundwater monitoring and institutional controls
- Alternative GW-3 – *In situ* treatment, groundwater monitoring, and institutional controls (Alternative GW-3A evaluates bioremediation, and Alternative GW-3B evaluates zero-valent iron injection)

C1.2.2 Identifying and Evaluating Federal ARARs

The Navy is responsible for identifying federal ARARs as the lead federal agency under CERCLA and the NCP. The final determination of federal ARARs will be made when the Navy issues the ROD. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or regulations

promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Safe Drinking Water Act, the Toxic Substances Control Act (TSCA), and their implementing regulations, to name a few. See the NCP preamble at 55 *Federal Register* (Fed. Reg.) 8764-8765 (1990) for a more complete listing.

The Navy reviewed the response action and alternatives against all potential federal ARARs, including but not limited to those set forth at 55 Fed. Reg. 8764–8765 (1990), to determine if they were applicable or relevant and appropriate using the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

C1.2.3 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the state and the Navy is described in this subsection.

C1.2.3.1 Solicitation of State ARARs under NCP

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA 1988b). In essence, the CERCLA and NCP requirements at 40 CFR § 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. Section 7.6 of the federal facility agreement for HPS between the Navy and the regulatory agencies also addresses the identification and determination of potential ARARs. As part of the agreement, the Navy is responsible for identifying potential federal ARARs and DTSC is responsible for coordinating with state and local governmental agencies and identifying potential state ARARs. The remainder of this subsection documents the Navy's efforts to date to identify and evaluate state ARARs.

C1.2.3.2 Chronology of Efforts to Identify State ARARs

The following chronology summarizes the Navy's efforts to obtain state assistance in identifying state ARARs for HPS Parcel B. Key correspondence between the Navy and the state agencies about this effort has been included in the administrative record.

In conjunction with amending the ROD, the Navy requested that the state identify ARARs in a letter dated October 21, 2003. On December 24, 2003, DTSC responded and identified potential state ARARs. This response also included potential state ARARs identified by the Department of Fish and Game, Office of Spill Prevention and Response, and the Department of Health Services. The Water Board also submitted a response to the Navy's ARARs request that identified potential state ARARs for remediation of soil and groundwater. The Navy analyzed

the requirements identified by DTSC, the Department of Fish and Game, the Department of Health Services, and the Water Board to identify any that qualified as state ARARs. This analysis also was intended to identify the requirements, if any, that were more stringent than or were in addition to potential federal ARARs. The results of this analysis are presented in this appendix.

C1.3 OTHER GENERAL ISSUES

General issues identified during the evaluation and selection of ARARs for HPS Parcel B are discussed below.

General Approach to Requirements of the Federal Resource Conservation and Recovery Act

RCRA is a federal statute passed in 1976 to meet four goals: the protection of human health and the environment, the reduction of waste, the conservation of energy and natural resources, and the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is RCRA hazardous waste, and either:

- The waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement; or
- The activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of the ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The State of California received approval for its base RCRA hazardous waste management program on July 23, 1992 (57 Fed. Reg. 32726 [1992]). The State of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 *California Code of Regulations*, Division 4.5 (Cal. Code Regs., Title [tit.] 22, Division [div.] 4.5), were approved by EPA as a component of the federally authorized State of California RCRA program. On September 26, 2001, California received final authorization of its revised State Hazardous Waste Management Program by the EPA (66 Fed. Reg. 49118 [2001]).

The regulations at Cal. Code of Regs, tit. 22, div. 4.5 are, therefore, a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The EPA July 23, 1992, notice approving the State of California RCRA program (57 Fed. Reg. 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Cal. Code Regs. tit. 22, div. 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether the contaminants at HPS Parcel B constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is included in Section C1.4.

C1.4 WASTE CHARACTERIZATION

Selection of ARARs involves characterization of wastes, as described below.

C1.4.1 RCRA Hazardous Waste Determination

A federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at Cal. Code Regs. tit. 22, div. 4.5 and other state requirements at Cal. Code Regs. tit. 23, div. 3, Chapter 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site and determine whether it constitutes a "listed" RCRA waste. The preamble to the NCP states that "it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in EPA guidance for CERCLA compliance with other laws (EPA 1988a), as follows:

> "To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes."

RCRA hazardous wastes that have been assigned EPA hazardous waste numbers (or codes) are listed in Cal. Code Regs tit. 22, §§ 66261.30-66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Knowledge of the exact source of a waste is required for source-specific listed wastes ("K" waste codes). Some knowledge of the nature or source of the waste is required even for listed wastes from nonspecific sources, such as spent solvents ("F" waste codes) or commercial chemical products ("P" and "U" waste codes). These listed RCRA hazardous wastes are restricted to commercially pure chemicals used in particular processes such as degreasing.

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-specification products (EPA 1991). Not every waste containing a P or U chemical is a hazardous waste. There must be direct evidence of product use to determine whether a CERCLA investigation-derived waste contains a P or U waste. In particular, all the following criteria must be met. The chemicals must be:

- Discarded (as described in 40 CFR § 261.2[a][2]),
- Either off-specification commercial products or a commercially sold grade,
- Not used (soil contaminated with spilled unused wastes is a P or U waste), and
- The sole active ingredient in a formulation.

The Navy used the facilities at HPS Parcel B from 1940 to 1974. The Navy concluded its activities 2 years before RCRA was originally enacted; therefore, there were no RCRA record-keeping requirements. No other documentation of past waste disposal practices was found that would serve to classify the sources of soil and groundwater contamination with respect to the RCRA waste listings. Therefore, the Navy has determined that the mere presence of contamination does not classify the soil or groundwater at HPS Parcel B as RCRA-listed hazardous waste.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in EPA guidance as follows (EPA 1988a):

> "Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 40 CFR §§ 261.21–261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.

> In determining whether to test for the toxicity characteristic using the extraction procedures (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed."

The identification of RCRA characteristic waste is relevant to the alternatives evaluated in the TMSRA that will generate waste. Therefore, the Navy will characterize all excavated soil or other waste it generates before any off-site disposal to determine whether it is RCRA hazardous waste.

Hazardous waste characteristics, as defined in 40 CFR §§ 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Cal. Code Regs., tit. 22, div. 4.5, were approved by EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Cal. Code Regs. tit. 22, §§ 66261.21–66261.24. According to Cal. Code Regs. tit. 22, § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Cal. Code Regs. tit. 22, § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on knowledge of the waste, provided that the waste has already been reliably tested or if there is documentation of the chemicals used. Based on the Navy's knowledge of soil contamination gained from sampling and analysis of the soil for off-site disposal under the remedial action selected in the ROD dated October 1997, the Navy does not anticipate that excavated soil or waste generated in the performance of various alternatives presented in the TMSRA will meet the definition of ignitable, corrosive, or reactive hazardous waste as defined in Cal. Code Regs. tit. 22, § 66261.21–66261.23.

The requirements at Cal. Code Regs. tit. 22, § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter. These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant concentrations in soil equal or exceed 20 times the TCLP limits, because the TCLP uses a 20-to-1 dilution for the extract (EPA 1988a).

C1.4.2 California-Regulated, Non-RCRA Hazardous Waste

A waste determined not to be RCRA hazardous waste may still be considered a state-regulated non-RCRA hazardous waste. The state's RCRA program is broader in scope in its hazardous waste determination. Cal. Code Regs. tit. 22, § 66261.24(a)(2) lists the total threshold limit concentrations (TTLC) and the soluble threshold limit concentrations (STLC) for non-RCRA hazardous waste. The state applies its own leaching procedure, the waste extraction test, that uses a different acid reagent and a different dilution factor (tenfold). Other state requirements may be broader in scope than federal ARARs for identifying non-RCRA wastes regulated by the state. These requirements may be potential ARARs for wastes not covered under federal ARARs. See additional subsections of Cal. Code Regs. tit. 22, § 66261.24. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations from the waste extraction test exceed the STLCs. A waste extraction test is required when the total concentrations exceed the STLCs but are less than the TTLCs (Cal. Code Regs. tit. 22, div. 4.5, chapter 11, Appendix II [b]).

The Navy will characterize all waste to be sent off site for disposal; and this characterization includes an evaluation against TTLC and STLC values to identify whether the material meets the definition of a state-regulated, non-RCRA hazardous waste.

C1.4.3 Other California Waste Classifications

For waste discharged after July 18, 1997, the solid waste classifications at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 are used to determine the applicability of waste management requirements. These requirements are summarized below.

A "designated waste" under Cal. Code Regs. tit. 27, § 20210 is defined at *California Water Code* § 13173. Under *California Water Code* § 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements or is nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state.

A nonhazardous solid waste under Cal. Code Regs. tit. 27, § 20220 is all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency), provided that such wastes do not contain wastes that must be managed as hazardous wastes or

wastes that contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of waters of the state.

The Navy will characterize any waste it generates for off-site disposal according to Cal. Code Regs. tit. 27, §§ 20210 and 20220.

C2.0 CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in establishment of a cleanup goal. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific).

This section presents ARARs conclusions addressing numerical values for groundwater, surface water, soil, and air and a summary of the ARARs conclusions and a more detailed discussion of the ARARs for groundwater, surface water, soil, and air.

Potential federal and state chemical-specific ARARs are summarized in Tables C-1 and C-2, which are at the end of this appendix.

C2.1 SUMMARY OF ARARs CONCLUSIONS BY MEDIUM

Groundwater, soil, and air are the environmental media potentially affected by the response actions at HPS Parcel B. The conclusions for ARARs pertaining to these media are presented in the following sections.

C2.1.1 ARARs Conclusions for Groundwater

Chemicals of concern in groundwater at HPS Parcel B are VOCs, semivolatile organic compounds, and metals. The substantive provisions of the following requirements are the most stringent of the potential federal and state chemical-specific ARARs and TBCs for the groundwater.

- RCRA groundwater protection standards in Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) for the A-aquifer.
- Federal maximum contaminant levels (MCL) for benzene, pentachlorophenol, trichloroethene, and 1,4-dichlorobenzene at 40 CFR § 141.61(a) and (c).
- Federal MCLs for antimony and arsenic at 40 CFR § 141.62(b).
- Federal maximum contaminant limit goal (MCLG) for thallium at 40 CFR § 141.51.

- The Navy accepts the substantive provisions of *California Water Code* §§ 13240, 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Act as enabling legislation as implemented through the beneficial uses, water quality objectives, waste discharge requirements, promulgated policies of the Water Quality Control Plan for the San Francisco Bay Region, as potential state ARARs.

- The substantive provisions for groundwater relating to beneficial uses, water quality objectives, waste discharge requirements, and promulgated policies in Chapters 2 and 3 of the Comprehensive Water Quality Control Plan (Basin Plan) for the San Francisco Region, except for the municipal and domestic supply designation for the A-aquifer.

- State Water Resources Control Board Resolution 88-63, identifying exceptions to potential sources of drinking water.

In addition, the Navy will generate waste in construction of the groundwater wells associated with groundwater Alternative GW-3. The Navy will characterize the waste according to the following potential federal and state chemical-specific ARARs:

- RCRA hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100.

- Non-RCRA, state-regulated hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, and § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F).

- Designated and nonhazardous solid waste definitions at Cal. Code Regs. tit. 27, §§ 20210 and 20220.

C2.1.2 ARARs Conclusions for Surface Water

There is no surface water body on HPS Parcel B. Groundwater at HPS Parcel B has the potential to discharge to the bay. The Navy has identified the substantive provisions of the California Toxics Rule (CTR) (40 CFR § 131.38) as potentially applicable federal chemical-specific ARARs and Table 3-3 of the Basin Plan as potentially applicable state chemical-specific ARARs for surface water, at the interface of the A-aquifer groundwater and the bay. In this TMSRA, the Navy is evaluating groundwater monitoring as a component of groundwater Alternatives GW-2, GW-3A, and GW-3B. This will allow the Navy to monitor any direct release of contamination to the bay.

C2.1.3 ARARs Conclusions for Soil

The following requirement of TSCA is a potential federal chemical-specific ARAR for polychlorinated biphenyls (PCB) in soil at HPS Parcel B:

- Requirements for risk-based cleanup and disposal of PCB remediation waste at 40 CFR § 761.61(c)

Potential federal and state chemical-specific ARARs for soil pertain to characterizing excavated soil and other waste generated in implementing the alternatives for off-site disposal. These potential ARARs are:

- RCRA hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100.
- Non-RCRA, state-regulated hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, and § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F).
- Designated and nonhazardous solid waste definitions at Cal. Code Regs. tit. 27, §§ 20210 and 20220.

C2.1.4 ARARs Conclusions for Air

The following requirement is a potential state ARAR for the methane source removal:

- The requirement that methane gas not exceed 1.25 percent by volume in air in any on-site structures and 5 percent by volume in air at the facility boundary at Cal. Code Regs. tit. 27, § 20921(a)(1) and (2).

The HHRA for Parcel B concluded that groundwater posed unacceptable risk from the vapor intrusion pathway. There are no chemical-specific ARARs for the vapor intrusion pathway.

The Navy is evaluating soil vapor extraction as a remedial alternative in this TMSRA. Potential action-specific ARARs for air associated with this soil vapor extraction system are discussed in Section C4.0 of this appendix.

C2.2 Detailed Discussion of ARARs by Medium

The following subsections provide a detailed discussion of federal and state ARARs for groundwater at HPS Parcel B and any waste generated in implementing the selected remedy.

C2.2.1 ARARs for Groundwater

The hydrostratigraphic units at HPS Parcel B include (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone. The shallow unconfined groundwater occurs continuously across all of HPS Parcel B in the A-aquifer. The B-aquifer is present as two laterally discontinuous areas. Groundwater at HPS Parcel B flows toward the bay.

C2.2.1.1 Federal ARARs

One of the significant issues in identifying ARARs for groundwater under the Safe Drinking Water Act and RCRA is whether the groundwater at the site can be classified as a source of drinking water. EPA groundwater policy is set forth in the preamble to the NCP (55 Fed. Reg. 8666, 8752–8756 [1990]). This policy uses the groundwater classification system set forth in the draft "EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy" (EPA 1986). Under this policy, groundwater is classified in one of three categories (Class I, II, or III), based on ecological importance, replaceability, and vulnerability considerations. Irreplaceable groundwater that is currently used by a substantial population or groundwater that supports a vital habitat is considered Class I. Class II consists of groundwater that is currently being used or that might be used as a source of drinking water in the future. Groundwater that cannot be used for drinking water because of insufficient quality (for example, high salinity or widespread, naturally occurring contamination) or quantity is considered Class III. The EPA guidelines define Class III groundwater as groundwater with total dissolved solids concentrations over 10,000 milligrams per liter (mg/L) and a yield of less than 150 gallons per day (EPA 1986). Class III groundwater can also be classified based on economic or technological treatability tests as well as quality or quantity (both criteria need not be met).

The average total dissolved solids concentration for groundwater in the A-aquifer at Parcel B is about 9,800 mg/L, and aquifer tests indicate a well in the A-aquifer could provide a sustainable yield that would meet the federal criterion of 150 gallons per day (see Appendix E). TDS data were not collected for the two B-aquifer wells at Parcel B; however, based on cation data collected from these wells, the TDS concentration in B-aquifer groundwater is likely below the federal TDS criterion of 10,000 mg/L and the state TDS criterion of 3,000 mg/L (see Appendix E). Both of these B-aquifer wells could provide a sustainable yield that would meet the federal criterion of 150 gallons per day; however, only one of two could meet the state sustainable yield requirement of 200 gallons per day (see Appendix E).

The Navy further evaluated the suitability of the A-aquifer and B-aquifer as a potential drinking water source based on eight site-specific factors developed in conjunction with EPA and the Base Realignment and Closure Cleanup Team (see Appendix E). These site-specific factors were: (1) aquifer thickness; (2) actual measured TDS levels; (3) actual groundwater yield; (4) proximity to saltwater and the potential for saltwater intrusion; (5) quality of underlying water-bearing units; (6) existence of institutional controls on well construction or aquifer use; (7) information on current and historical use of the aquifer at HPS or in the community surrounding HPS; and (8) depth to groundwater (see Appendix E). The discussion below summarizes the Navy's evaluation of these site-specific factors. A more detailed explanation of the evaluation is found in Appendix E.

A-Aquifer Drinking Water Source Evaluation

Aquifer thickness. The saturated thickness of the A-aquifer is about 25 feet at Parcel B. Assuming an average porosity of 25 percent, these values translate to about 220 acre-feet of available water in the A-aquifer for all of Parcel B, which is a relatively small groundwater

resource. Continuous pumping of any A-aquifer well at Parcel B will most likely induce saltwater intrusion because of the limited nature of this resource, which would further degrade the groundwater.

Actual measured TDS levels. The statistical evaluation of TDS data indicated that the average TDS concentration in the A-aquifer at Parcel B is about 9,800 mg/L, which is high for use as a source of drinking water.

Actual groundwater yield. Aquifer test results revealed pumping rates ranging from 1,080 gallons per day at well IR06MW30A to 3,744 gallons per day at well IR10MW13A1 and 23,040 gallons per day at well IR18MW21A. These results indicate that the A-aquifer provides a sustainable yield that would meet the federal criterion of 150 gallons per day.

Proximity to saltwater and potential for saltwater intrusion. Low-salinity groundwater is present in the upland areas of Parcel B away from the shoreline, whereas higher-salinity groundwater originating from San Francisco Bay is present along the shoreline. TDS concentrations are equal to or greater than 10,000 mg/L along the shoreline and about 300 feet inland from the shoreline. Farther inland, up to 750 feet from the shoreline, TDS concentrations are equal to or greater than 3,000 mg/L. These existing, large areas of saline groundwater exemplify the high potential for saltwater intrusion in Parcel B. On a small scale, zones of higher-salinity water are expected to be present in the transitional zone caused by incursion of saltwater from San Francisco Bay along utility corridors, behind dry dock walls, and along natural preferential flow paths.

Quality of underlying water bearing units. The water-bearing unit underlying the A-aquifer at Parcel B is the B-aquifer. TDS concentrations in the B-aquifer are likely much lower than federal or state TDS criteria.

Existence of institutional controls on well construction or aquifer use. The City and County of San Francisco prohibits installation of domestic wells within city boundaries. In addition, California well standards prohibit installation of domestic wells within 50 feet of a storm drain or sanitary sewer line. Storm drain and sanitary sewer lines are present throughout Parcel B. Although the Navy will remove these lines, the present condition is typical of sewer lines that the city would install during redevelopment of HPS. As a result, installation of domestic wells would be prohibited in many portions of the A-aquifer at Parcel B.

Historical and current groundwater use. A-aquifer groundwater at HPS has never been and is not currently used as a source of drinking water. San Francisco currently obtains and plans to continue to obtain its municipal water supply from the Hetch Hetchy watershed in the Sierra Nevada as a source of drinking water in the reasonably foreseeable future.

Depth to groundwater. The maximum depth to groundwater is typically 12 feet bgs, and most groundwater is encountered at depths less than 10 feet bgs. Furthermore, the saturated thickness of the A-aquifer is only about 25 feet. It is unlikely that a well could be installed in the

A-aquifer with the required 20-foot minimum well seal because of the shallow depth to groundwater and the thinness of the aquifer.

Based on the evaluation of these site-specific factors, groundwater in the A-aquifer is not considered suitable for use as a potential drinking water source (see Appendix E).

B-Aquifer Drinking Water Source Evaluation

Aquifer thickness. The extent of the B-aquifer is limited at Parcel B. The B-aquifer is not continuous across Parcel B, but exists primarily in two separate areas: along the western parcel boundary, and in a portion of the central area of the parcel. The B-aquifer is present over an area of about 18 acres with an average thickness of 10 feet. Assuming an average porosity of 25 percent, these values translate to approximately 45 acre-feet of available water in the B-aquifer for all of Parcel B, which is a small groundwater resource. Continuous pumping of any B-aquifer well at Parcel B will most likely induce saltwater intrusion because of the limited nature of this groundwater resource, which would further degrade the groundwater resource.

Actual measured TDS levels. TDS data were not collected for the two B-aquifer wells at Parcel B; however, based on sodium concentration data collected from these wells, the TDS concentration in B-aquifer groundwater is estimated to be below both the federal criterion of 10,000 mg/L and the state TDS criterion of 3,000 mg/L.

Actual groundwater yield. Available data on this factor are limited to the well purging records during sampling the two monitoring wells screened in the B-aquifer in Parcel B. Based on these data, both monitoring wells could provide a sustainable yield that would meet the federal criterion of 150 gallons per day. However, only one of the two could meet the state sustainable yield requirement of 200 gallons per day.

Proximity to saltwater and potential for saltwater intrusion. It is likely that long-term groundwater extraction would cause saltwater intrusion and ongoing degradation of the B-aquifer because much of Parcel B is located close to San Francisco Bay. In addition, long-term groundwater extraction from the B-aquifer could induce downward migration of groundwater in the overlying A-aquifer where much of the groundwater has a high TDS concentration.

Quality of underlying water-bearing units. The water-bearing unit underlying the B-aquifer at Parcel B is the bedrock water-bearing zone. Based on salinity levels measured in wells at Installation Restoration Site 06 in Parcel C adjacent to Parcel B, the TDS concentration in the bedrock water-bearing zone does not exceed the state and federal TDS criteria.

Existence of institutional controls on well construction or aquifer use. The City of San Francisco prohibits installation of domestic wells within city boundaries. In addition, California well standards prohibit installation of domestic wells within 50 feet of a storm drain or sanitary sewer line. Storm drain and sanitary sewer lines are present throughout Parcel B. Although the

Navy will remove these lines, the present condition is typical of sewer lines that the city would install during redevelopment of HPS. As a result, installation of domestic wells would be prohibited in many portions of the B-aquifer at Parcel B.

Historical and current groundwater use. B-aquifer groundwater at HPS has never been and is not currently used as a source of drinking water. San Francisco currently obtains and plans to continue to obtain its municipal water supply from the Hetch Hetchy watershed in the Sierra Nevada as a source of drinking water in the reasonably foreseeable future.

Depth to groundwater. Depth to the water-bearing zones of the B-aquifer at Parcel B typically ranges from 25 to 45 feet bgs in the area with drinking water quality groundwater. This depth is sufficient to ensure a well seal of at least 20 feet.

Based on EPA's groundwater classification criteria and the evaluation of these site-specific factors, groundwater in the B-aquifer is considered to have a low potential for use as a drinking water source (see Appendix E).

Safe Drinking Water Act

EPA has promulgated drinking water standards for public water supply systems pursuant to its authority under the Safe Drinking Water Act. These drinking water standards consist of primary and secondary MCLs and MCLGs. These standards are applicable requirements for drinking water quality at the tap of the end users of the regulated public water supply systems. They are not directly applicable to *in situ* groundwater and therefore do not qualify as applicable federal ARARs for groundwater response actions. However, they may be relevant and appropriate requirements for such actions.

EPA provided policy guidance in the 1990 NCP preamble directing that the EPA guidelines for groundwater classification set forth in the EPA Groundwater Protection Strategy (EPA 1986) be followed in determining when federal primary MCLs may be relevant and appropriate for groundwater response actions (see 55 Fed. Reg. 8666, 8752–8756 [1990]). The intent of this policy is to focus CERCLA cleanup efforts based on groundwater quality (classification).

Federal MCLs and MCLGs developed by EPA under the Safe Drinking Water Act are potential relevant and appropriate requirements for aquifers with Class I and Class II characteristics and therefore are potential federal ARARs for the B-aquifer. Groundwater in the A-aquifer is Class III groundwater and is not a current or potential source of drinking water. MCLs are neither applicable nor relevant and appropriate for aquifers with Class III characteristics and are not used to determine preliminary response action goals (EPA 1986; 55 Fed. Reg. 8666, 8750–8754 [1990]). Therefore, MCLs are not potential ARARs for the A-aquifer.

Groundwater in the B-aquifer is Class II groundwater with a low potential for use as a source of drinking water. MCLs for the B-aquifer are found at 40 CFR §§ 141.61(a) and (c) and 141.62(b). Although MCLs are developed using cost and technical considerations, EPA

considers them to be protective of human health as well. Federal MCLs are potentially relevant and appropriate ARARs for the B-aquifer.

EPA has also developed MCLGs to serve as guidance for establishing MCLs. MCLGs for organic contaminants are promulgated at 40 CFR § 141.50. MCLGs for inorganic contaminants are promulgated at 40 CFR § 141.51. An MCLG is set at a level at which no adverse health effects may arise, with a margin of safety. An MCL is required to be set as close as possible to its corresponding MCLG, taking into consideration the best technology, treatment techniques, and other factors, including cost. MCLs for noncarcinogens generally are set equal to MCLGs. MCLGs for carcinogens are set at the zero level.

The NCP states that MCLGs that are set at levels above zero should be considered to be relevant and appropriate requirements for groundwater that is a potential source of drinking water (40 CFR § 300.430[e][2][I][B] and 55 Fed. Reg. 8666, 8750–8754 [1990]). The Navy evaluated MCLGs as potential relevant and appropriate requirements. The table below lists the COCs identified for the B-aquifer, the federal MCL (if any), and the federal MCLG (if any). COCs for the B-aquifer were identified based on potential communication between the A- and the B-aquifers, discussed in more detail in Section 3.1.4 of the main text of the TMSRA. None of these COCs currently exceeds its MCL in the B-aquifer.

Chemical of Concern	Federal MCL	Citation	Federal MCLG	Citation
1,4-Dichlorobenzene	0.075 mg/L	40 CFR § 141.61(a)	0.075 mg/L	40 CFR § 141.50
Benzene	0.005 mg/L	40 CFR § 141.61(a)	Zero	40 CFR § 141.50
Chloroethane	No promulgated MCL	None	No promulgated MCLG	None
Pentachlorophenol	0.001 mg/L	40 CFR § 141.61(c)	Zero	40 CFR § 141.50
Trichloroethene	0.005 mg/L	40 CFR § 141.61(a)	Zero	40 CFR § 141.50
Antimony	0.006 mg/L	40 CFR § 141.62(b)	0.006 mg/L	40 CFR § 141.51
Arsenic	0.010 mg/L	40 CFR § 141.62(b)	Zero	40 CFR § 141.51
Manganese	No promulgated MCL	None	No promulgated MCLG	None
Thallium	0.002 mg/L	40 CFR § 141.62(b)	0.0005 mg/L	40 CFR § 141.51

Notes:

CFR *Code of Federal Regulations*
MCL Maximum contaminant level
MCLG Maximum contaminant level goal
mg/L Milligram per liter

Antimony and thallium are the only COCs for the B-aquifer have nonzero MCLGs. The MCLG for antimony is set at a level equal to the MCL. The Navy has determined that the MCLG for antimony is not the relevant and appropriate requirement because it is not more stringent that the MCL. The MCLG for thallium is more stringent than the MCL. Therefore, the Navy determined that the MCLG, not the MCL, is the relevant and appropriate requirement.

In addition, some inorganic chemicals have ambient concentrations established that are referred to as Hunters Point groundwater ambient levels (HGAL). CERCLA and the State of California do not require cleanup to below background conditions. The Navy compared the MCLs for antimony and arsenic, the MCLG for thallium, and the risk-based concentration for manganese to the HGALs. If the HGAL was greater than the MCL, MCLG, or risk-based concentration, the Navy used the HGAL as the basis for the remediation goal for B-aquifer groundwater.

Secondary MCLs are nonenforceable federal contaminant levels intended as guidelines for the states. Because they are nonenforceable, federal secondary MCLs are not potential ARARs.

Although the point of compliance for MCLGs and MCLs under the SDWA is at the tap, EPA has determined that for CERCLA remedies, nonzero MCLGs or MCLs should be obtained throughout the contaminated plume or at and beyond the edge of the waste management area, when waste is left in place (55 Fed. Reg. 8666, 8753 [1990]).

RCRA Groundwater Protection Standards

Groundwater concentration limits for RCRA-regulated units are promulgated at Cal. Code Regs. tit. 22, § 66264.94. For corrective action programs, Cal. Code Regs. tit. 22, § 66264.94(c) states that the concentrations of compounds must not exceed the background level of that constituent in groundwater or, if achieving background is shown to be technologically or economically infeasible, some concentration limit greater than background that is set as part of the corrective action program. Cal. Code Regs. tit. 22, § 66264.94(e) states that in no event shall a concentration limit greater than background exceed other applicable statutes or regulations (for example, an MCL) or the lowest concentration demonstrated to be technologically and economically achievable. Since the A-aquifer is not a potential source of drinking water, MCLs have been determined not to be potential ARARs. The lowest concentration determined to be technologically and economically achievable is a potential ARAR for the A-aquifer. In general, economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of chemicals of concern with the incremental cost of achieving those reductions. Therefore, the lowest feasible concentration limits are based on the site risk. The lowest concentration limit greater than background that is technologically and economically achievable for the A-aquifer is based on unacceptable risk from the vapor intrusion pathway.

The requirements at Cal. Code Regs. tit. 22, § 66264.94 are not applicable to groundwater because there is no RCRA-regulated unit at HPS Parcel B. These requirements are potentially relevant and appropriate for the A-aquifer.

C2.2.1.2 State ARARs

The Navy reviewed the requirements the state identified in its response to the Navy's request for ARARs, and the Navy has identified the following potential state ARARs discussed below.

Primary and Secondary State MCLs

Primary and secondary state MCLs are set forth in Cal. Code Regs. tit. 22:

- § 64431 (Maximum Contaminant Levels – Inorganic Chemicals)
- § 64444 (Maximum Contaminant Levels – Organic Chemicals)
- § 64449(a) (Secondary Maximum Contaminant Levels)

The Navy does not accept state primary and secondary MCLs as potential chemical-specific ARARs for the A-aquifer because it is not a source of drinking water. The Navy also does not accept state primary and secondary MCLs as potential chemical-specific ARARs for the B-aquifer because the B-aquifer is not a potential source of drinking water according to the state criteria in SWRCB Res. 88-63. Estimated TDS values in the B-aquifer may be below 3,000 mg/L; however, it is unlikely that the B-aquifer could sustain a yield of 200 gallons per day. The Navy has identified federal MCLs and non-zero MCLGs as potential chemical-specific ARARs for the B-aquifer because it is Class II groundwater under federal criteria and has a low potential for use as a drinking water source after evaluation of site-specific factors.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act became Division 7 of the *California Water Code* in 1969. The Porter-Cologne Water Quality Control Act requires each regional board to formulate and adopt Basin Plans for all areas within the region (*California Water Code* § 13240). It also requires each regional board to establish water quality objectives that will protect the beneficial uses of the water basin (*California Water Code* § 13241) and to prescribe waste discharge requirements that would implement the Basin Plan for any discharge of waste to the waters of the state (*California Water Code* § 13263[a]).

Other sections of the Porter-Cologne Water Quality Control Act include *California Water Code* § 13243, which allows regional boards to specify conditions or areas where waste discharge is not permitted. *California Water Code* § 13269 provides the boards authority for waivers for reports or compliance with requirements as long as it is not against the public interest. *California Water Code* § 13360 specifies circumstances for regional boards to order compliance in a specific manner.

The Navy accepts the substantive provisions of *California Water Code* §§ 13240, 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Water Quality Control Act as enabling legislation as implemented through the beneficial uses, water quality objectives, waste discharge requirements, promulgated policies of the water quality control plan for the San Francisco Region as potential state ARARs.

California Water Code § 13304 sets forth enforcement authority and an enforcement process (orders issued by the state) and is procedural. It does not constitute an ARAR because it does not itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" (CERCLA Section 121 [42 U.S.C. § 9621]) and is not in itself directive in intent. Through its enforcement authority and procedures, substantive state environmental standards set forth in other statutes, regulations, plans, and orders are enforced. In addition, *California Water Code* § 13304 is no more stringent than the substantive requirements of the potential state ARARs identified in the above paragraphs or potential federal ARARs for groundwater.

Comprehensive Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan)

The Navy accepts the substantive provisions for groundwater in Chapters 2 and 3 of the Basin Plan, including beneficial use, water quality objectives, and waste discharge requirements, as potential applicable state ARARs. The beneficial uses designated for HPS Parcel B groundwater, except the municipal and domestic supply designation for the A-aquifer, are potential applicable ARARs for this TMSRA.

The Water Board prepared and implemented the Basin Plan to protect and enhance the quality of the waters in the San Francisco Bay region. The Basin Plan establishes location-specific beneficial uses and water quality objectives for the surface water and groundwater of the region and is the basis of the Water Board's regulatory programs. The Basin Plan includes both numeric and narrative water quality objectives for specific groundwater subbasins. The water quality objectives are intended to protect the beneficial uses of the waters of the region and to prevent nuisance.

Beneficial use and reuse of water are key aspects of the Basin Plan for the San Francisco Bay Region. HPS Parcel B groundwater has the following existing and potential beneficial use designations (Water Board 1995):

- Municipal and domestic supply
- Industrial process supply
- Industrial service supply
- Agricultural supply

There is no existing or potential beneficial use designation of freshwater replenishment to surface water for groundwater at HPS Parcel B. The Water Board has concurred in the Navy's determination that groundwater in the A-aquifer is not a potential source of drinking water (Water Board 2003).

SWRCB Resolutions 92-49 and 68-16

SWRCB Resolution 92-49 (as Amended on April 21, 1994 and October 2, 1996) is titled "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges" under *California Water Code* § 13304. This resolution contains policies and procedures for the regional boards that apply to all investigations and cleanup and abatement for all types of discharges subject to *California Water Code* § 13304.

SWRCB Res. 68-16, Statement of Policy With Respect to Maintaining High Quality of Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It provides that whenever the existing quality of water is better than the required applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of the water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge necessary to assure that (a) pollution or a nuisance will not occur, and (b) the highest water quality consistent with maximum benefit to the people of the state will be maintained (SWRCB 1968).

Cleanup to below background water quality conditions is not required by the SWRCB under the Porter-Cologne Water Quality Control Act. SWRCB Res. 92-49 II.F.1 provides that regional boards may require cleanup and abatement to "conform to the provisions of the Resolution 68-16 of the State Water Board, and the Water Quality Control Plans of the State and Regional Water Quality Control Boards, provided that under no circumstances shall these provisions be interpreted to require cleanup and abatement which achieves water quality conditions that are better than background conditions" (SWRCB 1992).

Navy's Position Regarding SWRCB Res. 92-49 and 68-16

The Navy recognizes that the key substantive requirements of Cal. Code Regs. tit. 22, § 66264.94 (and the identical requirements of Cal. Code Regs tit. 23, § 2550.4 and § III.G of SWRCB Res. 92-49) require cleanup to ambient levels of constituents unless restoration proves to be technologically or economically infeasible and an alternative cleanup goal of constituents will not pose a substantial present or potential hazard to human health or the environment. In addition, the Navy recognizes that these provisions are more stringent than the corresponding provisions of 40 CFR § 264.94. Although they are federally enforceable via the RCRA program authorization, they are also independently based on state law to the extent that they are more stringent than the federal regulations.

The Navy has also determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining response action goals. However, SWRCB Res. 68-16 is an action-specific ARAR for regulating discharged treated groundwater back into the aquifer. The Navy has determined that further migration of already-contaminated groundwater is not a discharge governed by the language in Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The Navy's position is that SWRCB Res. 68-16 and 92-49 and Cal. Code Regs. tit. 23, § 2550.4 do not constitute chemical-specific ARARs for this response action because they are state requirements and are not more stringent than federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94. The NCP set forth in 40 CFR § 300.400(g)(4) provides that only state standards more stringent than federal standards may be ARARs (see also CERCLA § 121(d)(2)(A)(ii) [42 U.S.C. § 9621(d)(2)(A)(ii)]).

The substantive technical standard in the equivalent state requirements (Cal. Code Regs. tit. 23, div. 3, chapter (ch.) 15 and SWRCB Res. 92-49 and 68-16) is identical to the substantive technical standard in Cal. Code Regs. tit. 22, § 66264.94. This section of Cal. Code Regs. tit. 22 will likely be applied in a manner consistent with equivalent provisions of other regulations, including SWRCB Res. 92-49 and 68-16.

State of California's Position Regarding SWRCB Res. 92-49 and 68-16

The state does not agree with the Navy's determination that SWRCB Res. 92-49 and 68-16 and certain provisions Cal. Code Regs. tit. 23, div. 3, ch. 15 are not ARARs for this response action. SWRCB has interpreted the term "discharges" in the *California Water Code* to include the movement of waste from soils to groundwater and from contaminated to uncontaminated water (SWRCB 1994). However, the state agrees that the proposed action would comply with SWRCB Res. 92-49 and 68-16, and compliance with the provisions at Cal. Code Regs. tit. 22 should result in compliance with Cal. Code Regs. tit. 23. The state does not intend to dispute the ROD, but reserves its rights if implementation of the provisions at Cal. Code Regs. tit. 22 is not as stringent as state implementation of the provisions at Cal. Code Regs. tit. 23. Because Cal. Code Regs. tit. 22 regulation is part of the state's authorized hazardous waste control program, it is also the state's position that Cal. Code Regs. tit. 22, § 66264.94 is a state ARAR and not a federal ARAR (United States v. State of Colorado, 990 F.2d 1565 [1993]).

Whereas the Navy and the State of California have not agreed on whether SWRCB Res. 92-49 and 68-16 and Cal. Code Regs. tit. 23, § 2550.4 are ARARs for this response action, this TMSRA documents each of the parties' positions on the resolutions but does not attempt to resolve the issue.

SWRCB Resolution 88-63, Adoption of Policy Entitled "Sources of Drinking Water." SWRCB Res. 88-63 establishes criteria to help regional boards identify potential sources of drinking water (SWRCB 1988). According to this resolution, all groundwater in California is

considered suitable or potentially suitable for domestic or municipal freshwater supply except in cases where any one of the following water quality and production criteria cannot be met.

- Total dissolved solids exceed 3,000 mg/L (or electrical conductivity is greater than 5,000 micromhos per centimeter) and the regional board does not reasonably expect the groundwater to supply a public supply system.
- Groundwater is contaminated, either by natural processes or by human activity unrelated to a specific pollution incident, and cannot reasonably be treated for domestic use either by best management practices or best economically available treatment practices.
- The groundwater does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.

SWRCB Res. 88-63 has been incorporated by reference into the Basin Plan. The Navy has determined that the substantive provisions of this policy are potential applicable state ARARs. The Navy has determined that groundwater in the A-aquifer falls within these exceptions to potential sources of drinking water and cannot be a potential source of drinking water. The Water Board concurred with the Navy's determination (Water Board 2003). The Navy considers the B-aquifer to be a potential source of drinking water.

Cal. Code Regs. tit. 27, div. 2, subdiv. 1, §§ 20400

The Navy has reviewed the provisions of Cal. Code Regs. tit. 27, § 20400. This section addresses the concentration limits for monitoring at waste management units for other than hazardous wastes. The Navy has determined that these provisions are identical to those found in Cal. Code Regs. tit. 22, §§ 66264.94(d)(1), (2), and (4), and (e)(1) and (2). The requirements at Cal. Code Regs. tit. 27, § 20400 are therefore not ARARs because they are not more stringent than federal ARARs at Cal. Code Regs. tit. 22, § 66264.94(d)(1), (2), and (4), and (e)(1) and (2).

RCRA Requirements

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste with the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potentially applicable federal ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether any waste generated during implementation of the groundwater alternatives, such as waste related to installation of monitoring well, is a hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste.

State RCRA requirements included within the EPA-authorized RCRA program for California are considered potential federal ARARs and are discussed above. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

Any waste generated in construction of groundwater monitoring wells under groundwater Alternatives GW-2 and GW-3 would be compared with the definition of non-RCRA, state-regulated hazardous waste. The non-RCRA, state-regulated waste definition requirements at Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential applicable state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the TTLC and STLC. The site waste may be compared with these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

Cal. Code Regs. tit. 27, div. 2, subdiv. 1

Former Cal. Code Regs. tit. 23, div. 3, ch. 15 requirements were repealed and reenacted on July 18, 1997. The following sections of Cal. Code Regs. tit. 23, div. 3, ch. 15, define waste characteristics for discharge of waste to land. These requirements may be applicable for soil left in place that was discharged after the effective date of the requirements. They are not potentially applicable to discharges before that date but may be relevant and appropriate.

Cal. Code Regs. tit. 27, §§ 20210 and 20220 are state definitions for designated waste and nonhazardous waste, respectively. These are potentially applicable ARARs for waste that meets the definitions. These waste classifications determine state classification and siting requirements for discharging waste to land.

Any waste generated in construction of groundwater monitoring wells under groundwater Alternatives GW-2 and GW-3 would be compared with these definitions for proper off-site disposal.

C2.2.2 ARARs for Surface Water

There are no surface water bodies on HPS Parcel B; however, the Navy evaluated federal and state surface water criteria as potential ARARs for HPS Parcel B because groundwater discharges to the bay. For the A-aquifer, the Navy has determined that the state standards promulgated in Table 3-3 of the Basin Plan and the federal standards promulgated in the CTR are potential ARARs for HPS Parcel B to be met at the interface of A-aquifer groundwater and the bay.

CERCLA § 121(d)(2)(A) states that every remedial action shall require a level or standard of control which at least attains water quality criteria established under Section 304 or 303 of the CWA, where such criteria are relevant and appropriate under the circumstances of the release or threatened release. Under CWA § 304, the EPA has published the National Ambient Water Quality Criteria (NAWQC) and the National Recommended Water Quality Criteria (NRWQC). Under CWA § 303, the EPA has promulgated the water quality standards referred to as the National Toxics Rule and the CTR. In addition, the Water Board promulgated water quality objectives (WQO) for toxic pollutants in surface water with salinities greater than 10 parts per thousand (ppt) in Table 3-3 of the Basin Plan. All of these standards apply to surface water; none of them apply to groundwater. Therefore, these potential surface water ARARs would be applied to the surface water at the interface of A-aquifer groundwater with the bay and would not be used to set cleanup standards for in situ A-aquifer groundwater at HPS Parcel B.

For the B-aquifer groundwater, the Navy has identified federal and state MCLs as potential ARARs, as discussed above in Sections C2.2.1.1 and C2.2.1.2. These ARARs also would be protective of the discharge of B-aquifer groundwater to the bay; therefore, CWA §§ 304 and 303 surface water criteria are not identified as potential ARARs for the interface of the B-aquifer groundwater and the bay.

C2.2.2.1 Federal ARARs

National Ambient Water Quality Criteria

Section 304(a)(1) of the CWA (33 U.S.C. § 1314[a][1]) directs EPA to publish and periodically update the NAWQC. These standards are intended to protect human health and aquatic life from contamination in surface water. The NAWQC are updated in the *Federal Register*. The latest list of the NAWQC through June 2000 was published in the *Federal Register* on December 10, 1998, with amendments in 64 Fed. Reg. 19781 (1999). These criteria are to reflect the latest scientific knowledge on the identifiable effects of pollutants on public health and welfare, aquatic life, and recreation. These criteria serve as guidance to states in adopting water quality standards under Section 303(c) (33 U.S.C. § 1313[c]) of the CWA that protect aquatic life from acute and chronic effects.

In 2006, EPA revised the criteria for 150 priority and non-priority pollutants in the NRWQC (EPA 2006). The revised criteria are also for the protection of aquatic life and human health.

Although the NAWQC and NRWQC are nonenforceable guidelines and are not legally applicable requirements, they may be potentially relevant and appropriate surface water ARARs under certain circumstances (EPA 1990). These circumstances generally are when a state has not promulgated a state surface water quality standard and when the protection of aquatic life is a concern or human exposure from consumption of contaminated fish is a concern (EPA 1990). The Navy has determined that the NAWQC and the NRWQC are not potential ARARs for the interface of A-aquifer groundwater with the bay because there are other standards better suited to HPS Parcel B including state standards in Table 3-3 of the Basin Plan and the federal standards developed for the State of California codified in CTR, as discussed below.

In addition, the Navy has determined that the NAWQC and NRWQC are not potential ARARs for the in situ groundwater at HPS Parcel B. EPA has stated the federal water quality criteria should only be used to set groundwater cleanup standards when the groundwater is a current or potential source of drinking water and other cleanup standards for drinking water (such as MCLs and nonzero MCLGs) are not available (EPA 1990). Groundwater in the A-aquifer is not a current or potential drinking water source, and MCLs are available and have been identified as potential ARARs for the B-aquifer.

Water Quality Standards

EPA promulgated a rule on May 18, 2000, to fill a gap in California water quality standards that was created in 1994 when a state court overturned the state's water quality control plans that contained water quality criteria for priority toxic pollutants. The rule is commonly called the CTR. The rule is codified at 40 CFR § 131.38. These federal criteria are legally applicable in the State of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the CWA. The water quality standards at 40 CFR § 131.38 are potential applicable federal ARARs for the bay. The Navy has identified the substantive provisions of the CTR as potential ARARs because these standards are better suited to HPS Parcel B than national standards. The CTR standards will be applied at the interface of the A-aquifer and the bay for those chemicals that do not have standards promulgated in Table 3-3 of the Basin Plan. In addition, some inorganic chemicals have ambient concentrations established as HGALs. CERCLA and the State of California do not require clean up to below background conditions. The Navy will compare the CTR standards to these established HGALs, and if the HGAL is greater than the CTR standard, the Navy will meet the HGAL at the interface of the A-aquifer groundwater and the bay.

On December 22, 1992, EPA promulgated federal water quality standards under the authority of the federal CWA § 303(c)(2)(B), 33 U.S.C. Chapter 26, § 1313(c)(2)(B), in order to establish water quality standards required by the CWA where the State of California and other states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the *Federal Register* including amendments of the National Toxics Rule (60 Fed. Reg. 22228 [1995]). These water quality standards, as amended, are codified at 40 CFR § 131.36. The Navy has determined that these are not potential ARARs for the bay because there are better-suited standards promulgated in Table 3-3 of the Basin Plan and the CTR. Additional and revised water quality standards for salinity for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary were codified at 40 CFR § 131.37.

C2.2.2.2 State ARARs

Comprehensive Water Quality Control Plan for the San Francisco Bay Region (Basin Plan)

In Chapter 3, Table 3-3, of the Basin Plan, the Water Board established WQOs for chemicals in surface water with salinities equal to or greater than 10 ppt 95 percent of the time, many of them based on the CTR. These WQOs apply to all marine waters within the region, except for the

South Bay below Dumbarton Bridge. These WQOs apply to the bay, which meets the salinity threshold. These WQOs were identified by the Water Board as potentially applicable state ARARs. The Navy has accepted Table 3-3 of the Basin Plan as a potential state ARAR for the Bay because it is a state promulgation for the specific pollutants and the water body (the bay) at HPS Parcel B. The Navy will meet the WQOs promulgated in Table 3-3 of the Basin Plan in the bay, at the interface of the A-aquifer and the bay unless that standard is lower than an established HGAL. If the WQOs promulgated in Table 3-3 of the Basin Plan are lower than an established HGAL, then, because CERCLA and the State of California do not require cleanup to below background conditions, the Navy will meet the HGAL. For chemicals that do not have a WQO promulgated in Table 3-3 of the Basin Plan, the Navy will comply with the standards promulgated in the CTR, as discussed above in Section C2.2.2.1.

C2.2.3 ARARs for Soil

The key threshold question for soil ARARs is whether the wastes located at HPS Parcel B would be classified as hazardous waste. The waste may be classified as a federal hazardous waste as defined by RCRA and the state-authorized program, or as non-RCRA, state-regulated hazardous waste. If the waste is determined to be hazardous waste, the appropriate requirements will apply.

C2.2.3.1 Federal ARARs

RCRA Hazardous Waste

The federal RCRA requirements at 40 CFR Part 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs (see Section C1.4.1). The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste, whether the waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste with the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potentially applicable federal ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (see Section C1.4.1). Some soil and groundwater alternatives will result in the generation of waste for off-site disposal. If the Navy determines that this waste is RCRA hazardous waste, the Navy will comply with all applicable requirements for proper off-site disposal, such as packaging, manifesting, and land disposal

restrictions. The Navy has not identified any of these requirements as potential ARARs because none of the alternatives evaluate permanent on-site disposal of RCRA hazardous waste.

Toxic Substances Control Act

TSCA regulates the storage and disposal of PCBs. These requirements have both action- and chemical-specific aspects. They address storage and disposal activities, and they address only PCBs. Therefore, they may be discussed in this portion and in Section C4.0. Under the Toxic Substances Control Act, EPA has promulgated PCB remediation waste requirements at 40 CFR § 761.61 that provide cleanup and disposal options for PCB remediation waste. The options include (a) self-implementing on-site cleanup and disposal; (b) performance-based disposal, and (c) risk-based disposal. The self-implementing cleanup provisions are not binding on cleanups conducted under other authorities, including actions conducted under §§ 104 and 106 of CERCLA. However, in the preamble of the final rule for 40 CFR Part 761, EPA indicated that it anticipates that the final rule "will be a potential ARAR at CERCLA sites where PCBs are present. EPA expects that CERCLA cleanups would typically comply with the substantive requirements of one of the three options, provided by § 761.61, upon completion of the cleanups" (63 Fed. Reg. 35407, June 29, 1998). Therefore, 40 CFR § 761.61(c) is potentially applicable to soil containing PCB concentrations equal to or greater than 50 milligrams per kilogram (mg/kg) and potentially relevant and appropriate to soil containing PCB concentrations less than 50 mg/kg.

Risk-Based Option

At 40 CFR § 761.61(c), requirements for risk-based disposal are mostly procedural, requiring EPA approvals. The substantive provisions are at § 761.61(c)(2), which requires that the risk-based sampling, cleanup, and disposal will not pose an unreasonable risk of injury to health or the environment.

C2.2.3.2 State ARARs

RCRA Requirements

State RCRA requirements included within the EPA-authorized RCRA program for California are considered potential federal ARARs and are discussed above. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The site waste characteristics need to be compared with the definition of non-RCRA, state-regulated hazardous waste. The non-RCRA, state-regulated waste definition requirements at

Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential applicable state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the TTLC and STLC. The site waste may be compared with these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

Cal. Code Regs. tit. 27, div. 2, subdiv. 1

Former Cal. Code Regs. tit. 23, div. 3, ch. 15 requirements were repealed and reenacted on July 18, 1997. The following sections of Cal. Code Regs. tit. 23, div. 3, ch. 15, define waste characteristics for discharge of waste to land. These requirements may be applicable for soil left in place that was discharged after the effective date of the requirements. They are not potentially applicable to discharges before that date but may be relevant and appropriate.

Cal. Code Regs. tit. 27, §§ 20210 and 20220 are state definitions for designated waste and nonhazardous waste, respectively. These are potentially applicable ARARs for waste that meets the definitions. These waste classifications determine state classification and siting requirements for discharging waste to land.

Cal. Code Regs. tit. 27, §§ 20400(a), (c), (d), (e), and (g) have been identified by the state as potential monitoring and cleanup concentration limit ARARs for waste soil other than hazardous waste. This section is not more stringent than federal ARARs at Cal. Code Regs. tit. 22, § 66264.94(a)(1) and (3), (c), (d), and (e). Therefore, Cal. Code Regs. tit. 27, § 20400 is not an ARAR for waste at HPS Parcel B.

C2.2.4 ARARs for Air

Under Alternatives S-3, S-4, and S-5, the Navy will excavate soil in areas where concentrations of methane in soil gas exceed 1.25 percent by volume. The Navy will dispose of the soil off site.

C2.2.4.1 Federal ARARs

There are no potential federal ARARs for methane gas.

C2.2.4.2 State ARARs

The following is a potential relevant and appropriate state chemical-specific ARAR for the methane source removal:

- The requirement that methane gas not exceed 1.25 percent by volume in air in any on-site structures and 5 percent by volume in air at the facility boundary at Cal. Code Regs. tit. 27, § 20921(a)(1) and (2).

This requirement is applicable to regulated landfills. This potential ARAR is relevant and appropriate because the source of methane gas is not a regulated landfill.

C3.0 LOCATION-SPECIFIC ARARs

Potential location-specific ARARs are identified and discussed in this section and are presented in Tables C-3 and C-4, included at the end of this appendix. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain.

C3.1 SUMMARY OF LOCATION-SPECIFIC ARARs

Eight protected resource categories are associated with location-specific ARARs: (1) cultural resources; (2) wetlands protection; (3) floodplain management; (4) hydrologic resources; (5) biological resources; (6) coastal resources; (7) other natural resources; and (8) geologic characteristics. Wetlands protection and coastal resources are the resource categories relating to location-specific requirements potentially affected by the response actions at HPS Parcel B. The ARARs that pertain to these resources are presented in the following section.

C3.1.1 ARARs for Wetlands Protection

In Alternatives S-2 through S-5, the Navy would construct a shoreline revetment that would result in the discharge of fill into a wetland and cause filling of the bay.

C3.1.1.1 Federal ARARs

The Navy has identified the following potential federal location-specific ARAR:

- Wetlands protection requirements in Executive Order 11990 (codified at 40 CFR § 6.302[a]) and 40 CFR part 6, app. A, § 6(a)(1), (3), and (5).

C3.1.1.2 State ARARs

There are no potential state location-specific ARARs for wetlands protection.

C3.1.2 ARARs for Coastal Resources

Portions of HPS Parcel B are within 100 feet of the shoreline and will be affected by the implementation of several alternatives.

C3.1.2.1 Federal ARARs

The Navy has identified the substantive provisions of the following potential federal location-specific ARARs:

- Coastal Zone Management Act at 16 U.S.C. §§ 1456c and its accompanying implementing regulations in 15 CFR Part 930.

C3.1.2.2 State ARARs

The Navy accepts the substantive provisions of the following potential state location-specific ARARs:

- McAteer-Petris Act (*California Government Code* §§ 66600 through 66661), which is the enabling legislation for the San Francisco Bay Conservation and Development Commission and the San Francisco Bay Plan.

- San Francisco Bay Plan (Cal. Code Regs. tit. 14 §§ 10110 through 11990).

C3.2 DETAILED DISCUSSION OF LOCATION-SPECIFIC ARARS

The following subsections provide a detailed discussion of federal and state ARARs by location-specific resources. Pertinent and substantive provisions of the potential ARARs listed and described below were reviewed to determine whether they are potential federal or state ARARs for the HPS Parcel B TMSRA.

Requirements that are determined to be ARARs or TBCs are identified in Tables C-3 (federal) and C-4 (state), included at the end of this appendix. ARARs determinations are presented in the column with the heading "ARAR Determination." Determinations of status for location-specific ARARs were generally based on maps or lists included in the regulation or prepared by the administering agency. References to the document or agency consulted, if any, are provided in the "Comments" column and may be provided in footnotes to the table. Specific issues concerning some of the requirements are discussed in the following sections.

C3.2.1 ARARs for Wetlands Protection

A small wetland, approximately 1,300 square feet in size, is located at the edge of Installation Restoration Site 07 in Redevelopment Block BOS-1. Alternatives S-2 through S-5 evaluate the construction of a shoreline revetment. The construction of this shoreline revetment would result in the discharge of fill material into this wetland and would put fill material into the bay in construction of the shoreline revetment.

C3.2.1.1 Federal ARARs

Protection of Wetlands, Exec. Order No. 11990 (codified at 40 CFR § 6.302[a])

Executive Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists. This executive order was codified at 40 CFR § 6.302(a). The substantive provisions of 40 CFR § 6.302(a) are potentially relevant and appropriate federal ARARs for constructing the shoreline revetment in the wetland.

The construction of the shoreline revetment would destroy the wetland. No practicable alternative exists because the shoreline revetment must be built in this location to prevent contact between the shore and the bay. The Navy will replace this loss.

The Navy has also identified requirements promulgated under the Clean Water Act to protect wetlands as a potential federal action-specific ARAR for alternatives that would affect the wetland or the shoreline. The discussion of these potential ARARs is included in Section C4.0 of this appendix.

C3.2.1.2 State ARARs

There are no potential state ARARs for wetlands protection.

C3.2.2 ARARs for Coastal Resources

The construction of the shoreline revetment in Alternatives S-2 through S-5 would affect the coastal zone around the bay.

C3.2.2.1 Federal ARARs

Coastal Zone Management Act

The Coastal Zone Management Act (16 U.S.C. §§ 1451-1464) specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]). Therefore, the Coastal Zone Management Act is not potentially applicable to HPS Parcel B. The Coastal Zone Management Act will be evaluated as a potentially relevant and appropriate requirement. Section 1456(c)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the Coastal Zone Management Act and its accompanying implementing regulations in 15 CFR Part 930. A state

program sets forth objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone.

C3.2.2.2 State ARARs

McAteer-Petris Act and San Francisco Bay Plan

The San Francisco Bay Conservation and Development Commission (BCDC) administers the Coastal Zone Management Act within the bay. California's approved coastal management program includes the San Francisco Bay Plan (Bay Plan) developed by the BCDC. The BCDC was formed under the authority of the McAteer-Petris Act, *California Government Code* § 66600 *et seq.*, which authorizes the BCDC to regulate activities within San Francisco Bay and its shoreline (including 100 feet landward from the shoreline) in conformity with the policies of the Bay Plan. The McAteer-Petris Act and the Bay Plan were developed primarily to halt uncontrolled development and filling of the bay. Their broad goals include reducing bay fill and disposal of dredged material in the bay, maintaining marshes and mudflats to the fullest extent possible to conserve wildlife and abate pollution, and protecting the beneficial uses of the bay. The federal Coastal Zone Management Act, which requires compliance with approved state coastal zone management program, is a potentially relevant and appropriate federal ARAR. Therefore, the substantive provisions of the McAteer-Petris Act and the Bay Plan are potentially relevant and appropriate state ARARs for Parcel B.

Nonfederal entities must obtain a BCDC permit before placing fill material in the bay. The permit requirements are not ARARs for the Navy, but the Navy needs to comply with the substantive provisions of the McAteer-Petris Act and the Bay Plan. For example, the McAteer-Petris Act states that filling of the bay should be authorized only when (1) public benefits from fill clearly exceed public detriment from the loss of the water areas, and (2) no alternative upland location is available. When fill is authorized, the water area to be filled should be the minimum necessary to achieve the purpose of the fill project, the fill should minimize harmful effects to the bay area, and the fill project must be constructed in accordance with sound safety standards.

All of the Parcel B alternatives can be implemented in a manner consistent with the goals and substantive requirements of the McAteer-Petris Act and the Bay Plan.

C4.0 ACTION-SPECIFIC ARARs

The Navy is evaluating several alternatives for soil and groundwater at HPS Parcel B. The requirements determined to be pertinent to each alternative being evaluated for the HPS Parcel B action are discussed in this section. Tables C-5 and C-6, included at the end of this appendix, also present the potential action-specific ARARs.

C4.1 REMEDIAL ALTERNATIVES FOR SOIL

The Navy is evaluating five alternatives for soil.

C4.1.1 Alternative S-1 – No Action

There is no need to identify action-specific ARARs for the no-action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA § 121[e], 42 U.S.C. § 9621[e]). CERCLA § 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

C4.1.2 Alternative S-2 – Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Under this alternative, the Navy would use institutional controls, implemented parcel-wide, to prevent exposure to unacceptable risk. These institutional controls would restrict use of the parcel to those reuses identified when the ROD amendment is signed; prohibit growing produce in native soil; require maintenance of controls, such as fences and existing soil covers; require engineering controls on future buildings such as vapor barriers; and require compliance with a management plan for soil during construction. In addition, the Navy would construct a shoreline revetment to prevent contaminated soil from entering the bay.

C4.1.2.1 Federal ARARs

Institutional Controls

There are no potential federal ARARs for institutional controls.

Maintained Landscaping

There are no potential federal ARARs for maintained landscaping.

Shoreline Revetment

The Navy has identified the following potential relevant and appropriate federal action-specific ARARs under RCRA for construction of a shoreline revetment:

- Final cover requirement to accommodate lateral and vertical shear forces generated by the maximum credible earthquake at Cal. Code Regs. tit. 22, § 66264.310(a)(5).
- Final cover maintenance requirements and final cover run-on and run-off controls contained in Cal. Code Regs. tit. 22, § 66264.310(b)(1) and (4).
- Survey benchmark maintenance required in Cal. Code Regs. tit. 22, § 66264.310(b)(5).

These requirements are applicable to RCRA hazardous waste management units. These are not applicable ARARs because the covers are not being constructed over RCRA hazardous waste management units.

In addition, the Navy has identified the following potentially applicable federal action-specific ARAR under the Clean Water Act:

- Storm water discharge requirements for construction that will disturb 1 or more acres at 40 CFR §§ 122.44(k)(2) and (4).

Construction of the shoreline revetment would require dredging sediment from the shoreline of the bay. This dredged material would be temporarily stored on site awaiting permanent off-site disposal. The Navy has identified the following potential federal action-specific ARARs under RCRA for the storage of the dredged material:

- Temporary tank requirements for treatment or storage of hazardous remediation waste in Cal. Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f).

These requirements are applicable for dredged material that meets the definition of RCRA hazardous waste or non-RCRA, state regulated hazardous waste. The dredged material may meet the definition of a non-RCRA, state regulated hazardous waste if it contains a total threshold limit concentration wet weight of PCBs greater than or equal to 50 mg/kg as defined in Cal. Code Regs. tit. 22, § 66261.24(a)(2)(B). These requirements are relevant and appropriate requirements for dredged material that does not meet the definition of RCRA hazardous waste or non-RCRA, state regulated hazardous waste. Complying with these potential RCRA ARARs would also be protective for any PCB contamination in the dredged sediment.

The sediment would then be characterized for appropriate off-site disposal according to the potential chemical-specific ARARs for waste generated in implementing the alternatives discussed in Section C2.0.

The Navy has also identified the Clean Air Act requirement at Bay Area Air Quality Management District Regulation 6-302, which requires source emission not equal or exceed 20 percent opacity, as a potentially applicable federal action-specific ARAR for construction of the shoreline revetment.

Construction of the shoreline revetment also would result in filling in a wetland, approximately 1,300 square feet in size. The discharge of fill material into the waters of the United States is regulated under Clean Water Act § 404; therefore, the Navy has identified Clean Water Act § 404 as a potentially applicable federal action-specific ARAR. Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds, and

similar areas. Both EPA and the U.S. Army Corps of Engineers have jurisdiction over wetlands. EPA's § 404 guidelines are promulgated in 40 CFR § 230, and the U.S. Army Corps of Engineer's guidelines are promulgated in 33 CFR § 320.

Construction of the shoreline revetment will not result in the discharge of dredged material into the wetland or the bay. Pursuant to 33 CFR § 323.2(d)(2), earth moving in waters of the United States does not constitute discharge of dredged material if project-specific evidence shows that the activity results only in incidental fallback. Title 33 CFR § 323.2(d) defines incidental fallback as the redeposit of small volumes of dredged material that is incidental to excavation in waters of the United States when the material falls back to substantially the same place as the initial removal. Dredging the sediment around the bay at Parcel B is necessary for construction of the shoreline revetment; however, the Navy would remove the sediment for off-site disposal, and only incidental fallback of the dredged material would result.

Construction of the shoreline revetment will result in the discharge of fill material into the wetland and the bay. Pursuant to 33 CFR § 323.2(e), fill material is defined as any material placed in waters of the United States where the material has the effect of replacing any portion of a water of the United States with dry land. Construction of the shoreline revetment would result in the complete filling in of the wetland, the loss of which will be replaced by the Navy. The Navy has identified the substantive provisions of the following requirements, contained in titles 33 and 40 of the Code of Federal Regulations, as potentially applicable ARARs for the discharge of fill material:

- 33 CFR § 320.4 – presenting policies applicable to the review of discharge permits.
- 33 CFR § 323 – prescribing policies followed by the Corps of Engineers in reviewing applications for permits to discharge fill material.
- 40 CFR § 230.10 – prohibiting the discharge of fill material if: (1) a practicable alternative exists; (2) it violates water quality or other standards; or (3) it causes significant degradation of the waters of the United States.
- 40 CFR § 230.11 – presenting the factual determinations necessary for making a finding of compliance with 40 CFR § 230.10.
- 40 CFR §§ 230.20-230.25, 230.31, 230.32, 230.41, 230.42, and 230.53 – prescribing relevant factors to consider when evaluating the potential impacts of a discharge of fill material.

The Navy will discharge fill material into the wetland in a manner consistent with Nationwide General Permit 38 (Cleanup of Hazardous and Toxic Waste) available under the U.S. Army Corps of Engineers Nationwide Permit program at 33 CFR § 330. Nationwide Permit 38 is contained in 67 Fed. Reg. 2020, Appendix B. The Navy is not required to first obtain authorization from the U.S. Army Corps of Engineers, either through an individual permit or by filing a notice of intent to discharge under a general permit because CERCLA § 121(e) does not

require permits for remedial actions conducted entirely on site. Instead, the Navy will comply with the substantive provisions of the Nationwide Permit 38, including general conditions contained in 67 Fed. Reg. 2020, Appendix C as a means of complying with § 404 of the Clean Water Act and its implementing regulations (33 U.S.C. § 1344, 40 CFR § 230 and 33 CFR § 320 and 323) identified above as potential ARARs. These conditions include requirements to delineate the wetland, discharge suitable material, and mitigate the loss of the wetland by creating a new wetland that provides a functional replacement for the wetland loss. The Navy will mitigate the loss of the wetland using one of the following methods: compensatory mitigation, mitigation banking, or an in-lieu fee arrangement. The final details of the plan for wetland mitigation will be included in the remedial design.

C4.1.2.2 State ARARs

The Navy reviewed the requirements identified by the state and accepts the following as potential state ARARs.

Institutional Controls

The substantive provisions of the following state statutes and regulations have been accepted by Navy as potentially relevant and appropriate state ARARs for implementing institutional controls and entering into a Covenant to Restrict Use of Property with DTSC:

- California Civil Code Land Use Controls § 1471
- California Health and Safety Code Land Use Controls §§ 25202.5, 25222.1, 25232(b)(1)(A)-(E), 25233(c), 25234, and 25355.5(a)(1)(C)
- Cal. Code Regs. tit. 22, § 67391.1

The substantive provisions of California Civil Code § 1471 are the following general narrative standard: "... to do or refrain from doing some act on his or her own land ... where...: (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence on the land of hazardous materials, as defined in § 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the Covenant to Restrict Use of Property and run with the land.

The substantive provision of California Health and Safety Code § 25202.5 is the general narrative standard to restrict "present and future uses of all or part of the land on which the ... facility ... is located ...." This substantive provision would be implemented by incorporation of restrictive environmental covenants in the Covenant to Restrict Use of Property at the time of transfer for purposes of protecting present and future public health and safety.

California Health and Safety Code §§ 25222.1 and California Health and Safety Code § 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land use covenants with the owner of property. The substantive requirements of the following California Health and Safety Code § 25222.1 provisions are potentially relevant and appropriate: (1) the general narrative standard: "restricting specified uses of the property, ..." and (2) "... the agreement is irrevocable, and shall be recorded by the owner, ... as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following California Health and Safety Code § 25355.5(a)(1)(C) provisions are potentially relevant and appropriate: "... execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land."

The Navy would comply with the substantive requirements of California Health and Safety Code §§ 25222.1 and 25355.5(a)(1)(C) by incorporating CERCLA use restrictions into the Navy's deed of conveyance in the form of restrictive covenants under the authority of California Civil Code § 1471. The substantive provisions of California Health and Safety Code §§ 25222.1 and 25355.5 (a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of California Civil Code § 1471. The covenants would be recorded with the deed and run with the land.

Actual land-use restriction requirements are set forth in California Health and Safety Code § 25232(b)(1)(A)–(E). These include prohibitions on construction of residences, hospitals for humans, schools for persons under 21 years of age, day care centers, or any permanently occupied human habitation on hazardous waste property. California Health and Safety Code § 25233(c) sets forth potentially relevant and appropriate substantive criteria for granting variances from prohibited uses set forth in California Health and Safety Code § 25232(b) (that is, a residence used for permanently occupied human habitation, a hospital for humans, a school for persons under 21 years of age, a day care center for children, and any permanently occupied human habitation) based upon specified environmental and health criteria.

California Health and Safety Code § 25234 sets forth the following potentially relevant and appropriate substantive criteria for the removal of a land use restriction on the grounds that "... the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Covenant to Restrict Use of Property between the Navy and DTSC, the potentially relevant and appropriate portions of California Health and Safety Code §§ 25202.5, 25222.1, 25232(b)(1)(A)-(E), 25233(c), 25234, and 25355.5(a)(1)(C) and California Civil Code § 1471 would also be implemented through the deed between the Navy and the transferee.

DTSC promulgated a regulation on April 19, 2003, regarding "Requirements for Land-Use Covenants" at Cal. Code Regs., tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be potentially relevant and appropriate state ARARs by Navy.

EPA agrees that the substantive portions of the state statutes and regulations referenced in this section are potential ARARs. EPA specifically considers §§ (a), (b), (d), and (e) of Cal. Code Regs., tit. 22 § 67391.1, to be potential ARARs for this TMSRA. DTSC's position is that all of the state statutes and regulations referenced in this section are ARARs.

Maintained Landscaping

The following is a potential state ARAR for covering soil excavations in areas of naturally occurring asbestos:

- Toxic control measures for airborne asbestos during construction, grading, quarrying, and surface mining operations at Cal. Code Regs. tit. 17, § 93105.

Pursuant to Cal. Code Regs. tit. 17, § 93105(e)(4)(G), upon completion of construction activities in areas of naturally occurring asbestos, the disturbed surfaces must be stabilized using one or more of the following methods:

- A vegetative cover
- Placement of at least 3 inches of non-asbestos-containing material
- Paving
- Any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions

The maintained landscaping will comply with this potential ARAR.

Shoreline Revetment

The following are potentially relevant and appropriate state requirements for constructing the shoreline revetment:

- The allowance for engineered alternatives to the prescriptive final cover standards under Cal. Code Regs. tit. 27, § 20080(b).
- The requirement that public agencies comply with Title 27 to the extent feasible when taking action to clean up unauthorized releases at Cal. Code Regs. tit. 27, § 20090(d).
- Permanent monument requirements at Cal. Code Regs. tit. 27, § 20950(d).
- Final grading and maintenance requirements at Cal. Code Regs. tit. 27, § 21090(b)(1).

- Erosion and related damage prevention requirements at Cal. Code Regs. tit. 27, § 21090(c)(4).
- Aerial photographic survey, or alternative survey, requirements at Cal. Code Regs. tit. 27, § 21090(e)(1) and (e)(3).
- Final cover and alternative final cover standards at Cal. Code Regs. tit. 27, § 21140.
- Final slopes requirements at Cal. Code Regs. tit. 27, § 21145(a).
- Drainage and erosion control system requirements at Cal. Code Regs. tit. 27, § 21150.

The following is a potentially applicable state requirement for construction and grading in naturally occurring asbestos:

- Toxic control measures for airborne asbestos during construction, grading, quarrying, and surface mining operations at Cal. Code Regs. tit. 17, § 93105.

C4.1.3 Alternative S-3 – Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Under this alternative, the Navy would excavate soil contaminated with lead, mercury, and polynuclear aromatic hydrocarbons and dispose of it off site. The Navy would also excavate soil in areas where concentrations of methane in soil gas exceed 1.25 percent by volume and dispose of it off site. The Navy would implement parcel-wide institutional controls to prevent exposure to unacceptable risk. As with Alternative S-2, these institutional controls would restrict reuse of the parcel to uses identified when the ROD amendment is signed; prohibit growing produce in native soil; require maintenance of controls, such as fences and existing soil covers; require engineering controls on future buildings such as vapor barriers; and require compliance with a soil management plan during construction. The Navy would construct the shoreline revetment in Redevelopment Blocks BOS-1 and BOS-3 to prevent contaminated soil from entering the bay.

C4.1.3.1 Federal ARARs

Excavation and Off-Site Disposal

The Navy has identified the following potentially applicable action-specific ARARs for excavation and off-site disposal:

- RCRA hazardous waste identification requirements at Cal. Code Regs. tit. 22, § 66262.10(a) and 11.

- The requirement to analyze generated waste to determine if it is hazardous at Cal. Code Regs. tit. 22, § 66264.13(a) and (b).

The Navy has identified the following potential ARARs for staging the soil:

- Temporary staging pile requirements at 40 CFR § 264.554 (d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k).

These requirements are applicable to excavated soil that meets the definition of RCRA hazardous waste and relevant and appropriate to excavated soil that does not meet the definition of RCRA hazardous waste.

Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

In addition, the Navy has identified the following potentially applicable federal action-specific ARAR under the Clean Water Act:

- Storm water discharge requirements for construction that will disturb 1 or more acres at 40 CFR §§ 122.44(k)(2) and (4).

This regulation requires the use of best management practices to control or abate the discharge of pollutants when authorized under Clean Water Act § 402(p) to control storm water discharges. Under the Clean Water Act and its implementing regulations, individual National Pollutant Discharge Elimination System permits, or coverage under promulgated storm water general permits, are required for construction that disturbs at least 1 acre. The State of California has promulgated a storm water general permit as Order No. 99-08-DWQ. Under CERCLA § 121(e)(1), no federal, state, or local permit is required for any remedial action conducted entirely on site, where it is selected and carried out in compliance with CERCLA § 121. The Navy is therefore not required to obtain an individual storm water permit or submit a notice of intent to discharge under the state's general permit. The Navy will, however, use the substantive requirements of the state's general permit for storm water discharges as TBCs for complying with the requirement to apply best management practices for storm water discharges promulgated at 40 CFR § 122.44(k)(2) and (4).

The Navy has identified the following potentially applicable federal action-specific ARAR under the Clean Air Act for the excavation:

- The requirement that source emissions not equal or exceed 20 percent opacity under Bay Area Air Quality Management District Regulation 6-302.

Methane and Mercury Source Removal

The potential federal ARARs identified for excavation and off-site disposal are potential ARARs for soil excavation under this component. Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

There are no additional potential federal action-specific ARARs for the methane source removal.

Institutional Controls

There are no potential federal action-specific ARARs for institutional controls.

Maintained Landscaping

There are no potential federal action-specific ARARs for maintained landscaping.

Shoreline Revetment

The potential federal action-specific ARARs for the shoreline revetment are identified in Alternative S-2, Section C4.1.2.2.

C4.1.3.2 State ARARs

The Navy reviewed the requirements identified by the state and accepted the following as potential state ARARs.

Excavation and Off-Site Disposal

The following are potentially applicable state ARARs for discharging designated or nonhazardous solid waste to land:

- The requirement to characterize accurately wastes under Cal. Code Regs. tit. 27, § 20200(c).
- The discharge requirements for designated waste to Class I or Class II waste management units at Cal. Code Regs. tit. 27, § 20210.
- The discharge requirements for nonhazardous solid to classified units at Cal. Code Regs. tit. 27, §§ 20220(b), (c), and (d).

The Navy has accepted the substantive provisions of the following potentially applicable state Clean Air Act ARAR requiring dust mitigation measures for construction and grading in areas of naturally occurring asbestos for all soil excavations:

- The asbestos airborne toxics control measure for construction, grading, quarrying, and surface mining operations at Cal. Code Regs. tit. 17, § 93105.

In addition, Cal. Code Regs. tit. 17, § 93105(e)(4)(G) requires that upon completion of the project , the disturbed surfaces in areas of naturally occurring asbestos must be stabilized using one or more of the following methods:

- A vegetative cover
- Placement of at least 3 inches of non-asbestos-containing material
- Paving
- Any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions

The soil excavations will be covered with a non-asbestos-containing soil cover or paving that will comply with this potential ARAR.

In addition, the Navy will use the substantive provisions of the state's general permit, Order Number 99-08-DWQ, as TBCs for complying with the storm water discharge requirements under the potential federal Clean Water Act ARAR at 40 CFR §§ 122.44(k)(2) and (4).

Methane and Mercury Source Removal

The potential state action-specific ARARs for excavation and off-site disposal would be potential ARARs for the excavation and off-site disposal associated with the methane and mercury source removal component. In addition, the Navy has identified a potential state chemical-specific ARAR for methane gas that is presented in Section C2.0 of this appendix.

Institutional Controls

Potential state action-specific ARARs for institutional controls are identified in Alternative S-2, Section C4.1.2.2.

Maintained Landscaping

Potential state action-specific ARARs for maintained landscaping are identified in Alternative S-2, Section C4.1.2.2.

Shoreline Revetment

Potential state action-specific ARARs for shoreline revetment are identified in Alternative S-2, Section C4.1.2.2.

C4.1.4 Alternative S-4 – Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Under this alternative, the Navy would install soil, asphalt, or concrete covers to prevent exposure to unacceptable risk. The Navy would also excavate soil contaminated with mercury and soil in areas where methane concentrations in soil gas exceed 1.25 percent by volume and dispose of it off site. As with Alternatives S-2 and S-3, the Navy would implement parcel-wide institutional controls. These institutional controls would restrict reuse of the parcel to the uses identified when the ROD is signed; prohibit growing produce in native soil; require maintenance of controls, such as fences; require maintenance of all new and existing covers; require engineering controls on future buildings, such as vapor barriers; and require compliance with a soil management plan during construction. The Navy would also construct the shoreline revetment in Redevelopment Blocks BOS-1 and BOS-3 to prevent contaminated soil from entering the bay.

C4.1.4.1 Federal ARARs

Installing Covers

The potential federal action-specific ARARs for constructing the shoreline revetment, identified in Section C4.1.2.1, are potential ARARs for the covers contemplated under this alternative.

Methane and Mercury Source Removal

The potential federal ARARs identified for excavation and off-site disposal are potential ARARs for the soil excavation under this component. Also, any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

There are no additional potential federal action-specific ARARs for the methane and mercury source removal.

Institutional Controls

There are no potential federal action-specific ARARs for institutional controls.

Shoreline Revetment

The potential federal action-specific ARARs for the shoreline revetment are identified in Alternative S-2, Section C4.1.2.1.

C4.1.4.2 State ARARs

Installing Covers

The potential state ARARs for constructing the shoreline revetment, identified in Section C4.1.2.2, are potential ARARs for placing the covers contemplated in this alternative.

Methane and Mercury Source Removal

The potential state action-specific ARARs for excavation and off-site disposal would be potential ARARs for the excavation and off-site disposal associated with the methane and mercury source removal component. In addition, the Navy has identified a potential state chemical-specific ARAR for methane gas that is presented in Section C2.0 of this appendix.

Institutional Controls

Potential state action-specific ARARs for institutional controls are identified in Alternative S-2, Section C4.1.2.2.

Shoreline Revetment

Potential state action-specific ARARs for constructing the shoreline revetment are identified in Alternative S-2, Section C4.1.2.2.

C4.1.5 Alternative S-5 – Excavation, Methane and Mercury Source Removal, Disposal Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment

This alternative evaluates all the components of Alternatives S-2 through S-4 as one alternative. In addition, Alternative S-5 includes operating a soil vapor extraction system for the VOC contamination at Redevelopment Block 8.

C4.1.5.1 Federal ARARs

Excavation and Off-Site Disposal

Potential federal action-specific ARARs for excavation and off-site disposal are identified in Alternative S-3, Section C4.1.3.1. Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

Methane and Mercury Source Removal

The potential federal ARARs identified for excavation and off-site disposal, identified in Section C4.1.3.1, are potential ARARs for soil excavation under this component. Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

There are no additional potential federal action-specific ARARs for the methane and mercury source removal.

Installing Covers

The potential federal action-specific ARARs for constructing the shoreline revetment, identified in Section C4.1.2.1, are potential ARARs for the covers contemplated under this alternative.

Soil Vapor Extraction

Any waste generated in implementing the soil vapor extraction system would be disposed of off site at an appropriate facility. The potential federal action-specific ARARs identified for excavation and off-site disposal of soil are potential ARARs for the waste generated in implementing the soil vapor extraction system. These potential ARARs are identified in Alternative S-3, Section C4.1.3.1.

In addition, the Navy has identified the following potentially applicable federal action-specific ARARs from the Clean Air Act for operating a soil vapor extraction system:

- The requirement to use the best available control technology for new emission sources contained in Bay Area Air Quality Management District Regulation 2-1-301.
- The requirements for soil vapor extraction systems contained in Bay Area Air Quality Management District Regulation 8-47.

Institutional Controls

There are no potential federal action-specific ARARs for institutional controls.

Shoreline Revetment

The potential federal action-specific ARARs for the shoreline revetment are identified in Alternative S-2, Section C4.1.2.1.

C4.1.5.2 State ARARs

Excavation and Off-Site Disposal

Potential state action-specific ARARs for excavation are identified in Alternative S-3, Section C4.1.3.2.

Installing Covers

The potential state ARARs constructing the shoreline revetment, identified in Section C4.1.2.2, are potential ARARs for the covers contemplated in this alternative.

Methane and Mercury Source Removal

The potential state action-specific ARARs for excavation and off-site disposal would be potential ARARs for the excavation and off-site disposal associated with the methane and mercury source removal component. In addition, the Navy has identified a potential state chemical-specific ARAR for methane gas that is presented in Section C2.0 of this appendix.

Soil Vapor Extraction

Any waste generated in implementing the soil vapor extraction system will be characterized for appropriate disposal. The potential state ARARs for excavation and off-site disposal of waste are identified in Alternative S-3, Section C4.1.3.2.

Institutional Controls

Potential state action-specific ARARs for institutional controls are identified in Alternative S-2, Section C4.1.2.2.

Shoreline Revetment

Potential state action-specific ARARs for constructing the shoreline revetment are identified in Alternative S-2, Section C4.1.2.2.

C4.2 ARARs FOR GROUNDWATER REMEDIAL ALTERNATIVES

The following sections present ARARs for all the groundwater remedial alternatives.

C4.2.1 Alternative GW-1 – No Action

There is no need to identify action-specific ARARs for the no-action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA § 121(e), 42 U.S.C. § 9621[e]). CERCLA § 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

C4.2.2 Alternative GW-2 – Long-Term Groundwater Monitoring and Institutional Controls

Under this alternative, the Navy would monitor the groundwater to verify that contaminants do not enter the bay at unacceptable levels. The Navy would also implement institutional controls as described in Section 4.3 of the main TMSRA document.

C4.2.2.1 Federal ARARs

Groundwater Monitoring

The Navy has identified the following potentially relevant and appropriate federal ARARs for establishing a corrective action groundwater monitoring program because this alternative contemplates a groundwater response action:

- The requirement to implement a corrective action monitoring program that demonstrates the effectiveness of the corrective action program at Cal. Code Regs. tit. 22, § 66264.100(d).
- Constituents of concern requirements identified in Cal. Code Regs. tit. 22, § 66264.93.
- The requirement to establish a sufficient number of monitoring points at Cal. Code Regs. tit. 22, § 66264.97(b)(1)(A) and (b)(1)(D)(1) and (2).

- Monitoring well construction requirements at Cal. Code Regs. tit. 22, § 66264.97(b)(4), (5), (6), and (7).

- Sample collection requirements at Cal. Code Regs. tit. 22, § 66264.97(e)(6), (e)(12)(A)(3), (e)(12)(B), (e)(13), and (e)(15).

The concentration limit requirements contained in Cal. Code Regs. tit. 22, § 66264.94(a), (b), (c), (d), and (e) are the chemical-specific ARARs for the groundwater monitoring (see Section C2.2.1.1).

The Navy has identified the following potentially applicable federal action-specific ARARs for the disposal of any investigation-derived waste generated in constructing monitoring wells under this alternative:

- The requirement to determine if generated waste is hazardous at Cal. Code Regs. tit. 22, §§ 66262.10(a) and 66262.11.

- The requirement to analyze generated waste to determine if it is hazardous at Cal. Code Regs. tit. 22, § 66264.13(a) and (b).

Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

Institutional Controls

There are no potential federal ARARs for institutional controls.

C4.2.2.2 State ARARs

The Navy reviewed the requirements identified by the state and determined that the substantive provisions of the following are potential state ARARs.

Groundwater Monitoring

The following requirements for disposal of investigation-derived waste generated in constructing additional monitoring wells under this alternative are potentially applicable state ARARs.

- The requirement to accurately characterize wastes under Cal. Code Regs. tit. 27, § 20200(c).

- The discharge requirements for designated waste to Class I or Class II waste management units at Cal. Code Regs. tit. 27, § 20210.

- The discharge requirements for nonhazardous solid to classified units at Cal. Code Regs. tit. 27, §§ 20220(b), (c), and (d).

Institutional Controls

Potential state ARARs for institutional controls are identified in Section C4.1.2.2.

C4.2.3 Alternative GW-3 – In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls

Alternative GW-3 is divided into two parts. Under Alternative GW-3A, the Navy would inject a biological amendment into the source area of the VOC plume at Building 123 in Redevelopment Block 8. Under Alternative GW-3B, the Navy would inject zero-valent iron into the source area of the VOC plume at Building 123 in Block 8. Under both of these alternatives, the Navy would monitor groundwater to verify that groundwater contamination does not enter the bay at unacceptable levels. The length of time the Navy will monitor groundwater under either Alternative GW-3A or GW-3B is expected to be shorter than under Alternative GW-2 because the Navy would be treating a source area of contamination, thus reducing the level of contamination in a shorter time frame. The Navy would also implement the same institutional controls identified in Alternative GW-2.

C4.2.3.1 Federal ARARs

In Situ Treatment

The Navy has identified the following potentially applicable federal action-specific ARAR under the Underground Injection Control Program of the Safe Drinking Water Act:

- The prohibition against constructing, operating, maintaining, converting, plugging, abandoning, or conducting any other injection in a manner that allows movement of fluid containing any contaminant into underground sources of drinking water. This prohibition applies if the presence of the contaminant may violate any primary drinking water regulation under 40 CFR § 142 or may otherwise adversely affect the health of persons at 40 CFR § 144.12(a).

Either a biological amendment or zero-valent iron would be injected into the groundwater through a Class V injection well. Class V injection wells are authorized by rule under 40 CFR § 144.24(a), so a specific permit is not required. Basic information about the Class V well is required under 40 CFR § 144.83. The requirement to compile and submit this basic information is procedural and, therefore, cannot be an ARAR; however, the Navy will use the basic information requirements at 40 CFR § 144.83 as TBCs for complying with the substantive requirement of the potential federal ARAR at 40 CFR § 144.12(a).

Groundwater Monitoring

Potential federal action-specific ARARs for groundwater monitoring are identified in Section C4.2.2.1. Any hazardous substance, pollutant, or contaminant that is shipped off site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA's off-site rule at 40 CFR § 300.440.

Institutional Controls

There are no potential federal action-specific ARARs for institutional controls.

C4.2.3.2 State ARARs

The Navy reviewed the requirements identified by the state and determined that the following are potential state ARARs.

In Situ Treatment

There are no potential state ARARs for injection of a biological amendment or zero-valent iron.

Groundwater Monitoring

Potential state ARARs for groundwater monitoring are identified in Section C4.2.2.2.

Institutional Controls

Potential state ARARs for institutional controls are identified in Section C4.1.2.2.

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TABLES

TABLE C-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
GROUNDWATER				
Safe Drinking Water Act (42 U.S.C., ch. 6A, § 300[f]–300[j]-26)[b]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system.	40 CFR § 141.61(a) and (c)	Relevant and appropriate	The Navy considers the B-aquifer a Class II aquifer under federal criteria and a potential source of drinking water based on an evaluation of site-specific factors. The Navy and the Water Board have determined that the A-aquifer is not a potential source of drinking water; therefore, drinking water standards (MCLs) are not potential ARARs.
MCLGs pertain to known or anticipated adverse health effects (also known as recommended MCLs).	Public water system.	40 CFR § 141.51	Relevant and appropriate	The Navy considers the B-aquifer a Class II aquifer under federal criteria and a potential source of drinking water based on an evaluation of site-specific factors. The Navy has identified the non-zero MCLG for thallium as a potential chemical-specific ARAR for the B-aquifer. The Navy and the Water Board have determined that the A-aquifer is not a potential source of drinking water; therefore, drinking water standards (MCLs and non-zero MCLGs) are not potential ARARs.

TABLE C-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
GROUNDWATER				
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[b]				
Groundwater protection standards: owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Cal. Code Regs. tit. 22, § 66264.94 in the uppermost aquifer underlying the waste management area of concern at the POC.	A regulated unit that receives or has received hazardous waste before July 26, 1982, or regulated units that ceased receiving hazardous waste prior to July 26, 1982, where constituents in or derived from the waste may pose a threat to human health or the environment.	Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e)	Relevant and appropriate	There is no RCRA-regulated unit at HPS Parcel B; therefore, these standards are not applicable. These standards are potentially relevant and appropriate for the A-aquifer. The Navy will develop site-specific concentration limits for use in its groundwater monitoring program.
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	These requirements are potential ARARs for all waste generated by the Navy in constructing monitoring wells for groundwater Alternatives GW-2 and GW-3. The Navy would determine if the waste is RCRA hazardous at the time it is generated.

TABLE C-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
		SURFACE WATER		
Clean Water Act (Title 33 U.S.C., Chapter 26, §§ 1251-1387)[b]				
Surface water quality standards.	Discharge to waters of the United States.	40 CFR § 131.38	Applicable	These standards, known as the CTR, are potentially applicable surface water ARARs for the bay. The Navy has identified the CTR as potential ARARs for the A-aquifer at HPS Parcel B because contaminated groundwater may discharge to the bay. The Navy will meet the potential CTR ARARs at the interface of the A-aquifer groundwater and the bay for contaminants in the groundwater that do not have a promulgated concentration in Table 3-3 of the Basin Plan, identified as potential state chemical-specific ARARs. The Navy has identified MCLs as potential ARARs for the B-aquifer groundwater, which are protective of any discharge of B-aquifer groundwater to the bay. Therefore, the CTR are not potential ARARs for the B-aquifer.
		SOIL		
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[b]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	These requirements are potential ARARs for all waste generated by the Navy in implementing soil Alternatives S-2, S-3, S-4, and S-5. The Navy would determine if the waste is RCRA hazardous at the time it is generated.

TABLE C-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
SOIL (Continued)				
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[b]				
LDRs prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal.	Cal. Code Regs. tit. 22, §§ 66268.1(f), 66268.40, 66268.44, 66268.48, 66268.49	Not ARARs	None of the alternatives evaluate the permanent on-site disposal of excavated soil or other waste. Therefore, requirements that RCRA hazardous waste comply with LDRs are not ARARs. There are alternatives that evaluate the off-site disposal of excavated soil and other waste. The Navy will characterize this waste for off-site disposal and will dispose of it at an appropriately licensed facility if necessary. If the excavated soil or other waste is determined to be RCRA hazardous waste, the disposal facility will have responsibility for complying with these LDRs.
Toxic Substances Control Act (15 U.S.C., ch. 53, §§ 2601–2692)[b]				
Regulates storage and disposal of PCB remediation waste. There are three options: (a) self-implementing on-site cleanup and disposal; (b) performance-based disposal using existing approved disposal technologies; and (c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 mg/kg.	40 CFR § 761.61(c)	Applicable and relevant and appropriate	This is a potentially applicable requirement for soil containing PCB concentrations equal to or greater than 50 mg/kg. This is a potentially relevant and appropriate requirement for soil containing PCB concentrations less than 50 mg/kg. A measured concentration of 50 mg/kg has been documented near the shoreline at IR-07.

TABLE C-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs.
b	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.
§	Section
§§	Sections
ARAR	Applicable or relevant and appropriate requirement
Cal. Code Regs.	California Code of Regulations
CFR	*Code of Federal Regulations*
CTR	California Toxics Rule
HPS	Hunters Point Shipyard
MCL	Maximum contaminant level
mg/kg	Milligram per kilogram
LDR	Land disposal restriction
PCB	Polychlorinated biphenyl
POC	Point of compliance
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity characteristic leaching procedure
U.S.C.	*United States Code*
Water Board	San Francisco Regional Water Quality Control Board

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
		GROUNDWATER		
State and Regional Water Quality Control Boards[b]				
Authorizes the SWRCB and Water Board to establish in water quality control plans beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality. Authorizes regional water boards to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.		Cal. Water Code, div. 7, §§ 13240, 13241, 13243, 13263(a), 13269, and 13360 (Porter-Cologne Water Quality Control Act)	Applicable	The Navy accepts the substantive provisions of §§ 13240, 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Act enabling legislation, as implemented through the beneficial uses, WQOs, waste discharge requirements, promulgated policies of the Basin Plan for the San Francisco Bay Region as potential ARARs.
Describes the water basins in the San Francisco Bay Region, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, and incorporates statewide water quality control plans and policies.	Waters of the state.	Chapters 2 and 3 of the Water Quality Control Plan for the San Francisco Bay Basin (Cal. Water Code §13240), Except the MUN designation for the A-aquifer	Applicable	Substantive requirements pertaining to beneficial uses, WQOs, and certain statewide water quality control policies are potential state ARARs for the groundwater components of this response action.

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
GROUNDWATER (Continued)				
State and Regional Water Quality Control Boards[b]				
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.	High quality waters of the state.	Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Not an ARAR	The Navy has determined that SWRCB Res. 68-16 is not a potential chemical-specific ARAR for HPS Parcel B. SWRCB Res. 68-16 is not more stringent than the potential federal chemical-specific ARAR at Cal. Code Regs., tit. 22, § 66264.94. SWRCB Res. 68-16 is also not a potential action-specific ARAR for the groundwater alternatives evaluated in this TMSRA because none of the alternatives contemplates a direct discharge of groundwater.

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
GROUNDWATER (Continued)				
State and Regional Water Quality Control Boards[b]				
Describes requirements for Water Board oversight of investigation and cleanup and abatement resulting from discharges of hazardous substances. Water boards may decide on cleanup and abatement goals and objectives for the protection of water quality and beneficial uses of water within each region. Establishes criteria for "containment zones" where cleanup to established water-quality goals is not economically or technically practicable.	Discharge of hazardous substance into waters of the state.	Policies and procedures for investigation and cleanup and abatement of discharges under Cal. Water Code § 13304, SWRCB Res. 92-49	Not an ARAR	SWRCB Res. 92-49 is not a potential chemical-specific ARAR for HPS Parcel B because it is not more stringent than the potential federal ARAR at Cal. Code Regs. tit. 22, § 66264.94.
Incorporated into all Water Board basin plans. Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonable be treated for domestic use using either best management practices or best economically achievable treatment practices.	Waters of the state.	SWRCB Res. 88-63	Applicable	Pursuant to SWRCB Res. 88-63, groundwater in the A and B-aquifers is not a potential source of drinking water. The Navy will consider groundwater in the B-aquifer a potential source of drinking water under federal criteria and site-specific factors.
California Environmental Protection Agency, Department of Toxic Substances Control[b]				
Definition of "non-RCRA hazardous waste."	Waste.	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F)	Applicable	These requirements are potential ARARs for all waste the Navy generates in constructing monitoring wells under groundwater Alternatives GW-2 and GW-3. The Navy would determine if the waste is non-RCRA hazardous waste when it is generated.

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
GROUNDWATER (Continued)				
State and Regional Water Quality Control Boards[b]				
Definitions of designated and nonhazardous waste.	Waste.	Cal. Code Regs. tit. 27, §§ 20210 and 20220	Applicable	These requirements are potential ARARs for all waste the Navy generates in constructing monitoring wells under groundwater Alternatives GW-2 and GW-3. The Navy would determine if the waste is non-RCRA hazardous waste when it is generated.
SURFACE WATER				
State and Regional Water Quality Control Boards[b]				
Surface water quality standards.	Marine waters with salinities equal to or greater than 10 ppt 95 percent of the time.	Basin Plan Table 3-3	Applicable	These standards are potentially applicable to the bay. The Navy has identified Table 3-3 as potential ARARs for HPS Parcel B because contaminated groundwater may discharge to the bay. The Navy will meet the potential Table 3-3 ARARs at the interface of the A-aquifer groundwater and the bay. The Navy has identified MCLs as potential ARARs for the B-aquifer groundwater, which are protective of any discharge of B-aquifer groundwater to the bay. Therefore, Table 3-3 is not a potential ARAR for the B-aquifer.

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
SOIL				
California Environmental Protection Agency, Department of Toxic Substances Control[b]				
Definition of "non-RCRA hazardous waste."	Waste.	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F)	Applicable	These requirements are potential ARARs for all waste the Navy generates in implementing various alternatives. The Navy would determine if the waste is non-RCRA hazardous waste when it is generated.
State and Regional Water Quality Control Boards[b]				
Definitions of designated and nonhazardous waste.	Waste.	Cal. Code Regs. tit. 27, §§ 20210 and 20220	Applicable	These requirements are potential ARARs for all waste generated by the Navy in implementing various alternatives. The Navy would determine if the waste is designated or nonhazardous waste when it is generated.
AIR				
State Water Resources Control Board and Regional Water Quality Control Boards[b]				
Requires the operator of a landfill to ensure that the concentration of methane gas migrating from a landfill does not exceed 5 percent by volume in air at the facility property boundary and that the concentration of methane gas does not exceed 1.25 percent by volume in air in any on-site structures during closure and post-closure of the landfill.	Landfill.	Cal. Code Regs. tit. 27, § 20921(a)(1) and (2)	Relevant and appropriate	There is no landfill at Parcel B; however, the Navy has determined this requirement is potentially relevant and appropriate for excavating waste that contains methane gas in excess of these limits.

TABLE C-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs.
b	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.
§	Section
§§	Sections
ARAR	Applicable or relevant and appropriate requirement
Cal. Water Code	California Water Code
Cal. Code Regs.	Code of California Regulations
gpd	Gallon per day
HPS	Hunters Point Shipyard
MCL	Maximum contaminant level
MUN	Municipal and domestic supply
ppm	Part per million
ppt	Part per thousand
NPDES	National Pollutant Discharge Elimination System
RCRA	Resource Conservation and Recovery Act
Res.	Resolution
SWRCB	*State Water Resources Control Board*
TDS	Total dissolved solids
TMSRA	Technical memorandum in support of a record of decision amendment
Water Board	San Francisco Bay Regional Water Quality Control Board
WQO	Water quality objective

TABLE C-3: POTENTIAL FEDERAL LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Exec. Order No. 11990, Protection of Wetlands[b]					
Wetland	Avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if practicable alternatives exist.	Wetland meeting definition of Section 7.	40 CFR § 6.302(a) and 40 CFR pt. 6, app. A, § 6(a)(1), (3), and (5) (at the end of § 6.1007)	Relevant and appropriate	Construction of the shoreline revetment will result in filling of a small (1,300 ft^2) wetland.
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone, including lands thereunder and adjacent shore land.	16 U.S.C. § 1456(c)(1)(A) 15 CFR Part 930	Relevant and appropriate	The CZMA excludes federal lands from the coastal zone; however, since portions of HPS Parcel B are within the coastal zone, the Navy has determined that it is relevant and appropriate.

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs.

b Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

§ Section
§§ Sections
ARAR Applicable or relevant and appropriate requirement
CFR *Code of Federal Regulations*
CZMA Coastal Zone Management Act
ft^2 Square foot
HPS Hunters Point Shipyard
U.S.C. *United States Code*

TABLE C-4: POTENTIAL STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
McAteer-Petris Act (California Government Code §§ 66600 through 66661)[b]					
Within the San Francisco Bay coastal zone	Reduce fill and disposal of dredged material in San Francisco Bay, maintain marshes and mudflats to the fullest extent possible to conserve wildlife, abate pollution, and protect the beneficial uses of the bay.	Activities affecting the San Francisco Bay and 100 feet landward of the shoreline.	San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110 through 11990	Relevant and appropriate	The Navy has determined that the substantive provisions of the Coastal Zone Management Act are potentially relevant and appropriate federal location-specific requirements for HPS Parcel B. The Coastal Zone Management Act requires federal agency activity be conducted in a manner consistent with approved state management programs to the maximum extent practicable. The McAteer-Petris Act is enabling legislation for the San Francisco Bay Plan, an approved state management program for the San Francisco Bay. Substantive provisions of the McAteer-Petris Act and the San Francisco Bay Plan are relevant and appropriate because their authority is derived from the Coastal Zone Management Act, a relevant and appropriate federal requirement. The Navy will continue to conduct its response actions in accordance with the substantive provisions of the San Francisco Bay Plan.

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs.

b Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

§§ Sections

ARAR Applicable or relevant and appropriate requirement

Cal. Code Regs. *California Code of Regulations*

HPS Hunters Point Shipyard

TABLE C-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
			SOIL ALTERNATIVES		
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment or soil cover.	The final cover must accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the final cover is maintained.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(a)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the post-closure period. Prevent runon and runoff from eroding or otherwise damaging the final cover throughout the post-closure period.	RCRA hazardous waste management unit.	Cal Code Regs. tit. 22, § 66264.310(b)(1) and (4)	Relevant and appropriate	The Navy has determined that these requirements are potential ARARs for constructing a shoreline revetment and covers for the soil. These requirements are relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Protect and maintain surveyed benchmarks throughout the post-closure period.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(b)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE C-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment.	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	Temporary storage of RCRA hazardous waste.	Cal Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f)	Applicable or relevant and appropriate	These requirements are applicable for the temporary storage of dredged material that meets the definition of RCRA hazardous waste or non-RCRA, state regulated hazardous waste under Cal. Code Regs. tit. 22, including sediment with TTLC wet weight concentrations of PCBs greater than or equal to 50 mg/kg. Concentrations of PCBs equal to or greater than 50 mg/kg have been measured in the sediment along the shoreline of IR-07. These requirements are relevant and appropriate for dredged material that does not meet the definition of RCRA hazardous waste.
Excavate soil or generate waste.	Person who generates waste shall determine if the waste is a RCRA hazardous waste.	Generator of waste.	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11	Applicable	These regulations are applicable to excavation of soil and generation of waste. The Navy will determine whether the soil or any waste is RCRA hazardous waste when it is generated.
Excavate soil or generate waste.	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	Applicable	These regulations are applicable to the excavation of soil and the generation of waste. The Navy will determine whether the soil or any waste is RCRA hazardous waste when it is generated.

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Stockpile soil for off-site disposal.	Allows generators to accumulate solid remediation waste in an EPA-designated pile for storage only up to 2 years during remedial operations without triggering land disposal restrictions.	RCRA hazardous remediation waste temporarily stored in piles.	40 CFR § 264.554(d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k)	Applicable or relevant and appropriate	The Navy will temporarily stockpile soil in staging piles for off-site disposal. The Navy will characterize the soil, but does not anticipate that all soil will be RCRA hazardous waste, in which case the requirements will be relevant and appropriate. These requirements would be applicable to stockpiled soil that meets the definition of RCRA hazardous waste. Therefore, the Navy will identify these requirements as either applicable or relevant and appropriate, depending on the results of sampling and analysis for waste characterization.
Clean Water Act, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[a]					
Construct a shoreline revetment.	Action to prohibit discharge of dredged or fill material into waters of the United States without permit.	Waters of the United States.	33 U.S.C. § 1344 40 CFR § 230.10; 230.11; 230.20 through 230.25; 230.31; 230.32; 230.41; 230.42; 230.53	Applicable	Alternatives S-2 through S-5 for soil evaluate construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be done in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means by which to comply with these potential ARARs. In addition, the loss of the wetland will be mitigated by the Navy.

TABLE C-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment.	U.S. Army Corps of Engineers requirements for permitting discharges of dredged material into waters of the United States.	Discharge of dredged material into waters of the United States.	33 CFR § 320.4 and 323	Applicable	Alternatives S-2 through S-5 for soil evaluate construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be done in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means by which to comply with these potential ARARs. In addition, the loss of the wetland will be mitigated by the Navy.
Construct a soil cover or excavate soil.	Owners and operators of construction activities must be in compliance with discharge standards.	Construction activities at least 1 acre in size.	Clean Water Act §402 40 CFR § 122.44(k)(2) and (4)	Applicable	The Navy anticipates disturbing more than 1 acre in the alternatives that involve excavation and off-site disposal of soil and constructing soil covers. The Navy will use the requirements of state general storm water discharge permit, Order 99-08-DWQ, as TBCs for complying with the storm water discharge requirements under the Clean Water Act.
Clean Air Act (42 U.S.C. §§ 7401–7671)[a]					
Construct a shoreline revetment or soil cover; excavate soil.	Prohibits emission equal or greater to 20 percent opacity.	Emission from a source.	BAAQMD Rule 6-302	Applicable	This requirement is applicable to construction required for installation of the shoreline revetment and soil covers as well as for excavation.

TABLE C-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
Clean Air Act (42 U.S.C. §§ 7401–7671)[a] (Continued)					
Operate an SVE system.	New emission sources must use best available control technology.	New emission source.	BAAQMD Regulation 2-1-301	Applicable	The Navy would treat the off-gas resulting from the SVE system with a granular activated carbon unit.
Operate an SVE system.	Requirements for SVE systems.	SVE system.	BAAQMD Regulation 8-47	Applicable	These requirements are applicable to the SVE system.
GROUNDWATER ALTERNATIVES					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Monitor groundwater.	In conjunction with corrective action measures, the owner or operator shall establish and implement a water quality monitoring program to demonstrate the effectiveness of the corrective action program and be effective in determining compliance with the water quality protection standard and in determining the success of the corrective action measures.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22 § 66264.100(d)	Relevant and appropriate	These requirements are applicable to RCRA hazardous waste facilities; however, the Navy has determined that they are relevant and appropriate to the monitoring component of the groundwater response action.
Monitor groundwater.	Contaminants of concern are the waste constituents, reaction products, and hazardous constituents that are reasonably expected to be in or derived from the waste contained in the regulated unit.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22 § 66264.93	Relevant and appropriate	These requirements are applicable to RCRA hazardous waste facilities; however, the Navy has determined that they are relevant and appropriate to the monitoring component of the groundwater response action.

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
GROUNDWATER ALTERNATIVES (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Monitor groundwater.	Owner or operator of shall establish a groundwater monitoring system for each regulated unit and include a sufficient number of monitoring points installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that represent the quality of groundwater passing the point of compliance.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22 § 66264.97(b)(1)(A), (b)(1)(D)(1) and (b)(1)(D)(2)	Relevant and appropriate	These requirements are applicable to RCRA hazardous waste facilities; however, the Navy has determined that they are relevant and appropriate to the monitoring component of the groundwater response action.
Monitor groundwater.	Requirements for monitoring well construction and sampling intervals.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22 § 66264.97(b)(4), (5), (6), and (7)	Relevant and appropriate	These requirements are applicable to RCRA hazardous waste facilities; however, the Navy has determined that they are relevant and appropriate to the monitoring component of the groundwater response action.
Monitor groundwater.	Requirements for collecting samples.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22 § 66264.97(e)(6), (e)(12)(A)(3), (e)(12)(B), (e)(13), and (e)(15)	Relevant and appropriate	These requirements are applicable to RCRA hazardous waste facilities; however, the Navy has determined that they are relevant and appropriate to the monitoring component of the groundwater response action.
Generate investigation-derived waste.	Person who generates waste shall determine if the waste is a RCRA hazardous waste.	Generator of waste.	Cal. Code Regs. tit. 22, §§ 66262.10(a), 66262.11	Applicable	These regulations are applicable to generation of waste associated with groundwater alternatives. The Navy will determine whether the waste is RCRA hazardous waste when it is generated.
Generate investigation-derived waste.	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	Applicable	These regulations are applicable to the generation of waste associated with groundwater alternatives. The Navy will determine whether the waste is RCRA hazardous waste when it is generated.

TABLE C-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
GROUNDWATER ALTERNATIVES (Continued)					
Safe Drinking Water Act (42 U.S.C. § 300[f]-300[j]-26)[a]					
Inject biological amendment or zero-valent iron into groundwater.	The underground injection control program prohibits injection that allows movement of contaminants into underground sources of drinking water that may result in violations of MCLs or adversely affect health.	An approved UIC program is required in states listed under SDWA Section 1422. Class I wells and Class IV wells are the relevant classifications for CERCLA sites. Class I wells are used to inject hazardous waste beneath the lowermost formation that contains an underground source of drinking water within 0.25 mile of the well.	40 CFR § 144.12(a) excluding the reporting requirements in § 144.12(b) and 144.12(c)(1)	Applicable	This requirement is applicable to the Navy's injection of zero-valent iron into the groundwater. The Navy will use the basic information requirements contained in 40 CFR §144.83 as TBCs for complying with the requirement in 40 CFR §144.12(a).

Notes:

a Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs follow each general heading, and only substantive requirements of the specific citations are considered potential ARARs.

§	Section	MCL	Maximum contaminant level
§§	Sections	mg/kg	Milligram per kilogram
ARAR	Applicable or relevant and appropriate requirement	PCB	Polychlorinated biphenyl
BAAQMD	Bay Area Air Quality Management District	RCRA	Resource Conservation and Recovery Act
Cal. Code Regs.	*California Code of Regulations*	SDWA	Safe Drinking Water Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	SVE	Soil vapor extraction
CFR	*Code of Federal Regulations*	TBC	To be considered
EPA	U.S. Environmental Protection Agency	UIC	Underground injection control
IR	Installation Restoration	U.S.C.	*United States Code*

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES					
California Civil Code (Cal. Civil Code § 1471)[a]					
Land use controls.	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency.	Cal. Civil Code § 1471	Relevant and Appropriate	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land ... where (c) each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence of hazardous materials, as defined in § 25260 of the California Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
California Health and Safety Code Land Use Controls (Cal. Health & Safety Code § 25202.5, § 25222.1, § 25232(b), § 25233(c), § 25234, § 25355.5)[a]					
Land use controls.	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code § 25202.5	Relevant and Appropriate	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located."
Land use controls.	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)–(E).	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code § 25222.1	Relevant and Appropriate	Cal. Health & Safety Code § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land use covenants with the owner of the property. The substantive provision of Cal. Health & Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property."

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
California Health and Safety Code Land Use Controls (Cal. Health & Safety Code § 25202.5, § 25222.1, § 25232(b), § 25233(c), § 25234, § 25355.5)[a]					
Land use controls.	Prohibits certain uses of land containing hazardous waste without a specific variance.	Hazardous waste property.	Cal. Health & Safety Code § 25232(b)(1)(A)–(E)	Relevant and Appropriate	This section is a potential ARAR for ICs that prohibit construction of residences, hospitals for humans, schools for persons under 21 years of age, day care centers, or any permanently occupied human habitation on hazardous waste property.
Land use controls.	Provides a process and criteria for obtaining a written variance from a land use restriction.	Transfer property from the Navy to a nonfederal entity.	Cal. Health & Safety Code § 25233(c)	Relevant and Appropriate	Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in § 25232(b)(1)(A)-(E) based on specific environmental and health criteria.
Land use controls.	Provides a process and criteria by which DTSC can remove land use restrictions.	Transfer property from the Navy to a nonfederal entity.	Cal. Health & Safety Code § 25234	Relevant and Appropriate	Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land use restriction on the grounds that "...the waste no longer creates a significant existing or potential hazard to present or future public health or safety."
Land use controls.	Authorizes DTSC to enter into an enforceable agreement that imposes restrictions on present and future uses of the property.	Transfer property from the Navy to a nonfederal entity.	Cal. Health & Safety Code § 25355.5(a)(1)(C)	Relevant and Appropriate	The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "...execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the site."

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
		SOIL ALTERNATIVES (Continued)			
Department of Toxic Substances Control[a]					
Implementing an institutional control.	A land use covenant imposing appropriate limitations on land use shall be executed and recorded when Facility closure, corrective action, remedial or removal action, or other response actions are undertaken and hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land.	Property transfer by federal government to non-federal entity.	Cal. Code Regs. tit. 22, § 67391.1	Relevant and appropriate	These requirements are relevant and appropriate when the Navy is transferring property to a nonfederal agency. EPA specifically considers substantive provisions of §§ (a), (b), (d), and (e) to be potential ARARs.
State Water Resources Control Board[a]					
Constructing a shoreline revetment and soil covers.	Alternatives to construction or prescriptive standards contained in the SWRCB-promulgated regulations of this subdivision may be considered.	Waste management unit. Cal. Code Regs. tit. 27 requirements are only applicable for waste discharged after 18 July 1997 unless otherwise noted.	Cal. Code Regs. tit. 27 § 20080(b)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	Actions taken by or at the direction of public agencies to clean up or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment; provided that wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to the SWRCB-promulgated sections of Article 2, Subchapter 2, Chapter 3, Subdivision 1 of this division (§ 20200 et seq.); and further provided that remedial actions intended to contain the wastes at the place of release shall implement applicable SWRCB-promulgated provisions of this division to the extent feasible.	Action taken by or at the direction of a public agency to cleanup release of pollutant.	Cal. Code Regs. tit. 27, § 20090(d)	Relevant and appropriate	This requirement is a potential ARAR for the Navy's response actions.

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
State Water Resources Control Board[a]					
Constructing a shoreline revetment and soil covers.	Closed units shall be provided with at least two permanent monuments installed by a licensed land surveyor or a registered civil engineer, from which the location and elevation of containment structures can be determined throughout the post-closure maintenance period.	Waste management unit.	Cal. Code Regs. tit. 27 § 20950(d)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	In spite of differential settlement, the final cover of closed landfills (including waste piles and surface impoundments closed as landfills) shall be designed, graded, and maintained to prevent ponding and to prevent soil erosion caused by high run-off velocities. All portions of the final cover shall have a slope of at least 3 percent unless Water Board allows portions of the final cover to be built with slopes of less than three percent when the discharger proposes an effective system for diverting surface drainage from laterally adjacent areas and preventing ponding in the allowed flatter portion. The final grading design shall be designed and approved by a registered civil engineer or certified engineering geologist taking into consideration pertinent natural and constructed topographic features (including any related to the proposed post-closure land use), and climate.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(b)(1)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
State Water Resources Control Board[a]					
Constructing a shoreline revetment and soil covers.	Throughout post-closure maintenance period, the discharger shall prevent erosion and related damage of the final cover caused by drainage.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(c)(4)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	For a closed landfill, when all closure activities are complete for the unit, the discharger shall conduct an aerial photographic survey, or alternative survey under (e)(3), of the closed portions of the unit and of its immediate surrounding area, including at least the surveying monuments [of § 20950(d)]. The data obtained shall be used to produce a topographic map of the site at a scale and contour interval sufficient to depict the as-closed topography of each portion of the unit, and to allow the early identification of any differential settlement. The map produced pursuant to this paragraph shall act as a baseline against which to measure the total settlement, through time, of all portions of the final cover since the date when that landfill, or portion thereof, was closed.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(e)(1) and (3)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
		SOIL ALTERNATIVES (Continued)			
State Water Resources Control Board[a]					
Constructing a shoreline revetment and soil covers.	The final cover shall function with minimum maintenance and shall be compatible with post-closure land use. Alternative final cover designs shall meet the performance requirements of paragraph (a). The local enforcement agency may require additional thickness, quality, and type of final cover depending on, but not limited to the future reuse of the site.	Waste management unit.	Cal. Code Regs. tit. 27, § 21140	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The operator shall ensure the integrity of final slopes under both static and dynamic conditions to protect public health and safety and prevent damage to post-closure land uses, roads, structures, utilities, and to prevent exposure of waste.	Waste management unit.	Cal. Code Regs. tit. 27, §21145(a)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The drainage and erosion control system shall be designed and maintained to ensure integrity of post-closure land uses, roads, and structures; to prevent public contact with waste; to prevent safety hazards; and to prevent exposure of waste. Slopes not underlain by waste shall be stabilized to prevent soil erosion. Methods used to protect slopes and control erosion shall include, but are not limited to, terracing, contour furrows, and trenches.	Waste management unit.	Cal. Code Regs. tit. 27, § 21150	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
SOIL ALTERNATIVES (Continued)					
Air Resources Board[a]					
Maintaining landscape on previous excavations, excavating soil, constructing a shoreline revetment, and constructing soil covers.	No person shall engage in any construction or grading operation on property where the area to be disturbed is greater than 1 acre unless an asbestos dust mitigation plan for the operation has been submitted to and approved by the district before the start of any construction or grading; and the provisions of that dust mitigation plan are implemented at the beginning and maintained throughout the duration of the construction or grading. Further, upon completion of project, the disturbed areas must be stabilized using one of the following methods: (1) vegetative cover, (2) placement of at least 3 inches of non-asbestos-containing material; (3) paving; (4) any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions.	Construction and grading activities in an ultramafic rock unit; or naturally occurring asbestos, serpentine, or ultramafic rock.	Cal. Code Regs. tit. 17, § 93105	Applicable	The Navy has determined that this regulation is a potential ARAR for maintained landscaping, excavating, constructing a shoreline revetment, and soil covers.
State Water Resources Control Board[a]					
Excavation of soil and generation of waste.	Sampling and analysis of discharges shall be used for accurate characterization of wastes.	Waste.	Cal. Code Regs. tit. 27, 20200(c)	Applicable	This regulation is applicable to excavation of soil and generation of waste. The Navy will characterize the soil or any waste when it is generated.
Excavation of soil and generation of waste.	Requires that designated waste as defined at *California Water Code* § 13173 be discharged to Class I or Class II waste management units.	Discharges of designated waste after July 18, 1997, (nonhazardous waste that could cause degradation of surface or groundwaters) to land for treatment, storage, or disposal.	Cal. Code Regs. tit. 27, § 20210	Applicable	This regulation is applicable to excavation of soil and generation of waste. The Navy will determine whether the soil or any waste is designated waste when it is generated.
Excavation of soil and generation of waste.	Requires that nonhazardous solid waste as defined at § 20220(a) be discharged to a classified waste management unit.	Discharge of nonhazardous solid waste after July 18, 1997, to land for treatment, storage, or disposal.	Cal. Code Regs. tit. 27, § 20220(b), (c), and (d)	Applicable	This regulation is applicable to excavation of soil and generation of waste. The Navy will determine whether the soil or any waste is nonhazardous solid waste when it is generated.

TABLE C-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix C, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
GROUNDWATER ALTERNATIVES					
State Water Resources Control Board[a]					
Generation of investigation-derived waste.	Sampling and analysis of discharges shall be used for accurate characterization of wastes.	Waste.	Cal. Code Regs. tit. 27, 20200(c)	Applicable	This regulation is applicable to generation of waste associated with groundwater alternatives. The Navy will characterize any waste when it is generated.
GROUNDWATER ALTERNATIVES (Continued)					
State Water Resources Control Board[a]					
Generation of investigation-derived waste.	Requires that designated waste as defined at *California Water Code* § 13173 be discharged to Class I or Class II waste management units.	Discharges of designated waste after July 18, 1997, (nonhazardous waste that could cause degradation of surface or groundwater) to land for treatment, storage, or disposal.	Cal. Code Regs. tit. 27, § 20210	Applicable	This regulation is applicable to generation of waste associated with groundwater alternatives. The Navy will determine whether the waste is designated waste when it is generated.
Generation of investigation-derived waste.	Requires that nonhazardous solid waste as defined at § 20220(a) be discharged to a classified waste management unit.	Discharge of nonhazardous solid waste after July 18, 1997, to land for treatment, storage, or disposal.	Cal. Code Regs. tit. 27, § 20220(b), (c), and (d)	Applicable	This regulation is applicable to generation of waste associated with groundwater alternatives. The Navy will determine whether the waste is nonhazardous waste when it is generated.

Notes:

a Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs follow each general heading, and only substantive requirements of the specific citations are considered potential ARARs.

§ Section
ARAR Applicable or relevant and appropriate requirement
Cal. Code Regs. *California Code of Regulations*
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR *Code of Federal Regulations*
SWRCB State Water Resources Control Board
TBC To be considered
Water Board San Francisco Bay Regional Water Quality Control Board
WDR Waste discharge requirement

APPENDIX D
REMEDIAL ACTION ALTERNATIVE COST SUMMARY SHEETS

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... D-iv

D1.0 INTRODUCTION D-1

D2.0 PURPOSE OF ESTIMATES D-1

D3.0 TYPES OF COST ESTIMATING METHODS D-2

D4.0 METHODOLOGY D-2

D4.1 DESCRIPTION OF MEANS D-3
D4.2 DESCRIPTION OF RACER D-3
D4.3 USER-DEFINED COSTS D-3

D5.0 COMPONENTS OF COST ESTIMATE D-4

D5.1 CAPITAL COSTS D-4
D5.2 ANNUAL OPERATION AND MAINTENANCE AND PERIODIC COSTS D-5
D5.3 PRESENT VALUE ANALYSIS D-5
D5.3.1 Discount Rate D-5
D5.3.2 Present Value D-5
D5.4 CONTINGENCY ALLOWANCES D-6

D6.0 INDIVIDUAL COST ESTIMATE ASSUMPTIONS D-7

D6.1 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-2: INSTITUTIONAL CONTROLS, MAINTAINED LANDSCAPING, AND SHORELINE REVETMENT D-8
D6.1.1 Shoreline Revetment Costs D-8
D6.2 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-3: EXCAVATION, METHANE AND MERCURY SOURCE REMOVAL, MAINTAINED LANDSCAPING, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT D-14
D6.3 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-4: COVER, METHANE AND MERCURY SOURCE REMOVAL, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT D-15
D6.4 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-5: EXCAVATION, SOIL/ASPHALT COVER, SVE, METHANE AND MERCURY SOURCE REMOVAL, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT D-16
D6.5 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-2: LONG-TERM GROUNDWATER MONITORING AND INSTITUTIONAL CONTROLS D-17
D6.6 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-3A: IN SITU TREATMENT, REDUCED GROUNDWATER MONITORING, AND INSTITUTIONAL CONTROLS - BIOREMEDIATION D-18

D6.7 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-3B: IN SITU TREATMENT, REDUCED GROUNDWATER MONITORING, AND INSTITUTIONAL CONTROLS - ZVI INJECTION D-19

D7.0 SUMMARY D-20

D8.0 REFERENCES D-22

TABLES

D-1 Soil Alternatives Cost Estimate Summary

D-2A Capital and Labor Cost Estimate, Alternative S-2

D-2B O&M and Periodic Cost Estimate, Alternative S-2

D-2C Present Value Cost Estimate, Alternative S-2

D-3A Capital and Labor Cost Estimate, Alternative S-3

D-3B O&M and Periodic Cost Estimate, Alternative S-3

D-3C Present Value Cost Estimate, Alternative S-3

D-4A Capital and Labor Cost Estimate, Alternative S-4

D-4B O&M and Periodic Cost Estimate, Alternative S-4

D-4C Present Value Cost Estimate, Alternative S-4

D-5A Capital and Labor Cost Estimate, Alternative S-5

D-5B O&M and Periodic Cost Estimate, Alternative S-5

D-5C Present Value Cost Estimate, Alternative S-5

D-6 Groundwater Alternatives Cost Estimate Summary

D-7A Capital and Labor Cost Estimate, Alternative GW-2

D-7B O&M and Periodic Cost Estimate, Alternative GW-2

D-7C Present Value Cost Estimate, Alternative GW-2

D-8A Capital and Labor Cost Estimate, Alternative GW-3A

D-8B O&M and Periodic Cost Estimate, Alternative GW-3A

D-8C Present Value Cost Estimate, Alternative GW-3A

D-9A Capital and Labor Cost Estimate, Alternative GW-3B

D-9B O&M and Periodic Cost Estimate, Alternative GW-3B

D-9C Present Value Cost Estimate, Alternative GW-3B

ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
bgs	Below ground surface
ECHOS	Environmental Cost Handling Options and Solutions
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
GW	Groundwater
HPAL	Hunters Point ambient level
mg/kg	Milligram per kilogram
O&M	Operation and maintenance
RACER	Remedial Action Cost Engineering and Requirements System
ROD	Record of decision
S	Soil
SVE	Soil vapor extraction
TCE	Trichloroethene
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment
ZVI	Zero-valent iron

D1.0 INTRODUCTION

This appendix describes each alternative and the associated components and assumptions used to develop the cost estimates used in the Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) for Hunters Point Shipyard in San Francisco, California. This appendix is organized as follows:

- Section D2.0 describes the purpose of the estimates.
- Section D3.0 presents the types of cost-estimating methods used.
- Section D4.0 summarizes the cost estimate methodology.
- Section D5.0 describes the components of each alternative's cost estimate.
- Section D6.0 provides assumptions used for each cost estimate.
- Section D7.0 summarizes the total costs for each alternative for soil and groundwater.
- Section D8.0 lists the references used in preparing the cost estimates.

Cost estimate tables are included at the end of this appendix, following Section D8.0.

D2.0 PURPOSE OF ESTIMATES

The cost estimates developed for this TMSRA follow the same general guidelines as for feasibility studies (FS). Cost estimates are developed for FSs primarily to compare remedial alternatives during the remedy selection process, and not to establish project budgets or to negotiate Superfund enforcement settlements. The cost estimates in FSs are typically also used in the proposed plan for public comment during remedy selection. The cost estimate in the record of decision reflects any changes to the remedial alternative that occur during the remedy selection process as a result of new information or public comment (U.S. Environmental Protection Agency [EPA] 2000).

Cost estimates developed during the detailed analysis phase of an FS are used to compare alternatives and to support remedy selection. The National Oil and Hazardous Substances Pollution Contingency Plan includes the following language in its description of the cost criterion for the detailed analysis and remedy selection.

> "The types of costs that shall be assessed include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operations and maintenance costs; and (3) Net present value of capital and O&M [operation and maintenance] costs" (Title 40 Code of Federal Regulations Part 300.430 (e)(9)(iii)(G) (EPA 2000).

The costs presented in this appendix are for comparison only; their estimated accuracy is plus 50 percent to minus 30 percent, in accordance with the guidelines for conducting FSs under the Comprehensive Environmental Response, Compensation, and Liability Act (EPA 1988). Many design variables and permitting requirements have not yet been established. A contingency of 20 percent is included in these estimates to reflect the resulting uncertainty.

D3.0 TYPES OF COST ESTIMATING METHODS

The cost estimates presented in this appendix were developed using both detailed and parametric approaches; both are accepted by EPA, as described below.

The detailed approach estimates cost on an item-by-item basis. Detailed methods typically rely on compiled sources of unit cost data for each item, taken from either a built-in database (if part of a software package, for example) or from other sources (for example, cost estimating references). This method, also known as "bottom up" estimating, is used when design information is available (EPA 2000).

The parametric approach relies on relationships between cost and design parameters. These relationships are usually either statistical or model-based. Statistically based approaches rely on scaled-up or scaled-down versions of projects where historical data on cost are available. Model-based approaches use a generic design linked to a cost database and adjusted for site-specific information. This method, also know as "top down" estimating, is used when design information is not available (EPA 2000).

D4.0 METHODOLOGY

Cost estimates for this TMSRA were prepared in accordance with "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study" (EPA 2000). For the most part, all costs were developed using the Environmental Cost Handling Options and Solutions (ECHOS) cost database developed and maintained by the RS Means Company, Inc. (2004).

The ECHOS publication used is the "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions" (known as "Means"), which provides unit costs for activities specific to remediation projects (RS Means Company, Inc. 2004). Another ECHOS-based system is the Remedial Action Cost Engineering and Requirements System (RACER) (Earth Tech 2005). RACER was also used in support of the cost estimates presented in this appendix.

Costs for unique line items that are not included in Means or RACER were estimated based on vendor quotes and are referred to in this appendix as user-defined costs.

Excel spreadsheets were used to tabulate costs and calculate present values in 2005 dollars.

D4.1 DESCRIPTION OF MEANS

Means is a compilation of construction costs across the United States that is updated annually. Means provides detailed unit costs for all phases of remediation. It can be used to evaluate costs for interim studies and measures, design of remedial and corrective measures, remedial and corrective actions, operation and maintenance (O&M), long-term monitoring, and site closeout.

Costs given in Means are national averages. These averages must be adjusted for local labor, material, and equipment costs. The costs do not reflect project safety levels, management, design, or oversight, and contingencies or profit. Means provides guidelines for applying design, oversight, contingency, overhead and profit; for relating national average unit costs to specific regions of the country; and for applying markups related to site safety levels.

D4.2 DESCRIPTION OF RACER

RACER is a tool that estimates costs for all phases of remediation. It applies ECHOS costs combined with costs for project management, project design, project oversight, contingencies, and profit. RACER can be used to evaluate costs for interim studies and measures, design of remedial and corrective measures, remedial and corrective actions, O&M, long-term monitoring, and site closeout. The system was originally developed in 1991 under U.S. Department of the Air Force funding. Numerous revisions and updates have been incorporated through several releases since RACER was introduced.

RACER is a parametric cost modeling system that uses a patented methodology for estimating costs. The RACER cost database is a duplicate of the ECHOS database. RACER cost estimates are based on generic engineering solutions for environmental projects, technologies, and processes. Historical project information, industry data, government laboratories, construction management agencies, vendors, contractors, and engineering analysis were used to develop generic solutions to engineering problems. Cost estimates in RACER are tailored specifically to each project by adding site-specific parameters to reflect project-specific conditions and requirements. The tailored design is then translated into specific quantities of work, and the quantities of work are priced using current data.

D4.3 USER-DEFINED COSTS

It was not always possible to develop cost estimates using the tools described above because of the unique characteristics for some elements of the remediation alternatives. In these cases, the costs of these elements were estimated using vendor quotes and were evaluated and adjusted as necessary to account for inflation. These instances are noted in the cost tables.

D5.0 COMPONENTS OF COST ESTIMATE

Cost estimates for the remediation alternatives include seven components: grand total, total capital costs, total direct costs, annual O&M costs, future value of O&M costs, net present value of O&M costs, and contingency costs. Each of these factors is discussed in further detail in the following text.

Grand Total	Sum of capital costs (including direct costs, engineering labor and other direct costs, and contingency) and net present value of annual O&M costs (calculated using annual O&M costs plus contingency).
Total Capital Costs	Sum of the total direct costs, total engineering and legal assistance labor costs and other direct costs, and 20 percent contingency.
Total Direct Costs	Costs based on unit rates for remediation tasks, not including the cost for O&M.
O&M/Periodic Costs	Costs for both routine O&M and follow-up inspection and for any necessary action. Both annual inspections and 5-year reviews are assumed to occur for 30 years. A 20 percent contingency is applied to all costs.
Future Value of O&M Costs	Future worth of O&M costs based on a 3.1 percent discount factor, applied as appropriate to estimated annual costs plus contingency.
Net Present Value O&M Costs	Total net present value for 30 years of future value O&M costs, based on a 3.1 percent annual discount rate, applied as appropriate to future value annual costs.
Contingency	Twenty percent contingency applied to total of capital and present value of O&M and periodic costs.

D5.1 CAPITAL COSTS

Capital costs include direct and indirect costs. Direct costs include costs incurred for equipment, material, labor, construction, development, and implementation of remedial technologies. Indirect costs include health and safety, site supervision, engineering, overhead and profit, and startup. Indirect costs are included in the estimate as either a separate line item or as a percentage of the direct capital cost.

D5.2 ANNUAL OPERATION AND MAINTENANCE AND PERIODIC COSTS

Annual O&M costs are incurred after construction. These costs are necessary to assure the effectiveness of a remedial action. Annual O&M costs typically include power, operating labor, consumable materials, purchased services (for example, laboratory analysis), equipment replacement, maintenance, sampling, permit fees, annual reports, and site reviews.

Periodic costs occur once every few years or once during the entire period of O&M. Examples include 5-year reviews, equipment replacement, site closeout, and remedy repairs and replacement.

D5.3 PRESENT VALUE ANALYSIS

Remedial action projects typically involve construction costs that are expended at the beginning of a project (capital costs) and costs in subsequent years (O&M or periodic costs). Present value analysis is a method to evaluate expenditures that occur over various periods. This standard methodology allows for cost comparisons of different remedial alternatives based on a single value for each. This single value, referred to as the present value, is the amount that must be set aside at the initial point in time (base year) to assure that funds will be available in the future, as they are needed. A discount rate and period of analysis are used to calculate the present value of each expenditure. Both factors are discussed in the subsequent subsections.

D5.3.1 Discount Rate

A discount rate is similar to an interest rate and is used to account for the time value of money. A dollar is worth more today than in the future because the dollar would earn interest, if invested in an alternative use today. If the capital were not employed in a specific use, it would have a productivity value in alternative uses. The choice of a discount rate is important because the rate selected directly alters the present value of a cost estimate, which is then used as one factor in selecting a remedy.

EPA policy on the use of discount rates for remedial investigation and FS cost analysis is set forth in the preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (55 *Federal Register* 8722). Discount rates used in economic analysis by the federal government are specified in Office of Management and Budget Circular A-94. The current discount rate for a 30-year stream of payments is 3.1 percent (Office of Management and Budget 2005).

D5.3.2 Present Value

The present value of a series of equal annual future payments such as for annual O&M is calculated using the equation below.

$$PV = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

where:

PV	=	Present value
x_t	=	Payment in year t (t = 0 for present or base year)
i	=	Discount factor
t	=	Number of years after construction that expenditures start
n	=	Number of years that the stream of equal annual future payments will run

The present value of a single periodic future payment is calculated using the equation below.

$$PV = \frac{x_t}{(1+i)^t}$$

where:

PV	=	Present value
x_t	=	Payment in year t (t = 0 for present or base year)
i	=	Discount factor
t	=	Number of years after construction that expenditures occur

The present value of a remedial alternative represents the sum of the present values of all future payments associated with the project. Present value for this cost estimate was calculated using 2005 dollars.

D5.4 CONTINGENCY ALLOWANCES

Contingency is factored into a cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate based on the data on hand when the estimate is prepared. A contingency of 20 percent is applied to the total of capital and present value of O&M and periodic costs for all alternatives.

D6.0 INDIVIDUAL COST ESTIMATE ASSUMPTIONS

This section identifies the assumptions and parameters used in developing cost estimates in support of the Parcel B TMSRA.

The following subsections briefly describe the alternatives for remediation of soil and groundwater proposed for Parcel B and the assumptions used in estimating the costs. Components of each alternative were identified based on the alternative descriptions in Section 5.0 of the Parcel B TMSRA. In most cases, engineering judgment was used to estimate labor requirements.

The estimated costs presented in this appendix are organized into two general categories.

1. Soil remedial alternatives. The cost estimates for the soil alternatives are summarized in Table D-1. The individual cost estimates for soil (S) alternatives S-2, S-3, S-4, and S-5 appear in Tables D-2 through D-5. These tables use the Means system augmented with results from treatability studies at Parcel B and vendor quotes. The Means reference number and various assumptions appear in the cost tables.

2. Groundwater remedial alternatives. The cost estimates for the groundwater alternatives are summarized in Table D-6. The individual cost estimates for groundwater (GW) alternatives GW-2, GW-3A, and GW-3B appear in Tables D-7 through D-9. These tables use vendor quotes, augmented with results from the treatability studies at Parcels B and C, Means, and the RACER system.

Each separate remedial alternative cost estimate is subdivided into three tables. For example, the cost estimate for Alternative S-3, Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment, is presented in Tables D-3A, D-3B, and D-3C. The "A" table provides the estimate of capital cost for the alternative. The "B" table provides the estimate of O&M and periodic cost for the alternative. The "C" table provides the present-value estimate for O&M and periodic costs for the alternative.

General assumptions used to estimate costs in all alternatives are summarized below.

1. There are general project-management tasks for each alternative. The cost estimates for these tasks are based on labor-hour projections grouped by professional level, along with anticipated direct costs.

2. There are legal actions to be taken for each alternative. The cost estimates for these actions are based on labor-hour projections grouped by legal discipline, along with anticipated direct costs.

3. A 20 percent contingency was added to the subtotal of the capital and present value of O&M and periodic costs for each alternative.

4. Present worth costs for O&M and periodic costs are discounted back to 2005 values using the appropriate discount factor.

The cost estimate components and specific assumptions are presented for each alternative below.

D6.1 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-2: INSTITUTIONAL CONTROLS, MAINTAINED LANDSCAPING, AND SHORELINE REVETMENT

Alternative S-2 will include costs for legal fees, signage, annual drive-by inspections, the 5-year review, transfer and documentation of institutional controls, oversight, and the shoreline revetment. No assumptions other than the cost items identified in Table D-2A are required for the institutional controls.

This alternative includes soil covers for areas disturbed during the radiological removal action. It is estimated that 20,000 square yards (about 4 acres) will be disturbed and will require soil covers.

Assumptions for the shoreline revetment are also presented in this section. These costs also include wetlands mitigation for 1,300 square feet (0.03 acre) disturbed during installation of the shoreline revetment.

D6.1.1 Shoreline Revetment Costs

Shoreline areas in Redevelopment Blocks BOS-1 and BOS-3 will be protected by revetments to reduce the possibility that contaminated soil or sediment will enter the bay. The revetments will cover the shoreline and consist of layers of riprap overlying geofabric filters designed to prevent erosion of fine material. The revetments will extend from below low tide to above high tide with an allowance for wave "run-up." Approximately 2,500 feet of shoreline would need revetment.

Key design factors for the revetment include:

- Tidal influences
- Wind and wave dynamics
- Shoreline topography
- Economic consequences of failure

To develop estimated costs for the shoreline revetment, certain assumptions are made about wave heights, wave run-up, and other wind and wave phenomena. These assumptions are intended only for TMSRA cost estimating purposes and should not be used as engineering design

parameters. A conservative approach is presented in this appendix; a complete engineering analysis will be required during design. This design will address any updates to site conditions and may consider other alternatives to the riprap revetment discussed in this appendix.

The design of the revetment depends on computation of a proper design wave generated over the relatively shallow San Francisco Bay. This computation is complicated and generally requires computer modeling to account properly for reflection, refraction, diffraction, sloughing, and interaction of waves. This level of computation was not executed for this cost estimate.

The following approach was used to develop the estimated shoreline revetment costs for the TMSRA:

1. Assume that the revetment will extend, at a minimum, to the top of the existing bank.

2. Compare the assumed revetment elevation to adjacent properties on San Francisco Bay with wind and wave exposures similar to Parcel B. The exposure, or fetch, at Parcel B is to the north and north-northeast, where about 8 to 10 miles of open water face the shoreline[1].

3. Identify tidal elevations.

4. Compute the difference between this top-of-bank elevation and the high tide level, This difference represents the area were waves can run up and dissipate and is denoted here as the wave "run-up area." Then, determine the height of a wave that would just cause such a run-up.

5. Using a literature search, compare the wave height to other design waves in the San Francisco Bay area.

6. If the comparison is reasonable, adopt the top-of-bank elevation as the upper level of the revetment. If the comparison is not reasonable, raise the top-of-revetment elevation and repeat the process.

7. Review the shallow beach slope at BOS-3.

8. After the top-of-revetment elevation has been selected, identify the type and size of the revetment material.

9. Set expected 30-year O&M requirements.

All elevations in this section are referenced to the National Geodetic Vertical Datum-1929, unless otherwise noted.

[1] The fetch is broken by the Bay Bridge and somewhat by Treasure Island.

D6.1.1.1 Top of Bank Elevations

The top-of-the-bank elevation at BOS-1 is 10 feet. Above elevation 10 feet, the ground gradually gains in elevation to the south. The shoreline slope below elevation 10 feet ranges from nearly vertical to a gentler 1 vertical to 5 to 8 horizontal. It is assumed that the average embankment slope is 1 vertical to 4 horizontal.

The top-of-the-bank elevation at BOS-3 is 8 feet. The bank extends no higher than elevation 8 to 8.5 feet in the immediate vicinity. The shoreline slope below elevation 8 feet is similar to BOS-1. It is assumed that the average embankment slope is 1 vertical to 4 horizontal.

To equate the level of protection at the two sites, it is assumed that the revetment at site BOS-3 will continue up to and over the contour at elevation 8 feet. Since the graded riprap will be 2.5 feet thick, the top of the revetment will be at about elevation 10 feet.

D6.1.1.2 Comparison to Adjacent Properties

As a guide to estimating proper quantities and layout for the revetment, aerial photographs were reviewed of other sites north of Parcel B with similar wave exposure. These sites showed either sheet pile walls or revetments.

The shoreline immediately northwest of Parcel B has recently been modified to include two parallel lines of riprap, each about 5 to 10 feet wide at the base. The upper line is at about elevation 7 or 8 feet. A revetment set at the top-of-bank elevation of 10 feet would be at least as high as at the adjacent property.

D6.1.1.3 Tidal Levels

Tidal levels are referenced to the mean lower low water datum, which in 1976 was 3.12 feet below the common National Geodetic Vertical Datum-1929 (National Oceanic and Atmospheric Administration 1983)[2]. The table below lists tidal phenomena for the Hunters Point Shipyard area in general.

[2] The table given is taken from the National Oceanic and Atmospheric Administration National Ocean Service for Hunters Point, San Francisco Bay Station ID 9414358, based on tide data from November 1974 to February 1976. Later data were not found.

Elevation of Various Tidal Phenomena, Hunters Point Shipyard		
Tidal Phenomenon	Elevation Referenced to Mean Lower Low Water Datum (feet)	Elevation Referenced to National Geodetic Vertical Datum-1929 Datum (feet)
Highest Observed Water Level (12/27/1974)	8.16	5.04
Mean Higher High Water	6.73	3.61
Mean High Water	6.10	2.98
Mean Tide Level	3.61	0.49
National Geodetic Vertical Datum-1929	3.12	0.00
Mean Low Water	1.12	-2.00
Mean Lower Low Water	0.00	-3.12
Lowest Observed Water Level (12/01/1975)	-1.86	-4.98

A rounded value of elevation 3 feet was selected for the mean high water (high tide) elevation. A rounded value of elevation minus 2 feet was selected for the mean low water (low tide) elevation.

D6.1.1.4 Wave Run-up Area and Wave Heights

The vertical difference between mean high water and the top-of-bank elevation of 10 feet is 7 feet. The ratio of total wave run-up to wave height is about 150 percent for short-period waves breaking at a relatively permeable riprap revetment on a 1 vertical to 4 horizontal embankment slope[3] (Linsley and Franzini 1979). A wave of 4.7 feet[4] will just overtop the revetment at high tide for a revetment height set at elevation 10 feet.

D6.1.1.5 Literature Search and Comparison

In 1997, a FS was conducted for San Francisco Marina on the Northern waterfront of San Francisco (Moffatt and Nichols Engineers 1997). The Marina site is exposed to long fetchs to the north to northeast. Although the fetch lengths would be shorter than Parcel B, they are not broken by bridges or islands. The site is also exposed to ocean waves through the Golden Gate.

The study adopted a "significant wave height"[5] — the design wave height — of 4 feet for locally generated wind waves, based on wind at Alameda Naval Air Station. These "results are in

[3] Table 7-16 (Linsley 1979) gives run-up ratio versus revetment slope for "relatively permeable rubble mounds." The mounds are grouped by the wave "steepness" (ratio of wave height to wave length). Wave length is directly related to wave period, the time between successive wave peaks. The wave period is assumed to be 3 to 4 seconds (Moffat and Nichol 1997). For 3.5 seconds, the resulting wavelength is about 65 feet (equation 7-5, Linsley and Franzini 1979). For a 4-foot wave with this wavelength, the wave steepness is about 0.06. The resulting run-up ratio for a 1:4 slope is 0.48. The overall ratio of (wave run-up plus wave height) to wave height is thus 1+ 0.48 =1.48, rounded to 150 percent.
These wave heights are for shallow waves affected by sloughing and other factors as they approach shore.

[4] This value equals the run-up area vertical distance, 7 feet, divided by the run-up ratio of 150 percent.

[5] "Significant wave height" is a technical term describing the wave height that is overtopped by 13 percent of the waves. It is a common design wave height, especially for structures such as revetment on shorelines, where significant loss of life is not generally a consequence of failure.

agreement with previous locally generated wind wave analyses presented by the U.S. Army Corps of Engineers (1973) for Gas House Cove Harbor, U.S. Army Corps of Engineers (1985) for Fisherman's Wharf Harbor, and Ecker & Whelan (1983) for Fort Point Station" (Moffatt & Nichols Engineers 1997).

A 4.7-foot wave would compare favorably with 4-foot significant wave height selected in the San Francisco Marina FS.

D6.1.1.6 Adopted Top of Revetment Elevations

The top of the revetment at Redevelopment Block BOS-1 will be set at the contour at elevation 10 feet. The bottom will extend below mean low water or elevation minus 2 feet[6].

The revetment at Redevelopment Block BOS-3 will continue up to and over the contour at elevation 8 feet. The top of the revetment will reach elevation 10 feet. Storm drainage will pass through the porous riprap or through purpose-built storm drains. The bottom of the revetment will be set in the same manner as BOS-1.

D6.1.1.7 Shallow Beaches at BOS-3

The beach slope can be shallow at BOS-3. Riprap on these slopes could extend 100 feet or more horizontally from the beach. At these locations, it is likely that the design will be modified to reduce the area covered by riprap. This modification would likely entail higher riprap near the shore, additional grading of the slope and additional site drainage.

The cost estimate, however, treats areas with shallow beach slopes the same as other slopes. It is assumed that costs for this layout would be comparable to a layout with piled riprap, grading, and drains.

D6.1.1.8 Revetment Material and Size of Riprap

The cost estimate assumed that the revetment will consist of graded dumped rock, with the armor units (large individual rocks) designed to withstand a 4-foot wave. The riprap will extend from low tide to elevation 10 feet, at or above the top of bank. The riprap will lie on geofabric, which in turn will rest on a gravel filter.

Additional assumptions include:

[6] Bathymetric data are available for the offshore area of HPS. For the BOS-3 area, the offshore slope ranges from1:3 to 1:5 for the southwestern half of the revetment and from 1:5 to greater than 1:14 for the northwestern half. It is assumed that the underwater slope near the shoreline is 1 vertical to 5 horizontal. This slope will place the bottom of the revetment at 20 feet offshore of the 2-foot contour, the lowest contour available for on-shore Parcel B surveys.

- The toe of the revetment will consist of a buried section. The last 6 feet of the revetment will form a 4-foot thick section. Design of the toe section will require extra attention during the remedial design because the toe of the revetment is the area most at risk for failure.
- There is existing concrete riprap on the shoreline for BOS-3. It is assumed that this riprap be integrated into the final revetment. It is also assumed that the cost of temporarily stockpiling this riprap and then integrating it into the new revetment will roughly balance the savings in hauled riprap. There will be, therefore, neither costs for stockpiling nor any subsequent reduction in riprap volume in the cost estimate.
- Existing beach material will be dredged for offshore work. The final revetment profile will match the existing profile and there will be no net gain in the volume of fill material. The dredged material will be sampled and disposed of off site as a nonhazardous waste. It is assumed that 6,000 cubic yards of sediment will be excavated and disposed of to establish appropriate grades and allow placement of erosion control materials at the correct elevation relative to sea level.
- It is assumed for onshore work that existing shoreline material will be regraded under the revetment, but that no material will be removed or added.
- It is assumed that the project would require 90 days to complete. A barge and tugboat will be required for offshore work. Offshore work will occur at low tide. Therefore, there will be no need for dewatering or a cofferdam.

The shoreline area that will require preparation before the riprap is installed is approximately 3 acres, or 14,520 square yards. This area is larger than the 1.8 acres of existing shoreline because additional area will be affected by the installation of the revetment.

The required weight of the median riprap can be estimated by U.S. Army Corps of Engineers procedures (U.S. Army Corps of Engineers 1995). The required weight for a median rock is 330 pounds for a 4-foot wave using 165 pounds per cubic foot graded riprap on a 1:4 slope[7]. The nominal diameter of the rock is 15 inches[8].

The revetment will be about 30 inches thick for the recommended two layers of rock. Each 100 square feet of revetment will contain about 9 cubic yards or 13 tons[9] of dumped graded riprap.

The thickness for the toe of the revetment will be increased to 4 feet. Each 100 square feet of revetment toe will contain about 15 cubic yards or 22 tons of dumped graded riprap. A total of 22,500 tons of riprap is estimated for the entire revetment.

The contingency applied to construction for the revetment is 10 percent in addition to the 20 percent used for all construction activities to cover the risks associated with other

[7] Using equation 2-15 (USACE 1995) with a K_D of 2.2 and a 1:4 slope.
[8] The diameter is based on USACE procedures, equation 2-24 (USACE 1995).
[9] Assuming 37 percent voids (Table 2-4 USACE 1995).

miscellaneous items, such as: working off shore; working in an area that can be impaired by storms, waves, and boat traffic; and extra costs that can be expected while working around utilities, addressing drainage issues, and tying the flanks of the revetment into existing structures.

D6.1.1.9 Shoreline Revetment O&M Costs

A properly designed revetment could be expected to last 30 years or more, the window of future O&M costs for this cost estimate. From time to time, however, large storms or maritime activities could damage the revetment. To account for these future costs, the following are assumed:

- An engineering inspection, report, rehabilitation design, and rehabilitation oversight of the revetment will be required every 10 years.
- Based on engineering judgment, the capital costs for repairs will be estimated to be equal to the cost of replacing 5 percent of the riprap every 10 years.

D6.2 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-3: EXCAVATION, METHANE AND MERCURY SOURCE REMOVAL, MAINTAINED LANDSCAPING, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the assumptions for Alternative S-2, the following assumptions apply to Alternative S-3.

1. The sites designated for excavation are shown on Figures 5-2 through 5-6 of the Parcel B TMSRA. Each site's dimensions and orientations are shown in detail on these figures.

2. Standard excavation areas are proposed for three excavation areas in Blocks 8, 9, and 15 (see Figures 5-2, 5-3, and 5-4 of the Parcel B TMSRA). Each of these excavations will be 15 feet by 15 feet. The depth of each excavation is the maximum depth for the planned land use (10 feet for these residential reuse areas). Excavated soil will be loaded directly into trucks.

3. Nine soil samples will be collected at each site to augment existing soil sample data to characterize each excavation. Areas where excavations will be larger than the standard 15-foot-by-15-foot square (such as Excavation B1031 for the methane source removal or the excavation for mercury source removal at former Excavation EE-05) will require more samples.

4. Areas with known radiological concerns include additional costs for excavation and characterization. Radiological screening will be required for handling soils excavated from areas designated in the final Historical Radiological Assessment (Radiological Affairs Support Office 2004) as radiologically impacted areas. Soils removed from these areas will be stockpiled and screened on site to assess the potential radionuclide impacts. It is assumed that screening results will allow disposal off site as nonradiological waste.

5. The methane source removal will consist of an excavation of areas where methane concentrations exceed 0.625 percent by volume in air (a factor of safety of 2 over the regulatory requirement of 1.25 percent). The actual extent of the excavation will be established by future exploratory trenching or soil borings. This appendix assumes an excavation to a maximum depth of 20 feet below ground surface (bgs) and an area of 50 feet by 150 feet. Other assumptions for the methodology of excavation in this area will be the same as for other excavations in this alternative.

6. Mercury source removal will consist of excavation of the soil beneath former Excavation EE-05 in Redevelopment Block 16. The horizontal extent of mercury in soil was delineated to the record of decision (ROD) cleanup goal for mercury (the Hunters Point ambient level, or HPAL) during the remedial action, and this delineation will bound the horizontal extent for the mercury source removal. The maximum depth of mercury source removal will be to bedrock or to the maximum depth practicable. Cone penetrometer tests or soil borings may be required to locate the depth of bedrock in this area. The cost estimate for this excavation assumes that contaminated soil will be excavated from within the area of former Excavation EE-05 from 10 feet bgs to a depth of 15 feet bgs (the estimated depth of bedrock in the area) over an area of 60 feet by 250 feet. It is assumed that five soil borings will be necessary to delineate the depth to bedrock. The top 10 feet of excavated material is clean backfill from the previous remedial action and will be stockpiled and returned to the excavation. The material from 10 to 15 feet bgs (approximately 2,800 cubic yards) will be disposed of off site. The excavation for removal of the mercury source will extend to bedrock unless local site conditions (for example, excessive groundwater infiltration) prevent completion to bedrock.

D6.3 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-4: COVER, METHANE AND MERCURY SOURCE REMOVAL, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the assumptions for Alternative S-2, the following assumptions apply to Alternative S-4.

1. The redevelopment block areas with existing surface covers and areas that will require new surface covers include all redevelopment blocks.

2. Existing asphalt will be resealed at the start of the remedial action construction and will be maintained by resealing in year 10. After year 10, development by the new owner is assumed to be substantial and will not be maintained by the Navy in years 20 and 30.

3. In residential or industrial land use areas, the ground will be covered with a minimum of 4 inches of asphalt paving, with the exception the steep hillside (southern) portions of Redevelopment Blocks 1, 4, and 7, which will be covered with 2 feet of new soil. Asphalt covers will be installed at the start of the remedial action construction and will be maintained by re-sealing in year 10.

4. In recreational land use areas, the ground will be covered with 2 feet of clean soil, unless the area is already paved, and then asphalt will be used. Redevelopment Block BOS-1 will receive a soil cover; Redevelopment Blocks BOS-2 and BOS-3 will receive an asphalt cover.

D6.4 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE S-5: EXCAVATION, SOIL/ASPHALT COVER, SVE, METHANE AND MERCURY SOURCE REMOVAL, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the assumptions for associated with Alternatives S-2, S-3, and S-4, the following assumptions apply to Alternative S-5. Most assumptions are related to the soil vapor extraction (SVE) component.

1. No pilot study will be necessary because an SVE treatability study has been conducted in the treatment area (International Technology Corporation 2002).

2. The treatment area consists of approximately 11,350 square feet in the northeast corner of Building 123. The depth of the vadose zone is approximately 10 feet; therefore, the volume of the treatment zone is approximately 113,500 cubic feet, or 4,200 cubic yards.

3. A porosity of 40 percent and bulk density of 106.3 pounds per cubic feet were assumed based on data collected as part of the SVE treatability study conducted at Building 123 (International Technology Corporation 2002).

4. Design vacuum head is 7.5 inches of mercury based on the SVE treatability study. The average radius of influence at this vacuum is approximately 25 feet (International Technology Corporation 2002).

5. A blower that can achieve 700 standard cubic feet per minute air flow and 7.5 inches of mercury vacuum is assumed to be sufficient based on data from the SVE treatability study (International Technology Corporation 2002).

6. The 14 existing vapor extraction wells that were used in the treatability study are assumed to be in good condition and available for use. These 14 wells, which were assumed to have a radius of influence of 10 feet during design of the treatability study, cover 6,000 square feet of the treatment zone. Assuming a radius of influence of 20 feet, four additional wells will need to be installed to cover adequately the remaining 5,350 square feet.

7. A total of 220 feet of 6-inch, 400 feet of 4-inch, and 1,200 feet of 2-inch Schedule 80 polyvinyl chloride piping will be required to connect the SVE wells to the SVE system.

8. It is assumed that a power supply will be available and that a generator is not required.

9. The average trichloroethene (TCE) concentration is assumed to be 10.5 milligrams per kilogram (mg/kg), which is the average that has been observed in the treatment zone, excluding data in the area of the treatabilty study before June 1, 2001. A concentration of 10.5 mg/kg averaged over the 113,500-cubic foot treatment zone, which has a soil density of 106.3 pounds per cubic feet, yields an initial TCE mass of 130 pounds.

10. Assuming 79 percent of the TCE will be removed in 6 months, which was observed during the SVE treatability study (Tetra Tech 2003), the mass remaining in the soil would be approximately 27 pounds after 6 months and 6 pounds after a year. One year of treatment is assumed to be sufficient for source reduction. Operating the system longer is not recommended because asymptotic conditions are expected to be established by that time. The SVE operation of 1 year includes the monitoring period associated with operation of the system.

11. The concentration of TCE in air that will flow into granular activated carbon unit is assumed to be 1,000 micrograms per liter (µg/L), which was the average concentration observed during the pilot test. Based on this concentration and an inflow of 700 standard cubic feet per minute, approximately 6,000 pounds of granular activated carbon will be needed for 90 percent reduction (Tetra Tech 2005c). This value provides a conservative estimate of the cost associated with vapor treatment. The concentration of TCE extracted by the SVE system is expected to decrease over time; therefore, the carbon usage will also decrease.

D6.5 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-2: LONG-TERM GROUNDWATER MONITORING AND INSTITUTIONAL CONTROLS

The following assumptions apply to Alternative GW-2.

1. Institutional controls will be imposed for 30 years, after which time it is assumed that volatile organic compounds will have attenuated to allowable levels.

2. Quarterly groundwater monitoring will be required for the first year at 31 wells, and annual monitoring will be required for 29 years (years 2 through 30).

3. The wells sampled include 28 existing wells, two groundwater monitoring wells (IR26MW49A and IR26MW50A) that were installed in July 2006 near well IR26MW47A, and a third well that will be installed within the area of former Excavation EE-05 after the mercury source removal is complete. (See Section 5.3.2 of the Parcel B TMSRA for well identification, location, and analyte.)

D6.6 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-3A: *IN SITU* TREATMENT, REDUCED GROUNDWATER MONITORING, AND INSTITUTIONAL CONTROLS - BIOREMEDIATION

The following assumptions apply to Alternative GW-3A.

1. No pilot study will be necessary because a lactate injection treatability study has been completed at Parcel C, which is nearby. In addition, the size of the full-scale treatment is similar to the size of a typical pilot study.

2. The treatment zone consists of 4,000-square foot area near monitoring wells IR10MW61A and IR10MW71A, which is where concentrations of TCE and dichloroethene are most elevated. The depth of the A-aquifer, where chlorinated hydrocarbon contamination has been observed, extends approximately 20 feet, from 10 feet bgs to 30 feet bgs. Therefore, the volume of the treatment zone is 80,000 cubic feet (3,000 cubic yards)

3. The radius of influence is assumed to be 10 feet, based on the zero-valent iron (ZVI) direct injection treatability study (Engineering/Remediation Resources Group, Inc. 2004) and knowledge that hydrogen produced from lactate is slightly more mobile (Tetra Tech 2005a).

4. A porosity of 40 percent was assumed based on data collected as part of the SVE treatability study conducted at Building 123 (International Technology Corporation 2002). Consequently, the volume of water in the treatment zone is approximately 32,000 cubic feet or 906,000 liters.

5. Approximately 3,300 pounds of sodium lactate is needed for a treatment volume of water of 32,000 cubic feet, according to the lactate vendor. Sodium lactate is delivered in 600-pound drums; therefore, 3,600 pounds of sodium lactate would be purchased for the project (Tetra Tech 2005b).

6. With a treatment area of 4,000 square feet and a radius of influence of 10 feet, approximately 15 injection points are required. It is assumed that five of the injection points will be inside Building 123 and will require concrete coring.

7. It is assumed that one injection of lactate will reduce the chemicals of concern to concentrations at or near the remediation goal.

8. The monitoring period under Alternative GW-3A will differ from Alternative GW-2. The monitoring period for the first year will be quarterly and will be conducted concurrently with the *in situ* treatment. The monitoring frequency will be reduced to semiannual events for years 2, 3, and 4, then monitoring will occur annually thereafter (starting in year 5). In year 15, monitoring will be quarterly for a 1-year "proof period" to demonstrate attainment of remediation goals.

D6.7 COST ASSUMPTIONS ASSOCIATED WITH ALTERNATIVE GW-3B: *IN SITU* TREATMENT, REDUCED GROUNDWATER MONITORING, AND INSTITUTIONAL CONTROLS - ZVI INJECTION

Assumptions for Alternative GW-3B are as follows:

1. No pilot study will be necessary because ZVI treatability study has been completed in the treatment area. In addition, the size of the full-scale treatment is similar to the size of typical pilot studies.

2. The treatment zone consists of 4,000 square feet near monitoring wells IR10MW61A and IR10MW71A, which is where concentrations of TCE and dichloroethene are most elevated. The depth of the A-aquifer, where chlorinated hydrocarbon contamination has been observed, extends 20 feet, from 10 feet bgs to 30 feet bgs. Therefore, the volume of the treatment zone is 80,000 cubic feet (3,000 cubic yards).

3. The radius of influence is assumed to be 8 feet, based on results from the ZVI treatability study conducted at Parcel B (Engineering/Remediation Resources Group, Inc. 2004). Therefore, a minimum of 20 injection points will be required to cover the area of the treatment zone.

4. A porosity of 40 percent was assumed, based on data collected as part of the SVE treatability study at Building 123 (International Technology Corporation 2002). Consequently, the volume of water in the treatment zone is approximately 32,000 cubic feet (906,000 liters).

5. The density of soil in the treatment zone is assumed to be 106.3 pounds per cubic feet, based on data collected as part of the SVE treatability study (International Technology Corporation 2002)

6. TCE concentrations are used to estimate the requirements for ZVI treatment. The mass of TCE in groundwater in the treatment zone is assumed to be about 1 pound. A TCE concentration of 340 µg/L was used for this calculation because it is the highest concentration observed in groundwater during the most recent available quarterly monitoring event (November 2004). The result from the most recent groundwater monitoring event was used because it represents conditions after the ZVI treatability study.

7. The required ratio of iron to TCE is 500 (Engineering/Remediation Resources Group, Inc. 2004). Therefore, 340 pounds of iron are required to meet the iron-to-TCE ratio requirement.

8. Based on a treatment zone volume of 80,000 cubic feet and a soil density of 106.3 pounds per cubic feet, the mass of soil in the treatment zone is estimated at 8,504,000 pounds. With a required iron-to-soil ratio of 0.005 (Engineering/ Remediation Resources Group, Inc. 2004), 42,520 pounds of iron will be required. A total of 44,000 pounds is assumed as a conservative estimate (Tetra Tech 2005d).

9. It is assumed that one injection of the ZVI will reduce the chemicals of concern to concentrations at or near the remediation goal.

10. The monitoring period under Alternative GW-3B will be that same as for Alternative GW-3A. The monitoring period for the first year will be quarterly and will be conducted concurrently with the *in situ* treatment. The monitoring frequency will be reduced to semiannual events for years 2, 3, and 4, then monitoring will occur annually thereafter (starting in year 5). In year 15, monitoring will be quarterly for a 1-year "proof period" to demonstrate attainment of remediation goals. The monitoring for Alternative GW-3B will differ from Alternative GW-3A because it will include include additional analysis for metals.

D7.0 SUMMARY

The total cost for each alternative — including capital, present worth of O&M, and periodic costs — are summarized below.

Alternative Name and Description	Estimated Cost
Alternative S-2, Institutional Controls, Maintained Landscaping, and Shoreline Revetment	$5,470,000
Alternative S-3, Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment	$10,680,000
Alternative S-4, Soil/Asphalt Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment	$11,900,000

Alternative Name and Description	Estimated Cost
Alternative S-5, Excavation, Soil/Asphalt Cover, SVE, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment	$12,420,000
Alternative GW-2, Long-Term Groundwater Monitoring and Institutional Controls	$1,760,000
Alternative GW-3A, *In-Situ* Treatment, Reduced Groundwater Monitoring, and Institutional Controls-Bioremediation	$2,410,000
Alternative GW-3B, *In-Situ* Treatment, Reduced Groundwater Monitoring, and Institutional Controls-ZVI Injection	$2,790,000

D8.0 REFERENCES

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TABLES

TABLE D-1: SOIL ALTERNATIVES COST ESTIMATE SUMMARY

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Site: Parcel B **Base Year:** 2005
Location: Hunters Point Shipyard, San Francisco, California

Description	Alternative S-1 No Action	Alternative S-2 Institutional Controls, Maintained Landscaping, and Shoreline Revetment	Alternative S-3 Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment	Alternative S-4 Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment	Alternative S-5 Excavation, Covers, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment
Total Project Duration (Years)		**30**	**30**	**30**	**30**
Capital and Labor Cost	$0	$3,904,887	$7,441,652	$8,201,654	$8,637,669
Present Value of Periodic Costs	$0	$654,371	$654,371	$915,887	$915,887
20% Contingency	$0	$911,852	$1,619,205	$1,823,508	$1,910,711
Total Present Value of Alternative	**$0**	**$5,471,110**	**$9,715,228**	**$10,941,049**	**$11,464,267**
(Rounded)	**$0**	**$5,470,000**	**$9,720,000**	**$10,940,000**	**$11,460,000**

Notes:

S Soil

SVE Soil vapor extraction

TABLE D-2A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-2

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Institutional Controls

Physical Controls

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Signage Capital Costs (24" x 24" reflectorized)											Signage Capital Costs (24" x 24" reflectorized) Subtotal =	$ 11,896	
Block 2	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 3	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
Block 6	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 7	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 8	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 9	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 12	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 15	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
BOS-1	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
BOS-3	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
Total Physical Controls Capital Costs											**Total Physical Controls Capital Costs Subtotal =**	**$ 11,896**	

Legal Controls Professional Unit Costs

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Land Use Control Remedial Design											Land Use Control Remedial Design Subtotal =	$ 33,225	
LUC RD scoping meeting	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
Submit draft LUC RD	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
BCT review period	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
BCT comments due	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
RTC meeting and BCT concurrence	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Prepare draft final LUC RD	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
Submit draft final LUC RD	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT review and concurrence period	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT concurrence letters due	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
Prepare final LUC RD with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final LUC RD with RTC	11	hours	$ 75.00	$ 825	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 825	
Findings of Suitability to Transfer											Findings of Suitability to Transfer Subtotal =	$ 21,300	
Prepare draft FOST	88	hours	$ 75.00	$ 6,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,600	
Submit draft FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
Prepare draft final FOST	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit draft final FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review and concurrence period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Prepare final FOST with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final FOST with RTC	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT letters due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Covenant to Restrict Use of Property											Covenant to Restrict Use of Property Subtotal =	$ 7,500	
Prepare draft covenant	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File covenant	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Deed Restrictions											Deed Restrictions Subtotal =	$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	

TABLE D-2A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-2 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment																			
Location Factors	Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.																		
Project Duration: 6.0 Months or 133 working days																			
Risk Management Plan																Risk Management Plan Subtotal =	$	7,200	
Navy review draft RMP	40	hours	$	75.00	$	3,000	$ -	$ -	$ -	$ -	$ -	$ -	$	75.00	$	3,000	
Discuss comments on draft RMP	8	hours	$	75.00	$	600	$ -	$ -	$ -	$ -	$ -	$ -	$	75.00	$	600	
Review draft final RMP	40	hours	$	75.00	$	3,000	$ -	$ -	$ -	$ -	$ -	$ -	$	75.00	$	3,000	
Discuss comments on draft final	8	hours	$	75.00	$	600	$ -	$ -	$ -	$ -	$ -	$ -	$	75.00	$	600	
Total Legal Controls Capital Costs																**Total Legal Controls Capital Costs Subtotal =**	**$**	**76,725**	
Total Institutional Controls Capital Costs																***Total Institutional Controls Capital Costs Subtotal =***	***$***	***88,621***	

TABLE D-2A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-2 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Shoreline Revetment

Physical Costs

Description		Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs														
Distributive Costs												Distributive Costs Subtotal =	$ 355,910	
1 Project Manager	50%	532	hr	$ 34.00	$ 28,941	$ -	$ -	$ 100 /day	$ 6,650	$ -	$ -	$ 66.90	$ 35,591	
1 Superintendent	100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Engineer	100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Health & Safety Officer	100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Quality Control Officer	100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Procurement Specialist	50%	532	hr	$ 34.00	$ 28,941	$ -	$ -	$ 100 /day	$ 6,650	$ -	$ -	$ 66.90	$ 35,591	
Temporary Facilities												Temporary Facilities Subtotal =	$ 29,663	*Assume no set-up of buildings/work areas/etc. required
Portable Toilets (2)		6	mo	$ -	$ -	$ -	$ -	$ 1,006	$ 6,552	$ -	$ -	$ 1,092.00	$ 6,552	Means 2004 Heavy Construction. Pg. 24. 01590 400 6410
Rental Trucks (5) (for supervisory staff)		6	mo	$ -	$ -	$ -	$ -	$ 3,550	$ 23,111	$ -	$ -	$ 3,851.83	$ 23,111	Assuming rental from Enterprise
Mobilization												Mobilization Subtotal =	$ 19,412	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
Graders		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
20-ton dump truck		5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	Assumed $1 per mile for 50 miles; location factor and O&P N/A
100,000 gallon Modular Storage Tank Mobilization		3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ 16,368	$ 5,456.00	$ 16,368	Reed Margulis, ModuTank Inc., (800) 245-6964; location factor and O&P N/A
13 t/hr radiological screening equipment assembly		0	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*Means 33, 18, 04, 02
13 t/hr radiological screening rental		0	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*Means 33, 18, 04, 04
Demobilization												Demobilization Subtotal =	$ 19,412	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
Graders		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
20-ton dump truck		5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	
100,000 gallon Modular Storage Tank Mobilization		3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ 16,368	$ -	$ 16,368	
13 t/hr Radiological screening equipment disassembly		0	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*Means 33, 18, 04, 03
Oversight												Oversight Subtotal =	$ 62,187	
Engineer	100% on project; location factor N/A	1064	hr	$ 34.00	$ 62,187	$ -	$ -	$ -	$ -	$ -	$ -	$ 58.45	$ 62,187	*Calculated as overall cost
Total Site Wide Capital Costs												**Total Site Wide Capital Costs Subtotal =**	**$ 486,584**	
Shoreline Preparation												Shoreline Preparation Subtotal =	$ 57,370	
Clearing and grubbing		3	ac	$ 4,577	$ 23,605	$ 3,349	$ 10,900	$ -	$ -	$ -	$ -	11501.67	$ 34,505	Means 2005 17 01 0107
On-shore Rough Grading		14,520	sy	$ 0.47	$ 11,689	$ 0.71	$ 11,176	$ -	$ -	$ -	$ -	$ 1.57	$ 22,865	Means 2005 17 03 0103
Materials and Dredging												Materials and Dredging Subtotal =	$ 1,064,756	
Riprap		22,500	ton	$ 0.82	$ 31,716	$ 1.53	$ 37,351	$ 30.00	$ 732,375		$ -	$ 35.62	$ 801,442	Means 02370 200 1520
Geofabric		17,500	sy	$ 0.18	$ 5,415	$ -	$ -	$ 1.71	$ 32,469		$ -	$ 2.16	$ 37,884	Means 02340 300 1510
Crushed Stone Filter		2,000	cy	$ 2.99	$ 10,280	$ 4.40	$ 9,548	$ 27.50	$ 59,675		$ -	$ 39.75	$ 79,503	Means 02720 200 1520
Barge rental		3	mo	$ -	$ -	$ 3,100	$ 10,091	$ -	$ -		$ -	$ 3,363.67	$ 10,091	Means 01500 800 0240
Tug Boat rental		3	mo	$ -	$ -	$ 2,825	$ 9,195	$ -	$ -		$ -	$ 3,065.00	$ 9,195	Means 01500 800 2040
Dredging Mob & Demobilization		1	ea	$ 18,900	$ 32,489	$ 23,600	$ 25,606	$ -	$ -		$ -	$ 58,095.00	$ 58,095	Means 02325 250 0100
Dredging with Barge mounted Clamshell		6,000	bcy	$ 4.26	$ 43,938	$ 3.78	$ 24,608	$ -	$ -		$ -	$ 11.42	$ 68,546	Means 02325 250 0101
Waste Hauling and Disposal (33% volume added to account for bulking)												Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,534,472	
Sampling		12	ea		$ -		$ -	$ 1,000.00	$ 13,020		$ -	$ 1,085.00	$ 13,020	Means 33, 02, 0612, assume 1 sample per 500 bcy
Haul (20 ton dump less than 200 mi.)		6,000	bcy		$ -		$ -	$ 94.12	$ 612,721		$ -	$ 102.12	$ 612,721	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge		6,000	bcy		$ -		$ -	$ 119.36	$ 777,034		$ -	$ 129.51	$ 777,034	Means 33, 19, 03, 24
Truck decontamination		6,000	bcy		$ -		$ -	$ 20.23	$ 131,697		$ -	$ 21.95	$ 131,697	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Wetlands Mitigation												Wetlands Mitigation Subtotal =	$ 97,650	
Wetlands Mitigation		1	ea		$ -		$ -	$ 90,000.00	$ 97,650		$ -	$ 97,650.00	$ 97,650	Based on engineering judgment
Miscellaneous Work													$ 112,213	10% Additional cost associated with working in tidally influenced area
Total Shoreline Revetment Costs												**Total Shoreline Revetment Costs Subtotal =**	**$ 2,866,461**	

TABLE D-2A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-2 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Soil Covers (Maintained Landscaping) for Areas Disturbed During RAD Removal Action

Area															
Total area disturbed during RAD removal	20,000	sy													
Cover													Cover Subtotal =	$	44,997
Soil cover - Borrow, fill and compact 0.5 ft. thick)	3,333	cy	$ 1.68	$ 9,626	$ 2.63	$ 9,512	$ 7.15	$ 25,859	$ -	$ -	$ 13.50	$	44,997	Means 17, 03, 04, 23	
Seeding (soil cap only)													Seeding (soil cap only) Subtotal =	$	9,339
Hydroseeding	200	csy	$ 2.59	$ 890	$ 2.25	$ 488	$ 9.37	$ 2,033	$ -	$ -	$ 17.06	$	3,411	Means 18, 05, 04, 01	
Hydro fertilizer	200	csy	$ 1.03	$ 354	$ 0.75	$ 163	$ 2.18	$ 473	$ -	$ -	$ 4.95	$	990	Means 18, 05, 04, 08	
Water - 10 times	200	csy	$ 8.89	$ 3,056	$ 7.69	$ 1,669	$ 0.98	$ 213	$ -	$ -	$ 24.69	$	4,938	Means 18, 05, 04, 13	
Total Soil Cover (Maintained Landscaping) For Areas Disturbed During RAD Removal Action					**Total Soil Cover (Maintained Landscaping) For Areas Disturbed During RAD Removal Action Subtotal =**							**$**	**54,336**		
Total --- Capital Costs											**Total --- Capital Costs Subtotal =**	**$**	**3,407,381**		

Construction Cost Summary

Total Construction Capital Costs	**Total Construction Capital Costs Subtotal =**	**$**	**3,407,381**
Design Cost	**Design Cost Subtotal =**	**$**	**408,886**
Assume 12% of construction cost		$	408,886

*Calculated as overall cost. Percentage based on engineering judgment

Project Capital & Labor Cost =	**$**	**3,904,887**	from calculations shown on this page
Present Value of 30 Years of Periodic Costs = (Five-Year Reviews)	**$**	**654,371**	from calculations shown on Table D-2C and Table D-2B
SubTotal =	**$**	**4,559,258**	
20% Contingency =	**$**	**911,852**	
Total Project Cost =	**$**	**5,471,109**	

Notes:

"	Inch
%	Percent
ac	Acre
BCT	Base Realignment and Closure Cleanup Team
bcy	Bulk cubic yard
csy	100 square yards
cy	Cubic yard
ea	Each
FOST	Finding of suitability to transfer
LUC RD	Land Use Control Remedial Design
Means	RS Means Company, Inc. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions." Kingston, Massachusetts. October
mo	Month
O&P	Overhead and profit
ODC	Other direct cost
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System
RMP	Risk Management Plan
RTC	Response to comments

TABLE D-2B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE S-2
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs, below, for labor, equipment and material.

Project Duration: 1.0 Months or 22 working days

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Drive-by Inspection												Annual Drive-by Inspection Subtotal =			$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Maintain Landscaping												Maintain Landscaping Subtotal =			$ 933	
Hydroseeding	20	csy	$2.59	$ 89.00	$2.25	$ 49.00	$9.37	$ 203.00	0	$ -	$17.05	$ 341.00	-	-	-	Means 18, 05, 04, 01, assume 10% total area disturbed is maintained annually.
Hydro fertilizer	20	csy	$1.03	$ 35.00	$0.75	$ 16.00	$2.18	$ 47.00	0	$ -	$4.90	$ 98.00	-	-	-	Means 18, 05, 04, 08
Water - 10 times	20	csy	$8.89	$ 306.00	$7.69	$ 167.00	$0.98	$ 21.00	0	$ -	$24.70	$ 494.00	-	-	-	Means 18, 05, 04, 13
Enforce Deed Restrictions												Enforce Deed Restrictions Subtotal =			$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan												Oversight of Risk Management Plan Subtotal =			$ 3,000	
Oversight and inspections	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
												Total Annual Costs =			**$ 14,333**	For drive-by inspection, enforcement of deed restrictions, and RMP oversight
5-Year Report on Site Inspection												5-Year Report on Site Inspection Subtotal =			$ 77,573	
Inspection	150	hours	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hours	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	$9,000	$ 29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	ODCs assume 10% for miscellaneous legal costs
												Total 5 Year Cost =			**$ 91,906**	Total annual cost plus 5-year report
10-Year Shoreline Protection Inspection												10-Year Shoreline Protection Inspection Subtotal =			**$ 56,472**	
Inspection	120	hours	$75.00	$ 9,000.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 9,000	$ 100	$ 9,100	ODCs for travel
Engineering Report, Design and Oversight	96	hours	$75.00	$ 7,200.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 7,200	$ 100	$ 7,300	ODCs for printing
Repair revetment															$ 40,072	Based on engineering judgment; 5% of total riprap cost
												Total 10 Year Cost =			**$ 148,378**	Total 5 year cost plus 10 year subtotal cost

Notes:

csy	100 square yards
ea	each
O&M	Operation and maintenance
O&P	Overhead and profit
ODC	Other direct cost
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System

TABLE D-2C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE S-2

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at: 3.10 %

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative S-2[1]	Present Value Cost for Alternative S-2	Description of Cost
1	0.970	$14,333	$13,902	Annual Drive-by Inspection
2	0.941	$14,333	$13,484	Annual Drive-by Inspection
3	0.912	$14,333	$13,079	Annual Drive-by Inspection
4	0.885	$14,333	$12,685	Annual Drive-by Inspection
5	0.858	$91,906	$78,895	5-Year Review
6	0.833	$14,333	$11,934	Annual Drive-by Inspection
7	0.808	$14,333	$11,575	Annual Drive-by Inspection
8	0.783	$14,333	$11,227	Annual Drive-by Inspection
9	0.760	$14,333	$10,890	Annual Drive-by Inspection
10	0.737	$148,378	$109,341	5-Year Review and 10-Year Shoreline Inspection
11	0.715	$14,333	$10,245	Annual Drive-by Inspection
12	0.693	$14,333	$9,936	Annual Drive-by Inspection
13	0.672	$14,333	$9,638	Annual Drive-by Inspection
14	0.652	$14,333	$9,348	Annual Drive-by Inspection
15	0.633	$91,906	$58,139	5-Year Review
16	0.614	$14,333	$8,794	Annual Drive-by Inspection
17	0.595	$14,333	$8,530	Annual Drive-by Inspection
18	0.577	$14,333	$8,273	Annual Drive-by Inspection
19	0.560	$14,333	$8,025	Annual Drive-by Inspection
20	0.543	$148,378	$80,574	5-Year Review and 10-Year Shoreline Inspection
21	0.527	$14,333	$7,549	Annual Drive-by Inspection
22	0.511	$14,333	$7,322	Annual Drive-by Inspection
23	0.496	$14,333	$7,102	Annual Drive-by Inspection
24	0.481	$14,333	$6,889	Annual Drive-by Inspection
25	0.466	$91,906	$42,843	5-Year Review
26	0.452	$14,333	$6,481	Annual Drive-by Inspection
27	0.439	$14,333	$6,286	Annual Drive-by Inspection
28	0.425	$14,333	$6,097	Annual Drive-by Inspection
29	0.413	$14,333	$5,913	Annual Drive-by Inspection
30	0.400	$148,378	$59,376	5-Year Review and 10-Year Shoreline Inspection
		Total Present Value Cost Over 30 Years	**$654,371**	

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operation and maintenance

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs													
Distributive Costs											Distributive Costs Subtotal =	$ 355,910	
1 Project Manager 50%	532	hr	$ 34.00	$ 28,941	$ -	$ -	$ 100 /day	$ 6,650	$ -	$ -	$ 66.90	$ 35,591	
1 Superintendent 100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Engineer 100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Health & Safety Officer 100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Quality Control Officer 100%	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Procurement Specialist 50%	532	hr	$ 34.00	$ 28,941	$ -	$ -	$ 100 /day	$ 6,650	$ -	$ -	$ 66.90	$ 35,591	
Temporary Facilities											Temporary Facilities Subtotal =	$ 29,663	*Assume no set-up of buildings/work areas/etc. required
Portable Toilets (2)	6	mo	$ -	$ -	$ -	$ -	$ 1,006.40	$ 6,552	$ -	$ -	$ 1,092.00	$ 6,552	Means 2004 Heavy Construction. Pg. 24. 01590 400 6410
Rental Trucks (5) (for supervisory staff)	6	mo	$ -	$ -	$ -	$ -	$ 3,550.00	$ 23,111	$ -	$ -	$ 3,851.83	$ 23,111	Assuming rental from Enterprise
Mobilization											Mobilization Subtotal =	$ 127,332	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
Graders	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
20-ton dump truck	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	Assumed $1 per mile for 50 miles; location factor and O&P N/A
100,000 gallon Modular Storage Tank Mobilization	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ 16,368	$ 5,456.00	$ 16,368	Reed Margulis, ModuTank Inc., (800) 245-6964; location factor and O&P N/A
13 t/hr radiological screening equipment assembly	1	ea	$ -	$ -	$ -	$ -	$ 44,874.00	$ 48,688.00	$ -	$ -	$ 48,688.00	$ 48,688	*Means 33, 18, 04, 02
13 t/hr radiological screening rental	0.5	mo	$ -	$ -	$ -	$ -	$ 109,184.00	$ 59,232.00	$ -	$ -	$ 118,464.00	$ 59,232	*Means 33, 18, 04, 04
Demobilization											Demobilization Subtotal =	$ 129,326	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
Graders	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
20-ton dump truck	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	
100,000 gallon Modular Storage Tank Mobilization	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 16,368	$ 5,456.00	$ 16,368	
13 t/hr Radiological screening equipment disassembly	1	ea	$ -	$ -	$ -	$ -	$ 101,303.00	$ 109,914	$ -	$ -	$ 109,914.00	$ 109,914	*Means 33, 18, 04, 03
Oversight											Oversight Subtotal =	$ 62,187	
Engineer 100% on project; location factor N/A	1,064	hr	$ 34.00	$ 62,187	$ -	$ -	$ -	$ -	$ -	$ -	$ 58.45	$ 62,187	*Calculated as overall cost - not per individual excavation. Unit cost numbers same as previous
Total Site Wide Capital Costs											**Total Site Wide Capital Costs Subtotal =**	**$ 704,418**	
Excavation Costs													
Excavation Costs for Excavation Area Including Site ID Redevelopment Block 15 B4716													
Site Preparation											Site Preparation Subtotal =	$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201; assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation											Excavation Subtotal =	$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-18; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 15 B4716											**Total Excavation Capital Costs Redevelopment Block 15 B4716 Subtotal =**	**$ 40,840**	

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors: Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Excavation Costs Site ID Redevelopment Block 8 B3426													
Site Preparation											Site Preparation Subtotal =	$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201, assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation											Excavation Subtotal =	$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 8 B3426											**Total Excavation Capital Costs Redevelopment Block 8 B3426 Subtotal =**	**$ 40,840**	
Excavation Costs Site ID Redevelopment Block 9 B3415													
Site Preparation											Site Preparation Subtotal =	$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201, assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation											Excavation Subtotal =	$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 9 B3415											**Total Excavation Capital Costs Redevelopment Block 9 B3415 Subtotal =**	**$ 40,840**	
Total Excavation Capital Costs											**Total Excavation Capital Costs Subtotal =**	**$ 122,520**	

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors: Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Methane Source Removal Cost													
Methane Source Removal Redevelopment Block 3													
Excavation											Excavation Subtotal =	$ 383,573	
Standard soil excavation													50ft X 150ft X 20ft deep
Excavation	5,556	cy	$ 1.35	$ 12,893	$ 1.71	$ 10,308	$ -	$ -	$ -	$ -	$ 4.18	$ 23,201	Means 17, 03, 02, 77
Dewatering excavation													
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,250	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 22,432	$ -	$ -	$ 17.95	$ 22,432	Highest non-resident cost cited on San Francisco Public Utilities website
RAD soil excavation													
Extra charge for excavation in RAD	5,556	cy	$ 0.96	$ 9,168	$ 1.14	$ 6,872	$ -	$ -	$ -	$ -	$ 2.89	$ 16,040	Means 17, 03, 02, 77
RAD screening operation	5,556	cy	$ 13.65	$ 130,358	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.46	$ 130,358	Means 33, 18, 04, 05, assuming 13 tons/hr at $105.15/hr and 125lb/cf
Confirmation sampling													
Sampling	62	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 67,270	$ -	$ -	$ 1,085.00	$ 67,270	Means 33, 02, 0612
Post excavation soil gas survey	1	ea	$ -	$ -	$ -	$ -	$ 15,000.00	$ 16,275	$ -	$ -	$ 16,275.00	$ 16,275	TEG quote, 30 locations
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	7,389	cy	$ 1.68	$ 21,339	$ 2.63	$ 21,085	$ 7.15	$ 57,321	$ -	$ -	$ 13.50	$ 99,745	Means 17, 03, 04, 23
Grading													
Rough grade	833	sy	$ 0.29	$ 415	$ 0.51	$ 461	$ -	$ -	$ -	$ -	$ 1.05	$ 876	Means 17, 03, 01, 02
Fine grade	833	sy	$ 0.20	$ 287	$ 0.21	$ 190	$ -	$ -	$ -	$ -	$ 0.57	$ 477	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 596	
2-foot high (and 2-ft wide) berm around open excav	44	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 334	$ 7.59	$ 334	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,873,640	
Haul (20 ton dump less than 200 mi.)	7,389	cy	$ -	$ -		$ -	$ 94.12	$ 754,555		$ -	$ 102.12	$ 754,555	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	7,389	cy	$ -	$ -		$ -	$ 119.36	$ 956,902		$ -	$ 129.51	$ 956,902	Means 33, 19, 03, 24
Truck decontamination	7,389	cy	$ -	$ -		$ -	$ 20.23	$ 162,183		$ -	$ 21.95	$ 162,183	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Radiological waste disposal charge	0	cy	$ -	$ -		$ -	$ 295.38	$ -		$ -	$ -	$ -	Means 33, 18, 09, 01, assume 0% of screened soil will require special disposal for RAD
Total Methane Source Removal Capital Costs Redevelopment Block 3											**Total Methane Source Removal Capital Costs Redevelopment Block 3 Subtotal =**	**$ 2,257,809**	
Mercury Source Removal Cost													
Mercury Source Removal Redevelopment Block 16													
Excavation											Excavation Subtotal =	$ 327,885	
Soil borings to delineate depth of excavation													60ft X 250ft X 15ft deep
Drilling (5 borings, 20 feet each)	100	ft	$ -	$ -	$ -	$ -	$ 25.00	$ 2,713	$ -	$ -	$ 27.13	$ 2,713	Based on previous experience at other sites
Standard soil excavation													60ft X 250ft X 15ft deep
Excavation	8,300	cy	$ 1.35	$ 19,261	$ 1.71	$ 15,399	$ -	$ -	$ -	$ -	$ 4.18	$ 34,660	Means 17, 03, 02, 77
Dewatering excavation													
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,500	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 26,919	$ -	$ -	$ 17.95	$ 26,919	Highest non-resident cost cited on San Francisco Public Utilities website
Confirmation sampling													
Sampling	149	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 161,665	$ -	$ -	$ 1,085.00	$ 161,665	Means 33, 02, 0612
Filling/soil cover (33% volume added to account for compaction of fill)													
Fill Material	3,724	cy		$ -		$ -	$ 7.15	$ 28,890	$ -	$ -	$ 7.76	$ 28,890	Means 17, 03, 04, 23, to replace soil disposed of off-site
Place and compact	11,039	cy	$ 1.68	$ 31,880	$ 2.63	$ 31,500		$ -	$ -	$ -	$ 5.74	$ 63,380	Means 17, 03, 04, 23, volume includes clean backfill from Excavation EE-05 and new backfill
Grading													
Rough grade	1700	sy	$ 0.29	$ 847	$ 0.51	$ 941	$ -	$ -	$ -	$ -	$ 1.05	$ 1,788	Means 17, 03, 01, 02
Fine grade	1700	sy	$ 0.20	$ 584	$ 0.21	$ 387	$ -	$ -	$ -	$ -	$ 0.57	$ 971	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 2,253	
2-foot high (and 2-ft wide) berm around open excav	90	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 683	$ 7.59	$ 683	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	600	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 1,570	$ 2.62	$ 1,570	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 944,315	
Haul (20 ton dump less than 200 mi.)	3,724	cy	$ -	$ -		$ -	$ 94.12	$ 380,296		$ -	$ 102.12	$ 380,296	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	3,724	cy	$ -	$ -		$ -	$ 119.36	$ 482,279		$ -	$ 129.51	$ 482,279	Means 33, 19, 03, 24
Truck decontamination	3,724	cy	$ -	$ -		$ -	$ 20.23	$ 81,740		$ -	$ 21.95	$ 81,740	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Mercury Source Removal Capital Costs Redevelopment Block 16											**Total Mercury Source Removal Capital Costs Redevelopment Block 16 Subtotal =**	**$ 1,274,453**	

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors: Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Soil Covers for Areas Disturbed During RAD Removal Action													
Area													
Total area disturbed during RAD removal	20,000	sy											
Cover											Cover Subtotal =	$ 44,997	
Soil cover - Borrow, fill and compact (0.5 ft. thick)	3,333	cy	$ 1.68	$ 9,626	$ 2.63	$ 9,512	$ 7.15	$ 25,859	$ -	$ -	$ 13.50	$ 44,997	Means 17, 03, 04, 23
Seeding (soil cap only)										Seeding (soil cap only) Subtotal =		$ 9,339	
Hydroseeding	200	csy	$ 2.59	$ 890	$ 2.25	$ 488	$ 9.37	$ 2,033	$ -	$ -	$ 17.06	$ 3,411	Means 18, 05, 04, 01
Hydro fertilizer	200	csy	$ 1.03	$ 354	$ 0.75	$ 163	$ 2.18	$ 473	$ -	$ -	$ 4.95	$ 990	Means 18, 05, 04, 08
Water - 10 times	200	csy	$ 8.89	$ 3,056	$ 7.69	$ 1,669	$ 0.98	$ 213	$ -	$ -	$ 24.69	$ 4,938	Means 18, 05, 04, 13
Total Soil Cover (Maintained Landscaping) For Areas Disturbed During RAD Removal Action										**Total Soil Cover (Maintained Landscaping) For Areas Disturbed During RAD Removal Action Subtotal =**		**$ 54,336**	
Shoreline Revetment													
Shoreline Preparation											Shoreline Preparation Subtotal =	$ 57,370	
Clearing and grubbing	3	ac	$ 4,577.30	$ 23,605	$ 3,348.72	$ 10,900	$ -	$ -	$ -	$ -	$ 11,501.67	$ 34,505	Means 2005 17 01 0107
On-shore Rough Grading	14,520	sy	$ 0.47	$ 11,689	$ 0.71	$ 11,176	$ -	$ -	$ -	$ -	$ 1.57	$ 22,865	Means 2005 17 03 0103
Materials and Dredging											Materials and Dredging Subtotal =	$ 1,064,756	
Riprap	22,500	ton	$ 0.82	$ 31,716	$ 1.53	$ 37,351	$ 30.00	$ 732,375		$ -	$ 35.62	$ 801,442	Means 02370 200 1520
Geofabric	17,500	sy	$ 0.18	$ 5,415	$ -	$ -	$ 1.71	$ 32,469		$ -	$ 2.16	$ 37,884	Means 02340 300 1510
Crushed Stone Filter	2,000	cy	$ 2.99	$ 10,280	$ 4.40	$ 9,548	$ 27.50	$ 59,675		$ -	$ 39.75	$ 79,503	Means 02720 200 1520
Barge rental	3	mo	$ -	$ -	$ 3,100.00	$ 10,091	$ -	$ -		$ -	$ 3,363.67	$ 10,091	Means 01500 800 0240
Tug Boat rental	3	mo	$ -	$ -	$ 2,825.00	$ 9,195	$ -	$ -		$ -	$ 3,065.00	$ 9,195	Means 01500 800 2040
Dredging Mob & Demobilization	1	ea	$ 18,900.00	$ 32,489	$ 23,600.00	$ 25,606	$ -	$ -		$ -	$ 58,095.00	$ 58,095	Means 02325 250 0100
Dredging with Barge mounted Clamshell	6,000	bcy	$ 4.26	$ 43,938	$ 3.78	$ 24,608	$ -	$ -		$ -	$ 11.42	$ 68,546	Means 02325 250 0101
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,534,472	
Sampling	12	ea		$ -		$ -	$ 1,000.00	$ 13,020		$ -	$ 1,085.00	$ 13,020	Means 33, 02, 0612, assume 1 sample per 500 bcy
Haul (20 ton dump less than 200 mi.)	6,000	bcy		$ -		$ -	$ 94.12	$ 612,721		$ -	$ 102.12	$ 612,721	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	6,000	bcy		$ -		$ -	$ 119.36	$ 777,034		$ -	$ 129.51	$ 777,034	Means 33, 19, 03, 24
Truck decontamination	6,000	bcy		$ -		$ -	$ 20.23	$ 131,697		$ -	$ 21.95	$ 131,697	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Wetlands Mitigation											Wetlands Mitigation Subtotal =	$ 97,650	
Wetlands Mitigation	1	ea		$ -		$ -	$ 90,000.00	$ 97,650		$ -	$ 97,650.00	$ 97,650	Based on engineering judgment
Miscellaneous Work												$ 112,213	10% Additional cost associated with working in tidally influenced area
Total Shoreline Revetment Capital Costs										**Total Shoreline Revetment Capital Costs Subtotal =**		**$ 2,866,461**	
Construction Cost Summary													
Total Construction Capital Costs										**Total Construction Capital Costs Subtotal =**		**$ 7,279,997**	
Design Cost										**Design Cost Subtotal =**		**$ 873,600**	*Calculated as overall cost - not per individual excavation. Unit cost numbers same as previous. Percentage based on engineering judgment
Assume 12% of construction cost												$ 873,600	

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Institutional Controls

Physical Controls

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Signage Capital Costs (24" x 24" reflectorized)								Signage Capital Costs (24" x 24" reflectorized) Subtotal =				$ 11,896	
Block 2	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 3	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
Block 6	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 7	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 8	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 9	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 12	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 15	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
BOS-1	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
BOS-3	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
Total Physical Controls Capital Costs										**Total Physical Controls Capital Costs Subtotal =**		**$ 11,896**	

Legal Controls Professional Unit Costs

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Land Use Control Remedial Design										Land Use Control Remedial Design Subtotal =		$ 33,225	
LUC RD scoping meeting	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
Submit draft LUC RD	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
BCT review period	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
BCT comments due	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
RTC meeting and BCT concurrence	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Prepare draft final LUC RD	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
Submit draft final LUC RD	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT review and concurrence period	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT concurrence letters due	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
Prepare final LUC RD with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final LUC RD with RTC	11	hours	$ 75.00	$ 825	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 825	
Findings of Suitability to Transfer										Findings of Suitability to Transfer Subtotal =		$ 21,300	
Prepare draft FOST	88	hours	$ 75.00	$ 6,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,600	
Submit draft FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
Prepare draft final FOST	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit draft final FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review and concurrence period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Prepare final FOST with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final FOST with RTC	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT letters due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	

TABLE D-3A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-3 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covenant to Restrict Use of Property										Covenant to Restrict Use of Property Subtotal =		$ 7,500	
Prepare draft covenant	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File covenant	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Deed Restrictions										Deed Restrictions Subtotal =		$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan										Risk Management Plan Subtotal =		$ 7,200	
Navy review draft RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Navy review draft final RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft final RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Total Legal Controls Capital Costs										**Total Legal Controls Capital Costs Subtotal =**		**$ 76,725**	
Total Institutional Controls Capital Costs										**Total Institutional Controls Capital Costs Subtotal =**		**$ 88,621**	

Project Capital & Labor Cost =	**$ 8,242,217**	from calculations shown on this page
Present Value of 30 Years of Periodic Costs =	**$ 654,371**	from calculations shown on Table D-3C
SubTotal =	**$ 8,896,588**	
20% Contingency =	**$ 1,779,318**	
Total Project Cost =	**$ 10,675,905**	

Notes:

"	Inch
%	Percent
ac	Acre
BCT	Base Realignment and Closure Cleanup Team
bcy	Bank cubic yard
csy	100 square yards
cy	Cubic yard
ea	Each
FOST	Finding of suitability to transfer
ft	Foot
hr	Hour
LUC RD	Land Use Control Remedial Design
Means	Means, RS. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions," RS Means Company, Inc, Kingston, MA. October.
mi	Mile
mo	Month
N/A	Not applicable
O&P	Overhead and Profit
ODC	Other direct cost
Pg	Page
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System
RAD	Radiological
RMP	Risk Management Plan
RTC	Response to comments
sy	Square yard
t	Ton

TABLE D-3B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE S-3
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-3: Excavation, Methane and Mercury Source Removal, Maintained Landscaping, Institutional Controls and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs, below, for labor, equipment and material.

Project Duration: 2.0 Months or 44 working days

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Drive-by Inspection													Annual Drive-by Inspection Subtotal =		$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Maintain Landscaping													Maintain Landscaping Subtotal =		$ 933	
Hydroseeding	20	csy	$2.59	$ 89.00	$2.25	$ 49.00	$9.37	$ 203.00	0	$ -	$17.05	$ 341.00	-	-	-	Means 18, 05, 04, 01, assume 10 percent of the total area disturbed needs to be maintained annually
Hydro fertilizer	20	csy	$1.03	$ 35.00	$0.75	$ 16.00	$2.18	$ 47.00	0	$ -	$4.90	$ 98.00	-	-	-	Means 18, 05, 04, 08
Water - 10 times	20	csy	$8.89	$ 306.00	$7.69	$ 167.00	$0.98	$ 21.00	0	$ -	$24.70	$ 494.00	-	-	-	Means 18, 05, 04, 13
Enforce Deed Restrictions													Enforce Deed Restrictions Subtotal =		$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan													Oversight of Risk Management Plan Subtotal =		$ 3,000	
Oversight and Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
													Total Annual Costs =		**$ 14,333**	Drive-by inspection, enforcement of deed restrictions, and RMP oversight
5-Year Report on Site Inspection													5-Year Report on Site Inspection Subtotal =		$ 77,573	
Inspection	150	hours	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hours	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	$9,000	$ 29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	Assume 10% for miscellaneous costs
													Total 5 Year Cost =		**$ 91,906**	Total annual cost plus 5-year report
10-Year Shoreline Protection Inspection													10-Year Shoreline Protection Inspection Subtotal =		**$ 56,472**	
Inspection	120	hours	$75.00	$ 9,000.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 9,000	$ 100	$ 9,100	ODCs for travel
Engineering Report, Design and Oversight	96	hours	$75.00	$ 7,200.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 7,200	$ 100	$ 7,300	ODCs for printing
Repair revetment															$ 40,072	Based on engineering judgment; 5% of total riprap cost
													Total 10 Year Cost =		**$ 148,378**	Total 5-year cost plus 10-year subtotal cost

Notes:

csy	100 square yards
ea	each
ODC	Other direct cost
O&M	Operation and maintenance
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System

TABLE D-3C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE S-3

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at: 3.10 %

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative S-3[1]	Present Value Cost for Alternative S-3	Description of Cost
1	0.970	$14,333	$13,902	Annual Drive-by Inspection
2	0.941	$14,333	$13,484	Annual Drive-by Inspection
3	0.912	$14,333	$13,079	Annual Drive-by Inspection
4	0.885	$14,333	$12,685	Annual Drive-by Inspection
5	0.858	$91,906	$78,895	5-Year Review
6	0.833	$14,333	$11,934	Annual Drive-by Inspection
7	0.808	$14,333	$11,575	Annual Drive-by Inspection
8	0.783	$14,333	$11,227	Annual Drive-by Inspection
9	0.760	$14,333	$10,890	Annual Drive-by Inspection
10	0.737	$148,378	$109,341	5-Year Review and 10-Year Shoreline Inspection
11	0.715	$14,333	$10,245	Annual Drive-by Inspection
12	0.693	$14,333	$9,936	Annual Drive-by Inspection
13	0.672	$14,333	$9,638	Annual Drive-by Inspection
14	0.652	$14,333	$9,348	Annual Drive-by Inspection
15	0.633	$91,906	$58,139	5-Year Review
16	0.614	$14,333	$8,794	Annual Drive-by Inspection
17	0.595	$14,333	$8,530	Annual Drive-by Inspection
18	0.577	$14,333	$8,273	Annual Drive-by Inspection
19	0.560	$14,333	$8,025	Annual Drive-by Inspection
20	0.543	$148,378	$80,574	5-Year Review and 10-Year Shoreline Inspection
21	0.527	$14,333	$7,549	Annual Drive-by Inspection
22	0.511	$14,333	$7,322	Annual Drive-by Inspection
23	0.496	$14,333	$7,102	Annual Drive-by Inspection
24	0.481	$14,333	$6,889	Annual Drive-by Inspection
25	0.466	$91,906	$42,843	5-Year Review
26	0.452	$14,333	$6,481	Annual Drive-by Inspection
27	0.439	$14,333	$6,286	Annual Drive-by Inspection
28	0.425	$14,333	$6,097	Annual Drive-by Inspection
29	0.413	$14,333	$5,913	Annual Drive-by Inspection
30	0.400	$148,378	$59,376	5-Year Review and 10-Year Shoreline Inspection
Total Present Value Cost Over 30 Years			**$654,371**	

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operation and maintenance

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description		Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs														
Distributive Costs											Distributive Costs Subtotal =		$ 391,501	
1 Project Manager	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Superintendent	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Engineer	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Heatlh & Safety Officer	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Quality Control Officer	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Procurement Spec.	50% on project; location factor N/A	532	hr	$ 34.00	$ 28,941	$ -	$ -	$ 100 /day	$ 6,650	$ -	$ -	$ 66.90	$ 35,591	
Temporary Facilities											Temporary Facilities Subtotal =		$ 29,663	*Assume no set-up of buildings/work areas/etc. required
Portable Toilets (2)		6	mo	$ -	$ -	$ -	$ -	$ 1,006.40	$ 6,552	$ -	$ -	$ 1,092.00	$ 6,552	Means 2004 Heavy Construction. Pg. 24. 01590 400 6410
Rental Trucks (5) (for supervisory staff)		6	mo	$ -	$ -	$ -	$ -	$ 3,550.00	$ 23,111	$ -	$ -	$ 3,851.83	$ 23,111	Assuming rental from Enterprise
Mobiliation											Mobiliation Subtotal =		$ 127,332	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
Graders		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
20 ton dump truck		5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	Assumed $1 per mile for 50 miles; location factor and O&P N/A
100,000 gallon Modular Storage Tank Mobilization		3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ 16,368	$ 5,456.00	$ 16,368	Reed Margulis, ModuTank Inc., (800) 245-6964; location factor and O&P N/A
13 t/hr radiological screening equipment assembly		1	ea	$ -	$ -	$ -	$ -	$ 44,874.00	$ 48,688.00	$ -	$ -	$ 48,688.00	$ 48,688	*Means 33, 18, 04, 02
13 t/hr radiological screening rental		0.5	mo	$ -	$ -	$ -	$ -	$ 109,184.00	$ 59,232.00	$ -	$ -	$ 118,464.00	$ 59,232	*Means 33, 18, 04, 04
Demobilization											Demobilization Subtotal =		$ 129,326	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	From previous
Graders		5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	From previous
20 ton dump truck		5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	
100,000 gallon Modular Storage Tank Mobilization		3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 16,368	$ 5,456.00	$ 16,368	
13 t/hr Radiological screening equipment disassembly		1	ea	$ -	$ -	$ -	$ -	$ 101,303.00	$ 109,914	$ -	$ -	$ 109,914.00	$ 109,914	*Means 33, 18, 04, 03
Oversight											Oversight Subtotal =		$ 62,187	
Engineer	100% on project; location factor N/A	1,064	hr	$ 34.00	$ 62,187	$ -	$ -	$ -	$ -	$ -	$ -	$ 58.45	$ 62,187	*Calculated as overall cost - not per individual excavation. Unit cost numbers same as previous
Total Site Wide Capital Costs											**Total Site Wide Capital Costs Subtotal =**		**$ 740,009**	
Cover Costs														
Covering Redevelopment Block 1														
Area														
Block Area Cover - Soil		3,456	sy											
Cover											Cover Subtotal =		$ 31,103	
Soil cover - Borrow, fill and compact (2 ft. thick)		2,304	cy	$ 1.68	$ 6,654	$ 2.63	$ 6,575	$ 7.15	$ 17,874	$ -	$ -	$ 13.50	$ 31,103	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =		$ 1,613	
Hydroseeding		35	csy	$ 2.59	$ 154	$ 2.25	$ 84	$ 9.37	$ 351	$ -	$ -	$ 17.04	$ 589	Means 18, 05, 04, 01
Hydro fertilizer		35	csy	$ 1.03	$ 61	$ 0.75	$ 28	$ 2.18	$ 82	$ -	$ -	$ 4.95	$ 171	Means 18, 05, 04, 08
Water - 10 times		35	csy	$ 8.89	$ 528	$ 7.69	$ 288	$ 0.98	$ 37	$ -	$ -	$ 24.68	$ 853	Means 18, 05, 04, 13
Total Covering Capital Costs BLK-1											**Total Covering Capital Costs BLK-1 Subtotal =**		**$ 32,716**	
Covering Redevelopment Block 2														
Area														
Block Area Cover - Asphalt		27,480	sy											
New asphalt cover (to existing unpaved areas)													$ -	
Unpaved Area		27,480	sy											
Covering											Covering Subtotal =		$ 97,556	
Asphalt cover - bituminous (4 in. thick)		3,053	cy	$ 10.35	$ 54,324	$ 0.50	$ 1,656	$ 12.55	$ 41,576	$ -	$ -	$ 31.95	$ 97,556	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-2											**Total Covering Capital Costs BLK-2 Subtotal =**		**$ 97,556**	
Covering Redevelopment Block 3														
Area														
Block Area Cover - Asphalt		9,459	sy											
New asphalt cover (to existing unpaved areas)													$ -	
Unpaved Area		9,459	sy											
Covering											Covering Subtotal =		$ 33,580	
Asphalt cover - bituminous (4 in. thick)		1,051	cy	$ 10.35	$ 18,699	$ 0.50	$ 570	$ 12.55	$ 14,311	$ -	$ -	$ 31.95	$ 33,580	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-3											**Total Covering Capital Costs BLK-3 Subtotal =**		**$ 33,580**	

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covering Redevelopment Block 4													
Area													
Block Area Cover - Asphalt	10,343	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 20,722	
Paved Area	10,343	sy											
Sealcoat Area	10,343	sy	$ 0.73	$ 12,979	$ 0.40	$ 4,489	$ 0.29	$ 3,254	$ -	$ -	$ 2.00	$ 20,722	Means 02785 250 1960
Total Covering Capital Costs BLK-4											**Total Covering Capital Costs BLK-4 Subtotal =**	**$ 20,722**	
Covering Redevelopment Block 5													
Area													
Block Area Cover - Asphalt	12,545	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 25,134	
Paved Area	12,545	sy											
Sealcoat Area	12,545	sy	$ 0.73	$ 15,742	$ 0.40	$ 5,445	$ 0.29	$ 3,947	$ -	$ -	$ 2.00	$ 25,134	Means 02785 250 1960
Total Covering Capital Costs BLK-5											**Total Covering Capital Costs BLK-5 Subtotal =**	**$ 25,134**	
Covering Redevelopment Block 6													
Area													
Block Area Cover - Asphalt	13,556	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 27,159	
Paved Area	13,556	sy											
Sealcoat Area	13,556	sy	$ 0.73	$ 17,011	$ 0.40	$ 5,883	$ 0.29	$ 4,265	$ -	$ -	$ 2.00	$ 27,159	Means 02785 250 1960
Total Covering Capital Costs BLK-6											**Total Covering Capital Costs BLK-6 Subtotal =**	**$ 27,159**	
Covering Redevelopment Block 7													
Area	17,165												The north portion of Block 7 is existing asphalt and will be sealcoated; the south portion of Block 7 is unpaved hillside, and will be covered with a soil cover
Block Area Cover - Asphalt	6,691	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 13,405	
Paved Area	6,691	sy											
Sealcoat Area	6,691	sy	$ 0.73	$ 8,396	$ 0.40	$ 2,904	$ 0.29	$ 2,105	$ -	$ -	$ 2.00	$ 13,405	Means 02785 250 1960
Covering											Covering Subtotal =	$ 99,155	
Block Area Cover - Soil	10,474	sy											
Cover											Cover Subtotal =	$ 94,264	
Soil cover - Borrow, fill and compact (2 ft. thick)	6,983	cy	$ 1.68	$ 20,166	$ 2.63	$ 19,926	$ 7.15	$ 54,172	$ -	$ -	$ 13.50	$ 94,264	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =	$ 4,891	
Hydroseeding	105	csy	$ 2.59	$ 466	$ 2.25	$ 256	$ 9.37	$ 1,065	$ -	$ -	$ 17.06	$ 1,787	Means 18, 05, 04, 01
Hydro fertilizer	105	csy	$ 1.03	$ 185	$ 0.75	$ 85	$ 2.18	$ 248	$ -	$ -	$ 4.95	$ 518	Means 18, 05, 04, 08
Water - 10 times	105	csy	$ 8.89	$ 1,601	$ 7.69	$ 874	$ 0.98	$ 111	$ -	$ -	$ 24.69	$ 2,586	Means 18, 05, 04, 13
Total Covering Capital Costs BLK-7											**Total Covering Capital Costs BLK-7 Subtotal =**	**$ 112,560**	
Covering Redevelopment Block 8													
Area													
Block Area Cover - Asphalt	6,594	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 11,296	
Paved Area	5,638	sy											
Sealcoat Area	5,638	sy	$ 0.73	$ 7,075	$ 0.40	$ 2,447	$ 0.29	$ 1,774	$ -	$ -	$ 2.00	$ 11,296	Means 02785 250 1960
New asphalt cover (to existing unpaved areas)											New asphalt cover (to existing unpaved areas) Subtotal =	$ -	
Unpaved Area	956	sy											
Covering											Covering Subtotal =	$ 3,394	
Asphalt cap - bituminous (0.5 ft. Thick)	106	cy	$ 10.35	$ 1,890	$ 0.50	$ 58	$ 12.55	$ 1,446	$ -	$ -	$ 31.95	$ 3,394	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-8											**Total Covering Capital Costs BLK-8 Subtotal =**	**$ 14,690**	
Covering Redevelopment Block 9													
Area													
Block Area Cover - Asphalt	9,940	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 19,915	
Paved Area	9,940	sy											
Sealcoat Area	9,940	sy	$ 0.73	$ 12,473	$ 0.40	$ 4,314	$ 0.29	$ 3,128	$ -	$ -	$ 2.00	$ 19,915	Means 02785 250 1960
Total Covering Capital Costs BLK-9											**Total Covering Capital Costs BLK-9 Subtotal =**	**$ 19,915**	

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covering Redevelopment Block 12													
Area													
Block Area Cover - Asphalt	11,671	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 23,382	
Paved Area	11,671	sy											
Sealcoat Area	11,671	sy	$ 0.73	$ 14,645	$ 0.40	$ 5,065	$ 0.29	$ 3,672	$ -	$ -	$ 2.00	$ 23,382	Means 02785 250 1960
Total Covering Capital Costs BLK-12											**Total Covering Capital Costs BLK-12 Subtotal =**	**$ 23,382**	
Covering Redevelopment Block 15													
Area													
Block Area Cover - Asphalt	7,332	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 13,516	
Paved Area	6,746	sy											
Sealcoat Area	6,746	sy	$ 0.73	$ 8,465	$ 0.40	$ 2,928	$ 0.29	$ 2,123	$ -	$ -	$ 2.00	$ 13,516	Means 02785 250 1960
New asphalt cover (to existing unpaved areas)												$ -	
Unpaved Area	586	sy											
Covering											Covering Subtotal =	$ 2,080	
Asphalt cover - bituminous (4 in. thick)	65	cy	$ 10.35	$ 1,158	$ 0.50	$ 35	$ 12.55	$ 887	$ -	$ -	$ 31.95	$ 2,080	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-15											**Total Covering Capital Costs BLK-15 Subtotal =**	**$ 15,596**	
Covering Redevelopment Block 16													
Area													
Block Area Cover - Asphalt	8,804	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 17,639	
Paved Area	8,804	sy											
Sealcoat Area	8,804	sy	$ 0.73	$ 11,048	$ 0.40	$ 3,821	$ 0.29	$ 2,770	$ -	$ -	$ 2.00	$ 17,639	Means 02785 250 1960
Total Covering Capital Costs BLK-16											**Total Covering Capital Costs BLK-16 Subtotal =**	**$ 17,639**	
Covering Redevelopment Block BOS-1													
Area													
Block Area Cover - Soil	26,109	sy											
Cover											Cover Subtotal =	$ 234,967	
Soil cover - Borrow, fill and compact (2 ft. thick)	17,406	cy	$ 1.68	$ 50,267	$ 2.63	$ 49,669	$ 7.15	$ 135,031	$ -	$ -	$ 13.50	$ 234,967	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =	$ 12,191	
Hydroseeding	261	csy	$ 2.59	$ 1,162	$ 2.25	$ 637	$ 9.37	$ 2,654	$ -	$ -	$ 17.06	$ 4,453	Means 18, 05, 04, 01
Hydro fertilizer	261	csy	$ 1.03	$ 462	$ 0.75	$ 212	$ 2.18	$ 618	$ -	$ -	$ 4.95	$ 1,292	Means 18, 05, 04, 08
Water - 10 times	261	csy	$ 8.89	$ 3,990	$ 7.69	$ 2,178	$ 0.98	$ 278	$ -	$ -	$ 24.69	$ 6,446	Means 18, 05, 04, 13
Total Covering Capital Costs BOS-1											**Total Covering Capital Costs BOS-1 Subtotal =**	**$ 247,158**	
Covering Redevelopment Block BOS-2													
Area													
Block Area Cover - Asphalt	41,764	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 83,675	
Paved Area	41,764	sy											
Sealcoat Area	41,764	sy	$ 0.73	$ 52,408	$ 0.40	$ 18,126	$ 0.29	$ 13,141	$ -	$ -	$ 2.00	$ 83,675	Means 02785 250 1960
Total Covering Capital Costs BOS-2											**Total Covering Capital Costs BOS-2 Subtotal =**	**$ 83,675**	
Covering Redevelopment Block BOS_3													
Area													
Block Area Cover - Asphalt	24,136	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 48,356	
Paved Area	24,136	sy											
Sealcoat Area	24,136	sy	$ 0.73	$ 30,287	$ 0.40	$ 10,475	$ 0.29	$ 7,594	$ -	$ -	$ 2.00	$ 48,356	Means 02785 250 1960
Total Covering Capital Costs BOS-3											**Total Covering Capital Costs BOS-3 Subtotal =**	**$ 48,356**	
Total Covering Capital Costs											**Total Covering Capital Costs Subtotal =**	**$ 819,838**	

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors: Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Methane Source Removal Costs													
Methane Source Removal Redevelopment Block 3													
Excavation											Excavation Subtotal =	$ 383,573	50ft X 150ft X 20 ft deep
Standard soil excavation													
Excavation	5,556	cy	$ 1.35	$ 12,893	$ 1.71	$ 10,308	$ -	$ -	$ -	$ -	$ 4.18	$ 23,201	Means 17, 03, 02, 77
Dewatering excavation													
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,250	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 22,432	$ -	$ -	$ 17.95	$ 22,432	Highest non-resident cost cited on San Francisco Public Utilities website
RAD soil excavation													
Extra charge for excavation in RAD	5,556	cy	$ 0.96	$ 9,168	$ 1.14	$ 6,872	$ -	$ -	$ -	$ -	$ 2.89	$ 16,040	Means 17, 03, 02, 77
RAD screening operation	5,556	cy	$ 13.65	$ 130,358	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.46	$ 130,358	Means 33, 18, 04, 05, assuming 13 tons/hr at $105.15/hr and 125 lb/cf
Confirmation sampling													
Sampling	62	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 67,270	$ -	$ -	$ 1,085.00	$ 67,270	Means 33, 02, 0612
Post excavation soil gas survey	1	ea	$ -	$ -	$ -	$ -	$ 15,000.00	$ 16,275	$ -	$ -	$ 16,275.00	$ 16,275	TEG quote, 30 locations
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	7,389	cy	$ 1.68	$ 21,339	$ 2.63	$ 21,085	$ 7.15	$ 57,321	$ -	$ -	$ 13.50	$ 99,745	Means 17, 03, 04, 23
Grading													
Rough grade	833	sy	$ 0.29	$ 415	$ 0.51	$ 461	$ -	$ -	$ -	$ -	$ 1.05	$ 876	Means 17, 03, 01, 02
Fine grade	833	sy	$ 0.20	$ 287	$ 0.21	$ 190	$ -	$ -	$ -	$ -	$ 0.57	$ 477	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 596	
2-foot high (and 2-ft wide) berm around open excav	44	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 334	$ 7.59	$ 334	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,873,640	
Haul (20 ton dump less than 200 mi.)	7,389	cy	$ -	$ -		$ -	$ 94.12	$ 754,555		$ -	$ 102.12	$ 754,555	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	7,389	cy	$ -	$ -		$ -	$ 119.36	$ 956,902		$ -	$ 129.51	$ 956,902	Means 33, 19, 03, 24
Truck decontamination	7,389	cy	$ -	$ -		$ -	$ 20.23	$ 162,183		$ -	$ 21.95	$ 162,183	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Radiological waste disposal charge	0	cy	$ -	$ -		$ -	$ 295.38	$ -		$ -	$ -	$ -	Means 33, 18, 09, 01, assume 0% of screened soil will require special disposal for RAD
Total Methane Source Removal Capital Costs Redevelopment Block 3											**Total Methane Source Removal Capital Costs Redevelopment Block 3 Subtotal =**	**$ 2,257,809**	
Mercury Source Removal Cost													
Mercury Source Removal Redevelopment Block 16													
Excavation											Excavation Subtotal =	$ 327,885	
Soil borings to delineate depth of excavation													
Drilling (5 borings, 20 feet each)	100	ft	$ -	$ -	$ -	$ -	$ 25.00	$ 2,713	$ -	$ -	$ 27.13	$ 2,713	Based on previous experience at other sites
Standard soil excavation													60ft X 250ft X15ft deep
Excavation	8,300	cy	$ 1.35	$ 19,261	$ 1.71	$ 15,399	$ -	$ -	$ -	$ -	$ 4.18	$ 34,660	Means 17, 03, 02, 77
Dewatering excavation										$ -			
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,500	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 26,919	$ -	$ -	$ 17.95	$ 26,919	Highest non-resident cost cited on San Francisco Public Utilities website
Confirmation sampling										$ -			
Sampling	149	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 161,665	$ -	$ -	$ 1,085.00	$ 161,665	Means 33, 02, 0612
Filling/soil cover (33% volume added to account for compaction of fill)										$ -			
Fill Material	3,724	cy		$ -		$ -	$ 7.15	$ 28,890	$ -	$ -	$ 7.76	$ 28,890	Means 17, 03, 04, 23, to replace soil disposed of off-site
Place and compact	11,039	cy	$ 1.68	$ 31,880	$ 2.63	$ 31,500		$ -	$ -	$ -	$ 5.74	$ 63,380	Means 17, 03, 04, 23, volume includes clean backfill from Excavation EE-05 and new backfill
Grading										$ -			
Rough grade	1700	sy	$ 0.29	$ 847	$ 0.51	$ 941	$ -	$ -	$ -	$ -	$ 1.05	$ 1,788	Means 17, 03, 01, 02
Fine grade	1700	sy	$ 0.20	$ 584	$ 0.21	$ 387	$ -	$ -	$ -	$ -	$ 0.57	$ 971	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 2,253	
2-foot high (and 2-ft wide) berm around open excav	90	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 683	$ 7.59	$ 683	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	600	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 1,570	$ 2.62	$ 1,570	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 944,315	
Haul (20 ton dump less than 200 mi.)	3,724	cy	$ -	$ -		$ -	$ 94.12	$ 380,296		$ -	$ 102.12	$ 380,296	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	3,724	cy	$ -	$ -		$ -	$ 119.36	$ 482,279		$ -	$ 129.51	$ 482,279	Means 33, 19, 03, 24
Truck decontamination	3,724	*cy*	$ -	$ -		$ -	$ 20.23	$ 81,740		$ -	$ 21.95	$ 81,740	Means 33, 19, 03, 11, *adjusted per cubic yard (assuming 20 tons/truck)*
Total Mercury Source Removal Capital Costs Redevelopment Block 16											**Total Mercury Source Removal Capital Costs Redevelopment Block 16 Subtotal =**	**$ 1,274,453**	

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Shoreline Revetment													
Shoreline Preparation											Shoreline Preparation Subtotal =	$ 57,370	
Clearing and grubbing	3	ac	$ 4,577.30	$ 23,605	$ 3,348.72	$ 10,900	$ -	$ -	$ -	$ -	$ 11,501.67	$ 34,505	Means 2005 17 01 0107
On-shore Rough Grading	14,520	sy	$ 0.47	$ 11,689	$ 0.71	$ 11,176	$ -	$ -	$ -	$ -	$ 1.57	$ 22,865	Means 2005 17 03 0103
Materials and Dredging				$ -		$ -					Materials and Dredging Subtotal =	$ 1,064,756	
Riprap	22,500	ton	$ 0.82	$ 31,716	$ 1.53	$ 37,351	$ 30.00	$ 732,375		$ -	$ 35.62	$ 801,442	Means 02370 200 1520
Geofabric	17,500	sy	$ 0.18	$ 5,415	$ -	$ -	$ 1.71	$ 32,469		$ -	$ 2.16	$ 37,884	Means 02340 300 1510
Crushed Stone Filter	2,000	cy	$ 2.99	$ 10,280	$ 4.40	$ 9,548	$ 27.50	$ 59,675		$ -	$ 39.75	$ 79,503	Means 02720 200 1520
Barge rental	3	mo	$ -	$ -	$ 3,100.00	$ 10,091	$ -	$ -		$ -	$ 3,363.67	$ 10,091	Means 01500 800 0240
Tug Boat rental	3	mo	$ -	$ -	$ 2,825.00	$ 9,195	$ -	$ -		$ -	$ 3,065.00	$ 9,195	Means 01500 800 2040
Dredging Mob & Demobilization	1	ea	$ 18,900.00	$ 32,489	$ 23,600.00	$ 25,606	$ -	$ -		$ -	$ 58,095.00	$ 58,095	Means 02325 250 0100
Dredging with Barge-mounted Clamshell	6,000	bcy	$ 4.26	$ 43,938	$ 3.78	$ 24,608	$ -	$ -		$ -	$ 11.42	$ 68,546	Means 02325 250 0101
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,534,472	
Sampling	12	ea		$ -		$ -	$ 1,000.00	$ 13,020		$ -	$ 1,085.00	$ 13,020	Means 33, 02, 0612, assume 1 sample per 500 bcy
Haul (20 ton dump less than 200 mi.)	6,000	bcy		$ -		$ -	$ 94.12	$ 612,721		$ -	$ 102.12	$ 612,721	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	6,000	bcy		$ -		$ -	$ 119.36	$ 777,034		$ -	$ 129.51	$ 777,034	Means 33, 19, 03, 24
Truck decontamination	6,000	bcy		$ -		$ -	$ 20.23	$ 131,697		$ -	$ 21.95	$ 131,697	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Wetlands Mitigation											Wetlands Mitigation Subtotal =	$ 97,650	
Wetlands Mitigation	1	ea		$ -		$ -	$ 90,000.00	$ 97,650		$ -	$ 97,650.00	$ 97,650	Based on engineering judgment
Miscellaneous Work												$ 112,213	10% Additional cost associated with working in tidally influenced area
Total Shoreline Revetment Capital Costs											**Total Shoreline Revetment Capital Costs Subtotal =**	**$ 2,866,461**	
Construction Cost Summary													
Total Construction Capital Costs											**Total Construction Capital Costs Subtotal =**	**$ 7,958,570**	
Design Cost											**Design Cost Subtotal =**	**$ 955,028**	*Calcualted as overall cost - not per individual excavation; 12% of Total Construction Capital Cost, based on engineering
Assume 12% of construction cost												$ 955,028	judgment
Institutional Controls													
Physical Controls													
Signage Capital Costs (24" x 24" reflectorized)											Signage Capital Costs (24" x 24" reflectorized) Subtotal =	$ 11,896	
Block 2	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 3	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
Block 6	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 7	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 8	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 9	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 12	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 15	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
BOS-1	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
BOS-3	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
Total Physical Controls Capital Costs											**Total Physical Controls Capital Costs Subtotal =**	**$ 11,896**	
Legal Controls Professional Unit Costs													
Land Use Control Remedial Design											Land Use Control Remedial Design Subtotal =	$ 33,225	
LUC RD scoping meeting	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
Submit draft LUC RD	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
BCT review period	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
BCT comments due	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
RTC meeting and BCT concurrence	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Prepare draft final LUC RD	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
Submit draft final LUC RD	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT review and concurrence period	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT concurrence letters due	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
Prepare final LUC RD with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final LUC RD with RTC	11	hours	$ 75.00	$ 825	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 825	

TABLE D-4A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-4 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including Profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Findings of Suitability to Transfer											Findings of Suitability to Transfer Subtotal =	$ 21,300	
Prepare draft FOST	88	hours	$ 75.00	$ 6,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,600	
Submit draft FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
Prepare draft final FOST	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit draft final FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review and concurrence period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Prepare final FOST with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final FOST with RTC	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT letters due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Covenant to Restrict Use of Property											Covenant to Restrict Use of Property Subtotal =	$ 7,500	
Prepare draft covenant	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File covenant	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Deed Restrictions											Deed Restrictions Subtotal =	$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	*20*	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan											Risk Management Plan Subtotal =	$ 7,200	
Navy review draft RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Navy review draft final RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft final RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Total Legal Controls Capital Costs											**Total Legal Controls Capital Costs Subtotal =**	**$ 76,725**	
Total Institutional Controls Capital Costs											**Total Institutional Controls Capital Costs Subtotal =**	**$ 88,621**	

Project Capital & Labor Cost =	**$ 9,002,219**	from calculations shown on this page
Present Value of 30 Years of Periodic Costs =	**$ 915,887**	from calculations shown on Table D-4C
SubTotal =	**$ 9,918,106**	
20% Contingency =	**$ 1,983,621**	
Total Project Cost =	**$ 11,901,727**	

Notes:

"	Inch
ac	Acre
BCT	Base Realignment and Closure Cleanup Team
bcy	Bank cubic yards
csy	100 Square Yards
cy	Cubic yard
ea	Each
FOST	Finding of suitability to transfer
ft	Foot
hr	Hour
LUC RD	Land Use Control Remedial Design
Means	Means, RS. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions," RS Means Company, Inc, Kingston, MA. October.
mo	Month
N/A	Not applicable
O&P	Overhead and profit
ODC	Other Direct Costs
Pg	Page
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System
RMP	Risk Management Plan
RTC	Response to comments
sy	Square Yards
t	Ton

TABLE D-4B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE S-4
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-4: Cover, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 2.0 Months or 44 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Asphalt Maintenance Year 10								**Asphalt Maintenance Year 10 Subtotal =**		**$ 379,382**	
Block 2	27,480	sy	$ 0.73	$ 34,484	$ 0.40	$ 11,926	$ 0.29	$ 8,647	$ 2.00	$ 55,057	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 3	9,459	sy	$ 0.73	$ 11,870	$ 0.40	$ 4,105	$ 0.29	$ 2,976	$ 2.00	$ 18,951	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 4	10,343	sy	$ 0.73	$ 12,979	$ 0.40	$ 4,489	$ 0.29	$ 3,254	$ 2.00	$ 20,722	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 5	12,545	sy	$ 0.73	$ 15,742	$ 0.40	$ 5,445	$ 0.29	$ 3,947	$ 2.00	$ 25,134	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 6	13,556	sy	$ 0.73	$ 17,011	$ 0.40	$ 5,883	$ 0.29	$ 4,265	$ 2.00	$ 27,159	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 7	6,691	sy	$ 0.73	$ 8,396	$ 0.40	$ 2,904	$ 0.29	$ 2,105	$ 2.00	$ 13,405	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 8	5,638	sy	$ 0.73	$ 7,075	$ 0.40	$ 2,447	$ 0.29	$ 1,774	$ 2.00	$ 11,296	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 9	9,940	sy	$ 0.73	$ 12,473	$ 0.40	$ 4,314	$ 0.29	$ 3,128	$ 2.00	$ 19,915	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 12	11,671	sy	$ 0.73	$ 14,646	$ 0.40	$ 5,065	$ 0.29	$ 3,672	$ 2.00	$ 23,383	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 15	7,332	sy	$ 0.73	$ 9,201	$ 0.40	$ 3,182	$ 0.29	$ 2,307	$ 2.00	$ 14,690	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 16	8,804	sy	$ 0.73	$ 11,048	$ 0.40	$ 3,821	$ 0.29	$ 2,770	$ 2.00	$ 17,639	Assume sealcoat maintenance in year 10; Means 02785 250 1960
BOS-2	41,764	sy	$ 0.73	$ 52,408	$ 0.40	$ 18,126	$ 0.29	$ 13,141	$ 2.00	$ 83,675	Assume sealcoat maintenance in year 10; Means 02785 250 1960
BOS-3	24,136	sy	$ 0.73	$ 30,287	$ 0.40	$ 10,475	$ 0.29	$ 7,594	$ 2.00	$ 48,356	Assume sealcoat maintenance in year 10; Means 02785 250 1960
								Year 10 Asphalt Cost		**$ 379,382**	

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Drive-by Inspection												Annual Drive-by Inspection Subtotal =			$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Enforce Deed Restrictions												Enforce Deed Restrictions Subtotal =			$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan												Oversight of Risk Management Plan Subtotal =			$ 3,000	
Oversight and inspections	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
												Total Annual Costs =			**$ 13,400**	For drive-by inspection, enforcement of deed restrictions, RMP oversight
5 Year Report on Site Inspection												5 Year Report on Site Inspection Subtotal =			$ 77,573	
Inspection	150	hours	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5 year engineering report	450	hours	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	hours		$ -	0	$ -	$9,000	$ 29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	ODCs assume 10% for miscellaneous costs
												Total 5 Year Cost =			**$ 90,973**	Total annual cost plus 5-year report
10 Year Shoreline Protection Inspection												10 Year Shoreline Protection Inspection Subtotal =			$ 56,472	
Inspection	120	hours	$75.00	$ 9,000.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 9,000	$ 100	$ 9,100	ODCs for travel
Engineering Report, Design and Oversight	96	hours	$75.00	$ 7,200.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 7,200	$ 100	$ 7,300	ODCs for printing
Repair revetment															$ 40,072	Based on engineering judgment; 5% of total riprap cost
												Total 10 Year Cost =			**$ 526,827**	Total 5-year cost plus 10-year subtotal cost (including asphalt maintenance)

Notes:

ODC	Other direct cost
O&M	Operation and mainetnance
O&P	Overhead and profit
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System
sy	Square yard

TABLE D-4C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE S-4

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at: 3.10 %

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative S-4[1]	Present Value Cost for Alternative S-4	Description of Cost
1	0.970	$13,400	$12,997	Annual Drive-by Inspection
2	0.941	$13,400	$12,606	Annual Drive-by Inspection
3	0.912	$13,400	$12,227	Annual Drive-by Inspection
4	0.885	$13,400	$11,860	Annual Drive-by Inspection
5	0.858	$90,973	$78,094	5-Year Review
6	0.833	$13,400	$11,157	Annual Drive-by Inspection
7	0.808	$13,400	$10,822	Annual Drive-by Inspection
8	0.783	$13,400	$10,496	Annual Drive-by Inspection
9	0.760	$13,400	$10,181	Annual Drive-by Inspection
10	0.737	$526,827	$388,223	5-Year Review and 10-Year Shoreline Inspection and Asphalt Maintenance
11	0.715	$13,400	$9,578	Annual Drive-by Inspection
12	0.693	$13,400	$9,290	Annual Drive-by Inspection
13	0.672	$13,400	$9,010	Annual Drive-by Inspection
14	0.652	$13,400	$8,739	Annual Drive-by Inspection
15	0.633	$90,973	$57,548	5-Year Review
16	0.614	$13,400	$8,222	Annual Drive-by Inspection
17	0.595	$13,400	$7,975	Annual Drive-by Inspection
18	0.577	$13,400	$7,735	Annual Drive-by Inspection
19	0.560	$13,400	$7,502	Annual Drive-by Inspection
20	0.543	$147,445	$80,068	5-Year Review and 10-Year Shoreline Inspection and Asphalt Maintenance
21	0.527	$13,400	$7,058	Annual Drive-by Inspection
22	0.511	$13,400	$6,846	Annual Drive-by Inspection
23	0.496	$13,400	$6,640	Annual Drive-by Inspection
24	0.481	$13,400	$6,440	Annual Drive-by Inspection
25	0.466	$90,973	$42,408	5-Year Review
26	0.452	$13,400	$6,059	Annual Drive-by Inspection
27	0.439	$13,400	$5,877	Annual Drive-by Inspection
28	0.425	$13,400	$5,700	Annual Drive-by Inspection
29	0.413	$13,400	$5,528	Annual Drive-by Inspection
30	0.400	$147,445	$59,002	5-Year Review and 10-Year Shoreline Inspection and Asphalt Maintenance
		Total Present Value Cost Over 30 Years	**$915,887**	

Notes:

Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of 1 dollar paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operations and maintenance

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs													
Distributive Costs										Distributive Costs Subtotal =		$ 427,092	
1 Project Manager 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Superintendent 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Engineer 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Health & Safety Office 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Quality Control Office 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
1 Procurement Spec. 100% on project; location factor N/A	1064	hr	$ 34.00	$ 57,882	$ -	$ -	$ 100 /day	$ 13,300	$ -	$ -	$ 66.90	$ 71,182	
Temporary Facilities										Temporary Facilities Subtotal =		$ 29,663	*Assume no set-up of buildings/work areas/etc required
Portable Toilets (2)	6	mo	$ -	$ -	$ -	$ -	$ 1,006.40	$ 6,552	$ -	$ -	$ 1,092.00	$ 6,552	Means 2004 Heavy Construction. Pg. 24. 01590 400 6410
Rental Trucks (5) (for supervisory staff)	6	mo	$ -	$ -	$ -	$ -	$ 3,550.00	$ 23,111	$ -	$ -	$ 3,851.83	$ 23,111	Assuming rental from Enterprise
Mobilization										Mobilization Subtotal =		$ 127,332	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
Graders	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	Means 2005 Heavy Construction. 02300 250 0020
20-ton dump truck	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	Assumed $1 per mile for 50 miles; location factor and O&P N/A
100,000-gallon Modular Storage Tank Mobilization	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ 16,368	$ 5,456.00	$ 16,368	Reed Margulis, ModuTank Inc., (800) 245-6964; location factor and O&P N/A
13 t/hr radiological screening equipment assembly	1	ea	$ -	$ -	$ -	$ -	$ 44,874.00	$ 48,688.00	$ -	$ -	$ 48,688.00	$ 48,688	*Means 33, 18, 04, 02
13 t/hr radiological screening rental	0.5	mo	$ -	$ -	$ -	$ -	$ 109,184.00	$ 59,232.00	$ -	$ -	$ 118,464.00	$ 59,232	*Means 33, 18, 04, 04
Demobilization										Demobilization Subtotal =		$ 129,326	*Assume that these will be used overall (not calculated for every excavation)
Crawler mounted backhoes	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
Graders	5	ea	$ 53.00	$ 456	$ 168.00	$ 911	$ -	$ -	$ -	$ -	$ 273.40	$ 1,367	
20-ton dump truck	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.00	$ 310	$ 62.00	$ 310	
100,000-gallon Modular Storage Tank Mobilization	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 16,368	$ 5,456.00	$ 16,368	
13 t/hr Radiological screening equipment disassembly	1	ea	$ -	$ -	$ -	$ -	$ 101,303.00	$ 109,914	$ -	$ -	$ 109,914.00	$ 109,914	*Means 33, 18, 04, 03
Oversight										Oversight Subtotal =		$ 62,187	
Engineer 100% on project; location factor N/A	1064	hr	$ 34.00	$ 62,187	$ -	$ -	$ -	$ -	$ -	$ -	$ 58.45	$ 62,187	*Calculated as overall cost - not per individual excavation. Unit cost numbers same as previous
Total Site Wide Capital Costs										**Total Site Wide Capital Costs Subtotal =**		**$ 775,600**	
Excavation Costs													
Excavation Costs Site ID Redevelopment Block 15 B4716													
Site Preparation										Site Preparation Subtotal =		$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201; assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation										Excavation Subtotal =		$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Storm Water Control										Storm Water Control Subtotal =		$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)										Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =		$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 15 B4716										**Total Excavation Capital Costs Redevelopment Block 15 B4716 Subtotal =**		**$ 40,840**	
Excavation Costs Site ID Redevelopment Block 8 B3426													
Site Preparation										Site Preparation Subtotal =		$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201, assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation										Excavation Subtotal =		$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06
Storm Water Control										Storm Water Control Subtotal =		$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)										Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =		$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 8 B3426										**Total Excavation Capital Costs Redevelopment Block 8 B3426 Subtotal =**		**$ 40,840**	
Excavation Costs Site ID Redevelopment Block 9 B3415													
Site Preparation										Site Preparation Subtotal =		$ 875	15ft X 15ft X 10ft deep
Clearing asphalt	25	sy	$ 15.39	$ 661	$ 7.89	$ 214	$ -	$ -	$ -	$ -	35	$ 875	Means 17 02 0201, assume site preparation only includes clearing existing asphalt if necessary; current cover is asphalt based on 2004 aerial photograph
Excavation										Excavation Subtotal =		$ 11,643	
Standard soil excavation													
Excavation	83	cy	$ 1.35	$ 193	$ 1.71	$ 154	$ -	$ -	$ -	$ -	$ 4.18	$ 347	Means 17, 03, 02, 77
Confirmation sampling													
Sampling	9	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 9,765	$ -	$ -	$ 1,085.00	$ 9,765	Means 33, 02, 0612, assume 2 samples per side and 1 sample at bottom
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	110	cy	$ 1.68	$ 319	$ 2.63	$ 315	$ 7.15	$ 856	$ -	$ -	$ 13.50	$ 1,490	Means 17, 03, 04, 23
Grading													
Rough grade	25	sy	$ 0.29	$ 12	$ 0.51	$ 14	$ -	$ -	$ -	$ -	$ 1.04	$ 26	Means 17, 03, 01, 02
Fine grade	25	sy	$ 0.20	$ 9	$ 0.21	$ 6	$ -	$ -	$ -	$ -	$ 0.60	$ 15	Means 17, 03, 01, 06

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Storm Water Control											Storm Water Control Subtotal =	$ 330	
2-foot high (and 2-ft wide) berm around open excav	9	cy		$ -		$ -		$ -	$ 6.12	$ 68	$ 7.56	$ 68	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft		$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)										Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =		$ 27,992	
Haul (20 ton dump less than 200 mi.)	110	cy		$ -		$ -	$ 94.12	$ 11,273		$ -	$ 102.12	$ 11,273	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	110	cy		$ -		$ -	$ 119.36	$ 14,296		$ -	$ 129.50	$ 14,296	Means 33, 19, 03, 24
Truck decontamination	110	cy		$ -		$ -	$ 20.23	$ 2,423		$ -	$ 21.95	$ 2,423	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Excavation Capital Costs Redevelopment Block 9 B3415											**Total Excavation Capital Costs Redevelopment Block 9 B3415 Subtotal =**	**$ 40,840**	
Total Excavation Capital Costs											**Total Excavation Capital Costs Subtotal =**	**$122,520**	
Cover Costs													
Covering Redevelopment Block 1													
Area													
Block Area Cover - Soil	3,456	sy											
Cover											Cover Subtotal =	$ 31,103	
Soil cover - Borrow, fill and compact (2 ft. thick)	2,304	cy	$ 1.68	$ 6,654	$ 2.63	$ 6,575	$ 7.15	$ 17,874	$ -	$ -	$ 13.50	$ 31,103	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =	$ 1,613	
Hydroseeding	35	csy	$ 2.59	$ 154	$ 2.25	$ 84	$ 9.37	$ 351	$ -	$ -	$ 17.04	$ 589	Means 18, 05, 04, 01
Hydro fertilizer	35	csy	$ 1.03	$ 61	$ 0.75	$ 28	$ 2.18	$ 82	$ -	$ -	$ 4.95	$ 171	Means 18, 05, 04, 08
Water - 10 times	35	csy	$ 8.89	$ 528	$ 7.69	$ 288	$ 0.98	$ 37	$ -	$ -	$ 24.68	$ 853	Means 18, 05, 04, 13
Total Covering Capital Costs BLK-1											**Total Covering Capital Costs BLK-1 Subtotal =**	**$ 32,716**	
Covering Redevelopment Block 2													
Area													
Block Area Cover - Asphalt	27,480	sy											
New asphalt cover (to existing unpaved areas)												$ -	
Unpaved Area	27,480	sy											
Covering											Covering Subtotal =	$ 97,556	
Asphalt cover - bituminous (4 in. thick)	3,053	cy	$ 10.35	$ 54,324	$ 0.50	$ 1,656	$ 12.55	$ 41,576	$ -	$ -	$ 31.95	$ 97,556	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-2											**Total Covering Capital Costs BLK-2 Subtotal =**	**$ 97,556**	
Covering Redevelopment Block 3													
Area													
Block Area Cover - Asphalt	9,459	sy											
New asphalt cover (to existing unpaved areas)												$ -	
Unpaved Area	9,459	sy											
Covering											Covering Subtotal =	$ 33,580	
Asphalt cover - bituminous (4 in. thick)	1,051	cy	$ 10.35	$ 18,699	$ 0.50	$ 570	$ 12.55	$ 14,311	$ -	$ -	$ 31.95	$ 33,580	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-3											**Total Covering Capital Costs BLK-3 Subtotal =**	**$ 33,580**	
Covering Redevelopment Block 4													
Area													
Block Area Cover - Asphalt	10,343	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 20,722	
Paved Area	10,343	sy											
Sealcoat Area	10,343	sy	$ 0.73	$ 12,979	$ 0.40	$ 4,489	$ 0.29	$ 3,254	$ -	$ -	$ 2.00	$ 20,722	Means 02785 250 1960
Total Covering Capital Costs BLK-4											**Total Covering Capital Costs BLK-4 Subtotal =**	**$ 20,722**	

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — *Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.*

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (Including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covering Redevelopment Block 5													
Area													
Block Area Cover - Asphalt	12,545	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 25,134	
Paved Area	12,545	sy											
Sealcoat Area	12,545	sy	$ 0.73	$ 15,742	$ 0.40	$ 5,445	$ 0.29	$ 3,947	$ -	$ -	$ 2.00	$ 25,134	Means 02785 250 1960
Total Covering Capital Costs BLK-5											**Total Covering Capital Costs BLK-5 Subtotal =**	**$ 25,134**	
Covering Redevelopment Block 6													
Area													
Block Area Cover - Asphalt	13,556	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 27,159	
Paved Area	13,556	sy											
Sealcoat Area	13,556	sy	$ 0.73	$ 17,011	$ 0.40	$ 5,883	$ 0.29	$ 4,265	$ -	$ -	$ 2.00	$ 27,159	Means 02785 250 1960
Total Covering Capital Costs BLK-6											**Total Covering Capital Costs BLK-6 Subtotal =**	**$ 27,159**	
Covering Redevelopment Block 7													
Area	17,165												The north portion of Block 7 is existing asphalt and will be sealcoated; the south portion of Block 7 is unpaved hillside and will be covered with a soil cover
Block Area Cover - Asphalt	6,691	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 13,405	
Paved Area	6,691	sy											
Sealcoat Area	6,691	sy	$ 0.73	$ 8,396	$ 0.40	$ 2,904	$ 0.29	$ 2,105	$ -	$ -	$ 2.00	$ 13,405	Means 02785 250 1960
Covering											Covering Subtotal =	$ -	
Block Area Cover - Soil	10,474	sy											
Cover											Cover Subtotal =	$ 94,264	
Soil cover - Borrow, fill and compact (2 ft. thick)	6,983	cy	$ 1.68	$ 20,166	$ 2.63	$ 19,926	$ 7.15	$ 54,172	$ -	$ -	$ 13.50	$ 94,264	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =	$ 4,891	
Hydroseeding	105	csy	$ 2.59	$ 466	$ 2.25	$ 256	$ 9.37	$ 1,065	$ -	$ -	$ 17.06	$ 1,787	Means 18, 05, 04, 01
Hydro fertilizer	105	csy	$ 1.03	$ 185	$ 0.75	$ 85	$ 2.18	$ 248	$ -	$ -	$ 4.95	$ 518	Means 18, 05, 04, 08
Water - 10 times	105	csy	$ 8.89	$ 1,601	$ 7.69	$ 874	$ 0.98	$ 111	$ -	$ -	$ 24.69	$ 2,586	Means 18, 05, 04, 13
Total Covering Capital Costs BLK-7											**Total Covering Capital Costs BLK-7 Subtotal =**	**$ 112,560**	
Covering Redevelopment Block 8													
Area													
Block Area Cover - Asphalt	6,594	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 11,296	
Paved Area	5,638	sy											
Sealcoat Area	5,638	sy	$ 0.73	$ 7,075	$ 0.40	$ 2,447	$ 0.29	$ 1,774	$ -	$ -	$ 2.00	$ 11,296	Means 02785 250 1960
New asphalt cover (to existing unpaved areas)											New asphalt cover (to existing unpaved areas) Subtotal =	$ -	
Unpaved Area	956	sy											
Covering											Covering Subtotal =	$ 3,394	
Asphalt cover - bituminous (4 in. thick)	106	cy	$ 10.35	$ 1,890	$ 0.50	$ 58	$ 12.55	$ 1,446	$ -	$ -	$ 31.95	$ 3,394	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-8											**Total Covering Capital Costs BLK-8 Subtotal =**	**$ 14,690**	

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covering Redevelopment Block 9													
Area													
Block Area Cover - Asphalt	9,940	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 19,915	
Paved Area	9,940	sy											
Sealcoat Area	9,940	sy	$ 0.73	$ 12,473	$ 0.40	$ 4,314	$ 0.29	$ 3,128	$ -	$ -	$ 2.00	$ 19,915	Means 02785 250 1960
Total Covering Capital Costs BLK-9											**Total Covering Capital Costs BLK-9 Subtotal =**	**$ 19,915**	
Covering Redevelopment Block 12													
Area													
Block Area Cover - Asphalt	11,671	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 23,382	
Paved Area	11,671	sy											
Sealcoat Area	11,671	sy	$ 0.73	$ 14,645	$ 0.40	$ 5,065	$ 0.29	$ 3,672	$ -	$ -	$ 2.00	$ 23,382	Means 02785 250 1960
Total Covering Capital Costs BLK-12											**Total Covering Capital Costs BLK-12 Subtotal =**	**$ 23,382**	
Covering Redevelopment Block 15													
Area													
Block Area Cover - Asphalt	7,332	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 13,516	
Paved Area	6,746	sy											
Sealcoat Area	6,746	sy	$ 0.73	$ 8,465	$ 0.40	$ 2,928	$ 0.29	$ 2,123	$ -	$ -	$ 2.00	$ 13,516	Means 02785 250 1960
New asphalt cover (to existing unpaved areas)												$ -	
Unpaved Area	586	sy											
Covering											Covering Subtotal =	$ 2,080	
Asphalt cover - bituminous (4 in. thick)	65	cy	$ 10.35	$ 1,158	$ 0.50	$ 35	$ 12.55	$ 887	$ -	$ -	$ 31.95	$ 2,080	Means 18 03 03 06, adjusted for 4-inch thickness
Total Covering Capital Costs BLK-15											**Total Covering Capital Costs BLK-15 Subtotal =**	**$ 15,596**	
Covering Redevelopment Block 16													
Area													
Block Area Cover - Asphalt	8,804	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 17,639	
Paved Area	8,804	sy											
Sealcoat Area	8,804	sy	$ 0.73	$ 11,048	$ 0.40	$ 3,821	$ 0.29	$ 2,770	$ -	$ -	$ 2.00	$ 17,639	Means 02785 250 1960
Total Covering Capital Costs BLK-16											**Total Covering Capital Costs BLK-16 Subtotal =**	**$ 17,639**	
Covering Redevelopment Block BOS-1													
Area													
Block Area Cover - Soil	26,109	sy											
Cover											Cover Subtotal =	$ 234,967	
Soil cover - Borrow, fill and compact (2 ft. thick)	17,406	cy	$ 1.68	$ 50,267	$ 2.63	$ 49,669	$ 7.15	$ 135,031	$ -	$ -	$ 13.50	$ 234,967	Means 17, 03, 04, 23
Seeding (soil cap only)											Seeding (soil cap only) Subtotal =	$ 12,191	
Hydroseeding	261	csy	$ 2.59	$ 1,162	$ 2.25	$ 637	$ 9.37	$ 2,654	$ -	$ -	$ 17.06	$ 4,453	Means 18, 05, 04, 01
Hydro fertilizer	261	csy	$ 1.03	$ 462	$ 0.75	$ 212	$ 2.18	$ 618	$ -	$ -	$ 4.95	$ 1,292	Means 18, 05, 04, 08
Water - 10 times	261	csy	$ 8.89	$ 3,990	$ 7.69	$ 2,178	$ 0.98	$ 278	$ -	$ -	$ 24.69	$ 6,446	Means 18, 05, 04, 13
Total Covering Capital Costs BOS-1											**Total Covering Capital Costs BOS-1 Subtotal =**	**$ 247,158**	

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Covering Redevelopment Block BOS-2													
Area													
Block Area Cover - Asphalt	41,764	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 83,675	
Paved Area	41,764	sy											
Sealcoat Area	41,764	sy	$ 0.73	$ 52,408	$ 0.40	$ 18,126	$ 0.29	$ 13,141	$ -	$ -	$ 2.00	$ 83,675	Means 02785 250 1960
Total Covering Capital Costs BOS-2											**Total Covering Capital Costs BOS-2 Subtotal =**	**$ 83,675**	
Covering Redevelopment Block BOS-3													
Area													
Block Area Cover - Asphalt	24,136	sy											
Asphalt sealcoat (to existing paved areas)											Asphalt sealcoat (to existing paved areas) Subtotal =	$ 48,356	
Paved Area	24,136	sy											
Sealcoat Area	24,136	sy	$ 0.73	$ 30,287	$ 0.40	$ 10,475	$ 0.29	$ 7,594	$ -	$ -	$ 2.00	$ 48,356	Means 02785 250 1960
Total Covering Capital Costs BOS-3											**Total Covering Capital Costs BOS-3 Subtotal =**	**$ 48,356**	
Total Covering Capital Costs											**Total Covering Capital Costs Subtotal =**	**$ 819,838**	
SVE System Costs													
SVE System											SVE System Subtotal =	$ 221,453	
Trailer-Mounted SVE Unit (including 700 scfm- 7.5-inch Hg blower,	1	ea	$ -	$ -	$ -	$ -	$ 106,000.00	$ 115,010	$ -	$ -	$ 115,010.00	$ 115,010	Vendor Quote: H2Oil Recover Equipment, Inc., Kevin Wooster (541)419-0860
25-HP motor, inlet and outlet silencers, vacuum relief valve,						$ -							
flow meter, electrical assembly, check valve, vacuum gauge,						$ -							
Shipping for Trailer-Mounted SVE unit						$ -						$ 2,000	
liquid vapor separator with pump, and one 3,000-lb GAC unit						$ -							
Second 3,000-lb GAC Unit	1	ea	$ -	$ -	$ -	$ -	$ 18,000.00	$ 19,530	$ -	$ -	$ 19,530.00	$ 19,530	Vendor Quote: Carbonair, Tom FitzGerald, (763)512-4923
SVE System Piping from Wells				$ -		$ -		$ -					
6-inch Schedule 80 PVC	220	ft	$ 7.65	$ 2,893	$ -	$ -	$ 4.60	$ 1,098	$ -	$ -	$ 18.14	$ 3,991	Means 33, 26, 04, 31
4-inch Schedule 80 PVC	400	ft	$ 5.74	$ 3,947	$ -	$ -	$ 2.44	$ 1,059	$ -	$ -	$ 12.52	$ 5,006	Means 33, 26, 04, 30
2-inch Schedule 80 PVC	1,200	ft	$ 2.67	$ 5,508	$ -	$ -	$ 0.82	$ 1,068	$ -	$ -	$ 5.48	$ 6,576	Means 33, 26, 04, 28
Fittings						$ -						$ 3,115	Assume fittings cost is 20% of piping cost
Wells						$ -							
Pressure Gauge	60	ea	$ -	$ -	$ -	$ -	$ 271.00	$ 17,642	$ -	$ -	$ 294.03	$ 17,642	Dwyer Instruments 2005
Sample Port	60	ea	$ -	$ -	$ -	$ -	$ 12.28	$ 799	$ -	$ -	$ 13.32	$ 799	USA Bluebook 2005, item number 12620
Globe Valve (2-inch, 1 per well head)	60	ea	$ 37.50	$ 3,868	$ -	$ -	$ 44.65	$ 2,907	$ -	$ -	$ 112.92	$ 6,775	USA Bluebook 2005, item number 15419, Means 33, 27, 04, 25
System Startup and Shakedown				$ -	$ -	$ -	$ -	$ -		$ -		$ -	
2 Engineers for 10 days	160	hours	$ 145.00	$ 39,881	$ -	$ -	$ -	$ -		$ -	$ 249.26	$ 39,881	Based on professional judgment
Electrical Connection for SVE Skid				$ -	$ -	$ -	$ -	$ -		$ -			
1 Electrician	16	hours	$ 41.00	$ 1,128	$ -	$ -	$ -	$ -		$ -	$ 70.50	$ 1,128	
Vapor Extraction Wells											Vapor Extraction Wells Subtotal =	$ 3,234	
Mobilization/Demobilization	2	dy	$ -	$ -	$ -	$ -	$ 350.00	$ 760	$ -	$ -	$ 380.00	$ 760	Vendor Quote: Gregg Drilling & Testing, Inc., Chris Pruner, (925)313-5800
Drill sample, and install vapor extraction wells to 10 feet	4	well	$ -	$ -	$ -	$ -	$ 570.00	$ 2,474	$ -	$ -	$ 618.50	$ 2,474	Vendor Quote: Gregg Drilling & Testing, Inc., Chris Pruner, (925)313-5800
Vapor Monitoring Wells											Vapor Monitoring Wells Subtotal =	$ 2,843	
Mobilization/Demobilization	2	dy	$ -	$ -	$ -	$ -	$ 350.00	$ 760	$ -	$ -	$ 380.00	$ 760	Vendor Quote: Gregg Drilling & Testing, Inc., Chris Pruner, (925)313-5800
Drill sample, and install vapor extraction wells to 10 feet	4	well	$ -	$ -	$ -	$ -	$ 480.00	$ 2,083	$ -	$ -	$ 520.75	$ 2,083	Vendor Quote: Gregg Drilling & Testing, Inc., Chris Pruner, (925)313-5800

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Waste Handling and Disposal										Waste Handling and Disposal Subtotal =		$ 3,658	
55-gallon drums	6	ea	$ -	$ -	$ -	$ -	$ 50.00	$ 326	$ -	$ -	$ 54.33	$ 326	Vendor Quote: Gregg Drilling &Testing, Inc., Chris Pruner, (925)313-5800
Sampler to collect 3 samples (including QC) for waste characterization	4	hr	$ 35.00	$ 241	$ -	$ -	$ -	$ -	$ -	$ -	$ 60.25	$ 241	Altamont Landfill Requires of 2 per 2,000 cy of soil
TCLP Metals (including full validation)	3	ea	$ -	$ -	$ -	$ -	$ 108.04	$ 352	$ -	$ -	$ 117.33	$ 352	2005 AECRU BOA cost database
WET Metals (inlcuding full validation)	3	ea	$ -	$ -	$ -	$ -	$ 109.00	$ 355	$ -	$ -	$ 118.33	$ 355	2005 AECRU BOA cost database
VOAs (inlcuding full validation)	3	ea	$ -	$ -	$ -	$ -	$ 161.11	$ 524	$ -	$ -	$ 174.67	$ 524	2005 AECRU BOA cost database
SVOAs (inlcuding full validation)	3	ea	$ -	$ -	$ -	$ -	$ 272.31	$ 886	$ -	$ -	$ 295.33	$ 886	2005 AECRU BOA cost database
PCBs (inlcuding full validation)	3	ea	$ -	$ -	$ -	$ -	$ 190.20	$ 619	$ -	$ -	$ 206.33	$ 619	2005 AECRU BOA cost database
Haul (20 ton dump less than 200 mi.)	1.4	cy	$ -	$ -	$ -	$ -	$ 94.12	$ 143	$ -	$ -	$ 102.14	$ 143	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	1.4	cy	$ -	$ -	$ -	$ -	$ 119.36	$ 181	$ -	$ -	$ 129.29	$ 181	Means 33, 19, 03, 24
Truck decontamination	1.4	cy	$ -	$ -	$ -	$ -	$ 20.23	$ 31	$ -	$ -	$ 22.14	$ 31	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total SVE System Capital Cost										**Total SVE System Capital Cost Subtotal =**		**$ 231,188**	
Methane Source Removal Cost													
Methane Source Removal Redevelopment Block 3													
Excavation										Excavation Subtotal =		$ 383,573	
Standard soil excavation													50ft X 150ft X 20ft deep
Excavation	5,556	cy	$ 1.35	$ 12,893	$ 1.71	$ 10,308	$ -	$ -	$ -	$ -	$ 4.18	$ 23,201	Means 17, 03, 02, 77
Dewatering excavation													
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,250	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 22,432	$ -	$ -	$ 17.95	$ 22,432	Highest non-resident cost cited on San Francisco Public Utilities website
RAD soil excavation													
Extra charge for excavation in RAD	5,556	cy	$ 0.96	$ 9,168	$ 1.14	$ 6,872	$ -	$ -	$ -	$ -	$ 2.89	$ 16,040	Means 17, 03, 02, 77
RAD screening operation	5,556	cy	$ 13.65	$ 130,358	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.46	$ 130,358	Means 33, 18, 04, 05 assuming 13 tons/hr at $105.15/hr and 125 lb/cf
Confirmation sampling													
Sampling	62	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 67,270	$ -	$ -	$ 1,085.00	$ 67,270	Means 33, 02, 0612
Post excavation soil gas survey	1	ea	$ -	$ -	$ -	$ -	$ 15,000.00	$ 16,275	$ -	$ -	$ 16,275.00	$ 16,275	TEG quote, 30 locations
Filling/soil cover (33% volume added to account for compaction of fill)													
Borrow, fill and compact	7,389	cy	$ 1.68	$ 21,339	$ 2.63	$ 21,085	$ 7.15	$ 57,321	$ -	$ -	$ 13.50	$ 99,745	Means 17, 03, 04, 23
Grading													
Rough grade	833	sy	$ 0.29	$ 415	$ 0.51	$ 461	$ -	$ -	$ -	$ -	$ 1.05	$ 876	Means 17, 03, 01, 02
Fine grade	833	sy	$ 0.20	$ 287	$ 0.21	$ 190	$ -	$ -	$ -	$ -	$ 0.57	$ 477	Means 17, 03, 01, 06
Storm Water Control										Storm Water Control Subtotal =		$ 596	
2-foot high (and 2-ft wide) berm around open excav	44	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 334	$ 7.59	$ 334	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	100	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 262	$ 2.62	$ 262	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)										Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =		$ 1,873,640	
Haul (20 ton dump less than 200 mi.)	7,389	cy	$ -	$ -		$ -	$ 94.12	$ 754,555		$ -	$ 102.12	$ 754,555	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	7,389	cy	$ -	$ -		$ -	$ 119.36	$ 956,902		$ -	$ 129.51	$ 956,902	Means 33, 19, 03, 24
Truck decontamination	7,389	cy	$ -	$ -		$ -	$ 20.23	$ 162,183		$ -	$ 21.95	$ 162,183	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Radiological waste disposal charge	0	cy	$ -	$ -		$ -	$ 295.38	$ -		$ -	$ -	$ -	Means 33, 18, 09, 01, assume 0% of screened soil will require special disposal for RAD
Total Methane Source Removal Capital Costs Redevelopment Block 3										**Total Methane Source Removal Capital Costs Redevelopment Block 3 Subtotal =**		**$ 2,257,809**	

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Materiel (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Mercury Source Removal Cost													
Mercury Source Removal Redevelopment Block 16													
Excavation											Excavation Subtotal =	$ 327,885	
Soil borings to delineate depth of excavation													
Drilling (5 borings, 20 feet each)	100	ft	$ -	$ -	$ -	$ -	$ 25.00	$ 2,713	$ -	$ -	$ 27.13	$ 2,713	Based on previous experience at other sites
Standard soil excavation													60ft X 250ft X 15ft deep
Excavation	8,300	cy	$ 1.35	$ 19,261	$ 1.71	$ 15,399	$ -	$ -	$ -	$ -	$ 4.18	$ 34,660	Means 17, 03, 02, 77
Dewatering excavation										$ -			
Pump	5	day	$ 96.00	$ 825	$ 117.50	$ 637	$ -	$ -	$ 2	$ 12	$ 294.80	$ 1,474	
Confirmation sampling for dewatering	5	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 5,425	$ -	$ -	$ 1,085.00	$ 5,425	
Disposal of water	1,500	100 cf	$ -	$ -	$ -	$ -	$ 16.54	$ 26,919	$ -	$ -	$ 17.95	$ 26,919	Highest non-resident cost cited on San Francisco Public Utilities website
Confirmation sampling										$ -			
Sampling	149	ea	$ -	$ -	$ -	$ -	$ 1,000.00	$ 161,665	$ -	$ -	$ 1,085.00	$ 161,665	Means 33, 02, 0612
Filling/soil cover (33% volume added to account for compaction of fill)										$ -			
Fill Material	3,724	cy		$ -		$ -	$ 7.15	$ 28,890	$ -	$ -	$ 7.76	$ 28,890	Means 17, 03, 04, 23 , to replace soil disposed of off-site
Place and compact	11,039	cy	$ 1.68	$ 31,880	$ 2.63	$ 31,500		$ -	$ -	$ -	$ 5.74	$ 63,380	Means 17, 03, 04, 23 , volume includes clean backfill from Excavation EE-05 and new backfill
Grading										$ -			
Rough grade	1700	sy	$ 0.29	$ 847	$ 0.51	$ 941	$ -	$ -	$ -	$ -	$ 1.05	$ 1,788	Means 17, 03, 01, 02
Fine grade	1700	sy	$ 0.20	$ 584	$ 0.21	$ 387	$ -	$ -	$ -	$ -	$ 0.57	$ 971	Means 17, 03, 01, 06
Storm Water Control											Storm Water Control Subtotal =	$ 2,253	
2-foot high (and 2-ft wide) berm around open excav	90	cy	$ -	$ -		$ -		$ -	$ 6.12	$ 683	$ 7.59	$ 683	Means 2004 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	600	ft	$ -	$ -		$ -		$ -	$ 2.11	$ 1,570	$ 2.62	$ 1,570	Means 2004 Environmental Remediation - Unit Price; Pg 5-19; 18 05 0206
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 944,315	
Haul (20 ton dump less than 200 mi.)	3,724	cy	$ -	$ -		$ -	$ 94.12	$ 380,296		$ -	$ 102.12	$ 380,296	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	3,724	cy	$ -	$ -		$ -	$ 119.36	$ 482,279		$ -	$ 129.51	$ 482,279	Means 33, 19, 03, 24
Truck decontamination	3,724	cy	$ -	$ -		$ -	$ 20.23	$ 81,740		$ -	$ 21.95	$ 81,740	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)
Total Mercury Source Removal Capital Costs Redevelopment Block 16											**Total Mercury Source Removal Capital Costs Redevelopment Block 16 Subtotal =**	**$ 1,274,453**	
Shoreline Revetment													
Shoreline Preparation											Shoreline Preparation Subtotal =	$ 57,370	
Clearing and grubbing	3	ac	$ 4,577.30	$ 23,605	$ 3,348.72	$ 10,900	$ -	$ -	$ -	$ -	$ 11,501.67	$ 34,505	Means 2005 17 01 0107
On-shore Rough Grading	14,520	sy	$ 0.47	$ 11,689	$ 0.71	$ 11,176	$ -	$ -	$ -	$ -	$ 1.57	$ 22,865	Means 2005 17 03 0103
Materials and Dredging											Materials and Dredging Subtotal =	$ 1,064,756	
Riprap	22,500	ton	$ 0.82	$ 31,716	$ 1.53	$ 37,351	$ 30.00	$ 732,375		$ -	$ 35.62	$ 801,442	Means 02370 200 1520
Geofabric	17,500	sy	$ 0.18	$ 5,415	$ -	$ -	$ 1.71	$ 32,469		$ -	$ 2.16	$ 37,884	Means 02340 300 1510
Crushed Stone Filter	2,000	cy	$ 2.99	$ 10,280	$ 4.40	$ 9,548	$ 27.50	$ 59,675		$ -	$ 39.75	$ 79,503	Means 02720 200 1520
Barge rental	3	mo	$ -	$ -	$ 3,100.00	$ 10,091	$ -	$ -		$ -	$ 3,363.67	$ 10,091	Means 01500 800 0240
Tug Boat rental	3	mo	$ -	$ -	$ 2,825.00	$ 9,195	$ -	$ -		$ -	$ 3,065.00	$ 9,195	Means 01500 800 2040
Dredging Mob & Demobilization	1	ea	$ 18,900.00	$ 32,489	$ 23,600.00	$ 25,606	$ -	$ -		$ -	$ 58,095.00	$ 58,095	Means 02325 250 0100
Dredging with Barge mounted Clamshell	6,000	bcy	$ 4.26	$ 43,938	$ 3.78	$ 24,608	$ -	$ -		$ -	$ 11.42	$ 68,546	Means 02325 250 0101
Waste Hauling and Disposal (33% volume added to account for bulking)											Waste Hauling and Disposal (33% volume added to account for bulking) Subtotal =	$ 1,534,472	
Sampling	12	ea		$ -		$ -	$ 1,000.00	$ 13,020		$ -	$ 1,085.00	$ 13,020	Means 33, 02, 0612, assume 1 sample per 500 bcy
Haul (20 ton dump less than 200 mi.)	6,000	bcy		$ -		$ -	$ 94.12	$ 612,721		$ -	$ 102.12	$ 612,721	Means 33, 19, 02, 09, adjusted per cubic yard (assuming 20 tons/truck)
Dump charge	6,000	bcy		$ -		$ -	$ 119.36	$ 777,034		$ -	$ 129.51	$ 777,034	Means 33, 19, 03, 24
Truck decontamination	6,000	bcy		$ -		$ -	$ 20.23	$ 131,697		$ -	$ 21.95	$ 131,697	Means 33, 19, 03, 11, adjusted per cubic yard (assuming 20 tons/truck)

TABLE D-5A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE S-5 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Locaiton Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Wetlands Mitigation										Wetlands Mitigation Subtotal =		$ 97,650	
Wetlands Mitigation	1	ea		$ -		$ -	$ 90,000.00	$ 97,650		$ -	$ 97,650.00	$ 97,650	Based on engineering judgment
Miscellaneous Work												$ 112,213	10% Additional cost associated with working in tidally influenced area
Total Shoreline Revetment Capital Costs										**Total Shoreline Revetment Capital Costs Subtotal =**		**$ 2,866,461**	
Construction Cost Summary													
Total Construction Capital Costs										**Total Construction Capital Costs Subtotal =**		**$ 8,347,868**	
Design Cost										**Design Cost Subtotal =**		**$ 1,001,744**	*Calculated as overall cost - not per individual excavation. Unit cost numbers same as previous. Based on engineering judgment
Assume 12% of construction cost												$ 1,001,744	
Institutional Controls													
Physical controls													

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Signage Capital Costs (24" x 24" reflectorized)										Signage Capital Costs (24" x 24" reflectorized) Subtotal =		$ 11,896	
Block 2	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 3	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
Block 6	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 7	15	ea	$ 33.88	$ 874	$ -	$ -	$ 30.66	$ 499	$ -	$ -	$ 91.53	$ 1,373	Large block
Block 8	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 9	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 12	10	ea	$ 33.88	$ 582	$ -	$ -	$ 30.66	$ 333	$ -	$ -	$ 91.50	$ 915	Medium block
Block 15	5	ea	$ 33.88	$ 291	$ -	$ -	$ 30.66	$ 166	$ -	$ -	$ 91.40	$ 457	Small block
BOS-1	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large block
BOS-3	25	ea	$ 33.88	$ 1,456	$ -	$ -	$ 30.66	$ 832	$ -	$ -	$ 91.52	$ 2,288	Long-large
Total Physical Controls Capital Costs										**Total Physical Controls Capital Costs Subtotal =**		**$ 11,896**	
Legal Controls Professional Unit Costs													
Land Use Control Remedial Design										Land Use Control Remedial Design Subtotal =		$ 33,225	
LUC RD scoping meeting	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
Submit draft LUC RD	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
BCT review period	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
BCT comments due	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
RTC meeting and BCT concurrence	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Prepare draft final LUC RD	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
Submit draft final LUC RD	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT review and concurrence period	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT concurrence letters due	32	hours	$ 75.00	$ 2,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,400	
Prepare final LUC RD with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final LUC RD with RTC	11	hours	$ 75.00	$ 825	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 825	

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs from Means, below, for labor, equipment and material.

Project Duration: 6.0 Months or 133 working days

Description	Quantitity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Findings of Suitability to Transfer										Findings of Suitability to Transfer Subtotal =		$ 21,300	
Prepare draft FOST	88	hours	$ 75.00	$ 6,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,600	
Submit draft FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
Prepare draft final FOST	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit draft final FOST	4	hours	$ 75.00	$ 300	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 300	
BCT review and concurrence period	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
BCT comments due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Prepare final FOST with RTC	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Submit final FOST with RTC	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
BCT letters due	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Covenant to Restrict Use of Property										Covenant to Restrict Use of Property Subtotal =		$ 7,500	
Prepare draft covenant	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File covenant	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Deed Restrictions										Deed Restrictions Subtotal =		$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan										Risk Management Plan Subtotal =		$ 7,200	
Navy review draft RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Navy review draft final RMP	40	hours	$ 75.00	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,000	
Discuss comments on draft final RMP	8	hours	$ 75.00	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 600	
Total Legal Controls Capital Costs										**Total Legal Controls Capital Costs Subtotal =**		**$ 76,725**	
Total Institutional Controls Capital Costs										***Total Institutional Controls Capital Costs Subtotal =***		***$ 88,621***	

Project Capital and Labor Cost =	**$**	**9,438,233**	from calculations shown on this page
Present Value of 30 Years of Periodic Costs =	**$**	**915,887**	from calculations shown on Table D-5C
(Five-Year Reviews, Ten-Year Shoreline Inspection and Asphalt Maintenance)			
SubTotal =	**$**	**10,354,121**	
20% Contingency =	**$**	**2,070,824**	
Total Project Cost =	**$**	**12,424,945**	

Notes:

"	Inch
BCT	*Base Realignment and Closure Cleanup Team*
bcy	Bank cubic yard
csy	100 square yards
cy	Cubic yard
ea	Each
FOST	Finding of suitability to transfer
ft	Foot
hr	Hour
ID	Identification
IR	Installation restoration
LUC RD	Land Use Control Remedial Design
Means	Means, RS. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options
mi.	Mile
mo	Month
N/A	Not applicable
O&M	*Operations and maintenance*
O&P	Overhead and profit
ODC	Other direct cost
Pg	Page
PPE	Personal protective equipment
RACER	Remedial Action Cost Engineering and Requirements System
RAD	Radiological
RMP	Risk Management Plan
RTC	Response to comments
SVE	Soil vapor extraction
sy	Square yard
t	Ton

TABLE D-5B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE S-5
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative S-5: Excavation, Cover, Methane and Mercury Source Removal, SVE, Institutional Controls, and Shoreline Revetment

Location Factors — Additional cost based on San Francisco location factor already added to unit costs, below, for labor, equipment and material.

Project Duration: 2.0 Months or 44 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Asphalt Maintenance Year 10								**Asphalt Maintenance Year 10 Subtotal =**		**$ 379,382**	
Block 2	27480	sy	$ 0.73	$ 34,484	$ 0.40	$ 11,926	$ 0.29	$ 8,647	$ 2.00	$ 55,057	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 3	9459	sy	$ 0.73	$ 11,870	$ 0.40	$ 4,105	$ 0.29	$ 2,976	$ 2.00	$ 18,951	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 4	10,343	sy	$ 0.73	$ 12,979	$ 0.40	$ 4,489	$ 0.29	$ 3,254	$ 2.00	$ 20,722	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 5	12,545	sy	$ 0.73	$ 15,742	$ 0.40	$ 5,445	$ 0.29	$ 3,947	$ 2.00	$ 25,134	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 6	13,556	sy	$ 0.73	$ 17,011	$ 0.40	$ 5,883	$ 0.29	$ 4,265	$ 2.00	$ 27,159	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 7	6,691	sy	$ 0.73	$ 8,396	$ 0.40	$ 2,904	$ 0.29	$ 2,105	$ 2.00	$ 13,405	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 8	5638	sy	$ 0.73	$ 7,075	$ 0.40	$ 2,447	$ 0.29	$ 1,774	$ 2.00	$ 11,296	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 9	9,940	sy	$ 0.73	$ 12,473	$ 0.40	$ 4,314	$ 0.29	$ 3,128	$ 2.00	$ 19,915	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 12	11,671	sy	$ 0.73	$ 14,646	$ 0.40	$ 5,065	$ 0.29	$ 3,672	$ 2.00	$ 23,383	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 15	7332	sy	$ 0.73	$ 9,201	$ 0.40	$ 3,182	$ 0.29	$ 2,307	$ 2.00	$ 14,690	Assume sealcoat maintenance in year 10; Means 02785 250 1960
Block 16	8804	sy	$ 0.73	$ 11,048	$ 0.40	$ 3,821	$ 0.29	$ 2,770	$ 2.00	$ 17,639	Assume sealcoat maintenance in year 10; Means 02785 250 1960
BOS-2	41764	sy	$ 0.73	$ 52,408	$ 0.40	$ 18,126	$ 0.29	$ 13,141	$ 2.00	$ 83,675	Assume sealcoat maintenance in year 10; Means 02785 250 1960
BOS-3	24,136	sy	$ 0.73	$ 30,287	$ 0.40	$ 10,475	$ 0.29	$ 7,594	$ 2.00	$ 48,356	Assume sealcoat maintenance in year 10; Means 02785 250 1960
								Year 10 Asphalt Cost		**$ 379,382**	

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (Including profit)	Total Unit Cost (Including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Drive-by Inspection														Annual Drive-by Inspection Subtotal =	$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Enforce Deed Restrictions														Enforce Deed Restrictions Subtotal =	$ 5,200	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan														Oversight of Risk Management Plan Subtotal =	$ 3,000	
Oversight and inspections	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$1,500	$ 3,000	ODCs for travel
														Total Annual Costs =	**$ 13,400**	Drive-by inspection, enforcement of deed restrictions, RMP oversight
5-Year Report on Site Inspection														5-Year Report on Site Inspection Subtotal =	$ 77,573	
Inspection	150	hours	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$11,250.00	$11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hours	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$33,750.00	$33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	$9,000	$ 29,430.00	0	$ -	$9,810	$29,430.00	$29,430	$2,943	$ 32,373	ODCs assume 10% for miscellaneous costs
														Total 5 Year Cost =	**$ 90,973**	Total annual cost plus 5-year report
10-Year Shoreline Protection Inspection														10-Year Shoreline Protection Inspection Subtotal =	**$ 56,472**	
Inspection	120	hours	$75.00	$ 9,000.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 9,000	$ 100	$ 9,100	ODCs for travel
Engineering Report, Design and Oversight	96	hours	$75.00	$ 7,200.00	0	$ -	0	$ -	0	$ -	0	$ -	$ 7,200	$ 100	$ 7,300	ODCs for printing
Repair revetment															$ 40,072	Based on engineering judgment; 5% of total riprap cost
														Total 10 Year Cost =	**$ 526,827**	Total 5-year cost plus 10-year subtotal cost (including asphalt maintenance)

Notes:

ea	Each
ODC	Other direct cost
O&P	Overhead and profit
RACER	Remedial Action Cost Engineering and Requirements System

TABLE D-5C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE S-5

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at: 3.10 %

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative S-5[1]	Present Value Cost for Alternative S-5	Description of Cost
1	0.970	$13,400	$12,997	Annual Drive-by Inspection
2	0.941	$13,400	$12,606	Annual Drive-by Inspection
3	0.912	$13,400	$12,227	Annual Drive-by Inspection
4	0.885	$13,400	$11,860	Annual Drive-by Inspection
5	0.858	$90,973	$78,094	5-Year Review
6	0.833	$13,400	$11,157	Annual Drive-by Inspection
7	0.808	$13,400	$10,822	Annual Drive-by Inspection
8	0.783	$13,400	$10,496	Annual Drive-by Inspection
9	0.760	$13,400	$10,181	Annual Drive-by Inspection
10	0.737	$526,827	$388,223	5-Year Review, 10-Year Shoreline Inspection and Asphalt Maintenance
11	0.715	$13,400	$9,578	Annual Drive-by Inspection
12	0.693	$13,400	$9,290	Annual Drive-by Inspection
13	0.672	$13,400	$9,010	Annual Drive-by Inspection
14	0.652	$13,400	$8,739	Annual Drive-by Inspection
15	0.633	$90,973	$57,548	5-Year Review
16	0.614	$13,400	$8,222	Annual Drive-by Inspection
17	0.595	$13,400	$7,975	Annual Drive-by Inspection
18	0.577	$13,400	$7,735	Annual Drive-by Inspection
19	0.560	$13,400	$7,502	Annual Drive-by Inspection
20	0.543	$147,445	$80,068	5-Year Review, 10-Year Shoreline Inspection and Asphalt Maintenance
21	0.527	$13,400	$7,058	Annual Drive-by Inspection
22	0.511	$13,400	$6,846	Annual Drive-by Inspection
23	0.496	$13,400	$6,640	Annual Drive-by Inspection
24	0.481	$13,400	$6,440	Annual Drive-by Inspection
25	0.466	$90,973	$42,408	5-Year Review
26	0.452	$13,400	$6,059	Annual Drive-by Inspection
27	0.439	$13,400	$5,877	Annual Drive-by Inspection
28	0.425	$13,400	$5,700	Annual Drive-by Inspection
29	0.413	$13,400	$5,528	Annual Drive-by Inspection
30	0.400	$147,445	$59,002	5-Year Review, 10-Year Shoreline Inspection and Asphalt Maintenance
		Total Present Value Cost Over 30 Years	**$915,887**	

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operation and maintenance

TABLE D-6: GROUNDWATER ALTERNATIVES COST ESTIMATE SUMMARY

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Site: Parcel B **Base Year:** 2005
Location: Hunters Point Shipyard, San Francisco, California

	Alternative GW-1	Alternative GW-2	Alternative GW-3	
	No Action	Long-Term Groundwater Monitoring	Plume Treatment and Short-Term Groundwater Monitoring	
Description	GW-1	GW-2	GW-3A (Biological	GW-3B (ZVI)
Total Project Duration (Years)		30	30	30
Capital and Labor Cost	$0	$75,359	$147,559	$484,520
Total O&M and Periodic Cost	$0	$1,388,951	$1,858,276	$1,842,059
Contingency	$0	$292,862	$401,167	$465,316
Total Present Value of Alternative	**$0**	**$1,757,172**	**$2,407,002**	**$2,791,895**
(Rounded)	**$0**	**$1,760,000**	**$2,410,000**	**$2,790,000**

Notes:

GW	Groundwater
O&M	Operation and maintenance
ZVI	Zero-valent iron

TABLE D-7A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE GW-2
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls

Location Factors

Project Duration: 0.5 Months or 11 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Groundwater Monitoring Cost													
Groundwater Monitoring Well Installation										**Groundwater Monitoring Well Installation Subtotal =**		**$ 1,709**	
Drill and Construct monitoring well in mercury source area	25	feet					$ 48.00	$ 1,302.00			$52.08	$1,302.00	Based on previous experience
Development, Equipment Decontamination, Completion	1	ea					$ 375.00	$ 407.00			$407.00	$407.00	Based on previous experience
(Existing monitoring wells [plus well in mercury source area] are sufficent for long-term monitoring													
Institutional Controls													
Land Use Control Remedial Design										**Land Use Control Remedial Design Subtotal =**		**$ 49,800**	
LUC RD scoping meeting	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	180	hours	$ 75.00	$ 13,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 13,500	
Submit draft LUC RD	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT review period	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
BCT comments due	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
RTC meeting and BCT concurrence	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Prepare draft final LUC RD	108	hours	$ 75.00	$ 8,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 8,100	
Submit draft final LUC RD	12	hours	$ 75.00	$ 900	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 900	
BCT review and concurrence period	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
BCT concurrence letters due	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
Prepare final LUC RD with RTC	60	hours	$ 75.00	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 4,500	
Submit final LUC RD with RTC	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Covenant to Restrict Use of Property										**Covenant to Restrict Use of Property Subtotal =**		**$ 11,250**	
Prepare draft covenant	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
File covenant	30	hours	$ 75.00	$ 2,250	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,250	
Deed Restrictions										**Deed Restrictions Subtotal =**		**$ 7,500**	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan										**Risk Management Plan Subtotal =**		**$ 5,100**	
Navy Review draft RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Navy Review draft final RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft Final RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Total Institutional Controls Capital Costs										**Total Institutional Controls Capital Costs Subtotal =**		**$ 73,650**	
										Total Project Capital Cost =		**$ 75,359**	from calculations shown on this page
										Present Value of 30 Years of Periodic Costs =		**$ 1,388,951**	from calculations shown on Table D-7C
										(Groundwater Monitoring, Institutional Controls, 5-Year Reviews, and Closeout)			and Table D-7B
										SubTotal =		**$ 1,464,310**	
										20% Contingency =		**$ 292,862**	
										Total Project Cost =		**$ 1,757,172**	

Notes:

LUC RD Land Use Control Remedial Design
RMP Risk Management Plan
RTC Response to comments

TABLE D-7B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-2

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls

Location Factors

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Annual Distributive													
Annual Distributive Cost											**Annual Distributive Cost Subtotal =**	**$ 1,680**	
Project Manager 2% on project; location factor N/A	21	hr	$ 50.00	$ 1,680	$ -	$ -	$ -	$ -	$ -	$ -	$ 80.00	$ 1,680	
Groundwater Monitoring													
Groundwater Monitoring Event											**Groundwater Monitoring Event Subtotal =**	**$ 35,651**	31 wells will be sampled quarterly 1st year, and annually thereafter
Mobilization/Demobilization	16	hr	$34.00	$870	$ -	$ -			$ -	$ -	$ 54.40	$ 870	
Equipment	1	ea	$ -	$0	$ 5,000.00	$5,425			$ -	$ -	$ 5,425.00	$ 5,425	
Sampling (31 wells)	160	hr	$34.00	$8,704	$ -	$ -	$ 200.00	$4,000.00	$ -	$ -	$ 79.40	$ 12,704	Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A
Analysis (assume 20% QC samples)													
28 Volatile Organic Compounds (8260 VOA)	34	ea	$ -		$ -	$ -	$ 125.00	$4,557.00	$ -	$ -	$ 135.63	$ 4,557	2005 BOA cost database; location factor NA
7 Mercury by 1631	8	ea	$ -		$ -	$ -	$ 75.00	$683.55	$ -	$ -	$ 81.38	$ 684	2005 BOA cost database; location factor NA
2 Metals (Copper or Lead)	2	ea	$ -		$ -	$ -	$ 45.00	$117.18	$ -	$ -	$ 48.83	$ 117	2005 BOA cost database; location factor NA
4 Hexavalent Chromium	5	ea	$ -		$ -	$ -	$ 45.00	$234.36	$ -	$ -	$ 48.83	$ 234	2005 BOA cost database; location factor NA
Cursory Data Validation (90 % of samples)													
Volatile Organic Compounds (8260 VOA)	30	ea	$ -		$ -	$ -	$ 30.00	$984.31	$ -	$ -	$ 32.55	$ 984	2005 BOA cost database; location factor NA
Mercury by 1631	8	ea	$ -		$ -	$ -	$ 9.00	$73.82	$ -	$ -	$ 9.77	$ 74	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	2	ea	$ -		$ -	$ -	$ 8.50	$18.45	$ -	$ -	$ 9.22	$ 18	2005 BOA cost database; location factor NA
Hexavalent Chromium	4	ea	$ -		$ -	$ -	$ 8.50	$36.89	$ -	$ -	$ 9.22	$ 37	2005 BOA cost database; location factor NA
Full Data Validation (10 % of samples)													
Volatile Organic Compounds (8260 VOA)	3	ea	$ -		$ -	$ -	$ 35.61	$129.82	$ -	$ -	$ 38.64	$ 130	2005 BOA cost database; location factor NA
Mercury by 1631	1	ea	$ -		$ -	$ -	$ 12.57	$11.46	$ -	$ -	$ 13.64	$ 11	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	0	ea	$ -		$ -	$ -	$ 10.00	$4.34	$ -	$ -	$ 10.85	$ 4	2005 BOA cost database; location factor NA
Hexavalent Chromium	1	ea	$ -		$ -	$ -	$ 10.00	$8.68	$ -	$ -	$ 10.85	$ 9	2005 BOA cost database; location factor NA
Groundwater Monitoring Report													
Report Preparation per event	180	hr	$34.00	$9,792				$0.00	$ -	$ -	$ 54.40	$ 9,792	
Closeout (Year 30)													
Closeout (Year 30)											**Closeout (Year 30) Subtotal =**	**$ 53,563**	
Well Abandonment	31	ea	$837	$ 44,603	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,438.81	$ 44,603	RACER
Closeout Report	160	hr	$35.00	$8,960	$ -	$ -	$ -	$ -	$ -	$ -	$ 56.00	$ 8,960	

TABLE D-7B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-2 (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls

Location Factors

Project Duration: 6.0 Months or 133 working days

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Inspections																
Annual Drive-by Inspection												**Annual Drive-by Inspection Subtotal =**			**$ 5,200**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hr	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Enforce Deed Restrictions												**Enforce Deed Restrictions Subtotal =**			**$ 5,200**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hr	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan												**Oversight of Risk Management Plan Subtotal =**			**$ 3,000**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
5-Year Review Report																
5-Year Report on Site Inspection												**5-Year Report on Site Inspection Subtotal =**			**$ 77,573**	
Inspection	150	hr	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hr	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	9000	$29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	Based on previous experiences at Parcel B. Assume 10%

Notes:
BOA Basic ordering agreement
ea Each
hr Hour
ODC Other direct cost
O&P Overhead and profit
QC Quality control
VOA Volatile organic analysis

TABLE D-7C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE GW-2

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at 3.10%

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative GW-2[1]	Present Value Cost for Alternative GW-2	Present Value Cost for Alternative GW-2
1	0.970	$157,685	Quarterly Groundwater Monitoring and Institutional Controls	$152,944
2	0.941	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$47,726
3	0.912	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$46,291
4	0.885	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$44,899
5	0.858	$128,304	Annual Groundwater Monitoring, 5-Year Review, Inspections, and Project Management	$110,141
6	0.833	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$42,240
7	0.808	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$40,970
8	0.783	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$39,738
9	0.760	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$38,543
10	0.737	$128,304	Annual Groundwater Monitoring, 5-Year Review, Inspections, and Project Management	$94,548
11	0.715	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$36,260
12	0.693	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$35,170
13	0.672	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$34,112
14	0.652	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$33,087
15	0.633	$128,304	Annual Groundwater Monitoring, 5-Year Review, Inspections, and Project Management	$81,164
16	0.614	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$31,127
17	0.595	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$30,191
18	0.577	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$29,283
19	0.560	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$28,403
20	0.543	$128,304	Annual Groundwater Monitoring, 5-Year Review, Inspections, and Project Management	$69,674
21	0.527	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$26,720
22	0.511	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$25,917
23	0.496	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$25,138
24	0.481	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$24,382
25	0.466	$128,304	Annual Groundwater Monitoring, 5-Year Review, Inspections, and Project Management	$59,810
26	0.452	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$22,938
27	0.439	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$22,248
28	0.425	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$21,579
29	0.413	$50,731	Annual Groundwater Monitoring, Inspections, and Project Management	$20,930
30	0.400	$181,867	Groundwater Monitoring, 5-Year Review, Land Use Controls, and Closeout	$72,777
			Total Present Value Cost Over 30 Years	**$1,388,951**

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operation and maintenance

TABLE D-8A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE GW-3A
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3A: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - Bioremediation

Location Factors

Project Duration: 0.5 Months or 11 working days

Description		Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs														
Site-Wide Distributive Costs											**Site-Wide Distributive Costs Subtotal =**		**$ 38,622**	
Project Manager	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Superintendent	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Engineer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Health & Safety Officer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Quality Control Officer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Procurement Spec.	50% on project; location factor N/A	44	hr	$ 34.00	$ 2,394	$ -	$ -	$ 100 /day	$ 550	$ -	$ -	$ 66.91	$ 2,944	
Oversight engineer	100% on project; location factor N/A	88	hr	$ 34.00	$ 5,143	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 70.94	$ 6,243	
Groundwater Monitoring Cost														
Groundwater Monitoring Well Installation											**Groundwater Monitoring Well Installation Subtotal =**		**$ 1,709**	
Drill and Construct monitoring well in mercury source area		25	feet					$ 48.00	$ 1,302.00			$52.08	$1,302.00	Based on previous experience
Development, Equipment Decontamination, Completion		1	ea					$ 375.00	$ 407.00			$407.00	$407.00	Based on previous experience
(Existing monitoring wells [plus well in mercury source area] are sufficent for long-term monitoring)														
Lactate Injection Costs														
Lactate Injection											**Lactate Injection Subtotal =**		**$ 15,621**	
Concrete coring for injection points in Building 123		5	pt	$ -	$ -	$ -	$ -	$ 168.00	$ 911	$ -	$ -	$ 182.20	$ 911	Vendor Quote: Fine Line, Miguel Ornellas (510)793-6700
Lactate injection including mobilization, equipment, labor, point abandonment, and waste handling		2	dy	$ -	$ -	$ -	$ -	$ 3,200.00	$ 6,944	$ -	$ -	$ 3,472.00	$ 6,944	Vendor Quote: Vironex, John MacAssey (510)568-7676
Sodium Lactate		3,600	lb	$ -	$ -	$ -	$ -	$ 1.00	$ 3,906	$ -	$ -	$ 1.09	$ 3,906	Vendor Quote: JRW Technologies, Donovan Smith (913)438-5544
Shipping of Sodium Lactate		1	ea	$ -	$ -	$ -	$ -	$ 800.00	$ 868	$ -	$ -	$ 868.00	$ 868	Vendor Quote: JRW Technologies, Donovan Smith (913)438-5544
Preparation of data summmary tables		55	hr	$ 34.00	$ 2,992	$ -	$ -	$ -	$ -	$ -	$ -	$ 54.40	$ 2,992	
Waste Handling and Disposal Costs														
Waste Handling and Disposal											**Waste Handling and Disposal Subtotal =**		**$ 5,639**	
55-gallon drums		20	ea	$ -	$ -	$ -	$ -	$ 50.00	$ 1,085	$ -	$ -	$ 54.25	$ 1,085	Vendor Quote: Gregg Drilling &Testing, Inc., Chris Pruner, (925)313-5800
Sampler to collect 3 samples (including quality control) for waste characterization		4	hr	$ 34.00	$ 218	$ -	$ -	$ -	$ -	$ -	$ -	$ 54.50	$ 218	Altamont Landfill Requires of 2 per 2,000 cy of soil
Toxicity Characteristic Leaching Procedure Metals (including full validation)		3	ea	$ -	$ -	$ -	$ -	$ 108.04	$ 352	$ -	$ -	$ 117.33	$ 352	2005 BOA cost database
Waste Extraction Test Metals (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 109.00	$ 355	$ -	$ -	$ 118.33	$ 355	2005 BOA cost database
Volatile Organic Compounds (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 161.11	$ 524	$ -	$ -	$ 174.67	$ 524	2005 BOA cost database
Semivolatile Organic Compounds (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 272.31	$ 886	$ -	$ -	$ 295.33	$ 886	2005 BOA cost database
Polychlorinated Biphenyls (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 190.20	$ 619	$ -	$ -	$ 206.33	$ 619	2005 BOA cost database
Haul (20 ton dump less than 200 milies)		5.5	cy	$ -	$ -	$ -	$ -		$ 735	$ -	$ -	$ 133.64	$ 735	Means 33, 19, 02, 09
Dump charge		5.5	cy	$ -	$ -	$ -	$ -	$ 119.36	$ 712	$ -	$ -	$ 129.45	$ 712	Means 33, 19, 03, 24
Truck decontamination		5.5	cy	$ -	$ -	$ -	$ -		$ 153	$ -	$ -	$ 27.82	$ 153	Means 33, 19, 03, 11
Construction Cost Summary														
Total Construction Capital Costs											**Total Construction Capital Costs Subtotal =**		**$ 61,591**	
Design Cost											Design Cost Subtotal =		$ 12,318	Assume 20 percent cost of construction
Total Construction Capital Costs with Design											**Total Construction Capital Costs with Design Subtotal =**		**$ 73,909**	

TABLE D-8A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE GW-3A (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3A: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - Bioremediation

Location Factors

Project Duration: 0.5 Months or
11 working days

Institutional Controls

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Land Use Control Remedial Design										Land Use Control Remedial Design Subtotal =		$ 49,800	
LUC RD scoping meeting	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	180	hours	$ 75.00	$ 13,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 13,500	
Submit draft LUC RD	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT review period	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
BCT comments due	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
RTC meeting and BCT concurrence	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Prepare draft final LUC RD	108	hours	$ 75.00	$ 8,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 8,100	
Submit draft final LUC RD	12	hours	$ 75.00	$ 900	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 900	
BCT review and concurrence period	72	hours	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
BCT concurrence letters due	48	hours	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
Prepare final LUC RD with RTC	60	hours	$ 75.00	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 4,500	
Submit final LUC RD with RTC	16	hours	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Covenant to Restrict Use of Property										Covenant to Restrict Use of Property Subtotal =		$ 11,250	
Prepare draft covenant	120	hours	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
File covenant	30	hours	$ 75.00	$ 2,250	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,250	
Deed Restrictions										Deed Restrictions Subtotal =		$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan										Risk Management Plan Subtotal =		$ 5,100	
Navy Review draft RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Navy Review draft final RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft Final RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Total Institutional Controls Capital Costs										**Total Institutional Controls Capital Costs Subtotal =**		**$ 73,650**	

Total Project Capital Cost =	**$**	**147,559** from calculations shown on this page
Present Value of 30 Years of Periodic Costs =	**$**	**1,858,276** from calculations shown on Table D-8C
(Groundwater Monitoring, Institutional Controls, 5-Year Reviews, and Closeout)		and Table D-8B
SubTotal =	**$**	**2,005,835**
20% Contingency =	**$**	**401,167**
Total Project Cost =	**$**	**2,407,002**

Notes:

BCT	Base Realignment and Closure Cleanup Team
BOA	*Basic ordering agreement*
cy	Cubic yard
dy	Day
ea	Each
hr	Hour
lb	Pound
LUC RD	Land Use Control Remedial Design
Means	Means, RS. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions," RS Means
O&P	Overhead and profit
RMP	Risk Management Plan
RTC	Response to comments

TABLE D-8B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-3A
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3A: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - Bioremediation

Location Factors

Project Duration: 12.0 Months or 266 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Annual Distributive													
Annual Distributive Cost										**Annual Distributive Cost Subtotal =**		**$ 3,440**	
Project Manager 2% on project; location factor N/A	43	hr	$ 50.00	$ 3,440	$ -	$ -	$ -	$ -	$ -	$ -	$ 80.00	$ 3,440	
Groundwater Monitoring (per event)													
Groundwater Monitoring Event										**Groundwater Monitoring Event Subtotal =**		**$ 35,670**	31 wells sampled quarterly yr 1, semiannually yrs 2, 3, and 4, and annually to yr 15; quarterly yr 15 then annually to year 30
Mobilization/Demobilization	16	hr	$34.00	$870	$ -	$ -			$ -	$ -	$ 54.40	$ 870	
Equipment	1	ea	$ -	$0	$ 5,000.00	$5,425			$ -	$ -	$ 5,425.00	$ 5,425	
Sampling (31 wells)	160	hr	$34.00	$8,704	$ -	$ -	$ 200.00	$4,000.00	$ -	$ -	$ 79.40	$ 12,704	Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)
Analysis (assume 20% QC samples)													
28 VOC (8260 VOA)	34	ea	$ -		$ -	$ -	$ 125.00	$4,611.25	$ -	$ -	$ 135.63	$ 4,611	2005 BOA cost database; location factor NA
7 Mercury by 1631	8	ea	$ -		$ -	$ -	$ 75.00	$651.00	$ -	$ -	$ 81.38	$ 651	2005 BOA cost database; location factor NA
2 Metals (Copper or Lead)	2	ea	$ -		$ -	$ -	$ 45.00	$97.65	$ -	$ -	$ 48.83	$ 98	2005 BOA cost database; location factor NA
4 Hexavalent Chromium	5	ea	$ -		$ -	$ -	$ 45.00	$244.13	$ -	$ -	$ 48.83	$ 244	2005 BOA cost database; location factor NA
Cursory Data Validation (90 % of samples)													
VOC (8260 VOA)	31	ea	$ -		$ -	$ -	$ 30.00	$1,009.05	$ -	$ -	$ 32.55	$ 1,009	2005 BOA cost database; location factor NA
Mercury by 1631	7	ea	$ -		$ -	$ -	$ 9.00	$68.36	$ -	$ -	$ 9.77	$ 68	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	1	ea	$ -		$ -	$ -	$ 8.50	$9.22	$ -	$ -	$ 9.22	$ 9	2005 BOA cost database; location factor NA
Hexavalent Chromium	4	ea	$ -		$ -	$ -	$ 8.50	$36.89	$ -	$ -	$ 9.22	$ 37	2005 BOA cost database; location factor NA
Full Data Validation (10 % of samples)													
VOC (8260 VOA)	3	ea	$ -		$ -	$ -	$ 35.61	$115.91	$ -	$ -	$ 38.64	$ 116	2005 BOA cost database; location factor NA
Mercury by 1631	1	ea	$ -		$ -	$ -	$ 12.57	$13.64	$ -	$ -	$ 13.64	$ 14	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2005 BOA cost database; location factor NA
Hexavalent Chromium	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2005 BOA cost database; location factor NA
Groundwater Monitoring Report													
Report Preparation per event	180	hr	$34.00	$9,792				$0.00	$ -	$ -	$ 54.40	$ 9,792	
Bioremediation Monitoring (per event)													
Bioremediation Monitoring Event										**Bioremediation Monitoring Event Subtotal =**		**$ 13,892**	5 wells sampled quarterly yr 1, semiannually yrs 2, 3, and 4, and annually to year 15, quarterly in year 15 to monitor bioremediation
Mobilization/Demobilization	16	hr	$34.00	$870	$ -	$ -			$ -	$ -	$ 54.40	$ 870	
Equipment	1	ea	$ -	$0	$ 5,000.00	$5,425			$ -	$ -	$ 5,425.00	$ 5,425	
Sampling (5 wells)	60	hr	$34.00	$3,264	$ -	$ -	$ 200.00	$1,500.00	$ -	$ -	$ 79.40	$ 4,764	Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)
Analysis (assume 20% QC samples)													
5 Total Organic Carbon (TOC)	6	ea	$ -		$ -	$ -	$ 50.00	$325.50	$ -	$ -	$ 54.25	$ 326	2005 BOA cost database; location factor NA
5 Methane/Ethane/Ethene	6	ea	$ -		$ -	$ -	$ 100.00	$651.00	$ -	$ -	$ 108.50	$ 651	2005 BOA cost database; location factor NA
5 Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	6	ea	$ -		$ -	$ -	$ 100.00	$651.00	$ -	$ -	$ 108.50	$ 651	2005 BOA cost database; location factor NA
5 Alkalinity	6	ea	$ -		$ -	$ -	$ 25.00	$162.75	$ -	$ -	$ 27.13	$ 163	2005 BOA cost database; location factor NA
5 Dissolved Hydrogen (Modified Rsk 175)	6	ea	$ -		$ -	$ -	$ 91.80	$597.62	$ -	$ -	$ 99.60	$ 598	2002 BOA cost database; location factor NA
Cursory Data Validation (90 % of samples)													
Total Organic Carbon (TOC)	5	ea	$ -		$ -	$ -	$ 9.92	$53.82	$ -	$ -	$ 10.76	$ 54	2005 BOA cost database; location factor NA
Methane/Ethane/Ethene	5	ea	$ -		$ -	$ -	$ 17.64	$95.70	$ -	$ -	$ 19.14	$ 96	2005 BOA cost database; location factor NA
Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	5	ea	$ -		$ -	$ -	$ 16.54	$89.73	$ -	$ -	$ 17.95	$ 90	2005 BOA cost database; location factor NA
Alkalinity	5	ea	$ -		$ -	$ -	$ 13.23	$71.77	$ -	$ -	$ 14.35	$ 72	2005 BOA cost database; location factor NA
Dissolved Hydrogen (Modified Rsk 175)	5	ea	$ -		$ -	$ -	$ 7.58	$41.12	$ -	$ -	$ 8.22	$ 41	2002 BOA cost database; location factor NA
Full Data Validation (10 % of samples)													
Total Organic Carbon (TOC)	1	ea	$ -		$ -	$ -	$ 14.88	$16.14	$ -	$ -	$ 16.14	$ 16	2005 BOA cost database; location factor NA
Methane/Ethane/Ethene	1	ea	$ -		$ -	$ -	$ 22.05	$23.92	$ -	$ -	$ 23.92	$ 24	2005 BOA cost database; location factor NA
Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	1	ea	$ -		$ -	$ -	$ 18.74	$20.33	$ -	$ -	$ 20.33	$ 20	2005 BOA cost database; location factor NA
Alkalinity	1	ea	$ -		$ -	$ -	$ 19.85	$21.54	$ -	$ -	$ 21.54	$ 22	2005 BOA cost database; location factor NA
Dissolved Hydrogen (Modified Rsk 175)	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2002 BOA cost database; location factor NA
Closeout (Year 30)													
Closeout (Year 30)										**Closeout (Year 30) Subtotal =**		**$ 53,563**	
Well Abandonment	31	ea	$837	$ 44,603	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,438.81	$ 44,603	RACER
Closeout Report	160	hr	$35.00	$8,960	$ -	$ -	$ -	$ -	$ -	$ -	$ 56.00	$ 8,960	

TABLE D-8B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-3A (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3A: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - Bioremediation

Location Factors

Project Duration: 12.0 Months or 266 working days

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Inspections																
Annual Drive-by Inspection												**Annual Drive-by Inspection Subtotal =**			**$ 5,200**	
Inspection	20	hours	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hours	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Enforce Deed Restrictions												**Enforce Deed Restrictions Subtotal =**			**$ 5,200**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hr	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan												**Oversight of Risk Management Plan Subtotal =**			**$ 3,000**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
5-Year Review Report																
5-Year Report on Site Inspection												**5-Year Report on Site Inspection Subtotal =**			**$ 77,573**	
Inspection	150	hours	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hours	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	9000	$29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	Based on previous experiences at Parcel B. Assume 10% for ODCs (printing, computer

Notes:
BOA Basic ordering agreement
ea Each
hr Hour
ODC Other direct cost
O&P Overhead and profit
QC Quality control
VOA Volatile organic analysis

TABLE D-8C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE GW-3A

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at 3.10%

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative GW-3A[1]	Present Value Cost for Alternative GW-3A	Present Value Cost for Alternative GW-3A
1	0.970	$215,090	Quarterly Groundwater and Bioremediation Monitoring, and Institutional Controls	$208,622
2	0.941	$115,965	Semiannual Groundwater and Bioremediation Monitoring, and Institutional Controls	$109,096
3	0.912	$115,965	Semiannual Groundwater and Bioremediation Monitoring, and Institutional Controls	$105,816
4	0.885	$115,965	Semiannual Groundwater and Bioremediation Monitoring, and Institutional Controls	$102,634
5	0.858	$143,975	Groundwater and Bioremediation Monitoring, 5-Year Review, and Institutional Controls	$123,593
6	0.833	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$55,288
7	0.808	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$53,626
8	0.783	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$52,013
9	0.760	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$50,449
10	0.737	$143,975	Groundwater and Bioremediation Monitoring, 5-Year Review, and Institutional Controls	$106,097
11	0.715	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$47,461
12	0.693	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$46,034
13	0.672	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$44,650
14	0.652	$66,402	Annual Groundwater and Bioremediation Monitoring, Inspections, and Project Maintenance	$43,307
15	0.633	$292,663	Quarterly Groundwater and Bioremediation Monitoring, 5-Year Review, and Institutional Controls	$185,134
16	0.614	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$32,218
17	0.595	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$31,250
18	0.577	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$30,310
19	0.560	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$29,399
20	0.543	$130,083	5-Year Review and Institutional Controls	$70,640
21	0.527	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$27,657
22	0.511	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$26,826
23	0.496	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$26,019
24	0.481	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$25,237
25	0.466	$130,083	5-Year Review and Institutional Controls	$60,639
26	0.452	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$23,742
27	0.439	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$23,028
28	0.425	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$22,336
29	0.413	$52,510	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$21,664
30	0.400	$183,646	5-Year Review, Institutional Controls, and Closeout	$73,489
			Total Present Value Cost Over 30 Years	**$1,858,276**

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operation and maintenance

TABLE D-9A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE GW-3B
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3B: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - ZVI Injection

Location Factors

Project Duration: 0.5 Months or 11 working days

Description		Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Site Wide Costs														
Site Wide Distributive Costs											**Site Wide Distributive Costs Subtotal =**		**$ 38,622**	
Project Manager	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Superintendent	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Engineer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Health & Safety Officer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Quality Control Officer	100% on project; location factor N/A	88	hr	$ 34.00	$ 4,787	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 66.90	$ 5,887	
Procurement Spec.	50% on project; location factor N/A	44	hr	$ 34.00	$ 2,394	$ -	$ -	$ 100 /day	$ 550	$ -	$ -	$ 66.91	$ 2,944	
Oversight Engineer	100% on project; location factor N/A	88	hr	$ 34.00	$ 5,143	$ -	$ -	$ 100 /day	$ 1,100	$ -	$ -	$ 70.94	$ 6,243	
Groundwater Monitoring Cost														
Groundwater Monitoring Well Installation											**Groundwater Monitoring Well Installation Subtotal =**		**$ 1,709**	
Drill and Construct monitoring well in mercury source area		25	feet					$ 48.00	$ 1,302.00			$52.08	$1,302.00	Based on previous experience
Development, Equipment Decontamination, Completion		1	ea					$ 375.00	$ 407.00			$407.00	$407.00	Based on previous experience
(Existing monitoring wells plus well in mercury source area is sufficent for long-term monitoimg														
ZVI Injection Costs														
ZVI Injection											**ZVI Injection Subtotal =**		**$ 347,900**	
Concrete coring for injection points in Building 123		5	pt	$ -	$ -	$ -	$ -	$ 168.00	$ 840	$ -	$ -	$ 168.00	$ 840	Vendor Quote: Fine Line, Miguel Ornellas (510)793-6700
Mobilization/Demobilization of ZVI injection team (including freight of Iron)		1	ea	$ -	$ -	$ -	$ -	$ 32,300.00	$ 32,300	$ -	$ -	$ 32,300.00	$ 32,300	Vendor Quote: ARS Technologies, Steve Chen, (732)296-6620
ZVI Material		44,000	lb	$ -	$ -	$ -	$ -	$ 2.54	$ 111,760	$ -	$ -	$ 2.54	$ 111,760	Vendor Quote: ARS Technologies, Steve Chen, (732)296-6620
ZVI Injection (including drilling, injection, and hole abandonment)		1	ea	$ -	$ -	$ -	$ -	$ 200,000.00	$ 200,000	$ -	$ -	$ 200,000.00	$ 200,000	Vendor Quote: ARS Technologies, Steve Chen, (732)296-6620
Preparation of data summmary tables		1	ea	$ -	$ -	$ -	$ -	$ 3,000.00	$ 3,000	$ -	$ -	$ 3,000.00	$ 3,000	Vendor Quote: ARS Technologies, Steve Chen, (732)296-6620
Waste Handling and Disposal Costs														
Waste Handling and Disposal											**Waste Handling and Disposal Subtotal =**		**$ 5,639**	
55-gallon drums		20	ea	$ -	$ -	$ -	$ -	$ 50.00	$ 1,085	$ -	$ -	$ 54.25	$ 1,085	Vendor Quote: Gregg Drilling &Testing, Inc., Chris Pruner, (925)313-5800
Sampler to collect 3 samples (including QC) for waste characterization		4	hr	$ 34.00	$ 218	$ -	$ -	$ -	$ -	$ -	$ -	$ 54.50	$ 218	Altamont Landfill Requires of 2 per 2,000 cy of soil
TCLP Metals (including full validation)		3	ea	$ -	$ -	$ -	$ -	$ 108.04	$ 352	$ -	$ -	$ 117.33	$ 352	2005 BOA cost database
WET Metals (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 109.00	$ 355	$ -	$ -	$ 118.33	$ 355	2005 BOA cost database
VOAs (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 161.11	$ 524	$ -	$ -	$ 174.67	$ 524	2005 BOA cost database
SVOAs (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 272.31	$ 886	$ -	$ -	$ 295.33	$ 886	2005 BOA cost database
PCBs (inlcuding full validation)		3	ea	$ -	$ -	$ -	$ -	$ 190.20	$ 619	$ -	$ -	$ 206.33	$ 619	2005 BOA cost database
Haul (20 ton dump less than 200 mi.)		5.5	cy	$ -	$ -	$ -	$ -		$ 735	$ -	$ -	$ 133.64	$ 735	Means 33, 19, 02, 09
Dump charge		5.5	cy	$ -	$ -	$ -	$ -	$ 119.36	$ 712	$ -	$ -	$ 129.45	$ 712	Means 33, 19, 03, 24
Truck decontamination		5.5	cy	$ -	$ -	$ -	$ -		$ 153	$ -	$ -	$ 27.82	$ 153	Means 33, 19, 03, 11
Construction Cost Summary														
Total Construction Capital Costs											**Total Construction Capital Costs Subtotal =**		**$ 393,870**	
Design Cost											Design Cost Subtotal =		$ 17,000	Vendor Quote: ARS Technologies, Steve Chen, (732)296-6620
Total Construction Capital Costs with Design											**Total Construction Capital Costs with Design Subtotal =**		**$ 410,870**	

TABLE D-9A: CAPITAL AND LABOR COST ESTIMATE, ALTERNATIVE GW-3B (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3B: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - ZVI Injection

Location Factors

Project Duration: 0.5 Months or 11 working days

Institutional Controls

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Land Use Control Remedial Design										Land Use Control Remedial Design Subtotal =		$ 49,800	
LUC RD scoping meeting	48	hr	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	Rounded average based on typical loaded professional unit costs
Prepare draft LUC RD	180	hr	$ 75.00	$ 13,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 13,500	
Submit draft LUC RD	48	hr	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
BCT review period	24	hr	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
BCT comments due	24	hr	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
RTC meeting and BCT concurrence	24	hr	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Prepare draft final LUC RD	108	hr	$ 75.00	$ 8,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 8,100	
Submit draft final LUC RD	12	hr	$ 75.00	$ 900	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 900	
BCT review and concurrence period	72	hr	$ 75.00	$ 5,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 5,400	
BCT concurrence letters due	48	hr	$ 75.00	$ 3,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 3,600	
Prepare final LUC RD with RTC	60	hr	$ 75.00	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 4,500	
Submit final LUC RD with RTC	16	hr	$ 75.00	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,200	
Covenant to Restrict Use of Property										Covenant to Restrict Use of Property Subtotal =		$ 11,250	
Prepare draft covenant	120	hr	$ 75.00	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 9,000	
File covenant	30	hr	$ 75.00	$ 2,250	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 2,250	
Deed Restrictions										Deed Restrictions Subtotal =		$ 7,500	
Prepare draft deed restrictions	80	hours	$ 75.00	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 6,000	
File deed restrictions	20	hours	$ 75.00	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,500	
Risk Management Plan										Risk Management Plan Subtotal =		$ 5,100	
Navy Review draft RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Navy Review draft final RMP	24	hours	$ 75.00	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 1,800	
Discuss Comments on Draft Final RMP	10	hours	$ 75.00	$ 750	$ -	$ -	$ -	$ -	$ -	$ -	$ 75.00	$ 750	
Total Institutional Controls Capital Costs										**Total Institutional Controls Capital Costs Subtotal =**		**$ 73,650**	
										Total Project Capital Cost =		**$ 484,520**	from calculations shown on this page
										Present Value of 30 Years of Periodic Costs =		**$ 1,842,059**	from calculations shown on Table D-9C
										(Groundwater Monitoring, Institutional Controls, 5-Year Reviews, and Closeout)			and Table D-9B
										SubTotal =		**$ 2,326,579**	
										20% Contingency =		**$ 465,316**	
										Total Project Cost =		**$ 2,791,894**	

Notes:

BCT	Base Realignment and Closure Cleanup Team
BOA	Baseic ordering agreement
cy	Cubic yard
dy	Day
ea	Each
hr	Hour
lb	Pound
LUC RD	Land Use Control Remedial Design
Means	Means, RS. 2004. "Environmental Remediation Cost Data – Unit Price, 10th Annual Edition, Environmental Cost Handling Options and Solutions," RS Means
O&P	Overhead and profit
RMP	Risk Management Plan
RTC	Response to comments
ZVI	Zero-valent iron

TABLE D-9B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-3B
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3B: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - ZVI injection

Location Factors

Project Duration: 12.0 Months or 266 working days

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments
Annual Distributive													
Annual Distributive Cost											**Annual Distributive Cost Subtotal =**	**$ 3,440**	
Project Manager 2% on project; location factor N/A	43	hr	$ 50.00	$ 3,440	$ -	$ -	$ -	$ -	$ -	$ -	$ 80.00	$ 3,440	
Groundwater Monitoring													
Groundwater Monitoring Event											**Groundwater Monitoring Event Subtotal =**	**$ 35,585**	
Mobilization/Demobilization	16	hr	$34.00	$870	$ -	$ -			$ -	$ -	$ 54.40	$ 870	31 wells sampled quarterly yr 1, semiannually yrs 2, 3, and 4, and annually to yr 15; quarterly yr 15 then annually to year 30
Equipment	1	ea	$ -	$0	$ 5,000.00	$5,425			$ -	$ -	$ 5,425.00	$ 5,425	
Sampling (31 wells)	160	hr	$34.00	$8,704	$ -	$ -	$ 200.00	$4,000.00	$ -	$ -	$ 79.40	$ 12,704	Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)
Analysis (assume 20% quality control samples)													
28 Volatile Organic Compound (8260 VOA)	34	ea	$ -		$ -	$ -	$ 125.00	$4,611.25	$ -	$ -	$ 135.63	$ 4,611	2005 BOA cost database; location factor NA
6 Mercury by 1631	7	ea	$ -		$ -	$ -	$ 75.00	$569.63	$ -	$ -	$ 81.38	$ 570	2005 BOA cost database; location factor NA
2 Metals (Copper or Lead)	2	ea	$ -		$ -	$ -	$ 45.00	$97.65	$ -	$ -	$ 48.83	$ 98	2005 BOA cost database; location factor NA
4 Hexavalent Chromium	5	ea	$ -		$ -	$ -	$ 45.00	$244.13	$ -	$ -	$ 48.83	$ 244	2005 BOA cost database; location factor NA
Cursory Data Validation (90 % of samples)													
Volatile Organic Compound (8260 VOA)	30	ea	$ -		$ -	$ -	$ 30.00	$976.50	$ -	$ -	$ 32.55	$ 977	2005 BOA cost database; location factor NA
Mercury by 1631	6	ea	$ -		$ -	$ -	$ 9.00	$58.59	$ -	$ -	$ 9.77	$ 59	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	1	ea	$ -		$ -	$ -	$ 8.50	$9.22	$ -	$ -	$ 9.22	$ 9	2005 BOA cost database; location factor NA
Hexavalent Chromium	4	ea	$ -		$ -	$ -	$ 8.50	$36.89	$ -	$ -	$ 9.22	$ 37	2005 BOA cost database; location factor NA
Full Data Validation (10 % of samples)													
Volatile Organic Compound (8260 VOA)	4	ea	$ -		$ -	$ -	$ 35.61	$154.55	$ -	$ -	$ 38.64	$ 155	2005 BOA cost database; location factor NA
Mercury by 1631	1	ea	$ -		$ -	$ -	$ 12.57	$13.64	$ -	$ -	$ 13.64	$ 14	2005 BOA cost database; location factor NA
Metals (Copper or Lead)	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2005 BOA cost database; location factor NA
Hexavalent Chromium	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2005 BOA cost database; location factor NA
Groundwater Monitoring Report													
Report Preparation per event	180	hr	$34.00	$9,792				$0.00	$ -	$ -	$ 54.40	$ 9,792	
ZVI Remediation Monitoring													
ZVI Remediation Monitoring Event											**ZVI Remediation Monitoring Event Subtotal =**	**$ 13,174**	
Equipment	1	ea	$ -	$0	$ 5,000.00	$5,425			$ -	$ -	$ 5,425.00	$ 5,425	5 wells sampled quarterly yr 1, semiannually yrs 2, 3, and 4, and annually to year 15; quarterly yr 15 to monitor ZVI
Sampling (5 wells)	60	hr	$34.00	$3,264	$ -	$ -	$ 200.00	$1,500.00	$ -	$ -	$ 79.40	$ 4,764	Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)
Analysis (assume 20% quality control samples)													
4 Individual Metals (6010B) (dissolved arsenic, manganese, and iron and total iron)	5	ea	$ -		$ -	$ -	$ 18.36	$99.60	$ -	$ -	$ 19.92	$ 100	2005 BOA cost database; location factor NA
5 Total Organic Carbon (TOC)	6	ea	$ -		$ -	$ -	$ 50.00	$325.50	$ -	$ -	$ 54.25	$ 326	2005 BOA cost database; location factor NA
5 Methane/Ethane/Ethene	6	ea	$ -		$ -	$ -	$ 100.00	$651.00	$ -	$ -	$ 108.50	$ 651	2005 BOA cost database; location factor NA
5 Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	6	ea	$ -		$ -	$ -	$ 100.00	$651.00	$ -	$ -	$ 108.50	$ 651	2005 BOA cost database; location factor NA
5 Alkalinity	6	ea	$ -		$ -	$ -	$ 25.00	$162.75	$ -	$ -	$ 27.13	$ 163	2005 BOA cost database; location factor NA
5 Dissolved Hydrogen (Modified Rsk 175)	6	ea	$ -		$ -	$ -	$ 91.80	$597.62	$ -	$ -	$ 99.60	$ 598	2002 BAECRU BOA cost database; location factor NA
Cursory Data Validation (90 % of samples)													
Individual Metals (6010B) (dissolved arsenic, manganese, and iron and total iron)	4	ea	$ -		$ -	$ -	$ 9.00	$39.06	$ -	$ -	$ 9.77	$ 39	2005 BOA cost database; location factor NA
Total Organic Carbon (TOC)	5	ea	$ -		$ -	$ -	$ 9.92	$53.82	$ -	$ -	$ 10.76	$ 54	2005 BOA cost database; location factor NA
Methane/Ethane/Ethene	5	ea	$ -		$ -	$ -	$ 17.64	$95.70	$ -	$ -	$ 19.14	$ 96	2005 BOA cost database; location factor NA
Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	5	ea	$ -		$ -	$ -	$ 16.54	$89.73	$ -	$ -	$ 17.95	$ 90	2005 BOA cost database; location factor NA
Alkalinity	5	ea	$ -		$ -	$ -	$ 13.23	$71.77	$ -	$ -	$ 14.35	$ 72	2005 BOA cost database; location factor NA
Dissolved Hydrogen (Modified Rsk 175)	5	ea	$ -		$ -	$ -	$ 7.58	$41.12	$ -	$ -	$ 8.22	$ 41	2002 BOA cost database; location factor NA
Full Data Validation (10 % of samples)													
Individual Metals (6010B) (dissolved arsenic, manganese, and iron and total iron)	1	ea	$ -		$ -	$ -	$ 12.57	$13.64	$ -	$ -	$ 13.64	$ 14	2005 BOA cost database; location factor NA
Total Organic Carbon (TOC)	1	ea	$ -		$ -	$ -	$ 14.88	$16.14	$ -	$ -	$ 16.14	$ 16	2005 BOA cost database; location factor NA
Methane/Ethane/Ethene	1	ea	$ -		$ -	$ -	$ 22.05	$23.92	$ -	$ -	$ 23.92	$ 24	2005 BOA cost database; location factor NA
Major Anions (Chloride/Nitrate/Nitrite/O-Phosphate/Sulfate)	1	ea	$ -		$ -	$ -	$ 18.74	$20.33	$ -	$ -	$ 20.33	$ 20	2005 BOA cost database; location factor NA
Alkalinity	1	ea	$ -		$ -	$ -	$ 19.85	$21.54	$ -	$ -	$ 21.54	$ 22	2005 BOA cost database; location factor NA
Dissolved Hydrogen (Modified Rsk 175)	1	ea	$ -		$ -	$ -	$ 10.00	$10.85	$ -	$ -	$ 10.85	$ 11	2002 BAECRU BOA cost database; location factor NA
Closeout (Year 30)													
Closeout (Year 30)											**Closeout (Year 30) Subtotal =**	**$ 53,563**	
Well Abandonment	31	ea	$837	$ 44,603	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,438.81	$ 44,603	RACER
Closeout Report	160	hr	$35.00	$8,960	$ -	$ -	$ -	$ -	$ -	$ -	$ 56.00	$ 8,960	

TABLE D-9B: O&M AND PERIODIC COST ESTIMATE, ALTERNATIVE GW-3B (CONTINUED)
Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Alternative GW-3B: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls - ZVI Injection

Location Factors

Project Duration: 12.0 Months or 266 working days

Description	Quantity	Unit	Loaded Labor Unit Cost	Total Labor	Loaded Equipment Unit Cost	Total Equipment (including profit)	Loaded Material Unit Cost	Total Material (including profit)	Loaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Labor	ODCs	Subtask	Comments
Annual Inspections																
Annual Drive-by Inspection												**Annual Drive-by Inspection Subtotal =**			**$ 5,200**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hr	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Enforce Deed Restrictions												**Enforce Deed Restrictions Subtotal =**			**$ 5,200**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
Report	28	hr	$75.00	$ 2,100.00	0	$ -	0	$ -	0	$ -	$75.00	$ 2,100.00	$ 2,100	$ 100	$ 2,200	ODCs for printing
Oversight of Risk Management Plan												**Oversight of Risk Management Plan Subtotal =**			**$ 3,000**	
Inspection	20	hr	$75.00	$ 1,500.00	0	$ -	0	$ -	0	$ -	$75.00	$ 1,500.00	$ 1,500	$ 1,500	$ 3,000	ODCs for travel
5-Year Review Report																
5 -year Report on Site Inspection												**5 -year Report on Site Inspection Subtotal =**			**$ 77,573**	
Inspection	150	hr	$75.00	$ 11,250.00	0	$ -	0	$ -	0	$ -	$75.00	$ 11,250.00	$ 11,250	$ 100	$ 11,350	ODCs for travel
5-year engineering report	450	hr	$75.00	$ 33,750.00	0	$ -	0	$ -	0	$ -	$75.00	$ 33,750.00	$ 33,750	$ 100	$ 33,850	ODCs for printing
Advertisements	3	ea		$ -	0	$ -	9000	$29,430.00	0	$ -	$9,810.00	$ 29,430.00	$ 29,430	$ 2,943	$ 32,373	10% for ODCs (printing, computer use)

Notes:
BOA Basic ordering agreement
ea Each
hr Hour
ODC Other direct cost
O&P Overhead and profit
QC Quality control
VOA Volatile organic analysis
ZVI Zero-valent iron

TABLE D-9C: PRESENT VALUE COST ESTIMATE, ALTERNATIVE GW-3B

Appendix D, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Annual Discount Factors at 3.10%

Year	Annual Discount Factor	Future Value of O&M and Periodic Cost for Alternative GW-3B[1]	Present Value Cost for Alternative GW-3B	Present Value Cost for Alternative GW-3B
1	0.970	$211,877	Quarterly Groundwater and ZVI Remediation Monitoring and Institutional Controls	$205,506
2	0.941	$114,358	Semiannual Groundwater and ZVI Remediation Monitoring and Institutional Controls	$107,585
3	0.912	$114,358	Semiannual Groundwater and ZVI Remediation Monitoring and Institutional Controls	$104,350
4	0.885	$114,358	Semiannual Groundwater and ZVI Remediation Monitoring and Institutional Controls	$101,212
5	0.858	$143,172	Groundwater and ZVI Remediation Monitoring, 5-Year Review, and Institutional Controls	$122,904
6	0.833	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$54,619
7	0.808	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$52,977
8	0.783	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$51,384
9	0.760	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$49,839
10	0.737	$143,172	Groundwater and ZVI Remediation Monitoring, 5-Year Review, and Institutional Controls	$105,505
11	0.715	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$46,887
12	0.693	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$45,477
13	0.672	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$44,110
14	0.652	$65,599	Annual Groundwater and ZVI Remediation Monitoring, Inspections, and Project Maintenance	$42,784
15	0.633	$289,450	Quarterly Groundwater and ZVI Remediation Monitoring, 5-Year Review, and Institutional Controls	$183,102
16	0.614	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$32,166
17	0.595	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$31,199
18	0.577	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$30,261
19	0.560	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$29,351
20	0.543	$129,998	5-Year Review and Institutional Controls	$70,593
21	0.527	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$27,613
22	0.511	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$26,782
23	0.496	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$25,977
24	0.481	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$25,196
25	0.466	$129,998	5-Year Review and Institutional Controls	$60,600
26	0.452	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$23,704
27	0.439	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$22,991
28	0.425	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$22,300
29	0.413	$52,425	Annual Groundwater Monitoring, Inspections, and Project Maintenance	$21,629
30	0.400	$183,561	5-Year Review, Institutional Controls, and Closeout	$73,455
			Total Present Value Cost Over 30 Years	**$1,842,059**

Notes: Annual discount factor = $1/(1+i)^t$, where i=0.031 and t=year (that is, the present value of $1 paid in year t at 3.1%).

1 Costs are for operation, maintenance, and 5-year reviews for 30 years

O&M Operations and maintenance