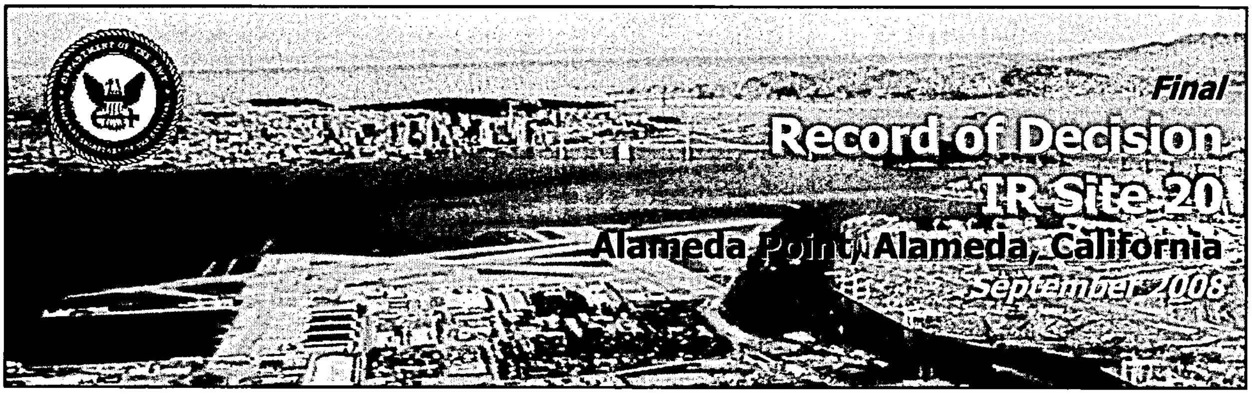
Final

Record of Decision IR Site 20

Alameda Point, Alameda, California

September 2008

BEI 7526-0087-0056



1 Declaration

1.1 Site Name and Location

This decision document addresses Installation Restoration (IR) Site 20, Oakland Inner Harbor, Operable Unit 4C at the former Naval Air Station (NAS) Alameda, now referred to as Alameda Point, in Alameda, California. IR Site 20 is an offshore site located on the southern side of the Oakland Inner Harbor Channel, adjacent to the northern shoreline of Alameda Point. The United States Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (referred to as CERCLIS) identification number for NAS Alameda is CA2170023236.

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedy, no further action, at IR Site 20. This document was developed in accordance with CERCLA (1980), as amended by the Superfund Amendments and Reauthorization Act of 1986 (Title 42 *United States Code* Section 9601, et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 *Code of Federal Regulations* Part 300).

This decision is based on information contained in the Administrative Record file (a site-specific Administrative Record Index[1] is included as part of this ROD), as well as on extensive field investigations, laboratory analyses, interpretation of the data, evaluation of current and future conditions, and thorough assessment of the potential human health and ecological risks. Based on these findings, no land-use restrictions, environmental monitoring, Resource Conservation and Recovery Act (RCRA) corrective action, or other actions are required at this site.

The Department of the Navy (DON), EPA, State of California Environmental Protection Agency Department of Toxic Substances Control (DTSC), and San Francisco Bay Regional Water Quality Control Board (Water Board) concur on the selected remedy for this site.

[1]**Bold blue text** identifies detailed site information available in the Administrative Record and listed in the References Table. This ROD is also available on CD whereby **bold blue text** serves as a hyperlink to referenced information. The excerpts referenced by the hyperlinks are part of the ROD. The hyperlink will open a text box at the top of the screen. A blue box surrounds applicable information in the hyperlink. To the extent there may be any inconsistencies between the referenced information attached to this ROD via hyperlinks and the information in the basic ROD itself, the language in the basic ROD controls.

1.3 Assessment of the Site

The DON, in coordination with the regulatory agencies, has concluded that no further action is necessary to protect public health and the environment at IR Site 20, based on the following:

- site histories
- field investigations
- laboratory analytical results
- previous removal action
- evaluation of potential ecological and human health risks
- current land use and reasonably anticipated future land use

Results of these investigations at IR Site 20 showed that the site does not pose an unacceptable risk to human health or the environment. The human health risk assessment, which evaluated dermal contact with sediment, ingestion of fish and shellfish, and incidental ingestion of sediment, indicated that risks are consistent with ambient conditions, and there are no unacceptable risks to human health, based on contaminant concentrations at IR Site 20. The ecological risk assessment evaluated potential risk to ecological receptors, including benthic invertebrates, fish, and birds, and concluded that there are no unacceptable ecological risks associated with IR Site 20.

1.4 Statutory Determinations

The DON has concluded that no remedial action is necessary at IR Site 20 because the site does not pose an unacceptable risk to human health or the environment. The selected remedy is protective of human health and the environment and complies with federal and State requirements. The selected remedy obviates the need for and satisfies potential requirements of RCRA or otherwise applicable State hazardous waste or water quality protection laws. A five-year status review is not required because this remedy does not result in hazardous substances, pollutants, or contaminants remaining on-site at levels above those that allow for unlimited use and unrestricted exposure.

1.5 Data Certification Checklist

The information provided in Table 1 is included in Section 2 of this ROD. Additional information can be found in the Administrative Record for this site.

TABLE 1: DATA CERTIFICATION CHECKLIST

Checklist Item	Description
Identification of chemicals of potential concern and their concentrations.	Chemicals of potential concern were characterized throughout IR Site 20 based on data from several investigations. Descriptions of these investigations are provided in Section 2.3 of this ROD.
Risk assessments for the chemicals of potential concern.	A baseline human health risk assessment and baseline ecological risk assessment were conducted as part of the remedial investigation using data representative of current conditions at IR Site 20. Results of these risk assessments are presented in Section 2.5 of this ROD.
How source materials constituting principal threats are addressed.	There are no principal threat wastes at IR Site 20, as described in Section 2.6.
Current and reasonably anticipated future land use assumptions.	IR Site 20 will remain a viable shipping channel. Current and potential future site uses are discussed in Section 2.4.

1.6 Authorizing Signatures

This signature sheet documents the DON's and the EPA's co-selection of no further action in this ROD for IR Site 20 at Alameda Point, and the State of California, by the Department of Toxic Substances Control's and the San Francisco Bay Regional Water Quality Control Board's concurrence with this ROD. The respective parties may sign this sheet in counterparts.

Signature **Date**

Mr. George Patrick Brooks
Base Realignment and Closure Environmental Coordinator
Base Realignment and Closure Program Management Office West
Department of the Navy

Signature **Date**

Mr. Michael M. Montgomery
Chief, Superfund Federal Facilities and Site Cleanup Branch, Region 9
United States Environmental Protection Agency

The State of California, Department of Toxic Substances Control had an opportunity to review and comment on the Record of Decision and the Department of Toxic Substances Control comments were addressed.

Signature **Date**

Mr. Anthony J. Landis, P.E.
Supervising Hazardous Substances Engineer II
Sacramento Office
Brownfields and Environmental Restoration Program
California Environmental Protection Agency
Department of Toxic Substances Control

Signature **Date**

Mr. Bruce H. Wolfe
Executive Officer
California Environmental Protection Agency
San Francisco Bay Regional Water Quality Control Board

1.6 AUTHORIZING SIGNATURES

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George Patrick Brooks — 9-10-08

Signature — **Date**

Mr. George Patrick Brooks
Base Realignment and Closure Environmental Coordinator
Base Realignment and Closure Program Management Office West
Department of the Navy

10-19-08

Signature — **Date**

Mr. Michael M. Montgomery
Chief, Superfund Federal Facilities and Site Cleanup Branch, Region 9
United States Environmental Protection Agency

The State of California, Department of Toxic Substances Control had an opportunity to review and comment on the Record of Decision and the Department of Toxic Substances Control comments were addressed.

10-29-08

Signature — **Date**

Mr. Anthony J. Landis, P.E.
Supervising Hazardous Substances Engineer II
Sacramento Office
Brownfields and Environmental Restoration Program
California Environmental Protection Agency
Department of Toxic Substances Control

Bruce H. Wolfe — 10/31/08

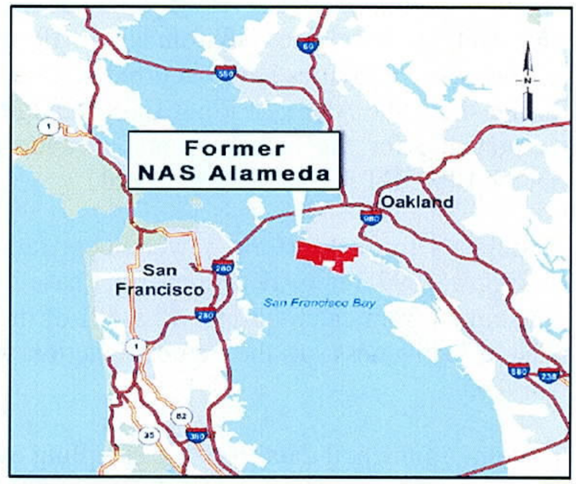
Signature — **Date**

Mr. Bruce H. Wolfe
Executive Officer
California Environmental Protection Agency
San Francisco Bay Regional Water Quality Control Board

2 Decision Summary

2.1 Site Description and History

FIGURE 1
Alameda Point Location Map

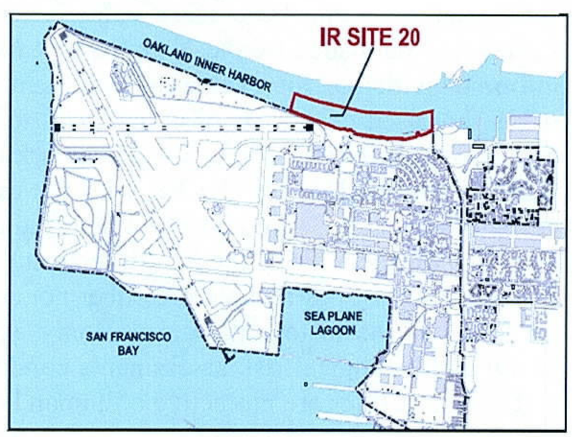


IR Site 20 is located at **the former NAS Alameda, now referred to as Alameda Point;** NAS Alameda ceased operations in 1997. Alameda Point is located on the western tip of Alameda Island, which is on the eastern side of San Francisco Bay (Figure 1). **IR Site 20** occupies offshore property located on the southern side of the Oakland Inner Harbor Channel, adjacent to the northern shoreline of the eastern portion of Alameda Point (Figure 2). The shoreline of IR Site 20 extends approximately 3,960 feet (1207 meters). The Oakland Inner Harbor Channel is a major industrial waterway serving marine terminals and repair facilities in the cities of Oakland and Alameda. Historical dredging of the Oakland Inner Harbor shipping channel has been conducted to a depth of approximately 15 meters, and additional dredging of the channel is expected in the future to improve and/or maintain this major shipping channel.

Stormwater and industrial wastes were discharged historically from Alameda Point to Oakland Inner Harbor via a series of drains located along the shore. In 1975, the direct discharge of industrial wastewater through the stormwater system was terminated.

2.2 Site Characteristics

FIGURE 2
IR Site 20 Location Map



The shoreline of IR Site 20 has been almost entirely modified by human activity. Industries located along the length of the Oakland Inner Harbor Channel include port facilities, shipbuilding and repair facilities, sand and gravel off-loading areas, and marinas. There are four storm sewer outfalls along the IR Site 20 shoreline.

The shoreline along IR Site 20 is characterized as rocky substrate (riprap) with limited intertidal areas (sand beaches and mudflats). This area is subjected to the same tidal influences as the remainder of northern and central San Francisco Bay. A submerged area of soft, undredged sediment extends approximately 245 feet (75 meters) from the shoreline. Beyond this shelf, within the dredged shipping channel, the sediment surface drops off steeply. Water depths range up to approximately 50 feet in the center of the Oakland Inner Harbor Channel, with water depths along the sediment shelf typically ranging from less than 10 feet to approximately 40 feet.

2.3 Previous Investigations

Several environmental investigations and a **removal action** were conducted at IR Site 20 under the DON's basewide environmental IR Program and are summarized in Table 2. No enforcement activities have occurred in association with IR Site 20, and there are no RCRA units at the site. The Alameda Point Base Realignment and Closure (BRAC) Cleanup Team (BCT) is responsible for the environmental cleanup program and consists of representatives from the DON, EPA, DTSC, and Water Board.

Sediments from the storm sewer lines leading to the outfalls along IR Site 20 were removed during a 1997 removal action. In Phase I of the removal action, debris and sediment were vacuumed from catch basins. Phase II of the removal action included cleaning the system lines. The effectiveness of the removal action was documented through closed-circuit television surveys.

The environmental data from the sampling events in 1993-1994 and 2001, as well as the 2005 RI data, were evaluated as part of the **remedial investigation** (RI) of IR Site 20. The RI Report for IR Site 20 was combined with the RI Report for IR Site 24 because at both offshore IR sites, the RI samples were collected in accordance with the same work plan. Separate risk assessments and evaluations were conducted for each site and were presented in the RI Report. During the sampling events at IR Site 20, **sediment data** were collected, and analyses for metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), tributylin, and pesticides were performed. Laboratory bioaccumulation and toxicity tests were conducted with sediments collected at IR Site 20, and **tissue data** were evaluated as part of the RI.

Concentrations of most inorganic constituents (metals) and organic chemicals in sediment are relatively uniform across the site, both horizontally and vertically, and typically do not exceed ecological screening benchmark values such as effects range-median (ER-M) values. ER-M values are published by the National Oceanic and Atmospheric Administration and used as an informal guideline for evaluating sediment chemical concentrations. For IR Site 20, ER-M values are used as a basis of comparison to describe site conditions. Analytical results for all metals were below the screening benchmark ER-M and/or ambient values in all surface sediment samples collected during the RI, with the exception of mercury at one location. Total PAHs, pesticides, and total PCBs were not detected at concentrations exceeding the ER-M values in any samples collected during the RI. In the historical (pre-RI) data set, no PAHs exceeded the ER-M values, and most pesticides were either not detected or below the ER-M value. The ER-M value for PCBs in the historical data was only exceeded at a few locations. Results of the human health and ecological risk assessments conducted using the sediment and tissue data concluded that site conditions are protective of human health and the environment.

TABLE 2: TIME LINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS

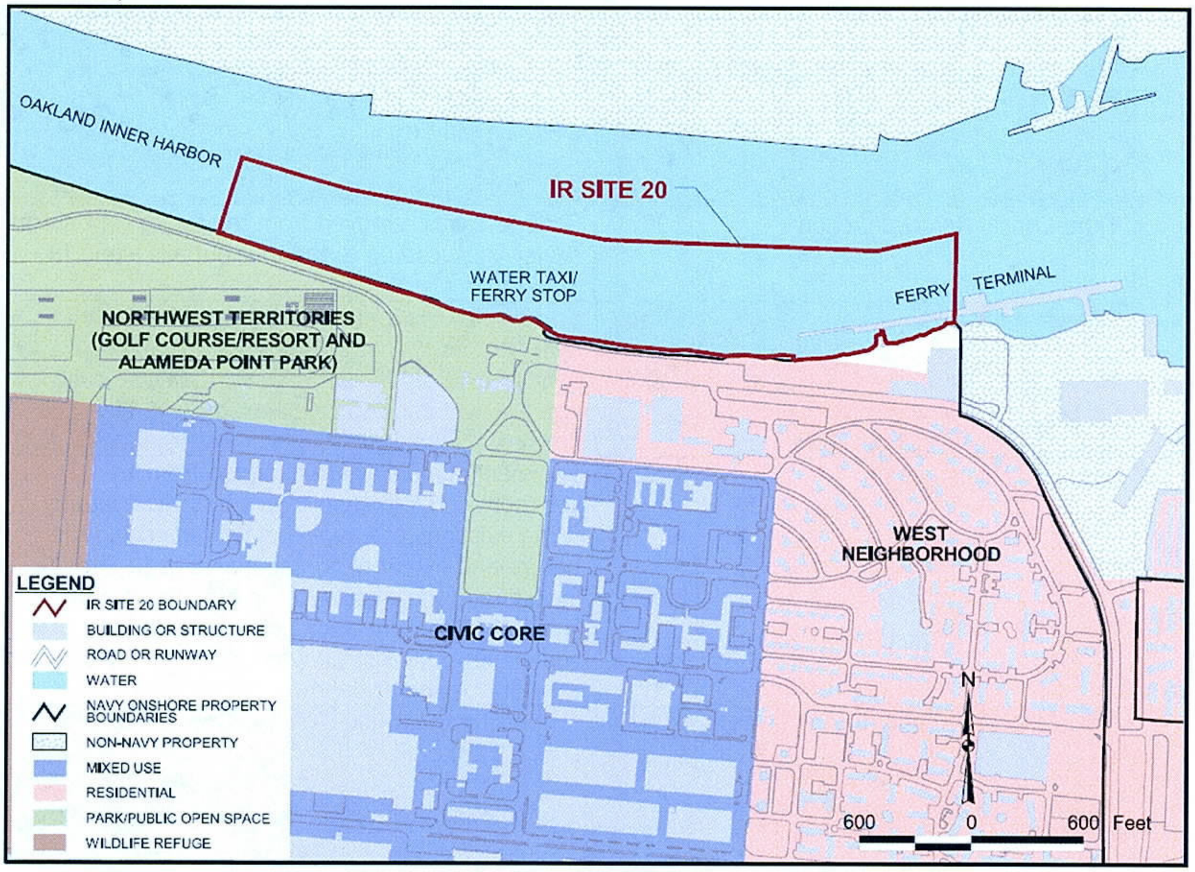
Previous Study/Investigation*	Date	Investigation Activities
Ecological Assessment of Alameda Point	1993-1994	Four surface sediment samples were collected for chemical and toxicity analyses. Based on sediment and tissue chemistry data and bioassay results, it was recommended that additional data be collected from IR Site 20.
Time-Critical Removal Action	1997	Sediment was removed from the upgradient storm sewer lines leading to the four outfalls along IR Site 20.
Sediment Sampling Event	2001	Surface sediment samples were collected and evaluated to characterize the nature and extent of indicator contaminants. Results indicated that contaminant concentrations were generally consistent with San Francisco Bay ambient levels.
Remedial Investigation	2005	Sediment samples were analyzed from 14 sediment cores to supplement historical data by filling existing data gaps and characterizing the nature and extent of contaminants at IR Site 20, including in the vicinity of the outfalls. The RI found that concentrations of chemicals in sediments at IR Site 20 were relatively uniform in the surface and at depth.
Remedial Investigation Report	2007	The RI Report detailed physical site conditions and ecological setting and described the nature and extent of sediment contaminants. The report also presented the ecological and human health risk assessments, which identified no unacceptable risks for any of the ecological receptors at IR Site 20 and determined that human health risks from direct contact with sediment and consumption of fish and shellfish were consistent with risk from ambient conditions. Based on this information, no further action was recommended for IR Site 20.

*The documents listed above are available in the Administrative Record and provide detailed information used to support the remedy selection at IR Site 20.

2.4 Current and Potential Future Site Uses

There are no land-use restrictions for IR Site 20, which is on the southern side of the Oakland Inner Harbor Channel. Currently, the Oakland Inner Harbor Channel is a major industrial waterway. In accordance with the City of Alameda's Alameda Point General Development Plan, as amended in 2003, Oakland Inner Harbor will remain a viable shipping channel in the future. Figure 3 shows the planned reuse for property in the vicinity of IR Site 20, as specified in the Alameda Point General Development Plan.

FIGURE 3
Community Reuse Plan



2.5 Summary of Site Risks

Risk assessments were performed to assess current and potential future risk for human and ecological receptors at IR Site 20. The RI Report concluded, and regulatory agencies concurred, that no further action is necessary at IR Site 20 based on the results of the human health and ecological risk assessments, which are summarized in Table 3 and below.

As part of the CERCLA risk assessment process, the site risks associated with potential exposure to chemicals are compared to risks for reference stations that represent ambient conditions. In accordance with the **ambient data** sets used in the other Alameda Point offshore RI reports, the IR Site 20 RI Report used ambient data from a variety of sources. As part of the data evaluation at IR Site 20, site risks associated with potential exposure to chemicals in sediment were compared with ambient risks from reference stations throughout the San Francisco Bay.

TABLE 3: SUMMARY OF RISK ASSESSMENT CONCLUSIONS FOR IR SITE 20

Assessment Endpoint	Summary of Risk Characterization	Conclusions
	HUMAN HEALTH RISK ASSESSMENT	
Direct Contact	• HQs all below 1. • Cancer risks were either below 10^{-6} or comparable to reference conditions.	No unacceptable risks associated with direct contact exposures
Adult – shellfish ingestion	• HQs all below 1. • Cancer risks were either below 10^{-6} or comparable to reference conditions.	No unacceptable risks associated with shellfish ingestion exposures.
Adult – finfish ingestion	• HQs all below 1 or comparable to reference conditions. • Cancer risks were either below 10^{-6} or comparable to reference conditions.	No unacceptable risks associated with fish ingestion exposures.
	ECOLOGICAL RISK ASSESSMENT	
Benthic Invertebrate Community AE(1)	• Limited toxicity observed in the 1993/94 bioassays likely associated with ammonia or other confounding factors. • Based on 2005 results, most sediment concentrations below effects range-median and ambient concentrations.	No unacceptable risk posed to AE(1) at IR Site 20.
Fish Community AE(2)	None of the modeled fish tissue concentrations exceeded the NOAEL or LOAEL ecotoxicity reference value for any constituent.	No unacceptable risk posed to AE(2) at IR Site 20.
Avian Community AE(3) – surf scoter	• Lead, chromium, and DDx were the only chemicals with low TRV exceedances. • For lead, there were no exceedances of the high TRV and risks appear comparable to ambient. • Neither chromium nor DDx were above the low TRV in the 2005 data set.	No unacceptable risk posed to AE(3) at IR Site 20.
Avian Community AE(3) – least tern	• No exceedance of high TRVs at realistic SUFs. • Risks generally comparable to ambient. • Small exposure areas relative to total foraging area.	No unacceptable risk posed to AE(3) at IR Site 20.
Avian Community AE(3) – double-crested cormorant	• No exceedance of high TRVs at realistic SUFs. • Risks generally comparable to ambient. • Small exposure areas relative to total foraging area.	No unacceptable risk posed to AE(3) at IR Site 20.

Acronyms:

AE – assessment endpoint
DDx – sum of the pesticides DDT, DDE, and DDD
HQ – hazard quotient
LOAEL – low observed adverse effects level
NOAEL – no observed adverse effect level
SUF – site-use factor
TRV – toxicity reference value

The Water Board established ambient threshold values (ambient background values) for chemicals in San Francisco Bay based on sediments collected from the least impacted portions of the Bay, located away from point and nonpoint sources of chemical contamination, in 1998, as presented in *Ambient Concentrations of Toxic Chemicals in Sediments*. The Water Board values in this document represent a point estimate of ambient conditions. However, the Tier 2 screening in the baseline ecological risk assessment involves comparison of the concentration distributions observed on-site to ambient distributions using distribution shift tests. For the purpose of developing the ambient distribution, sediment chemistry results collected by the Bay Protection and Toxic Cleanup Program (BPTCP) and the San Francisco Estuary Institute (SFEI) Regional Monitoring Program (RMP) were evaluated. Specifically, all available sediment chemistry results from 1993 through 1997 from stations classified as ambient in the Ambient Sediment Chemistry report were used. The BPTCP stations were Paradise Cove, San Pablo Bay Island #1, San Pablo Bay Tubbs Island, North South Bay, and South South Bay. The RMP stations were Alameda, Davis Point, Dumbarton Bridge, Grizzly Bay, Honker Bay, Horseshoe Bay, Oyster Point, Pacheco Creek, Petaluma River, Pinole Point, Point Isabel, Red Rock, Richardson Bay, Sacramento River, San Bruno Shoal, San Joaquin River, San Pablo Bay, South Bay, and Yerba Buena Island. For constituents that were not analyzed by the RMP or BPTCP, reference data collected at ten San Francisco Bay reference sites during the 1998 Alameda Point field sampling effort and the 2001 Hunters Point Shipyards Parcel F Validation Study were used.

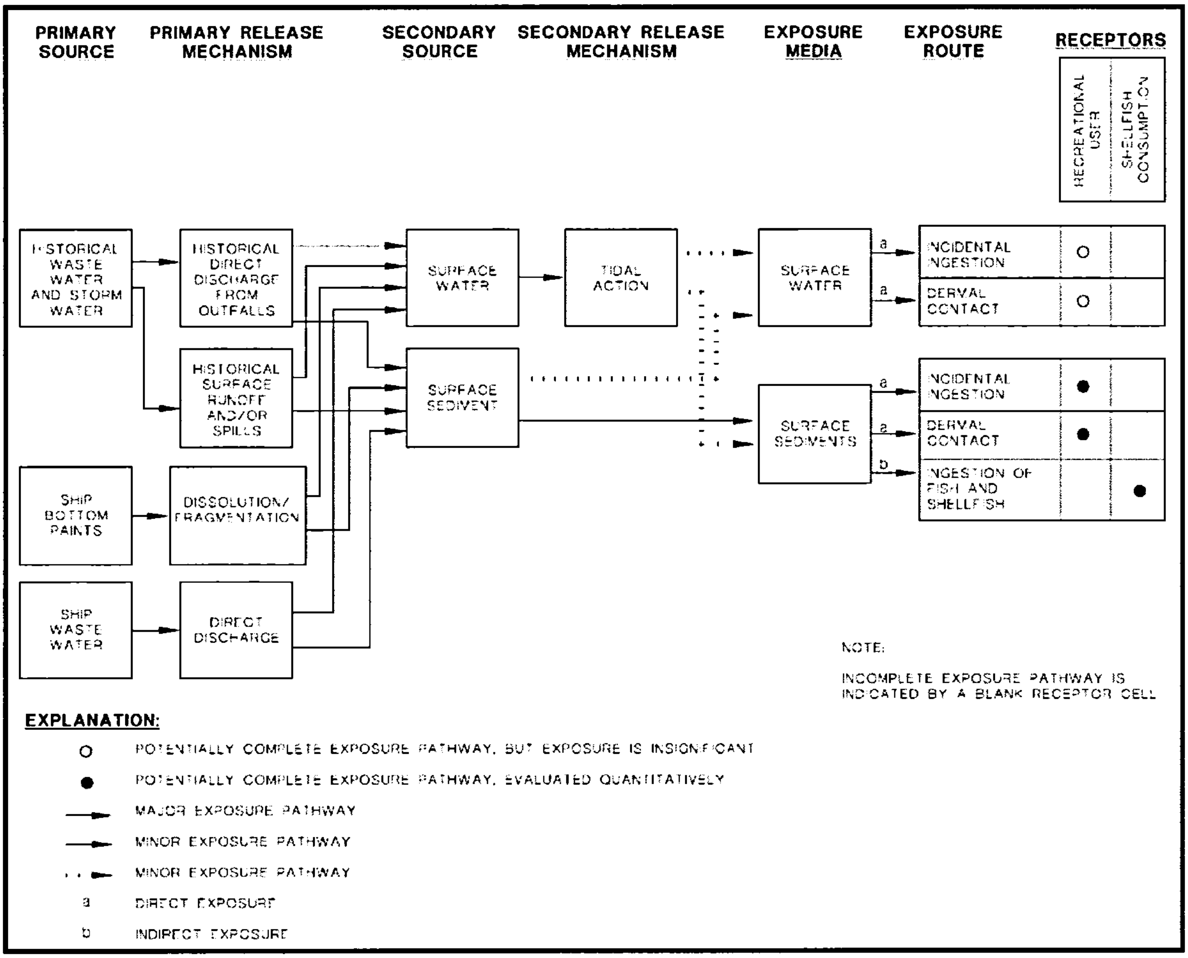
2.5.1 Human Health Risk Assessment

A **human health risk assessment** was performed for IR Site 20 as part of the evaluation in the RI Report. The human health risk assessment was conducted in accordance with EPA and DTSC guidance. The risk assessment was designed to provide a margin of safety to protect human health by using conservative assumptions so that risks were not underestimated. For the human health risk assessment, all historical data (sediment and tissue) as well as the RI data were used to identify chemicals of potential concern. Chemicals (including metals) that were detected at least once in any historical or RI sample (sediment or tissue) were selected as chemicals of potential concern for the risk assessment. The human health risk assessment calculated both the reasonable maximum exposure (RME) and central tendency exposure (CTE) risks. Due to the use of historical surface sediment data and multiple conservative assumptions, the CTE likely represents a more typical risk.

The exposure pathways in the risk assessment are based on current exposure scenarios and reasonable future exposure scenarios. The human health risk assessment conceptual site model (CSM) is shown on Figure 4.

IR Site 20 is located within a heavily industrialized area and is publicly accessible. It was assumed for risk assessment purposes that shellfish observed along the shoreline areas were accessible to people who could harvest and consume them. Fishing and ingestion of catch also was considered a complete exposure pathway. In addition, exposure to chemicals through dermal (skin) contact and through incidental ingestion of sediment were evaluated. The risk assessment included assessment of potential risks to children, including direct contact with sediment and fish ingestion.

FIGURE 4
Human Health Risk Assessment Conceptual Site Model



Cancer risk is expressed as a statistical probability that an individual could have an increased risk of cancer incidence. A 1 in 10,000 chance is a risk of 1×10^{-4}. For every 10,000 people, one additional cancer case may occur as a result of exposure. A 1 in 1,000,000 chance is expressed as 1×10^{-6}. In this case, for every 1,000,000 people, one additional cancer case might occur as a result of exposure. Therefore, a 1×10^{-4} cancer risk is a higher risk than 1×10^{-6}. In accordance with EPA guidance, the risk management range is 10^{-4} to 10^{-6}. The risk management range was established by EPA to set guidelines for making risk management decisions. EPA guidance states "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} and the noncarcinogenic hazard quotient (HQ) is less than 1, action generally is not warranted unless there are adverse environmental impacts." Site-specific factors are typically considered at sites where the cancer risks are in the 10^{-4} to 10^{-6} range to evaluate whether the estimated risk is acceptable. Risks below 10^{-6} are generally considered insignificant (acceptable), and no action is required. For noncancer adverse health effects, an HQ is calculated. An HQ of 1 or greater indicates that a lifetime of exposure may have the potential to cause adverse health effects. The HQ is based upon effects of a single chemical. To express health effects for multiple chemicals, the individual HQs are added together to obtain the hazard index (HI).

The average surface sediment concentrations for the historical and RI samples at IR Site 20 were compared to ambient values for San Francisco Bay for chemicals that were primary contributors to the risk estimates (Table 4). Total cancer and noncancer risks to human health from IR Site 20 sediments were found to be similar to risks associated with ambient conditions at the reference stations. For metals, arsenic was the primary contributor to risk, and for organic chemicals, PCBs were the primary contributor to risk. The average IR Site 20 surface sediment concentrations for arsenic and total PCBs were lower than the ambient concentrations (arsenic at 5.93 milligrams per kilogram [mg/kg] compared to the ambient concentration of 15.3 mg/kg, and total PCBs at 0.157 mg/kg compared to the ambient concentration of 0.200 mg/kg). Arsenic is a naturally occurring substance, ubiquitous in the Bay Area, and neither the Oakland Inner Harbor nor San Francisco is included on the Clean Water Act 303(d) list as impaired by arsenic. Additionally, the calculated risk and hazard from arsenic in fish and shellfish likely overestimates the actual risk because of the conservative assumption that all the arsenic present is in the more toxic inorganic form. Because site risks were often lower than ambient risks, incremental risk (total site risk minus risk associated with ambient conditions) was not calculated.

The following total HI values include metals present at ambient concentrations. For the direct contact with sediment pathway for both adults and children, the total HI (CTE and RME) for the All Years data set was less than 1. For the shellfish ingestion pathway, the total HI (RME) for the All Years data set was 1.39 compared to 0.93 for the more recent RI samples, and the HI (CTE) for the All Years data set was 0.1. The fish ingestion pathway HI (CTE and RME) exceeded 1, but was comparable to ambient values at the reference locations. In addition to metals, PCBs were the other major risk driver for the total HI values. The maximum total PCBs concentration in IR Site 20 surface sediment samples collected during the RI was 0.095 mg/kg. The average total PCBs concentration in IR Site 20 surface sediment collected in all years since 1993 is 0.157 mg/kg. Both of these IR Site 20 PCB concentrations are below ambient values and well below the total PCBs remedial goal used at other Alameda offshore sites of 1.13 mg/kg.

To summarize, as shown in Table 3, for direct contact with sediment, ingestion of fish and shellfish, and incidental ingestion of sediment, cancer risks were either lower than 10^{-6} or comparable to ambient conditions. For noncancer risks, HQs were either less than 1 or comparable to ambient conditions. Total cumulative risks for all exposure scenarios were comparable to or less than the risks for ambient conditions. The human health risk assessment concluded that there are no unacceptable risks at IR Site 20.

TABLE 4: SURFACE SEDIMENT CONCENTRATIONS COMPARED TO AMBIENT CONCENTRATIONS

Chemical Name	Average Concentration mg/kg	Ambient Concentration* mg/kg
Arsenic	5.93	15.3
Lead	40.1	43.2
4,4'-DDD	0.0057	None
4,4'-DDE	0.0025	None
4,4'-DDT	0.0213	None
Total PCBs	0.157	0.2

Note:
* ambient concentrations used to describe the distribution of chemicals in sediment (not used in risk assessment)

Acronym/Abbreviation:
mg/kg – milligrams per kilogram

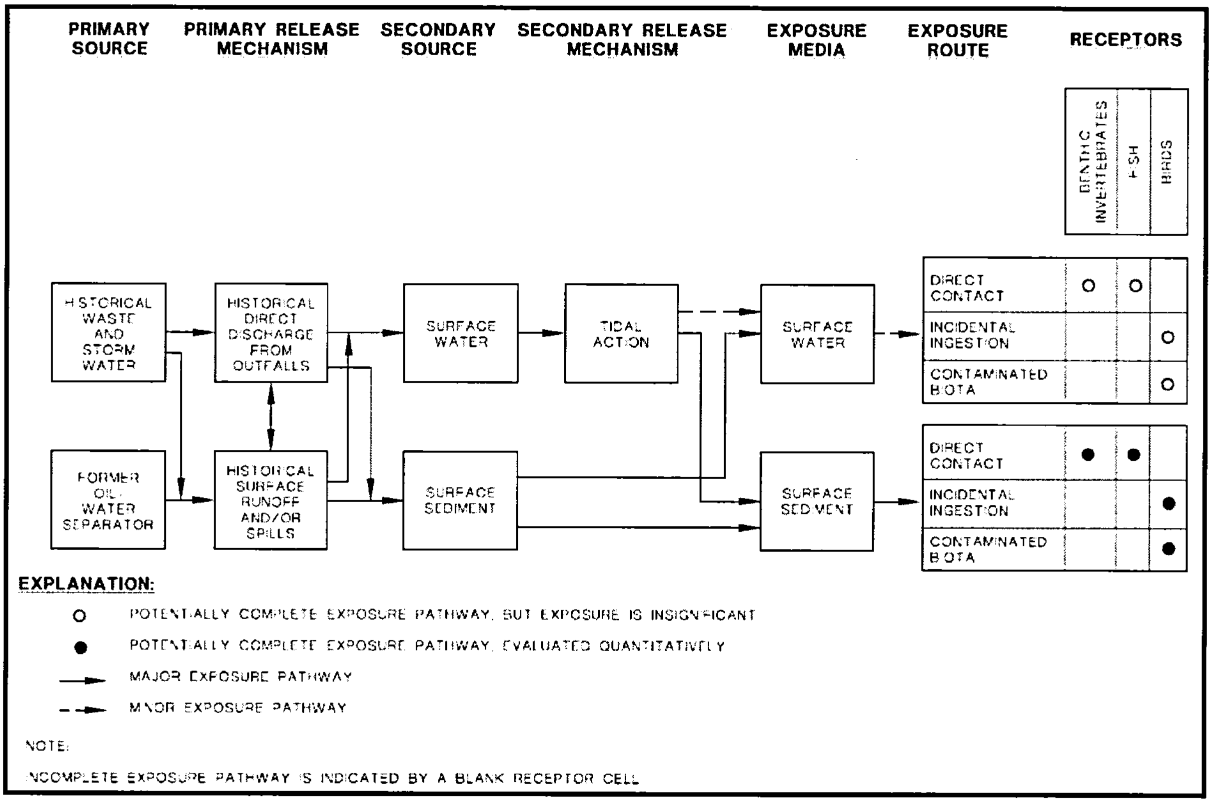
2.5.2 Ecological Risk Assessment

The **ecological risk assessment** presented in the RI Report used a tiered approach following EPA and DON guidelines, to estimate potential risk from chemicals at IR Site 20 to ecological receptors including benthic invertebrates, fish, and foraging birds. The risk assessment for the birds included evaluation of the least tern, surf scoter, and double-breasted cormorant (Table 3). The ecological risk assessment evaluated IR Site 20 data from chemical analysis of sediment, sediment toxicity tests, and tissue analysis from clams exposed to IR Site 20 sediment in laboratory studies. The ecological risk assessment CSM is shown on Figure 5.

The first tier of the ecological risk assessment is a screening-level risk estimate. The Tier 1 assessment uses conservative assumptions to estimate exposure and effects to potential ecological receptors, with the purpose of determining whether a site-specific baseline ecological risk assessment is necessary. The Tier 1 assessment compared exposures based on maximum concentrations of historical sediment data, as well as RI data, to conservative threshold values. The results of the Tier 1 risk assessment indicated that the potential risk to ecological receptors should be further evaluated in a site-specific baseline ecological risk assessment.

The baseline ecological risk assessment (Tier 2) used more typical exposure factors and site-specific data. Metals, PCBs, pesticides, and PAHs were evaluated. The site-specific laboratory toxicity tests showed that survival, growth, and development of benthic invertebrates were not adversely affected. The toxicity tests also showed that sediments were not toxic to benthic invertebrates. Estimated fish tissue concentrations were below protective screening values, showing that there is no unacceptable risk to fish. Risk estimates for foraging birds such as the least tern were low and similar to ambient risk estimates. The ecological risk assessment concluded that there are no unacceptable risks to ecological receptors at IR Site 20.

FIGURE 5
Ecological Risk Assessment Conceptual Site Model



2.5.3 Basis for No Further Action

No further action at IR Site 20 is proposed for the following reasons:

- Human health risks were determined to be consistent with ambient conditions or were less than 10^{-6} for cancer risk or an HQ of 1 for noncancer hazard.
- No unacceptable risk was identified for any of the ecological receptors at IR Site 20.

2.6 Principal Threat Waste

No principal threat wastes have been identified for IR Site 20. Principal threat wastes are source materials considered to be highly toxic, highly mobile, or those that would present a significant risk to human health or the environment should exposure occur.

2.7 Selected Remedy

The selected remedy for IR Site 20 is no further action. This determination is based on extensive field investigations, laboratory analyses, data evaluations, a review of current and future land use, and thorough assessment of potential human health risk and ecological risk. Results show that the site does not pose an unacceptable risk to human health or the environment.

2.8 Community Participation

A Community Relations Plan for Alameda Point was developed to document interests, issues, and concerns raised by the community regarding ongoing investigation and cleanup activities and to describe a specific program designed to address these issues and concerns. The initial plan for Alameda Point was prepared in February 1989 and was revised most recently in 2003. The revisions incorporated the most recent assessment of community issues, concerns, and informational needs related to the ongoing environmental investigation and remediation program at Alameda Point.

2.8.1 Restoration Advisory Board

In 1993, individuals from local communities began to play an increasingly significant role in the environmental restoration process with the establishment of the Alameda Point Restoration Advisory Board (RAB). Original membership in the board was solicited by the DON through newspaper notices and included business and homeowner representatives, residents, local elected officials, and regulatory agency staff.

The RAB currently consists of members of the DON, the community, and regulatory agencies. The RAB meetings occur monthly and are open to the public. Meetings are held in the evenings after normal working hours on the first Thursday of each month at Building 1, Room 140, at 950 West Mall Square at Alameda Point. RAB members also review and comment on technical documents.

The DON and regulators report information about IR Site 20, including the availability of site documents, to the RAB members during the monthly RAB meetings. Copies of the RAB meeting minutes and documents describing environmental investigations and removal actions are available at the following Alameda Point information repository and Administrative Record file locations:

Alameda Point Information Repository
950 West Mall Square
Building 1, Room 240
Alameda, California 94501

Administrative Record
Naval Facilities Engineering Command, Southwest
937 Harbor Drive, Building 1, 3rd Floor
San Diego, California 92132

The Alameda public library will also maintain new DON environmental documents during review periods. The Alameda public library is located at 1550 Oak Street, Alameda, CA 94501. RAB meeting minutes also are available at the **DON BRAC Program Management Office website** at http://www.bracpmo.navy.mil.

2.8.2 Public Mailings

Public mailings, including information updates, fact sheets, and Proposed Plans, have been used to ensure a broad distribution of information throughout the local community. Since March 1990, information updates announcing the program process at IR Site 20 have been delivered to residents living near Alameda Point and Fleet and Industrial Supply Center Oakland, Alameda

Facility/Alameda Annex and mailed to city, state, and federal officials; agencies; local groups; and individuals identified in the Community Relations Plan. Updates and fact sheets have included information concerning:

- status of environmental investigations,
- removal action activities,
- remedy selection process,
- opportunities for the public to participate in the investigation and remediation,
- history and geology of the area, and
- access to the Administrative Record for Alameda Point.

Proposed Plans provide an overview of environmental investigation results (including ecological and human health risk assessment results), present remedial alternatives for a site or group of sites (if applicable), and describe the preferred alternative. The updates, fact sheets, and Proposed Plans are mailed to between 400 and 1,400 households, businesses, public officials, and agencies in an effort to reach community members. These public documents related to basewide information or IR Site 20 are summarized in Table 5.

TABLE 5: SUMMARY OF ALAMEDA POINT FACT SHEETS, NEWSLETTER, AND PROPOSED PLAN RELATED TO IR SITE 20

Date	Title
March 1990	Fact Sheet 1: Remedial Investigation/Feasibility Study Update
September 1990	Fact Sheet 2: Remedial Investigation/Feasibility Study Update
May 1991	Fact Sheet 3: Remedial Investigation/Feasibility Study Update
March 1993	Fact Sheet 4: Installation Restoration Program Update
May 1995	Fact Sheet 5: Base Realignment and Closure Cleanup Plan
August 1995	Fact Sheet 6: Waterfront Actions
June 1996	Fact Sheet 7: History and Geology
December 1996	Fact Sheet 8: Naval Air Station Alameda Continues to Clean Up the Waterfront
Winter 2005	Alameda Point Focus Newsletter #3
February 2008	Proposed Plan for Installation Restoration Site 20, Former NAS Alameda

2.8.3 Community Participation at IR Site 20

A summary of the IR Site 20 RI Report was presented to the RAB in April 2007. The RI Report for IR Site 20 was finalized in August 2007. The Proposed Plan for IR Site 20 was released to the public in February 2008, at the beginning of the public comment period to provide information and solicit public input on the DON's recommended remedy. These documents are available to the public at the information repository maintained at Alameda Point and in the Administrative Record file maintained at the Naval Facilities Engineering Command, Southwest, located in San Diego, California. The information repository also contains a complete **index of the Administrative Record file.**

A 30-day public comment period for the IR Site 20 Proposed Plan extended from February 19, 2008 through March 20, 2008. In addition, a public meeting was held on March 12, 2008. A notice of the public comment period and public meeting was published in the *Alameda Journal* and in the *Oakland Tribune.*

At the public meeting, the BRAC Environmental Coordinator and the DON Project Manager were available to discuss IR Site 20 and describe the selected remedy. Representatives from the DON and environmental regulatory agencies were available to answer questions. A court reporter prepared a transcript of the meeting. Responses to comments that were received during the public comment period are included in the Responsiveness Summary as part of this ROD.

3 Responsiveness Summary

The participants in the public meeting held on March 12, 2008, included representatives of the DON, EPA, DTSC, and Water Board. The **meeting transcript** is included as part of this ROD. No questions or concerns were received during the public meeting. Responses to comments received during the public comment period are included in the Responsiveness Summary as part of this ROD.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
1	**the former NAS Alameda, now referred to as Alameda Point**	**Section 2.1**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 2.1, Page 2-1. Battelle 2007.
2	**IR Site 20**	**Section 2.1**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 2.1.1, Pages 2-1 through 2-2, Figures 2-2 and 2-3. Battelle 2007.
3	**removal action**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 2.1.1, Page 2-2, Figure 2-3. Battelle 2007.
4	**remedial investigation**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Sections 1.0 through 1.1, Page 1-1. Battelle 2007.
5	**sediment data**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Tables 4-1 through 4-4, Figure 2-6. Battelle 2007.
6	**tissue data**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Tables 5-1, 5-3, 5-5, 5-7, 5-9, 5-10, 5-12, 5-14, and 5-16. Battelle 2007.
7	**ambient data**	**Section 2.5**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 4.1.2, Pages 4-3 and 4-4; Figures 4-1 and 4-2. Battelle 2007.
8	**human health risk assessment**	**Section 2.5.1**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 7, Pages 7-1 through 7-13; Figure 7-1; Tables 7-1, and 7-3 through 7-15. Battelle 2007.
9	**ecological risk assessment**	**Section 2.5.2**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 6, Pages 6-1 through 6-26, 6-29 through 6-34, 6-36 through 6-41, and 6-44; Figures 6-1 through 6-3, and 6-5; Tables 6-1 through 6-5, 6-7, 6-9 through 6-15, 6-21, 6-22, 6-24 through 6-32; Appendix C. Battelle 2007.
10	**DON BRAC Program Management Office website**	**Section 2.8.1**	http://www.bracpmo.navy.mil
11	**index of the Administrative Record file**	**Section 2.8.3**	Alameda Point NAS Draft Administrative Record File Index. Pages 1 through 58.
12	**meeting transcript**	**Section 3**	Public Meeting Transcript, March 12, 2008, Public Comment Period for Proposed Plan for IR Site 20, Former NAS Alameda, Alameda, California.

[1]**Bold blue text** indicates hyperlinks available on the ROD's reference CD to detailed site information that also is contained in the publicly available Administrative Record. For access to information contained in the Administrative Record for Former NAS Alameda, please contact: Administrative Record, Naval Facilities Engineering Command, Southwest, Attn: Ms. Diane Silva, 937 Harbor Drive, Building 1, 3rd Floor, San Diego, California 92132, phone: (619) 532-3676

Comments by Mr. Patrick Lynch, Community Member:

Comment No. 1: A Feasibility Study should be conducted at Site 20 to determine the most effective remedy to address sediments contaminated with bioaccumulative toxic substances before these toxic substances are introduced into the food chain.

Response No. 1: A comprehensive baseline ecological risk assessment was conducted at Installation Restoration (IR) Site 20 that included toxicity testing of sediment and tissue analysis of clams exposed to IR Site 20 sediment. The results of the ecological risk assessment show that there are no unacceptable risks to any of the ecological receptors at IR Site 20, including risk associated with bioaccumulative chemicals.

Comment No. 2: The sediment at Site 20 was sampled at depths consistent with sediment accretion during the last 25 years rather than at depths that would correspond to sediment accretion from World War II to the present. The investigation therefore failed to sample sediment at sufficient depth to detect contamination or determine the full depth of contamination.

Response No. 2: The depth for the sediment sampling was discussed with the regulatory agencies during the development of the remedial investigation work plan. The agreed upon depths took into account the estimated sedimentation rates and the site history. The analytical results of the IR Site 20 sediment sampling did not show an increasing trend of contaminant concentrations with depth. For example, for total polychlorinated biphenyls (PCBs), total DDx (the sum of the pesticides DDT, DDE, and DDD), and total polycyclic aromatic hydrocarbons (PAHs) (including light PAHs and heavy PAHs), the maximum concentrations in the 25–50 cm depth interval were all lower than in the maximum concentrations in the previous depth interval. In addition, the sediment investigations at IR Site 20 used the same depth characterization as used at the other sediment sites at former Naval Air Station (NAS) Alameda, which has been successful in identifying contaminated sites, such as IR Site 17, the Seaplane Lagoon.

Comment No. 3: The Proposed Plan does not provide a determination of whether additional action is necessary for contaminated sediment at depths greater than 1.5 feet.

Response No. 3: Similar to Comment 2, the sediment depth is considered appropriate, and investigations at IR Site 20 used the same depth characterization as has been used at the other sediment sites at former NAS Alameda, which has been successful at identifying contaminated sites. The IR Site 20 Proposed Plan is for no further action for the entire IR Site 20, without depth restrictions.

Comment No. 4: The conclusion of the Proposed Plan that fish caught from the shores of Site 20 are safe to eat contradicts the fish advisory issued by Cal-EPA's Office of Environmental Health Hazard Assessment. Any modeling of PCB concentrations from sediment-to-food-fish at Site 20 that concluded no impact to human health is a flawed model. Fish in San Francisco Bay contain unsafe levels of PCBs because contaminated sediments at Site 20 and other toxic hot-spots are left unaddressed for decades, or as proposed for Site 20, are never addressed.

Response No. 4: As specified in the Final RI Report and summarized in the Proposed Plan, the concentrations of contaminants at IR Site 20 do not warrant further action based on the results of both the human health and ecological risk assessments. The Proposed Plan states that the risks to human health are similar to risks associated with ambient conditions at the reference locations located throughout San Francisco Bay. The fish advisory issued by California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) is applicable throughout San Francisco Bay and is not based on the sediment concentrations at IR Site 20.

The IR Site 20 human health risk assessment shows that the risks associated with the direct contact with sediment pathway are the lowest, with a risk of 3.87×10^{-7} for total PCBs for the reasonable maximum exposure scenario using both historical and the more recent RI data. This risk is lower than 10^{-6} risk, which is generally considered insignificant per EPA guidance. Toxicity testing of the sediment and tissue analysis conducted as part of the ecological risk assessment showed that the IR Site 20 sediment is not toxic.

Comment No. 5: The ambient concentration listed for PCBs contradicts San Francisco Bay Regional Water Quality Control Board's Staff Report on Total Maximum Daily Load for PCBs. The ambient concentration for PCBs listed in the Proposed Plan is a concentration the RWQCB associates with contaminated sites. The ambient PCB concentrations listed by the RWQCB are an order of magnitude lower than the value in the Proposed Plan. Why compare Site 20 sediment concentrations to sediment concentrations at a contaminated site to justify no further action?

Response No. 5: The ambient PCBs concentration presented in the Proposed Plan is the ambient concentration that the DON and regulatory agencies have determined is appropriate for this type of site evaluation. The Total Maximum Daily Load document's ambient values should not be compared to the RI Report's ambient values. The TMDL does not require any specific party to implement new actions for in-Bay PCB contaminated sites. The Water Board maintains a list of in-Bay contaminated sites with total PCBs in sediment that exceed 0.180 mg/kg. Even though the TMDL does not set a cleanup goal for sediment, PCB concentrations in the RI surface sediment samples collected at IR Site 20 are less than those in the Water Board list of in-Bay PCB contaminated sites. While the TMDL document has been adopted by the Regional Water Board, it still must be approved by the State Water Resources Control Board, the State Office of

Administrative Law, and U.S. EPA. The value listed in the Proposed Plan was used in the Nature and Extent of Contamination discussion in the RI Report to characterize the site concentrations relative to ambient concentrations. The human health and ecological risk assessment conclusions, however, were based on a comparison to the ambient risks at the reference locations. An ambient (reference) sampling location is typically located in the least impacted portions of the Bay, away from point and non-point sources of contaminants. The IR Site 20 PCB risks were comparable to those at the reference locations throughout San Francisco Bay, and concentrations of PCBs in the RI samples were well below the PCBs remedial goal used in other Alameda offshore sites. Both the Final RI Report and the Proposed Plan were reviewed and approved by federal and State regulatory agencies.

Comment No. 6: The Site 20 investigation does not appear to specifically address the potential impact of an illegal discharge that occurred during the time critical removal action at Site 5 in November 1998. The Site 5 removal action was performed in an unsafe manner that ultimately led to the discharge of a large volume of groundwater containing radioactive waste and other contamination to storm drains with an outfall at Site 20.

Response No. 6: No "illegal discharge" occurred during the time-critical removal action at IR Site 5, and there was no release into IR Site 20.

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1	**the former NAS Alameda, now referred to as Alameda Point**	**Section 2.1**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 2.1, Page 2-1. Battelle 2007.

2.0 SITE CHARACTERIZATION

This section describes the history of Alameda Point and areas under investigation, the physical and ecological setting, and provides a summary of the previous environmental investigations conducted at these sites. A summary of all available data for the sites is provided in Appendix A.

2.1 Site History and Description

Alameda Point is located on the western end of Alameda Island, which lies on the eastern side of San Francisco Bay, adjacent to the City of Oakland (Figure 2-1). The former NAS Alameda is rectangular, with dimensions of 2 miles long from east to west and 1 mile wide from north to south, and occupies 1,734 acres of land. The southwestern tip of the original Alameda peninsula was used as agricultural land prior to development as an industrial, ferry, and transit center in the late 1800s. From the 1850s, Alameda Point was used for whaling oil operations until 1869 when the Alameda Point Ferry was built (Department of Navy [DON], 1998). In the northern section of the point, railroad yards and rights-of-way for Southern Pacific, Central Pacific, and small local railways were built over the land and the sloughs.

The Army acquired the installation property from the City of Alameda in 1930 and began construction activities in 1931. In 1936, the Navy acquired the title to the land from the Army and began building NAS Alameda in response to the military buildup in Europe before World War II. After the United States entered the World War II in 1941, more land was acquired adjacent to the air station. Following the end of the war, Alameda Point returned to its original primary operation: to provide facilities and support for fleet aviation activities. The land use of Alameda Point consisted of a runway area in the extreme western end of the island, an industrial area in the central portion, and residential and personnel support areas on the northeastern and eastern portions. Table 2-1 presents a summary of development and potential historical sources and releases to the offshore sites.

In September 1993, NAS Alameda (including Naval Aviation Depot [NADEP]) was selected for closure by Congress. NADEP ceased operations in September 1996, and NAS Alameda officially closed on April 25, 1997. Navy staff currently at Alameda Point consists of civilian personnel involved with the cleanup and reuse of the former NAS Alameda.

Under the Community Reuse Plan for Alameda Point, prepared for the Alameda Reuse and Redevelopment Authority (ARRA) and dated January 1996 (ARRA, 1996), IR Site 20 will remain a viable shipping channel; therefore, it is likely that regular maintenance dredging will be conducted by the United States Army Corps of Engineers (USACE) and the Port of Oakland. Under the proposed reuse plan, IR Site 24 will be developed as a commercial marina along with the adjacent Seaplane Lagoon, with no plans to tear down the Piers. The area south of Pier 3 (Figure 2-2) is anticipated to be transferred to the California Department of Fish and Game (CDFG) as a marina.

2.1.1 IR Site 20

IR Site 20 is located on the southern side of the Oakland Inner Harbor Channel (Figure 2-2), adjacent to the northern shoreline of Alameda Point, and is managed under the Navy's IR Program.

IR Site 20 is defined as the 1,207-meter (m) portion of the Oakland Estuary adjacent to the northern boundary of former NAS Alameda. The Oakland Inner Harbor Channel is a major industrial waterway serving marine terminals and repair facilities in the cities of Oakland and Alameda. The shipping channel was dredged to a depth of 12 m below mean lower low water (MLLW) in 1993 (PRC Environmental Management, Inc. [PRC], 1994). A harbor deepening project has been funded for 2006 to deepen the inner harbor channel to depths of 15 m below MLLW to accommodate the latest generation of container

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vessels. Interim depths of 14 m below MLLW were dredged in 2005 (USACE, 2005; Port of Oakland, 2005).

The shoreline of the area is almost entirely modified by human activity, and a variety of industries are located along its length including port facilities, ship-building and repair facilities, sand and gravel off-loading areas, and marinas (PRC, 1994). IR Site 20 may also have been potentially impacted from the Navy's historical operations through wastewater, stormwater, ship wastewater discharge, fuel transfers, and the dissolution/fragmentation of ship bottom paints and creosote pilings. Stormwater and industrial wastes were discharged from NAS Alameda to IR Site 20 via a series of drains located along the shore (PRC, 1994). The storm sewer system at Alameda Point, designated as IR Site 18, served as a primary transport route for chemicals from industrial operations and for surface water runoff to reach the offshore sites. In 1975, the direct discharge of industrial wastewater through the storm sewer network was terminated and a pollution prevention program was initiated. In 1991, the Navy initiated several removal actions, designed to remove residual contaminated sediments from the sewer lines. Sediments from the upgradient storm-sewer lines leading to outfalls A, B, D, and E along IR Site 20 (Figure 2-3) were removed during a 1997 removal action. In Phase I of the removal action, sediments and debris were vacuumed from the storm-sewer catch basins; Phase II of the removal action included cleaning the system lines (Tetra Tech EM, Inc. [TtEMI], 1997). The effectiveness of these actions was documented through closed circuit television surveys, and the Navy issued a technical memorandum in February 2000 that removed Site 18 as a specific IR site (TtEMI, 2000).

2.1.2 IR Site 24

IR Site 24 is located along the southern edge of Alameda Point (Figure 2-2). The site consists of three piers located within the breakwall of Breakwater Beach which are currently being used to dock naval ships. The Navy began actively using the piers, which are constructed with concrete pilings/footings and walkways, in 1943 (Naval Energy and Environmental Support Activity [NEESA], 1983). A single layer of treated wood pilings spaced every 1.5 m and extending 0.6 m from the piers runs along the perimeter of the piers and quay walls. Piers 2 and 3 were routinely used to berth nuclear-powered surface ships as well as occasional nuclear-powered submarines (DON, 2000). Radioactive repair work was routinely conducted within the nuclear spaces of these ships, and not on the piers.

Three storm-sewer outfalls lead into IR Site 24 (Figure 2-3). System lines J and K discharge into the northeastern end of IR Site 24 between Piers 1 and 2, and line L discharges between Piers 2 and 3. Line J served buildings within Parcel 154 that were used as storage facilities supporting Alameda Point and Mare Island. It is suspected that potentially contaminated surface runoff may have discharged through this storm-sewer system (TtEMI, 2000). Building 167 was an aircraft hangar that stored various acids, alkalis, solvents, resins, and heavy metals in five above-ground dip tanks near the south wall of the building (TtEMI, 2000). Building 72B was used for chemical storage, and Building 555 was an electrical substation that stored minor amounts of oil. Building 340 was a fire protection pump house that had an associated underground storage tank used for diesel that since has been removed. The Storm-Sewer Study Report for Alameda Point, Alameda, California (TtEMI, 2000) identifies these buildings and the IR sites with which they are associated. Open spaces between buildings were used for temporary aircraft parking and chemical and equipment storage, which included hazardous material storage yards and an industrial dust silo. Sewer lines leading to outfall K and L have been replaced with polyvinyl chloride (PVC) piping in 1991, and line J was cleaned and inspected in 1991 (TtEMI, 1996).

The Navy reserve fleet is currently docked at the piers which are leased by the ARRA to Trident Corporation. Pier 1 is the smallest and northernmost of the three piers with a berth of 370 m that is designed to berth replenishment oiler and combat store ships. Pier 2 (the middle pier) has four berthing spaces with a total available space of 738 m. One of these spaces is reserved for fleet operations and is left vacant.

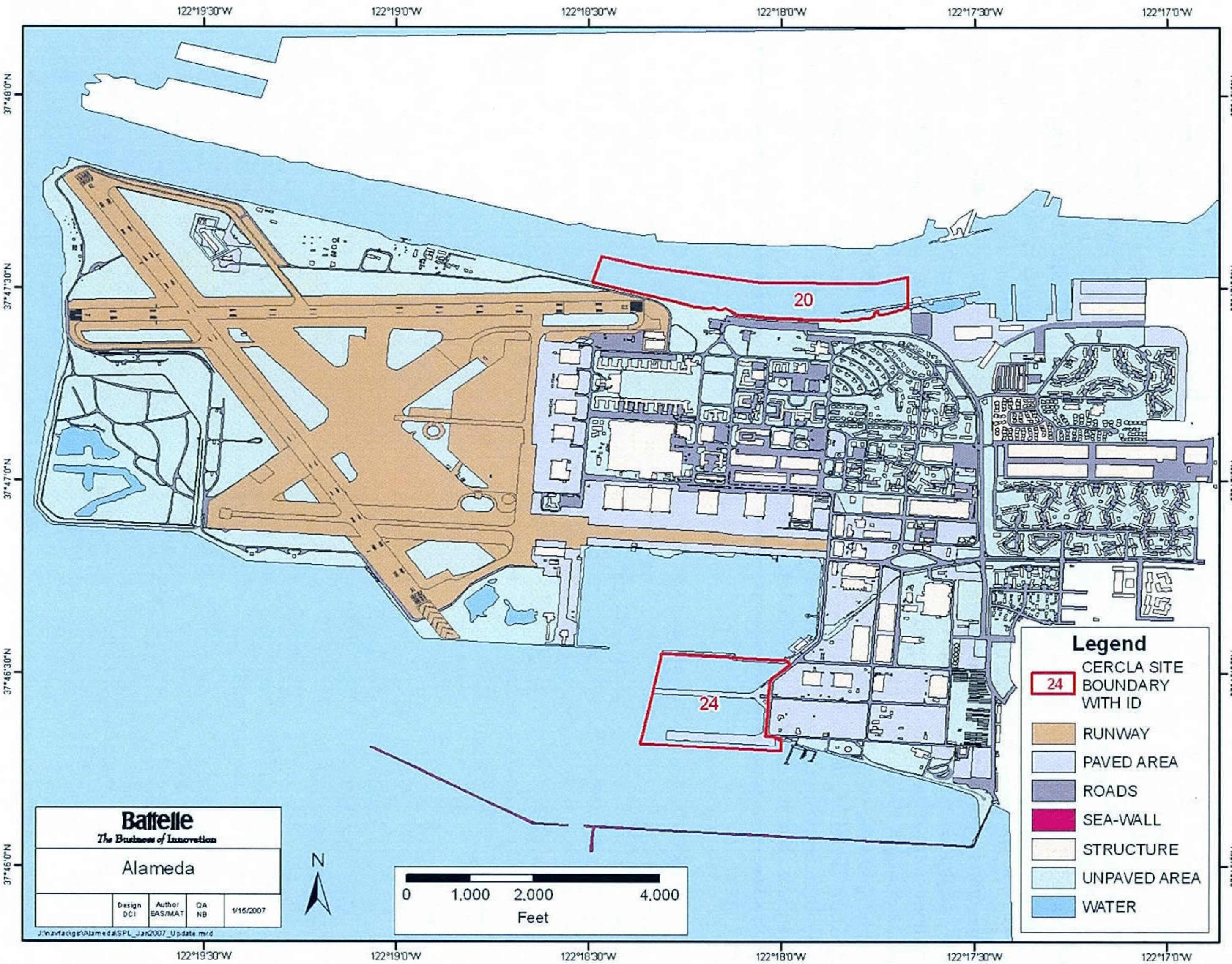

Figure 2-2. Alameda Point

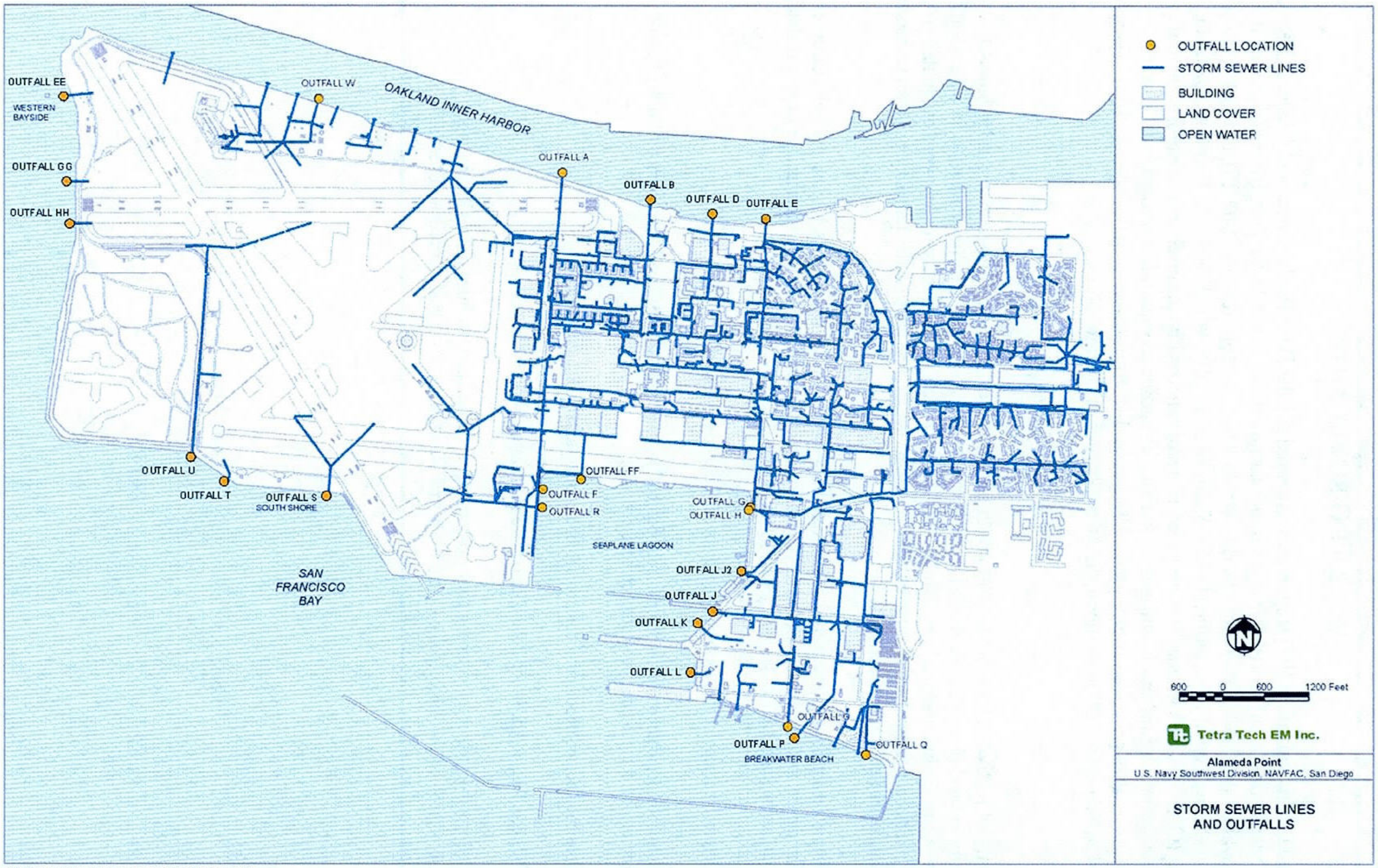

Figure 2-3. Storm-Sewer Lines and Outfalls at Alameda Point

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3	**removal action**	**Section 2.3**	**Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 2.1.1, Page 2-2, Figure 2-3. Battelle 2007.**

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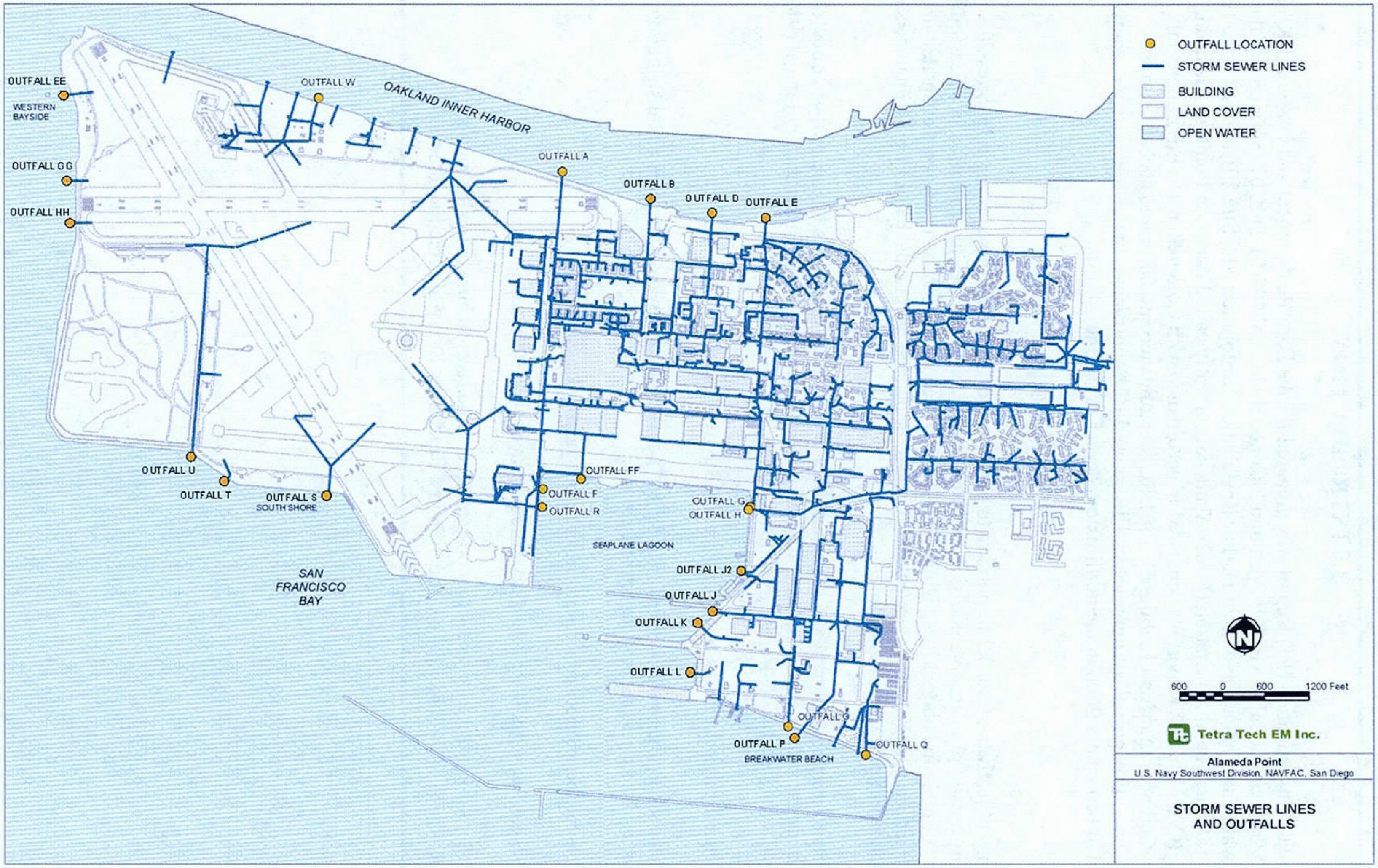

Figure 2-3. Storm-Sewer Lines and Outfalls at Alameda Point

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4	**remedial investigation**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Sections 1.0 through 1.1, Page 1-1. Battelle 2007.

1.0 INTRODUCTION

This Remedial Investigation (RI) Report was prepared for the Base Realignment and Closure (BRAC) Program Management Office (PMO) West under Contract No. N47408-01-D-8207 in support of the offshore evaluations at Oakland Inner Harbor (Installation Restoration [IR] Site 20) and Pier Area (IR Site 24), at former Naval Air Station (NAS) Alameda, currently called Alameda Point, in Alameda, California (CA). This RI Report was prepared in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance and takes into account current conditions as well as proposed future uses. This revised RI Report incorporates the nearshore sampling conducted in September 2006 in the northeastern corner of IR Site 24.

1.1 Objectives

The primary objectives of this RI Report are to characterize the quality of sediment at IR Sites 20 and 24, identify any area(s) of unacceptable risk, and delineate the area(s) requiring evaluation in a Feasibility Study (FS) of remedial alternatives. Both historical and recent sediment samples were evaluated in this RI Report to define the nature and extent of sediment-associated chemicals that may pose an unacceptable risk to human and ecological receptors.

This RI Report uses all sediment and biological data available for these sites for the purpose of determining the nature and extent of contamination as well as the potential for human and ecological risks. Specific objectives of this RI Report include the following:

- Describe the physical site conditions and ecological setting;
- Describe the nature and extent of sediment contaminants based on the chemical distributions determined through previous investigations;
- Present the methods and results of the ecological risk assessment;
- Present the methods and results of the human health risk assessment;
- Determine if there are areas that pose unacceptable risks to human health and the environment which require evaluation in a Feasibility Study of remedial alternatives.

1.2 Report Organization

This RI Report is organized as follows:

Section 1.0: Introduction

Section 2.0: Site Characterization. This section presents a summary of the site history for each IR area, physical setting, and historical information from previous investigations.

Section 3.0: Conceptual Site Model (CSM). This section provides information on known sources, possible transport mechanisms, and exposure media that will be used to conduct the ecological and human health risk assessments as part of this RI Report.

Section 4.0: Nature and Extent of Sediment Contamination. This section describes the distribution of chemicals present in sediment based on historical and recent investigations and includes a discussion of the background comparison tests.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
5	**sediment data**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Tables 4-1 through 4-4, Figure 2-5. Battelle 2007.

Table 4-1. Summary of Inorganic Constituent Results for Surface Sediment at IR Site 20

IR Site 20	1993/4			2001			2005			Threshold Values			
Analyte	D/N[(a)]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[(b)]	Ambient[(c)]	ER-M[(d)]	PRG Industrial[(e)]
Inorganic Constituents (mg/kg)													
ANTIMONY	4/4	21.33	37	10/10	0.363	5.41	8/14	[0.03]	0.47	2[(f)]	NA	25	410
ARSENIC	4/4	6.933	9.375	10/10	2.89	13.7	14/14	2.32	6.56	8.2	15.3	70	0.25
CADMIUM	3/4	[0.125]	0.9033	7/10	[0.0368]	0.3745	14/14	0.032	0.37	1.2	0.33	9.6	450
CHROMIUM	4/4	98.25	150	10/10	189	1230	14/14	20.5	86.9	81	112	370	450
COPPER	4/4	30.33	56	10/10	5.18	141	14/14	6.34	115	34	68.1	270	41000
LEAD	4/4	17	43	10/10	10.7	225.5	14/14	6.93	91.5	46.7	43.2	218	800
MERCURY	4/4	0.21	0.3825	10/10	0.0066	0.89	14/14	0.0419	8.83	0.15	0.43	0.71	310
NICKEL	4/4	48.75	74	10/10	17.2	288	14/14	12.7	61.4	20.9	112	51.6	20000
SELENIUM	0/4	[0.125]	[0.125]	9/10	[0.023]	0.471	0/14	[0.025]	[0.21]	0.7[(f)]	0.64	1.4	5100
SILVER	0/4	[0.25]	[0.25]	10/10	0.038	0.288	14/14	0.03	0.263	1	0.58	3.7	5100
ZINC	4/4	101.7	166.7	10/10	32.2	258	14/14	21.3	99.6	150	158	410	100000

NA = not applicable

Brackets indicate non-detected concentration at half the reported detection limit.

(a) D/N - Number of detected samples/total number of samples analyzed.

(b) Conservative ecological sediment screening benchmarks protective of benthic invertebrates and fish. Values represent the Effects Range-Low (ER-L) from Long et al., 1995, unless otherwise noted.

(c) Ambient values reflect data from the Bay Protection and Toxic Hotspot Cleanup Program (BPTCP), the SFEI RMP, and data from reference locations collected by Tetra Tech during the 1998 field sampling and by Battelle during 2001 sampling conducted for Hunters Point, unless otherwise noted.

(d) ER-M – Effects range-median from Long et al., 1995

(e) Preliminary remediation goals (PRG) reported by U.S. EPA (2004a), based on human health exposures to soil under an industrial exposure scenario. California-modified PRGs were listed when available.

(f) ER-L reported by Long and Morgan, 1991.

Table 4-2. Summary of Inorganic Constituent Results for Subsurface Sediment at IR Site 20

IR Site 20	0-5 cm			5-25 cm			25-50 cm			Threshold Values			
Analyte	D/N[a]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[b]	Ambient[c]	ER-M[d]	PRG Industrial[e]
Inorganic Constituents (mg/kg)													
ANTIMONY	8/14	[0.03]	0.47	8/14	[0.025]	5.18	9/14	[0.025]	20.9	2[f]	NA	25	410
ARSENIC	14/14	2.32	6.56	14/14	2.49	9.37	14/14	4.06	30.7	8.2	15.3	70	0.25
CADMIUM	14/14	0.032	0.37	14/14	0.058	0.898	14/14	0.149	1	1.2	0.33	9.6	450
CHROMIUM	14/14	20.5	86.9	14/14	24.1	91.1	14/14	33.3	105	81	112	370	450
COPPER	14/14	6.34	115	14/14	9.25	179	14/14	12.1	1290	34	68.1	270	41000
LEAD	14/14	6.93	91.5	14/14	7.67	109	14/14	5.37	1480	46.7	43.2	218	800
MERCURY	14/14	0.0419	8.83	14/14	0.0356	3.84	14/14	0.0095	12.3	0.15	0.43	0.71	310
NICKEL	14/14	12.7	61.4	14/14	15.7	65.3	14/14	25.3	72.4	20.9	112	51.6	20000
SELENIUM	0/14	[0.025]	[0.21]	0/14	[0.02]	[0.21]	2/14	[0.035]	0.54	0.7[f]	0.64	1.4	5100
SILVER	14/14	0.03	0.263	14/14	0.05	0.302	14/14	0.051	0.431	1	0.58	3.7	5100
ZINC	14/14	21.3	99.6	14/14	27.6	490	14/14	31.8	1800	150	158	410	100000

NA = not applicable
Brackets indicate non-detected concentration at half the reported detection limit.
(a) D/N - Number of detected samples/total number of samples analyzed.
(b) Conservative ecological sediment screening benchmarks protective of benthic invertebrates and fish. Values represent the Effects Range-Low (ER-L) from Long et al., 1995, unless otherwise noted.
(c) Ambient values reflect data from the Bay Protection and Toxic Hotspot Cleanup Program (BPTCP), the SFEI RMP, and data from reference locations collected by Tetra Tech during the 1998 field sampling and by Battelle during 2001 sampling conducted for Hunters Point, unless otherwise noted.
(d) ER-M - Effects range-median from Long et al., 1995.
(e) Preliminary remediation goals (PRG) reported by U.S. EPA (2004a), based on human health exposures to soil under an industrial exposure scenario. California-modified PRGs were listed when available.
(f) ER-L reported by Long and Morgan, 1991.

Table 4-3. Summary of Organic Chemical Results for Surface Sediment at IR Site 20

IR Site 20	1993/4			2001			2005			Threshold Values			
Analyte	D/N[(a)]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[(b)]	Ambient[(c)]	ER-M[(d)]	PRG Industrial[(e)]
Pesticides and PCBs (µg/kg)													
Total PCB[(g)]	4/4	172.5	4306	10/10	8.85	894.5	14/14	3.3	95.44	22.7	200[(h)]	180	NA
Total 4,4-DDx[(i)]	4/4	7.8	40.63	9/10	0.21	482	14/14	1.3	13.92	1.58	7	46.1	NA
Total DDx	NA	NA	NA	9/10	0.81	618.9	14/14	1.695	19.37	1.58[(f)]	7	46.1	NA
2,4'-DDD	NA	NA	NA	9/10	0.06	15.01	14/14	0.19	3.92	NA	NA	NA	10000
2,4'-DDE	NA	NA	NA	0/10	[0.27]	[0.53]	3/14	[0.015]	0.46	NA	NA	NA	7000
2,4'-DDT	NA	NA	NA	6/10	0.07	134.9	9/14	[0.025]	1.34	NA	NA	NA	7000
4,4'-DDD	4/4	4.067	22.37	9/10	0.1	45.29	14/14	0.57	9.54	2[(f)]	NA	20	10000
4,4'-DDE	3/4	[1.867]	16.2	9/10	0.05	11.8	14/14	0.37	3.55	2.2	NA	27	7000
4,4'-DDT	0/4	[1.867]	[2.988]	8/10	0.06	471.1	12/14	[0.02]	3.73	1	NA	7	7000
ALDRIN	0/4	[0.4683]	[0.6125]	0/10	[0.27]	[0.53]	0/14	[0.01]	[0.02]	0.2[(j)]	NA	NA	100
ALPHA-BHC	0/4	[0.4683]	[14.87]	0/10	[0.27]	[0.53]	0/14	[0.02]	[0.03]	0.6[(j)]	NA	NA	360
ALPHA-CHLORDANE	0/4	[0.4683]	[4.236]	9/10	0.04	3.14	6/14	[0.015]	0.66	0.5[(f)]	NA	6	6500
DIELDRIN	0/4	[9.333]	[43.67]	5/10	[0.27]	0.78	10/14	[0.015]	0.98	0.02[(f)]	0.44	8	110
ENDOSULFAN I	0/4	[0.9333]	[1.212]	0/10	[0.27]	[0.53]	0/14	[0.015]	[0.025]	0.93[(k)]	NA	NA	3700000
ENDOSULFAN II	0/4	[0.9333]	[1.212]	0/10	[0.27]	[0.53]	2/14	[0.055]	0.65	0.93[(k)]	NA	NA	3700000
ENDOSULFAN SULFATE	0/4	[0.9333]	[1.212]	0/10	[0.27]	[0.53]	0/14	[0.125]	[0.215]	NA	NA	NA	3700000
ENDRIN	0/4	[9.333]	[43.67]	0/10	[0.27]	[0.53]	0/14	[0.015]	[0.025]	0.02[(f)]	NA	45	180000
ENDRIN ALDEHYDE	0/4	[18.67]	[87.33]	3/10	0.23	13.43	0/14	[0.025]	[0.04]	NA	NA	NA	180000
GAMMA-BHC	0/4	[0.4683]	[16.11]	0/10	[0.27]	[0.53]	0/14	[0.015]	[0.025]	0.32[(l)]	NA	NA	1700
GAMMA-CHLORDANE	0/4	[0.4683]	[20.17]	2/10	[0.27]	2.15	7/14	[0.015]	0.95	0.5	NA	6	6500
HEPTACHLOR	0/4	[0.4683]	[0.6125]	0/10	[0.27]	[0.53]	0/14	[0.01]	[0.02]	NA	NA	NA	380
HEPTACHLOR EPOXIDE	0/4	[0.4683]	[0.6125]	0/10	[0.27]	[0.53]	0/14	[0.015]	[0.025]	NA	NA	NA	190
PAHs (µg/kg)													
2-METHYLNAPHTHALENE	0/4	[46.38]	[88.75]	10/10	0.32	22.12	14/14	0.27	15	70	19.4	670	NA
ACENAPHTHENE	1/4	[61.67]	113.9	10/10	0.11	62.82	14/14	0.26	20	16	26.6	500	29000000
ACENAPHTHYLENE	1/4	[61.67]	88.88	10/10	2.63	58.16	14/14	0.51	140	44	31.7	640	NA
ANTHRACENE	4/4	93.33	167.5	10/10	0.99	363.5	14/14	1.5	600	85.3	88	1100	100000000
BENZO(A)ANTHRACENE	4/4	140	300	10/10	13.6	797.5	14/14	3.5	1000	261	244	1600	2100
BENZO(A)PYRENE	4/4	228.3	548.5	10/10	20.34	1022	14/14	6.2	1200	430	412	1600	210
BENZO(B)FLUORANTHENE	4/4	283.3	677.5	10/10	14.1	837.6	14/14	6.6	650	NA	371	NA	2100
BENZO(G,H,I)PERYLENE	4/4	142.5	445	10/10	17.99	692.6	14/14	6	650	290[(m)]	310	NA	NA
BENZO(K)FLUORANTHENE	2/4	[61.67]	248.2	10/10	12.32	891.8	14/14	5	640	24[(j)]	258	NA	1300

Table 4-3. Summary of Organic Chemical Results for Surface Sediment at IR Site 20 (continued)

IR Site 20	1993/4			2001			2005			Threshold Values			
Analyte	D/N[(a)]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[(b)]	Ambient[(c)]	ER-M[(d)]	PRG Industrial[(e)]
CHRYSENE	4/4	191.7	622.5	10/10	15.73	1009	14/14	5.9	1300	384	289	2800	13000
DIBENZO(A,H)ANTHRACENE	1/4	[61.67]	96.88	10/10	1.52	175.8	14/14	0.75	120	63.4	32.7	260	210
DIBENZOFURAN	NA	NA	NA	NA	NA	NA	14/14	0.18	13	2290[(n)]	NA	NA	1600000
FLUORANTHENE	4/4	366.2	908.9	10/10	24.28	1426	14/14	7.4	2500	600	514	5100	22000000
FLUORENE	1/4	[31.33]	110.1	10/10	0.19	80.04	14/14	0.39	130	19	25.3	540	26000000
INDENO(1,2,3-CD)PYRENE	4/4	140	379.4	10/10	15.39	686.7	14/14	5.3	680	78[(n)]	382	—	2100
NAPHTHALENE	0/4	[46.38]	[88.75]	10/10	1.74	43.61	14/14	0.64	28	160	55.8	2100	4200
PERYLENE	NA	NA	NA	10/10	6.18	276.4	NA	NA	NA	NA	145	NA	NA
PHENANTHRENE	4/4	238.3	986	10/10	1.73	802.2	14/14	3.9	1600	240	237	1500	NA
PYRENE	4/4	406.7	1098	10/10	40.66	1504	14/14	9.4	3200	665	665	2600	29000000
Total LPAH (6)[(o)]	4/4	548	1492	10/10	8.18	1410	14/14	7.2	2513	NA	NA	NA	NA
Total HPAH (6)[(p)]	4/4	1425	3569	10/10	133.3	5934	14/14	33.15	9320	1700	3060	9600	NA
Organotins (µg/kg)													
TRIBUTYLTIN	4/4	25.5	37.5	NA	NA	NA	14/14	1.4	59	25.1[(q)]	NA	NA	180000

NA = Not applicable
Brackets indicate non-detected concentration at half the reported detection limit.
(a) D/N - Number of detected samples/total number of samples analyzed.
(b) Conservative ecological sediment screening benchmarks protective of benthic invertebrates and fish. Values represent the Effects Range-Low (ER-L) from Long et al., 1995, unless otherwise noted.
(c) Ambient values reflect data from the Bay Protection and Toxic Hotspot Cleanup Program (BPTCP), the SFEI RMP, and data from reference locations collected by Tetra Tech during the 1998 field sampling and by Battelle during 2001 sampling conducted for Hunters Point, unless otherwise noted.
(d) ER-M - Effects range-median from Long et al., 1995.
(e) Preliminary remediation goals (PRG) reported by U.S. EPA (2004a), based on human health exposures to soil under an industrial exposure scenario. California-modified PRGs were listed when available.
(f) ER-L reported by Long and Morgan, 1991.
(g) Total PCB is based on the sum of detected concentrations. The sum is based on 7 Aroclors prior to 1998 when PCBs were quantified using an Aroclor method, and is based on 2 times the sum of 20 congeners beginning in 1998 when PCBs analyses were quantified using a congener method. See Section 4.1.1 for lists of analytes in the sums.
(h) Upper-bound estimate of nearshore ambient as recommended by U.S. EPA, 2004b.
(i) Total DDx is based on the sum of detected concentrations of 3 isomers (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT). The 2,4'DDx isomers were not measured prior to 1998, so the sum based on 4,4-DDx isomers is used as a surrogate to measure Total DDx.
(j) Freshwater LEL (Persaud et al., 1993). One-tenth of the LEL was used as the screening value.
(k) EqP-derived TRV based on 1% OC, 4.1 Kow (U.S. EPA, 1995), and marine AWQC.
(l) TEL (MacDonald et al., 1996).
(m) Freshwater ERL based on 14-day *C. riparius* test (U.S. EPA, 1996).
(n) EqP-derived TRV based on 1% OC, 4.12 Kow (Jones et al., 1997), and freshwater toxicity data.
(o) Total LPAH (6) is based on the sum of the detected concentrations of 6 low-molecular-weight PAHs (Acenapthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, Phenanthrene). These are 6 of the 7 constituents used by Long to calculate the LPAH ER-L and ER-M. The seventh constituent, 2-Methylnaphthalene, was not measured in IR Site 24 in 2005, so the sum based on 6 constituents was chosen to provide consistency across all sampling locations.
(p) Total HPAH (6) is based on the sum of the detected concentrations of 6 high-molecular-weight PAHs (Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Pyrene). These were the 6 constituents used by Long to calculate the HPAH ER-L and ER-M.
(q) Value reported by Weston, 1996.

Table 4-4. Summary of Organic Chemical Results for Subsurface Sediment at IR Site 20

IR Site 20	0-5 cm			5-25 cm			25-50 cm			Threshold Values			
Analyte	D/N[a]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[b]	Ambient[c]	ER-M[d]	PRG Industrial[e]
Pesticides and PCBs (µg/kg)													
Total PCB[g]	14/14	3.3	95.44	14/14	1.19	354.2	13/13	0.97	146.6	22.7	200[h]	180	NA
Total 4,4-DDx[i]	14/14	1.3	13.92	14/14	1.285	82.75	13/13	0.85	25.73	1.58	7	46.1	NA
Total DDx[i]	14/14	1.695	19.37	14/14	1.37	109.3	13/13	0.92	28.57	1.58[f]	7	46.1	10000
2,4'-DDD	14/14	0.19	3.92	10/14	[0.02]	23.98	11/13	[0.025]	5.51	NA	NA	NA	7000
2,4'-DDE	3/14	[0.015]	0.46	4/14	[0.015]	0.49	3/13	[0.015]	0.47	NA	NA	NA	7000
2,4'-DDT	9/14	[0.025]	1.34	7/14	[0.025]	2.56	4/13	[0.025]	1.15	NA	NA	NA	10000
4,4'-DDD	14/14	0.57	9.54	14/14	0.49	58.48	13/13	0.48	15.93	2[f]	NA	20	7000
4,4'-DDE	14/14	0.37	3.55	14/14	0.39	10.19	13/13	0.35	4.3	2.2	NA	27	7000
4,4'-DDT	12/14	[0.02]	3.73	9/14	[0.015]	14.08	7/13	[0.015]	20.32	1	NA	7	NA
ALDRIN	0/14	[0.01]	[0.02]	0/14	[0.01]	[0.02]	0/13	[0.01]	[0.02]	0.2[j]	NA	NA	100
ALPHA-BHC	0/14	[0.02]	[0.03]	0/14	[0.02]	[0.03]	0/13	[0.02]	[0.035]	0.6[j]	NA	NA	360
ALPHA-CHLORDANE	6/14	[0.015]	0.66	5/14	[0.015]	0.88	5/13	[0.02]	1.12	0.5[f]	NA	6	6500
DIELDRIN	10/14	[0.015]	0.98	10/14	[0.015]	3.34	7/13	[0.015]	1.49	0.02[f]	0.44	8	110
ENDOSULFAN I	0/14	[0.015]	[0.025]	0/14	[0.015]	[0.02]	0/13	[0.015]	[0.025]	0.93[k]	NA	NA	3700000
ENDOSULFAN II	2/14	[0.055]	0.65	4/14	[0.06]	1.36	0/13	[0.055]	[0.1]	0.93[k]	NA	NA	3700000
ENDOSULFAN SULFATE	0/14	[0.125]	[0.215]	0/14	[0.13]	[0.205]	0/13	[0.13]	[0.23]	NA	NA	NA	3700000
ENDRIN	0/14	[0.015]	[0.025]	0/14	[0.015]	[0.025]	0/13	[0.015]	[0.025]	0.02[f]	NA	45	180000
ENDRIN ALDEHYDE	0/14	[0.025]	[0.04]	1/14	[0.025]	2.54	0/13	[0.025]	[0.045]	NA	NA	NA	180000
GAMMA-BHC	0/14	[0.015]	[0.025]	0/14	[0.015]	[0.02]	0/13	[0.015]	[0.025]	0.32[j]	NA	NA	1700
GAMMA-CHLORDANE	7/14	[0.015]	0.95	6/14	[0.015]	1.03	4/13	[0.015]	1.42	0.5	NA	6	6500
HEPTACHLOR	0/14	[0.01]	[0.02]	0/14	[0.01]	[0.02]	0/13	[0.01]	[0.02]	NA	NA	NA	380
HEPTACHLOR EPOXIDE	0/14	[0.015]	[0.025]	0/14	[0.015]	[0.02]	0/13	[0.015]	[0.025]	NA	NA	NA	190
PAHs (µg/kg)													
2-METHYLNAPHTHALENE	14/14	0.27	15	14/14	0.24	270	14/14	0.45	26	70	19.4	670	NA
ACENAPHTHENE	14/14	0.26	20	13/14	[0.09]	130	14/14	0.18	100	16	26.6	500	29000000
ACENAPHTHYLENE	14/14	0.51	140	14/14	0.41	870	14/14	0.2	280	44	31.7	640	NA
ANTHRACENE	14/14	1.5	600	14/14	0.67	2900	14/14	0.75	450	85.3	88	1100	100000000
BENZO(A)ANTHRACENE	14/14	3.5	1000	14/14	1.6	2200	14/14	1.3	2000	261	244	1600	2100
BENZO(A)PYRENE	14/14	6.2	1200	14/14	2.5	2100	14/14	3.1	3500	430	412	1600	210
BENZO(B)FLUORANTHENE	14/14	6.6	650	14/14	2	1200	14/14	3.6	3500	NA	371	NA	2100
BENZO(G,H,I)PERYLENE	14/14	6	650	14/14	2.4	1500	14/14	2.9	2100	290[m]	310	NA	NA
BENZO(K)FLUORANTHENE	14/14	5	640	14/14	1.8	1700	14/14	2.8	2400	24[j]	258	NA	1300

Table 4-4. Summary of Organic Chemical Results for Subsurface Sediment at IR Site 20 (continued)

IR Site 20	0-5 cm			5-25 cm			25-50 cm			Threshold Values			
Analyte	D/N[(a)]	Min	Max	D/N	Min	Max	D/N	Min	Max	Eco Screen[(b)]	Ambient[(c)]	ER-M[(d)]	PRG Industrial[(e)]
CHRYSENE	14/14	5.9	1300	14/14	2.4	2800	14/14	3.9	2100	384	289	2800	13000
DIBENZO(A,H)ANTHRACENE	14/14	0.75	120	14/14	0.22	270	14/14	0.42	580	63.4	32.7	260	210
DIBENZOFURAN	14/14	0.18	13	13/14	[0.115]	98	14/14	0.3	58	2290[(n)]	NA	NA	1600000
FLUORANTHENE	14/14	7.4	2500	14/14	4.4	5200	14/14	3.2	2300	600	514	5100	22000000
FLUORENE	14/14	0.39	130	14/14	0.44	1400	14/14	0.59	130	19	25.3	540	26000000
INDENO(1,2,3-CD)PYRENE	14/14	5.3	680	14/14	2.1	1500	14/14	2.3	2300	78[(n)]	382	—	2100
NAPHTHALENE	14/14	0.64	28	14/14	0.46	170	14/14	0.55	46	160	55.8	2100	4200
PHENANTHRENE	14/14	3.9	1600	14/14	2.9	7300	14/14	2.2	1000	240	237	1500	NA
PYRENE	14/14	9.4	3200	14/14	5.6	5900	14/14	3.8	4700	665	665	2600	NA
Total LPAH (6)[(o)]	14/14	7.2	2513	14/14	4.97	12680	14/14	4.47	1999	NA	NA	NA	29000000
Total HPAH (6)[(p)]	14/14	33.15	9320	14/14	16.72	17470	14/14	15.72	15180	1700	3060	9600	NA
Organotins (µg/kg)													
TRIBUTYLTIN	14/14	1.4	59	14/14	0.65	76	11/14	[0.0445]	31	25.1[(q)]	NA	NA	180000

NA = not applicable

Brackets indicate non-detected concentration at half the reported detection limit.

(a) D/N - Number of detected samples/total number of samples analyzed.
(b) Conservative ecological sediment screening benchmarks protective of benthic invertebrates and fish. Values represent the Effects Range-Low (ER-L) from Long et al., 1995, unless otherwise noted.
(c) Ambient values reflect data from the Bay Protection and Toxic Hotspot Cleanup Program (BPTCP), the SFEI RMP, and data from reference locations collected by Tetra Tech during the 1998 field sampling and by Battelle during 2001 sampling conducted for Hunters Point, unless otherwise noted.
(d) ER-M - Effects range-median from Long et al., 1995.
(e) Preliminary remediation goals (PRG) reported by U.S. EPA (2004a), based on human health exposures to soil under an industrial exposure scenario. California-modified PRGs were listed when available.
(f) ER-L reported by Long and Morgan, 1991.
(g) Total PCB is based on the sum of detected concentrations. The sum is based on 7 Aroclors prior to 1998 when PCBs were quantified using an Aroclor method, and is based on 2 times the sum of 20 congeners beginning in 1998 when PCBs analyses were quantified using a congener method. See Section 4.1.1 for lists of analytes in the sums.
(h) Upper-bound estimate of nearshore ambient as recommended by U.S. EPA, 2004b.
(i) Total DDx is based on the sum of detected concentrations of 6 isomers (2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT). Total 4,4-DDx is based on the sum of detected concentrations of 3 isomers (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT). The 2,4'DDx isomers were not measured prior to 1998, so the sum based on 4,4-DDx isomers is used as a surrogate to measure Total DDx.
(j) Freshwater LEL (Persaud et al., 1993). One-tenth the LEL was used as the screening value.
(k) EqP-derived TRV based on 1% OC, 4.1 Kow (U.S. EPA, 1995), and marine AWQC.
(l) TEL (MacDonald et al., 1996).
(m) Freshwater ERL based on 14-day *C. riparius* test (U.S. EPA, 1996).
(n) EqP-derived TRV based on 1% OC, 4.12 Kow (Jones et al., 1997), and freshwater toxicity data.
(o) Total LPAH (6) is based on the sum of the detected concentrations of 6 low-molecular-weight PAHs (Acenapthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, Phenanthrene). These are 6 of the 7 constituents used by Long to calculate the LPAH ER-L and ER-M. The seventh constituent, 2-Methylnaphthalene, was not measured in IR Site 24 in 2005, so the sum based on 6 constituents was chosen to provide consistency across all sampling locations.
(p) Total HPAH (6) is based on the sum of the detected concentrations of 6 high-molecular-weight PAHs (Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Pyrene). These were the 6 constituents used by Long to calculate the HPAH ER-L and ER-M.
(q) Value reported by Weston, 1996.

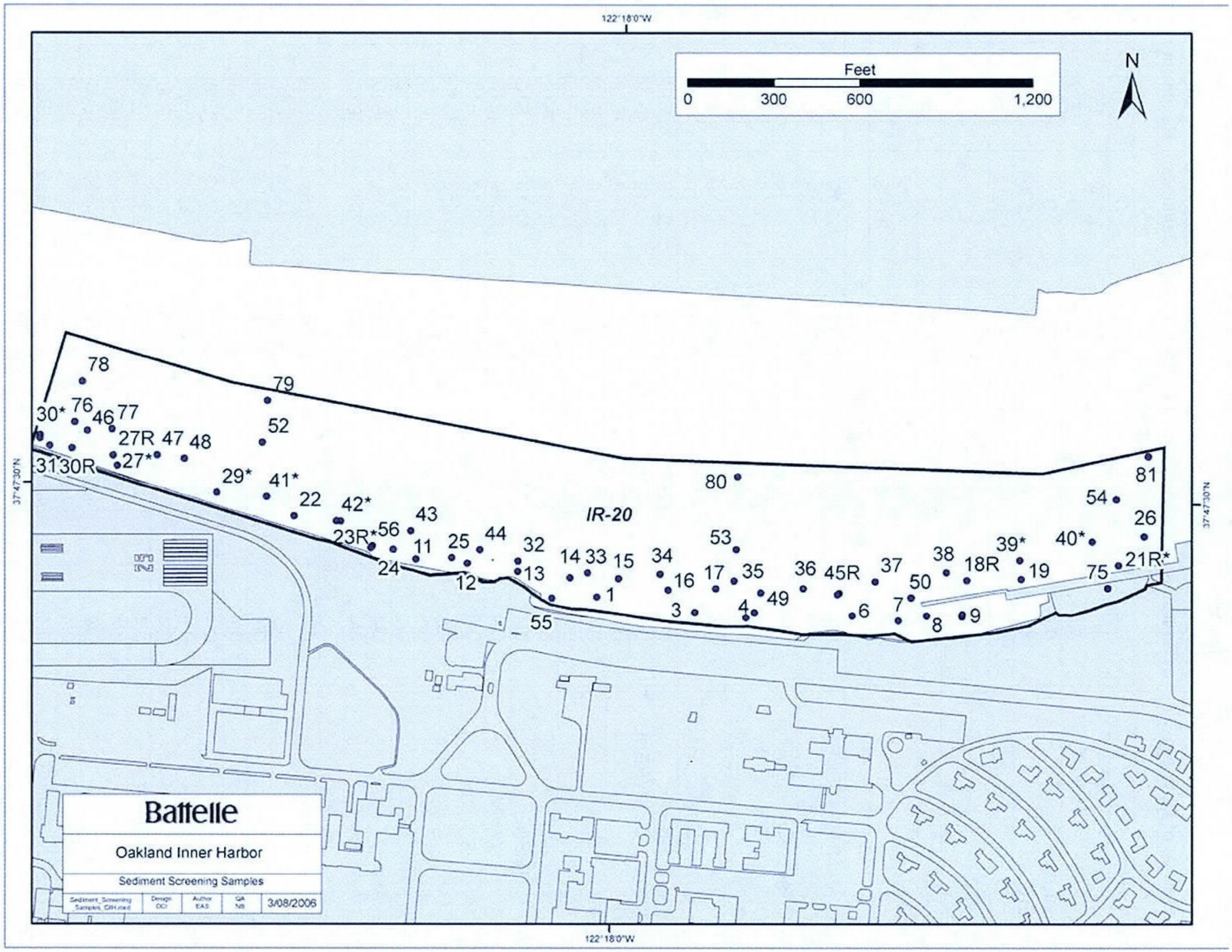


Figure 2-5. Sediment Screening Samples from IR Site 20

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
6	**tissue data**	**Section 2.3**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Tables 5-1, 5-3, 5-5, 5-7, 5-9, 5-10, 5-12, 5-14, and 5-16. Battelle 2007.

Table 5-1. Summary of *M. nasuta* Tissue Concentrations for IR Site 20

Chemical of Concern	No. of Detects/No. of Samples	Minimum Concentration	Maximum Concentration	Standard Deviation	Location of Maximum	q90
Inorganics (mg/kg DW)						
ANTIMONY	0/4	[0.5]	[0.5]	0	[E07]	0.1804
ARSENIC	4/4	19	22	1.269	E08	23.2
CADMIUM	0/4	[0.125]	[0.125]	0	[E07]	0.3588
CHROMIUM	0/4	[0.25]	[0.25]	0	[E07]	28.91
COPPER	4/4	14.4	15.6	0.526	E07	15.12
LEAD	4/4	1.76	2.54	0.3612	E07	3.577
MERCURY	1/4	0.045	0.045	0.02	E07	0.1385
NICKEL	1/4	1.25	1.25	0.5	E09	13.397
SELENIUM	0/4	[0.125]	[0.125]	0	[E07]	5.331
SILVER	0/4	[0.25]	[0.25]	0	[E07]	0.2329
ZINC	4/4	68.4	87.2	8.808	E08	125.1
PAHs (µg/kg DW)						
BENZO(A)ANTHRACENE	0/4	[273]	[301]	12.19	[E10]	21.131
BENZO(A)PYRENE	0/4	[273]	[301]	12.19	[E10]	30.803
BENZO(B)FLUORANTHENE	0/4	[273]	[301]	12.19	[E10]	30.74
BENZO(G,H,I)PERYLENE	0/4	[273]	[301]	12.19	[E10]	27.013
BENZO(K)FLUORANTHENE	0/4	[273]	[301]	12.19	[E10]	31.594
CHRYSENE	0/4	[273]	[301]	12.19	[E10]	39.294
DIBENZO(A,H)ANTHRACENE	0/4	[273]	[301]	12.19	[E10]	1.442
FLUORANTHENE	0/4	[273]	[301]	12.19	[E10]	91.566
INDENO(1,2,3-CD)PYRENE	0/4	[273]	[301]	12.19	[E10]	16.666
PYRENE	0/4	[273]	[301]	12.19	[E10]	116.703
Total HPAH (10)	0/4	[2730]	[3010]	121.9	[E10]	365.7
Total HPAH (6)	0/4	[1638]	[1806]	73.16	[E10]	365.7
2-METHYLNAPHTHALENE	0/4	[273]	[301]	12.19	[E10]	1.168
ACENAPHTHENE	0/4	[273]	[301]	12.19	[E10]	3.25
ACENAPHTHYLENE	0/4	[273]	[301]	12.19	[E10]	2.615
ANTHRACENE	0/4	[273]	[301]	12.19	[E10]	11.636
FLUORENE	0/4	[142]	[157]	6.652	[E10]	21
NAPHTHALENE	0/4	[273]	[301]	12.19	[E10]	21
PHENANTHRENE	0/4	[273]	[301]	12.19	[E10]	22.631
Total LPAH (6)	0/4	[1507]	[1662]	67.61	[E10]	70.72
Total LPAH (7)	0/4	[1780]	[1963]	79.8	[E10]	70.72
PCBs/Pesticides (µg/kg DW)						
Total PCB (Aroclors)	0/4	[720]	[743]	10.85	[E08]	154.18
4,4'-DDD	0/4	[9]	[9.3]	0.1414	[E08]	5.022
4,4'-DDE	0/4	[9]	[9.3]	0.1414	[E08]	7.803
4,4'-DDT	0/4	[9]	[9.3]	0.1414	[E08]	0.267
Total 4,4-DDx	0/4	[27]	[27.9]	0.4243	[E08]	11.944
ALDRIN	0/4	[2.25]	[2.32]	0.03304	[E08]	0.417
ALPHA-BHC	0/4	[2.25]	[2.32]	0.03304	[E08]	none
ALPHA-CHLORDANE	0/4	[2.25]	[2.32]	0.03304	[E08]	0.964
DIELDRIN	0/4	[4.55]	[4.65]	0.04856	[E08]	1.855
ENDOSULFAN I	0/4	[4.55]	[4.65]	0.04856	[E08]	none
ENDOSULFAN II	0/4	[4.55]	[4.65]	0.04856	[E08]	0.293
ENDOSULFAN SULFATE	0/4	[4.55]	[4.65]	0.04856	[E08]	none
ENDRIN	0/4	[4.55]	[4.65]	0.04856	[E08]	0.258
ENDRIN ALDEHYDE	0/4	[9]	[9.3]	0.1414	[E08]	none
GAMMA-BHC (LINDANE)	0/4	[2.25]	[2.32]	0.03304	[E08]	0.487
GAMMA-CHLORDANE	0/4	[2.25]	[2.32]	0.03304	[E08]	0.856
HEPTACHLOR	0/4	[2.25]	[2.32]	0.03304	[E08]	0.55
HEPTACHLOR EPOXIDE	0/4	[2.25]	[2.32]	0.03304	[E08]	0.487
Organotins (µg/kg DW)						
TRIBUTYLTIN	4/4	11	37.4	11.49	E09	42.378

Table 5-3. EPCs for Sediment at IR Site 20

IR Site 20 Constituent	Surface sediment from all years						Surface sediment (0-5 cm) from 2005						Subsurface sediment (5-25 cm) from 2005					
	N[a]	D[b]	Max[c]	Mean[d]	95% UCL[e]	Dist[f]	N	D	Max	Mean	95% UCL	Dist	N	D	Max	Mean	95% UCL	Dist
Inorganics (mg/kg)																		
Antimony	28	22	37	4.77	10.3	NP	14	8	0.47	0.094	0.16	LN	14	8	5.18	0.44	2.72	NP
Arsenic	28	28	13.7	5.93	7.04	LN	14	14	6.56	4.42	5.03	N	14	14	9.37	5.1	5.98	LN
Cadmium	28	24	0.9033	0.182	0.256	LN	14	14	0.37	0.155	0.199	N	14	14	0.898	0.253	0.386	LN
Chromium	28	28	1230	170	337	LN	14	14	86.9	49.9	60.3	N	14	14	91.1	53.6	63.7	N
Copper	28	28	141	44.2	68.5	LN	14	14	115	29.6	49.6	LN	14	14	179	35.1	61.5	LN
Lead	28	28	225.5	40.1	61.4	LN	14	14	91.5	23.8	38.3	LN	14	14	109	32.6	61.5	LN
Mercury	28	28	8.83	0.522	2.45	NP	14	14	8.83	0.8	4.66	NP	14	14	3.84	0.431	2.08	NP
Nickel	28	28	288	56.2	77.1	LN	14	14	61.4	35.2	42.5	N	14	14	65.3	40.1	46.8	N
Selenium	28	9	0.471	0.149	0.208	LN	14	0	[0.21]	>0.11<	>0.14<	N	14	0	[0.21]	>0.123<	>0.153<	N
Silver	28	24	0.288	0.145	0.172	NP	14	14	0.263	0.135	0.168	N	14	14	0.302	0.165	0.206	N
Zinc	28	28	258	91.2	121	LN	14	14	99.6	54.3	65	N	14	14	490	88.6	226	NP
Pesticides and PCBs (µg/kg)																		
Total PCB	28	28	893.3	157	451	LN	14	14	94.96	38.1	<95>	LN	14	13	353.9	77.5	<354>	LN
PCB110	24	21	86.23	4.24	12.3	LN	14	14	5.85	2.4	<5.85>	LN	14	13	21.5	6.95	<21.5>	LN
PCB129	14	8	0.48	0.145	0.236	NP	14	8	0.48	0.145	0.24	NP	14	9	0.97	0.26	0.47	NP
Total 4,4-DDx	28	27	482	28.9	143	NP	14	14	13.92	5.36	9.2	LN	14	14	82.75	8.62	35.7	LN
4,4'-DDD	28	27	45.29	5.74	12.6	LN	14	14	9.54	2.93	5.77	LN	14	14	58.48	5.97	20.6	LN
4,4'-DDE	28	26	16.2	2.5	4.78	LN	14	14	3.55	1.28	1.83	LN	14	14	10.19	1.87	3.43	LN
4,4'-DDT	28	20	471.1	21.3	190	NP	14	12	3.73	1.08	2.11	NP	14	9	14.08	1.43	11.2	NP
2,4'-DDD	24	23	15.01	1.92	3.84	LN	14	14	3.92	1.31	1.79	N	14	10	23.98	4.16	<24>	LN
2,4'-DDE	24	3	[0.53]	0.193	0.257	NP	14	3	0.46	0.093	0.211	NP	14	4	0.49	0.129	0.261	NP
2,4'-DDT	24	15	134.9	6.45	41.4	NP	14	9	1.34	0.536	0.781	NP	14	7	2.56	0.55	1.08	NP
Aldrin[g]	28	0	[0.6125]	>0.201<	>0.272<	NP	14	0	[0.02]	>0.014<	>0.015<	NP	14	0	[0.02]	>0.014<	>0.016<	NP
alpha-BHC[g]	28	0	[14.87]	>0.763<	>4.05<	NP	14	0	[0.03]	>0.024<	>0.026<	NP	14	0	[0.03]	>0.024<	>0.026<	NP
alpha-Chlordane	28	15	[4.236]	0.641	1.25	NP	14	6	0.66	0.174	0.304	NP	14	5	0.88	0.211	0.403	NP
Dieldrin	28	15	[43.67]	3.05	<0.98>	NP	14	10	0.98	0.406	0.557	N	14	10	3.34	0.705	1.9	NP
Endosulfan I[g]	28	0	[1.212]	>0.278<	>0.43<	NP	14	0	[0.025]	>0.016<	>0.019<	NP	14	0	[0.02]	>0.017<	>0.018<	NP
Endosulfan II	28	2	[1.212]	0.333	0.467	NP	14	2	0.65	0.127	0.321	NP	14	4	1.36	0.248	0.863	NP
Endosulfan Sulfate[g]	28	0	[1.212]	>0.347<	>0.493<	NP	14	0	[0.215]	>0.155<	>0.167<	N	14	0	[0.205]	>0.16<	>0.174<	NP
Endrin[g]	28	0	[43.67]	>2.82<	>11.5<	NP	14	0	[0.025]	>0.018<	>0.02<	NP	14	0	[0.025]	>0.019<	>0.021<	NP
Endrin Aldehyde	28	3	[87.33]	6.01	<13.4>	NP	14	0	[0.04]	>0.029<	>0.032<	NP	14	1	2.54	0.21	1.33	NP
gamma-BHC[g]	28	0	[16.11]	>0.805<	>4.37<	NP	14	0	[0.025]	>0.016<	>0.019<	NP	14	0	[0.02]	>0.017<	>0.018<	NP
gamma-Chlordane	28	9	[20.17]	1.4	<2.15>	NP	14	7	0.95	0.208	0.419	NP	14	6	1.03	0.261	0.497	NP
Heptachlor[g]	28	0	[0.6125]	>0.201<	>0.274<	NP	14	0	[0.02]	>0.014<	>0.015<	NP	14	0	[0.02]	>0.014<	>0.016<	NP
Heptachlor Epoxide[g]	28	0	[0.6125]	>0.202<	>0.275<	NP	14	0	[0.025]	>0.016<	>0.019<	NP	14	0	[0.02]	>0.017<	>0.018<	NP

Table 5-3. EPCs for Sediment at IR Site 20 (continued)

IR Site 20 Constituent	Surface sediment from all years						Surface sediment (0-5 cm) from 2005						Subsurface sediment (5-25 cm) from 2005					
	N[a]	D[b]	Max[c]	Mean[d]	95% UCL[e]	Dist[f]	N	D	Max	Mean	95% UCL	Dist	N	D	Max	Mean	95% UCL	Dist
PAHs (µg/kg)																		
Total LPAH (6)	28	28	2513	628	1536	LN	14	14	2513	548	<2513>	LN	14	14	12680	1652	12314	LN
Total HPAH (6)	28	28	9320	2332	5226	LN	14	14	9320	2320	<9320>	LN	14	14	17470	3961	<17470>	LN
2-Methylnaphthalene	28	24	[88.75]	15.6	<22.1>	LN	14	14	15	4.81	12	LN	14	14	270	23.5	163	LN
Acenaphthene	28	25	113.9	26.8	76.2	LN	14	14	20	6.44	9.1	N	14	13	130	26.2	<130>	LN
Acenaphthylene	28	25	140	41.9	95.6	LN	14	14	140	33.7	<140>	LN	14	14	870	107	787	LN
Anthracene	28	28	600	156	407	LN	14	14	600	123	<600>	LN	14	14	2900	344	2580	LN
Benzo(a)anthracene	28	28	1000	269	587	LN	14	14	1000	246	<1000>	LN	14	14	2200	414	<2200>	LN
Benzo(a)pyrene	28	28	1200	364	728	LN	14	14	1200	350	<1200>	LN	14	14	2100	596	<2100>	LN
Benzo(b)fluoranthene	28	28	837.6	302	624	LN	14	14	650	214	<650>	LN	14	14	1200	401	<1200>	LN
Benzo(g,h,i)perylene	28	28	692.6	238	434	LN	14	14	650	232	<650>	LN	14	14	1500	365	<1500>	LN
Benzo(k)fluoranthene	28	26	891.8	231	461	LN	14	14	640	220	<640>	LN	14	14	1700	430	<1700>	LN
Chrysene	28	28	1300	370	805	LN	14	14	1300	331	<1300>	LN	14	14	2800	576	<2800>	LN
Dibenzo(a,h)anthracene	28	25	175.8	52.6	123	LN	14	14	120	34.2	<120>	LN	14	14	270	71.8	<270>	LN
Dibenzofuran	14	14	13	4.38	<13>	LN	14	14	13	4.38	<13>	LN	14	13	98	16.7	<98>	LN
Fluoranthene	28	28	2500	492	754	NP	14	14	2500	627	<2500>	LN	14	14	5200	1031	<5200>	LN
Fluorene	28	25	130	42.7	114	LN	14	14	130	27.7	<130>	LN	14	14	1400	115	906	LN
Indeno(1,2,3-cd)pyrene	28	28	686.7	211	286	NP	14	14	680	239	<680>	LN	14	14	1500	389	<1500>	LN
Naphthalene	28	24	[88.75]	20.6	39.6	LN	14	14	28	10.2	13.9	N	14	14	170	31.3	<170>	LN
Perylene	10	10	276.4	92.9	<276>	LN	0						0					
Phenanthrene	28	28	1600	305	477	NP	14	14	1600	345	<1600>	LN	14	14	7300	999	<7300>	LN
Pyrene	28	28	3200	676	1370	LN	14	14	3200	723	<3200>	LN	14	14	5900	1240	<5900>	LN
Organotins (µg/kg)																		
Tributyltin	18	18	59	22.7	31.6	NP	14	14	59	21.1	<59>	LN	14	14	76	16.8	<76>	LN

[a] N = Number of samples analyzed. Caution, if N<5 the EPCs have limited utility.
[b] D = number of detected results. Caution: If D/N<25%, EPCs have limited utility.
[c] Max = maximum result; [ ] indicates that the maximum result was a non-detect reported at the half-detection limit.
[d] The Mean is calculated based on a distribution assumption, where distributions are normal, lognormal, or neither (nonparametric); values enclosed in "><" indicate an estimate based solely on non-detects.
[e] 95% UCL = 95% Upper Confidence Limit. This EPC is calculated based on a distribution assumption, where distributions are normal, lognormal, or neither (nonparametric); values enclosed in "><" indicate an estimate based solely on non-detects; values enclosed in "<>" indicate that the calculated UCL value exceeded the maximum detect and the maximum detect is used as the estimate of the EPC (maximum half-detection limit is used if no detects).
[f] Dist = distribution that the data conform to based on the Shapiro Wilk goodness of fit test. N = Normal, LN = Lognormal, NP = nonparametric; none = too few samples to run a distribution test OR all samples reported at same value.
[g] This constituent will be eliminated because it was not detected in sediment nor tissue at the site.

Table 5-5. Statistical Summary of *M. nasuta* Data at IR Site 20

IR Site 20 Constituent	*Macoma nasuta* Tissue (1993)									
	N[a]	D[b]	Max[c]	Mean[d]	95% UCL[e]	Dist[f]	Max[c]	Mean[d]	95% UCL[e]	Dist[f]
Inorganics (mg/kg)			dry wt summary				wet wt summary			
Arsenic	4	4	22	20.8	<22>	N	2.47	2.3	<2.47>	N
Copper	4	4	15.6	15.2	<15.6>	N	1.72	1.67	<1.72>	N
Lead	4	4	2.54	2.08	2.5	N	0.279	0.229	0.276	N
Mercury	4	1	0.045	0.015	<0.045>	NP	0.005	0.002	<0.005>	NP
Nickel	4	1	1.25	0.5	<1.25>	NP	0.138	0.055	<0.138>	NP
Zinc	4	4	87.2	78.5	<87.2>	N	9.75	8.66	<9.75>	N
Pesticides and PCBs (µg/kg)			dry wt summary				wet wt summary			
Endosulfan II	4	0	[4.65]	>4.58<	<4.65>	NP	[0.52]	>0.505<	<0.52>	NP
Endrin Aldehyde	4	0	[9.3]	>9.1<	>9.27<	N	[1.04]	>1<	<1.04>	NP
gamma-Chlordane	4	0	[2.32]	>2.27<	>2.31<	N	[0.259]	>0.251<	<0.259>	NP
PAHs (µg/kg)			dry wt summary				wet wt summary			
2-Methylnaphthalene	4	0	[301]	>286<	>301<	N	[33.6]	>33.6<	>33.6<	N
Dibenzofuran	4	0	[301]	>286<	>300<	N	[33.6]	>33.6<	>33.6<	N
Organotins (µg/kg)			dry wt summary				wet wt summary			
Tributyltin	4	4	37.4	21	34.5	N	4.11	2.27	3.79	N

This table contains the constituents that were detected in site tissue, or if never detected in tissue, that were detected in site sediment and for which there is no BAF. There is no BAF for constituents that were not measured, or were never detected in both sediment and tissue, in paired sediment and tissue results.

[a] N = Number of samples analyzed. Caution, if N<5 the EPCs have limited utility.

[b] D = number of detected results. Caution: If D/N<25%, EPCs have limited utility.

[c] Max = maximum result; [ ] indicates that the maximum result was a non-detect reported at the half-detection limit.

[d] The Mean is calculated based on a distribution assumption, where distributions are normal, lognormal, or neither (nonparametric); values enclosed in "><" indicate an estimate based solely on non-detects.

[e] 95% UCL = 95% Upper Confidence Limit. This EPC is calculated based on a distribution assumption, where distributions are normal, lognormal, or neither (nonparametric); values enclosed in "><" indicate an estimate based solely on non-detects; values enclosed in "<>" indicate that the calculated UCL value exceeded the maximum detect and the maximum detect is used as the estimate of the EPC (maximum half-detection limit is used if no detects).

[f] Dist = distribution that the data conform to based on the Shapiro Wilk goodness of fit test. N = Normal, LN = Lognormal, NP = nonparametric; none = too few samples to run a distribution test OR all samples reported at same value.

[g] This constituent will be eliminated because it was not detected in sediment nor tissue at the site.

Table 5-7. Modeled Dry Weight *M. nasuta* Tissue Concentrations for IR Site 20

IR Site 20				All Years		2005 Surface		2005 Subsurface	
Constituent	***Macoma* BAF (DW)[a]**	**N[b]**	**D[c]**	**Sediment 95% UCL[d] (mg/kg DW)**	***Macoma* 95% UCL[e] (mg/kg DW)**	**Sediment 95% UCL (mg/kg DW)**	***Macoma* 95% UCL (mg/kg DW)**	**Sediment 95% UCL (mg/kg DW)**	***Macoma* 95% UCL (mg/kg DW)**
Antimony	1.97E-01	25	25	1.03E+01	2.04E+00	1.60E-01	3.16E-02	2.72E+00	5.37E-01
Cadmium	1.22E-01	25	25	2.56E-01	3.12E-02	1.99E-01	2.42E-02	3.86E-01	4.70E-02
Chromium	1.92E-01	25	25	3.37E+02	6.46E+01	6.03E+01	1.16E+01	6.37E+01	1.22E+01
Selenium	3.82E+00	25	9	2.08E-01	7.94E-01	1.40E-01	5.35E-01	1.53E-01	5.84E-01
Silver	1.71E-01	25	25	1.72E-01	2.95E-02	1.68E-01	2.88E-02	2.06E-01	3.53E-02
Total PCB	1.41E+00	25	21	4.51E-01	6.35E-01	9.50E-02	1.34E-01	3.54E-01	4.98E-01
Total 4,4-DDx	4.63E+00	10	9	4.68E-02	2.17E-01	9.17E-03	4.25E-02	3.56E-02	1.65E-01
alpha-Chlordane	6.55E-01	25	7	1.25E-03	8.17E-04	3.04E-04	1.99E-04	4.03E-04	2.64E-04
Dieldrin	6.52E+00	25	21	9.80E-04	6.39E-03	5.57E-04	3.63E-03	1.90E-03	1.24E-02
Total HPAH (6)	1.17E+00	25	25	5.22E+00	6.10E+00	9.32E+00	1.09E+01	1.75E+01	2.04E+01
Total LPAH (6)	3.58E-01	25	25	7.82E-01	2.80E-01	2.51E+00	8.99E-01	1.22E+01	4.36E+00

This table includes those constituents that were detected in sediment but not detected in site tissue and for which there is a BAF. There is no BAF for constituents that were not measured, or were never detected in both sediment and tissue, in paired sediment and tissue results.

[a] *Macoma* BAF (bioaccumulation factor) calculation (described in Section 5.1) calculated using dry wt concentrations of tissue.

[b] N = number of samples analyzed in *Macoma* tissue and used in calculation of the BAF.

[c] D = number of detected concentrations in *Macoma* tissue (out of N) used in calculation of the BAF. Zero means all non-detects (using half the reported detection limits). Small numbers lead to greater uncertainty (see plots in Appendix D).

[d] Sediment EPC from listed site data set: All Years Surface samples, 2005 Surface samples, or 2005 (5-25 cm) samples.

[e] Modeled fish EPC based on model from sediment to tissue using BAF.

Table 5-9. Modeled Wet Weight *M. nasuta* Tissue Concentrations for IR Site 20

IR Site 20				All Years		2005 Surface	
Constituent	*Macoma* BAF (wet wt)[a]	N[b]	D[c]	Sediment 95% UCL[d] (mg/kg wet wt)	*Macoma* 95% UCL[e] (mg/kg wet wt)	Sediment 95% UCL (mg/kg wet wt)	*Macoma* 95% UCL (mg/kg wet wt)
Antimony	3.17E-02	25	25	1.03E+01	3.28E-01	1.60E-01	5.07E-03
Cadmium	1.93E-02	25	25	2.56E-01	4.94E-03	1.99E-01	3.84E-03
Chromium	3.14E-02	25	25	3.37E+02	1.06E+01	6.03E+01	1.89E+00
Selenium	6.19E-01	25	9	2.08E-01	1.29E-01	1.40E-01	8.67E-02
Silver	2.83E-02	25	25	1.72E-01	4.87E-03	1.68E-01	4.76E-03
Total PCB	2.27E-01	25	21	4.51E-01	1.03E-01	9.50E-02	2.16E-02
2,4'-DDD	2.25E-01	25	17	3.84E-03	8.64E-04	1.79E-03	4.03E-04
2,4'-DDE	1.91E-01	25	2	2.57E-04	4.91E-05	2.11E-04	4.03E-05
2,4'-DDT	4.65E-01	25	0	4.14E-02	1.93E-02	7.81E-04	3.63E-04
4,4'-DDD	2.62E-01	25	23	1.26E-02	3.30E-03	5.77E-03	1.51E-03
4,4'-DDE	5.03E-01	25	24	4.78E-03	2.41E-03	1.83E-03	9.21E-04
4,4'-DDT	1.81E-01	8	1	1.90E-01	3.43E-02	2.11E-03	3.82E-04
alpha-Chlordane	1.05E-01	25	7	1.25E-03	1.31E-04	3.04E-04	3.18E-05
Dieldrin	1.08E+00	25	21	9.80E-04	1.06E-03	5.57E-04	6.03E-04
Acenaphthene	5.96E-02	25	18	7.62E-02	4.54E-03	9.10E-03	5.42E-04
Acenaphthylene	1.07E-01	25	22	9.56E-02	1.02E-02	1.40E-01	1.50E-02
Anthracene	7.58E-02	25	24	4.07E-01	3.08E-02	6.00E-01	4.55E-02
Benzo(a)anthracene	1.26E-01	25	25	5.87E-01	7.40E-02	1.00E+00	1.26E-01
Benzo(a)pyrene	1.15E-01	25	25	7.28E-01	8.33E-02	1.20E+00	1.37E-01
Benzo(b)fluoranthene	1.27E-01	25	25	6.24E-01	7.91E-02	6.50E-01	8.24E-02
Benzo(g,h,i)perylene	4.24E-02	25	20	4.34E-01	1.84E-02	6.50E-01	2.76E-02
Benzo(k)fluoranthene	1.08E-01	25	25	4.61E-01	4.97E-02	6.40E-01	6.89E-02
Chrysene	9.98E-02	25	25	8.05E-01	8.03E-02	1.30E+00	1.30E-01
Dibenzo(a,h)anthracene	2.91E-02	25	16	1.23E-01	3.58E-03	1.20E-01	3.49E-03
Fluoranthene	2.31E-01	25	25	7.54E-01	1.74E-01	2.50E+00	5.78E-01
Fluorene	4.57E-02	25	11	1.14E-01	5.21E-03	1.30E-01	5.94E-03
Indeno(1,2,3-cd)pyrene	3.07E-02	25	25	2.86E-01	8.77E-03	6.80E-01	2.09E-02
Naphthalene	3.20E-01	25	1	3.96E-02	1.27E-02	1.39E-02	4.46E-03
Phenanthrene	3.04E-02	25	6	4.77E-01	1.45E-02	1.60E+00	4.86E-02
Pyrene	3.34E-01	25	25	1.37E+00	4.58E-01	3.20E+00	1.07E+00

This table includes those constituents that were detected in sediment but not detected in site tissue and for which there is a BAF. There is no BAF for constituents that were not measured, or were never detected in both sediment and tissue, in paired sediment and tissue results.

[a] *Macoma* BAF (bioaccumulation factor) calculation (described in Section 5.1) calculated using wet wt concentrations of tissue.

[b] N = number of samples analyzed in *Macoma* tissue and used in calculation of the BAF.

[c] D = number of detected concentrations in *Macoma* tissue (out of N) used in calculation of the BAF. Zero means all non-detects (using half the reported detection limits). Small numbers lead to greater uncertainty (see plots in Appendix D).

[d] Sediment EPC from listed site data set: All Years Surface samples, 2005 Surface samples, or 2005 (2-25 cm) samples.

[e] Modeled fish EPC based on model from sediment to tissue using BAF

Table 5-10. Modeled Dry Weight Forage Fish Tissue Concentrations for IR Site 20

Constituent	Fish BAF (unitless DW)[a]	D[b]	IR Site 20 All Years: Max Sed Conc[c] (mg/kg)	IR Site 20 All Years: Fish Conc[d] (mg/kg)	IR Site 20 All Years: Sediment 95% UCL[e] (mg/kg DW)	IR Site 20 All Years: Fish 95% UCL[f] (mg/kg DW)	IR Site 20 2005 Surface: Max Sed Conc (mg/kg)	IR Site 20 2005 Surface: Fish Conc (mg/kg)	IR Site 20 2005 Surface: Sediment 95% UCL (mg/kg) DW	IR Site 20 2005 Surface: Fish 95% UCL (mg/kg) DW	IR Site 20 2005 Subsurface: Max Sed Conc (mg/kg)	IR Site 20 2005 Subsurface: Fish Conc (mg/kg)	IR Site 20 2005 Subsurface: Sediment 95% UCL (mg/kg) DW	IR Site 20 2005 Subsurface: Fish 95% UCL (mg/kg) DW
Antimony	8.10E-03	0	3.70E+01	3.00E-01	1.03E+01	8.38E-02	4.70E-01	3.81E-03	1.60E-01	1.30E-03	5.18E+00	4.20E-02	2.72E+00	2.20E-02
Arsenic	1.28E-01	1	1.37E+01	1.75E+00	7.04E+00	8.98E-01	6.56E+00	8.36E-01	5.03E+00	6.42E-01	9.37E+00	1.19E+00	5.98E+00	7.62E-01
Cadmium	2.74E-02	34	9.03E-01	2.48E-02	2.56E-01	7.02E-03	3.70E-01	1.01E-02	1.99E-01	5.44E-03	8.98E-01	2.46E-02	3.86E-01	1.06E-02
Chromium	1.54E-02	13	1.23E+03	1.89E+01	3.37E+02	5.19E+00	8.69E+01	1.34E+00	6.03E+01	9.29E-01	9.11E+01	1.40E+00	6.37E+01	9.82E-01
Copper	8.07E-02	34	1.41E+02	1.14E+01	6.85E+01	5.52E+00	1.15E+02	9.28E+00	4.96E+01	4.00E+00	1.79E+02	1.44E+01	6.15E+01	4.96E+00
Lead	1.73E-02	34	2.26E+02	3.90E+00	6.14E+01	1.06E+00	9.15E+01	1.58E+00	3.83E+01	6.63E-01	1.09E+02	1.89E+00	6.15E+01	1.06E+00
Mercury	2.53E-01	34	8.83E+00	2.23E+00	2.45E+00	6.20E-01	8.83E+00	2.23E+00	4.66E+00	1.18E+00	3.84E+00	9.71E-01	2.08E+00	5.26E-01
Nickel	5.20E-03	4	2.88E+02	1.50E+00	7.71E+01	4.01E-01	6.14E+01	3.19E-01	4.25E+01	2.21E-01	6.53E+01	3.40E-01	4.68E+01	2.43E-01
Selenium	1.76E+00	0	4.71E-01	8.27E-01	2.08E-01	3.65E-01	2.10E-01	3.69E-01	1.40E-01	2.46E-01	2.10E-01	3.69E-01	1.53E-01	2.69E-01
Silver	3.16E-02	10	2.88E-01	9.10E-03	1.72E-01	5.43E-03	2.63E-01	8.31E-03	1.68E-01	5.31E-03	3.02E-01	9.54E-03	2.06E-01	6.51E-03
Zinc	3.43E-01	30	2.58E+02	8.85E+01	1.21E+02	4.15E+01	9.96E+01	3.42E+01	6.50E+01	2.23E+01	4.90E+02	1.68E+02	2.26E+02	7.74E+01
alpha-Chlordane	2.38E+00	34	3.14E-03	7.47E-03	1.25E-03	2.97E-03	6.60E-04	1.57E-03	3.04E-04	7.23E-04	8.80E-04	2.09E-03	4.03E-04	9.60E-04
Dieldrin	1.48E+00	34	9.80E-04	1.45E-03	9.80E-04	1.45E-03	9.80E-04	1.45E-03	5.57E-04	8.22E-04	3.34E-03	4.93E-03	1.90E-03	2.81E-03
Endosulfan II	6.09E-02	0	6.50E-04	3.96E-05	4.67E-04	2.85E-05	6.50E-04	3.96E-05	3.21E-04	1.95E-05	1.36E-03	8.28E-05	8.63E-04	5.25E-05
Endrin Aldehyde	2.70E-02	0	1.34E-02	3.63E-04	1.34E-02	3.63E-04	4.00E-05	1.08E-06	3.17E-05	8.56E-07	2.54E-03	6.86E-05	1.33E-03	3.59E-05
gamma-Chlordane	7.96E-01	34	2.15E-03	1.71E-03	2.15E-03	1.71E-03	9.50E-04	7.56E-04	4.19E-04	3.33E-04	1.03E-03	8.20E-04	4.97E-04	3.96E-04
Tributyltin	8.58E+00	16	5.90E-02	5.06E-01	3.16E-02	2.71E-01	5.90E-02	5.06E-01	5.90E-02	5.06E-01	7.60E-02	6.52E-01	7.60E-02	6.52E-01
Total PCB	3.12E+00	34	8.93E-01	2.79E+00	4.51E-01	1.41E+00	9.50E-02	2.97E-01	9.50E-02	2.97E-01	3.54E-01	1.11E+00	3.15E-01	9.83E-01
Total 4,4-DDx	4.55E+00	34	4.82E-01	2.20E+00	4.68E-02	2.13E-01	1.39E-02	6.34E-02	9.17E-03	4.18E-02	8.28E-02	3.77E-01	2.19E-02	9.98E-02
Total HPAH (6)	2.18E-02	33	9.32E+00	2.03E-01	4.79E+00	1.04E-01	9.32E+00	2.03E-01	9.32E+00	2.03E-01	1.75E+01	3.81E-01	1.75E+01	3.81E-01
Total LPAH (6)	7.93E-02	34	2.51E+00	1.99E-01	7.82E-01	6.20E-02	2.51E+00	1.99E-01	2.51E+00	1.99E-01	1.27E+01	1.01E+00	1.22E+01	9.66E-01

[a] Fish BAF (bioaccumulation factor) calculation (described in Section 5.1) calculated using dry wt concentrations of tissue.
[b] D = number of detected concentrations in forage fish tissue (out of 34 total) used in calculation of the BAF. Zero means all non-detects (using half the reported detection limits). Small numbers lead to greater uncertainty (see plots in Appendix D).
[c] Maximum sediment concentration for the listed site data set: All Years Surface samples, 2005 Surface samples, or 2005 (5-25 cm) samples.
[d] Modeled maximum fish concentration based on model from sediment to tissue using BAF.
[e] Sediment EPC from listed site data set.
[f] Modeled fish EPC based on model from sediment to tissue using BAF.

Table 5-12. Modeled Wet Weight Forage Fish Tissue Concentrations for IR Site 20

IR Site 20			All Years		2005 Surface	
Constituent	Fish BAF (wet wt)[a]	D[b]	Sediment 95% UCL[e] (mg/kg wet wt)	Fish 95% UCL[f] (mg/kg wet wt)	Sediment 95% UCL (mg/kg wet wt)	Fish 95% UCL (mg/kg wet wt)
Antimony	1.00E-03	0	1.03E+01	1.03E-02	1.60E-01	1.60E-04
Arsenic	2.98E-02	1	7.04E+00	2.10E-01	5.03E+00	1.50E-01
Cadmium	3.90E-03	34	2.56E-01	9.99E-04	1.99E-01	7.75E-04
Chromium	2.60E-03	13	3.37E+02	8.76E-01	6.03E+01	1.57E-01
Copper	1.45E-02	34	6.85E+01	9.93E-01	4.96E+01	7.20E-01
Lead	2.70E-03	34	6.14E+01	1.66E-01	3.83E+01	1.03E-01
Mercury	4.44E-02	34	2.45E+00	1.09E-01	4.66E+00	2.07E-01
Nickel	1.10E-03	4	7.71E+01	8.48E-02	4.25E+01	4.68E-02
Selenium	3.45E-01	0	2.08E-01	7.16E-02	1.40E-01	4.83E-02
Silver	4.50E-03	10	1.72E-01	7.74E-04	1.68E-01	7.57E-04
Zinc	6.45E-02	30	1.21E+02	7.81E+00	6.50E+01	4.19E+00
Total PCB	6.74E-01	34	4.51E-01	3.04E-01	9.50E-02	6.40E-02
2,4'-DDD	4.10E-03	0	3.84E-03	1.57E-05	1.79E-03	7.33E-06
2,4'-DDE	2.59E-01	0	2.57E-04	6.67E-05	2.11E-04	5.48E-05
2,4'-DDT	6.91E-02	0	4.14E-02	2.86E-03	7.81E-04	5.40E-05
4,4'-DDD	5.15E-01	34	1.26E-02	6.49E-03	5.77E-03	2.97E-03
4,4'-DDE	1.27E+00	34	4.78E-03	6.06E-03	1.83E-03	2.32E-03
4,4'-DDT	1.21E-01	30	1.90E-01	2.29E-02	2.11E-03	2.55E-04
alpha-Chlordane	3.53E-01	34	1.25E-03	4.41E-04	3.04E-04	1.07E-04
Dieldrin	2.29E-01	34	9.80E-04	2.25E-04	5.57E-04	1.28E-04
Endosulfan II	9.10E-03	0	4.67E-04	4.25E-06	3.21E-04	2.92E-06
Endrin Aldehyde	5.80E-03	0	1.34E-02	7.79E-05	3.17E-05	1.84E-07
gamma-Chlordane	1.18E-01	34	2.15E-03	2.54E-04	4.19E-04	4.95E-05
2-Methylnaphthalene	4.40E-03	14	2.21E-02	9.73E-05	1.20E-02	5.28E-05
Acenaphthene	2.65E-02	34	7.62E-02	2.02E-03	9.10E-03	2.41E-04
Acenaphthylene	1.40E-03	19	9.56E-02	1.34E-04	1.40E-01	1.96E-04
Anthracene	4.80E-03	33	4.07E-01	1.95E-03	6.00E-01	2.88E-03
Benzo(a)anthracene	1.90E-03	28	5.87E-01	1.11E-03	1.00E+00	1.90E-03
Benzo(a)pyrene	1.40E-03	10	7.28E-01	1.02E-03	1.20E+00	1.68E-03
Benzo(b)fluoranthene	1.50E-03	11	6.24E-01	9.36E-04	6.50E-01	9.75E-04
Benzo(g,h,i)perylene	1.70E-03	22	4.34E-01	7.38E-04	6.50E-01	1.11E-03
Benzo(k)fluoranthene	2.60E-03	10	4.61E-01	1.20E-03	6.40E-01	1.66E-03
Chrysene	3.90E-03	31	8.05E-01	3.14E-03	1.30E+00	5.07E-03
Dibenzo(a,h)anthracene	6.00E-04	2	1.23E-01	7.38E-05	1.20E-01	7.20E-05
Fluoranthene	6.90E-03	33	7.54E-01	5.20E-03	2.50E+00	1.73E-02
Fluorene	1.45E-02	34	1.14E-01	1.65E-03	1.30E-01	1.89E-03
Indeno(1,2,3-cd)pyrene	1.30E-03	14	2.86E-01	3.71E-04	6.80E-01	8.84E-04
Naphthalene	7.30E-03	3	3.96E-02	2.89E-04	1.39E-02	1.02E-04
Phenanthrene	1.88E-02	22	4.77E-01	8.96E-03	1.60E+00	3.01E-02
Pyrene	3.40E-03	31	1.37E+00	4.66E-03	3.20E+00	1.09E-02
Tributyltin	1.26E+00	16	3.16E-02	3.97E-02	5.90E-02	7.42E-02

[a] Fish BAF (bioaccumulation factor) calculation (described in Section 5.1) calculated using wet wt concentrations of tissue.

[b] D = number of detected concentrations in forage fish tissue (out of 34 total) used in calculation of the BAF. Zero means all non-detects (using half the reported detection limits). Small numbers lead to greater uncertainty (see plots in Appendix D).

[c] Maximum sediment concentration for the listed site data set: All Years Surface samples, 2005 Surface samples, or 2005 (5-25 cm) samples.

[d] Modeled maximum fish concentration based on model from sediment to tissue using BAF.

[e] Sediment EPC from listed site data set.

[f] Modeled fish EPC based on model from sediment to tissue using BAF.

Table 5-14. Summary of EPCs for IR Site 20 Dry Weight Tissues

IR Site 20 BERA EPCs	*Macoma* EPCs (95% UCL)				Forage Fish EPCs (95% UCL)			
Constituent	**All Years**	**2005 (0-5 cm)**	**2005 (5-25 cm)**	**Type**	**All Years**	**2005 (0-5 cm)**	**2005 (5-25 cm)**	**Type**
Inorganics (mg/kg dry wt)								
Antimony	2.04	0.0316	0.537	model	>0.0838<	>0.0013<	>0.022<	model
Arsenic	22			tissue	0.898	0.642	0.762	model
Cadmium	0.0312	0.0242	0.047	model	0.00702	0.00544	0.0106	model
Chromium	64.6	11.6	12.2	model	5.19	0.929	0.982	model
Copper	15.6			tissue	5.52	4	4.96	model
Lead	2.5			tissue	1.06	0.663	1.06	model
Mercury	0.045			tissue	0.62	1.18	0.526	model
Nickel	1.25			tissue	0.401	0.221	0.243	model
Selenium	0.794	0.535	0.584	model	>0.365<	>0.246<	>0.269<	model
Silver	0.0295	0.0288	0.0353	model	0.00543	0.00531	0.00651	model
Zinc	87.2			tissue	41.5	22.3	77.4	model
Pesticides and PCBs (mg/kg dry wt)								
Total PCB	0.635	0.134	0.498	model	1.41	0.297	1.11	model
Total 4,4-DDx	0.664	0.0426	0.166	model	0.213	0.0418	0.162	model
alpha-Chlordane	0.000817	0.000199	0.000264	model	0.00297	0.000723	0.00096	model
Dieldrin	0.00639	0.00363	0.0124	model	0.00145	0.000822	0.00281	model
Endosulfan II	>0.00465<			tissue	>0.0000285<	>0.0000195<	>0.0000525<	model
Endrin Aldehyde	>0.00927<			tissue	>0.000363<	>0.00000086<	>0.0000359<	model
gamma-Chlordane	>0.00231<			tissue	0.00171	0.000333	0.000396	model
PAHs (mg/kg dry wt)								
Total LPAH (6)	0.549	0.899	4.41	model	0.122	0.199	0.976	model
Total HPAH (6)	6.1	10.9	20.4	model	0.114	0.203	0.381	model
Organotins (mg/kg dry wt)								
Tributyltin	0.0345			tissue	0.271	0.506	0.652	model

[a] Type refers to the method used to calculate the EPC for a constituent, including model and tissue (depending on whether or not it was ever detected in site tissue).

Type = model when a BAF was used to model tissue EPCs from sediment EPCs for each of the listed sediment data sets: All Years surface samples, 2005 surface samples or 2005 subsurface (5-25 cm) samples (more details in Table 5-5 and Table 5-9).

Type = tissue produces only one EPC value calculated directly from site-specific tissue samples (more details in Table 5-3).

Table 5-16. Summary of EPCs for IR Site 20 Wet Weight Tissues

IR Site 20 HH EPCs	*Macoma* EPCs (95% UCL)			Forage Fish EPCs (95% UCL)		
Constituent	**All Years**	**2005 (0-5 cm)**	**Type[a]**	**All Years**	**2005 (0-5 cm)**	**Type**
Inorganics (mg/kg wet wt)						
Antimony	0.328	0.00507	model	>0.0103<	>0.00016<	model
Arsenic	2.47		tissue	0.21	0.15	model
Cadmium	0.00494	0.00384	model	0.000999	0.000775	model
Chromium	10.6	1.89	model	0.876	0.157	model
Copper	1.72		tissue	0.993	0.72	model
Lead	0.276		tissue	0.166	0.103	model
Mercury	0.005		tissue	0.109	0.207	model
Nickel	0.138		tissue	0.0848	0.0468	model
Selenium	0.129	0.0867	model	>0.0716<	>0.0483<	model
Silver	0.00487	0.00476	model	0.000774	0.000757	model
Zinc	9.75		tissue	7.81	4.19	model
Pesticides and PCBs (mg/kg wet wt)						
Total PCB	0.103	0.0216	model	0.304	0.064	model
4,4'-DDD	0.0033	0.00151	model	0.00649	0.00297	model
4,4'-DDE	0.00241	0.000921	model	0.00606	0.00232	model
4,4'-DDT	0.0343	0.000382	model	0.0229	0.000255	model
2,4'-DDD	0.000864	0.000403	model	>0.0000157<	>0.00000733<	model
2,4'-DDE	0.0000491	0.0000403	model	>0.0000667<	>0.0000548<	model
2,4'-DDT	>0.0193<	>0.000363<	model	>0.00286<	>0.000054<	model
alpha-Chlordane	0.000131	0.0000318	model	0.000441	0.000107	model
Dieldrin	0.00106	0.000603	model	0.000225	0.000128	model
Endosulfan II	>0.00052<		tissue	>0.00000425<	>0.00000292<	model
Endrin Aldehyde	>0.00104<		tissue	>0.0000779<	>0.00000018<	model
gamma-Chlordane	>0.000259<		tissue	0.000254	0.0000495	model
PAHs (mg/kg wet wt)						
2-Methylnaphthalene	>0.0336<		tissue	0.0000973	0.0000528	model
Acenaphthene	0.00454	0.000542	model	0.00202	0.000241	model
Acenaphthylene	0.0102	0.015	model	0.000134	0.000196	model
Anthracene	0.0308	0.0455	model	0.00195	0.00288	model
Benzo(a)anthracene	0.074	0.126	model	0.00111	0.0019	model
Benzo(a)pyrene	0.0833	0.137	model	0.00102	0.00168	model
Benzo(b)fluoranthene	0.0791	0.0824	model	0.000936	0.000975	model
Benzo(g,h,i)perylene	0.0184	0.0276	model	0.000738	0.00111	model
Benzo(k)fluoranthene	0.0497	0.0689	model	0.0012	0.00166	model
Chrysene	0.0803	0.13	model	0.00314	0.00507	model
Dibenzo(a,h)anthracene	0.00358	0.00349	model	0.0000738	0.000072	model
Dibenzofuran	>0.0336<		tissue	—	—	no data
Fluoranthene	0.174	0.578	model	0.0052	0.0173	model
Fluorene	0.00521	0.00594	model	0.00165	0.00189	model
Indeno(1,2,3-cd)pyrene	0.00877	0.0209	model	0.000371	0.000884	model
Naphthalene	0.0127	0.00446	model	0.000289	0.000102	model
Phenanthrene	0.0145	0.0486	model	0.00896	0.0301	model
Pyrene	0.458	1.07	model	0.00466	0.0109	model
Organotins (mg/kg wet wt)						
Tributyltin	0.00379		tissue	0.0397	0.0742	model

[a] Type refers to the method used to calculate the EPC for a constituent, including model and tissue (depending on whether or not it was ever detected in site tissue).

Type = model when a BAF was used to model tissue EPCs from sediment EPCs for each of the listed sediment data sets: All Years surface samples or 2005 surface samples (more details in Table 5-7 and Table 5-11).

Type = tissue produces only one EPC value calculated directly from site-specific tissue samples (more details in Table 5-3).

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
7	ambient data	Section 2.5	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 4.1.2, Pages 4-3 and 4-4; Figures 4-1 and 4-2. Battelle 2007.

- Total PCB concentrations in 1993/1994 were estimated by summing the individual Aroclor concentrations (i.e., individual congener concentrations were not measured during these investigations). Total PCB concentrations in 2001, 2005, and 2006 were estimated by multiplying the total summed congener concentrations (i.e., for the regional ambient data and the IR Site 20 data) by two. This approach follows a NOAA procedure (O'Connor, 1997), that looked at the relationship between the NOAA Status and Trends list of 18 congeners and Total PCBs in several data sets, and concluded that a multiplier of 2 is a reasonable estimator for Total PCBs.

4.1.2 Ambient Sediment Data

As part of the data evaluation, chemical concentrations at IR Sites 20 and 24 were compared to background or ambient concentrations from throughout the San Francisco Bay area. The Cal/EPA Regional Water Quality Control Board (RWQCB) established ambient threshold values (ambient background values) for chemicals in San Francisco Bay based on sediments collected from the least impacted portions of the Bay, located away from point and nonpoint sources of chemical contamination (RWQCB, 1998). To acknowledge the influence of physical factors on chemical concentrations, sediment grain size was considered and separate thresholds were listed for coarse (<40% fines) and fine (>40% fines) grain sediments. The guidance noted that it is appropriate that the threshold values for metals, chlorinated hydrocarbons, and pesticides be based upon the value for 100% fines. Based on the data distribution as a function of particle size, one of three models was used to calculate the ambient thresholds. Parametric methods were used for normal (or normal after log transformation) data; non-parametric methods were used if the data could not be shown to be normal. The thresholds serve as estimates of ambient chemical concentrations that can be compared to sediment chemistry results from a potentially contaminated site. A threshold was calculated as the 95% upper confidence limit on the 85th percentile of the ambient chemical concentrations (an upper tolerance limit, UTL). The choice of the percentile, p-value=0.85, was considered a policy decision intended to best "fit" the data clusters; p-values in the range of 0.7 to 0.95 were initially calculated and considered in the original report by the statistical consultants (Smith and Riege, 1998). This screening criterion is considered conservative as the false-positive rate on an 85th percentile UTL is quite high.

The RWQCB values described above represent a point estimate of ambient conditions. However, the Tier 2 screening applied in the ecological risk assessment (Section 6.4.1.2) involves comparison of the concentration distributions observed on site to ambient distributions using distribution shift tests (see Section 6.4 and Appendix C for a discussion of the ERA process and the distribution shift tests, respectively). For the purpose of developing the ambient distribution, sediment chemistry results collected by the Bay Protection and Toxic Cleanup Program (BPTCP), and San Francisco Estuary Institute (SFEI) Regional Monitoring Program (RMP) were considered. Specifically, all available sediment chemistry results from 1993 through 1997 from stations classified as ambient in the Ambient Sediment Chemistry report (RWQCB, 1998) were used. The BPTCP stations were Paradise Cove, San Pablo Bay Island #1, San Pablo Bay Tubbs Island, North South Bay, and South South Bay. The RMP stations were Alameda, Davis Point, Dumbarton Bridge, Grizzly Bay, Honker Bay, Horseshoe Bay, Oyster Point, Pacheco Creek, Petaluma River, Pinole Point, Point Isabel, Red Rock, Richardson Bay, Sacramento River, San Bruno Shoal, San Joaquin River, San Pablo Bay, South Bay, and Yerba Buena Island. All samples included were collected from the top 5 cm of sediment using a van Veen sampler and evaluated using standard analytical methods (BPTCP, 1998; RMP, 1997). Because of observed differences (Smith and Riege, 1998), multiple ambient values for chromium were calculated based on two extraction methods (hydrofluoric acid and acid regia); the ambient chromium results using hydrofluoric acid were not comparable to site data and were excluded from the dataset.

For constituents that were not analyzed by the RMP or BPTCP, reference data collected at 10 San Francisco Bay reference sites during the 1998 Alameda Point field sampling effort (TtEMI, 1998) and the 2001 Hunters Point Shipyards Parcel F Validation Study (Battelle et al., 2005b) were used. Reference data from San Francisco Bay were collected from five 1998 reference sites, and from five 2001 reference sites used in the Hunters Point Shipyards Parcel F Validation Study. The 10 reference sites are as follows:

1998 stations (Figure 4-1):

- RL01–North South Bay (BPTCP station number 20013)
- RL02–Alameda (RMP station number BB70)
- RL03–Oakland Entrance (offshore from Western Bayside [Chapman et al., 1987])
- RL04–Yerba Buena (RMP station number BC11)
- RL05–Paradise Cove (BPTCP station number 20005).

2001 stations (Figure 4-2):

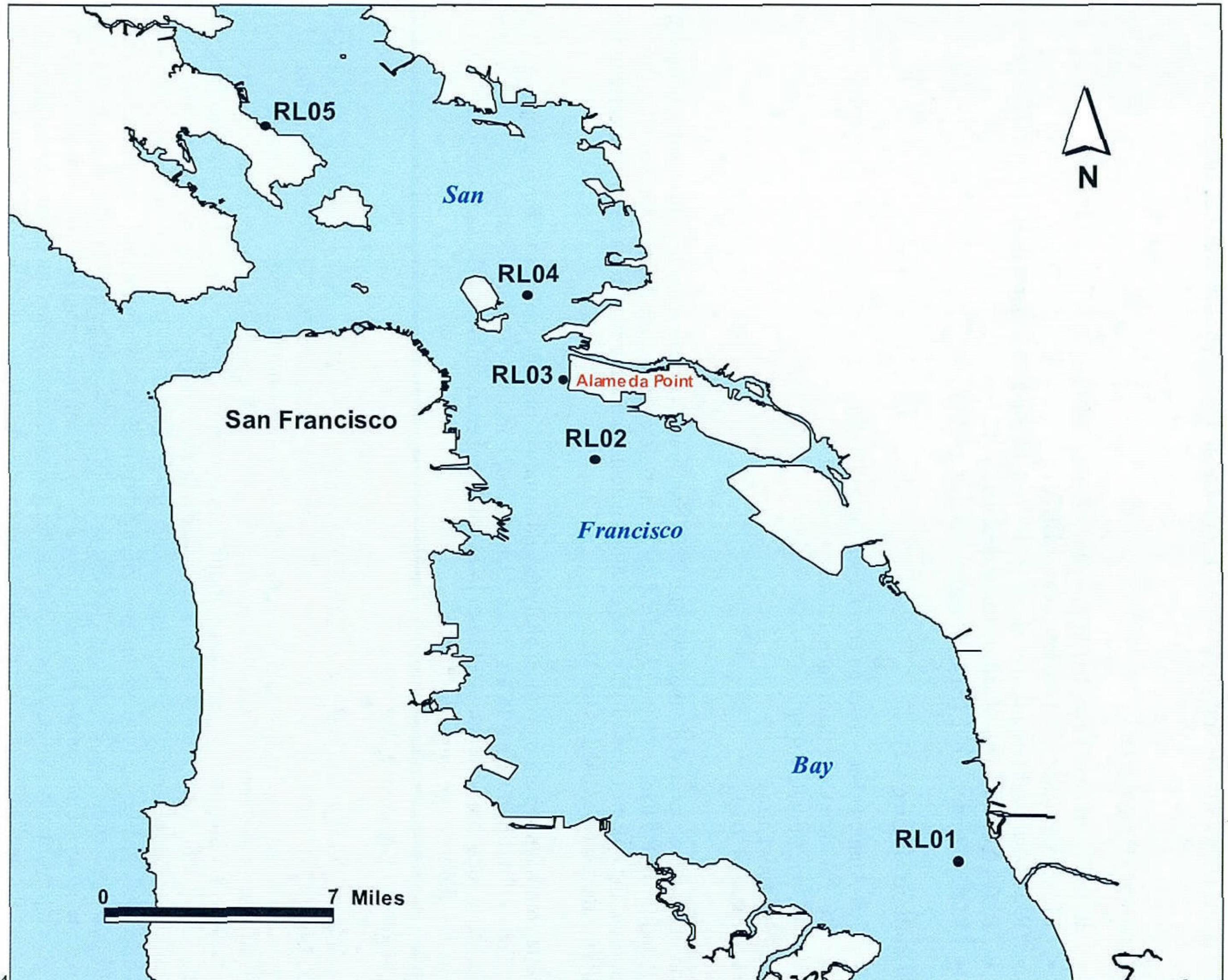
- AB-Alameda Buoy (same general location as RL02)
- PC-Paradise Cove (same general location as RL05)
- AE-Alcatraz Environs
- BF-Bay Farms
- RR-Red Rocks.

Detection limits were reported for the 1998 and 2001 San Francisco Bay reference site results; whereas, the RMP and BPTCP databases have coded values for non-detected results and no reported DLs. For presentation in the box plots, one-half of the smallest detected concentration for a specific analyte in the RMP/BPTCP data set was used as the DL.

For organic compounds, both individual analytes and summed totals of analytes within a group (i.e., Total LPAHs, Total HPAHs, and Total PCBs) are presented. For consistency of presentation, total concentrations at ambient locations were summed from individual congeners following the same methodology applied to the Alameda site sampling results.

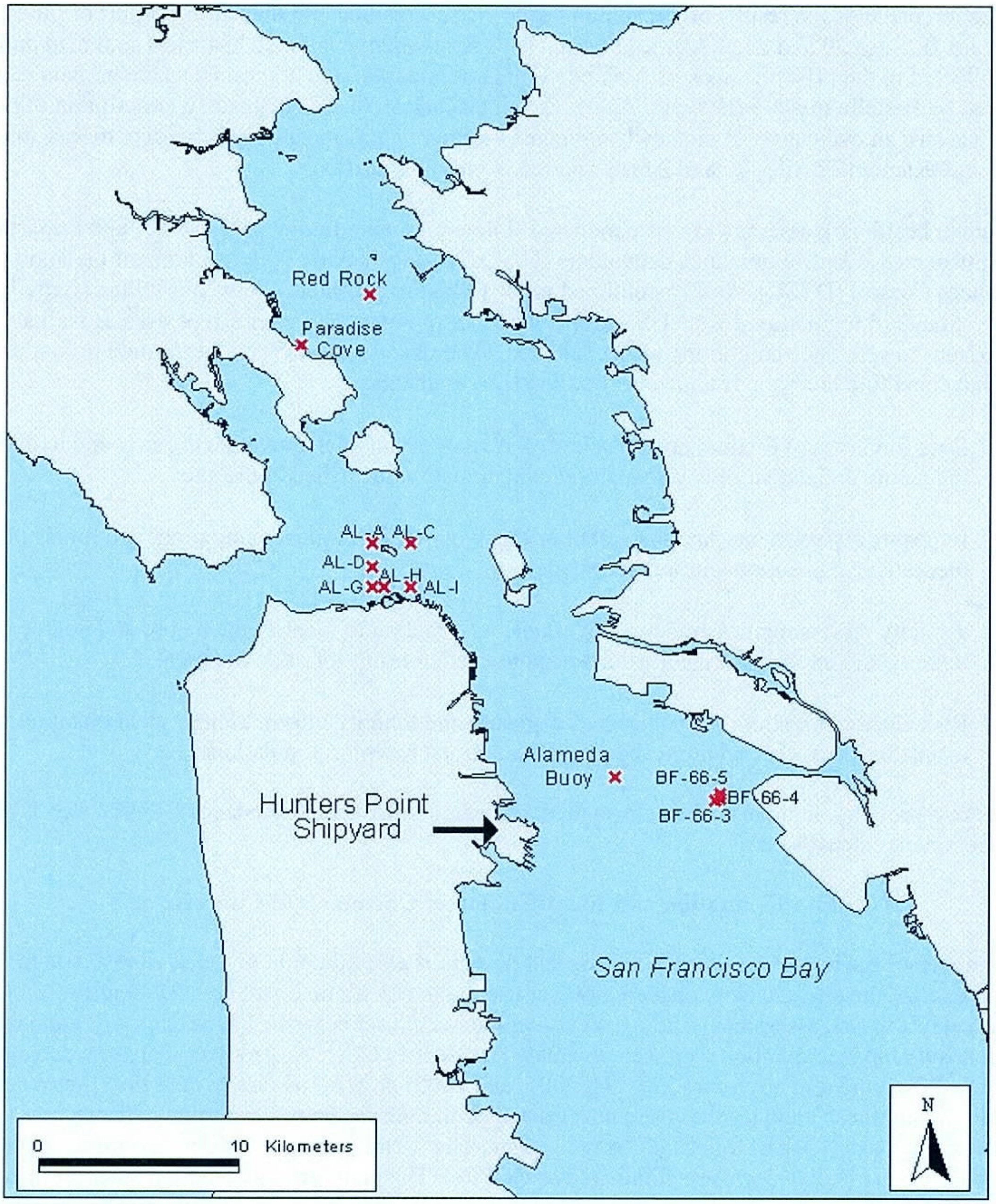
4.1.3 Sediment Chemistry Box Plots

Box plots are presented in Appendix A for all compounds that were detected in one or more samples from the 1993, 1994, 1996, 1997, 1998, 2001, 2005, and 2006 field investigations. Box plots summarize information about the shape and spread of the distribution of concentrations from a data set. The Y-axis displays the observed concentrations of the data in the appropriate units. The bottom edge of the box represents the lower quartile (Q1, equivalent to the 25th percentile) of the data; 25% of the data falls below this value. The upper edge of the box represents the third or upper quartile of the data (Q3, equivalent to the 75th percentile); 25% of the data are above this value. The height of the box (i.e., the interquartile range, Q3-Q1) provides a measure of the spread of the concentrations. The horizontal line across the box represents the median (i.e., the 50th percentile or second quartile) of the data, providing a measure of the center of the concentration distribution. In a normal distribution, the median line divides the box into approximately two equal parts, indicating that the shape of the concentration distribution is symmetric. If the median divides the box into unequal parts, it indicates that the distribution is skewed or nonsymmetric.



24

Figure 4-1. 1998 Reference Sampling Locations



Note: AL = Alcatraz Environs, BF = Bay Farm

Figure 4-2. 2001 Reference Site Sampling Locations

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
8	**human health risk assessment**	**Section 2.5.1**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 7, Pages 7-1 through 7-13; Figure 7-1; Tables 7-1, and 7-3 through 7-15. Battelle 2007.

7.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the results of the human health risk assessment conducted in support of the RI Report for IR Sites 20 and 24 at Alameda Point. This assessment evaluated historical sediment and tissue data collected in the offshore areas of Alameda Point and incorporated additional sediment data recently collected by Battelle in 2005 (Battelle, 2005). A full discussion of the site history, description of previous investigations, an evaluation of the newly collected sediment data, and a comprehensive discussion of nature and extent at IR Sites 20 and 24 is provided in previous sections.

The human health risk assessment was conducted following methodology in U.S. EPA and Department of Toxic Substances Control guidance documents (U.S. EPA, 1989b and 2002; Department of Toxic Substances Control [DTSC], 2002) as outlined in the Offshore Sediment Study Work Plan (Battelle et al., 2005a). Standard regulatory dose relationships were incorporated, and cumulative risks as well as comparisons to reference conditions were evaluated. The risk assessment was performed in four essential steps that constitute the basic framework for all risk assessments:

- Data Review and Evaluation: A review of available data to characterize the site; and to define the nature and extent of environmental contamination identified at the site.
- Exposure Assessment: An assessment of the magnitude, frequency, duration, and routes of theoretical exposure to site-related waste.
- Toxicity Assessment: A review of available information to identify the nature and degree of toxicity and to characterize the dose-response relationship for each chemical.
- Risk Characterization: A synthesis of exposure and toxicity information to yield quantitative estimates of cancer and non-cancer risks to defined receptor populations.

Appendix F provides summary tables, formatted according to U.S. EPA guidance (RAGS, Part D) for the risk assessment calculations.

7.1 Data Evaluation and Identification of Chemicals of Concern

The first step of the human health risk assessment process is an evaluation of the available data to: (1) characterize the site, (2) develop a data set for use in the risk assessment, and (3) identify COPCs. For the human health risk assessment, the All Years sediment data set described in Section 4.1.1 and the 28-day *M. nasuta* bioaccumulation data were evaluated to identify COPCs. Analytes that were detected at least once in sediment in any year (1993/94, 2001, and 2005) or in *M. nasuta* tissue (1993) were selected as COPCs; only those analytes that were never detected in both media were eliminated from consideration. As a result of this COPC screen, *alpha*-BHC, endosulfan I, endosulfan sulfate, endrin, *gamma*-BHC, and heptachlor were eliminated as COPCs. The non-detect sediment results for these contaminants were reviewed to verify that the associated detection limits were sufficiently sensitive. They were compared to U.S. EPA preliminary remediation goals (PRG) (U.S. EPA, 2004a) to ascertain whether or not these contaminants were present at concentrations capable of eliciting an adverse human health effect. The maximum sediment detection limits reported for these six pesticides were all well below U.S. EPA's industrial PRGs (Table 4-3). In addition, human health risks and hazards for these six pesticides that were not detected were evaluated, and all cancer risks and hazard quotients for these contaminants were well below the target cancer risk of 1×10^{-6} and hazard quotient of 1.

As described in Section 5.5, two approaches were used to calculate EPCs for *M. nasuta* tissue. Analytes that were detected in historical *M. nasuta* tissue data were used to calculate tissue EPCs. However, many of the organic compounds were non-detects, and detection limits were elevated. Therefore, for analytes detected in sediment, but not detected in historical site-specific tissue, EPCs were modeled by multiplying the sediment EPCs by a BAF. A list of the COPCs evaluated is provided in Table 7-1.

7.2 Exposure Assessment

The exposure assessment includes an assessment of the magnitude, frequency, duration, and routes of theoretical human exposure to site-related COPCs. In this step, both current and hypothetical future site uses are considered, and complete exposure pathways to actual or probable human receptors that would come in contact with site-related COPCs are identified and evaluated.

7.2.1 Exposure Pathways and Receptors

In general, an exposure pathway describes the course a chemical takes from the source to the exposed receptor. An exposure pathway analysis links the source, location, and type of environmental release with population location and activity patterns to determine the primary pathways of exposure. If potentially complete and significant exposure pathways exist between contaminants and receptors, an assessment of potential effects and exposure is conducted. Only those potentially complete exposure pathways likely to contribute significantly to the total exposure have been quantitatively evaluated. All other potentially complete exposure pathways which result in minor exposures or for which there are no exposure models or insufficient toxicity data were not quantitatively evaluated in this assessment.

An exposure pathway is considered complete if all four of the following elements are present:

- A source and mechanism of chemical release;
- A retention or transport medium;
- A point of contact between the human receptor and the medium; and
- A route of exposure for the potential human receptor at the contact point.

A complete exposure pathway from the source of chemicals in the environment (i.e., from sediment) to human receptors must exist in order for chemical intake to occur. If all exposure pathways are incomplete for human receptors, no chemical intake occurs and, hence, no human health effects are associated with site-related COPCs. Section 3 discussed the sources and transport mechanisms for each site; a summary of the exposure pathways for each site is presented below. In accordance with U.S. EPA guidance (U.S. EPA, 1989b), both current and anticipated future conditions are considered.

7.2.1.1 IR Site 20

IR Site 20 is a waterway in a highly industrialized area, serving as a major transit route for ships moving in and out of docks and repair facilities. The majority of the waterway is lined with riprap and a seawall, is continuously submerged up to a depth of 42 feet, and is subjected to significant tidal currents. Shellfish have been observed along the shoreline areas and could be accessible to individuals wishing to harvest them. Currently no actual or anecdotal evidence indicates that individuals are actually harvesting and consuming shellfish from this area; however, due to the accessibility of shellfish, indirect exposures of chemicals associated with the consumption of shellfish located along the riprap and seawall were conservatively considered in this evaluation (Figure 7-1). In addition, it was assumed that individuals harvesting shellfish would also be exposed to chemicals in sediments through dermal contact and incidental ingestion. Direct contact with surface water was identified as a complete pathway, but as discussed in Section 3, water is not considered a primary exposure medium due to the rapid dilution of chemicals resulting from tidal action and San Francisco Bay currents. In addition, activities associated with shellfish collection would occur at low tide, further limiting contact with surface water. Consequently, exposures via surface water were not proposed for quantitative evaluation.

Indirect exposure via fishing was considered a complete exposure pathway at IR Site 20; however, risk associated with ingestion of local catch is a bay-wide issue that has resulted in health advisories on all major waterways in the San Francisco Bay Area (SFEI, 1999). Most of the sport fish targeted by recreational anglers have extensive foraging ranges; therefore, it is difficult to distinguish the risk attributable to the site from risk associated with other point sources along IR Site 20 or bay-wide conditions. Thus, risks associated with ingestion of fish were not considered a primary pathway. As a conservative estimate of potential risks, forage fish tissue concentrations modeled for the ecological risk assessment were evaluated.

Under the proposed reuse plan (ARRA, 1996), IR Site 20 will remain a viable shipping channel. Therefore, it is assumed that the future use of IR Site 20 will be similar to current conditions and that the area will continue to be a major shipping channel, with the potential for an additional ferry terminal or other docking facilities. Based on these assumed future uses, the receptors and exposure scenarios outlined in Figure 7-1 should apply to both current and future conditions, with the exception that direct exposures to sediments may decrease slightly at IR Site 20 as a result of potential future dock construction. In addition, it is likely that regular maintenance dredging will be conducted by the USACE and the Port of Oakland. Future dredging may reduce concentrations in surface sediment.

Risks to children associated with consumption of shellfish were not calculated because as observed by SFEI (2002), children under the age of 6 years are unlikely to consume shellfish. Only 13% of the SFEI study (2002) participants reported that children under the age of six eat locally caught fish and only 2% reported that pregnant or breastfeeding woman eat a portion of their catch. Given that only 5% of the overall seafood consumption among San Francisco anglers is comprised of shellfish (Wong, 1997), it can be assumed that less than 1% of Bay-area children under the age of six (0.65%) may be consuming shellfish from San Francisco Bay. Overall, there is a low probability of child exposure (with respect to intake amounts and frequency of exposure); as such, this pathway is considered a potentially complete but insignificant route. However, risks to children associated with direct contact to sediment during collection of shellfish and with sport fish ingestion were estimated to ensure that evaluation of the adult receptor was adequately protective.

7.2.1.2 IR Site 24

Similar to IR Site 20, sediments are the primary exposure medium at IR Site 24. However, the current and potential future land uses are very different. Whereas the physical setting at IR Site 20 makes it possible for individuals to access the shoreline areas to harvest shellfish, similar activities at IR Site 24 are unlikely. The area is dominated by three piers consisting of concrete platforms supported by concrete columns, with water depths of up to 40 feet. The area under the roadway is difficult to access from land, as there are no open walkways or ladders. A few emergency exit ladders are present, but none of them reach solid or intertidal ground; the ladder bottoms have contact with floating or attached large wooden beams. The water depth at the pier face ranges from approximately 12 feet in the northeast corner at Station PA C-20 to approximately 28 feet at the southwestern station PA C-28. Due to the water depth, it is not possible to walk under the roadway from the pier. Access by boat is blocked by pier pilings and cross members. Only one entrance under the pier was available for sampling, near PA C-28, and this entrance could easily be closed. During the 2006 sampling event, movement under the roadway was only possible at low tide.

Sediment observed at low tide under the roadway was primarily sand covering rip-rap; areas of sand covering mud were always submerged. As a result, the habitat required to support clam beds (i.e., intertidal mudflats) is not present and, therefore, a resident shellfish population is not likely. A small population of mussels has been noted on the pier structures; however, the limited and difficult access to water and shoreline reduces the likelihood that humans could harvest sufficient numbers of these mussels to make shellfish consumption a significant exposure pathway. During the 2006 sampling survey, there was no evidence of any shellfish collection activities in the area (fishing gear, scrape marks on pilings, debris, etc.). In addition, IR Site 24 is fully operational under its proposed reuse as a commercial marina to berth cruise ships and historical landmark vessels. Both of these activities further limit the ability of individuals to access the area for recreational purposes. The Community Reuse Plan for Alameda Point (ARRA, 1996) does not include any plans to tear down the piers. Based on this information, no complete human health exposure pathways were identified for IR Site 24, and this area was not evaluated further.

With respect to consumption of sport fish, individuals have been reported to fish from the piers. The limited shallow habitat makes it unlikely that there are a significant number of resident fish species; therefore, fish targeted by anglers at the site are likely to be sport fish with relatively large foraging ranges, making it difficult to apportion site-specific risks. To evaluate the potential risks, fish tissue concentrations were modeled based on the sediment EPCs and the BAFs developed in Section 5 (see Section 5.6.1) and compared to tissue concentrations reported at reference locations (Table 7-2). In general, tissue concentrations are lower than or similar to those reported for reference. The risks associated with those reference concentrations are presented in Table 7-3. Based on this information, the potential risks to human health were determined to be low and comparable to reference and no further evaluation is recommended.

7.2.2 Exposure Point Concentrations

Estimates of chemical concentrations at points of potential human exposure are necessary for evaluating chemical intakes by potentially-exposed individuals. For the human health risk assessment, EPCs were developed for sediment and shellfish. In addition, EPCs for forage fish calculated for use in the ecological risk assessment were considered as a conservative estimate of potential risks associated with consuming sport fish.

As discussed in Section 5.0, exposure point concentrations for sediment were developed based on three data sets: All Years, 2005 Surface, and 2005 Subsurface. For the human health assessment, sediment EPCs (in dry weight) developed for the All Years and the 2005 Surface data sets were considered. The 95% UCL or the maximum concentration, whichever was less, was used as the EPC for all exposure scenarios. For *M. nasuta* tissue, wet weight EPCs were generated using historical tissue data for all constituents that were detected in tissue. For constituents that were detected in sediment in any year, but not in tissue, EPCs were calculated by multiplying a bioaccumulation factor times the sediment EPC for each area. Wet weight concentrations also were modeled for forage fish, as described in Section 5.6.

Exposure point concentrations also were developed to reflect reference conditions, for the purpose of comparison. As described in Section 4.1.2, ambient background concentrations of San Francisco Bay sediment were based on reference station sediment data collected from five 1998 reference sites (Alameda Point field sampling effort, TtEMI, 1998) and from five 2001 reference sites used in the Hunters Point Shipyards Parcel F validation study (Battelle et al., 2005b). To characterize exposure to ambient background concentrations of invertebrate prey, *M. nasuta* exposed in the laboratory for 28 days to sediment from ten reference station locations in San Francisco Bay was used. Five of the reference bioaccumulation assays were conducted in 1998 as part of the Seaplane Lagoon field sampling effort (TtEMI, 1998), and the remaining five stations were collected as part of the Hunters Point Shipyards validation study (Battelle et al., 2005b).

7.2.3 Exposure Parameters

Intake is estimated by combining exposure point concentrations with the variables that describe exposure:

- Rate of contact with the medium containing the constituent;
- Frequency of contact;
- Duration of contact; and
- Body weight of the exposure individual

Intake of individual chemicals as a result of exposure was estimated following U.S. EPA (1989b) guidance and using U.S. EPA standard default parameters (U.S. EPA, 1991) and literature-derived values regarding conservative exposure conditions. An intake factor is the concentration of a chemical in a quantity of a medium (e.g., seafood tissue) taken into the body through an exposure route (e.g., ingestion) and available for absorption. It is expressed in units of milligram (mg) of chemical per kilogram (kg) body weight per day (mg/kg-day). For the purpose of this assessment, parameters were selected to model exposures under both a Reasonable Maximum Exposure (RME) and a Central Tendency Exposure (CTE) scenario. The RME relies on conservative exposure factors to estimate the reasonable maximum exposures anticipated for the site, whereas the CTE describes a more typical or average exposure to an individual.

Table 7-4 summarizes the specific exposure factors used to derive the dose calculated for each exposure scenario using Equations 7-1 and 7-2 described below. The doses derived in this manner for each scenario were then summed to estimate a lifetime average daily dose (LADD) and average daily dose (ADD) for each constituent by sampling area based on the adult and child RME and CTE exposure scenarios, respectively. A summary of each of the key exposure parameters and the rationale for their selection is provided below.

Fish Ingestion Rate (IR_{tissue}): The SFEI recently completed an extensive survey of consumption of fish from San Francisco Bay (SFEI, 2002). Based on the data provided in this report, the median fish consumption rate for all participants was 16 g/day (0.016 kg/day) and the 95th percentile was 108 g/day (0.108 kg/day). Based on data presented in Table 10-61 of the U.S. EPA Exposure Factors Handbook (1997b), the mean total fish consumption rate for children 1 to 5 years of age who reside in households with recreational fish consumption is 11 g/day (RME). The mean consumption rate of recreational fish by children from the same study is 5.6 g/day (CTE).

Shellfish Ingestion Rate (IR_{tissue}): Data are not available to describe the consumption rate of shellfish in the San Francisco Bay area. However, it has been reported that shellfish typically comprise less than five percent of total seafood consumption among San Francisco anglers (Wong, 1997). Therefore, in the absence of information specific to shellfish, it was conservatively assumed that the shellfish consumption rate was 5 percent of the fish consumption rate reported by SFEI (2002). This equates to an assumption of 0.8 g/day (0.0008 kg/day) for the CTE and 5.4 g/day (0.0054 kg/day) for the RME.

Risks to children associated with consumption of shellfish were not calculated because as observed by SFEI (2002), children under the age of 6 years are unlikely to consume shellfish. Only 13% of the SFEI study (2002) participants reported that children under the age of six eat locally caught fish, and only 2% reported that pregnant or breastfeeding women eat a portion of their catch. Given that only 5% of the overall seafood consumption among San Francisco anglers is comprised of shellfish (Wong, 1997), it can be assumed that less than 1% of Bay-area children under the age of six (0.65%) may be consuming shellfish from San Francisco Bay. However, risks to children associated with direct contact to sediment during collection of shellfish and consumption of sport fish were estimated to ensure that evaluation of the adult receptor was adequately protective.

Sediment Ingestion (IR_{sed}): To estimate incidental ingestion of sediment as a result of clamming activities, the daily soil ingestion rates for adults (100 mg/day) and children (200 mg/day) from U.S. EPA PRG Table (U.S. EPA, 2004a) were used for the RME scenario. One half the daily ingestion rates for adults (50 mg/day) and children (100 mg/day) were assumed for the CTE.

Fraction Ingested (FI): To account for the fact that the ingestion rates and dermal contact rates applied include exposures to sediments from other sources, the FI was included to distinguish that portion assumed to be specific to exposures at IR Site 20. The FI accounts for the potential exposures of contaminants from other anthropogenic and natural sources which are not associated with IR Site 20. For the CTE, it was assumed that one-half of the total exposure to chemicals was from the site based on professional judgment, whereas for the RME, it was conservatively assumed that 100% of the exposures that occurred were associated with IR Site 20.

Exposure Frequency (EF): The shellfish ingestion rates are annualized and presented on a daily basis. Therefore, the exposure frequency for the shellfish ingestion pathway is assumed to be 365 days per year (U.S. EPA, 1989b).

It was assumed that individuals harvesting shellfish from the site would engage in this activity one day per week for six months of the year (RME) or one day every two weeks for six months of the year (CTE). Therefore, for the purpose of calculating risks associated with direct sediment exposures (i.e., dermal contact and incidental ingestion), the exposure frequency was assumed to be 13 days per year for the CTE and 26 days per year for the RME.

Exposure Duration (ED): An assumed exposure duration of 9 years was used for typical individuals. For the RME, an exposure duration of 30 years was assumed. These assumptions were based on recommendations by U.S. EPA (1989b) and represent median and 90th percentile estimates of residential tenure at a single location, respectively. For the child scenario, an exposure duration of 6 years was used (U.S. EPA, 1989b).

Body Weight (BW): Based on information presented by U.S. EPA (2004a), a body weight of 70 kg for adult and 15 kg for child was assumed for both the typical exposure and the RME.

Skin Surface Area (SA): To evaluate dermal exposures, it was assumed that individuals would wear a short-sleeve shirt and shorts, exposing hands, forearms, lower legs, and feet (i.e., 5,700 cm^2/day for adult and 2,800 cm^2/day for child) (U.S. EPA, 2004a).

Adherence Factor (AF): An adherence factor of 0.07 mg/cm^2 for adult and 0.20 mg/cm^2 for child was assumed for both the CTE and RME (U.S. EPA, 2004a).

Dermal Absorption Factor (DAF): Dermal absorption factors were based on data reported by DTSC's Preliminary Endangerment Assessment (PEA) Manual for Inorganic and Organic Compounds (DTSC, 1994). For those COPCs with no available information, a DAF of 0.01 was assumed for metals, and 0.1 for organics.

Averaging Time (AT): Averaging time is equal to the lifetime of the individual (70 years × 365 days per year) when evaluating risks to carcinogens. For noncarcinogens, the averaging time is equal to the exposure duration (U.S. EPA, 2004a).

7.2.4 Exposure to Lead

Exposure to lead in environmental media cannot be evaluated by calculating a chemical intake or dermal dose. Lead presents an exception to the paradigm that noncarcinogenic effects of chemicals occur only at exposure levels exceeding some physiological threshold at which natural defense mechanisms are overwhelmed. Some of the effects of lead exposures, particularly changes in the levels of certain blood enzymes, appear to occur at blood lead levels so low as to be essentially without a threshold. Studies have shown that the absorption of lead through food ingestion by infants up to six months old is known to be very high, and is much lower in adults. Less information is available regarding the potential absorption of lead through ingestion of affected food for older infants, toddlers, and children. As a result, the U.S. EPA has deemed it inappropriate to estimate toxicity-based dose levels. Instead, potential risk associated with lead exposure is assessed by means of blood lead levels.

The U.S. EPA (1994) and DTSC (2002) have established a target blood lead level for children less than eight years of age, who are particularly susceptible to lead toxicity, of no more than 10 μg/dL (micrograms of lead per deciliter of blood) for both short- and long-term exposures. However, the models proposed by these agencies are designed to estimate blood-lead level in children based on lead contamination of soil, drinking water, homegrown vegetables, respirable dust, and air. Because these models are not designed to predict lead levels associated with seafood uptake from sediment, estimates of risk associated with lead ingestion were not quantified. The maximum concentrations for lead in surface sediment at IR Site 20 sampling locations were 225.5 mg/kg at OIH 57 in 2001 and 186 mg/kg at OIH 28 in 2001. All other surface sediment lead values were less than 106 mg/kg for the All Years dataset, and the 95% UCL for lead for the site was 61.4 mg/kg. For comparison purposes, U.S. EPA Region 9 recommends a PRG of 400 mg/kg of lead in soil based on acceptable blood-lead levels in children less than six years of age. In the State of California, a Cal-Modified lead PRG (150 mg/kg), which has been calculated using California EPA toxicity values and EPA Region 9 exposure methodology, should be used as a screening level because it is more stringent than the Federal value (U.S. EPA, 2004a). Assuming a bioaccumulation factor of 1, the lead concentrations at IR Site 20 are two times lower than the U.S. EPA Region 9 PRG, and most individual sample concentrations, as well as the site-wide 95% UCL, are well below the Cal-Modified lead PRG determined to be health-protective for children. Consequently, further modeling of lead uptake by children was not warranted.

7.2.5 Dose Estimates

Using the EPCs for each media and the parameters described above, doses associated with each scenario were calculated using the following standard risk equations:

Sediment exposures:

$$\text{Dose (mg/kg/day)} = \frac{(C_{sed} \times IR_{sed} \times FI \times EF \times ED) + (C_{sed} \times SA \times AF \times DAF \times FI \times EF \times ED)}{BW \times AT} \qquad (7\text{-}1)$$

Consumption of fish and shellfish:

$$\text{Dose (mg/kg/day)} = \frac{C_{tissue} \times IR_{tissue} \times EF \times ED \times FI}{BW \times AT} \qquad (7\text{-}2)$$

where: Dose = rate of chemical intake across the body (mg/kg-day)
C = chemical concentration in contaminated media or EPC (mg/kg)
IR = contact or ingestion rate (mg/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
FI = fraction ingestion (unitless)

SA = skin surface area exposed (cm^2/day)
AF = skin adherence factor (mg/cm^2)
DAF = dermal absorption factor (unitless)
BW = body weight (kg)
AT = averaging time (days).

Calculating doses based on carcinogenic effects for a combined 30-year recreational receptor requires mathematical adjustment of exposure parameters so that both childhood and adult exposures are considered. Generally, U.S. EPA recommends that, for the RME scenario, a standard exposure duration of 30 years is used to evaluate exposures to residents (i.e., children and adult). Because children, as well as adults, may have access to site-related contamination through direct contact, this evaluation used age-adjusted intake rates for the estimates of cancer risk for the RME scenario. This approach takes into account the difference in daily intake rate, body weight, and exposure durations for children from 1 to 6 years old and adults from 7 to 31 years old. The lower intake rate and body weight produces a more conservative risk estimate than if adult-only exposures were assumed. The derivation of the age-adjusted intake rates for the RME is provided in Appendix F. Age-adjusted rates were not used for the shellfish ingestion scenario because it was assumed that there was no childhood exposure.

7.3 Toxicity Assessment

The toxicity assessment determines the relationship between the magnitude of exposure to a COPC and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of risk assessment, COPCs are classified into two broad categories: carcinogens and noncarcinogens.

Carcinogens are agents that induce cancer. Numerical estimates of cancer potency are presented as cancer slope factors (CSFs). The CSF defines the cancer risk due to constant lifetime exposure (24 hours a day for 365 days per year) to one unit of carcinogen (in units of risk per mg/kg/day). CSFs are derived by calculating the 95% UCL on the slope of the linearized portion of the dose-response curve obtained from a multistage (nonlinear) cancer model. Use of the 95% UCL of the slope means that there is only a 5% chance that the probability of a response could be greater than the estimated value for the experimental data used. This is a conservative approach and is likely to overestimate the actual risk given that the actual risk is expected to be between zero and the calculated value. Carcinogenic slope factors assume no threshold for effects such that exposure to any level of concentration is likely to produce a carcinogenic effect.

EPA's guidance for evaluating the potential carcinogenicity of chemicals have been updated over the years to reflect increased understanding of the processes of cancer development and the modes of actions of disease at the cellular level. U.S. EPA issued the first set of final risk assessment guidelines in 1986, including *Guidelines for Carcinogen Risk Assessment* (51 FR 33992, September 24, 1986). These guidelines detailed a WOE approach for classifying the carcinogenic potential of chemicals. The five general classifications used under the U.S. EPA 1986 guidance are listed below:

Group A - Human Carcinogen. Sufficient evidence from human epidemiological studies exists to support a causal association between exposure and cancer.

Group B - Probable Human Carcinogen. This group consists of (1) compounds for which limited evidence of carcinogenicity in humans exists based on epidemiological studies (B1 carcinogens), and (2) compounds for which sufficient evidence of carcinogenicity in animals exists; however, adequate evidence of carcinogenicity in humans is not available (B2 carcinogens).

Group C - Possible Human Carcinogen. This includes those compounds for which there is limited evidence of carcinogenicity in animals.

Group D - Not Classifiable as a Human Carcinogen. This includes those compounds for which there is inadequate animal evidence of carcinogenicity.

Group E - Evidence of Noncarcinogenicity in Humans. This includes compounds for which there is no evidence for carcinogenicity in at least two adequate animal tests in difference species, or in both adequate epidemiological and animal studies.

In 1996, U.S. EPA released *Proposed Guidelines for Carcinogen Risk Assessment* (61 FR 17960 [April 23, 1996]), which used descriptive phrases rather than the alphanumeric classification to classify carcinogenic potential:

"Known/Likely". This category of descriptors is appropriate when the available tumor effects and other key data are adequate to convincingly demonstrate carcinogenic potential for humans.

"Cannot Be Determined". This category of descriptors is appropriate when available tumor effects or other key data are suggestive or conflicting or limited in quantity and, thus, are not adequate to convincingly demonstrate carcinogenic potential for humans. In general, further agent specific and generic research and testing are needed to be able to describe human carcinogenic potential.

"Not Likely". This is the appropriate descriptor when experimental evidence is satisfactory for deciding that there is no basis for human hazard concern, as follows (in the absence of human data suggesting a potential for cancer effects):

The proposed guidelines underwent several peer reviews and revisions, including interim final guidelines released in 1999, leading to the publication of the final revision to the *Guidelines for Carcinogen Risk Assessment* in March 2005 (70 FR 17765 [April 7, 2005]). Under these guidelines, a weight of evidence narrative summarizes the results of the hazard assessment and provides a conclusion with regard to human carcinogenic potential, which is in contrast to the step-wise approach in the 1986 cancer guidelines. The narrative summarizes the full range of available evidence and describes any conditions associated with conclusions about an agent's hazard potential. To provide additional clarity and consistency in weight-of-evidence narratives, standard descriptors are utilized as part of the hazard assessment narrative to summarize the biological evidence. The five descriptors currently used by the U.S. EPA are listed below:

Carcinogenic To Humans: This descriptor is appropriate when there is convincing epidemiologic evidence demonstrating causality between human exposure and cancer, or exceptionally when there is strong epidemiological evidence, extensive animal evidence, knowledge of the mode of action, and information that the mode of action is anticipated to occur in humans and progress to tumors.

Likely to be Carcinogenic to Humans: This descriptor is appropriate when the available tumor effects and other key data are adequate to demonstrate carcinogenic potential to humans, but does not reach the weight-of-evidence for the descriptor "carcinogenic to humans."

Suggestive Evidence of Carcinogenic Potential: This descriptor is appropriate when the evidence from human or animal data is suggestive of carcinogenicity, which raises a concern for carcinogenic effects but is judged not sufficient for a stronger conclusion.

Inadequate Information to Assess Carcinogenic Potential: This descriptor is used when available data are judged inadequate to perform an assessment.

Not likely to Be Carcinogenic to Humans: This descriptor is used when the available data are considered robust for deciding that there is no basis for human hazard concern.

Noncarcinogenic effects were evaluated using reference doses (RfDs) developed by the U.S. EPA. RfDs are expressed as acceptable daily doses in milligrams of compound per kilogram of body weight per day (mg/kg-day). The RfD is a health-based criterion based on the assumption that thresholds exist for non-carcinogenic toxic effects (e.g., liver or kidney damage) based on a length of time of exposure (chronic and subchronic). In general, the chronic RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime of exposure (U.S. EPA, 1989b). Chronic RfDs are specifically developed to be protective for long-term exposure between 7 years and a lifetime to a compound. Chronic RfDs were used in this assessment to evaluate the noncarcinogenic effects associated with exposure to site-related COPCs.

The toxicity for most of the COPCs at IR Site 20 is relatively well-known and their toxicity criteria have been well established. If available, toxicity criteria were selected (in order of preference) from the following sources: (1) California DTSC Office of Environmental Health Hazard Assessment (OEHHA) Criteria for Carcinogens (DTSC, 2002); (2) U.S. EPA's Integrated Risk Information System (IRIS) (U.S. EPA, 2005b); and (3) U.S. EPA's Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 2001c). This is the same hierarchy used to derive toxicity values in the Seaplane Lagoon RI Report (Battelle et al., 2004b). Table 7-5 presents the cancer slope factors (CSFs) and noncarcinogenic chronic RfDs for all of the IR Site 20 COPCs. The majority of the COPCs at IR Site 20 were classified as Class B2 carcinogen based on animal studies (Table 7-5).

Compounds that did not have DTSC or U.S. EPA-approved toxicity criteria were not evaluated quantitatively. There are a variety of reasons why a chemical may not have a toxicity criterion. U.S. EPA may withdraw values due to lack of consensus among their scientists regarding the toxicity of particular compounds. This is not an indication by U.S. EPA that the compounds were nontoxic, but that the degree of toxicity is questionable. Other compounds (including organotins) have no U.S. EPA-accepted toxicity assigned to them and consequently, dose and risks estimates were not evaluated for these compounds.

However, because toxicity criteria are available for most of the chemicals with known or documented effects, it is assumed that the majority of the potential risk at the site is captured in this evaluation. Potential risks associated with exposure to any chemicals lacking U.S. EPA- or DTSC-approved toxicity criteria are discussed qualitatively in the uncertainty section.

7.4 Risk Characterization

Risk characterization involves estimating the magnitude of the potential adverse health effects of the hazardous chemicals under investigation and making summary judgments about the nature of the human health threat to the defined receptor populations. It combines the results of the dose-response (toxicity) and exposure assessment. During the risk characterization, estimates of cancer risk and the potential for noncarcinogenic effects are determined. Site-specific risks and hazards were compared to the risks and hazards associated with the reference locations in order to provide a perspective of the relative risk associated with IR Site 20. In addition, cumulative risks were determined by summing the risks associated with each COPC.

7.4.1 Estimating Cancer Risks

The cancer risk was estimated using the following linear dose-response relation where risk is directly related to intake (U.S. EPA, 1989b):

$$\text{Risk} = \text{CSF} \times \text{LADD} \qquad (7\text{-}3)$$

where: Risk = Excess lifetime cancer risk (probability)
CSF = Cancer Slope Factor $(\text{mg/kg-day})^{-1}$
LADD = Lifetime average daily dose (mg/kg-day).

LADDs are used in conjunction with cancer slope factors to obtain excess lifetime cancer risk estimates as slope factors are based on average lifetime exposures. Slope factors are derived for specific routes of exposure, so only oral toxicity values were applied in this assessment. Cancer risks from exposure to multiple carcinogens were assumed to be additive (U.S. EPA, 1989b). Risks are estimated as probabilities for constituents, which elicit a carcinogenic response. The excess lifetime cancer risk is the incremental increase in the probability of getting cancer compared to the reference probability or that with no exposure to site COPCs. A risk of 1×10^{-6}, for example, represents the probability that for every one million people exposed during their lifetime (70 years) to a particular carcinogen at the specified level, one addition cancer case may occur.

7.4.2 Estimating Noncarcinogenic Hazard Quotients

The potential for noncarcinogenic health effects is estimated by comparing ADD of a compound with the chronic RfD based on the oral route of exposure. The ratio of the intake to reference dose (ADD/RfD) for an individual chemical is termed the hazard quotient (HQ). A HQ greater than benchmark of 1 indicates the potential for adverse health effects, as the RfD is exceeded by the intake (U.S. EPA, 1989b). These ratios are calculated for each chemical that elicits a noncarcinogenic health effect when an oral RfD is available for the chemical. HQs less than the benchmark hazard level indicate that no adverse health effects are predicted from exposure to COPCs at IR Site 20 for future residents and current recreational users. HQs greater than one indicate that exposure to that contaminant may cause adverse health effects in exposed populations. It is important to note, however, that the level of concern associated with exposure to noncarcinogenic compounds does not increase linearly as the HQ exceeds one.

Typically, chemical-specific HQs are summed to calculate pathway hazard index (HI) values. The HI is calculated by summing all HQs for all noncarcinogenic constituents through an exposure pathway:

$$\begin{aligned} \text{HI} &= \text{HQ}_1 + \text{HQ}_2 + \ldots + \text{HQ}_j \\ &= \left(\text{ADD}_1 / \text{RfD}_1\right) + \left(\text{ADD}_2 / \text{RfD}_2\right) + \ldots + \left(\text{ADD}_j / \text{RfD}_j\right) \end{aligned} \qquad (7\text{-}4)$$

where: HQ_j = Hazard quotient of the j^{th} chemical
ADD_j = Average daily dose of the j^{th} chemical
RfD_j = Reference dose for the j^{th} chemical.

This approach can result in the situation where HI values exceed one even when no chemical-specific HQ exceeds one (i.e., adverse systemic health effects would be expected to occur only if the receptor were exposed to several contaminants simultaneously). In this case, chemicals are segregated by similar effect on a target organ, and a separate HI value for each effect/target organ is calculated (U.S. EPA, 1989b). If any of the separate HI values exceed one, adverse, noncarcinogenic health effects are possible.

7.4.3 Risk Characterization Results

A summary of the individual risk values and hazard quotients calculated for all chemicals evaluated within each exposure scenario are presented in Tables 7-6 through 7-15. Cancer risks derived in this assessment can be compared to U.S. EPA's risk management range (i.e., 10^{-6} to 10^{-4}) for health protectiveness at Superfund sites. In addition to the calculation of individual risk values and hazard quotients, cumulative risks and hazard indices were calculated for each scenario, and for the site overall. To calculate cumulative risks and hazard indices, individual risks and hazard quotients estimated for individual chemicals were summed.

In general, risks and hazards associated with the site were comparable to, and sometimes less than, those associated with reference conditions. The lowest cancer risks and hazard quotients were associated with the direct contact pathway; those associated with consumption of fish and shellfish were relatively similar for both the site and reference conditions. Cancer risks and hazard quotients associated with each of the exposure pathways are described below.

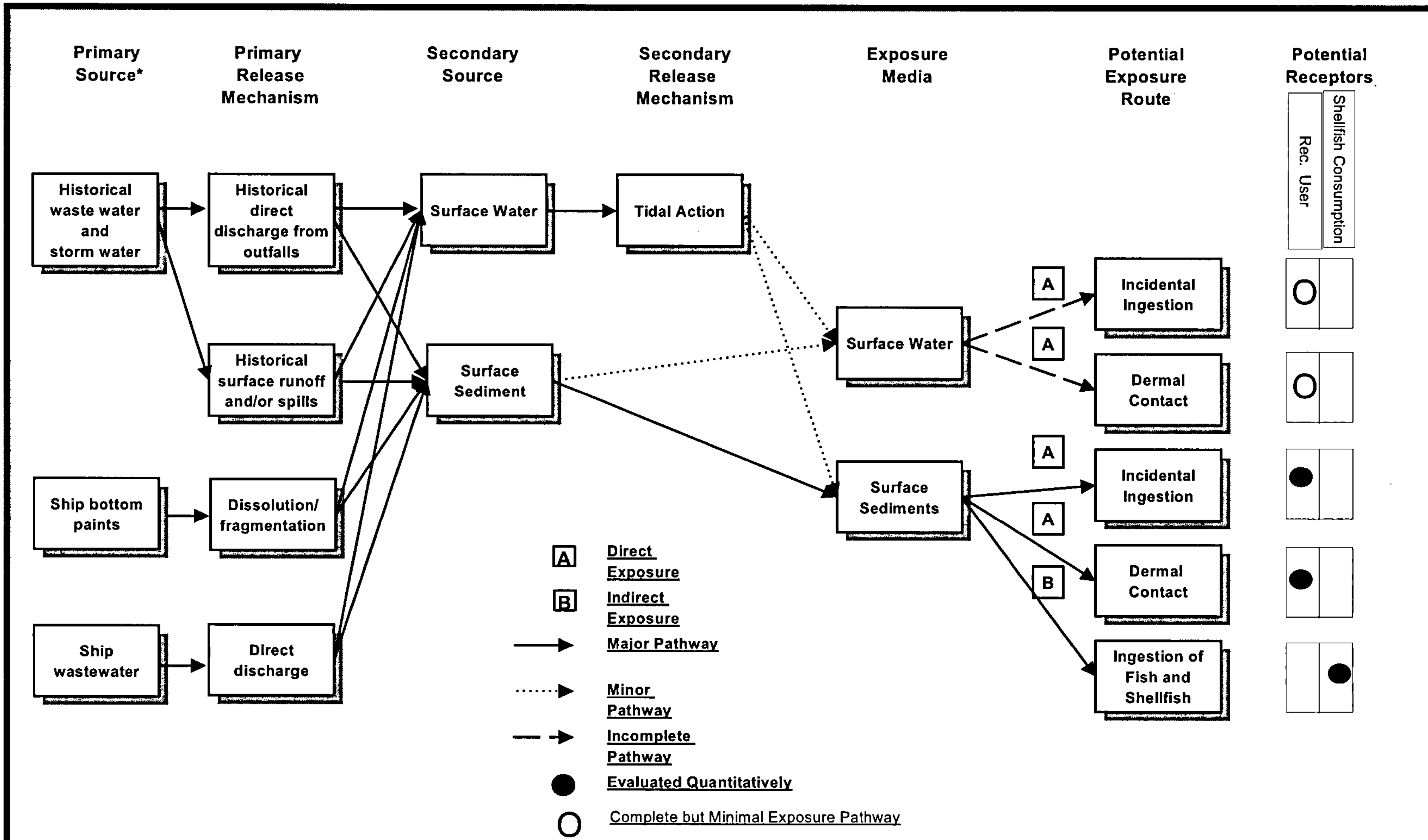
Hazard quotients were below one for all chemicals of concern under the RME and CTE scenarios for the shellfish consumption pathway (Table 7-6). The hazard index for shellfish consumption was greater than the one for the RME scenario (1.39) but was similar to reference conditions (1.25) (Table 7-6). The hazard index for the shellfish CTE scenario was well below one (0.10). Arsenic (45.67%), Total PCBs (28.42%), and chromium (19.52%) were the main contributors to the shellfish consumption hazard index. Individual cancer risks for arsenic, chromium, benzo(a)pyrene, Total PCBs, benzo(b)fluoranthene, benzo(a)anthracene, and benzo(k)fluoranthene were greater than 1×10^{-6} under the RME scenario, but the risk values for these chemicals of concern were similar to or lower than the reference risks (Table 7-7). Under the CTE scenario, only arsenic and chromium had individual cancer risks greater than 1×10^{-6} but similar to reference. Cumulative site cancer risks associated with shellfish consumption (9.0×10^{-4}) were less than those associated with reference conditions (1.3×10^{-3}) under the RME scenario. Arsenic (85.9%) and chromium (7.4%) were the main contributors to potential cancer risk associated with shellfish consumption.

The lowest cancer risks and hazard quotients were associated with the direct contact pathway with sediments at IR Site 20. The RME cumulative hazard index for adults (0.02) and children (0.22) were well below the benchmark hazard level of one and were similar to reference values (0.008 and 0.07, respectively) (Tables 7-8 and 7-9). Chromium, Total PCBs, antimony, arsenic, and mercury were the main (i.e., greater than 5% each) contributors to the sediment exposure hazard index, although the individual hazard quotients for these chemicals of concern were below one. Arsenic, chromium, and benzo(a)pyrene all had individual cancer risks greater than 1×10^{-6} and were the main contributors to cancer risk through the direct contact pathway (Tables 7-10 and 7-11). However, these individual risk values were similar to reference risk values. Cumulative cancer risks for adults (1.8×10^{-5}) and children (1.3×10^{-5}) associated with the RME sediment exposure pathway were within EPA's risk management range (i.e., 10^{-6} to $10^{-}4$) and were similar to reference risks (1.4×10^{-5} and 9.4×10^{-6}, respectively). The cancer risks under the CTE scenario were 2.9×10^{-7} for adults and 1.7×10^{-6} for children.

For the fish consumption pathway, Total PCBs (23.48) and mercury (1.68) had hazard quotients greater than one for the adult RME scenario and were the main contributors to the RME non-cancer hazard to adults (Table 7-12). Only Total PCBs exceeded the benchmark hazard level of one for the child RME non-cancer hazard (11.16) and the adult (1.74) and child (2.84) CTE non-cancer hazards (Tables 7-12 and 7-13). The hazard quotients for all these chemicals of concern were lower than or similar to reference values. The cumulative hazard index for adults and children under both the RME and CTE scenarios were greater than one but similar to reference values. Arsenic, Total PCBs, and chromium all had individual cancer risks greater than 1 x 10^{-6} for the RME and CTE scenarios for adults and children, with arsenic (53.51%) and Total PCBs (41.07%) being the main contributors to cancer risk through the fish consumption pathway (Tables 7-14 and 7-15). In addition, benzo(a)pyrene had a cancer risk slightly greater than 1 x 10^{-6} (i.e., 7.24 x 10^{-6}) for the adult RME scenario. However, these individual risk values were similar to or lower than reference risk values. The cumulative RME cancer risks for adults (2.2 x 10^{-3}) and children (2.3 x 10^{-4}) were very similar to reference risks (2.3 x 10^{-3} and 2.4 x 10^{-4}, respectively). In addition, the cancer risks under the CTE scenario were within U.S. EPA's risk management range (i.e., 5.4 x 10^{-5} for adults and 5.9 x 10^{-5} for children) and were similar to reference (i.e., 5.6 x 10^{-5} for adults and 6.1 x 10^{-5} for children).

7.5 Summary of Human Health Evaluation

Based on the results of the human health evaluation, risks and hazards to humans from chemicals in IR Site 20 sediments appear to be similar to risks and hazards from ambient conditions. Total cumulative risks and hazard indices for all scenarios were comparable to or even less than those reported for reference conditions. In addition, with the exception of benzo(a)pyrene, risks and hazards associated with those contaminants contributing most to the total risk or hazard index also were comparable to reference. However, the distribution of benzo(a)pyrene appears to be consistent with an urban background distribution of PAHs (see Section 4.2.2.1); therefore, risks associated with this chemical are not considered site-related. Given that the majority of assumptions regarding EPCs and exposure parameters made in the human health risk assessment are conservative and tend to overestimate exposure and risk/hazard (see Section 8.3), the incremental risks and hazards to the defined receptor populations from exposure to chemicals of concern at IR Site 20 are likely to be overestimated. For example, the calculated risk and hazard from arsenic in fish and shellfish tissue likely overestimates the actual risk and hazard by 90% because of the conservative assumption that all of the arsenic present is the more toxic inorganic form. In addition, the human health risk assessment conservatively assumed that 100% of the fish and shellfish consumption exposures were associated with IR Site 20. Based on the conservative results of the human health risk assessment, and the present and future use of the site as a viable shipping channel, it is concluded that there are no unacceptable risks to human health at IR Site 20, and it is recommended that no further action is required.



Note: Incomplete exposure pathway is indicated by a blank receptor cell.

Figure 7-1. Human Health Conceptual Site Model

Table 7-1. Chemicals of Potential Concern for the Human Health Risk Assessment

Inorganics	SVOCs	PCBs/Pesticides
Ag	Acenaphthene	2,4′-DDD
As	Acenaphthylene	2,4′-DDE
Cd	Anthracene	2,4′-DDT
Cr	Benzo(a)anthracene	4,4′-DDD
Cu	Benzo(a)pyrene	4,4′-DDE
Hg	Benzo(b)fluoranthene	4,4′-DDT
Ni	Benzo(g,h,i)perylene	*alpha*-Chlordane
Pb	Benzo(k)fluoranthene	Dieldrin
Sb	Chrysene	Endosulfan II
Se	Dibenz(a,h)anthracene	Endrin aldehyde
Zn	Fluoranthene	*gamma*-Chlordane
	Fluorene	Total PCBs
Organotins	Indeno(1,2,3-cd)pyrene	
Tributyltin	2-Methylnaphthalene	
	Naphthalene	
	Phenanthrene	
	Pyrene	

Table 7-3. Total Cumulative Risks from Exposures at Reference Locations Based on U.S. EPA Toxicity Values

Risk Scenario	Risk		Hazard	
	CTE	RME	CTE	RME
Sediment	3.37E-08	7.90E-07	2.35E-03	1.71E-02
Ingestion of fish	5.77E-06	2.60E-04	1.15E+00	1.56E+01
Ingestion of shellfish	4.59E-05	2.06E-03	1.02E+00	1.38E+01
Total	5.17E-05	2.33E-03	2.17E+00	2.93E+01

Source: Table 6-6a from Battelle et al., 2004c

Table 7-4. Exposure Factors

Exposure Parameters	Symbol	Units	Average Adult/Child	RME Adult/Child	Reference
Exposure Point Concentration	EPC	mg/kg	95% UCL	95% UCL	See Section 5
Ingestion Rate - Fish	IR_{fish}	kg/day	0.016 / 0.0056	0.108 / 0.011	SFEI, 2002; U.S. EPA 1997b
Ingestion Rate - Shellfish	IR_{shell}	kg/day	0.0008/NA	0.0054/NA	SFEI, 2002; U.S. EPA 1997b
Ingestion Rate - Sediment	IR_{sed}	mg/day	50 / 100	100 / 200	U.S. EPA, 2004a
Fraction Ingested from Contaminated Source	FI	unitless	0.5	1	Prof. Judgment
Exposure Frequency - Bivalve	EF	days/year	365	365	U.S. EPA, 1989b
Exposure Frequency - Direct Contact	EF	days/year	13	26	Prof. Judgment
Skin Surface Area	SA	cm^2/day	5,700 / 2,800	5,700 / 2,800	U.S. EPA, 2004a
Adherence Factor	AF	mg/cm^2	0.07 / 0.2	0.07 / 0.2	U.S. EPA, 2004a
Dermal Absorption Factor	DAF	unitless	chemical-specific	chemical-specific	U.S. EPA, 2004a
Exposure Duration	ED	years	9 / 6	30 / 6	U.S. EPA 1989b & 1991
Body Weight	BW	kg	70 / 15	70 / 15	U.S. EPA, 2004a
Averaging Time- cancer	AT_c	days	25,550	25,550	U.S. EPA, 2004a
Averaging Time - noncancer	AT_{nc}	days	3,285 / 2,190	10,950 / 2,190	U.S. EPA, 2004a

Table 7-5. Summary of Toxicity Criteria

COPC	Carcinogen Classification[a]	Dermal Absorption Factor[d]	Oral Cancer Slope Factor[b] (mg/kg-day)$^{-1}$	Oral Reference Dose[b] (mg/kg-day)
		Inorganics		
Ag	D	1.00E-02	NA	5.0E-03 [2]
As	A	3.00E-02	9.45E+00 [1]	3.0E-04 [2]
Cd	B1	1.00E-03	3.8E-01 [1]	5.0E-04 [2]
Cr	A (CrVI), NA (CrIII)	1.00E-02	1.9E-01 [1,c]	3.0E-03 [2]
Cu	D	1.00E-02	NA	3.7E-02 [3]
Hg	NA	1.00E-01	NA	1.0E-04 [2,4]
Ni	NA	1.00E-02	NA	2.0E-02 [2]
Sb	NA	1.00E-02	NA	4.0E-04 [2]
Se	D	1.00E-02	NA	5.0E-03 [2]
Zn	D	1.00E-02	NA	3.0E-01 [2]
		SVOCs		
Acenaphthene	NA	1.00E-01	NA	6.0E-02 [2]
Acenaphthylene	NA	1.00E-01	NA	NA
Anthracene	D	1.00E-01	NA	3.0E-01 [2]
Benzo(a)anthracene	B2	1.30E-01	1.2E+00 [1]	NA
Benzo(a)pyrene	B2	1.30E-01	1.2E+01 [1]	NA
Benzo(b)fluoranthene	B2	1.30E-01	1.2E+00 [1]	NA
Benzo(g,h,i)perylene	D	1.00E-01	NA	NA
Benzo(k)fluoranthene	B2	1.30E-01	1.2E+00 [1]	NA
Chrysene	B2	1.30E-01	1.2E-01 [1]	NA
Dibenz(a,h)anthracene	B2	1.30E-01	4.1E+00 [1]	NA
Fluoranthene	D	1.30E-01	NA	4.0E-02 [2]
Fluorene	D	1.00E-01	NA	4.0E-02 [2]
Indeno(1,2,3-cd)pyrene	B2	1.30E-01	1.2E+00 [1]	NA
2-Methylnaphthalene	NA	1.00E-01	NA	4.0E-03 [2]
Naphthalene	C	1.00E-01	1.2E-01 [1]	2.0E-02 [2]
Phenanthrene	D	1.00E-01	NA	NA
Pyrene	D	1.00E-01	NA	3.0E-02 [2]
		PCBs/Pesticides		
2,4'-DDD	B2	3.00E-02	2.4E-01 [2]	NA
2,4'-DDE	B2	3.00E-02	3.4E-01 [2]	NA
2,4'-DDT	B2	3.00E-02	3.4E-01 [2]	5.0E-04 [2]
4,4'-DDD	B2	3.00E-02	2.4E-01 [1,2]	NA
4,4'-DDE	B2	3.00E-02	3.4E-01 [1,2]	NA
4,4'-DDT	B2	3.00E-02	3.4E-01 [1,2]	5.0E-04 [2]
alpha-Chlordane	B2	4.00E-02	1.3E+00 [1]	5.0E-04 [2,5]
Dieldrin	B2	1.00E-01	1.6E+01 [1,2]	5.0E-05 [2]
Endosulfan II	NA	1.00E-01	NA	6.0E-03 [2]
Endrin aldehyde	D	1.00E-01	NA	NA
gamma-Chlordane	B2	4.00E-02	1.3E+00 [1,2]	5.0E-04 [2,5]
Total PCBs	B2	1.40E-01	5.0E+00 [1]	2.00E-05 [2,6]
		Organotins		
Tributyltin	NA	1.00E-01	NA	3.0E-04 [2]

(a) Carcinogen Classification defined as: (A) human carcinogen, (B1) probable human carcinogen based on human epidemiological studies, (B2) probable human carcinogen based on animal studies, (C) probable human carcinogen with limited animal evidence, and (D) not classifiable as a human carcinogen.

(b) Toxicity values are referenced as follows: (1) Cal/U.S. EPA OEHHA Cancer Slope Factors (DTSC, 2002); (2) U.S. EPA IRIS (U.S. EPA, 2005b); (3) U.S. EPA HEAST (2001b); (4) oral RfD for methylmercury; (5) oral RfD for technical chlordane; and (6) oral RfD for Aroclor 1254.

(c) CSF withdrawn from Cal/U.S. EPA OEHHA in 1991.

(d) Dermal absorption factors (DAF) were based on data reported by U.S. EPA Region 9 in the development of PRGs (U.S. EPA, 2004a). For those COPCs with no available information, a DAF of 0.01 was assumed for metals, and 0.1 for organics.

NA = not applicable (no U.S. EPA-acceptable toxicity values are provided for this compound).

Table 7-6. Summary of Non-Cancer Hazards Associated with Shellfish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Hazard	
	Hazard Quotient		% Contribution to Total Hazard	Hazard Quotient		% Contribution to Total Hazard		
	RME	CTE		RME	CTE		RME	CTE
Ag	0.00008	0.000006	0.005	0.00007	0.000005	0.008	0.0004	0.00003
As	0.64	0.05	45.67	0.65	0.05	69.74	1.06	0.08
Cd	0.001	0.00006	0.05	0.0006	0.00004	0.06	0.02	0.001
Cr	0.27	0.02	19.52	0.05	0.004	5.23	0.09	0.01
Cu	0.004	0.0003	0.26	0.003	0.0002	0.31	0.006	0.0004
Hg	0.004	0.0003	0.27	0.13	0.01	13.63	0.02	0.001
Ni	0.001	0.00004	0.04	0.01	0.001	0.90	0.01	0.001
Sb	0.06	0.005	4.54	0.001	0.00007	0.10	0.005	0.0003
Se	0.002	0.0001	0.14	0.001	0.0001	0.14	0.01	0.001
Zn	0.003	0.0002	0.18	0.002	0.0001	0.17	0.005	0.0004
Acenaphthene	0.000006	0.0000004	0.0004	0.0000007	0.00000005	0.0001	0.0000005	3.58E-08
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	0.000008	0.0000006	0.001	0.00001	0.0000009	0.001	0.0000003	0.00000002
Benzo(a)anthracene	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---
Fluoranthene	0.0003	0.00002	0.02	0.001	0.00008	0.12	0.00002	0.000001
Fluorene	0.00001	0.0000007	0.001	0.00001	0.0000008	0.001	0.0000008	0.00000006
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---
2-Methylnaphthalene	NA	NA	---	NA	NA	NA	0.000003	0.0000002
Naphthalene	0.00005	0.000004	0.004	0.00002	0.000001	0.002	0.000008	0.0000006
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	0.001	0.00009	0.08	0.003	0.0002	0.30	0.00003	0.000002
2,4'-DDD	---	---	---	---	---	---	---	---
2,4'-DDE	---	---	---	---	---	---	---	---
2,4'-DDT	0.003	0.0002	0.17	0.00006	0.000004	0.01	0.00001	0.000001
4,4'-DDD	---	---	---	---	---	---	---	---
4,4'-DDE	---	---	---	---	---	---	---	---
4,4'-DDT	0.005	0.0004	0.38	0.00006	0.000004	0.01	0.00002	0.000001
alpha-Chlordane	0.00002	0.000001	0.001	0.000005	0.0000004	0.001	0.00002	0.000001
Dieldrin	0.002	0.0001	0.12	0.0009	0.00007	0.10	0.0003	0.00002
Endosulfan II	NA	NA	---	NA	NA	NA	0.00000047	0.00000003
Endrin aldehyde	NA	NA	---	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	---	NA	NA	NA	0.00002	0.000001
Total PCBs	0.40	0.03	28.42	0.08	0.006	---	0.026	0.002
TBT	0.0010	0.00007	0.07	0.002	0.0002	0.24	0.001	0.0001
Hazard Index	1.39	0.10		0.93	0.07		1.25	0.09

Note: Concentrations for chemicals that were not detected in shellfish tissue were derived from sediment EPCs using bioaccumulation factors.

Table 7-7. Summary of Cancer Risks Associated with Shellfish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Risks	
	Risk Values		% Contribution to Total Risk	Risk Values		% Contribution to Total Risk		
	RME	CTE		RME	CTE		RME	CTE
Ag	---	---	---	---	---	---	---	---
As	7.73E-04	1.72E-05	85.89	7.89E-04	1.75E-05	90.45	1.28E-03	2.86E-05
Cd	6.21E-08	1.38E-09	0.007	4.82E-08	1.07E-09	0.01	1.41E-06	3.14E-08
Cr	6.64E-05	1.48E-06	7.38	1.19E-05	2.64E-07	1.36	2.12E-05	4.72E-07
Cu	---	---	---	---	---	---	---	---
Hg	---	---	---	---	---	---	---	---
Ni	---	---	---	---	---	---	---	---
Sb	---	---	---	---	---	---	---	---
Se	---	---	---	---	---	---	---	---
Zn	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	---	---	---	---
Benzo(a)anthracene	2.94E-06	6.53E-08	0.33	5.01E-06	1.11E-07	0.57	1.05E-07	2.33E-09
Benzo(a)pyrene	3.31E-05	7.35E-07	3.67	5.45E-05	1.21E-06	6.25	1.51E-06	3.35E-08
Benzo(b)fluoranthene	3.14E-06	6.97E-08	0.35	3.27E-06	7.27E-08	0.37	1.45E-07	3.22E-09
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	1.97E-06	4.38E-08	0.22	2.73E-06	6.08E-08	0.31	1.52E-07	3.37E-09
Chrysene	3.19E-07	7.08E-09	0.04	5.15E-07	1.14E-08	0.06	1.71E-08	3.81E-10
Dibenz(a,h)anthracene	4.85E-07	1.08E-08	0.05	4.73E-07	1.05E-08	0.05	3.43E-08	7.63E-10
Fluoranthene	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	3.48E-07	7.73E-09	0.04	8.28E-07	1.84E-08	0.09	7.21E-08	1.60E-09
2-Methylnaphthalene	---	---	---	---	---	---	---	---
Naphthalene	5.03E-08	1.12E-09	0.006	1.77E-08	3.93E-10	0.002	7.84E-09	1.74E-10
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	---	---	---	---
2,4'-DDD	6.86E-09	1.52E-10	0.001	3.20E-09	7.10E-11	0.0004	1.21E-09	2.68E-11
2,4'-DDE	5.52E-10	1.23E-11	0.00004	4.53E-10	1.01E-11	0.0001	9.14E-10	2.03E-11
2,4'-DDT	2.16E-07	4.81E-09	0.02	4.08E-09	9.08E-11	0.0005	9.54E-10	2.12E-11
4,4'-DDD	2.62E-08	5.82E-10	0.003	1.20E-08	2.67E-10	0.001	5.12E-09	1.14E-10
4,4'-DDE	2.71E-08	6.01E-10	0.003	1.04E-08	2.30E-10	0.001	1.03E-08	2.29E-10
4,4'-DDT	3.85E-07	8.57E-09	0.04	4.29E-09	9.53E-11	0.0005	1.17E-09	2.60E-11
alpha-Chlordane	5.61E-09	1.25E-10	0.0006	1.37E-09	3.04E-11	0.0002	5.03E-09	1.12E-10
Dieldrin	5.61E-07	1.25E-08	0.06	3.19E-07	7.08E-09	0.04	1.14E-07	2.53E-09
Endosulfan II	---	---	---	---	---	---	---	---
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	NA	NA	NA	NA	NA	NA	4.32E-09	9.59E-11
Total PCBs	1.70E-05	3.77E-07	1.89	3.57E-06	7.93E-08	0.41	1.11E-06	2.47E-08
TBT	---	---	---	---	---	---	---	---
Total Cumulative Risk	9.0E-04	2.0E-05		8.7E-04	1.9E-05		1.3E-03	2.9E-05

Note: Concentrations for chemicals that were not detected in shellfish tissue were derived from sediment EPCs using bioaccumulation factors.

Table 7-8. Summary of Non-Cancer Hazards Associated with Direct Contact with Sediments for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Hazard	
	Hazard Quotient		% Contribution to Total Hazard	Hazard Quotient		% Contribution to Total Hazard		
	RME	CTE	RME	RME	CTE	RME	RME	CTE
Ag	3.64E-06	4.72E-07	0.02	3.56E-06	4.62E-07	0.03	6.38E-06	8.28E-07
As	2.67E-03	3.70E-04	11.19	1.91E-03	2.64E-04	18.73	3.61E-03	4.99E-04
Cd	5.23E-05	6.57E-06	0.22	4.06E-05	5.10E-06	0.40	6.82E-05	8.56E-06
Cr	1.14E-02	1.43E-03	47.79	2.05E-03	2.56E-04	20.05	2.76E-03	3.45E-04
Cu	1.96E-04	2.54E-05	0.82	1.42E-04	1.84E-05	1.39	1.18E-04	1.54E-05
Hg	2.60E-03	3.37E-04	10.87	4.93E-03	6.40E-04	48.37	4.27E-04	5.55E-05
Ni	4.08E-04	5.30E-05	1.71	2.25E-04	2.92E-05	2.21	4.20E-04	5.45E-05
Sb	2.74E-03	3.55E-04	11.45	4.23E-05	5.49E-06	0.41	2.50E-04	3.25E-05
Se	4.40E-06	5.71E-07	0.02	2.96E-06	3.85E-07	0.03	1.02E-05	1.32E-06
Zn	4.27E-05	5.54E-06	0.18	2.29E-05	2.98E-06	0.22	3.79E-05	4.92E-06
Acenaphthene	2.07E-07	3.55E-08	0.001	2.47E-08	4.24E-09	0.0002	2.32E-08	3.98E-09
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	2.21E-07	3.79E-08	0.001	3.25E-07	5.59E-08	0.003	2.02E-08	3.47E-09
Benzo(a)anthracene	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---
Fluoranthene	3.07E-06	5.27E-07	0.01	1.02E-05	1.75E-06	0.10	6.92E-07	1.19E-07
Fluorene	4.63E-07	7.96E-08	0.002	5.29E-07	9.08E-08	0.005	2.74E-08	4.71E-09
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---
2-Methylnaphthalene	9.00E-07	1.55E-07	0.004	4.88E-07	8.38E-08	0.005	2.61E-07	4.49E-08
Naphthalene	3.22E-07	5.53E-08	0.001	1.13E-07	1.94E-08	0.001	7.81E-08	1.34E-08
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	7.43E-06	1.28E-06	0.03	1.74E-05	2.98E-06	0.17	1.16E-06	1.99E-07
2,4'-DDD	---	---	---	---	---	---	---	---
2,4'-DDE	---	---	---	---	---	---	---	---
2,4'-DDT	1.01E-05	1.47E-06	0.04	1.91E-07	2.78E-08	0.002	---	---
4,4'-DDD	---	---	---	---	---	---	---	---
4,4'-DDE	---	---	---	---	---	---	---	---
4,4'-DDT	4.63E-05	6.75E-06	0.19	5.16E-07	7.52E-08	0.005	4.03E-07	5.87E-08
alpha-Chlordane	3.05E-07	4.44E-08	0.001	7.42E-08	1.08E-08	0.0007	3.22E-08	4.69E-09
Dieldrin	2.39E-06	3.49E-07	0.01	1.36E-06	1.98E-07	0.01	---	---
Endosulfan II	9.51E-09	1.39E-09	0.00004	6.52E-09	9.51E-10	0.0001	---	---
Endrin aldehyde	5.46E-06	7.97E-07	0.02	---	---	---	---	---
gamma-Chlordane	5.25E-07	7.65E-08	0.002	1.02E-07	1.49E-08	0.001	---	---
Total PCBs	3.67E-03	6.31E-04	15.36	7.72E-04	1.33E-04	7.57	9.76E-05	1.68E-05
TBT	1.50E-05	2.41E-06	0.06	2.80E-05	4.50E-06	0.27	1.79E-06	2.87E-07
Hazard Index	0.02	0.003		0.01	0.001		0.008	0.001

Table 7-9. Summary of Non-Cancer Hazards to Children Associated with Direct Contact with Sediments for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Hazard	
	Hazard Quotient		% Contribution to Total Hazard	Hazard Quotient		% Contribution to Total Hazard		
	RME	CTE	RME	RME	CTE	RME	RME	CTE
Ag	3.36E-05	4.31E-06	0.02	3.28E-05	4.22E-06	0.04	5.88E-05	7.56E-06
As	2.42E-02	3.25E-03	11.09	1.73E-02	2.33E-03	18.53	3.26E-02	4.39E-03
Cd	4.88E-04	6.12E-05	0.22	3.79E-04	4.74E-05	0.41	6.36E-04	7.97E-05
Cr	1.07E-01	1.33E-02	48.96	1.91E-02	2.39E-03	20.48	2.57E-02	3.22E-03
Cu	1.81E-03	2.32E-04	0.83	1.31E-03	1.68E-04	1.40	1.09E-03	1.40E-04
Hg	2.40E-02	3.08E-03	11.00	4.55E-02	5.85E-03	48.84	3.94E-03	5.06E-04
Ni	3.76E-03	4.83E-04	1.73	2.08E-03	2.67E-04	2.23	3.88E-03	4.98E-04
Sb	2.53E-02	3.24E-03	11.60	3.90E-04	5.01E-05	0.42	2.31E-03	2.97E-04
Se	4.06E-05	5.21E-06	0.02	2.73E-05	3.51E-06	0.03	9.40E-05	1.21E-05
Zn	3.94E-04	5.06E-05	0.18	2.12E-04	2.72E-05	0.23	3.49E-04	4.49E-05
Acenaphthene	1.71E-06	2.78E-07	0.001	2.05E-07	3.31E-08	0.0002	1.92E-07	3.11E-08
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	1.83E-06	2.96E-07	0.001	2.70E-06	4.37E-07	0.003	1.67E-07	2.71E-08
Benzo(a)anthracene	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---
Fluoranthene	2.54E-05	4.12E-06	0.01	8.43E-05	1.37E-05	0.09	5.74E-06	9.30E-07
Fluorene	3.84E-06	6.22E-07	0.002	4.38E-06	7.10E-07	0.005	2.27E-07	3.68E-08
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---
2-Methylnaphthalene	7.46E-06	1.21E-06	0.003	4.05E-06	6.55E-07	0.004	2.17E-06	3.51E-07
Naphthalene	2.67E-06	4.32E-07	0.001	9.38E-07	1.52E-07	0.001	6.48E-07	1.05E-07
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	6.16E-05	9.98E-06	0.03	1.44E-04	2.33E-05	0.15	9.59E-06	1.55E-06
2,4'-DDD	---	---	---	---	---	---	---	---
2,4'-DDE	---	---	---	---	---	---	---	---
2,4'-DDT	8.97E-05	1.26E-05	0.04	1.69E-06	2.38E-07	0.002	---	---
4,4'-DDD	---	---	---	---	---	---	---	---
4,4'-DDE	---	---	---	---	---	---	---	---
4,4'-DDT	4.11E-04	5.77E-05	0.19	4.57E-06	6.42E-07	0.005	3.57E-06	5.01E-07
alpha-Chlordane	2.70E-06	3.79E-07	0.001	6.58E-07	9.23E-08	0.0007	2.86E-07	4.01E-08
Dieldrin	2.12E-05	2.98E-06	0.01	1.21E-05	1.69E-06	0.01	---	---
Endosulfan II	8.43E-08	1.18E-08	0.00004	5.78E-08	8.12E-09	0.0001	---	---
Endrin aldehyde	4.85E-05	6.80E-06	0.02	---	---	---	---	---
gamma-Chlordane	4.66E-06	6.53E-07	0.002	9.07E-07	1.27E-07	0.001	---	---
Total PCBs	3.04E-02	4.93E-03	13.98	6.40E-03	1.04E-03	6.87	8.09E-04	1.31E-04
TBT	1.28E-04	1.95E-05	0.06	2.39E-04	3.64E-05	0.26	1.52E-05	2.32E-06
Hazard Index	0.22	0.03		0.09	0.01		0.07	0.009

Table 7-10. Summary of Cancer Risks Associated with Direct Contact with Sediments for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Risks	
	Risk Values		% Contribution to Total Risk	Risk Values		% Contribution to Total Risk		
	RME[1]	CTE	RME[1]	RME[1]	CTE	RME[1]	RME[1]	CTE
Ag	---	---	---	---	---	---	---	---
As	8.47E-06	1.35E-07	46.22	6.05E-06	9.64E-08	56.75	1.14E-05	1.82E-07
Cd	1.14E-08	1.60E-10	0.06	8.81E-09	1.24E-10	0.08	1.48E-08	2.09E-10
Cr	7.44E-06	1.05E-07	40.60	1.33E-06	1.87E-08	12.49	1.80E-06	2.53E-08
Cu	---	---	---	---	---	---	---	---
Hg	---	---	---	---	---	---	---	---
Ni	---	---	---	---	---	---	---	---
Sb	---	---	---	---	---	---	---	---
Se	---	---	---	---	---	---	---	---
Zn	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	---	---	---	---
Benzo(a)anthracene	1.21E-07	2.53E-09	0.66	2.06E-07	4.31E-09	1.93	1.49E-08	3.12E-10
Benzo(a)pyrene	1.50E-06	3.14E-08	8.17	2.47E-06	5.17E-08	23.13	2.71E-07	5.67E-09
Benzo(b)fluoranthene	1.28E-07	2.69E-09	0.70	1.34E-07	2.80E-09	1.25	2.26E-08	4.73E-10
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	9.49E-08	1.99E-09	0.52	1.32E-07	2.76E-09	1.23	2.24E-08	4.69E-10
Chrysene	1.65E-08	3.47E-10	0.09	2.67E-08	5.61E-10	0.25	1.61E-09	3.39E-11
Dibenz(a,h)anthracene	8.65E-08	1.81E-09	0.47	8.43E-08	1.77E-09	0.79	1.34E-08	2.80E-10
Fluoranthene	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	5.88E-08	1.23E-09	0.32	1.40E-07	2.93E-09	1.31	2.28E-08	4.78E-10
2-Methylnaphthalene	---	---	---	---	---	---	---	---
Naphthalene	8.14E-10	1.71E-11	0.004	2.86E-10	6.00E-12	0.003	1.98E-10	4.14E-12
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	---	---	---	---
2,4'-DDD	1.24E-10	2.11E-12	0.001	5.78E-11	9.82E-13	0.0005	8.25E-12	1.40E-13
2,4'-DDE	1.18E-11	2.00E-13	0.0001	9.67E-12	1.64E-13	0.00009	1.41E-11	2.40E-13
2,4'-DDT	1.90E-09	3.22E-11	0.01	3.58E-11	6.08E-13	0.0003	---	---
4,4'-DDD	4.07E-10	6.92E-12	0.002	1.87E-10	3.17E-12	0.002	6.16E-11	1.05E-12
4,4'-DDE	2.19E-10	3.72E-12	0.001	8.38E-11	1.42E-12	0.001	4.66E-11	7.91E-13
4,4'-DDT	8.69E-09	1.48E-10	0.05	9.67E-11	1.64E-12	0.001	7.55E-11	1.28E-12
alpha-Chlordane	2.19E-10	3.71E-12	0.001	5.32E-11	9.04E-13	0.0005	2.31E-11	3.92E-13
Dieldrin	2.11E-09	3.59E-11	0.01	1.20E-09	2.04E-11	0.01	---	---
Endosulfan II	---	---	---	---	---	---	---	---
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	3.76E-10	6.39E-12	0.13	7.33E-11	1.25E-12	0.001	---	---
Total PCBs	3.87E-07	8.11E-09	2.11	8.14E-08	1.71E-09	0.76	1.03E-08	2.16E-10
TBT	---	---	---	---	---	---	---	---
Total Cumulative Risks	1.8E-05	2.9E-07		1.1E-05	1.8E-07		1.4E-05	2.2E-07

1. RME Risks are based on age-adjusted exposure factors.

Table 7-11. Summary of Cancer Risks to Children Associated with Direct Contact with Sediments for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Risks	
	Risk Values		% Contribution to Total Risk	Risk Values		% Contribution to Total Risk		
	RME	CTE	RME	RME	CTE	RME	RME	CTE
Ag	---	---	---	---	---	---	---	---
As	5.87E-06	7.91E-07	46.19	4.20E-06	5.65E-07	57.15	7.92E-06	1.07E-06
Cd	7.95E-09	9.96E-10	0.06	6.16E-09	7.73E-10	0.08	1.04E-08	1.30E-09
Cr	5.21E-06	6.51E-07	40.98	9.33E-07	1.17E-07	12.70	1.26E-06	1.57E-07
Cu	---	---	---	---	---	---	---	---
Hg	---	---	---	---	---	---	---	---
Ni	---	---	---	---	---	---	---	---
Sb	---	---	---	---	---	---	---	---
Se	---	---	---	---	---	---	---	---
Zn	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	---	---	---	---
Benzo(a)anthracene	8.14E-08	1.32E-08	0.64	1.39E-07	2.25E-08	1.89	1.00E-08	1.63E-09
Benzo(a)pyrene	1.01E-06	1.64E-07	7.94	1.66E-06	2.70E-07	22.67	1.83E-07	2.96E-08
Benzo(b)fluoranthene	8.65E-08	1.40E-08	0.68	9.02E-08	1.46E-08	1.23	1.52E-08	2.47E-09
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	6.40E-08	1.04E-08	0.50	8.88E-08	1.44E-08	1.21	1.51E-08	2.45E-09
Chrysene	1.12E-08	1.81E-09	0.09	1.80E-08	2.92E-09	0.25	1.09E-09	1.76E-10
Dibenz(a,h)anthracene	5.83E-08	9.45E-09	0.46	5.69E-08	9.21E-09	0.77	9.01E-09	1.46E-09
Fluoranthene	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	3.96E-08	6.42E-09	0.31	9.43E-08	1.53E-08	1.28	1.54E-08	2.49E-09
2-Methylnaphthalene	---	---	---	---	---	---	---	---
Naphthalene	5.49E-10	8.89E-11	0.004	1.93E-10	3.13E-11	0.003	1.33E-10	2.16E-11
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	---	---	---	---
2,4'-DDD	8.55E-11	1.20E-11	0.001	3.98E-11	5.59E-12	0.0005	5.68E-12	7.98E-13
2,4'-DDE	8.11E-12	1.14E-12	0.0001	6.66E-12	9.35E-13	0.00009	9.73E-12	1.37E-12
2,4'-DDT	1.31E-09	1.83E-10	0.01	2.47E-11	3.46E-12	0.0003	---	---
4,4'-DDD	2.81E-10	3.94E-11	0.002	1.29E-10	1.80E-11	0.002	4.25E-11	5.96E-12
4,4'-DDE	1.51E-10	2.12E-11	0.001	5.78E-11	8.11E-12	0.001	3.21E-11	4.51E-12
4,4'-DDT	5.99E-09	8.40E-10	0.05	6.66E-11	9.35E-12	0.001	5.21E-11	7.31E-12
alpha-Chlordane	1.51E-10	2.11E-11	0.001	3.67E-11	5.14E-12	0.0005	1.59E-11	2.23E-12
Dieldrin	1.46E-09	2.04E-10	0.01	8.27E-10	1.16E-10	0.01	---	---
Endosulfan II	---	---	---	---	---	---	---	---
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	2.59E-10	3.64E-11	0.002	5.05E-11	7.09E-12	0.001	---	---
Total PCBs	2.61E-07	4.23E-08	2.05	5.49E-08	8.89E-09	0.75	6.94E-09	1.12E-09
TBT	---	---	---	---	---	---	---	---
Total Cumulative Risks	1.3E-05	1.7E-06		7.3E-06	1.0E-06		9.4E-06	1.3E-06

Table 7-12. Summary of Non-Cancer Hazards Associated with Fish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Hazard	
	Hazard Quotient		% Contribution to Total Hazard	Hazard Quotient		% Contribution to Total Hazard		
	RME	CTE		RME	CTE		RME	CTE
Ag	0.0002	0.00002	0.0009	0.0016	0.0001	0.0034	0.01	0.0004
As	1.08	0.08	3.98	3.30	0.24	6.9	1.51	0.11
Cd	0.003	0.0002	0.0114	0.0168	0.0012	0.0351	0.06	0.005
Cr	0.45	0.03	1.66	0.48	0.04	0.9972	0.33	0.02
Cu	0.04	0.003	0.15	0.17	0.01	0.3487	0.06	0.005
Hg	1.68	0.12	6.20	18.19	1.35	38	0.92	0.07
Ni	0.01	0.0005	0.024	0.017	0.001	0.0356	0.01	0.001
Sb	0.04	0.003	0.15	0.005	0.0004	0.0104	0.01	0.001
Se	0.02	0.002	0.08	0.08	0.01	0.1584	0.08	0.01
Zn	0.04	0.003	0.15	0.11	0.01	0.2395	0.10	0.01
Acenaphthene	0.0001	0.000004	0.0002	0.00004	0.000003	0.0001	0.0001	0.00001
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	0.000010	0.000001	0.00004	0.00010	0.00001	0.0002	0.000003	0.0000002
Benzo(a)anthracene	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---
Fluoranthene	0.0002	0.00001	0.0007	0.0040	0.0003	0.0084	0.00018	0.00001
Fluorene	0.0001	0.000005	0.0002	0.0005	0.00004	0.0010	0.00013	0.00001
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---
2-Methylnaphthalene	0.000038	0.000003	0.0001	0.0001	0.00001	0.0003	0.0005	0.00004
Naphthalene	0.000022	0.000002	0.0001	0.0001	0.000004	0.0001	0.0002	0.00002
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	0.0002	0.00002	0.0009	0.0033	0.0002	0.0070	0.00006	0.000004
2,4'-DDD	---	---	---	---	---	---	---	---
2,4'-DDE	---	---	---	---	---	---	---	---
2,4'-DDT	0.01	0.001	0.033	0.001	0.0001	0.0023	0.00009	0.00001
4,4'-DDD	---	---	---	---	---	---	---	---
4,4'-DDE	---	---	---	---	---	---	---	---
4,4'-DDT	0.07	0.01	0.26	0.005	0.0004	0.0104	0.01	0.001
alpha-Chlordane	0.0014	0.0001	0.0050	0.0022	0.0002	0.0047	0.005	0.0004
Dieldrin	0.01	0.001	0.026	0.025	0.002	0.0529	0.06	0.005
Endosulfan II	0.000001	0.0000001	0.000004	0.000005	0.0000004	0.00001	0.000011	0.000001
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	0.001	0.0001	0.0029	0.0010	0.0001	0.0021	0.001	0.0001
Total PCBs	23.48	1.74	86.52	22.88	1.70	48	13.41	0.99
TBT	0.20	0.02	0.75	2.60	0.19	5	0.19	0.01
Hazard Index	27.13	2.01		47.89	3.55		16.76	1.24

Table 7-13. Summary of Cancer Risks Associated with Fish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Risks	
	Risk Values		% Contribution to Total Risk	Risk Values		% Contribution to Total Risk		
	RME[1]	CTE		RME[1]	CTE		RME[1]	CTE
Ag	---	---	---	---	---	---	---	---
As	1.17E-03	2.91E-05	53.51	3.59E-03	8.91E-05	76.55	1.64E-03	4.07E-05
Cd	2.25E-07	5.58E-09	0.010	1.22E-06	3.04E-08	0.03	4.62E-06	1.15E-07
Cr	9.85E-05	2.44E-06	4.49	1.04E-04	2.59E-06	2.23	7.21E-05	1.79E-06
Cu	---	---	---	---	---	---	---	---
Hg	---	---	---	---	---	---	---	---
Ni	---	---	---	---	---	---	---	---
Sb	---	---	---	---	---	---	---	---
Se	---	---	---	---	---	---	---	---
Zn	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	---	---	---	---
Benzo(a)anthracene	7.91E-07	1.96E-08	0.04	8.59E-06	2.13E-07	0.18	9.91E-08	2.46E-09
Benzo(a)pyrene	7.24E-06	1.80E-07	0.33	7.33E-05	1.82E-06	1.56	4.40E-07	1.09E-08
Benzo(b)fluoranthene	6.65E-07	1.65E-08	0.03	4.52E-06	1.12E-07	0.10	2.39E-07	5.94E-09
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	8.52E-07	2.12E-08	0.04	7.23E-06	1.79E-07	0.15	3.66E-08	9.09E-10
Chrysene	2.23E-07	5.53E-09	0.01	2.20E-06	5.46E-08	0.05	4.60E-08	1.14E-09
Dibenz(a,h)anthracene	1.79E-07	4.45E-09	0.01	1.08E-06	2.67E-08	0.02	1.05E-07	2.60E-09
Fluoranthene	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	2.64E-07	6.55E-09	0.01	3.62E-06	8.99E-08	0.08	8.80E-08	2.18E-09
2-Methylnaphthalene	---	---	---	---	---	---	---	---
Naphthalene	2.05E-08	5.10E-10	0.001	4.68E-08	1.16E-09	0.001	2.11E-07	5.24E-09
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	---	---	---	---
2,4'-DDD	2.23E-09	5.55E-11	0.0001	7.11E-09	1.77E-10	0.0002	3.31E-09	8.21E-11
2,4'-DDE	1.34E-08	3.33E-10	0.001	6.00E-08	1.49E-09	0.0013	1.55E-08	3.86E-10
2,4'-DDT	5.76E-07	1.43E-08	0.03	7.14E-08	1.77E-09	0.0015	6.08E-09	1.51E-10
4,4'-DDD	9.21E-07	2.29E-08	0.04	2.83E-06	7.02E-08	0.06	7.49E-07	1.86E-08
4,4'-DDE	1.22E-06	3.03E-08	0.06	3.19E-06	7.91E-08	0.07	3.30E-06	8.19E-08
4,4'-DDT	4.61E-06	1.15E-07	0.21	3.24E-07	8.05E-09	0.01	8.94E-07	2.22E-08
alpha-Chlordane	3.39E-07	8.42E-09	0.02	5.56E-07	1.38E-08	0.01	1.24E-06	3.09E-08
Dieldrin	2.13E-06	5.29E-08	0.10	7.78E-06	1.93E-07	0.17	1.94E-05	4.83E-07
Endosulfan II	---	---	---	---	---	---	---	---
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	1.96E-07	4.86E-09	0.01	2.57E-07	6.37E-09	0.01	3.60E-07	8.94E-09
Total PCBs	9.01E-04	2.24E-05	41.07	8.78E-04	2.18E-05	18.73	5.14E-04	1.28E-05
TBT	---	---	---	---	---	---	---	---
Total Cumulative Risk	2.2E-03	5.4E-05		4.7E-03	1.2E-04		2.3E-03	5.6E-05

1. RME Risks are based on age-adjusted exposure factors.

Table 7-14. Summary of Non-Cancer Hazards to Children Associated with Fish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Hazard	
	Hazard Quotient		% Contribution to Total Hazard	Hazard Quotient		% Contribution to Total Hazard		
	RME	CTE		RME	CTE		RME	CTE
Ag	0.0001	0.00003	0.001	0.0008	0.0002	0.003	0.002	0.001
As	0.51	0.13	3.98	1.57	0.40	6.89	0.72	0.18
Cd	0.001	0.0004	0.01	0.01	0.002	0.04	0.03	0.01
Cr	0.2	0.05	1.66	0.23	0.06	1.00	0.16	0.04
Cu	0.02	0.01	0.15	0.08	0.02	0.35	0.03	0.01
Hg	0.8	0.2	6.20	8.64	2.20	37.97	0.44	0.11
Ni	0.003	0.001	0.02	0.01	0.002	0.04	0.005	0.001
Sb	0.02	0.005	0.15	0.002	0.001	0.01	0.01	0.002
Se	0.01	0.003	0.08	0.04	0.01	0.16	0.04	0.01
Zn	0.02	0.005	0.15	0.05	0.01	0.24	0.05	0.01
Acenaphthene	0.00002	0.00001	0.0002	0.00002	0.00001	0.0001	0.00004	0.00001
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	0.000005	0.000001	0.00004	0.00005	0.00001	0.0002	0.000002	0.0000004
Benzo(a)anthracene	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---
Fluoranthene	0.0001	0.00002	0.001	0.002	0.00049	0.01	0.0001	0.00002
Fluorene	0.00003	0.00001	0.0002	0.0002	0.00006	0.001	0.0001	0.00002
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---
2-Methylnaphthalene	0.00002	0.000005	0.0001	0.0001	0.00002	0.0003	0.0003	0.0001
Naphthalene	0.00001	0.000003	0.0001	0.000	0.00001	0.0001	0.0001	0.00003
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	0.0001	0.00003	0.001	0.002	0.00040	0.01	0.00003	0.00001
2,4'-DDD	---	---	---	---	---	---	---	---
2,4'-DDE	---	---	---	---	---	---	---	---
2,4'-DDT	0.004	0.001	0.03	0.001	0.00013	0.002	0.00004	0.00001
4,4'-DDD	---	---	---	---	---	---	---	---
4,4'-DDE	---	---	---	---	---	---	---	---
4,4'-DDT	0.03	0.01	0.26	0.002	0.001	0.01	0.01	0.002
alpha-Chlordane	0.001	0.0002	0.01	0.0011	0.0003	0.005	0.002	0.001
Dieldrin	0.003	0.0008	0.03	0.01	0.003	0.05	0.03	0.01
Endosulfan II	0.000001	0.0000001	0.000004	0.000002	0.000001	0.00001	0.00001	0.000001
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	0.0004	0.0001	0.003	0.0005	0.0001	0.002	0.001	0.0002
Total PCBs	11.16	2.84	86.52	10.88	2.77	47.78	6.37	1.62
TBT	0.1	0.02	0.75	1.24	0.32	5.44	0.09	0.02
Hazard Index	12.90	3.28		22.76	5.79		7.97	2.03

Table 7-15. Summary of Cancer Risks to Children Associated with Fish Consumption Pathway for IR Site 20

Chemical	All Years Surface			2005 Surface			Reference Risks	
	Risk Values		% Contribution to Total Risk	Risk Values		% Contribution to Total Risk		
	RME	CTE	RME	RME	CTE	RME	RME	CTE
Ag	---	---	---	---	---	---	---	---
As	1.25E-04	3.17E-05	53.51	3.81E-04	9.70E-05	76.55	1.74E-04	4.43E-05
Cd	2.39E-08	6.07E-09	0.010	1.30E-07	3.31E-08	0.03	4.91E-07	1.25E-07
Cr	1.05E-05	2.66E-06	4.49	1.11E-05	2.82E-06	2.23	7.66E-06	1.95E-06
Cu	---	---	---	---	---	---	---	---
Hg	---	---	---	---	---	---	---	---
Ni	---	---	---	---	---	---	---	---
Sb	---	---	---	---	---	---	---	---
Se	---	---	---	---	---	---	---	---
Zn	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	---	---	---	---
Benzo(a)anthracene	8.41E-08	2.14E-08	0.04	9.13E-07	2.32E-07	0.18	1.05E-08	2.68E-09
Benzo(a)pyrene	7.68E-07	1.96E-07	0.33	7.78E-06	1.98E-06	1.56	4.67E-08	1.19E-08
Benzo(b)fluoranthene	7.06E-08	1.80E-08	0.03	4.80E-07	1.22E-07	0.10	2.54E-08	6.47E-09
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	9.05E-08	2.30E-08	0.04	7.68E-07	1.95E-07	0.15	3.89E-09	9.89E-10
Chrysene	2.37E-08	6.02E-09	0.01	2.33E-07	5.94E-08	0.05	4.88E-09	1.24E-09
Dibenz(a,h)anthracene	1.90E-08	4.84E-09	0.01	1.14E-07	2.91E-08	0.02	1.11E-08	2.83E-09
Fluoranthene	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	2.80E-08	7.13E-09	0.01	3.85E-07	9.79E-08	0.08	9.34E-09	2.38E-09
2-Methylnaphthalene	---	---	---	---	---	---	---	---
Naphthalene	2.18E-09	5.55E-10	0.001	4.97E-09	1.27E-09	0.001	2.24E-08	5.71E-09
Phenanthrene	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	---	---	---	---
2,4'-DDD	2.37E-10	6.04E-11	0.0001	7.55E-10	1.92E-10	0.0002	3.51E-10	8.94E-11
2,4'-DDE	1.43E-09	3.63E-10	0.001	6.37E-09	1.62E-09	0.0013	1.65E-09	4.20E-10
2,4'-DDT	6.11E-08	1.56E-08	0.03	7.58E-09	1.93E-09	0.0015	6.45E-10	1.64E-10
4,4'-DDD	9.78E-08	2.49E-08	0.04	3.00E-07	7.64E-08	0.06	7.96E-08	2.03E-08
4,4'-DDE	1.29E-07	3.30E-08	0.06	3.38E-07	8.61E-08	0.07	3.50E-07	8.92E-08
4,4'-DDT	4.90E-07	1.25E-07	0.21	3.45E-08	8.77E-09	0.01	9.49E-08	2.42E-08
alpha-Chlordane	3.60E-08	9.17E-09	0.02	5.91E-08	1.50E-08	0.01	1.32E-07	3.36E-08
Dieldrin	2.26E-07	5.76E-08	0.10	8.26E-07	2.10E-07	0.17	2.06E-06	5.25E-07
Endosulfan II	---	---	---	---	---	---	---	---
Endrin aldehyde	---	---	---	---	---	---	---	---
gamma-Chlordane	2.08E-08	5.29E-09	0.01	2.72E-08	6.93E-09	0.01	3.82E-08	9.73E-09
Total PCBs	9.56E-05	2.43E-05	41.07	9.32E-05	2.37E-05	18.73	5.46E-05	1.39E-05
TBT	---	---	---	---	---	---	---	---
Total Cumulative Risk	2.3E-04	5.9E-05		5.0E-04	1.3E-04		2.4E-04	6.1E-05

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
9	**ecological risk assessment**	**Section 2.5.2**	Final Remedial Investigation Report IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area). Section 6, Pages 6-1 through 6-26, 6-29 through 6-34, 6-36 through 6-41, and 6-44; Figures 6-1 through 6-3, and 6-5; Tables 6-1 through 6-5, 6-7, 6-9 through 6-15, 6-21, 6-22, 6-24 through 6-32; Appendix C. Battelle 2007.

6.0 ECOLOGICAL RISK ASSESSMENT

This section presents the results of the ecological risk assessment conducted in support of the RI at the offshore sediment sites at IR Site 20 and IR Site 24. This ecological risk assessment evaluated historical (sediment, tissue, and toxicity bioassay) data collected in the offshore areas of Alameda Point and incorporated additional sediment data recently collected by Battelle (2005 and 2006). A full discussion of the site history, description of previous investigations, an evaluation of the newly collected sediment data, and a comprehensive discussion of nature and extent at IR Sites 20 and 24 is provided in previous sections.

6.1 Ecological Risk Assessment Objectives and Approach

The main objectives of the ecological risk assessment are to (1) evaluate the potential for adverse effects to the environment through exposure to sediment contaminants from IR Sites 20 and 24 under current conditions, and (2) provide information for risk management decisions.

To evaluate these potential ecological risks, guidance from U.S. EPA (1992 and 1997a) and the Navy (DON, 2001) was followed. As outlined in these guidance documents, a tiered process was used (Figure 6-1). In the first tier, a screening-level ecological risk assessment (SLERA) was conducted (encompassing Steps 1 and 2 of the U.S. EPA guidance), which consisted of a preliminary problem formulation, and a screening-level dose assessment using conservative assumptions. The second tier, or baseline ecological risk assessment (BERA) (Steps 3 through 7 of the U.S. EPA process), used the output of the SLERA to refine the problem formulation and to further evaluate the potential for adverse effects to receptors of concern (ROC) by using more site-specific data, when available.

Although the existing guidance provides a general framework for ecological risk assessments, it recognizes that approaches and methodologies must be tailored to assessment scenarios at individual sites. U.S. EPA characterizes the assessment of ecological risk as a complex, nonlinear process that involves many parallel activities and emphasizes that the ecological risk assessment framework was designed to be flexible, thereby allowing studies to be scaled in a manner appropriate to the requirements of and conditions at each site (U.S. EPA, 1997a).

The following provides an overview of the proposed approach.

SLERA: The objective of the SLERA is to conservatively screen the offshore sites and to determine whether additional assessment is necessary. It is used as a tool to focus the BERA on only those assessment endpoints (AEs) and contaminants that require further evaluation. The SLERA consisted of:

- **Preliminary Problem Formulation:** In this first step, key factors to be considered in the ecological risk assessment were identified. This included compiling available information and data on the offshore areas of Alameda Point and characterizing the nature and extent of site-specific stressors and the natural resources at risk. In this preliminary analysis, contaminants of potential ecological concern (COPECs) were identified and biological species and endpoints were selected for evaluation. This information was used to formulate a CSM and to identify the scope and goals of the ecological risk assessment.

- **Screening-Level Risk Estimate:** In the SLERA, a preliminary estimate of risk was conducted. The SLERA used conservative assumptions to estimate exposure and effects to potential ecological receptors. This ensured high confidence in any determination of no unacceptable risk. However, findings of potential risk were not definitive indications of risk but, rather, indications of a possibility of risk that required further evaluation. Those receptors and COPECs identified in the SLERA as posing the potential for risk were evaluated more fully in the BERA.

BERA: In the BERA, the preliminary problem formulation developed in the SLERA was refined, and an assessment of exposure and effects was conducted on the selected AEs. The measurements of exposure and effects were then integrated into a characterization of risk. The specific components of the BERA were:

- **Refined Problem Formulation:** The first step of the BERA was to refine the preliminary problem formulation and CSM developed in the SLERA. The CSM was re-evaluated in light of the outcome of the SLERA and was refined as necessary. The AEs selected in the SLERA also were re-evaluated to ensure that they were applicable and relevant to the BERA. Specific measurement endpoints (MEs) also were selected to maximize the use of existing, historical data collected from the offshore area.

- **Exposure and Effects Assessment:** In this phase, refinements were made to the conservative screening model conducted in the SLERA to better estimate the potential for adverse effects based on site-specific information rather than conservative defaults. The relationship between the degree of exposure and ecological effects was assessed using field measures and available ecotoxicological literature.

- **Risk Characterization:** The risk characterization step of the BERA integrates the exposure and effects assessment to evaluate the potential for unacceptable ecological risk at the site. In the BERA, the risk characterization for each AE included an estimation of potential risks and a determination of the ecological significance of potential risks.

Quantitative data were collected and used to assess exposure and the potential toxic effects of COPECs to selected AEs. The following specific types of data were collected or reviewed during the ecological risk assessment:

- Site-specific ecological surveys to identify ecological receptors;

- Chemical analysis of samples of sediment to evaluate the nature and extent of contamination;

- Measurements of other parameters such as grain size, pH, and organic carbon that aid in estimating the bioavailability of chemical stressors;

- Bioassays to evaluate the direct toxicity of COPECs to benthic invertebrates;

- Chemical analysis of tissue residue from sediment invertebrates and fish to evaluate the potential for bioaccumulation and trophic transfer of chemicals;

- Food-chain modeling to estimate potential doses received by higher-trophic level receptors; and,

- Literature review on a variety of topics to help interpret site-specific data.

6.2 Preliminary Problem Formulation

The primary goal of the preliminary problem formulation is to establish the goals and the focus of the ecological risk assessment based on the site history, physical and ecological setting, and potentially complete exposure pathways. This information is used to develop a preliminary CSM and preliminary AEs. The site description and history for each of the sites evaluated in this RI is provided in Section 2.

6.2.1 Ecological Setting

San Francisco Bay is commonly subdivided into three geographical areas designated as the North Bay, Central Bay, and South Bay, with Alameda Point located in the Central Bay area. Although a complete habitat evaluation has not been conducted for the offshore areas of Alameda Point, information presented in previous ecological assessments for Alameda Point (PRC, 1994) was used to describe the composition of the biotic communities in the offshore areas. Additionally, habitat assessments conducted for the Port of Oakland (GGAS, 1994; ENTRIX, Inc., 1997) provided supplementary information. This information is summarized below. Full species list tables can be found in Appendix E. A conceptual food web that illustrates the relationships among the species found in the offshore area of Alameda Point can be found in Figure 6-2.

6.2.1.1 Invertebrates

The offshore waters and sediment around Alameda Point support a variety of prey items such as plankton (phytoplankton and zooplankton) and benthic organisms (e.g., polychaete worms, mollusks and crustaceans) (PRC, 1994; PRC, 1996a; ENTRIX, 1997). The benthic community at Oakland Inner Harbor was found to be dominated by annelids and molluscs (PRC, 1994). A number of crustacean species also were identified, the most abundant being *Ampelisca abdita* (PRC, 1994). On the western edge of Alameda Point (at Western Bayside), the benthic fauna are dominated by crustaceans, annelids, and molluscs. The most abundant species include black shrimp (*Crangon nigricauda*), sand shrimp (*Crangon franciscorum*), and dungeness crab (*Cancer magister*). Several species of polychaete worms and bivalves (e.g., *Mytilus edulis*) are also abundant (PRC, 1996b; TtEMI, 2000). In sediment samples collected in the general vicinity of Western Bayside, Chapman et al. (1987) reported an abundance of crustacean species (*Ampelisca abdita, Photis californica,* and *Leptochelia* sp.), as well as the presence of polychaetes (*Euchone analis*) and phoronidae (tube worms; *Phoronis* sp.). Sediment sampling conducted in 2001 (Battelle et al., 2004a) at Western Bayside in support of the Skeet Range RI found shallow sediments in the area containing thick mats of amphipod tubes (*A. abdita*). No specific benthic sampling has been conducted at IR Site 24, but it is likely that benthic organisms found there are similar to those found at the other offshore areas. A list of potentially occurring benthic invertebrate species in the offshore sediment areas of Alameda Point can be found in Appendix E.

6.2.1.2 Fish

The benthic invertebrate species found in offshore sediments represent a food source for predators such as fish and benthic-feeding birds. The varying depths and substrate types found in open water areas of Oakland Inner Harbor create habitat for many fish species including topsmelt (*Atherinops affinis*), three-spine stickleback (*Gasterosteus aculeatus*), and shiner perch (*Cymatogaster aggregata*). Although seasonal variations may occur, fish species such as Pacific tomcod (*Microgadus proximus*), plainfin midshipman (*Porichthys notatus*), and white croaker (*Genyonemus lineatus*) may occur more commonly in deep dredged habitats; species including northern anchovy (*Engraulis mordax*) and Pacific herring (*Clupea harengus*) occur in shallow subtidal habitats (ENTRIX, 1997). The nearshore environment in the vicinity of Western Bayside supports a diverse fish community (ENTRIX, 1997), including estuarine, marine, and anadromous fishes. Among them are various flatfish, surfperch, gobies, sculpin, silversides, pipefish, sharks, and rays. Several species of both pelagic and benthic fish are anticipated to be present, including shiner perch (*Cymatogaster aggregata*), bay pipefish (*Syngnathus leptorhynchus*), walleye surfperch (*Hyperprosopon urgenteum*), and redtail surfperch (*Amphistichus rhodoterus*). No specific sampling for fish has been conducted at IR Site 24, but it is likely that fish found in other offshore areas of

Alameda would potentially use habitat at IR Site 24. A list of potentially occurring fish species in the offshore areas of Alameda Point can be found in Appendix E.

6.2.1.3 Birds

Field surveys of bird communities in the vicinity of the Port of Oakland and Alameda Point were conducted in the winter (January-April) and summer (June-July) of 1997 (ENTRIX, 1997). Two of the survey areas were located off of the northern side of Alameda Point and encompass the Oakland Inner Harbor and Western Bayside Area. These surveys indicated that the open water habitat of the channel supports a variety of bird species including diving birds such as the double-crested cormorant (*Phalacrocorax auritus*), western and Clark's grebes (*Aechmorphorus* sp.), American wigeon (*Anas americana*) and common and Pacific loons (*Gavia sp.*). Surface diving birds including the federally and state-endangered California least tern (*Sterna antillarum browni*) and California brown pelican (*Pelecanus occidentalis*) are known to forage and rest in areas within and adjacent to the Oakland Inner Harbor, although only one pelican was observed in the ENTRIX (1997) field surveys. Other water-dependent bird species such as American coots (*Fulica americana*), gulls (*Larus* sp.) and wading birds (e.g., egrets) also have been observed in Oakland Inner Harbor (ENTRIX, 1997). No specific bird surveys have been conducted in IR Site 24. A full avian species list, including seasonal information, can be found in Appendix E.

6.2.1.4 Mammals

Based on historical observations and known activity patterns for marine mammals in San Francisco Bay (GGAS, 1994), it is possible that both California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina*) may forage in the vicinity of Alameda Point. Although the presence of either of these species in specific areas of Alameda Point has not been documented, harbor seal foraging activities and haul-outs have been observed along and near the breakwaters on the southern side of Alameda Point. However, available radiotelemetry data for seals in San Francisco Bay suggest that none of the seven discreet feeding stations typically frequented by seals within the bay is in the immediate vicinity of Alameda Point (Harvey and Torok, 1994). Appendix E provides a list of potential marine mammal species observed within or near Alameda, as well as a qualitative exposure assessment for the harbor seal.

6.2.1.5 Special-Status Species

Special status species known to occur in the Central Bay include green sturgeon (*Acipenser medirostris*), winter-run Chinook salmon (*Oncorhynchus tshawytscha*), central California steelhead (*Oncorhynchus mykiss*), Barrow's goldeneye (*Bucephala islandica*), double-crested cormorant, California least tern, California brown pelican (*Pelecanus occidentalis californicus*), western snowy plover (*Charadrius alexandrinus nivosus*), white-tailed kite (*Elanus leucurus*), Cooper's hawk (*Accipiter cooperii*), American peregrine falcon (*Falco peregrinus anatum*), California sea lion, and harbor seal (ENTRIX, 1997). None of these species are known to nest or breed in the offshore areas, although several species are known to use adjacent upland areas for nesting and/or foraging activities (e.g., least tern).

Additional information detailing conservation status, distribution, abundance, seasonality, life history, and occurrence in the vicinity of Alameda Point for each of the special status species is discussed in more detail in Appendix E.

6.2.2 Development of Conceptual Site Model

The CSM is a framework for relating ecological receptors to contaminated media and determining the degree of completion and significance of exposure pathways. In general, an exposure pathway describes the course a chemical takes from the source to the exposed receptor. An exposure pathway analysis links the source, location, and type of environmental release with population location and activity patterns to determine the primary pathways of exposure. If potentially complete and significant exposure pathways exist between contaminants and receptors, an assessment of potential effects and exposure was conducted. Only those potentially complete exposure pathways likely to contribute significantly to the total exposure were quantitatively evaluated. All other potentially complete exposure pathways which result in minor exposures or for which there are no exposure models or insufficient toxicity data were not quantitatively evaluated in this assessment.

An exposure pathway was considered complete if all four of the following elements were present:

(1) A source and mechanism of chemical release to the environment;

(2) An environmental retention or transport medium (e.g., water or sediment) for the released chemical;

(3) A point of potential physical contact of a receptor with the contaminated medium (exposure point); and,

(4) An exposure route (e.g., ingestion of contaminated prey, incidental ingestion of sediment).

The potentially complete and significant ecological exposure pathways present at the offshore sites were similar except for differences among sites in the potential primary sources and primary release mechanisms. Site-specific CSMs for IR Sites 20 and 24 can be found in Figures 6-3 and 6-4.

For both sites, sediment was considered the primary exposure media. Although it is recognized that sediment-associated porewater can be a potentially important exposure pathway, porewater analyses were not considered necessary at this time because bulk sediment analyses were expected to adequately characterize the site (Battelle et al., 2005a). The other potential exposure medium identified in the CSM was surface water. Although chemicals from the site may have historically been released to surface water as a result of historical discharges, those potential sources have been addressed as part of an upland storm water investigation. Additionally, surface water was not considered a significant exposure medium due to tidal action and San Francisco Bay currents, which result in rapid dilution.

Benthic invertebrates in offshore sediments may be exposed to COPECs through ingestion of and direct contact with surface sediments. An evaluation of major exposure pathways to higher trophic levels indicates that there are potentially complete exposure pathways to benthic feeding and piscivorous fish and birds. Exposure to these secondary and tertiary trophic consumers is through ingestion of prey that has been exposed to COPECs, as well as incidental ingestion of surface sediments in the area.

Tertiary trophic consumers with the highest potential exposure to COPECs are piscivorous birds. While, marine mammals such as the harbor seal may be observed in the areas offshore of Alameda Point, their exposure to contaminants in the offshore sediments is likely to be minimal (see Appendix E for a detailed discussion regarding marine mammal usage of Alameda Point). Therefore, marine mammals will not be evaluated quantitatively in this risk assessment.

6.2.3 Selection of Assessment Endpoints

Based on the ecological resources and complete exposure pathways identified in the CSM, AEs were developed to identify the ecological values at the site that should be protected. In general, AE selection considered the ecosystem, communities, and species relevant to a specific site. AEs were defined based on technical considerations, including the:

- Chemicals present and their concentration;
- Mechanisms of toxicity of the chemicals to different groups of organisms;
- Ecologically relevant receptor groups that are potentially sensitive or highly exposed to the chemicals; and,
- Potentially complete exposure pathways.

Based on the conceptual food web (Figure 6-2) and the CSMs (Figures 6-3 and 6-4), preliminary AEs were identified for the offshore areas as follows:

AE(1): Sufficient rates of survival, growth, and reproduction to sustain the benthic invertebrate community in the offshore areas of Alameda Point.

AE(2): Sufficient rates of survival, growth, and reproduction to sustain benthic-feeding and piscivorous-feeding fish communities in the offshore areas of Alameda Point.

AE(3): Sufficient rates of survival, growth, and reproduction to sustain the avian community in the offshore areas of Alameda Point. This AE also includes the protection at the level of the individual for special-status species as appropriate.[1]

6.2.4 Selection of Receptors of Concern

Because it is impractical to assess the toxic effects of COPECs to all potentially exposed ecological receptors, a subset of potential receptors was chosen to act as a "surrogate species" for each AE. These ROCs were defined as follows:

- Species that represent a functional group of organisms at the site for the evaluation of AEs; and
- Species that are chosen based primarily on their function in the ecosystem and secondarily on taxonomic relatedness and known or presumed similarities in physiology and life history.

Because they represent a larger group, ROCs were selected so that they maximize exposure, thus producing conservative estimates of risk. For those AEs that are generic in nature [e.g., AE(1) and AE(2)], selection of representative receptors was not necessary. These AEs are evaluated using benchmarks that are not specific to a particular species. For example, the benthic invertebrate sediment benchmarks used to evaluate benthic invertebrates were developed based on observed toxicity to a number of invertebrate species and are considered protective of a variety of species; thus, it is not necessary to select a specific representative species for these AEs. Therefore, the selection of ROCs focused on the upper trophic-level avian receptor groups addressed by AE(3).

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[1] This assessment endpoint was modified from those described in the Final Offshore Sediment Study Work Plan (Battelle et al., 2005a) by combining both the non-special and special-status avian species into one assessment endpoint.

Avian ROCs were selected to conservatively represent the avian community that forages in the offshore area of Alameda Point. To provide consistency, ROCs also were chosen that were evaluated in past ecological risk assessments at Alameda Point (e.g., Skeet Range and Seaplane Lagoon). For the offshore areas of Alameda Point, the avian trophic groups with the most significant potential for exposure to sediment-bound contaminants are the benthic-invertebrate eating birds, omnivorous birds and piscivorous birds (Figure 6-2). To bound the range of exposure, benthic-invertebrate eating birds and piscivorous birds were chosen to represent this AE. Additionally, because special-status bird species are regulated at the level of the individual and non-special status species are regulated at the population level, both non-special status and special-status bird species were selected.

6.2.4.1 Selection of the Benthic Invertebrate-Eating ROC

Benthic-feeding birds feed on invertebrates by probing or plucking prey from the substrate in intertidal and subtidal areas. Because these species feed on prey that are in close contact with sediments, they may be exposed to COPECs in sediments through either the prey (which has bioaccumulated COPECs in tissues) or through incidental ingestion of contaminated sediment (via their foraging behavior or sediment found in the guts of their prey). Wading shorebirds, such as the dowitcher, probe in shallow waters to sift small crustacea out of sandy sediments. Diving birds, such as surf scoters and ruddy ducks, dive and pluck prey (such as molluscs) from the substrate. Although wading shorebirds may be the most exposed because of the substantial amount of sediment contacted during feeding, there is no available foraging area for these species along the shorelines of IR Sites 20 and 24 (due to the riprap shoreline, docks, and quays). Because the majority of available habitat is subtidal, diving birds such as benthic-feeding diving ducks were considered the most appropriate ROC for the offshore areas.

A number of species of diving ducks have been observed at Alameda Point including surf scoters, white-winged scoters, black scoters, ruddy ducks, greater scaups, buffleheads, and common goldeneyes. All are present as winter residents that breed in northern Canada and Alaska.

Of these species, the surf scoter was selected as the ROC representative of benthic-feeding birds. The scoter was selected for the following reasons:

- Surf scoters have been observed offshore of Alameda Point (excess of 3,000 surf scoters have been observed on the waters west of Alameda Point).
- Surf scoters can frequently forage in waters up to 10 m deep (Savard et al., 1998). This would allow them to forage in most of the subtidal offshore areas.
- Surf scoters feed primarily on molluscs (Vermeer and Bourne, 1984; Ohlendorf et al., 1986). Bioaccumulation data are available for the clam *M. nasuta* from the offshore sites, so food-chain modeling using *M. nasuta* body burdens is an ecologically relevant scenario.
- There is a substantial body of comparative contaminant literature on the scoter. Trace metal analyses of scoter tissue and scoter prey items have been reported from British Columbia (Vermeer and Peakall, 1979), and trace element and organochlorine residues in scoters have been reported from San Francisco Bay (Ohlendorf et al., 1991).
- Surf scoters have been evaluated in other ecological risk assessments conducted at Alameda Point (Skeet Range and Seaplane Lagoon) and exposure parameters have been agreed upon by the agencies (Battelle et al., 2004a and 2004b).

Surf scoters are a long-lived species with low reproductive output. They breed in Alaska and Canada and winter along the Pacific and Atlantic coasts; they are present in the San Francisco Bay from mid-October/November through late April (Savard et al., 1998). Pairs form at wintering grounds (Morrier et al., 1997 as cited in Savard et al., 1998) and females have single broods and begin laying their clutch in concealed nests constructed in the ground and clutch size ranges from 6 to 9 eggs (Morrier at al. 1997 as cited in Savard et al., 1998). The young are precocial and can fly by 55 days (Lesage et al., 1997 as cited in Savard et al., 1998).

Scoters feed on mollusks at their wintering grounds, herring eggs when available during spring migration, and freshwater invertebrates while breeding (Savard et al., 1998). On their wintering grounds, they dive down and prey on stationary invertebrates such as mussels, barnacles, and clams (Ohlendorf et al., 1986; Savard et al., 1998).

No specific information has been identified regarding scoter home ranges while wintering in San Francisco Bay. However, a radiotelemetry study conducted in Puget Sound found that wintering birds stayed within 9 to 11 kilometers (km) of their capture location. Most birds used between two and seven locations (defined as 1 km diameter areas) 76 to 87% of the time studied (Mahaffy et al., 1995).

6.2.4.2 Selection of the Piscivorous Avian ROC

Piscivorous birds may also be potentially exposed to COPECs from offshore sediments through foraging on prey that have bioaccumulated contaminants. Several species of diving piscivorous birds have been observed near Alameda Point including the double-crested cormorant, the pie-billed grebe, horned grebe, eared grebe, western grebe, Clark's grebe, Pacific loon, common loon, California least tern, California brown pelican, and Caspian and Forster's terns.

Of the piscivorous bird species observed offshore of Alameda, the double-crested cormorant and the California least tern were selected as ROCs. The double-crested cormorant was selected for the following reasons:

- The species is widespread in San Francisco Bay with nesting colonies potentially within foraging distance of the offshore areas of Alameda Point (located on the Bay Bridge; Ainley, 2000); as such, they are found year round in San Francisco Bay;
- Double-crested cormorants have been observed offshore of Alameda Point;
- Because double-crested cormorants forage in shallow waters overlying bottoms of flat relief (<8 m deep) (Hatch and Weseloh, 1999; Ainley, 2000), they could be exposed to most of the offshore areas. This is contrasted with piscivorous wading birds [e.g., the great blue heron (*Ardea herodias*) or the snowy egret (*Egretta thula*)] that are restricted to the shallow inter-tidal zone, which makes up only a small proportion of the area off of Western Bayside.
- Double-crested cormorants have been evaluated in other ecological risk assessments conducted at Alameda Point (Seaplane Lagoon) and exposure parameters have been agreed upon by the agencies (Battelle et al., 2004b).

Double-crested cormorants are a California species of special concern. In the San Francisco Bay Area, they are most prevalent in the winter; however, there is a large breeding population in the summer (Ainley, 2000). They breed April through August. Twelve colonies are located in the San Francisco Bay area, with the largest colonies on the Oakland-San Francisco Bay Bridge and the Richmond-San Rafael Bridge (Ainley, 2000). Clutch size is usually three to four eggs (Zeiner et al., 1990).

Double-crested cormorants usually forage in water less than 8 m deep (Hatch and Weseloh, 1999). Around the Richmond-San Rafael Bridge, their diet consisted mainly of midshipman (*Porichthys notatus*), various species of smelt (*Osmeridae*), and yellowfin gobies (*Acanthogobius flavimanus*) (Stenzel et al., 1995). Other studies on the West Coast found that atherinids (topsmelt), embiotocids (surfperch), engraulids (herring), scaenids (rockfish), and midshipman are commonly eaten by the double-crested cormorant (Ainley et al., 1981). Prey fish are generally less than 15 cm in length (Hatch and Weseloh, 1999). Ainley et al. (1981) also found that the double-crested cormorant preferred to forage on schooling prey from the surface to near flat bottoms.

In San Francisco Bay, double-crested cormorants were found to forage within 5 km of the Richmond-San Rafael Bridge (Stenzel et al., 1995). Birds from the Farallon Islands frequently travel to mainland estuaries to feed (over 70 km). In Wisconsin, birds flew less than 3 km on average (maximum distance 40 km) from the breeding colony to the first foraging site (Custer and Bunck, 1992). In Mississippi, the average distance flown was 15.7 km (in King et al., 1995 as cited in Cal/U.S. EPA, 1999).

The California least tern was selected as an ROC for the following reasons:

- The California least tern is a federally listed endangered species that breeds on Alameda Point and has been recorded to feed predominantly in waters close to the shore (Collins, 1994). Because it has been observed breeding at Alameda Point, it is present during a sensitive life stage (egg laying and rearing of nestlings).

- The nesting success of least tern colonies at Alameda Point and elsewhere is closely monitored; therefore if needed, additional site-specific data are available for this species. The number of pairs nesting, the number of eggs laid per nest, and the number of young fledged per nest have all been used as measures of reproductive success in the least tern and other seabirds. It is a convenient measure and one that has already accumulated several years of data (since 1993) as well as adequate reference data (the statewide average young-per-nest is approximately 0.7) (Collins, 1994).

- Least terns have been evaluated in other ecological risk assessments conducted at Alameda Point (Seaplane Lagoon) and exposure parameters have been agreed upon by the agencies (Battelle et al., 2004b).

Least terns winter south of California and are absent from San Francisco Bay from mid-October through late April. Least terns are present at their nesting colony from April through August. Nesting starts in mid-May, with most nests completed by mid-June (Bent, 1929; Davis, 1968; Massey, 1974; Elliot and Sydeman, 2002). Late-season nests may be renested by late-arriving second-year individuals (Wilbur, 1974; Collins and Bailey, 1980; Massey and Atwood, 1981; Elliot and Sydeman, 2002). Clutch size is usually two-three and a single brood is raised yearly. Incubation, by both parents, lasts 17-28 days, usually 20-25 days. The semiprecocial young are tended by both parents. Young become strong and mobile at three days, and can fly by 28 days (Terres, 1980; United States Fish and Wildlife Service [USFWS], 1980). The young continue to be fed by parents for about two weeks after leaving the colony.

Terns nesting at Alameda Point forage around the Point and all along the entire south shore of Alameda, from the breakwater west of Seaplane Lagoon to the Elsie B. Roemer Sanctuary and beyond to Tidal Pond at the northwest end of the Oakland Airport (Collins and Feeney, 1993). However, the area adjacent to Alameda Point had the highest usage by terns. Least terns feed primarily in shallow estuaries or lagoons where small fish are abundant. They hover and then plunge for fish near the surface, without submerging completely. Prey in CA includes anchovy (*Engraulis* sp.), silversides (*Atherinops* sp.), and shiner surfperch (*Cymatogaster aggregata*). Considerable feeding also takes place near shore in the open ocean (Cogswell, 1977), especially where lagoons are nearby, or at mouths of bays.

Human disturbance at former coastal nesting areas has reduced the breeding population in California (Garrett and Dunn, 1981). At Alameda Point, however, the least tern colony has grown in size (over 10% per yr) and is now the largest in northern California. In the 2001 breeding study (Elliot and Sydeman, 2002), 267 breeding pairs of terns were estimated at the Alameda Point colony and the estimated number of fledglings was 320, with an estimated 1.2 fledglings/pair. This exceeds the state-wide average of 0.7 young-per-nest (Collins, 1994).

6.2.5 Selection of SLERA Measurement Endpoints

A measurement endpoint (ME) is defined as a "measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint" and is a measure of biological effects (e.g., mortality, reproduction, growth) (U.S. EPA, 1997a). The AEs and their associated MEs selected for the SLERA are summarized below.

AE(1): Sufficient rates of survival, growth, and reproduction to sustain the benthic invertebrate community in offshore areas.

- ME(1): Compare bulk sediment chemistry results to conservative screening benchmarks from the literature.

AE(2): Sufficient rates of survival, growth, and reproduction to sustain benthic feeding and piscivorous fish communities in offshore areas.

- ME(1): Compare conservative bulk sediment chemistry results (maximum concentrations) to conservative screening benchmarks from the literature.

AE(3): Sufficient rates of survival, growth, and reproduction to sustain the avian community in the area. This assessment endpoint also includes the protection at the level of the individual for special-status species as appropriate.

- ME(1): Compare conservative exposure doses (i.e., derived from maximum sediment and tissue concentrations and conservative exposure parameters) for benthic feeding birds to toxicity reference values (TRVs).
- ME(2): Compare conservative exposure doses for piscivorous birds represented by the least tern (a special status species) to TRVs.
- ME(3): Compare conservative exposure doses for piscivorous birds represented by the double-crested cormorant to TRVs.

6.2.6 Data To Be Considered

Based on the potentially complete exposure pathways identified in the CSM and the preliminary AEs identified above, the available data for the offshore areas that are relevant to assessing ecological receptors were identified. Data to be considered included historical and newly-collected sediment chemistry data, historical biological tissue chemistry (*M. nasuta*) data, and historical site-specific toxicity bioassay data.

6.2.7 Selection of Preliminary COPECs

All chemicals detected in sediment were selected as COPECs for the SLERA. A detailed discussion of the nature and extent of sediment constituents at IR Sites 20 and 24 can be found in Section 4 of the RI Report.

6.3 Tier 1 Screening-Level Risk Estimate

The objective of the screening-level risk estimate is to use conservative screening methodologies to screen the offshore sites and to determine whether additional ecological assessment is necessary. It is used as a tool to focus the baseline evaluation only on those AEs and contaminants that require further evaluation. In the absence of site-specific data, a screening-level assessment uses conservative assumptions to estimate exposure and effects to potential ecological receptors. This ensures high confidence in any determinations of no unacceptable risk. However, findings of potential risk are not definitive indications of risk but, rather, indications of a possibility of risk that requires further evaluation. Those receptors and COPECs identified in the SLERA as posing the potential for risk will be evaluated more fully in the BERA.

This section presents the screening-level assessment and includes a discussion of approaches used to assess exposure and ecological effects. Results are presented in the form of hazard quotients (HQ) or risk estimates. A characterization of risk is not included in the assessment because screening-level exceedances do not provide evidence of risk. Instead, the results of the assessment are used to focus the BERA on those compound-receptor pairs that fail the conservative screen. Based on the preliminary CSM and AEs identified, exposures via direct contact (to benthic invertebrates and fish) and indirectly through the food chain (to birds) were evaluated in the SLERA.

6.3.1 Screening-Level Exposure Assessment

This section presents the approaches used to develop screening-level exposure estimates for the offshore sediment areas. The general approach was to incorporate considerable conservatism into the development of exposure estimates in order to minimize the potential for falsely screening a COPEC from further evaluation based on the screening-level assessment. Two types of exposure estimates were included in this screening-level evaluation:

- Exposure to COPECs in abiotic media via direct contact;
- Exposure to COPECs via uptake through the food web.

Three separate sediment data sets were evaluated for each site, representing different time periods and exposure scenarios. The data sets for IR Site 20 were:

- All Years: This data set encompassed all the historical data collected in the surface sediment (0-5 cm) at each site.
- 2005 Surface: This data set includes all the surface data (0-5 cm) collected in 2005.
- 2005 Subsurface: This data set includes the deeper sediment (5-25 cm) collected in 2005 that was requested by the regulatory agencies to be evaluated in the ecological risk assessment.

The data sets for IR Site 24 were:

- All Years: This data set encompassed all the historical data collected in the surface sediment (0-5 cm) at each site.
- 2005/2006 Surface: This data set includes all the surface data (0-5 cm) collected in 2005 and 2006.
- 2005/2006 Subsurface: This data set includes the deeper sediment (5-25 cm) collected in 2005 and 2006 that was requested by the regulatory agencies to be evaluated in the ecological risk assessment.

The most relevant data set to the ecological risk assessment are the 2005 Surface data set for IR Site 20 and the 2005/2006 Surface data set for IR Site 24 as they are (1) representative of current conditions, (2) the sediment horizon that results in the most significant portion of exposure to receptors, and (3) consistent with the sediment horizon evaluated in ongoing monitoring programs in San Francisco Bay (SFEI, 2001).

6.3.1.1 Calculation of EPCs for Screening-Level Direct Contact Evaluation

A potentially complete exposure route based on direct contact of sediment to receptors (benthic invertebrates and fish) exists (see Figures 6-3 and 6-4); therefore, a screening-level assessment of potential direct contact risks was conducted by comparing the maximum sediment concentrations measured in each of the sediment data sets (e.g., All Years, 2005 or 2005/2006 Surface, and 2005 or 2005/2006 Subsurface) to conservative sediment screening benchmark values. A description of the methods used to calculate sediment EPCs is provided in Section 5.4.

6.3.1.2 Calculation of EPCs for Screening-Level Dose Assessment

To evaluate potential risks from the potentially completed exposure pathways to higher trophic level organisms at the offshore sites, a screening-level dose assessment was performed using a food-chain model. Dose estimates were calculated for all constituents detected in the three sediment data sets for each IR site (All Years, 2005 or 2005/2006 Surface and 2005 or 2005/2006 Subsurface) using the maximum sediment concentration and an exposure model that incorporated natural history information and species characteristics including diet composition, ingestion rates (IRs), body weights (BWs), and foraging ranges for each receptor.

The basic dose equation that was used to characterize exposure is as follows:

$$Dose = \{[(C_{sed} \times IR_{sed}) + (C_{prey} \times IR_{prey})] \times SUF\}/BW \qquad (6\text{-}1)$$

where Dose = daily dose resulting from ingestion of sediment and prey (mg COPEC per kg BW per day)

C_{sed} = COPEC-specific concentration in surface sediments datasets (mg COPEC per kg sediment)

C_{prey} = COPEC-specific concentration in prey (mg COPEC per kg prey)

IR_{sed} = estimate of receptor's daily incidental ingestion rate of surface sediments (kg sediment per day)

IR_{prey} = estimate of daily ingestion rate of prey (kg prey per day)

SUF = site use factor (unitless)

BW = body weight (kg).

For the SLERA, U.S. EPA and Navy guidance (U.S. EPA, 1997a; Chief of Naval Operations [CNO], 1999) was followed by biasing the exposure toward conservatism (i.e., an overestimation) of exposure and therefore, an overestimation of risk. This included using maximum surface sediment and tissue concentrations as the EPCs, and assuming 100% site use, assimilation efficiency, and bioavailability of the COPEC. Thus, if the screen concluded that negligible risk exists, then there was strong support for a no further action recommendation. It should be noted that any exceedances observed during the screening process were an indication that further evaluation may be necessary before a definitive decision can be made.

The exposure parameters that were used in the screening assessment for the scoter, double-crested cormorant, and the least tern were the same as those used at the other Alameda Point ecological risk assessments (Battelle et al., 2004a and 2004b) and were based on site-specific data, where available, or from natural history information from the literature. The rationale for the selected exposure parameters for the scoter, cormorant, and least tern are provided in detail below and summarized in Table 6-1.

6.3.1.3 Exposure Parameters for the Surf Scoter

A detailed description of the rationale used to develop each exposure parameter for the surf scoter can be found in the following sections.

Exposure Point Concentrations in Sediment (C_{sed}): For the screening-level evaluation, the maximum dry weight concentrations of COPECs detected in each of the three sediment data sets for each IR site (All Years, 2005 or 2005/2006 Surface and 2005 or 2005/2006 Subsurface) was used as the EPC in sediment.

Exposure Point Concentrations in Prey (C_{prey}): The dry weight concentrations of COPECs in *Macoma nasuta* tissue were conservatively estimated by combining both empirical tissue data from bioaccumulation assays conducted with site sediment and modeled tissue data using bioaccumulation factors. For the screening-level dose assessment, the maximum concentration in tissue was used as the EPC for prey. A detailed description of how exposure point concentrations for scoter prey can be found in Section 5.5 and Tables 5-5 and 5-6.

Incidental Sediment Ingestion Rate (IR_{sed}): Scoters may incidentally ingest sediment while foraging for molluscs in sediment or through the small quantities of sediment that may be in the guts of prey on which they feed. Additionally, many scoter species ingest gravel to use as grit in their muscular gizzard to help crush the shells of the bivalves they eat. Where gravel is not present, they may substitute barnacle and mollusc shells for grit (Vermeer and Bourne, 1984).

Species-specific information on the rate of incidental sediment ingestion was lacking 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 in three of the four stations had between 1.5 and 3.2 g of grit in their guts, with a mean of 2.3 g. A fourth station measured 20.8 g of grit composed mostly of gravel. The station with scoters with the most grit (Cumshewa Inlet) also was the station which had a gravel substrate.

An incidental sediment ingestion rate for the scoter of 2.3 g/day was used in the exposure model. This value is assumed to be a conservative and appropriate value for the surf scoter for the following reasons:

- White-winged scoters and surf scoters forage in similar manners, thus their exposure is likely to be similar (Vermeer and Bourne, 1984);

- The substrate at the stations where grit was measured in scoter guts between 1.5 and 3.2 g (mean = 2.3 g) are likely to be more similar to Alameda Point than the station with 20.8 g of gravel, because the sand-gravel-mud-shell hash substrate of those stations is more like the substrate off of Alameda Point than the cobble and gravel substrate of Cumshewa Inlet;

- The assumption that the mean value of 2.3 g of grit is composed solely of sediment rather than shells is a conservative assumption of sediment exposure; and,

- The assumption that the scoters eat 2.3 g of sediment every day (the daily sediment ingestion rate) is a conservative assumption because grit is likely to stay in the gizzard for more than a day before it needs to be replenished.

Prey Ingestion Rate (IR_{prey}): No empirical data were found that measured prey ingestion rates in scoters. Although field studies have been conducted that looked at stomach contents in birds (Vermeer, 1981; Vermeer and Bourne, 1984), stomach content data are unreliable indicators of a bird's daily intake (Vermeer, 1981). Therefore, the following allometric equation was used to model a daily prey ingestion rate for the scoter (Nagy et al., 1999):

$$\text{Field Metabolic Rate (FMR) kJ/day} = a(g)^b \qquad (6\text{-}2)$$

where: a = 14.25 (marine birds)
b = 0.659 (marine birds)
g = body mass for the scoter, 1100 g.

This resulted in a field metabolic rate of 1,439.11 kJ/day. The FMR was then converted into a daily intake rate by dividing the FMR by a conversion factor that converts kJ/day into a g/day dry weight ration of food. No benthic-invertebrate eating avian conversion factors were listed in Nagy et al. (1999). Therefore, the mean of the insectivore (18.0 kJ/g DW) and the piscivore (16.2 kJ/g DW) avian conversion factors was used for the scoter: 17.1 kJ/g DW. This resulted in a modeled IR_{prey} of 84.16 g/day DW or 0.084 kg/day dry weight.

Foraging Range: No San Francisco Bay-specific home range studies have been conducted for the scoter (Takekawa, personal communication, 2001). However, a two-year radiotelemetry study conducted in the Commencement Bay Area of Puget Sound found that wintering birds stayed within 9 to 11 km of their capture location. Most birds used between two to seven locations (defined as 1 km in diameter areas) 76 to 87% of the time studied (Mahaffy et al., 1995). If one assumes that on average, 3 locations are visited the majority of the time by scoters (the mean number of locations visited during the first tracking season was 2.5 and for the second year, 3.9), the average diameter for a foraging area would be 3 km. This would result in a foraging area (assuming that it is round) of 7 km^2. This assumes that the foraging area within this 7 km^2 area is similar to habitat near Alameda Point.

SUF: For the screening-level assessment, it will be assumed that the scoter's foraging range equals the size of the site; thus, the SUF was set at 1.

Body Weight: Male scoters are generally slightly heavier than females (Savard et al., 1998). To develop a reasonable average body weight, data from wintering birds measured between 1986 and 1990 were evaluated (White et al., 1987, 1988, 1989; and Urquhart and Regalado, 1991, as cited in Savard et al., 1998). The average body weight of adult males was 1,148 g ± 7 standard error (SE) (n = 22) and adult females 1,047 g ± 22 SE (n = 21), resulting in an average body weight of 1.1 kg. This is the same as the average body weight measured in scoters from British Columbia (Vermeer, 1981).

6.3.1.4 *Exposure Parameters for the Least Tern*

Both adult and juvenile least terns were evaluated as part of the ecological risk assessment conducted for the Seaplane Lagoon RI (Battelle et al., 2004b). In that evaluation, the models used resulted in the adult least tern having higher exposure and being a more sensitive receptor than juvenile least terns. Therefore, to provide a simpler and more conservative evaluation of the least tern, only the adult least tern will be evaluated in this ecological risk assessment, and it will be assumed to be a conservative surrogate for other life stages. A detailed description of the rationale used to develop each exposure parameter for the adult least tern can be found in the following sections.

C_{sed}: For the screening-level evaluation, the maximum dry weight concentrations of COPECs detected in each of the three sediment data sets for each IR site (All Years, 2005 or 2005/2006 Surface and 2005 or 2005/2006 Subsurface) was used as the EPC in sediment.

C_{prey}: Least terns feed on planktivorous fish which have minimal exposure to site-specific sediments at Alameda Point. Planktivorous fish were not sampled in the offshore areas of Alameda Point, but benthic forage fish were sampled within Seaplane Lagoon. BAFs developed from the forage fish data collected in Seaplane Lagoon were used to model prey concentrations for the least tern. The methodology used to develop forage fish BAFs and the EPCs generated from these BAFs can be found in Section 5.6 (Tables 5-10 and 5-11).

IR_{sed}: Least terns feed primarily on fish in the family of silversides (Atherinae). Based on a study of dropped fish at the Alameda Point least tern colony in 2001 (Elliot and Sydeman, 2002), terns at Alameda were found to forage mainly on topsmelt (*Atherinops affinis*) and jacksmelt (*Atherinopsis californiensis*) (82% of the fish identified). Silversides tend to group in large schools and swim near the surface. Least terns, diving from above, penetrate the water surface to a depth of approximately 8 inches, rarely going deep enough to cover their wings. The tern emerges in flight, rarely alighting on the water, generally shaking a minnow held crosswise in their bill. This feeding mechanism results in the tern eating prey with virtually no contamination from suspended sediment. Therefore, the amount of sediment in the tern diet is negligible.

Prey Ingestion Rate: No empirical data were found that measured prey ingestion rates in least terns. Therefore, an allometric equation based on piscivorous birds with nestlings was used to model a daily prey ingestion rate for the least tern (Nagy et al., 1999):

$$FMR\ (kJ/day) = 7.76(g)^{0.75} \qquad (6\text{-}3)$$

where: g = body mass for the least tern, 45 g.

This resulted in a field metabolic rate of 134.82 kJ/day. The FMR was then converted into a daily intake rate by dividing the FMR by a conversion factor that converts kJ/day into a g/day DW ration of food. For the least tern, the piscivore (16.2 kJ/g DW) avian conversion factor was used. This resulted in a modeled IR_{prey} of 8.3 g/day DW or 0.0083 kg/day DW.

Foraging Range: Foraging data compiled from 10 years of foraging studies at Alameda Point were used to develop an estimate of the foraging range of the least tern (Bailey, 1984, 1985, 1986, 1988, 1990a, 1990b, 1992; Collins and Feeney, 1993, 1995) at each of the IR Sites. Terns nesting at Alameda Point forage around the Point and all along the entire south shore of Alameda, from the breakwater west of Seaplane Lagoon to the Elsie B. Roemer Sanctuary and beyond to Tidal Pond at the northwest end of the Oakland Airport (Collins and Feeney, 1993). However, the area adjacent to Alameda Point had the highest usage by terns, and the focus of all studies was on the foraging distribution around the Point.

Figure 6-5 delineates the main study areas around Alameda Point. Table 6-2 summarizes 10 years of foraging data regarding where the terns feed around Alameda Point. As can be seen from Table 6-2 and Figure 6-5, the majority of the time the terns feed off the south-western side of Alameda Point.

Areas 13/15 (on Figure 6-5) encompass IR Site 20 in Oakland Inner Harbor. Based on a 10 year mean, least terns were observed to spend approximately 1% of the year's total foraging time in the area around IR Site 20 (Table 6-2). Area 14 (on Figure 6-5) includes Seaplane Lagoon and IR Site 24, approximately 9.4% of the time least terns are seen foraging at Area 14 (Table 6-2). Since Area 14 includes a larger area than just IR Site 24, the percentage of the total area that is IR Site 24 was used to estimate the amount of time least tern might forage at IR Site 24, assuming equal habitat use in Seaplane Lagoon and IR Site 24. IR Site 24 is approximately 30% of the total area of Area 14. Thus, 30% of 9.14% is approximately 3% of the total foraging time spent in the area around IR Site 24.

SUF: For the screening-level assessment, it was assumed that the least tern's foraging range equals the size of the site resulting in a SUF of one.

Body Weight: Average body weight reported for eight least terns in the Museum of Vertebrate Zoology, University of California Berkeley (Cicero, 1998) was used to calculate the average body weight. Weights were 43.1, 43.5, 43.6, 44.1, 44.4, 45.2, 48.6, and 50.5 g. Thus, the average was 45 g.

6.3.1.5 Exposure Parameters for the Double-Crested Cormorant

A detailed description of the rationale used to develop each exposure parameter for the double-crested cormorant can be found in the following sections.

C_{sed}: For the screening-level evaluation, the maximum dry weight concentrations of COPECs detected in each of the three sediment data sets for each IR site (All Years, 2005 or 2005/2006 Surface and 2005 or 2005/2006 Subsurface) was used as the EPC in sediment.

C_{prey}: As with the least tern, BAFs developed from the forage fish data collected in Seaplane Lagoon were used to model prey concentrations for the double-crested cormorant. The methodology used to develop forage fish BAFs and the EPCs generated from these BAFs can be found in Section 5.6 (Tables 5-10 and 5-11).

IR_{sed}: No species-specific information on incidental sediment ingestion was found. Based on the work conducted by Ainley et al. (1981), double-crested cormorants observed in California are likely to feed on schooling prey located from the surface to near the bottom, but not on the bottom. Therefore, their potential for exposure is likely to be limited. Based on this information, an incidental sediment ingestion rate of 2% (a value commonly used for birds unlikely to ingest significant sediment; see U.S. EPA, 1993) was used. This would correspond to 0.0018 kg/day dry weight sediment ingestion.

IR_{prey}: Prey ingestion rate is affected by numerous factors including foraging effort, reproductive state of the bird, palatability, and the nutrient content of the prey species (Brugger, 1993). A variety of studies have estimated double-crested cormorant ingestion rates in the field (e.g., Schramm et al., 1984; Brugger, 1993). Hatch and Weseloh (1999) report a range of ingestion rates from 208 to 537 g/day wet weight with an average of about 320 g/day wet weight for adult birds. Brugger (1993) measured an average intake of 283 g/day wet weight when adult birds (approximately weighing 1.6 kg) were fed *ad libitum*. Brugger found that this was nearly identical to the modeled prediction derived from Nagy's (1987) allometric model for 1.5 kg seabirds. Thus, Brugger's empirical estimate of 283 g/day wet weight was selected. This can be converted into a dry weight IR_{prey} of 0.091 kg/day DW by assuming 68% water in pacific herring (U.S. EPA, 1993).

Foraging Range: Double-crested cormorant breeding at the Richmond-San Rafael Bridge foraged within 5 km of the bridge (Stenzel et al., 1995); however, there is no known rookery within 5 km of Alameda Point. No information on foraging range was found for birds that nest at the San Francisco-Oakland Bay Bridge. To develop a foraging range estimate, it was assumed that birds from the closest rookery will be visiting Alameda Point and that the foraging range should be based on the distance from the rookery to Alameda Point. The foraging distance covered by double-crested cormorant nesting at the San Francisco-Oakland Bay Bridge was calculated as the distance from the mid-point of the bridge (Yerba Buena Island) to the northwest corner of Seaplane Lagoon (foraging distance of approximately 3.3 miles or 5.3 km). Therefore, it was assumed that double-crested cormorant nesting at the San Francisco-Oakland Bay Bridge will forage 5.3 km in either direction. The total water surface area in the Bay within a circle of a radius of 5.3 km (89 km^2) was then estimated using Global Information System (GIS) and found to be 40% resulting in a foraging range of about 53 km^2.

SUF: For the screening-level assessment, it was assumed that the double-crested cormorant's foraging range equals the size of the site, resulting in a SUF of one.

Body Weight: Hatch and Weseloh (1999) state that regional differences in double-crested cormorants' body mass are large (range of 1 to 3 kg), and that the mean mass of southeastern birds are half that of northern and western birds. Double-crested cormorants are also sexually dimorphic with males being slightly heavier than females. Dunning (1993) lists a mean body weight (for both males and females) of approximately 1.67 kg. The mean body weight given by Dunning (1.67 kg) was chosen for the following reasons: (1) no San Francisco Bay specific studies were found, (2) the study used to develop the prey ingestion rate was based on a body weight of 1.6 kg, and (3) this is consistent with the body weight used at other Navy sites such as Mare Island.

6.3.2 Screening-Level Effects Assessment

For the purpose of the screening-level risk estimate, conservative toxicity values were chosen that represented protective concentrations. Toxicity values for direct contact and food chain exposure were developed as discussed in the following sections.

6.3.2.1 Benthic Invertebrate Direct Contact Benchmarks

The potential effects associated with direct contact to impacted sediment were evaluated via direct contact toxicity benchmarks. Receptors at the offshore sediment sites that are potentially exposed to COPECs via direct contact pathways include sediment-associated biota (invertebrates and fish). The screening-level benchmarks, which represent conservative (i.e., protective) concentrations below which it is unlikely that adverse ecological effects will occur, are presented as the "low" benchmarks in Table 6-3. The "high" benchmarks shown in Table 6-3 represent concentrations above which risk may be probable or further evaluation is needed. The "high" values provide additional context to the conservative screening "low" benchmarks.

Screening-level benchmarks for benthic invertebrates in marine sediments were selected in the following order of priority from the following references:

1. Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. *Env. Management*, 19:81-97.

2. Long, E.R., and L.G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration.

3. MacDonald, DD, BL Charlish, ML Haines, and K Brydges. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters: Volume 3-Supporting Documentation: Biological Effects Database for Sediment, Florida Department of Environmental Protection, Tallahassee, Fla. In: Jones, Suter, and Hull. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision*, Prepared for the U.S. Department of Energy.

4. U.S. EPA. 1989c. Evaluation of the Apparent Effects Threshold (AET) Approach for Assessing Sediment Quality, Report of the Sediment Criteria Subcommittee. Science Advisory Board. SAB-EETFC-89-027 *IN* NOAA, National Sediment Quality Survey, Appendix D, Screening Values for Chemicals Evaluated.

Long and Morgan, 1991; and Long et al., 1995

The NOAA ER-L values for estuarine and marine sediments were selected as screening-level benchmarks to evaluate potential risk to sediment-associated biota. NOAA collected sediment data from a variety of approaches and then ranked chemical concentrations associated with biological effects. ER-Ls represent the low end of the range (lower 10th percentile) of concentrations in marine sediments in which effects were observed or predicted, and are used by NOAA as the concentration below which effects would rarely be observed (Long et al., 1995; Long and Morgan, 1991).

MacDonald et al., 1994

The Florida Department of Environmental Protection (MacDonald et al., 1994) developed marine threshold effect levels (TELs) and probable effect levels (PELs) using the same updated and revised data set used by Long et al. (1995). However, the TELs and PELs also incorporate chemical concentrations observed or predicted to be associated with no adverse biological effects data (no effects data). Specifically, the TEL is the geometric mean of the 15th percentile in the effects data set and the 50th percentile in the no effects data set. As a result, the TEL represents the upper limit of the range of sediment contaminant concentrations dominated by no effects data. The TEL was used as the screening-level benchmark in cases where an ER-L was not available.

U.S. EPA Apparent Effect Thresholds (AETs)

AETs were used as benchmarks in situations where neither a NOAA ER-L nor a Florida Department of Environmental Protection (FDEP) TEL was available. The AET approach uses data from matched sediment chemistry and biological effects measures and reports sediment concentrations above which statistically significant biological effects always occur. This concentration is identified as a high no effect concentration (NEC). AETs are used for preliminary comparisons to give an indication of the magnitude of contamination, but are only used in cases where other benchmarks are not available.

6.3.2.2 Food Web Toxicity Reference Values

For the purpose of evaluating the potential effects associated with the doses calculated in the exposure assessment, chemical- and receptor-specific TRVs will be compared to the calculated doses. In general, a TRV is defined as a dose level at which a particular biological effect may occur in an organism, based on laboratory toxicological investigations.

The Navy, in consultation with the U.S. EPA Region 9 Biological Technical Assistance Group (BTAG), developed effects-based TRVs. Each of these values represents a critical exposure level from a toxicological study and is supported by a published data set of toxicological exposures and effects (DON, 1998). Rather than derive a single point estimate associated with specific adverse biological effects, high and low TRVs were derived for each receptor and COPEC to reflect the variability of parameters within an ecological risk context. The low TRV is a conservative value consistent with a chronic, no observed adverse effects level (NOAEL). The NOAEL represents a concentration that is not likely to be associated with adverse effects and is used to identify sites posing little or no risk. Conversely, the high TRV is a less conservative estimator of potential adverse effects, falling approximately mid-range of all of the reported adverse effects. The high TRV represents a level at which adverse effects are highly likely to occur, helping to identify sites posing immediate risks.

In some cases, the high and low TRV were derived using a NOAEL and lowest observed adverse effects level (LOAEL) from the same study; in other cases, independent NOAELs and LOAELs were selected as the low and high TRVs, respectively. For those COPECs that did not have a Navy/BTAG TRV, the U.S. EPA's Ecological Soil Screening Levels (Eco-SSLs) (U.S. EPA, 2005a) or the Oak Ridge National Laboratory (ORNL) toxicity benchmarks (Sample et al., 1996) were used to evaluate potential toxicity with priority given to the Ecological Soil Screening Levels.

Surrogate toxicity data were used for some related compounds where COPEC-specific TRVs were lacking. In this assessment, the low- and high-chlordane TRVs were used for evaluation of the following components of chlordane: *alpha*-chlordane, *gamma*-chlordane, *trans*-nonachlor, and *cis*-nonachlor. The BTAG avian low TRV for DDT and metabolites was used as a surrogate, and the high TRV for DDE was used for evaluation of 2,4′-DDE, 4,4′-DDE, for the sum of 2,4′- and 4,4′-DDE (Total DDEs) and for the sum of DDT and metabolites (all six 2,4′- and 4,4′-DDT, DDD, and DDE compounds). The low and high TRVs for DDT and metabolites were used for evaluation of 2,4′-DDD, 4,4′-DDD, Total DDDs (the sum of 2,4′- and 4,4′-DDD), 2,4′-DDT, 4,4′-DDT, and Total DDTs (the sum of 2,4′- and 4,4′-DDT). Avian TRVs for Total PCBs were derived from studies that exposed birds to Aroclor 1254 and Aroclor 1242. These TRVs were used to evaluate risk from Total PCB values that were calculated by summing individual PCB congener values.

In the screening-level risk estimate, only low TRVs were used. Table 6-4 summarizes the TRVs used in the ecological risk assessment and identifies the sources.

TRVs were scaled to account for differences in body weights between the organism used to establish the TRVs (high and low) and the ecological receptor chosen for evaluation. This was accomplished by using the following equation (Sample and Arenal, 1999):

$$TRV_w = TRV_l * (BW_s/BW_r)^{1-1.2} \quad (6\text{-}4)$$

where: TRV_w = weight-adjusted TRV (mg/kg-day)
TRV_l = literature-based TRV (mg/kg-day)
BW_s = body weight of toxicity study receptor (kg)
BW_r = body weight of ecological receptor (kg).

Weight-adjusted TRVs for each ROC (surf scoter, least tern, and double-crested cormorant) are presented in Appendix E.

6.3.3 Screening-Level Risk Estimate

In the screening-level risk estimate, the exposure and effects assessments are combined to provide a quantitative estimate of the potential risks to the receptor. As described in Sections 6.3.1.1 and 6.3.1.2, estimated exposure will be calculated for each COPEC using the maximum site sediment concentrations for the direct contact exposure route and the maximum site sediment concentrations and tissue concentrations for the food-chain exposure and compared to the low toxicity benchmarks (according to the following equations:

$$HQ_{direct\ contact} = EPC_{sed}/Benchmark_{direct\ contact} \quad (6\text{-}5)$$

$$HQ_{food\ chain} = dose/TRV \quad (6\text{-}6)$$

As noted previously, conservative exposure parameters and toxicity values will be used to calculate doses for the screening-level risk estimate. When the dose is lower than the low TRV (i.e., $HQ_{low} < 1$), it is likely that the specific COPEC presents acceptable risk. When the dose exceeds the low TRV (i.e., $HQ_{low} \geq 1$) in a screening-level ecological risk assessment, it does not necessarily indicate that there is potential risk; rather, it indicates that further evaluation is warranted in the baseline ecological risk assessment.

6.3.3.1 Direct Contact Screening-Level Risk Estimate

Screening-level risk estimates were developed for direct contact pathways for both IR Sites 20 and 24. The results of this screen are described in detail below.

Direct Contact Screening-Level Risk Estimate for IR Site 20

Table 6-5 summarizes the direct contact screening-level risk estimates for IR Site 20. As described previously, three sediment data sets were evaluated: All Years, 2005 Surface, and 2005 Subsurface. All detected compounds in sediment were screened; direct contact toxicity benchmarks exist for about half of the detected compounds. In all cases (All Years, 2005 Surface, and 2005 Subsurface), the majority of the constituents did not pass the conservative screen against the low toxicity value. The highest magnitude, low benchmark HQs were from the All Years data set. The lowest magnitude, low benchmark HQs were from the 2005 Surface data set. In general, the 2005 Subsurface data set yielded higher magnitude, low benchmark HQs than the 2005 Surface data set, indicating that surface sediments pose less of a potential risk to direct contact receptors than the deeper sediments.

Direct Contact Screening-Level Risk Estimate for IR Site 24

Table 6-6 summarizes the direct contact screening-level risk estimates for IR Site 24. As with IR Site 20, all detected compounds in sediment were screened; direct contact toxicity benchmarks exist for about half of the detected compounds. Additionally, in all cases (All Years, 2005 or 2005/2006 Surface, and 2005 or 2005/2006 Subsurface), the majority of the constituents did not pass the conservative screen against the low toxicity value. The highest magnitude, low benchmark HQs for inorganic constituents were from the 2005/2006 Subsurface data set, while the highest magnitude, low benchmark HQs for organic constituents were from the All Years data set.

Summary of Direct Contact Screening-Level Risk Estimate

At both IR Site 20 and 24, a majority of the compounds for all three data sets (All Years, 2005 or 2005/2006 Surface, and 2005 or 2005/2006 Subsurface) with direct contact benchmarks failed the screen. Additionally, there were numerous analytes that were detected in sediment but had no benchmarks for comparison. These results indicate that the benthic invertebrate and fish AEs [AE(1) and AE(2)] should be evaluated further in the BERA.

6.3.3.2 *Food Chain Screening-Level Risk Estimate*

A screening-level risk estimate for indirect exposure through the food chain was developed by comparing the modeled dose based on maximum sediment exposure to the low TRV. Three receptors were evaluated (the scoter, double-crested cormorant, and the California least tern) for all three data sets (All Years, 2005 or 2005/2006 Surface, and 2005 or 2005/2006 Subsurface) at both IR Sites. The results of the screen are described in the following subsections.

Food Chain Screening-Level Risk Estimate for IR Site 20

A summary of the HQ results for IR Site 20 can be found in Table 6-7. Supporting tables that contain the full set of HQ calculations can be found in Appendix E. The surf scoter was generally the least sensitive avian receptor evaluated and the California least tern was the most sensitive receptor evaluated. The only constituent that failed the screen for the surf scoter in all three data sets was lead. For the least tern, eight constituents failed the screen for the All Years data set, five for the 2005 Surface data set, and six for the 2005 Subsurface data set. For the double-crested cormorant, four constituents failed in the All Years data set, two in the 2005 Surface, and three in the 2005 Subsurface.

As with the direct contact screen, the All Years sediment data set resulted in the highest magnitude HQs. In general, most HQ exceedances were less than 50. The highest magnitude screening-level HQ was for the least tern exposed to Total DDx in the sediment from the All Years data set (HQ_{low} = 107). Total DDx concentrations in the 2005 Surface data set resulted in significantly lower magnitude HQ exceedances for Total DDx (HQ_{low} = 3) than the other data sets.

Seven of the detected constituents in sediment that had TRVs passed the screen in all three data sets. Eight of the detected constituents did not have TRVs and while they can not be evaluated quantitatively, they will be carried forward into the BERA and discussed in Section 8.0. Eight of the detected constituents had low TRV HQs greater than one for at least one receptor and sediment data set and will be carried forward into the BERA. These compounds include chromium, copper, lead, mercury, selenium, zinc, Total PCB, and Total DDx.

Food Chain Screening-Level Risk Estimate for IR Site 24

A summary of the HQ results for IR Site 24 can be found in Table 6-8. Supporting tables that contain the full set of HQ calculations can be found in Appendix E. The double-crested cormorant was the least sensitive avian receptor evaluated and the California least tern was the most sensitive receptor evaluated. Cadmium, lead, Total PCB, and Total DDx failed the screen for the double-crested cormorant in all three data sets. For both the surf scoter and the least tern, nine constituents failed the screen for the All Years data set. For the surf scoter, nine constituents failed the screen for the 2005/2006 Surface data set and eight failed for the 2005/2006 Subsurface data set. Eight constituents failed the screen for the 2005/2006 Surface data set for the least tern, and nine failed for the 2005/2006 Subsurface data set.

In general, the 2005/2006 Subsurface sediment data set resulted in the highest magnitude HQs. The majority of the low TRV HQs were less than 50; however, there were some higher magnitude exceedances. The highest magnitude screening-level HQs were for lead, with the highest HQ from the 2005/2006 Subsurface data set for the surf scoter (HQlow = 599). Low TRV HQs for organic compounds were generally less than 50.

Six of the detected constituents in sediment that had TRVs passed the screen in all data sets for all receptors. Eleven of the detected constituents did not have TRVs and while they can not be evaluated quantitatively, they will be carried forward into the BERA and discussed in Section 8: Uncertainty. Eleven of the detected constituents had low TRV HQs greater than one for at least one receptor and sediment data set and will be carried forward into the BERA. These compounds include cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, tributyltin, Total PCB, and Total DDx.

6.3.3.3 Summary of Screening-Level Risk Estimate

Based on the direct contact toxicity screen, at both IR Site 20 and 24, a majority of the compounds for all three data sets (All Years, 2005 or 2005/2006 Surface, and 2005 or 2005/2006 Subsurface) with direct contact benchmarks failed the screen. Additionally, there were numerous analytes that were detected in sediment and had no benchmarks for comparison. These results indicate that the benthic invertebrate and fish AEs [AE(1) and AE(2)] should be evaluated further in the BERA.

The food-chain screening-level risk estimate also indicated that a number of constituents at both IR Sites 20 and 24 should be evaluated further in the BERA because they either (1) did not have TRVs and could not be evaluated quantitatively, or (2) had low TRV HQs that exceeded one for at least one avian receptor and sediment data set.

6.4 Baseline Ecological Risk Assessment

In the screening-level risk estimate, potentially complete and significant exposure pathways were defined from sediment to benthic invertebrates, fish, and birds foraging at the offshore sediment sites. The results of the screen indicated that all three AEs should be evaluated further in the BERA.

In the BERA, the preliminary problem formulation was refined (Step 3A, Figure 6-1). Then measurements of exposure and effects were refined and integrated into a characterization of risk that included a comprehensive discussion of the potential uncertainties associated with the assessment. The following sections present the results of these evaluations. After defining the refined problem formulation, the BERA is organized by AE.

6.4.1 Refined Problem Formulation

The first step of the BERA was to refine the preliminary problem formulation and CSM developed in Section 3.0. The CSMs (Figures 6-3 and 6-4) were re-evaluated in light of the outcome of the screening-level evaluation and were found to require no additional revisions. The AEs and their associated ROCs selected in the SLERA also were found to be applicable and relevant to the BERA. The only issues that required further refinement in the BERA were (1) the selection of specific measurement endpoints for the baseline assessment, and (2) a Tier 2 COPEC screen.

6.4.1.1 Selection of BERA Measurement Endpoints

While the SLERA conducted generic screens to identify what AEs might require further evaluation in the BERA, more specific MEs are required in the BERA to evaluate potential impacts to selected assessment endpoints. MEs are defined as a "measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint" and are a measure of biological effects (e.g., mortality, reproduction, growth) (U.S. EPA, 1997a). The AEs and their associated MEs selected for the BERA are summarized below.

AE(1): Sufficient rates of survival, growth, and reproduction to sustain the benthic invertebrate community in offshore areas.

- ME(1): Toxicity to benthic invertebrates in acute and chronic sediment bioassays.

AE(2): Sufficient rates of survival, growth, and reproduction to sustain benthic feeding and piscivorous fish communities in offshore areas.

- ME(1): Model forage fish tissue concentrations and compare to literature-based effects thresholds.

AE(3): Sufficient rates of survival, growth, and reproduction to sustain the avian community in the area. This assessment endpoint also includes the protection at the level of the individual for special-status species as appropriate.[2]

- ME(1): Estimate site-specific doses (based on measured or modeled *M. nasuta* body burdens) to benthic-invertebrate eating birds (such as the scoter) and compare to TRVs.

- ME(2): Estimate site-specific doses (based on modeled fish tissue body burdens) to the least tern and compare to TRVs.

- ME(3): Estimate site-specific doses (based on modeled fish tissue body burdens) to piscivorous birds (such as the double-crested cormorant) and compare to TRVs.

6.4.1.2 Tier 2 COPEC Selection

In the BERA, a COPEC screen was conducted to help focus the list of COPECs requiring additional evaluation by comparing site constituent sediment concentrations with ambient background concentrations to identify those constituents that are above ambient concentrations, and whose presence in offshore sediments could be attributed to Navy operations. To identify those constituents that were within the range of ambient concentrations, or were elevated as compared to ambient, statistical tests were conducted. Distribution shift tests (e.g., the t-test, Gehan test, quantile test, and slippage test) were performed to compare the concentration distributions from the site with ambient background data sets, following Navy guidance (DON, 2001). If one or more tests failed, then that chemical was retained for full evaluation in the BERA. For constituents where all tests passed, the chemical concentrations were found to be consistent with ambient background conditions and no further evaluation in the BERA was necessary. However, to provide a comprehensive evaluation of potential risk, calculations for all chemicals (within or above background) are presented and discussed in the risk characterization step.

Appendix C provides a detailed description of the statistical tests that were conducted on the data. Summary tables of the statistical comparisons to ambient can be found in Section 4 (Tables 4-5 and 4-6 for IR Site 20 and Tables 4-11 and 4-12 for IR Site 24). The ambient comparison was done separately for the All Years data set and the 2005 Surface (for IR Site 20) and 2005/2006 Surface (for IR Site 24) data sets. Because there are no ambient data sets for deeper sediments (greater than 5 cm deep), the 2005 Subsurface data set could not be statistically evaluated. Therefore, for the purposes of the ecological risk assessment, the output of the 2005 and 2005/2006 Surface background comparisons was applied to the 2005 and 2005/2006 Subsurface data sets as a surrogate. Additionally, any constituent that had

[2] This assessment endpoint was modified from those described in the Final Offshore Sediment Study Work Plan (Battelle et al., 2005a) by combining both the non-special and special-status avian species into one assessment endpoint.

insufficient data to conduct a statistical background comparison was conservatively included in the Tier 2 COPEC list.

At both IR Site 20 and 24 (Tables 4-5, 4-6, 4-11 and 4-12), the majority of the inorganic constituents were greater than ambient concentrations. A few more of the inorganic constituents were greater than ambient concentrations in the All Years data set than the 2005 and 2005/2006 Surface data sets. Most of the pesticides were not evaluated statistically due to the high frequency of non-detects; therefore, they were conservatively carried forward as Tier 2 COPECs.

6.4.2 Assessment of AE(1): Benthic Invertebrate Community

In the SLERA, maximum sediment concentrations were compared to direct contact toxicity benchmarks and a number of compounds exceeded the low benchmarks, indicating the need for further evaluation. In the BERA, the benthic invertebrate community assessment endpoint was evaluated further through sediment toxicity bioassay results. The assessment of AE(1) for each IR site is provided in the following sections.

6.4.2.1 IR Site 20

At IR Site 20, a number of constituents failed the direct contact screen. Because the direct contact screen uses non-site specific, conservative, screening values to screen compounds, an exceedance of the low direct contact toxicity benchmark does not necessarily indicate that sediments are toxic to benthic invertebrates. Therefore, historical bioassays conducted in IR Site 20 were used to further evaluate this endpoint.

6.4.2.1.1 Exposure and Effects Assessment

Toxicity tests were performed on sediment collected at four stations (EO7, EO8, EO9, and EO10) from IR Site 20 in 1993/1994. Bulk sediment chemistry data for IR Site 20 bioassay locations are presented in Appendix A, Table A-1. Sediment composites were obtained from the upper 5 cm of van Veen grab samples, and the following acute and chronic toxicity tests were performed:

- 10-day bulk sediment toxicity tests with the amphipod, *Eohaustorius estuarius*;
- 20-day bulk sediment toxicity (survival and growth) tests with 14- to 21-day-old polychaetes, *Neanthes arenaceodentata*; and,
- 48-hour suspended particulate phase embryo development tests using sediment elutriates and the mussel, *Mytilus edulis*.

These three bioassays were used as MEs to assess effects to the benthic invertebrate community. Amphipods and polychaetes are important members of the benthic ecosystem. The amphipod and polychaete bioassays measure a response to direct sediment exposure and are highly relevant to assessing the risk to the overall benthic and benthic-supported community. The larval development bioassay provides a sensitive endpoint associated with a water-column species; the sediment-water interface exposure is particularly important for linking this response to sediment exposure.

The three bioassays have a large body of San Francisco Bay data associated with them. The State Water Resources Control Board (SWRCB) has developed "reference envelope" thresholds for the amphipod survival and larval development endpoints and has published minimum significant difference (MSD) values for the polychaete survival and growth endpoints (Table 6-9) (SWRCB, 1998a and 1998b). The

MSD is the percentage of control response at which a significant difference from control was observed 90% of the time. A sample would be considered toxic if its result was lower than the MSD *and* significantly lower than its concurrently tested control (Student t-test, $\alpha = 0.05$). These thresholds allow identification of sites or stations that are more toxic than most San Francisco Bay reference sites. Comparison of toxicity test results relative to SWRCB threshold levels is the basis for the toxicity assessment conclusions for IR Site 20.

Bioassay tests followed standard procedures recommended for amphipod (Puget Sound Estuary Program [PSEP], 1989 and 1995), polychaete (Johns and Ginn, 1990), and mussel larvae (PSEP, 1989 and 1995) tests. Inchcape Testing Services (Aquatec Biological Sciences) performed the laboratory tests. Test organisms were supplied by the following organizations: Northwest Aquatics, Yaquina Bay, Oregon (OR) (amphipods); Dr. Donald J. Reish, California State University at Long Beach (juvenile polychaetes); and Sea Farms West, Carlsbad, CA (adult mussels). Sediment collected at IR Site 20 was tested during four separate solid-phase testing events, with concurrently tested control sediments for each testing event. Data on bulk porewater salinity and grain size of sediment for IR Site 20 samples are presented in Table 6-10.

Amphipod Test Results

Adequate control survival and response to the reference toxicant validated the *Eohaustorius estuarius* 10-day sediment test events. Mean survival of test organisms at IR Site 20 stations ranged from 57 to 73% (Table 6-11). Four stations (E07, E08, E09, and E10) were reported to have statistically significant reductions in survival relative to concurrently tested controls. Two IR Site 20 stations (E07 and E10) had survival levels less than the reference envelope tolerance limits established by the State Water Resources Control Board (SWRCB, 1998a) of 69.5% of control survival.

Polychaete Tests

The 20-day bulk sediment toxicity (survival and growth) tests using 14-21 day old polychaetes, *Neanthes arenaceodentata,* demonstrated appropriate control survival and response to the reference toxicant. Mean survival of test organisms at IR Site 20 was 96 to 100% (Table 6-12). Unlike tests performed for other locations at Alameda Point, these tests used five test organisms per replicate with five replicates per treatment.

Polychaete growth was reported to be statistically significantly lower than the concurrently tested control at two stations, E07 and E08 (Table 6-13). Growth was never lower than the MSD of 44% of the highest control growth (MSD = 44% of 21.4 mg/worm = 9.42 mg/worm). Therefore, the observed statistically significant decreases in growth are not considered to be biologically significant.

Mussel Larval Tests

Mussel larval tests were conducted at just two stations, E07 and E08. Control survival in the 48-hour mussel (*Mytilus edulis*) embryo development test of sediment elutriates was 84.2%. In the percent normal developmental control, 98.6% of larvae were normally developed. The reference toxicant median effective concentrations (EC_{50} values) for these tests were 7.8 to 10.9 µg/L of copper sulfate, all within the laboratory's reported control chart limits of approximately 3 to 12 µg/L. *M. edulis* larval survival exposed to sediment elutriates from two stations (E07, E08) was 95.7% and >100%, with >90% normal development in all treatments (Table 6-14). No treatments were identified as having significantly different normal development from the concurrently tested control. The combined endpoint of normal development of stocked larvae to the D-cell stage was greater than 94% in all test containers and, when normalized to control normal development, the lowest combined survival/normality endpoint was greater than 114%. None of the IR Site 20 treatments fell below the SWRCB reference envelope tolerance limit of 60% of control larval development. Though the SWRCB limit was developed using an echinoderm species and different exposure, the *M. edulis* results do not indicate biologically significant effects as a result of exposure to IR Site 20 sediment elutriates.

6.4.2.1.2 Risk Characterization

The three toxicity tests (with five different endpoints) conducted on sediments from IR Site 20 (i.e., amphipod, polychaetes, and mussel larval) were all validated by acceptable control survival rates. There is no evidence that confounding factors influenced the outcomes of these tests. The variability associated with the polychaete growth data does not influence the utility of the data or the acceptability of the test. Toxicity data for the two easternmost IR Site 20 stations (E09 and E10) were limited to two of the three toxicity tests; the mussel larval tests were not available for these stations which limits the conclusions that can be drawn about the eastern portion of the channel from the available toxicity data. Although the broader comparability of the mussel larvae data is limited by the use of a different method and species than those used to establish SWRCB tolerance levels, the available data are still useful in characterizing IR Site 20 sediments; they represent a sensitive endpoint that did not demonstrate any adverse effect. Based on the historical toxicity tests for IR Site 20 (conducted in sediment from 1993/1994), sediment was generally not significantly toxic to the test species evaluated. Only two samples (from Stations E07 and E10) had statistically significant differences from the control and exceeded SWRCB reference envelope tolerance limits for one of the five endpoints (Table 6-15). It is believed that the 1993/1994 bioassay results are a conservative estimator of potential toxicity because the 1993/1994 study design was focused on characterizing potential sources, and these bioassay samples were biased toward the higher end of the sediment concentration range (as can be seen by the box plots of the sediment data in Appendix A). The 2005 sample design was meant to be more representative of the general sediment condition throughout the IR site, and for most contaminants, this data set has lower concentrations than the earlier data set. In the 2005 Surface data set, only one constituent (mercury) exceeded the benthic high direct contact toxicity benchmark (ER-M) and ambient concentrations, and that exceedance was only at one station (OIH C-2). The rest of the stations had no exceedances of ER-Ms and ambient concentrations, reinforcing the conclusion that the slight sediment toxicity seen in 1993 is unlikely to be present under current conditions.

6.4.2.2 IR Site 24

At IR Site 24, a number of constituents failed the direct contact screen. Because the direct contact screen uses non-site specific, conservative, screening values to screen compounds, an exceedance of the low direct contact toxicity benchmark does not necessarily indicate that sediments are toxic to benthic invertebrates. Therefore, historical bioassays conducted in IR Site 24 were used to further evaluate this endpoint.

6.4.2.2.1 Exposure and Effects Assessment

Toxicity tests were conducted on five sediment stations at IR Site 24 in 1998 (PA-1, PA-2, PA-3, PA-4, PA-5) and three reference samples (RL-1, RL-2, RL-3). Bulk sediment chemistry data for IR Site 24 bioassay locations are presented in Appendix A, Table A-2. The following tests were performed:

- 10-day bulk sediment toxicity tests with the amphipod, *Eohaustorius estuarius*;
- 28-day bulk sediment toxicity tests with the polychaete, *Neanthes arenaceodentata*; and,
- 72-hr sea urchin (*Strongylocentrotus purpuratus*) embryo development tests at the sediment: water interface (SWI).

Based on this evaluation, it is concluded that there may have been inconsistencies in the overall conduct of the tests, non-random placement of test organisms in exposure containers, or some other laboratory deviation that contributed to the high variation observed in this data. Thus, given the unusual responses observed and the uncertainties associated with the conduct of the tests, it is difficult to confidently interpret the results of the toxicological data associated with IR Site 24.

Although it is difficult to interpret the 1998 sediment bioassays, other lines of evidence support the conclusion that current conditions are unlikely to result in toxicity to benthic organisms over the majority of the area of IR Site 24. Surface sediment from 2005 and 2006 is the best estimate of current conditions to which invertebrates are exposed. As seen in the bubble plots and box plots of the surface sediment (Appendix A) the highest concentrations of COPECs are generally restricted to the northeast corner of the site and the sediment shelf that extends eastward past the quay wall beneath the roadway in the vicinity of outfalls J and K. Current surface sediment concentrations of COPECs in the rest of IR Site 24 are typically lower, reinforcing the conclusion that the sediment toxicity seen in 1998 is unlikely to be present under current conditions over the majority of the site. It is unknown whether the sediments in the shelf that extends eastward past the quay wall pose an unacceptable risk to benthic invertebrates.

6.4.3 Assessment of AE(2): Fish Community

In the SLERA, maximum sediment concentrations were compared to direct contact toxicity benchmarks and a number of compounds exceeded the low benchmarks, indicating the need for further evaluation. In the BERA, the fish community assessment endpoint was evaluated further by comparing modeled fish tissue concentrations to protective tissue benchmarks. Results of this comparison are discussed in the following sections.

6.4.3.1 IR Site 20

The exposure and effects assessment and the risk characterization for the fish community AEs are provided below for IR Site 20.

6.4.3.1.1 Exposure and Effects Assessment

Forage fish tissue concentrations at IR Site 20 were modeled from 95% UCL sediment concentrations developed for each of the three data sets at IR Site 20 from BAFs that were developed from whole-body fish tissue and sediment concentrations from Seaplane Lagoon, as described in Section 5.6. Forage fish BAFs were developed from species collected from Seaplane Lagoon including Pacific staghorn sculpin, yellowfin goby, chameleon goby, English sole, speckled sanddab, starry flounder, plainfin midshipman, white croaker, and several varieties of surfperch. These species are considered conservative estimators of exposure to the fish community because they have a high affinity with sediment and small home ranges. The concentrations of constituents detected in the forage fish were assumed to be dependent on site-specific bioavailability from Seaplane Lagoon sediments and to represent uptake under equilibrium conditions. BAFs developed from these data are considered a relevant way to estimate fish tissue concentrations using sediment data gathered from other areas offshore of Alameda Point. Table 5-10 summarizes the 95% UCL sediment concentrations, BAFs, and modeled fish tissue concentrations for constituents detected at IR Site 20 in the All Years sediment data set, the 2005 Surface Data set, and the 2005 Subsurface data set.

To evaluate effects, ecotoxicity reference values (ERVs) based on effects-based critical body residues (i.e., critical tissue values [CTV]) developed for the U.S. Navy for the BERA at Pearl Harbor were used (DON, 2002). Although the fish ERVs are draft values currently under review by U.S. EPA Region 9 and the Navy, they are not expected to change significantly (Yoshioka, 2005). However, updates may be incorporated as the Pearl Harbor ERVs are finalized. It is assumed that the ERVs, although developed for comparison to Pearl Harbor's tropical species, can be considered as surrogates for general bottom fish in the BERA for Alameda Point. This is a reasonable assumption because the ERVs are based on a review of available studies from commonly recognized databases such as the Environmental Residue and Effects Database (ERED) (USACE/U.S. EPA, 2003) or U.S. EPA's ECOTOX (Jarvinen and Ankley, 1999) and included species in temperate as well as tropical systems.

Both bounded NOAEL and LOAEL ERVs were developed and are summarized in Table 6-21. Modeled tissue concentrations below the bounded NOAEL ERV were considered acceptable. Modeled tissue concentrations above the LOAEL ERVs were of concern because they indicated the potential for adverse effects to the fish community. ERVs were not available for nickel, aldrin, or dibenzofuran. A bounded NOAEL ERV was available for silver, but a LOAEL was not.

6.4.3.1.2 Risk Characterization

The modeled 95% UCL concentrations of constituents in fish tissue from IR Site 20 were compared to the fish ERV values, and HQs were developed. These results are presented in Table 6-22. None of the modeled fish tissue concentrations exceeded the NOAEL or LOAEL ERV for any constituent. PAHs were conservatively evaluated by comparing summed high (HPAH), low (LPAH), and Total PAHs to the most conservative benchmark for an individual compound within each sum (e.g., the benchmark for benzo(a)pyrene compared to Total PAH concentration). Based on these results, it is concluded that unacceptable risk is not posed to the fish community at IR Site 20.

6.4.3.2 IR Site 24

The exposure and effects assessment and the risk characterization for the fish community AEs are provided below for IR Site 24.

6.4.3.2.1 Exposure and Effects Assessment

The exposure and effects assessment for IR Site 24 was conducted as described for IR Site 20. The 95% UCL sediment concentrations for the All Years, 2005/2006 Surface, and 2005/2006 Subsurface sediment data sets used to model fish tissue concentrations are summarized in Table 5-11, and the ERVs are listed in Table 6-21.

6.4.3.2.2 Risk Characterization

The modeled 95% UCL concentrations of constituents in fish tissue from IR Site 24 were compared to the fish ERV values, and HQs were developed. These results are presented in Table 6-23. To summarize:

- Fish tissue concentrations modeled using the 95% UCL sediment concentrations from the All Years sediment data set did not exceed the LOAEL or NOAEL ERV for any constituent.

- Fish tissue concentrations modeled using the 95% UCL sediment concentrations from the 2005/2006 Surface data set also did not exceed the LOAEL or NOAEL ERV for any constituent.

- Fish tissue concentrations modeled using the 95% UCL sediment concentrations from the 2005/2006 Subsurface data set exceeded the NOAEL ERV for cadmium and silver, and both

HQs were less than three. Fish tissue concentrations only exceeded the LOAEL ERV for cadmium, and the HQ was less than two. There is no LOAEL ERV for silver.

The only COPECs that were identified as potentially posing a threat to the fish community at IR Site 24 were cadmium and silver; however, elevated concentrations of these COPECs are restricted to the deeper sediments in the shelf that extends eastward past the quay wall beneath the roadway in the vicinity of outfalls J and K. Outside of this small area, concentrations of cadmium and silver are much lower (Appendix A). Based on this evaluation it was concluded that, in general, sediment concentrations at IR Site 24 do not pose an unacceptable risk to the fish community over the majority of the site, and any indications of potential adverse effects to fish under current conditions are associated with the deeper sediments in a small restricted area in the northeast corner of the site and the sediment shelf that extends eastward past the quay wall.

6.4.4 Assessment of AE(3): Avian Community

In the screening-level risk estimate, a number of constituents were above the low TRV requiring further evaluation for the surf scoter, least tern, and the double-crested cormorant. In the BERA, the exposure and effects assessment was further refined and risk characterized for the three receptors at IR Sites 20 and 24. The baseline evaluation for the avian community AE is discussed in more detail in the following sections.

6.4.4.1 IR Site 20

The screening-level risk estimate at IR Site 20 identified that eight of the detected constituents had low TRV HQs greater than one for at least one receptor and sediment data set. These compounds include chromium, copper, lead, mercury, selenium, zinc, Total PCB, and Total DDx. Additionally, eight of the detected constituents did not have TRVs and, while they can not be evaluated quantitatively, they were carried forward into the BERA.

6.4.4.1.1 Exposure and Effects Assessment

As in the SLERA, exposure to the three avian receptors was conducted using a dose model. Refinements were made to the conservative screening model conducted in the SLERA to better estimate the potential for adverse effects based on site-specific information rather than conservative defaults. The specific refinements conducted are discussed in more detail below.

Exposure Point Concentrations

EPCs in the BERA were refined using an estimate of the central tendency of the sediment and tissue concentrations for each offshore area. The central tendency was estimated as the 95% UCL of the mean. The BERA EPC chosen was either the 95% UCL or the maximum sediment or tissue concentration (*M. nasuta*), whichever was lower (in accordance with U.S. EPA, 2002). A detailed description of the development of 95% UCLs can be found in Section 5.0. At IR Site 20, sediment and *M. nasuta* EPCs are summarized in Tables 5-3 and 5-5, respectively.

In the SLERA, all dose calculations were conducted using a SUF of 1.0, assuming that a receptor feeds within each offshore area 100% of the time. It is unlikely that any of the identified bird species forage 100% of their time at each area given the diverse environmental setting of the Bay Area. Therefore, estimates were made to characterize avian exposure in each area based on their known or expected foraging range in San Francisco Bay as follows.

Surf Scoter

As discussed in Section 6.3.1.3, data are not available to define the foraging area for the scoter in San Francisco Bay. Data from a two-year study of wintering birds in the Commencement Bay area of Puget Sound estimated the foraging range of the scoter at about 7 km^2 (Mahaffy et al., 1995). For the BERA, the area of IR Site 20 was divided into the foraging area of the scoter to develop a SUF. IR Site 20 is about 25.98 acres or 0.105 km^2. Thus, the SUF is 0.105 km2/7 km2 or 0.015 (or 1.5%) as defined spatially.

Least Tern

Based on an average of over 10 years of study at Alameda Point (see Table 6-2), least terns are seen foraging at IR Site 20 approximately 1.19% of the time. Thus, an SUF of 0.012 was used.

Double-Crested Cormorant

As described in Section 6.3.1.3, studies conducted in San Francisco Bay were used to estimate a foraging range for the double-crested cormorant of 53 km^2, or about 13,132 acres. The area of IR Site 20 is 25.98 acres or 0.105 km^2. The SUF for the double-crested cormorant foraging at IR Site 20 is estimated to be 0.002 or 0.2%.

Estimated foraging ranges and SUFs for IR Site 20 are summarized in Table 6-1. The SUF estimates for IR Site 20 suggest that the ROCs are likely to be using the IR site for only a small fraction of their dietary needs. However, because of the uncertainty inherent in these estimates, a range of SUFs was evaluated. The SUF was reduced incrementally: 1, 0.5, 0.25, and the estimated SUF for the ROC based on the literature or site-specific studies. To calculate a comprehensive evaluation of risk, as the SUF was reduced, the remaining (i.e., non-IR site) exposure was assumed to be at reference concentrations. This scenario assumes that each ROC's entire exposure occurs within San Francisco Bay, and does not account for seasonal migration. For comparison, an SUF of 0 (100% reference exposure) also is presented. To represent reference exposure, the following data sets were used to develop reference exposure point concentrations for sediment, invertebrate, and forage fish tissue.

Sediment

To characterize exposure to ambient background concentrations of San Francisco Bay sediment, reference station sediment data collected from five 1998 reference sites (Alameda Point field sampling effort [TtEMI, 1998]), and from five 2001 reference sites used in the Hunters Point Shipyards Parcel F validation study (Battelle et al., 2005b) were used. These 10 reference sites are as follows:

1998 stations:

- RL01–North South Bay (BPTCP station number 20013)
- RL02–Alameda (RMP station number BB70)
- RL03–Oakland Entrance (offshore from Western Bayside [Chapman et al., 1987])
- RL04–Yerba Buena (RMP station number BC11)
- RL05–Paradise Cove (BPTCP station number 20005).

2001 stations:

- AB-Alameda Buoy (same general location as RL02)
- PC-Paradise Cove (same general location as RL05)
- AE-Alcatraz Environs
- BF-Bay Farms
- RR-Red Rocks.

Invertebrate Tissue

Tissue concentrations from *M. nasuta* exposed in the laboratory for 28 days to sediment from ten reference station locations in San Francisco Bay were used to characterize ambient concentrations of invertebrate prey. Five of the reference bioaccumulation assays were conducted in 1998 as part of the Seaplane Lagoon field sampling effort (TtEMI, 1998) and the remaining five stations were collected as part of the Hunters Point Shipyards validation study (Battelle et al., 2005b). The 1998 bioaccumulation results are based on a single tissue sample exposed to sediment from that station. This resulted in five *M. nasuta* ambient samples from 1998. In 2001, five replicate test chambers containing *M. nasuta* were exposed to sediments from five stations, which resulted in 25 reference site tissue results. Between the two studies there are 30 ambient *M. nasuta* samples.

Forage Fish

While reference forage fish tissue were collected at two reference locations in support of the Seaplane Lagoon RI (Battelle et al., 2004b), reference fish tissue concentrations used in the dose equation were modeled to be consistent with the site estimates. Forage fish tissue concentrations were modeled similarly to site data by multiplying the fish BAF by the reference sediment EPC for each constituent. The refined dose was calculated using the following equation:

$$\text{Dose} = \frac{\{[(C_{sed\text{-}site} * IR_{sed}) + (C_{prey\text{-}site} * IR_{prey})] \times SUF_{site}\} + \{[(C_{sed\text{-}ref} * IR_{sed}) + (C_{prey\text{-}ref} * IR_{prey})] * SUF_{ref}\}}{BW} \quad (6\text{-}7)$$

where $C_{sed\text{-}site}$ = COPEC-specific EPC[3] in surface sediments (milligrams COPEC per kilograms sediment) for the site.

$C_{sed\text{-}ref}$ = COPEC-specific EPC in surface sediments (milligrams COPEC per kilograms sediment) for all reference values.

$C_{prey\text{-}site}$ = COPEC-specific EPC in prey tissue (milligrams COPEC per kilograms tissue) for the site.

$C_{prey\text{-}ref}$ = COPEC-specific EPC in prey tissue (milligrams COPEC per kilograms tissue) for all reference values.

SUF_{site} = site use factor (unitless) for the site.

SUF_{ref} = 1 - site use factor for the site.

Toxicological effects to the ROCs were assessed using the same weight-adjusted avian TRVs developed for the SLERA (see Appendix E). In the BERA, both comparisons to low and high TRVS were conducted.

6.4.4.1.2 Risk Characterization

Potential risk to the avian assessment endpoint at IR Site 20 will be discussed by receptor.

Surf Scoter

A summary of the HQs calculated for the surf scoter based on a range of SUFs and the refined EPCs for the All Years, 2005 Surface, and 2005 Subsurface data sets are presented in Tables 6-24 through 6-26.

[3] The EPC is the lesser of the 95% UCL on the mean or the maximum detected concentration in each media.

Supporting tables can be found in Appendix E. At 100% site use, only lead had a HQ that exceeded one and was greater than ambient concentrations when compared to the low TRV for all three data sets. At 100% site use, Total DDx had a HQ that exceeded one and ambient concentrations in the All Years and in the 2005 Subsurface data sets. Additionally, the All Years data set had a HQ for chromium that exceeded one and ambient concentrations. At a SUF of 0.015, only lead had a low HQ that exceeded one and was greater than ambient concentrations. No HQs based on the high TRV exceeded one.

Least Tern

A summary of the HQs calculated for the least tern based on a range of SUFs and the refined EPCs for the All Years, 2005 Surface, and 2005 Subsurface data sets are presented in Tables 6-27 through 6-29. Supporting tables can be found in Appendix E. For the least tern at 100% site use, the HQ exceedances of the low TRV and of ambient concentrations were similar among the three data sets: lead, mercury, Total PCBs, and DDx. The All Years and the 2005 Subsurface data sets tended to have the highest magnitude low TRV exceedances. However, the low TRV HQ exceedance for mercury was greatest in the 2005 Surface data set. Mercury also was the only COPEC that had a high TRV HQ that exceeded one (in all three data sets).

At a SUF of 0.012, two constituents were greater than ambient concentrations and had low TRV HQs that exceeded one. For the All years and the 2005 Subsurface data sets, these constituents were lead and Total PCBs, and for the 2005 Surface data set the constituents were lead and mercury.

Double-Crested-Cormorant

A summary of the HQs calculated for the double-crested cormorant based on a range of SUFs and the refined EPCs for the All Years, 2005 Surface, and 2005 Subsurface data sets are presented in Tables 6-30 through 6-32. Supporting tables can be found in Appendix E. For the double-crested cormorant at 100% site use, three constituents were greater than ambient concentrations and had low TRV HQs that exceeded one (lead, mercury, and DDx) in at least one of the data sets. The magnitudes of the low TRV HQs were low, all below 5. No high TRV benchmarks were greater than one. At a SUF of 0.002, only lead had a low TRV HQ greater than one.

6.4.4.2 IR Site 24

The screening-level risk estimate at IR Site 24 identified 11 of the detected constituents with low TRV HQs greater than one for at least one receptor and sediment data set. These compounds include cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, tributyltin, Total PCB, and Total DDx. Additionally, 11 of the detected constituents did not have TRVs. Although they cannot be evaluated quantitatively, they were qualitatively evaluated in the BERA.

6.4.4.2.1 Exposure and Effects Assessment

As previously described, sediment concentrations in the BERA were refined by using an estimate of the central tendency of the sediment and tissue concentrations for each offshore area. The BERA EPC chosen was either the 95% UCL or the maximum, whichever was lower (in accordance with U.S. EPA, 2002). A detailed description of the development of 95% UCLs can be found in Section 5.2. At IR Site 24, sediment and *M. nasuta* EPCs are summarized in Tables 5-4 and 5-6.

In the SLERA, all dose calculations were conducted using a SUF of one, assuming that a receptor feeds within each offshore area 100% of the time. It is unlikely that any of the bird species identified forage 100% of their time at each area given the diverse environmental setting of the Bay Area. Therefore, benchmark that exceeded one and was greater than ambient concentrations in the 2005/2006 Surface data sets. Only lead had a low TRV HQ that exceeded one and ambient concentrations at a SUF of 0.029. At a SUF of 0.029, the low TRV HQ for lead only slightly exceeded one and was similar to the HQ at reference concentrations. No HQs based on the high TRV exceeded one.

Least Tern

A summary of the HQs calculated for the least tern based on a range of SUFs and the refined EPCs for the All Years, 2005/2006 Surface, and 2005/2006 Subsurface data sets are presented in Tables 6-36 through 6-38. Supporting tables can be found in Appendix E.

For the All Years data set, copper, lead, zinc, Total PCBs, and Total DDx exceeded the low TRV and exceeded ambient concentrations at a SUF of one. With the exception of lead, all the exceedances were of low magnitude (HQ of three or less). No constituent had a high TRV HQ that exceeded one.

For the 2005/2006 Surface data set at a SUF of one, only copper lead, Total PCBs and Total DDx were greater than ambient concentrations and also exceeded the low TRV. As with the All Years data set, all the exceedances except for lead were of low magnitude (HQ of six or less), and no constituent had a high TRV HQ that exceeded one.

The highest magnitude HQs were from the 2005/2006 Subsurface data set. Cadmium, copper, lead, Total PCBs, and Total DDx exceeded the low TRV and ambient concentrations. Similar to other data sets, the low TRV HQs for all COPECs except lead were of low magnitude (HQ of eight or less), and no constituent had a high TRV HQ greater than one.

For all data sets, at a SUF of 0.029, only lead and Total DDx had a low TRV HQ that exceeded one and was greater than ambient. At a SUF of 0.029, HQs for both lead and Total DDx were similar in magnitude as those modeled from reference concentrations.

Double-Crested Cormorant

A summary of the HQs calculated for the double-crested cormorant based on a range of SUFs and the refined EPCs for the All Years, 2005/2006 Surface, and 2005/2006 Subsurface data sets are presented in Tables 6-39 through 6-41. Supporting tables can be found in Appendix E.

For the double-crested cormorant, only lead had a low TRV HQ greater than one at all SUFs and all data sets. Additionally, in the 2005/2006 Subsurface data sets, Total PCBs had a low TRV HQ, slightly greater than one assuming 100% site use and less than one at all other SUFs. All other analytes had HQs less than one. No high TRV HQ exceeded one.

6.5 Summary

To evaluate potential risks to ecological receptors, a tiered process was used that encompasses the eight steps identified in the U.S. EPA and Navy guidelines. In the first tier, the problem formulation was developed which included a development of the CSM and identification of COPECs, then a screening-level risk estimate was conducted using conservative screening parameters. If AEs failed the screen, then the exposure assumptions and COPEC selection were refined further in the BERA. Risks were then characterized for each of the endpoints.

In the screening-level risk estimate for IR Sites 20 and 24, both a direct contact toxicity screen and a screening-level risk estimate were conducted. Based on the direct contact toxicity screen at both IR

Sites 20 and 24, a majority of the compounds for all three data sets (All Years, 2005/2006 Surface, and 2005/2006 Subsurface) with direct contact benchmarks failed the screen. Additionally, there were numerous analytes that were detected in sediment but had no benchmarks for comparison. Thus, the benthic invertebrate and fish AEs [AE(1) and AE(2)] were recommended for further evaluation in the BERA.

The food-chain screening-level risk estimate also indicated that a number of constituents at both IR Sites 20 and 24 should be evaluated further in the BERA because they either (1) did not have TRVs and could not be evaluated quantitatively, or (2) had low TRV HQs that exceeded one for at least one avian receptor and sediment data set.

In the BERA, the preliminary problem formulation was refined, and then measurements of exposure and effects were refined and integrated into a characterization of risk that included a comprehensive discussion of the potential uncertainties associated with the assessment. The AEs and their associated MEs selected for the BERA are summarized below.

AE(1): Sufficient rates of survival, growth, and reproduction to sustain the benthic invertebrate community in offshore areas.

- ME(1): Toxicity to benthic invertebrates in acute and chronic sediment bioassays.

AE(2): Sufficient rates of survival, growth, and reproduction to sustain benthic feeding and piscivorous fish communities in offshore areas.

- ME(1): Model forage fish tissue concentrations and compare to literature-based effects thresholds.

AE(3): Sufficient rates of survival, growth, and reproduction to sustain the avian community in the area. This assessment endpoint also includes the protection at the level of the individual for special-status species as appropriate.[4]

- ME(1): Estimate site-specific doses (based on modeled and measured *M. nasuta* body burdens) to benthic-invertebrate eating birds (such as the scoter) and compare to TRVs.
- ME(2): Estimate site-specific doses (based on modeled fish tissue body burdens) to the least tern and compare to TRVs.
- ME(3): Estimate site-specific doses (based on modeled fish tissue body burdens) to piscivorous birds (such as the double-crested cormorant) and compare to TRVs.

In the BERA, a COPEC screen was conducted that was used to help focus the list of COPECs requiring additional evaluation by comparing site constituent sediment concentrations with ambient background concentrations to identify those constituents that are above ambient concentrations, and whose presence in offshore sediments could be attributed to Navy operations. At both IR Site 20 and 24, the majority of the inorganic constituents were greater than ambient concentrations, with a larger number of the inorganic constituents being greater than ambient concentrations in the All Years data set than the 2005 Surface

[4] This assessment endpoint was modified from those described in the Final Offshore Sediment Study Work Plan (Battelle et al., 2005a) by combining both the non-special and special-status avian species into one assessment endpoint.

data set. Most of the pesticides were not evaluated statistically due to the high frequency of non-detects; therefore, they were conservatively carried forward as Tier 2 COPECs.

Assessment of the Benthic Invertebrate Community AE(1)

Based on the historical toxicity tests for IR Site 20 (conducted in sediment from 1993/1994), sediment was generally not significantly toxic to the test species evaluated. Only two samples had statistically significant differences from the control and exceeded SWRCB reference envelope tolerance limits for one of the five endpoints. In the 2005 Surface data set, only one constituent (mercury) at one location (OIH C-2) exceeded the high direct contact toxicity benchmark (ER-M) and was greater than ambient. The rest of the stations had no exceedances of ER-Ms and ambient, reinforcing the conclusion that the sediment toxicity seen in 1993 was likely to have been associated with ammonia or other confounding factors. Based on these results, it is concluded that IR Site 24 poses acceptable risk to the benthic invertebrate community.

IR Site 24 had significant toxicity (as compared to the SWRCB tolerance limits) at a number of stations in 1998. Significant toxicity was observed at all IR Site 24 stations, including the reference stations, for the amphipod bioassays. However, the fact that the reference stations also exhibited significant toxicity makes it difficult to interpret the amphipod results. For the other bioassays, only station PA-3 showed significant toxicity. It was concluded that there may have been inconsistencies in the overall conduct of the tests, non-random placement of test organisms in exposure containers, high concentrations of ammonia, or some other laboratory deviation that contributed to the high variation observed in these data. Similar confounding issues have been identified at other locations at Alameda Point (Battelle et al., 1999b; Battelle et al., 2004b).

Although it is difficult to interpret the 1998 sediment bioassays, other lines of evidence support the conclusion that current conditions are unlikely to result in toxicity to benthic organisms over the majority of the area of IR Site 24. Surface sediment from 2005 and 2006 is the best estimate of current conditions to which invertebrates are exposed. The highest concentrations of COPECs are generally restricted to the northeast corner of the site and the sediment shelf that extends eastward past the quay wall beneath the roadway in the vicinity of outfalls J and K. Current sediment concentrations of COPECs in the rest of IR Site 24 do not exceed ER-Ms or ambient sediment concentrations, reinforcing the conclusion that the sediment toxicity seen in 1998 is unlikely to be present under current conditions, or associated with a small restricted area in the northeast corner of the site and the sediment shelf that extends eastward past the quay wall. Based on these results, it is concluded that IR Site 24 poses acceptable risk to the benthic invertebrate community over the majority of the site. Any potential for adverse effects to the benthic community are likely to be restricted to the small area in the northeast corner and the sediment shelf that extends eastward past the quay wall and under the roadway. However, due to the lack of bioassay data in that area, it is unknown whether these sediments would result in toxicity to benthic invertebrates.

Assessment of the Fish Community AE(2)

The modeled 95% UCL concentrations of constituents in fish tissue from IR Site 20 and 24 were compared to the fish ERV values to calculate HQs. For IR Site 20, none of the modeled fish tissue concentrations exceeded the NOAEL or LOAEL ERV for any constituent. Based on these results, it is concluded that IR Site 20 poses acceptable risk to the fish community.

At IR Site 24, the only COPECs that were identified as potentially posing a threat to the fish community were cadmium and silver; however, elevated concentrations of these COPECs are restricted to the sediment shelf that extends eastward past the quay wall beneath the roadway in the vicinity of outfalls J and K. Outside of this small area, concentrations of cadmium and silver are much lower. Based on this evaluation it was concluded that, in general, sediment concentrations at IR Site 24 do not pose an unacceptable risk to the fish community over the majority of the site, and any potential for adverse effects to fish under current conditions are associated with a small restricted area in the northeast corner of the site and the sediment shelf that extends eastward past the quay wall.

Assessment of the Avian Community AE(3)

Potential risks to the surf scoter, the double-crested cormorant, and the least tern were evaluated at both IR Site 20 and 24. A summary of the results are described below.

IR Site 20

Surf Scoter: Chromium, lead, and Total DDx had low TRV HQs that exceeded one and had concentrations greater than ambient in at least one data set for the surf scoter. Risks to the surf scoter were deemed acceptable for the following reasons:

Lead

- While the lead HQ based on the low TRV exceeded one at all SUFs, the magnitude of the low TRV exceedance was moderate (<15) and there was no exceedance of the high TRV.

- The HQs based on the low TRV for lead for all the data sets were comparable (between 10 and 14). Thus, while lead concentrations at IR Site 20 were found to be statistically greater than ambient concentrations, the potential risk from ambient exposure is similar to site risk. This is because the EPCs calculated for the site and the reference area were similar.

Chromium and Total DDx

- The low TRV HQ exceedances of chromium and Total DDx were of low magnitude (HQ<3) at SUFs of 1 and 0.5. At lower SUFs (which are more representative of potential exposure), low TRV HQs are not greater than 1.

- The low TRV HQs greater than 1 for chromium and Total DDx are associated only with the All Years data set. HQs for these compounds from 2005, which is more representative of current conditions, are less than one.

- Neither chromium nor Total DDx has a high TRV HQ greater than one.

Least Tern: Lead, mercury, Total PCBs, and Total DDx had HQs that exceeded one and had concentrations greater than ambient in at least one data set for the least tern. Risks to the least tern were deemed acceptable for the following reasons:

Lead

- The lead HQ based on the low TRV exceeded one at all SUFs; however, the magnitude of the low TRV exceedance was moderate (<20) and there was no exceedance of the high TRV.

- The HQs based on the low TRV for lead for all the data sets were comparable. This is because the EPCs calculated for the site and the reference area were similar. Thus, while lead concentrations at IR Site 20 are statistically greater than ambient concentrations, the potential risk from ambient exposure is similar to site risk.

Mercury

- The low TRV HQ for mercury exceeds one in all three data sets. Additionally, the high TRV HQ exceeds one for a SUF of one in the All Years and the 2005 Surface data set, and for a SUF of 0.5 in the 2005 Surface data set. However, at SUFs more representative of least tern usage of IR Site 20, the low TRV HQ is at or below one, and the high TRV HQ is much less than one.

- Mercury in the sediments at IR Site 20 is only above ambient concentrations (0.48 mg/kg) at a few stations, located within the small backwater on the eastern edge of the site that is separated from the main portion of the channel by a small pier. Because of the small area associated with these concentrations, and the small amount of time that the least tern spends foraging in Oakland Inner Harbor, it was not considered necessary to evaluate further.

Total PCBs

- Although the low TRV HQ for PCBs is greater than one in all three data sets, the magnitude of the exceedance is low (HQ<6), and the high TRV HQ does not exceed one in any of the data sets. Additionally, at SUFs representative of tern usage of IR Site 20, both the low and high TRV HQ is below one.

- The distribution of PCBs at IR Site 20 can be seen in Figures 4-12 and 4-13. In general, higher concentrations of PCBs were detected in the historical data. Sampling conducted in 2005 near these locations was at much lower concentrations. Thus, sediment concentrations of PCBs do not appear to pose a risk under current conditions.

Total DDx

- The low TRV HQ for DDx is greater than one in all three data sets; however, the magnitude of the exceedance is low (HQ<8). The high TRV HQ does not exceed one in any of the data sets.

- At a SUF more representative of least tern usage of the site, the HQ exceedances in the All Years and the 2005 Subsurface data sets are barely above one, and much lower than one when compared to the high TRV. Current conditions in the sediment layer to which receptors are most exposed (2005 Surface data set) does not demonstrate a risk to the least tern for exposure to DDx.

- As can be seen from the bubble plots for Total DDx (see Figure 4-11), the highest concentrations of DDx were limited to the historical data, and sampling conducted in 2005 near these locations were at much lower concentrations. Thus, sediment concentrations of DDx do not appear to pose a risk under current conditions.

Double-Crested Cormorant: Lead, mercury and Total DDx had HQs that exceeded one and had concentrations greater than ambient in at least one data set for the double-crested cormorant. Risks to the double-crested cormorant were deemed acceptable for the following reasons:

Lead

- The lead HQ based on the low TRV exceeded one at all SUFs; however, the magnitude of the low TRV exceedance was low (<5) and there was no exceedance of the high TRV.

- The HQs based on the low TRV for lead for all the data sets were comparable. This is because the EPCs calculated for the site and the reference area were similar. Thus, while lead concentrations at IR Site 20 may be statistically greater than ambient concentrations, the potential risk from ambient exposure is similar to site risk.

Mercury

- The low TRV HQ for mercury exceeds one in only one data set (2005 Surface) at a SUF of one. In the other data sets and at SUFs more representative of least tern usage of IR Site 20, the low TRV HQ is at or below one, and the high TRV HQ is much less than one.
- Mercury in the sediments at IR Site 20 is only above ambient concentrations (0.48 mg/kg) at a few stations, located within the small backwater on the eastern edge of the site that is separated from the main portion of the channel by a small pier. Because of the small area associated with these concentrations, and the small amount of time that the cormorant spends foraging in Oakland Inner Harbor, it was not considered necessary to evaluate further.

Total DDx

- The low TRV HQ for DDx is only greater than one for the All Years and 2005 Subsurface data set. The magnitude is very low (just above one) and the high TRV benchmark is below one. The data set most representative of current conditions (the 2005 Surface sediment data set) does not indicate risk to the cormorant.
- As discussed above, the bubble plots for Total DDx (see Figure 4-11) indicate that the highest surface concentrations of DDx were limited to the historical data, and sampling conducted in 2005 near these locations were at much lower concentrations. Thus, sediment concentrations of DDx do not appear to pose a risk under current conditions.

Based on the above evaluation, while some constituents did have low TRV HQs that exceeded one, risks to the three receptors were deemed acceptable at IR Site 20.

IR Site 24

Surf Scoter: Cadmium, chromium, lead, and Total DDx are the only COPECs that had low TRV HQs that exceeded one and had concentrations greater than ambient in at least one data set at a SUF of one for the surf scoter.

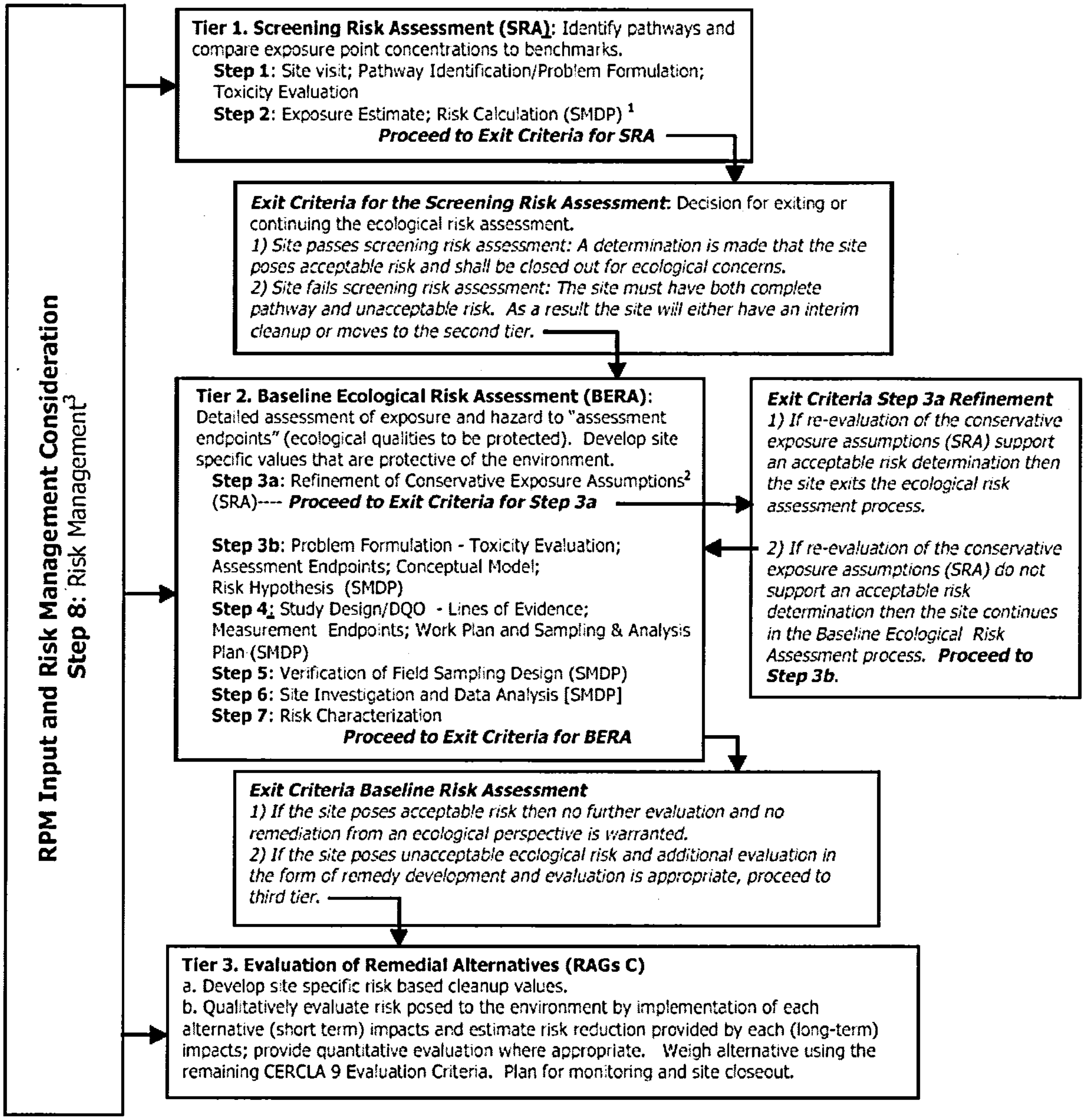
Cadmium and Chromium

- In all three data sets, the low TRV HQs for cadmium and chromium are just slightly elevated above one at a SUF of one. At lower SUFs (which are more representative of potential exposure), low TRV HQs are not greater than one.
- The high TRV HQ for cadmium and chromium do not exceed one for any data set of SUF.
- Elevated concentrations of cadmium and chromium are limited to the northeastern corner of the site.

water and ongoing human activity, this may make IR Site 24 less attractive to wildlife than other areas without ongoing human activity. Areas of elevated sediment concentrations are restricted to the small area in the northeast corner and the area that extends eastward of the quay wall. While birds may be able to contact sediment in this area, due to its small size and the roadway which acts as an overhang, access is likely to be restricted and exposure minimized, especially for diving birds like the least tern and the double-crested cormorant.

6.6 Conclusion

Based on the baseline evaluations conducted for IR Sites 20, it is recommended that no further action is required based on ecological risk considerations. For all of the assessment endpoints evaluated at IR Site 24, the majority of the area in the site poses acceptable ecological risks. The only area that shows any indication of a limited potential for adverse effects is restricted to a small nearshore area in the northeast corner and the sediment shelf that extends eastward past the quay wall between outfalls J and K. The potential for risk in this area is expected to be limited in scope due to the small size of the area and the location of the sediment shelf under the roadway, where exposure to receptors is likely to be minimal. Due to the uncertainties inherent in the risk assessment, it is not possible to conclude definitively whether this area presents an unacceptable risk to the three assessment endpoints evaluated. Uncertainties associated with the ecological risk assessment are presented in detail in Section 8.2. If this part of the site is examined separately, using conservative assumptions about the area over which an organism would be exposed, then concentrations in this small area may be of concern. Therefore, based on the ecological risk assessment conclusions, a Feasibility Study is recommended for a small area of elevated sediment concentrations. This area is located in the sediment shelf east of the quay wall and beneath the roadway between outfalls J and K, as represented by samples C-21, C-23, C-24, C-26, and C-27 (Figure 2-8).



Notes: 1) See EPA's 8 Step ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, detection frequency, etc.
3) Risk Management is incorporated throughout the tiered approach.

Figure 6-1. Overview of Ecological Risk Assessment Process (from CNO, 1999)

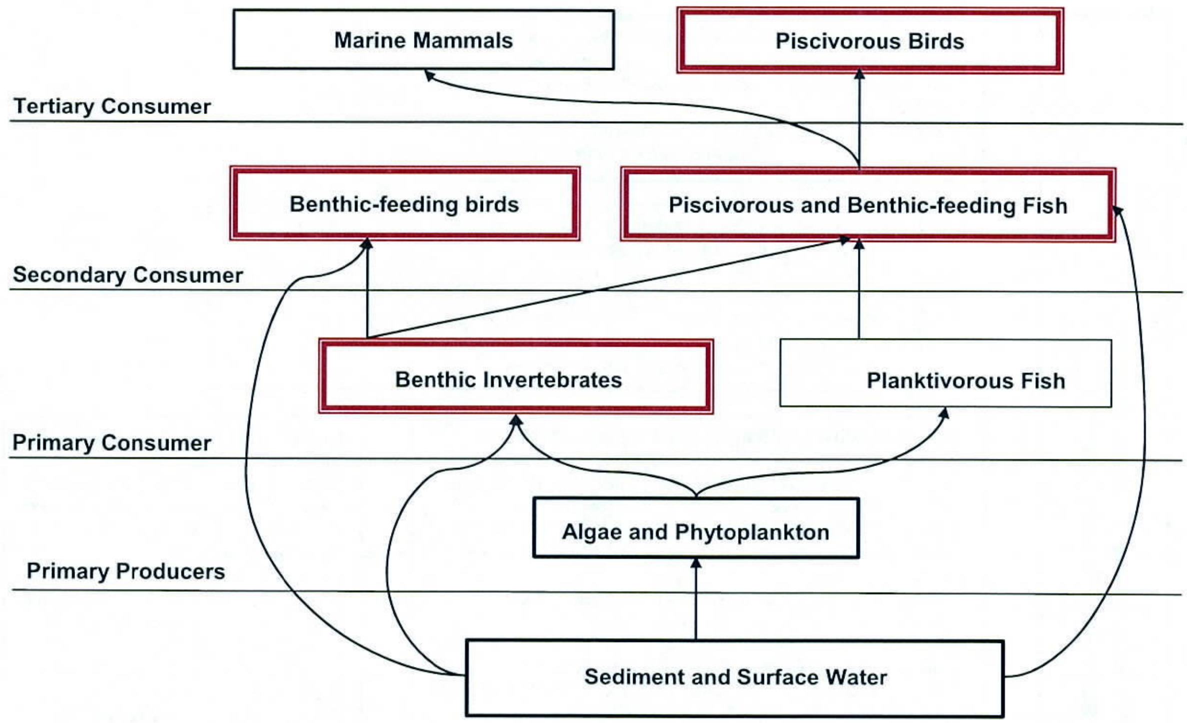
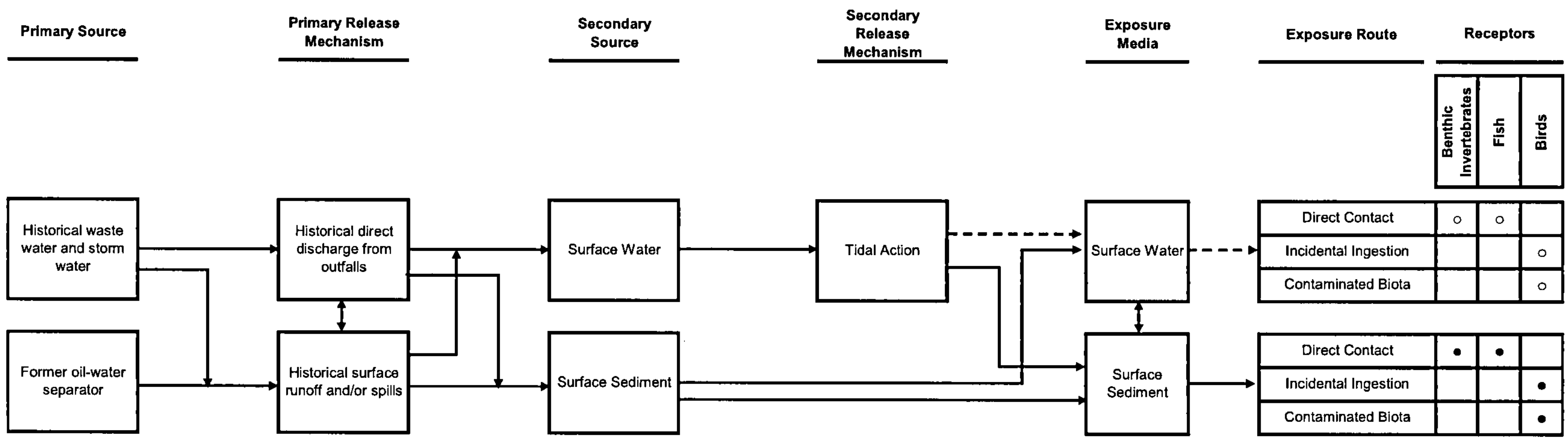


Figure 6-2. Conceptual Food Web for the Offshore Areas of Alameda Point.
Bold boxes are the trophic groups evaluated quantitatively in the ecological risk assessment.



Explanation:

- ○ Potentially complete exposure pathway, but exposure is insignificant.
- ● Potentially complete exposure pathway, evaluated quantitatively.
- ⟶ Major exposure pathway
- - -> Minor exposure pathway

Note: Incomplete exposure pathway is indicated by a blank receptor cell.

Figure 6-3. General Ecological Conceptual Site Model for Offshore Sites at IR Site 20

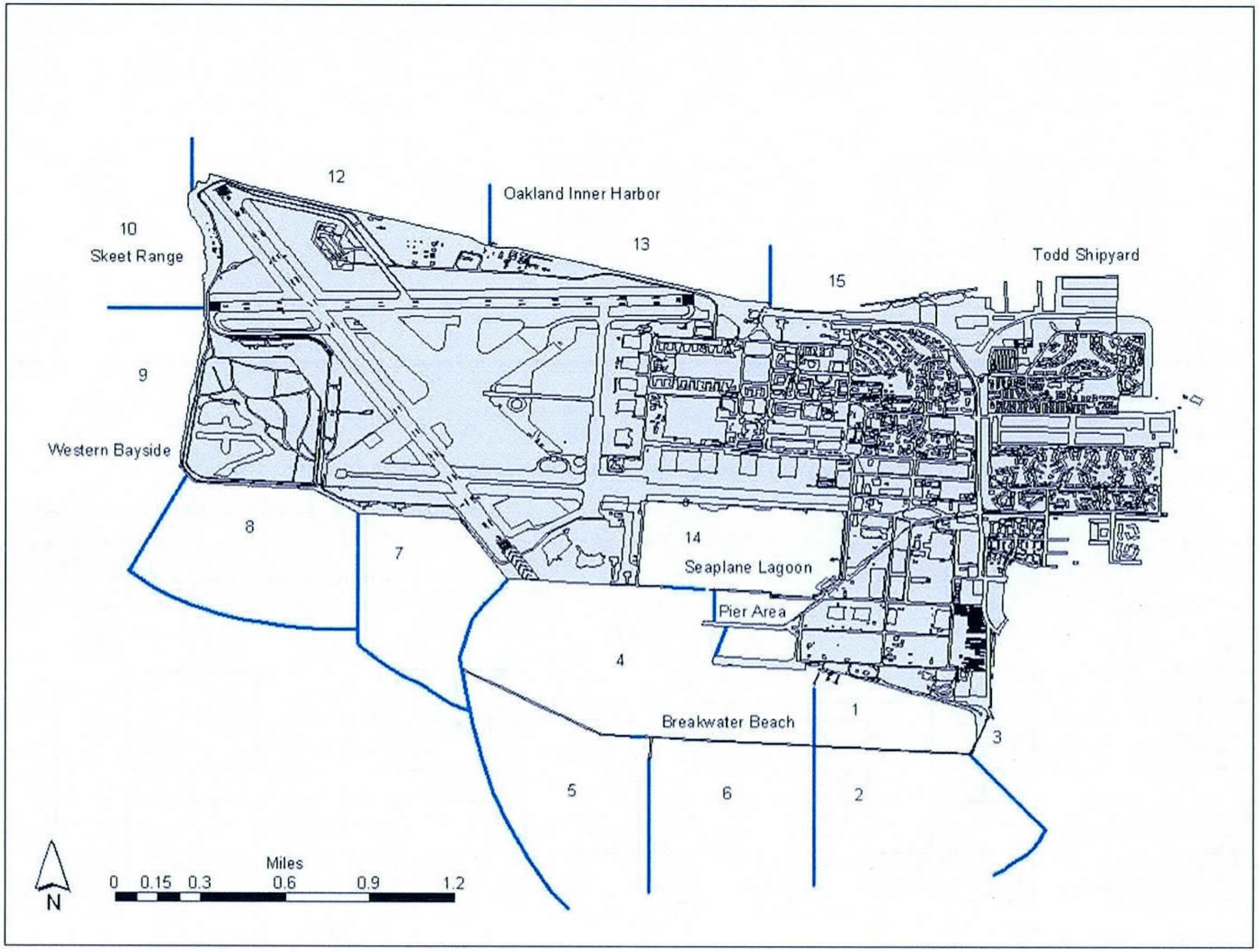


Figure 6-5. Least Tern Study Areas Around Alameda Point (Adapted from: Collins and Feeney, 1995)

Table 6-1. Dose Assessment Exposure Parameters for Receptors of Concern at Offshore Sediment Sites

Parameter	Surf Scoter	Least Tern (Adult)	Double-Crested Cormorant	Units
IR_{prey}	0.084	0.0083	0.091	kg/day dry wt
C_{prey}				
SLERA	Maximum *Macoma* tissue COPC concentration	Maximum *Macoma* and forage fish tissue COPC concentration	Maximum forage fish tissue COPC concentration	mg/kg dry wt
BERA	95% UCL of *Macoma* tissue COPC concentration	95% UCL of *Macoma* and forage fish tissue COPC concentration	95% UCL of forage fish tissue COPC concentration	mg/kg dry wt
IR_{sed}	0.0023	0	0.0018	kg/day dry wt
C_{sed}				
SLERA	Maximum sediment COPC concentration	NA	Maximum sediment COPC concentration	mg/kg dry wt
BERA	95% UCL or mean of sediment COPC concentration	NA	95% UCL or mean of sediment COPC concentration	mg/kg dry wt
Foraging Range	7	Offshore areas of Alameda Point down to Oakland Airport	89	km^2
SUF				
SLERA	1	1	1	unitless
BERA				unitless
IR Site 20	0.015	0.012	0.002	
IR Site 24	0.029	0.029	0.004	
Body weight	1.1	0.045	1.67	kg

Table 6-2. Least Tern Foraging Distribution Patterns around Alameda Point

Study Areas	Foraging Distribution (Percentage of the Year's Total)										
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	Mean
1	7	6.7	5.4	7.3	0.0	1.7	1.9	3.7	0.2	3.7	3.77
2	2.9	2.4	4.5	1.7	0.4	2.7	3.5	5.2	3.8	7.5	3.01
3	0.3	4.3	2.4	0.7	2.1	1.7	0.2	1.1	0.2	0.6	1.44
4	7.1	0.9	7.1	1.4	2.9	4.6	3.7	8.4	2.4	3.7	4.28
5	1.7	24.4	8.1	0.7	1.2	1.0	1.4	4.3	6.1	8.6	5.43
6	41.6	16.6	16.3	1.4	0.0	6.3	5.8	7.2	5.4	6.6	11.18
7	8.8	10.6	11.3	11.5	22.4	16.4	17.0	18.6	24.6	19.1	15.69
8	7.1	11.2	24	39.4	53.1	29.5	29.2	25.2	33.2	32.8	27.99
9	3.0	6.7	0.2	27.9	10.8	20.3	23.4	5.8	18.6	10.1	12.97
10	1.7	2.4	0.0	0.3	0.4	0.0	0.0	1.6	0.7	2.5	0.79
12	0.3	1.5	0.4	1.7	4.1	3.4	0.2	1.6	0.0	1.0	1.47
13/15	0.3	1.5	2.8	1.7	0.0	1.2	0.0	2.1	0.2	2.1	1.08
14	18.1	9.1	12.6	3.5	0.0	9.2	13.7	13.9	4.6	1.7	9.41
51	-	1.5	4.7	0.7	2.5	1.9	0.2	1.2	-	-	1.81
52	-	0.0	0.2	0.0	0.0	0.2	0.0	0.1	-	-	0.07

From: Bailey 1984, 1985, 1986, 1988, 1990a, b, and 1992; Collins and Feeney, 1993, 1995.

Table 6-3. Direct Contact Toxicity Benchmarks

Constituent	Low Benchmark	High Benchmark	Reference
	(mg/kg) DW	(mg/kg) DW	
ANTIMONY	2.00E+00	2.50E+01	Long and Morgan, 1991
ARSENIC	8.20E+00	7.00E+01	Long and Morgan, 1995
CADMIUM	1.20E+00	9.60E+00	Long and Morgan, 1995
CHROMIUM	8.10E+01	3.70E+02	Long and Morgan, 1995
COPPER	3.40E+01	2.70E+02	Long and Morgan, 1995
LEAD	4.67E+01	2.18E+02	Long and Morgan, 1995
MERCURY	1.50E-01	7.10E-01	Long and Morgan, 1995
NICKEL	2.09E+01	5.16E+01	Long and Morgan, 1995
SELENIUM	NA	NA	NA
SILVER	1.00E+00	3.70E+00	Long and Morgan, 1995
ZINC	1.50E+02	4.10E+02	Long and Morgan, 1995
ALDRIN	NA	NA	NA
ALPHA-CHLORDANE	5.00E-04	6.00E-03	Long and Morgan, 1991
DIELDRIN	2.00E-05	8.00E-03	Long and Morgan, 1991
ENDOSULFAN I	NA	NA	NA
ENDOSULFAN II	NA	NA	NA
ENDRIN	NA	NA	NA
ENDRIN ALDEHYDE	NA	NA	NA
GAMMA-BHC	3.20E-04	9.90E-04	MacDonald et al., 1994
GAMMA-CHLORDANE	NA	NA	NA
HEPTACHLOR EPOXIDE	NA	NA	NA
DIBENZOFURAN	NA	NA	NA
TRIBUTYLTIN	2.51E-05	NA	U.S. EPA 1996b
Total PCB	2.27E-02	1.80E-01	Long and Morgan, 1995
Total DDx	1.58E-03	4.61E-02	Long and Morgan, 1991
Total HPAH	1.70E+00	9.60E+00	Long and Morgan, 1995
Total LPAH	5.52E-01	3.16E+00	Long and Morgan, 1995
Total PAH	4.02E-03	4.48E-02	Long and Morgan, 1995

Table 6-4. Toxicity Reference Values

Constituent	NOAEL Study Receptor Body Weight (kg)	Literature-Based Low Avian TRV (mg/kg/day)	Reference	LOAEL Study Receptor Body Weight (kg)	Literature-Based High Avian TRV (mg/kg/day)	Reference
ANTIMONY	NA	NA	NA	NA	NA	NA
ARSENIC	1.17E+00	5.50E+00	DON, 1998	1.17E+00	2.20E+01	DON, 1998
CADMIUM	7.99E-01	8.00E-02	DON, 1998	8.40E-02	1.04E+01	DON, 1998
CHROMIUM	1.25E+00	2.66E+00	U.S. EPA, 2005	1.25E+00	1.56E+01	U.S. EPA, 2005a
COPPER	6.39E-01	2.30E+00	DON, 1998	4.09E-01	5.23E+01	DON, 1998
LEAD	8.40E-02	1.40E-02	DON, 1998	8.00E-01	8.75E+00	DON, 1998
MERCURY	1.00E+00	3.90E-02	DON, 1998	1.00E+00	1.80E-01	DON, 1998
NICKEL	6.14E-01	1.38E+00	DON, 1998	5.80E-01	5.63E+01	DON, 1998
SELENIUM	1.11E+00	2.30E-01	DON, 1998	1.11E+00	9.30E-01	DON, 1998
SILVER	NA	NA	NA	NA	NA	NA
ZINC	9.55E-01	1.72E+01	DON, 1998	9.55E-01	1.72E+02	DON, 1998
ALDRIN	NA	NA	NA	NA	NA	NA
ALPHA-CHLORDANE	6.40E-02	2.14E+00	Sample et al., 1996	6.40E-02	1.07E+01	Sample et al., 1996
DIELDRIN	4.66E-01	7.09E-02	U.S. EPA, 2005	4.66E-01	8.01E-01	U.S. EPA, 2005a
ENDOSULFAN I	NA	NA	NA	NA	NA	NA
ENDOSULFAN II	NA	NA	NA	NA	NA	NA
ENDRIN	1.81E-01	1.00E-02	Sample et al., 1996	1.81E-01	1.00E-01	Sample et al., 1996
ENDRIN ALDEHYDE	NA	NA	NA	NA	NA	
GAMMA-BHC	1.00E+00	2.00E+00	Sample et al., 1996	1.00E+00	2.00E+01	Sample et al., 1996
GAMMA-CHLORDANE	6.40E-02	2.14E+00	Sample et al., 1996	6.40E-02	1.07E+01	Sample et al., 1996
HEPTACHLOR EPOXIDE	NA	NA	NA	NA	NA	NA
DIBENZOFURAN	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	9.65E-02	7.30E-01	DON, 1998	9.65E-02	4.59E+01	DON, 1998
Total PCB	8.00E-01	9.00E-02	DON, 1998	1.72E+00	1.27E+00	DON, 1998
Total DDx	3.50E+00	9.00E-03	DON, 1998	1.00E+00	6.00E-01	DON, 1998
Total HPAH	NA	NA	NA	NA	NA	NA
Total LPAH	NA	NA	NA	NA	NA	NA
Total PAH	NA	NA	NA	NA	NA	NA

Table 6-5. Screening-Level Direct Contact Toxicity Evaluation for IR Site 20

Constituent	Maximum Sediment Concentration			Direct Contact Toxicity Benchmark		Surface All Years		2005 Surface		2005 Subsurface	
	Surface All Years (mg/kg)	2005 Surface (mg/kg)	2005 Subsurface (mg/kg)	Low (mg/kg)	High (mg/kg)	Low HQ (unitless)	High HQ (unitless)	Low HQ (unitless)	High HQ (unitless)	Low HQ (unitless)	High HQ (unitless)
ANTIMONY	3.70E+01	4.70E-01	5.18E+00	2.00E+00	2.50E+01	1.85E+01	1.48E+00	2.35E-01	1.88E-02	2.59E+00	2.07E-01
ARSENIC	1.37E+01	6.56E+00	9.37E+00	8.20E+00	7.00E+01	1.67E+00	1.96E-01	8.00E-01	9.37E-02	1.14E+00	1.34E-01
CADMIUM	9.03E-01	3.70E-01	8.98E-01	1.20E+00	9.60E+00	7.53E-01	9.41E-02	3.08E-01	3.85E-02	7.48E-01	9.35E-02
CHROMIUM	1.23E+03	8.69E+01	9.11E+01	8.10E+01	3.70E+02	1.52E+01	3.32E+00	1.07E+00	2.35E-01	1.12E+00	2.46E-01
COPPER	1.41E+02	1.15E+02	1.79E+02	3.40E+01	2.70E+02	4.15E+00	5.22E-01	3.38E+00	4.26E-01	5.26E+00	6.63E-01
LEAD	2.26E+02	9.15E+01	1.09E+02	4.67E+01	2.18E+02	4.83E+00	1.03E+00	1.96E+00	4.20E-01	2.33E+00	5.00E-01
MERCURY	8.83E+00	8.83E+00	3.84E+00	1.50E-01	7.10E-01	5.89E+01	1.24E+01	5.89E+01	1.24E+01	2.56E+01	5.41E+00
NICKEL	2.88E+02	6.14E+01	6.53E+01	2.09E+01	5.16E+01	1.38E+01	5.58E+00	2.94E+00	1.19E+00	3.12E+00	1.27E+00
SELENIUM	4.71E-01	2.10E-01	2.10E-01	NA	NA	NA	NA	NA	NA	NA	NA
SILVER	2.88E-01	2.63E-01	3.02E-01	1.00E+00	3.70E+00	2.88E-01	7.78E-02	2.63E-01	7.11E-02	3.02E-01	8.16E-02
ZINC	2.58E+02	9.96E+01	4.90E+02	1.50E+02	4.10E+02	1.72E+00	6.29E-01	6.64E-01	2.43E-01	3.27E+00	1.20E+00
ALPHA-CHLORDANE	3.14E-03	6.60E-04	8.80E-04	5.00E-04	6.00E-03	6.28E+00	5.23E-01	1.32E+00	1.10E-01	1.76E+00	1.47E-01
DIELDRIN	9.80E-04	9.80E-04	3.34E-03	2.00E-05	8.00E-03	4.90E+01	1.23E-01	4.90E+01	1.23E-01	1.67E+02	4.18E-01
ENDOSULFAN II	6.50E-04	6.50E-04	1.36E-03	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE	1.34E-02	4.00E-05	2.54E-03	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE	2.15E-03	9.50E-04	1.03E-03	NA	NA	NA	NA	NA	NA	NA	NA
DIBENZOFURAN	1.30E-02	1.30E-02	9.80E-02	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	5.90E-02	5.90E-02	7.60E-02	2.51E-02	NA	2.35E+00	NA	2.35E+00	NA	3.03E+00	NA
Total PCB	8.93E-01	9.50E-02	3.54E-01	2.27E-02	1.80E-01	3.94E+01	4.96E+00	4.18E+00	5.28E-01	1.56E+01	1.97E+00
Total 4,4-DDx ND/2	4.82E-01	1.39E-02	8.28E-02	1.58E-03	4.61E-02	3.05E+02	1.05E+01	8.81E+00	3.02E-01	5.24E+01	1.80E+00
Total HPAH (6) ND/2	9.32E+00	9.32E+00	1.75E+01	1.70E+00	9.60E+00	5.48E+00	9.71E-01	5.48E+00	9.71E-01	1.03E+01	1.82E+00
Total LPAH (6) ND/2	2.51E+00	2.51E+00	1.27E+01	5.52E-01	3.16E+00	4.55E+00	7.95E-01	4.55E+00	7.95E-01	2.30E+01	4.01E+00
Total PAH (12) ND/2	1.18E+01	1.18E+01	3.02E+01	4.02E+00	4.48E+01	2.94E+00	2.64E-01	2.94E+00	2.64E-01	7.50E+00	6.73E-01

Highlighted Cell = HQ > 1.

Table 6-7. Summary of Screening-Level Hazard Quotients for IR Site 20

Constituent	All Years			2005 Surface			2005 Subsurface			BERA COPEC?
	Surf Scoter	Least Tern	Double-Crested Cormorant	Surf Scoter	Least Tern	Double-Crested Cormorant	Surf Scoter	Least Tern	Double-Crested Cormorant	
ANTIMONY	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
ARSENIC	3.15E-01	1.12E-01	1.86E-02	3.12E-01	5.38E-02	8.91E-03	3.13E-01	7.69E-02	1.27E-02	No
CADMIUM	1.21E-01	1.01E-01	2.50E-02	4.94E-02	4.16E-02	1.03E-02	1.20E-01	1.01E-01	2.49E-02	No
CHROMIUM	7.94E+00	2.55E+00	8.37E-01	5.61E-01	1.80E-01	5.91E-02	5.88E-01	1.89E-01	6.20E-02	**Yes**
COPPER	5.80E-01	1.55E+00	2.77E-01	5.58E-01	1.27E+00	2.26E-01	6.11E-01	1.97E+00	3.52E-01	**Yes**
LEAD	2.84E+01	5.82E+01	1.79E+01	1.65E+01	2.36E+01	7.26E+00	1.80E+01	2.81E+01	8.65E+00	**Yes**
MERCURY	5.51E-01	1.96E+01	3.04E+00	5.51E-01	1.96E+01	3.04E+00	2.88E-01	8.54E+00	1.32E+00	**Yes**
NICKEL	4.50E-01	3.38E-01	2.33E-01	1.44E-01	7.20E-02	4.96E-02	1.50E-01	7.65E-02	5.27E-02	No
SELENIUM	6.03E-01	1.26E+00	1.83E-01	2.69E-01	5.62E-01	8.14E-02	2.69E-01	5.62E-01	8.14E-02	**Yes**
SILVER	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
ZINC	4.07E-01	1.75E+00	2.65E-01	3.88E-01	6.75E-01	1.02E-01	4.34E-01	3.32E+00	5.03E-01	**Yes**
ALPHA-CHLORDANE	4.33E-05	6.91E-04	9.99E-05	9.10E-06	1.45E-04	2.10E-05	1.21E-05	1.94E-04	2.80E-05	No
DIELDRIN	5.82E-03	6.00E-03	8.72E-04	5.82E-03	6.00E-03	8.72E-04	1.98E-02	2.05E-02	2.97E-03	No
ENDOSULFAN II	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
ENDRIN ALDEHYDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
GAMMA-CHLORDANE	4.81E-05	1.58E-04	2.33E-05	4.74E-05	6.99E-05	1.03E-05	4.74E-05	7.58E-05	1.11E-05	No
DIBENZOFURAN	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
TRIBUTYLTIN	3.47E-03	1.49E-01	2.14E-02	3.47E-03	1.49E-01	2.14E-02	4.47E-03	1.92E-01	2.76E-02	No
Total PCB	1.02E+00	1.02E+01	1.47E+00	1.08E-01	1.08E+00	1.56E-01	4.04E-01	4.03E+00	5.81E-01	**Yes**
Total 4,4-DDx	2.40E+01	1.07E+02	1.55E+01	6.94E-01	3.10E+00	4.47E-01	4.13E+00	1.85E+01	2.66E+00	**Yes**
Total HPAH	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
Total LPAH	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**
Total PAH	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Yes**

Highlighted Cell = HQ > 1.

Table 6-9. Evaluation Criteria for Toxicity Tests

Test	Endpoint	SWRCB Threshold[a]
10-d Amphipod *Eohaustorius estuaries*	Survival	69.5% of control survival
28-d Polychaete *Neanthes arenaceodentata*	Survival and growth	Survival: 64% of control Growth: 44% of control response
~72-h *Strongylocentrotus purpuratus*	Normal Development	60% of control response

(a) Source: SWRCB (1998a and 1998b)

Table 6-10. Bulk Porewater Salinity and Sediment Grain Size at IR Site 20

Station	Salinity (‰)	Percent Fine Grained (<0.075 mm)
E07	24.6-25.0	27.2
E08	24.6-25.0	23.2
E09	24.4-24.7	23.1
E10	24.2-24.6	39.4

Table 6-11. Survival of *E. estuarius* in IR Site 20 and Native Control Sediment

Station	Survival (%)					
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Mean
Control (E05-E10)	100	100	100	95	100	99
E07	55	60	65	55	50	57[a,b]
E08	60 60 (dup)	75	80	80	80	72.5[a]
E09	90	65	80	70	60	73[a]
E10	55 60 (dup)	60	65	65	75	63.3[a,b]

(a) Statistically significant difference from control reported ($p<0.05$).
(b) Survival was lower than the tolerance limit of 69.5% of control.

Table 6-12. Survival Data for *N. arenaceodentata* Test in IR Site 20 and Native Control Sediment

Station	Number Surviving					Mean Survival[a]
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	
Control (E05-E10)	5	5	5	5	5	100%
E07	5	5	5	5	5	100%
E08	5 5 (dup)	5	5	5	5	100%
E09	5	4	5	5	5	96%
E10	5 5 (dup)	5	5	5	5	100%

(a) Replicate assumed to be double-stocked with 10 organisms instead of 5; mean survival is based on this assumption.

Table 6-13. Growth Data for *N. arenaceodentata* Test in IR Site 20 and Native Control Sediment

Station	Growth (mg dry weight/worm)					Mean Growth (mg dry weight/worm)
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	
Control (E05-E10)	12.42	19.52	19.28	17.30	16.36	17.0
E07	10.26	12.20	11.42	10.18	14.48	11.7 [a]
E08	11.18 8.48 (dup)	12.22	12.58	10.98	15.22	11.8 [a]
E09	16.60	18.68	15.60	12.44	11.36	14.9
E10	12.08 12.54 (dup)	17.32	14.34	12.26	15.70	14.0

(a) Statistically significant differences from control reported ($p<0.05$).

Table 6-14. Survival and Normal Development of Mussel Larvae Exposed to Sediment from IR Site 20

Station	% Survival	% Normal	Combined % Normal and Survival[a]	Combined Normal and Survival as % of Control
E07	95.7	99.0	94.7	114
E08	110.6	98.4	98.4	119
E09	NA	NA	NA	NA
E10	NA	NA	NA	NA

(a) (Percent normal × percent survival)/100, assuming 100% survival for stations with >100% survival reported.
NA = not applicable.

Table 6-15. Summary of Biological Effects in Toxicity Tests at IR Site 20

Station	Biological Toxicity Measurements					
	Amphipod Survival (%)	Polychaete Survival (%)	Polychaete Growth (mg)	Mussel Larvae Elutriate Survival (%)	Mussel Larvae Elutriate Normal (%)	Sediment ERM-Q[a]
SWRCB Tolerance Limit[b]	68.8	64	7.48	NA	59.2	0.3 (UTL)
Control (E05-E10)	99	100	17.0	84.2	98.6	No data
E07	**57** [c]	100	11.7 [c]	95.7	99	0.802
E08	72.5[c]	100	11.8 [c]	110.6	98.4	0.385
E09	73[c]	96	14.9	No data	No data	0.278
E10	**63.3**[c]	100	14.0	No data	No data	0.439

(a) Effects Range Medium – Quotients (ERM-Qs) calculated using 19 COPCs.
(b) SWRCB tolerance limit is calculated using concurrently tested control response.
(c) Statistically significant difference from control reported ($p<0.05$)
NA = Not applicable.
Bold Type indicates station response falls below SWRCB tolerance limit

Table 6-21. Fish Ecotoxicity Reference Values

Constituent	NOAEL ERV (mg/kg) DW in tissue	LOAEL ERV (mg/kg) DW in tissue
ANTIMONY	2.50E+01	4.50E+01
ARSENIC	7.55E+00	8.60E+00
CADMIUM	2.50E-01	5.00E-01
CHROMIUM	1.15E+01	4.45E+01
COPPER	1.96E+01	2.24E+01
LEAD	1.27E+01	2.01E+01
MERCURY	4.00E+00	6.55E+00
NICKEL	NA	NA
SELENIUM	5.40E+00	6.58E+00
SILVER	3.00E-01	NA
ZINC	9.65E+01	1.13E+02
ALDRIN	NA	NA
ALPHA-CHLORDANE	3.00E+00	8.30E+01
DIELDRIN	6.00E-01	1.00E+00
ENDOSULFAN I	1.55E-02	1.55E-01
ENDOSULFAN II	1.55E-02	1.55E-01
ENDRIN	6.00E-01	1.05E+00
ENDRIN ALDEHYDE	6.00E-01	1.05E+00
GAMMA-BHC	3.07E+01	4.77E+01
GAMMA-CHLORDANE	3.00E+00	8.30E+01
HEPTACHLOR EPOXIDE	3.00E+00	8.30E+01
DIBENZOFURAN	NA	NA
TRIBUTYLTIN	1.30E+00	1.35E+00
Total PCB	3.80E+00	7.65E+00
Total DDx	9.60E+00	1.00E+01
Total HPAH	1.05E+00	1.05E+01
Total LPAH	1.15E+01	1.15E+02
Total PAH	1.05E+00	1.05E+01

Table 6-22. Summary of Forage Fish HQs for IR Site 20

Constituent	Modeled Fish Concentrations			ERVs		HQs					
	All Year (mg/kg) DW Tissue	2005 Surface (mg/kg) DW Tissue	2005 Subsurface (mg/kg) DW Tissue	NOAEL (mg/kg) DW Tissue	LOAEL (mg/kg) DW Tissue	All Years NOAEL (unitless)	All Years LOAEL (unitless)	2005 Surface NOAEL (unitless)	2005 Surface LOAEL (unitless)	2005 Subsurface NOAEL (unitless)	2005 Subsurface LOAEL (unitless)
ANTIMONY	8.38E-02	1.30E-03	2.20E-02	2.50E+01	4.50E+01	3.35E-03	1.86E-03	5.18E-05	2.88E-05	8.81E-04	4.89E-04
ARSENIC	8.98E-01	6.42E-01	7.62E-01	7.55E+00	8.60E+00	1.19E-01	1.04E-01	8.50E-02	7.46E-02	1.01E-01	8.86E-02
CADMIUM	7.02E-03	5.44E-03	1.06E-02	2.50E-01	5.00E-01	2.81E-02	1.40E-02	2.18E-02	1.09E-02	4.23E-02	2.11E-02
CHROMIUM	5.19E+00	9.29E-01	9.82E-01	1.15E+01	4.45E+01	4.51E-01	1.17E-01	8.07E-02	2.09E-02	8.54E-02	2.21E-02
COPPER	5.52E+00	4.00E+00	4.96E+00	1.96E+01	2.24E+01	2.82E-01	2.47E-01	2.04E-01	1.79E-01	2.53E-01	2.21E-01
LEAD	1.06E+00	6.63E-01	1.06E+00	1.27E+01	2.01E+01	8.36E-02	5.28E-02	5.22E-02	3.30E-02	8.38E-02	5.29E-02
MERCURY	6.20E-01	1.18E+00	5.26E-01	4.00E+00	6.55E+00	1.55E-01	9.47E-02	2.95E-01	1.80E-01	1.31E-01	8.03E-02
NICKEL	4.01E-01	2.21E-01	2.43E-01	NA	NA	NA	NA	NA	NA	NA	NA
SELENIUM	3.65E-01	2.46E-01	2.69E-01	5.40E+00	6.58E+00	6.76E-02	5.55E-02	4.55E-02	3.74E-02	4.97E-02	4.08E-02
SILVER	5.43E-03	5.31E-03	6.51E-03	3.00E-01	NA	1.81E-02	NA	1.77E-02	NA	2.17E-02	NA
ZINC	4.15E+01	2.23E+01	7.74E+01	9.65E+01	1.13E+02	4.30E-01	3.68E-01	2.31E-01	1.97E-01	8.02E-01	6.85E-01
ALPHA-CHLORDANE	2.97E-03	7.23E-04	9.60E-04	3.00E+00	8.30E+01	9.90E-04	3.58E-05	2.41E-04	8.71E-06	3.20E-04	1.16E-05
DIELDRIN	1.45E-03	8.22E-04	2.81E-03	6.00E-01	1.00E+00	2.41E-03	1.45E-03	1.37E-03	8.22E-04	4.68E-03	2.81E-03
ENDOSULFAN II	2.85E-05	1.95E-05	5.25E-05	1.55E-02	1.55E-01	1.84E-03	1.84E-04	1.26E-03	1.26E-04	3.39E-03	3.39E-04
ENDRIN ALDEHYDE	3.63E-04	8.56E-07	3.59E-05	6.00E-01	1.05E+00	6.04E-04	3.45E-04	1.43E-06	8.15E-07	5.98E-05	3.42E-05
GAMMA-CHLORDANE	1.71E-03	3.33E-04	3.96E-04	3.00E+00	8.30E+01	5.71E-04	2.06E-05	1.11E-04	4.02E-06	1.32E-04	4.77E-06
DIBENZOFURAN	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	2.71E-01	5.06E-01	6.52E-01	1.30E+00	1.35E+00	2.08E-01	2.01E-01	3.90E-01	3.75E-01	5.02E-01	4.83E-01
Total PCB	1.41E+00	2.97E-01	1.11E+00	3.80E+00	7.65E+00	3.71E-01	1.84E-01	7.81E-02	3.88E-02	2.91E-01	1.45E-01
Total 4,4-DDx ND/2	2.13E-01	4.18E-02	1.62E-01	9.60E+00	1.00E+01	2.22E-02	2.13E-02	4.35E-03	4.18E-03	1.69E-02	1.62E-02
Total HPAH (6) ND/2	1.14E-01	2.03E-01	3.81E-01	1.05E+00	1.05E+01	1.08E-01	1.08E-02	1.94E-01	1.94E-02	3.63E-01	3.63E-02
Total LPAH (6) ND/2	6.20E-02	1.99E-01	9.66E-01	1.15E+01	1.15E+02	5.39E-03	5.39E-04	1.73E-02	1.73E-03	8.40E-02	8.40E-03
Total PAH (12) ND/2	1.49E-01	2.58E-01	6.57E-01	1.05E+00	1.05E+01	1.42E-01	1.42E-02	2.46E-01	2.46E-02	6.26E-01	6.26E-02

Table 6-24. Summary of Surf Scoter BERA HQs for a Range of SUFs at IR Site 20 (All Years Data Set)

	SUF 1 / Ref 0			SUF 0.5 / Ref 0.5			SUF 0.25 / Ref 0.75			SUF 0.015 / Ref 0.985			SUF 0 / Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	1.78E-01	NA	NA	9.68E-02	NA	NA	5.64E-02	NA	NA	1.84E-02	NA	NA	1.60E-02	NA	NA
ARSENIC	1.69E+00	3.12E-01	7.80E-02	1.66E+00	3.05E-01	7.64E-02	1.64E+00	3.02E-01	7.55E-02	1.62E+00	2.99E-01	7.48E-02	1.62E+00	2.99E-01	7.47E-02
CADMIUM	2.92E-03	3.42E-02	1.68E-04	3.34E-03	3.91E-02	1.92E-04	3.55E-03	4.16E-02	2.04E-04	3.75E-03	4.39E-02	2.15E-04	3.76E-03	4.41E-02	2.16E-04
CHROMIUM	5.63E+00	2.17E+00	3.70E-01	3.49E+00	1.35E+00	2.30E-01	2.42E+00	9.35E-01	1.59E-01	1.42E+00	5.47E-01	9.33E-02	1.36E+00	5.23E-01	8.91E-02
COPPER	1.33E+00	5.20E-01	2.09E-02	1.24E+00	4.85E-01	1.95E-02	1.20E+00	4.68E-01	1.88E-02	1.16E+00	4.51E-01	1.82E-02	1.15E+00	4.50E-01	1.81E-02
LEAD	3.19E-01	1.36E+01	3.42E-02	2.84E-01	1.21E+01	3.05E-02	2.66E-01	1.14E+01	2.86E-02	2.50E-01	1.07E+01	2.68E-02	2.49E-01	1.06E+01	2.67E-02
MERCURY	8.57E-03	2.16E-01	4.67E-02	9.28E-03	2.34E-01	5.06E-02	9.64E-03	2.43E-01	5.26E-02	9.98E-03	2.51E-01	5.44E-02	1.00E-02	2.52E-01	5.45E-02
NICKEL	2.57E-01	1.66E-01	4.01E-03	8.98E-01	5.79E-01	1.40E-02	1.22E+00	7.86E-01	1.90E-02	1.52E+00	9.81E-01	2.38E-02	1.54E+00	9.93E-01	2.41E-02
SELENIUM	6.10E-02	2.66E-01	6.57E-02	1.01E-01	4.40E-01	1.09E-01	1.21E-01	5.27E-01	1.30E-01	1.40E-01	6.09E-01	1.51E-01	1.41E-01	6.14E-01	1.52E-01
SILVER	2.61E-03	NA	NA	3.58E-03	NA	NA	4.07E-03	NA	NA	4.52E-03	NA	NA	4.55E-03	NA	NA
ZINC	6.91E+00	3.91E-01	3.91E-02	7.46E+00	4.22E-01	4.22E-02	7.74E+00	4.37E-01	4.37E-02	8.00E+00	4.52E-01	4.52E-02	8.01E+00	4.53E-01	4.53E-02
ALPHA-CHLORDANE*	6.50E-05	1.72E-05	3.44E-06	3.59E-05	9.50E-06	1.90E-06	2.13E-05	5.64E-06	1.13E-06	7.65E-06	2.02E-06	4.05E-07	6.77E-06	1.79E-06	3.58E-07
*DIELDRIN**	4.90E-04	5.82E-03	5.15E-04	2.77E-04	3.29E-03	2.92E-04	1.71E-04	2.03E-03	1.80E-04	7.13E-05	8.47E-04	7.50E-05	6.50E-05	7.72E-04	6.83E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	1.81E-04	4.79E-05	9.58E-06	1.13E-04	3.00E-05	6.00E-06	7.97E-05	2.11E-05	4.22E-06	4.79E-05	1.27E-05	2.54E-06	4.59E-05	1.21E-05	2.43E-06
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	2.70E-03	2.27E-03	3.62E-05	2.69E-03	2.27E-03	3.60E-05	2.69E-03	2.26E-03	3.60E-05	2.68E-03	2.26E-03	3.59E-05	2.68E-03	2.26E-03	3.59E-05
Total PCB	4.94E-02	5.15E-01	4.26E-02	2.53E-02	2.64E-01	2.18E-02	1.33E-02	1.38E-01	1.14E-02	1.93E-03	2.01E-02	1.66E-03	1.20E-03	1.26E-02	1.04E-03
Total 4,4-DDx	1.67E-02	2.33E+00	2.72E-02	9.09E-03	1.27E+00	1.49E-02	5.31E-03	7.44E-01	8.68E-03	1.76E-03	2.46E-01	2.87E-03	1.53E-03	2.14E-01	2.50E-03
Total HPAH	4.77E-01	NA	NA	2.87E-01	NA	NA	1.93E-01	NA	NA	1.04E-01	NA	NA	9.79E-02	NA	NA
Total LPAH	2.30E-02	NA	NA	1.44E-02	NA	NA	1.00E-02	NA	NA	5.97E-03	NA	NA	5.71E-03	NA	NA
Total PAH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-25. Summary of Surf Scoter BERA HQs for a Range of SUFs at IR Site 20 (2005 Surface Data Set)

	SUF 1			SUF 0.5			SUF 0.25			SUF 0.015			SUF 0		
	Ref 0			Ref 0.5			Ref 0.75			Ref 0.985			Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	2.75E-03	NA	NA	9.35E-03	NA	NA	1.27E-02	NA	NA	1.58E-02	NA	NA	1.60E-02	NA	NA
ARSENIC	1.69E+00	3.11E-01	7.78E-02	1.66E+00	3.05E-01	7.63E-02	1.64E+00	3.02E-01	7.55E-02	1.62E+00	2.99E-01	7.48E-02	1.62E+00	2.99E-01	7.47E-02
CADMIUM	2.26E-03	2.65E-02	1.30E-04	3.01E-03	3.53E-02	1.73E-04	3.39E-03	3.97E-02	1.95E-04	3.74E-03	4.38E-02	2.15E-04	3.76E-03	4.41E-02	2.16E-04
CHROMIUM	1.01E+00	3.89E-01	6.63E-02	1.18E+00	4.56E-01	7.77E-02	1.27E+00	4.89E-01	8.34E-02	1.35E+00	5.21E-01	8.88E-02	1.36E+00	5.23E-01	8.91E-02
COPPER	1.30E+00	5.05E-01	2.03E-02	1.22E+00	4.78E-01	1.92E-02	1.19E+00	4.64E-01	1.87E-02	1.16E+00	4.51E-01	1.81E-02	1.15E+00	4.50E-01	1.81E-02
LEAD	**2.71E-01**	**1.16E+01**	**2.91E-02**	**2.60E-01**	**1.11E+01**	**2.79E-02**	**2.54E-01**	**1.09E+01**	**2.73E-02**	**2.49E-01**	**1.06E+01**	**2.67E-02**	**2.49E-01**	**1.06E+01**	**2.67E-02**
MERCURY	**1.32E-02**	**3.32E-01**	**7.19E-02**	**1.16E-02**	**2.92E-01**	**6.32E-02**	**1.08E-02**	**2.72E-01**	**5.88E-02**	**1.00E-02**	**2.53E-01**	**5.48E-02**	**1.00E-02**	**2.52E-01**	**5.45E-02**
NICKEL	1.84E-01	1.19E-01	2.88E-03	8.62E-01	5.56E-01	1.35E-02	1.20E+00	7.74E-01	1.88E-02	1.52E+00	9.80E-01	2.37E-02	1.54E+00	9.93E-01	2.41E-02
SELENIUM	4.11E-02	1.79E-01	4.43E-02	9.11E-02	3.97E-01	9.81E-02	1.16E-01	5.05E-01	1.25E-01	1.39E-01	6.08E-01	1.50E-01	1.41E-01	6.14E-01	1.52E-01
SILVER	2.55E-03	NA	NA	3.55E-03	NA	NA	4.05E-03	NA	NA	4.52E-03	NA	NA	4.55E-03	NA	NA
ZINC	6.79E+00	3.84E-01	3.84E-02	7.40E+00	4.18E-01	4.18E-02	7.71E+00	4.36E-01	4.36E-02	7.99E+00	4.52E-01	4.52E-02	8.01E+00	4.53E-01	4.53E-02
ALPHA-CHLORDANE*	1.58E-05	4.19E-06	8.38E-07	1.13E-05	2.99E-06	5.98E-07	9.04E-06	2.39E-06	4.78E-07	6.91E-06	1.83E-06	3.66E-07	6.77E-06	1.79E-06	3.58E-07
DIELDRIN*	2.78E-04	3.31E-03	2.93E-04	1.72E-04	2.04E-03	1.80E-04	1.18E-04	1.41E-03	1.24E-04	6.82E-05	8.10E-04	7.17E-05	6.50E-05	7.72E-04	6.83E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	1.77E-04	4.69E-05	9.39E-06	1.12E-04	2.95E-05	5.91E-06	7.88E-05	2.08E-05	4.17E-06	4.79E-05	1.27E-05	2.53E-06	4.59E-05	1.21E-05	2.43E-06
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**2.76E-03**	**2.32E-03**	**3.69E-05**	**2.72E-03**	**2.29E-03**	**3.64E-05**	**2.70E-03**	**2.27E-03**	**3.62E-05**	**2.68E-03**	**2.26E-03**	**3.59E-05**	**2.68E-03**	**2.26E-03**	**3.59E-05**
Total PCB	**1.04E-02**	**1.08E-01**	**8.96E-03**	**5.80E-03**	**6.05E-02**	**5.00E-03**	**3.50E-03**	**3.65E-02**	**3.02E-03**	**1.34E-03**	**1.40E-02**	**1.16E-03**	**1.20E-03**	**1.26E-02**	**1.04E-03**
Total 4,4-DDx	**3.26E-03**	**4.57E-01**	**5.34E-03**	**2.40E-03**	**3.36E-01**	**3.92E-03**	**1.96E-03**	**2.75E-01**	**3.21E-03**	**1.56E-03**	**2.18E-01**	**2.55E-03**	**1.53E-03**	**2.14E-01**	**2.50E-03**
Total HPAH	**8.51E-01**	**NA**	**NA**	**4.74E-01**	**NA**	**NA**	**2.86E-01**	**NA**	**NA**	**1.09E-01**	**NA**	**NA**	**9.79E-02**	**NA**	**NA**
Total LPAH	**7.39E-02**	**NA**	**NA**	**3.98E-02**	**NA**	**NA**	**2.28E-02**	**NA**	**NA**	**6.73E-03**	**NA**	**NA**	**5.71E-03**	**NA**	**NA**
Total PAH	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-26. Summary of Surf Scoter BERA HQs for a Range of SUFs at IR Site 20 (2005 Subsurface Data Set)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.015 Ref 0.985			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	4.67E-02	NA	NA	3.13E-02	NA	NA	2.36E-02	NA	NA	1.64E-02	NA	NA	1.60E-02	NA	NA
ARSENIC	1.69E+00	3.12E-01	7.79E-02	1.66E+00	3.05E-01	7.63E-02	1.64E+00	3.02E-01	7.55E-02	1.62E+00	2.99E-01	7.48E-02	1.62E+00	2.99E-01	7.47E-02
CADMIUM	4.40E-03	5.15E-02	2.53E-04	4.08E-03	4.78E-02	2.34E-04	3.92E-03	4.59E-02	2.25E-04	3.77E-03	4.42E-02	2.17E-04	3.76E-03	4.41E-02	2.16E-04
CHROMIUM	1.07E+00	4.11E-01	7.01E-02	1.21E+00	4.67E-01	7.96E-02	1.28E+00	4.95E-01	8.44E-02	1.35E+00	5.21E-01	8.88E-02	1.36E+00	5.23E-01	8.91E-02
COPPER	1.32E+00	5.15E-01	2.07E-02	1.24E+00	4.83E-01	1.94E-02	1.20E+00	4.66E-01	1.88E-02	1.16E+00	4.51E-01	1.82E-02	1.15E+00	4.50E-01	1.81E-02
LEAD	**3.19E-01**	**1.36E+01**	**3.43E-02**	**2.84E-01**	**1.21E+01**	**3.05E-02**	**2.66E-01**	**1.14E+01**	**2.86E-02**	**2.50E-01**	**1.07E+01**	**2.68E-02**	**2.49E-01**	**1.06E+01**	**2.67E-02**
MERCURY	**7.79E-03**	**1.96E-01**	**4.24E-02**	**8.89E-03**	**2.24E-01**	**4.85E-02**	**9.45E-03**	**2.38E-01**	**5.15E-02**	**9.97E-03**	**2.51E-01**	**5.43E-02**	**1.00E-02**	**2.52E-01**	**5.45E-02**
NICKEL	1.93E-01	1.25E-01	3.02E-03	8.66E-01	5.59E-01	1.35E-02	1.20E+00	7.76E-01	1.88E-02	1.52E+00	9.80E-01	2.37E-02	1.54E+00	9.93E-01	2.41E-02
SELENIUM	4.49E-02	1.96E-01	4.84E-02	9.29E-02	4.05E-01	1.00E-01	1.17E-01	5.09E-01	1.26E-01	1.40E-01	6.08E-01	1.50E-01	1.41E-01	6.14E-01	1.52E-01
SILVER	3.12E-03	NA	NA	3.84E-03	NA	NA	4.19E-03	NA	NA	4.53E-03	NA	NA	4.55E-03	NA	NA
ZINC	7.13E+00	4.03E-01	4.03E-02	7.57E+00	4.28E-01	4.28E-02	7.79E+00	4.40E-01	4.40E-02	8.00E+00	4.52E-01	4.52E-02	8.01E+00	4.53E-01	4.53E-02
ALPHA-CHLORDANE*	2.10E-05	5.56E-06	1.11E-06	1.39E-05	3.67E-06	7.35E-07	1.03E-05	2.73E-06	5.47E-07	6.99E-06	1.85E-06	3.70E-07	6.77E-06	1.79E-06	3.58E-07
DIELDRIN*	9.51E-04	1.13E-02	1.00E-03	5.08E-04	6.04E-03	5.34E-04	2.87E-04	3.40E-03	3.01E-04	7.83E-05	9.30E-04	8.23E-05	6.50E-05	7.72E-04	6.83E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	1.78E-04	4.70E-05	9.39E-06	1.12E-04	2.96E-05	5.91E-06	7.88E-05	2.09E-05	4.17E-06	4.79E-05	1.27E-05	2.53E-06	4.59E-05	1.21E-05	2.43E-06
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**2.79E-03**	**2.35E-03**	**3.74E-05**	**2.74E-03**	**2.30E-03**	**3.67E-05**	**2.71E-03**	**2.28E-03**	**3.63E-05**	**2.68E-03**	**2.26E-03**	**3.59E-05**	**2.68E-03**	**2.26E-03**	**3.59E-05**
Total PCB	**3.88E-02**	**4.04E-01**	**3.34E-02**	**2.00E-02**	**2.08E-01**	**1.72E-02**	**1.06E-02**	**1.10E-01**	**9.12E-03**	**1.77E-03**	**1.84E-02**	**1.52E-03**	**1.20E-03**	**1.26E-02**	**1.04E-03**
Total 4,4-DDx	**1.27E-02**	**1.77E+00**	**2.07E-02**	**7.10E-03**	**9.95E-01**	**1.16E-02**	**4.32E-03**	**6.04E-01**	**7.06E-03**	**1.70E-03**	**2.38E-01**	**2.78E-03**	**1.53E-03**	**2.14E-01**	**2.50E-03**
Total HPAH	**1.59E+00**	**NA**	**NA**	**8.46E-01**	**NA**	**NA**	**4.72E-01**	**NA**	**NA**	**1.20E-01**	**NA**	**NA**	**9.79E-02**	**NA**	**NA**
Total LPAH	**3.58E-01**	**NA**	**NA**	**1.82E-01**	**NA**	**NA**	**9.38E-02**	**NA**	**NA**	**1.10E-02**	**NA**	**NA**	**5.71E-03**	**NA**	**NA**
Total PAH	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-27. Summary of Least Tern BERA HQs for a Range of SUFs at IR Site 20 (All Years Data Set)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.012 Ref 0.988			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	1.55E-02	NA	NA	8.42E-03	NA	NA	4.91E-03	NA	NA	1.56E-03	NA	NA	1.39E-03	NA	NA
ARSENIC	1.66E-01	5.78E-02	1.44E-02	1.94E-01	6.78E-02	1.70E-02	2.09E-01	7.29E-02	1.82E-02	2.23E-01	7.77E-02	1.94E-02	2.23E-01	7.79E-02	1.95E-02
CADMIUM	1.29E-03	2.88E-02	1.41E-04	1.48E-03	3.29E-02	1.61E-04	1.57E-03	3.50E-02	1.72E-04	1.66E-03	3.70E-02	1.81E-04	1.67E-03	3.71E-02	1.82E-04
CHROMIUM	9.56E-01	6.99E-01	1.19E-01	5.93E-01	4.34E-01	7.39E-02	4.12E-01	3.01E-01	5.13E-02	2.39E-01	1.74E-01	2.98E-02	2.30E-01	1.68E-01	2.87E-02
COPPER	1.02E+00	7.53E-01	3.03E-02	8.15E-01	6.02E-01	2.42E-02	7.12E-01	5.27E-01	2.12E-02	6.15E-01	4.55E-01	1.83E-02	6.10E-01	4.51E-01	1.81E-02
LEAD	1.96E-01	1.58E+01	3.98E-02	1.36E-01	1.10E+01	2.77E-02	1.06E-01	8.61E+00	2.16E-02	7.80E-02	6.31E+00	1.59E-02	7.66E-02	6.20E+00	1.56E-02
MERCURY	1.14E-01	5.46E+00	1.18E+00	6.65E-02	3.17E+00	6.87E-01	4.26E-02	2.03E+00	4.40E-01	1.98E-02	9.44E-01	2.04E-01	1.87E-02	8.89E-01	1.93E-01
NICKEL	7.40E-02	9.04E-02	2.19E-03	7.49E-02	9.15E-02	2.22E-03	7.53E-02	9.20E-02	2.23E-03	7.57E-02	9.26E-02	2.24E-03	7.58E-02	9.26E-02	2.24E-03
SELENIUM	6.73E-02	5.56E-01	1.37E-01	1.11E-01	9.20E-01	2.27E-01	1.33E-01	1.10E+00	2.72E-01	1.54E-01	1.27E+00	3.15E-01	1.56E-01	1.28E+00	3.17E-01
SILVER	1.00E-03	NA	NA	1.38E-03	NA	NA	1.56E-03	NA	NA	1.74E-03	NA	NA	1.75E-03	NA	NA
ZINC	7.66E+00	8.20E-01	8.20E-02	7.21E+00	7.73E-01	7.73E-02	6.99E+00	7.49E-01	7.49E-02	6.78E+00	7.26E-01	7.26E-02	6.77E+00	7.25E-01	7.25E-02
ALPHA-CHLORDANE*	5.48E-04	2.75E-04	5.50E-05	3.03E-04	1.52E-04	3.03E-05	1.80E-04	9.02E-05	1.80E-05	6.29E-05	3.15E-05	6.31E-06	5.71E-05	2.86E-05	5.72E-06
DIELDRIN*	2.67E-04	6.00E-03	5.31E-04	1.51E-04	3.40E-03	3.01E-04	9.32E-05	2.10E-03	1.86E-04	3.81E-05	8.58E-04	7.60E-05	3.54E-05	7.96E-04	7.05E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	3.16E-04	1.58E-04	3.17E-05	1.62E-04	8.10E-05	1.62E-05	8.44E-05	4.23E-05	8.47E-06	1.10E-05	5.52E-06	1.10E-06	7.34E-06	3.68E-06	7.36E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	5.00E-02	7.97E-02	1.27E-03	2.80E-02	4.47E-02	7.10E-04	1.70E-02	2.71E-02	4.31E-04	6.54E-03	1.04E-02	1.66E-04	6.02E-03	9.60E-03	1.53E-04
Total PCB	2.60E-01	5.14E+00	4.24E-01	1.33E-01	2.63E+00	2.17E-01	6.98E-02	1.38E+00	1.14E-01	9.36E-03	1.85E-01	1.53E-02	6.34E-03	1.25E-01	1.03E-02
Total 4,4-DDx	3.93E-02	1.04E+01	1.22E-01	2.15E-02	5.69E+00	6.65E-02	1.25E-02	3.33E+00	3.88E-02	4.04E-03	1.07E+00	1.25E-02	3.61E-03	9.59E-01	1.12E-02
Total HPAH	2.10E-02	NA	NA	1.27E-02	NA	NA	8.49E-03	NA	NA	4.51E-03	NA	NA	4.31E-03	NA	NA
Total LPAH	1.14E-02	NA	NA	7.14E-03	NA	NA	4.99E-03	NA	NA	2.94E-03	NA	NA	2.84E-03	NA	NA
Total PAH	2.74E-02	NA	NA	1.59E-02	NA	NA	1.01E-02	NA	NA	4.59E-03	NA	NA	4.31E-03	NA	NA

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-28. Summary of Least Tern BERA HQs for a Range of SUFs at IR Site 20 (2005 Surface)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.012 Ref 0.988			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	2.39E-04	NA	NA	8.14E-04	NA	NA	1.10E-03	NA	NA	1.38E-03	NA	NA	1.39E-03	NA	NA
ARSENIC	1.18E-01	4.13E-02	1.03E-02	1.71E-01	5.96E-02	1.49E-02	1.97E-01	6.88E-02	1.72E-02	2.22E-01	7.75E-02	1.94E-02	2.23E-01	7.79E-02	1.95E-02
CADMIUM	1.00E-03	2.23E-02	1.09E-04	1.34E-03	2.97E-02	1.46E-04	1.50E-03	3.34E-02	1.64E-04	1.66E-03	3.69E-02	1.81E-04	1.67E-03	3.71E-02	1.82E-04
CHROMIUM	1.71E-01	1.25E-01	2.13E-02	2.01E-01	1.47E-01	2.50E-02	2.15E-01	1.57E-01	2.68E-02	2.29E-01	1.68E-01	2.86E-02	2.30E-01	1.68E-01	2.87E-02
COPPER	7.39E-01	5.46E-01	2.20E-02	6.74E-01	4.99E-01	2.01E-02	6.42E-01	4.75E-01	1.91E-02	6.12E-01	4.52E-01	1.82E-02	6.10E-01	4.51E-01	1.81E-02
LEAD	**1.22E-01**	**9.89E+00**	**2.48E-02**	**9.94E-02**	**8.05E+00**	**2.02E-02**	**8.80E-02**	**7.12E+00**	**1.79E-02**	**7.71E-02**	**6.24E+00**	**1.57E-02**	**7.66E-02**	**6.20E+00**	**1.56E-02**
MERCURY	**2.17E-01**	**1.04E+01**	**2.25E+00**	**1.18E-01**	**5.63E+00**	**1.22E+00**	**6.83E-02**	**3.26E+00**	**7.06E-01**	**2.10E-02**	**1.00E+00**	**2.17E-01**	**1.87E-02**	**8.89E-01**	**1.93E-01**
NICKEL	4.08E-02	4.99E-02	1.21E-03	5.83E-02	7.12E-02	1.73E-03	6.70E-02	8.19E-02	1.99E-03	7.54E-02	9.21E-02	2.23E-03	7.58E-02	9.26E-02	2.24E-03
SELENIUM	4.54E-02	3.74E-01	9.26E-02	1.00E-01	8.29E-01	2.05E-01	1.28E-01	1.06E+00	2.61E-01	1.54E-01	1.27E+00	3.15E-01	1.56E-01	1.28E+00	3.17E-01
SILVER	9.80E-04	NA	NA	1.36E-03	NA	NA	1.56E-03	NA	NA	1.74E-03	NA	NA	1.75E-03	NA	NA
ZINC	4.11E+00	4.41E-01	4.41E-02	5.44E+00	5.83E-01	5.83E-02	6.10E+00	6.54E-01	6.54E-02	6.74E+00	7.21E-01	7.21E-02	6.77E+00	7.25E-01	7.25E-02
ALPHA-CHLORDANE*	1.33E-04	6.69E-05	1.34E-05	9.52E-05	4.77E-05	9.55E-06	7.62E-05	3.82E-05	7.64E-06	5.80E-05	2.91E-05	5.81E-06	5.71E-05	2.86E-05	5.72E-06
DIELDRIN*	1.52E-04	3.41E-03	3.02E-04	9.35E-05	2.10E-03	1.86E-04	6.44E-05	1.45E-03	1.28E-04	3.67E-05	8.27E-04	7.32E-05	3.54E-05	7.96E-04	7.05E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	6.15E-05	3.08E-05	6.17E-06	3.44E-05	1.73E-05	3.45E-06	2.09E-05	1.05E-05	2.09E-06	7.99E-06	4.00E-06	8.01E-07	7.34E-06	3.68E-06	7.36E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**9.34E-02**	**1.49E-01**	**2.37E-03**	**4.97E-02**	**7.93E-02**	**1.26E-03**	**2.79E-02**	**4.45E-02**	**7.07E-04**	**7.06E-03**	**1.13E-02**	**1.79E-04**	**6.02E-03**	**9.60E-03**	**1.53E-04**
Total PCB	**5.47E-02**	**1.08E+00**	**8.93E-02**	**3.05E-02**	**6.03E-01**	**4.98E-02**	**1.84E-02**	**3.64E-01**	**3.01E-02**	**6.91E-03**	**1.37E-01**	**1.13E-02**	**6.34E-03**	**1.25E-01**	**1.03E-02**
Total 4,4-DDx	**7.70E-03**	**2.04E+00**	**2.39E-02**	**5.66E-03**	**1.50E+00**	**1.75E-02**	**4.64E-03**	**1.23E+00**	**1.44E-02**	**3.66E-03**	**9.72E-01**	**1.13E-02**	**3.61E-03**	**9.59E-01**	**1.12E-02**
Total HPAH	**3.75E-02**	**NA**	**NA**	**2.09E-02**	**NA**	**NA**	**1.26E-02**	**NA**	**NA**	**4.71E-03**	**NA**	**NA**	**4.31E-03**	**NA**	**NA**
Total LPAH	**3.68E-02**	**NA**	**NA**	**1.98E-02**	**NA**	**NA**	**1.13E-02**	**NA**	**NA**	**3.24E-03**	**NA**	**NA**	**2.84E-03**	**NA**	**NA**
Total PAH	**4.76E-02**	**NA**	**NA**	**2.59E-02**	**NA**	**NA**	**1.51E-02**	**NA**	**NA**	**4.83E-03**	**NA**	**NA**	**4.31E-03**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-29. Summary of Least Tern BERA HQs for a Range of SUFs at IR Site 20 (2005 Subsurface)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.012 Ref 0.988			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	4.06E-03	NA	NA	2.73E-03	NA	NA	2.06E-03	NA	NA	1.42E-03	NA	NA	1.39E-03	NA	NA
ARSENIC	1.41E-01	4.90E-02	1.23E-02	1.82E-01	6.35E-02	1.59E-02	2.03E-01	7.07E-02	1.77E-02	2.22E-01	7.76E-02	1.94E-02	2.23E-01	7.79E-02	1.95E-02
CADMIUM	1.95E-03	4.33E-02	2.12E-04	1.81E-03	4.02E-02	1.97E-04	1.74E-03	3.86E-02	1.89E-04	1.67E-03	3.71E-02	1.82E-04	1.67E-03	3.71E-02	1.82E-04
CHROMIUM	1.81E-01	1.32E-01	2.26E-02	2.06E-01	1.50E-01	2.56E-02	2.18E-01	1.59E-01	2.71E-02	2.29E-01	1.68E-01	2.86E-02	2.30E-01	1.68E-01	2.87E-02
COPPER	9.15E-01	6.76E-01	2.72E-02	7.63E-01	5.64E-01	2.27E-02	6.86E-01	5.07E-01	2.04E-02	6.14E-01	4.54E-01	1.83E-02	6.10E-01	4.51E-01	1.81E-02
LEAD	**1.96E-01**	**1.59E+01**	**3.99E-02**	**1.36E-01**	**1.10E+01**	**2.77E-02**	**1.06E-01**	**8.62E+00**	**2.16E-02**	**7.80E-02**	**6.31E+00**	**1.59E-02**	**7.66E-02**	**6.20E+00**	**1.56E-02**
MERCURY	**9.70E-02**	**4.62E+00**	**1.00E+00**	**5.78E-02**	**2.76E+00**	**5.97E-01**	**3.82E-02**	**1.82E+00**	**3.95E-01**	**1.96E-02**	**9.34E-01**	**2.02E-01**	**1.87E-02**	**8.89E-01**	**1.93E-01**
NICKEL	4.49E-02	5.48E-02	1.33E-03	6.03E-02	7.37E-02	1.79E-03	6.80E-02	8.32E-02	2.02E-03	7.54E-02	9.21E-02	2.23E-03	7.58E-02	9.26E-02	2.24E-03
SELENIUM	4.95E-02	4.09E-01	1.01E-01	1.03E-01	8.46E-01	2.09E-01	1.29E-01	1.06E+00	2.63E-01	1.54E-01	1.27E+00	3.15E-01	1.56E-01	1.28E+00	3.17E-01
SILVER	1.20E-03	NA	NA	1.47E-03	NA	NA	1.61E-03	NA	NA	1.74E-03	NA	NA	1.75E-03	NA	NA
ZINC	1.43E+01	1.53E+00	1.53E-01	1.05E+01	1.13E+00	1.13E-01	8.64E+00	9.26E-01	9.26E-02	6.86E+00	7.34E-01	7.34E-02	6.77E+00	7.25E-01	7.25E-02
ALPHA-CHLORDANE*	1.77E-04	8.88E-05	1.78E-05	1.17E-04	5.87E-05	1.17E-05	8.71E-05	4.37E-05	8.73E-06	5.85E-05	2.93E-05	5.87E-06	5.71E-05	2.86E-05	5.72E-06
DIELDRIN*	5.18E-04	1.17E-02	1.03E-03	2.77E-04	6.23E-03	5.51E-04	1.56E-04	3.51E-03	3.11E-04	4.11E-05	9.25E-04	8.19E-05	3.54E-05	7.96E-04	7.05E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	7.30E-05	3.66E-05	7.32E-06	4.02E-05	2.01E-05	4.03E-06	2.37E-05	1.19E-05	2.38E-06	8.12E-06	4.07E-06	8.15E-07	7.34E-06	3.68E-06	7.36E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**1.20E-01**	**1.92E-01**	**3.05E-03**	**6.32E-02**	**1.01E-01**	**1.60E-03**	**3.46E-02**	**5.52E-02**	**8.78E-04**	**7.38E-03**	**1.18E-02**	**1.87E-04**	**6.02E-03**	**9.60E-03**	**1.53E-04**
Total PCB	**2.04E-01**	**4.03E+00**	**3.33E-01**	**1.05E-01**	**2.08E+00**	**1.72E-01**	**5.57E-02**	**1.10E+00**	**9.09E-02**	**8.69E-03**	**1.72E-01**	**1.42E-02**	**6.34E-03**	**1.25E-01**	**1.03E-02**
Total 4,4-DDx	**2.99E-02**	**7.94E+00**	**9.27E-02**	**1.68E-02**	**4.45E+00**	**5.19E-02**	**1.02E-02**	**2.70E+00**	**3.16E-02**	**3.93E-03**	**1.04E+00**	**1.22E-02**	**3.61E-03**	**9.59E-01**	**1.12E-02**
Total HPAH	**7.02E-02**	**NA**	**NA**	**3.73E-02**	**NA**	**NA**	**2.08E-02**	**NA**	**NA**	**5.10E-03**	**NA**	**NA**	**4.31E-03**	**NA**	**NA**
Total LPAH	**1.78E-01**	**NA**	**NA**	**9.05E-02**	**NA**	**NA**	**4.66E-02**	**NA**	**NA**	**4.92E-03**	**NA**	**NA**	**2.84E-03**	**NA**	**NA**
Total PAH	**1.21E-01**	**NA**	**NA**	**6.28E-02**	**NA**	**NA**	**3.35E-02**	**NA**	**NA**	**5.71E-03**	**NA**	**NA**	**4.31E-03**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-30. Summary of Double-Crested Cormorant BERA HQs for a Range of SUFs at IR Site 20 (All Years Data Set)

	SUF= 1 Ref= 0			SUF= 0.5 Ref= 0.5			SUF= 0.25 Ref= 0.75			SUF= 0.002 Ref= 0.998			SUF= 0 Ref= 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	1.57E-02	NA	NA	8.57E-03	NA	NA	4.99E-03	NA	NA	1.44E-03	NA	NA	1.41E-03	NA	NA
ARSENIC	5.65E-02	9.57E-03	2.39E-03	6.64E-02	1.12E-02	2.81E-03	7.13E-02	1.21E-02	3.02E-03	7.62E-02	1.29E-02	3.23E-03	7.62E-02	1.29E-02	3.23E-03
CADMIUM	6.58E-04	7.10E-03	3.48E-05	7.53E-04	8.13E-03	3.98E-05	8.01E-04	8.64E-03	4.24E-05	8.48E-04	9.15E-03	4.48E-05	8.48E-04	9.15E-03	4.49E-05
CHROMIUM	6.46E-01	2.29E-01	3.91E-02	4.00E-01	1.42E-01	2.42E-02	2.78E-01	9.86E-02	1.68E-02	1.56E-01	5.54E-02	9.45E-03	1.55E-01	5.51E-02	9.39E-03
COPPER	3.75E-01	1.34E-01	5.41E-03	3.00E-01	1.08E-01	4.32E-03	2.62E-01	9.40E-02	3.78E-03	2.25E-01	8.06E-02	3.24E-03	2.24E-01	8.05E-02	3.24E-03
LEAD	1.24E-01	4.87E+00	1.22E-02	8.62E-02	3.39E+00	8.51E-03	6.74E-02	2.65E+00	6.65E-03	4.86E-02	1.91E+00	4.80E-03	4.85E-02	1.90E+00	4.78E-03
MERCURY	3.65E-02	8.44E-01	1.83E-01	2.12E-02	4.91E-01	1.06E-01	1.36E-02	3.14E-01	6.80E-02	6.00E-03	1.39E-01	3.01E-02	5.94E-03	1.37E-01	2.98E-02
NICKEL	1.05E-01	6.23E-02	1.51E-03	1.06E-01	6.30E-02	1.53E-03	1.07E-01	6.34E-02	1.54E-03	1.08E-01	6.38E-02	1.55E-03	1.08E-01	6.38E-02	1.55E-03
SELENIUM	2.01E-02	8.06E-02	1.99E-02	3.33E-02	1.33E-01	3.30E-02	3.99E-02	1.60E-01	3.95E-02	4.64E-02	1.86E-01	4.60E-02	4.65E-02	1.86E-01	4.60E-02
SILVER	4.81E-04	NA	NA	6.61E-04	NA	NA	7.50E-04	NA	NA	8.39E-04	NA	NA	8.40E-04	NA	NA
ZINC	2.39E+00	1.24E-01	1.24E-02	2.25E+00	1.17E-01	1.17E-02	2.18E+00	1.14E-01	1.14E-02	2.12E+00	1.10E-01	1.10E-02	2.11E+00	1.10E-01	1.10E-02
ALPHA-CHLORDANE*	1.63E-04	3.97E-05	7.95E-06	9.01E-05	2.19E-05	4.39E-06	5.36E-05	1.30E-05	2.61E-06	1.73E-05	4.21E-06	8.42E-07	1.70E-05	4.14E-06	8.28E-07
DIELDRIN*	7.98E-05	8.72E-04	7.72E-05	4.52E-05	4.94E-04	4.37E-05	2.79E-05	3.05E-04	2.70E-05	1.07E-05	1.17E-04	1.04E-05	1.06E-05	1.16E-04	1.02E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	9.56E-05	2.33E-05	4.65E-06	4.89E-05	1.19E-05	2.38E-06	2.56E-05	6.22E-06	1.24E-06	2.41E-06	5.86E-07	1.17E-07	2.22E-06	5.41E-07	1.08E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	1.48E-02	1.15E-02	1.82E-04	8.29E-03	6.42E-03	1.02E-04	5.03E-03	3.90E-03	6.20E-05	1.81E-03	1.40E-03	2.23E-05	1.78E-03	1.38E-03	2.19E-05
Total PCB	7.73E-02	7.41E-01	6.12E-02	3.96E-02	3.80E-01	3.14E-02	2.07E-02	1.99E-01	1.64E-02	2.03E-03	1.95E-02	1.61E-03	1.88E-03	1.81E-02	1.49E-03
Total 4,4-DDx	1.17E-02	1.50E+00	1.75E-02	6.37E-03	8.20E-01	9.58E-03	3.72E-03	4.79E-01	5.59E-03	1.09E-03	1.41E-01	1.64E-03	1.07E-03	1.38E-01	1.61E-03
Total HPAH	1.18E-02	NA	NA	7.13E-03	NA	NA	4.78E-03	NA	NA	2.45E-03	NA	NA	2.43E-03	NA	NA
Total LPAH	4.22E-03	NA	NA	2.63E-03	NA	NA	1.84E-03	NA	NA	1.05E-03	NA	NA	1.05E-03	NA	NA
Total PAH	1.55E-02	NA	NA	8.95E-03	NA	NA	5.69E-03	NA	NA	2.46E-03	NA	NA	2.43E-03	NA	NA

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-31. Summary of Double-Crested Cormorant BERA HQs for a Range of SUFs at IR Site 20 (2005 Surface Data Set)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.002 Ref 0.998			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	2.43E-04	NA	NA	8.28E-04	NA	NA	1.12E-03	NA	NA	1.41E-03	NA	NA	1.41E-03	NA	NA
ARSENIC	4.04E-02	6.84E-03	1.71E-03	5.83E-02	9.87E-03	2.47E-03	6.73E-02	1.14E-02	2.85E-03	7.62E-02	1.29E-02	3.22E-03	7.62E-02	1.29E-02	3.23E-03
CADMIUM	5.11E-04	5.51E-03	2.70E-05	6.80E-04	7.33E-03	3.59E-05	7.64E-04	8.24E-03	4.04E-05	8.48E-04	9.14E-03	4.48E-05	8.48E-04	9.15E-03	4.49E-05
CHROMIUM	1.16E-01	4.10E-02	6.99E-03	1.35E-01	4.80E-02	8.19E-03	1.45E-01	5.16E-02	8.79E-03	1.55E-01	5.51E-02	9.39E-03	1.55E-01	5.51E-02	9.39E-03
COPPER	2.72E-01	9.75E-02	3.92E-03	2.48E-01	8.90E-02	3.58E-03	2.36E-01	8.48E-02	3.41E-03	2.25E-01	8.06E-02	3.24E-03	2.24E-01	8.05E-02	3.24E-03
LEAD	**7.74E-02**	**3.04E+00**	**7.64E-03**	**6.30E-02**	**2.47E+00**	**6.21E-03**	**5.57E-02**	**2.19E+00**	**5.50E-03**	**4.86E-02**	**1.91E+00**	**4.79E-03**	**4.85E-02**	**1.90E+00**	**4.78E-03**
MERCURY	**6.93E-02**	**1.60E+00**	**3.47E-01**	**3.76E-02**	**8.70E-01**	**1.89E-01**	**2.18E-02**	**5.04E-01**	**1.09E-01**	**6.07E-03**	**1.40E-01**	**3.04E-02**	**5.94E-03**	**1.37E-01**	**2.98E-02**
NICKEL	5.79E-02	3.43E-02	8.32E-04	8.27E-02	4.91E-02	1.19E-03	9.51E-02	5.64E-02	1.37E-03	1.07E-01	6.37E-02	1.54E-03	1.08E-01	6.38E-02	1.55E-03
SELENIUM	1.36E-02	5.43E-02	1.34E-02	3.00E-02	1.20E-01	2.97E-02	3.82E-02	1.53E-01	3.79E-02	4.64E-02	1.86E-01	4.60E-02	4.65E-02	1.86E-01	4.60E-02
SILVER	4.71E-04	NA	NA	6.55E-04	NA	NA	7.48E-04	NA	NA	8.39E-04	NA	NA	8.40E-04	NA	NA
ZINC	1.29E+00	6.68E-02	6.68E-03	1.70E+00	8.84E-02	8.84E-03	1.91E+00	9.92E-02	9.92E-03	2.11E+00	1.10E-01	1.10E-02	2.11E+00	1.10E-01	1.10E-02
ALPHA-CHLORDANE*	3.97E-05	9.67E-06	1.93E-06	2.84E-05	6.90E-06	1.38E-06	2.27E-05	5.52E-06	1.10E-06	1.70E-05	4.15E-06	8.30E-07	1.70E-05	4.14E-06	8.28E-07
DIELDRIN*	4.54E-05	4.96E-04	4.39E-05	2.80E-05	3.06E-04	2.71E-05	1.93E-05	2.11E-04	1.87E-05	1.07E-05	1.16E-04	1.03E-05	1.06E-05	1.16E-04	1.02E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	1.86E-05	4.53E-06	9.06E-07	1.04E-05	2.54E-06	5.07E-07	6.32E-06	1.54E-06	3.08E-07	2.26E-06	5.49E-07	1.10E-07	2.22E-06	5.41E-07	1.08E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**2.77E-02**	**2.14E-02**	**3.41E-04**	**1.47E-02**	**1.14E-02**	**1.81E-04**	**8.25E-03**	**6.39E-03**	**1.02E-04**	**1.83E-03**	**1.42E-03**	**2.26E-05**	**1.78E-03**	**1.38E-03**	**2.19E-05**
Total PCB	**1.63E-02**	**1.56E-01**	**1.29E-02**	**9.08E-03**	**8.70E-02**	**7.19E-03**	**5.48E-03**	**5.26E-02**	**4.34E-03**	**1.91E-03**	**1.83E-02**	**1.52E-03**	**1.88E-03**	**1.81E-02**	**1.49E-03**
Total 4,4-DDx	**2.29E-03**	**2.94E-01**	**3.44E-03**	**1.68E-03**	**2.16E-01**	**2.53E-03**	**1.38E-03**	**1.77E-01**	**2.07E-03**	**1.07E-03**	**1.38E-01**	**1.62E-03**	**1.07E-03**	**1.38E-01**	**1.61E-03**
Total HPAH	**2.11E-02**	**NA**	**NA**	**1.18E-02**	**NA**	**NA**	**7.10E-03**	**NA**	**NA**	**2.47E-03**	**NA**	**NA**	**2.43E-03**	**NA**	**NA**
Total LPAH	**1.36E-02**	**NA**	**NA**	**7.31E-03**	**NA**	**NA**	**4.18E-03**	**NA**	**NA**	**1.07E-03**	**NA**	**NA**	**1.05E-03**	**NA**	**NA**
Total PAH	**2.68E-02**	**NA**	**NA**	**1.46E-02**	**NA**	**NA**	**8.52E-03**	**NA**	**NA**	**2.48E-03**	**NA**	**NA**	**2.43E-03**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

Table 6-32. Summary of Double-Crested Cormorant BERA HQs for a Range of SUFs at IR Site 20 (2005 Subsurface)

	SUF 1 Ref 0			SUF 0.5 Ref 0.5			SUF 0.25 Ref 0.75			SUF 0.002 Ref 0.998			SUF 0 Ref 1		
	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)	Dose (mg/kg/day)	NOAEL TRV HQ (unitless)	LOAEL TRV HQ (unitless)
ANTIMONY	4.13E-03	NA	NA	2.77E-03	NA	NA	2.09E-03	NA	NA	1.42E-03	NA	NA	1.41E-03	NA	NA
ARSENIC	4.80E-02	8.12E-03	2.03E-03	6.21E-02	1.05E-02	2.63E-03	6.92E-02	1.17E-02	2.93E-03	7.62E-02	1.29E-02	3.23E-03	7.62E-02	1.29E-02	3.23E-03
CADMIUM	9.92E-04	1.07E-02	5.25E-05	9.20E-04	9.93E-03	4.87E-05	8.84E-04	9.54E-03	4.68E-05	8.49E-04	9.15E-03	4.49E-05	8.48E-04	9.15E-03	4.49E-05
CHROMIUM	1.22E-01	4.34E-02	7.39E-03	1.39E-01	4.92E-02	8.39E-03	1.47E-01	5.22E-02	8.89E-03	1.55E-01	5.51E-02	9.39E-03	1.55E-01	5.51E-02	9.39E-03
COPPER	3.37E-01	1.21E-01	4.86E-03	2.81E-01	1.01E-01	4.05E-03	2.53E-01	9.06E-02	3.64E-03	2.25E-01	8.06E-02	3.24E-03	2.24E-01	8.05E-02	3.24E-03
LEAD	**1.24E-01**	**4.88E+00**	**1.23E-02**	**8.64E-02**	**3.39E+00**	**8.52E-03**	**6.74E-02**	**2.65E+00**	**6.65E-03**	**4.86E-02**	**1.91E+00**	**4.80E-03**	**4.85E-02**	**1.90E+00**	**4.78E-03**
MERCURY	**3.09E-02**	**7.15E-01**	**1.55E-01**	**1.84E-02**	**4.26E-01**	**9.23E-02**	**1.22E-02**	**2.82E-01**	**6.11E-02**	**5.99E-03**	**1.39E-01**	**3.00E-02**	**5.94E-03**	**1.37E-01**	**2.98E-02**
NICKEL	6.37E-02	3.78E-02	9.15E-04	8.56E-02	5.08E-02	1.23E-03	9.66E-02	5.73E-02	1.39E-03	1.07E-01	6.37E-02	1.54E-03	1.08E-01	6.38E-02	1.55E-03
SELENIUM	1.48E-02	5.93E-02	1.47E-02	3.06E-02	1.23E-01	3.04E-02	3.85E-02	1.54E-01	3.82E-02	4.64E-02	1.86E-01	4.60E-02	4.65E-02	1.86E-01	4.60E-02
SILVER	5.76E-04	NA	NA	7.08E-04	NA	NA	7.74E-04	NA	NA	8.39E-04	NA	NA	8.40E-04	NA	NA
ZINC	4.46E+00	2.32E-01	2.32E-02	3.29E+00	1.71E-01	1.71E-02	2.70E+00	1.40E-01	1.40E-02	2.12E+00	1.10E-01	1.10E-02	2.11E+00	1.10E-01	1.10E-02
ALPHA-CHLORDANE*	5.27E-05	1.28E-05	2.57E-06	3.49E-05	8.49E-06	1.70E-06	2.59E-05	6.31E-06	1.26E-06	1.71E-05	4.15E-06	8.31E-07	1.70E-05	4.14E-06	8.28E-07
DIELDRIN*	1.55E-04	1.69E-03	1.50E-04	8.28E-05	9.05E-04	8.01E-05	4.67E-05	5.10E-04	4.52E-05	1.09E-05	1.19E-04	1.05E-05	1.06E-05	1.16E-04	1.02E-05
ENDOSULFAN II*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMMA-CHLORDANE*	2.21E-05	5.38E-06	1.08E-06	1.22E-05	2.96E-06	5.92E-07	7.19E-06	1.75E-06	3.50E-07	2.26E-06	5.51E-07	1.10E-07	2.22E-06	5.41E-07	1.08E-07
DIBENZOFURAN*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRIBUTYLTIN	**3.56E-02**	**2.76E-02**	**4.39E-04**	**1.87E-02**	**1.45E-02**	**2.30E-04**	**1.02E-02**	**7.93E-03**	**1.26E-04**	**1.85E-03**	**1.43E-03**	**2.28E-05**	**1.78E-03**	**1.38E-03**	**2.19E-05**
Total PCB	**6.06E-02**	**5.81E-01**	**4.80E-02**	**3.13E-02**	**3.00E-01**	**2.48E-02**	**1.66E-02**	**1.59E-01**	**1.31E-02**	**2.00E-03**	**1.92E-02**	**1.58E-03**	**1.88E-03**	**1.81E-02**	**1.49E-03**
Total 4,4-DDx	**8.87E-03**	**1.14E+00**	**1.33E-02**	**4.97E-03**	**6.41E-01**	**7.48E-03**	**3.02E-03**	**3.89E-01**	**4.55E-03**	**1.09E-03**	**1.40E-01**	**1.64E-03**	**1.07E-03**	**1.38E-01**	**1.61E-03**
Total HPAH	**3.96E-02**	**NA**	**NA**	**2.10E-02**	**NA**	**NA**	**1.17E-02**	**NA**	**NA**	**2.50E-03**	**NA**	**NA**	**2.43E-03**	**NA**	**NA**
Total LPAH	**6.57E-02**	**NA**	**NA**	**3.34E-02**	**NA**	**NA**	**1.72E-02**	**NA**	**NA**	**1.18E-03**	**NA**	**NA**	**1.05E-03**	**NA**	**NA**
Total PAH	**6.83E-02**	**NA**	**NA**	**3.54E-02**	**NA**	**NA**	**1.89E-02**	**NA**	**NA**	**2.56E-03**	**NA**	**NA**	**2.43E-03**	**NA**	**NA**

Bold text indicates concentrations above background. Constituents retained as a Tier 2 COPEC.
*Insufficient data to conduct background comparison. Constituent retained as a Tier 2 COPEC.
Subsurface background data not available for background evaluation. Therefore surface data used as a surrogate.

This appendix contains additional information to support the data comparison to background concentrations. This appendix is organized in the following way.

The following tables are presented after the text.

C.1 Tier 2 Screening Refinement

The Tier 2 screening refinement step involves comparison of the concentration distributions observed on site to ambient distributions using distribution shift tests. It corresponds to Step 3a of the Navy's Ecological Risk Assessment (ERA) process. The steps involved in this process are described below:

1. Reach agreement on an adequate data set to represent ambient or background conditions, and prepare this data set in the same manner as the site data.

2. If adequate data are present for both the site and ambient conditions, perform distribution shift tests as per Navy guidance, i.e., the t-test, Gehan test, quantile test and slippage test (United States Department of the Navy [DON], 1999). If one or more tests fail, retain for full evaluation in the ERA. For constituents where all tests pass (we conclude they are within the ambient), consider the potential risk due to ambient concentrations in the uncertainty analysis of the risk characterization step.

A brief description of the distribution shift test methods and results are presented in the following paragraphs. Additionally, a visual review of the range of concentrations between site and ambient and/or reference concentrations using the box plots provided in Appendix A is summarized.

C.2 Distribution Shift Tests

Surface sediment chemistry results for the offshore areas were compared to data from San Francisco Bay ambient locations to determine if site-specific chemical concentrations were higher than ambient levels in San Francisco Bay. The data used to represent ambient conditions in San Francisco Bay were collected as part of the Bay Protection and Toxic Hotspot Cleanup Program (BPTCP) and the San Francisco Estuary Institute (SFEI) Regional Monitoring Program (RMP). All available sediment chemistry results from 1993 through 1997 from stations classified as ambient (RWQCB, 1998) were used. For chemicals that were not analyzed by the RMP or BPTCP, results were used from sediment samples collected at ten San Francisco Bay reference stations for the Navy's 1998 Alameda Point ERA (TtEMI, 1998) and the Navy's Hunter's Point Shipyard Validation Study (VS) (Battelle et al., 2005).

Distribution shift tests were conducted to statistically compare the data from each offshore site to the distribution of ambient concentrations. Each distribution shift test yielded a test statistic and an associated significance level (also known as a p-value). The significance level is the probability that the test statistic would be as large or larger than the one produced if the two data sets were from the same distribution (i.e., were both from the ambient distribution). A small significance level (i.e., <0.05) indicates that it is not likely that two given data sets come from the same distribution. Four distribution shift tests were used: the *t*-test, Gehan test (same as the Wilcoxon Rank Sum test with a robust ranking procedure to accommodate nondetects at multiple detection limits), quantile test and slippage test. The t-test and Gehan test are best suited for assessing complete shifts (of central location) in the distributions. The t-test test evaluates differences between two population means and the Gehan test evaluates differences between two population medians. The quantile test and slippage test are better suited by assessing partial shifts, (i.e., a shift of a subset of the site results to larger concentrations). The quantile test compares the relative proportions of site and ambient concentrations that are in the largest 20%, that is, larger than the combined 80^{th} percentile. A slippage test is used to determine whether the number of site concentrations larger than the maximum ambient concentration is statistically significant. The t-test is only appropriate when the populations being compared are either both normal or log-normal. The other three tests are nonparametric and applicable to any distribution. The tests are not conclusive for cases where either the site data or ambient data have a detection rate of less than 50%. Distributions of site data and San Francisco Bay ambient data for most detected chemicals are summarized in box plots included in

Appendix A. The distribution shift tests provide statistical significance to the differences that can be seen in the box plots.

Ambient inorganic concentrations were influenced by grain size; therefore, ambient stations having less than 40% fines were categorized as "coarse" and with 40% or more fines as "fine" (RWQCB, 1998). Distribution shift tests for inorganic chemicals were based on grain size to the extent possible. The sample locations in 1997 at Installation Restoration (IR) Site 24 and in 2001 at IR Site 20 did not analyze nor report grain size results. In order to include all site samples in a comparison and to accommodate the intended grain size distinction, the tests were performed multiple ways. Identified fine grain samples from the site are compared to ambient fine grain results, identified coarse grain samples from the site are compared to ambient coarse grain results, the combined set of all site samples are compared to the combined set of ambient results. The distribution shift test results for inorganic chemicals based on results from all years are listed in Table C-1 (IR Site 20) and C-2 (IR Site 24).

In addition to the distribution tests for the combined set of results for all years, the distribution tests were performed in the same manner on the data from 2005 (IR Site 20) or data from 2005 and 2006 (IR Site 24) to see if the more recent data would support the same conclusions. The results of the distribution shift tests on recent (2005 or 2005/2006) inorganic chemical data are listed in Table C-3 (IR Site 20) and C-4 (IR Site 24).

The distribution shift test results for organic chemicals based on results from all years are listed in Table C-5 (IR Site 20) and C-6 (IR Site 24). The tests were performed comparing the combined set of site samples to the combined set of ambient results. The organic chemical totals (sums of analytes within a suite) are based on sums that use half detection limits for nondetects. Due to the higher detection limits and lower detection rates observed in samples collected prior to 2005, the majority of comparisons for organic chemicals resulted in no conclusion. To take advantage of lower detection limits obtained in subsequent to 2005, the tests were also performed on recent data. The distribution shift test results for organic chemicals based on results from 2005 are listed in Table C-7 (IR Site 20) and C-8 (IR Site 24).

Compounds that failed any of the distribution shift tests or that could not be evaluated were carried forward as Tier 2 contaminants of potential ecological concern (COPECs) for evaluation in the baseline ecological risk assessment (BERA).

A general summary of the findings based on background comparison tests follows in separate paragraphs for IR Site 20 and IR Site 24.

C.3 IR Site 20 (Oakland Inner Harbor)

Results of background tests for inorganic chemicals at IR Site 20 are presented Tables C-1 and C-3. These tables indicate that arsenic, cadmium, nickel and silver were not different from ambient background in either the 2005 data set or the overall combined data set, nor were they different in any of the grain size classifications evaluated (fine, coarse, all). Antimony, chromium, copper and zinc were not different in the 2005 data, but were significantly different when data from all years were combined. The difference seen in all years for antimony was primarily a result of the samples collected in 1993 (see box plots, Figure A-1). Lead and mercury were different from San Francisco Bay ambient background in both the 2005 and all years combined data sets. The concentrations of mercury above ambient conditions appear to all be located offshore of Todd Shipyards (IR Site 28). Background comparisons excluding the results offshore of Todd Shipyards conclude that mercury is not greater than ambient in 2005 and all years combined (see test results for "MERCURY (no IR-28)" in Tables C-1 and C-3). The larger mercury concentrations offshore of Todd Shipyards are evident in the bubble plot (Figure A-69). Selenium could not be compared to background using standard background comparison tests due to the small number of detects at IR Site 20, but the IR Site 20 results (detects and the reported detection limits of nondetects) were all below the effects range-low (ER-L) (see Table 4-2). Modified background tests treating the IR Site 20 reported nondetects as detects at their reported detection limits and leaving the ambient data unchanged concluded that IR Site 20 selenium concentrations were not greater than ambient (see test results for "SELENIUM mod" in Tables C-1 and C-3).

The background comparison results for IR Site 20 organic chemicals are shown in Tables C-5 and C-7. Of the pesticides, background comparisons could only be conducted for the DDx compounds, because frequency of detection for the other pesticides was too low for statistical comparisons. Total DDx and Total 4,4'-DDx were statistically different than background in the 2005 and combined years data sets. Total PCBs, and all of the various Total PAH combinations evaluated, were also different than background in the 2005 and combined years data sets. The only individual PAH compounds not different than background were 2-methylnaphthalene, acenaphthene, benzo(g,h,i)perylene and naphthalene.

C.4 IR Site 24 (Pier Area)

Inorganic comparisons using coarse grained data could not be conducted because only two IR Site 24 sampling locations fit the definition for coarse grained sediment (< 40% fines). The two coarse stations in IR Site 24 were close to the shore line at SS005 (between Pier 2 and Pier 3) and PA C-19 (south of Pier 3 and just west of the Breakwater Beach docks). These stations are located south of the region that contained the largest concentrations and they did not produce elevated concentrations of any inorganic (see visual confirmation of largest concentrations to north of Pier 2 in bubble plots in Appendix A). The 1997 locations that had no grain size analyses were relatively distant from the shoreline and locations close to them were classified as fine (>40% fines). It can be assumed that the conclusions based on fine sediments and combined grain size at IR Site 24 will identify any inorganic chemicals above ambient.

Of the inorganic constituents, antimony, arsenic, nickel, and selenium were not different than San Francisco Bay ambient concentrations in either the All Years data set or the 2005/2006 data set (Table C-2 and Table C-4). Mercury was elevated compared to background in the All Years data set but not in the 2005/2006 data. Cadmium, chromium, copper, lead, silver and zinc were elevated compared to ambient in both the All Years data set and the 2005/2006 data.

Tributyl tin, 4,4'-DDx compounds, Total PCBs, and all PAHs were elevated compared to background in both the All Years and the 2005/2006 data sets (Table C-6 and Table C-8). Background comparisons could not be conducted for any pesticides other than the DDx compounds due to the infrequency of detection of those compounds.

References

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Table C-1. Distribution Shift Test Results for Inorganics from Combined Years at IR Site 20 (Oakland Inner Harbor)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[(a)]	Ambient D/N	Detect Rate	Test Results[(b)]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Fine Stations											
ANTIMONY	7/8	0.875	BPTCP[(d)]	20/20	1	F	0.5101	0.01481	0.003419		none
ARSENIC	8/8	1	RMP, BPTCP	148/148	1	P	0.9999	1	1		none
CADMIUM	7/8	0.875	RMP, BPTCP	148/148	1	P	0.9272	0.8267	0.05128		none
CHROMIUM	8/8	1	RMP[(c)]	128/128	1	P	0.557	0.1947	0.05882	0.4891	logN
COPPER	8/8	1	RMP, BPTCP	147/147	1	P	0.9726	0.8399	1	0.9523	logN
LEAD	8/8	1	RMP, BPTCP	148/148	1	P	0.5859	0.1958	1	0.5376	logN
MERCURY	8/8	1	RMP, BPTCP	159/159	1	P	0.9496	0.4931	1		none
MERCURY (no IR-28)	8/8	1	RMP, BPTCP	159/159	1	P	0.9496	0.4931	1		none
NICKEL	8/8	1	RMP, BPTCP	147/147	1	P	1	1	1		none
SELENIUM	0/8	0	RMP, BPTCP	142/148	0.959	NA					
SELENIUM mod	8/8	1	RMP, BPTCP	142/148	0.959	P	0.8781	1	1		none
SILVER	4/8	0.5	RMP, BPTCP	136/136	1	P	0.9995	1	1		none
ZINC	8/8	1	RMP, BPTCP	148/148	1	P	0.9147	0.4967	1		none
Coarse Stations											
ANTIMONY	5/10	0.5	BPTCP	1/1	1	P	0.9625	1	1		none
ARSENIC	10/10	1	RMP, BPTCP	51/51	1	P	1	1	1		none
CADMIUM	10/10	1	RMP, BPTCP	51/51	1	P	0.3849	0.3054	0.1639	0.5019	logN
CHROMIUM	10/10	1	RMP	50/50	1	P	1	1	1		none
COPPER	10/10	1	RMP, BPTCP	47/47	1	P	0.3607	0.1192	0.1754	0.3821	logN
LEAD	10/10	1	RMP, BPTCP	51/51	1	F	0.02187	0.01909	0.1639		none
MERCURY	10/10	1	RMP, BPTCP	51/51	1	F	0.01854	0.01909	0.1639		none
MERCURY (no IR-28)	9/9	1	RMP, BPTCP	51/51	1	P	0.05574	0.07017	1	0.06619	logN
NICKEL	10/10	1	RMP, BPTCP	51/51	1	P	1	1	1	0.9999	logN
SELENIUM	0/10	0	RMP, BPTCP	51/51	1	NA					
SELENIUM mod	10/10	1	RMP, BPTCP	51/51	1	P	0.3738	1	1	0.4506	logN
SILVER	10/10	1	RMP, BPTCP	42/44	0.955	P	0.07364	0.07464	1		none
ZINC	10/10	1	RMP, BPTCP	51/51	1	P	0.9997	1	1		none

Table C-1. Distribution Shift Test Results for Inorganics from Combined Years at IR Site 20 (Oakland Inner Harbor) (continued)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
All Stations											
ANTIMONY	22/28	0.7857	BPTCP	21/21	1	F	0.9946	0.4001	0.02694		none
ARSENIC	28/28	1	RMP, BPTCP	199/199	1	P	1	0.9989	1	1	logN
CADMIUM	24/28	0.8571	RMP, BPTCP	199/199	1	P	0.9918	0.6472	0.1233		none
CHROMIUM	28/28	1	RMP	178/178	1	F	0.3474	0.000537	3.97E-11	0.2093	logN
COPPER	28/28	1	RMP, BPTCP	194/194	1	F	0.9411	0.5199	2.29E-05		none
LEAD	28/28	1	RMP, BPTCP	199/199	1	F	0.03094	0.000569	0.00019		none
MERCURY	28/28	1	RMP, BPTCP	211/211	1	F	0.9591	0.6834	0.01329		none
MERCURY (no IR-28)	25/25	1	RMP, BPTCP	211/211	1	P	0.9956	0.9204	1		none
NICKEL	28/28	1	RMP, BPTCP	198/198	1	P	1	0.8543	0.1239	1	logN
SELENIUM	9/28	0.3214	RMP, BPTCP	193/199	0.970	NA					
SELENIUM mod	28/28	1	RMP, BPTCP	193/199	0.970	P	0.9927	0.9881	1		none
SILVER	24/28	0.8571	RMP, BPTCP	178/180	0.989	P	1	1	1		none
ZINC	28/28	1	RMP, BPTCP	199/199	1	F	0.9982	0.5194	0.01474		none

Note: grain size not analyzed for samples in 2001 (N=10).
The results for SELENIUM "mod" replaced site nondetects with detects at the reported detection limit and kept nondetects in ambient as nondetects.
D/N=number of detected results / number of samples
F=fail. One or more statistical tests indicate a shifted site distribution.
NA=not applicable; too few detects to run statistical tests (need Detect rate>0.5 for both sets)
Navy Ref=SF Bay Reference Locations sampled by the Navy in 1998 and 2001
RMP=(San Francisco Estuary Institute) Regional Monitory Program
a) BPTCP=Bay Protection and Toxic Cleanup Program
(b) P=pass. No statistically significant results for any of the distribution shift tests
(c) Chromium results from RMP are used for reference set. The BPTCP analytical method was not considered comparable.
(d) Antimony was not analyzed in RMP samples.

Table C-3. Distribution Shift Test Results for Inorganics from 2005 at IR Site 20 (Oakland Inner Harbor)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Fine Stations from 2005											
ANTIMONY	3/4	0.75	BPTCP[d]	20/20	1	P	0.9991	1	1	0.9995	logN
ARSENIC	4/4	1	RMP, BPTCP	148/148	1	P	0.9994	1	1	0.999	logN
CADMIUM	4/4	1	RMP, BPTCP	148/148	1	P	0.9882	1	1		none
CHROMIUM	4/4	1	RMP[c]	128/128	1	P	0.9917	1	1		none
COPPER	4/4	1	RMP, BPTCP	147/147	1	P	0.9924	1	1	0.96	logN
LEAD	4/4	1	RMP, BPTCP	148/148	1	P	0.8578	0.5891	1	0.7804	logN
MERCURY	4/4	1	RMP, BPTCP	159/159	1	P	0.9468	0.5866	1		none
MERCURY (no IR-28)	4/4	1	RMP, BPTCP	159/159	1	P	0.9468	0.5866	1		none
NICKEL	4/4	1	RMP, BPTCP	147/147	1	P	0.9994	1	1		none
SELENIUM	0/4	0	RMP, BPTCP	142/148	0.959	NA					
SELENIUM mod	4/4	1	RMP, BPTCP	142/148	0.959	P	0.4862	1	1		
SILVER	4/4	1	RMP, BPTCP	136/136	1	P	0.9897	1	1		none
ZINC	4/4	1	RMP, BPTCP	148/148	1	P	0.9987	1	1		none
Coarse Stations from 2005											
ANTIMONY	5/10	0.5	BPTCP	1/1	1	P	0.9625	1	1		none
ARSENIC	10/10	1	RMP, BPTCP	51/51	1	P	1	1	1		none
CADMIUM	10/10	1	RMP, BPTCP	51/51	1	P	0.3849	0.3054	0.1639	0.5019	logN
CHROMIUM	10/10	1	RMP	50/50	1	P	1	1	1		none
COPPER	10/10	1	RMP, BPTCP	47/47	1	P	0.3607	0.1192	0.1754	0.3821	logN
LEAD	10/10	1	RMP, BPTCP	51/51	1	F	0.02187	0.01909	0.1639		none
MERCURY	10/10	1	RMP, BPTCP	51/51	1	F	0.01854	0.01909	0.1639		none
MERCURY (no IR-28)	9/9	1	RMP, BPTCP	51/51	1	P	0.05574	0.07017	1	0.0662	logN
NICKEL	10/10	1	RMP, BPTCP	51/51	1	P	1	1	1	0.9999	logN
SELENIUM	0/10	0	RMP, BPTCP	51/51	1	NA					
SELENIUM mod	10/10	1	RMP, BPTCP	51/51	1	P	0.3738	1	1	0.4506	logN
SILVER	10/10	1	RMP, BPTCP	42/44	0.955	P	0.07364	0.07464	1		none
ZINC	10/10	1	RMP, BPTCP	51/51	1	P	0.9997	1	1		none

Table C-3. Distribution Shift Test Results for Inorganics from 2005 at IR Site 20 (Oakland Inner Harbor) (continued)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[(a)]	Ambient D/N	Detect Rate	Test Results[(b)]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
All Stations from 2005											
ANTIMONY	8/14	0.571	BPTCP	21/21	1	P	1	1	1	1	logN
ARSENIC	14/14	1	RMP, BPTCP	199/199	1	P	1	1	1		none
CADMIUM	14/14	1	RMP, BPTCP	199/199	1	P	0.9846	0.7795	1		none
CHROMIUM	14/14	1	RMP	178/178	1	P	1	1	1		none
COPPER	14/14	1	RMP, BPTCP	194/194	1	P	0.999	0.9587	0.06731		none
LEAD	14/14	1	RMP, BPTCP	199/199	1	P	0.6078	0.3218	0.06573		none
MERCURY	14/14	1	RMP, BPTCP	211/211	1	P	0.9024	0.5571	0.06222		none
MERCURY (no IR-28)	13/13	1	RMP, BPTCP	211/211	1	P	0.965	0.7652	1		none
NICKEL	14/14	1	RMP, BPTCP	198/198	1	P	1	1	1		none
SELENIUM	0/14	0	RMP, BPTCP	193/199	0.970	NA					
SELENIUM mod	14/14	1	RMP, BPTCP	193/199	0.970	P	0.9452	0.962	1		none
SILVER	14/14	1	RMP, BPTCP	178/180	0.989	P	0.9996	1	1		none
ZINC	14/14	1	RMP, BPTCP	199/199	1	P	1	1	1		none

The results for SELENIUM "mod" replaced site nondetects with detects at the reported detection limit and kept nondetects in ambient as nondetects.
D/N=number of detected results / number of samples
F=fail. One or more statistical tests indicate a shifted site distribution.
NA=not applicable; too few detects to run statistical tests (need Detect rate>0.5 for both sets).
Navy Ref=SF Bay Reference Locations sampled by the Navy in 1998 and 2001
RMP=(San Francisco Estuary Institute) Regional Monitoring Program
a) BPTCP=Bay Protection and Toxic Cleanup Program
(b) P=pass. No statistically significant results for any of the distribution shift tests.
(c) Chromium results from RMP are used for reference set. The BPTCP analytical method was not considered comparable.
(d) Antimony was not analyzed in RMP samples.

Table C-5. Distribution Shift Test Results for Organics from Combined Years at IR Site 20 (Oakland Inner Harbor)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Pesticides - All Stations											
2,4'-DDD	23/24	0.96	RMP, BPTCP	73/199	0.37	NA					
2,4'-DDE	3/24	0.13	RMP, BPTCP	19/199	0.10	NA					
2,4'-DDT	15/24	0.63	RMP, BPTCP	5/185	0.03	NA					
4,4'-DDD	27/28	0.96	RMP, BPTCP	179/199	0.90	F	0.00011	0.00011	1.84E-09		None
4,4'-DDE	26/28	0.93	RMP, BPTCP	185/199	0.93	F	0.1379	0.3513	0.001703		None
4,4'-DDT	20/28	0.71	RMP, BPTCP	84/199	0.42	NA					
ALDRIN	0/28	0.00	RMP, BPTCP	9/185	0.05	NA					
ALPHA-BHC	0/28	0.00	RMP, BPTCP	28/199	0.14	NA					
ALPHA-CHLORDANE	15/28	0.54	RMP, BPTCP	32/199	0.16	NA					
DIELDRIN	15/28	0.54	RMP, BPTCP	64/199	0.32	NA					
ENDOSULFAN I	0/28	0	BPTCP	0/21	0	NA					
ENDOSULFAN II	2/28	0.07	BPTCP	1/21	0.05	NA					
ENDOSULFAN SULFATE	0/28	0	BPTCP	0/21	0	NA					
ENDRIN	0/28	0	RMP, BPTCP	17/185	0.09	NA					
ENDRIN ALDEHYDE	3/28	0.11	none	0/0	0	NA					
GAMMA-BHC (LINDANE)	0/28	0.00	RMP, BPTCP	28/199	0.14	NA					
GAMMA-CHLORDANE	9/28	0.32	RMP	29/178	0.16	NA					
HEPTACHLOR	0/28	0.00	RMP, BPTCP	1/185	0.01	NA					
HEPTACHLOR EPOXIDE	0/28	0.00	RMP, BPTCP	4/199	0.02	NA					
PAHs - All Stations											
2-METHYLNAPHTHALENE	24/28	0.86	RMP, BPTCP	141/185	0.76	P	0.9546	0.9879	1		None
ACENAPHTHENE	25/28	0.89	RMP, BPTCP	139/185	0.75	P	0.3096	0.4344	1		none
ACENAPHTHYLENE	25/28	0.89	RMP, BPTCP	149/185	0.81	F	0.00137	0.01229	0.01467		none
ANTHRACENE	28/28	1.00	RMP, BPTCP	179/199	0.90	F	6.60E-06	2.58E-05	0.00019		none
BENZO(A)ANTHRACENE	28/28	1.00	RMP, BPTCP	196/199	0.98	F	0.0001	1.86E-05	0.001703		none
BENZO(A)PYRENE	28/28	1.00	RMP, BPTCP	192/199	0.96	F	0.00085	0.00893	0.01474		none
BENZO(B)FLUORANTHENE	28/28	1.00	RMP, BPTCP	194/199	0.97	F	0.00913	0.00245	1		none
BENZO(G,H,I)PERYLENE	28/28	1.00	RMP, BPTCP	196/199	0.98	P	0.06199	0.1611	1		none
BENZO(K)FLUORANTHENE	26/28	0.93	RMP, BPTCP	188/199	0.94	F	8.90E-06	1.86E-05	0.01474		none
CHRYSENE	28/28	1.00	RMP, BPTCP	193/199	0.97	F	3.38E-06	2.60E-06	2.05E-05		none
DIBENZO(A,H)ANTHRACENE	25/28	0.89	RMP, BPTCP	164/199	0.82	F	0.00293	0.00245	0.1233		none
FLUORANTHENE	28/28	1.00	RMP, BPTCP	196/197	0.99	F	2.47E-05	2.95E-06	0.000197		none
FLUORENE	25/28	0.89	RMP, BPTCP	157/185	0.85	F	0.01064	0.00823	0.002063		none
INDENO(1,2,3-CD)PYRENE	28/28	1.00	RMP, BPTCP	196/199	0.98	F	0.01438	0.0276	1		none
NAPHTHALENE	24/28	0.86	RMP, BPTCP	143/160	0.89	P	0.9976	0.9988	1		none
PHENANTHRENE	28/28	1.00	RMP, BPTCP	188/192	0.98	F	5.18E-05	0.00012	2.40E-05		none
PYRENE	28/28	1.00	RMP, BPTCP	196/197	0.99	F	0.00037	0.00266	0.015		none

Table C-5. Distribution Shift Test Results for Organics from Combined Years at IR Site 20 (Oakland Inner Harbor) (continued)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Organotins – All Stations											
TRIBUTYL TIN	18/18	1.00	BPTCP	10/19	0.53	F	1.92E-05	0.00309	7.62E-08		none
Totals, sum with nondetects=half detection limits – All Stations											
Total 4,4-DDx	27/28	0.96	RMP, BPTCP	189/199	0.95	F	0.001	0.00245	0.01474		none
Total DDx	23/24	0.96	Navy Ref	9/10	0.90	F	0.00566	0.1001	0.008725		none
Total PCB	28/28	1.00	RMP, BPTCP	190/211	0.90	F	3.39E-08	2.43E-09	1.15E-09		none
Total HPAH (10)	28/28	1.00	RMP, BPTCP	197/197	1.00	F	0.00041	0.00063	0.015		none
Total HPAH (6)	28/28	1.00	RMP, BPTCP	196/197	0.99	F	9.90E-05	0.00063	0.015		none
Total LPAH (7)	28/28	1.00	RMP, BPTCP	156/160	0.98	F	0.0008	0.00042	5.30E-05		none
Total LPAH (6)	28/28	1.00	RMP, BPTCP	173/178	0.97	F	0.0002	0.0001	3.34E-05		none
Total PAH (12)	28/28	1.00	Navy Ref	10/10	1.00	F	0.00207	0.09382	0.001368	0	logN
Total PAH (13)	28/28	1.00	Navy Ref	5/5	1.00	F	0.02367	0.3402	0.02607	0.03	logN

D/N=number of detected results / number of samples
F=fail. One or more statistical tests indicate a shifted site distribution.
NA=not applicable; too few detects to run statistical tests (need Detect rate>0.5 for both sets).
Navy Ref=SF Bay Reference Locations sampled by the Navy in 1998 and 2001
RMP=(San Francisco Estuary Institute) Regional Monitory Program
a) BPTCP=Bay Protection and Toxic Cleanup Program
(b) P=pass. No statistically significant results for any of the distribution shift tests.

Table C-7. Distribution Shift Test Results for Organics from 2005 at IR Site 20 (Oakland Inner Harbor)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Pesticides – All 2005 Stations											
2,4'-DDD	14/14	1	RMP, BPTCP	73/199	0.37	NA					
2,4'-DDE	3/14	0.21	RMP, BPTCP	19/199	0.10	NA					
2,4'-DDT	9/14	0.64	RMP, BPTCP	5/185	0.03	NA					
4,4'-DDD	14/14	1	RMP, BPTCP	179/199	0.90	F	0.009801	0.04007	0.000229		none
4,4'-DDE	14/14	1	RMP, BPTCP	185/199	0.93	P	0.2806	0.9586	1		none
4,4'-DDT	12/14	0.86	RMP, BPTCP	84/199	0.42	NA					
ALDRIN	0/14	0	RMP, BPTCP	9/185	0.05	NA					
ALPHA-BHC	0/14	0	RMP, BPTCP	28/199	0.14	NA					
ALPHA-CHLORDANE	6/14	0.43	RMP, BPTCP	32/199	0.16	NA					
DIELDRIN	10/14	0.71	RMP, BPTCP	64/199	0.32	NA					
ENDOSULFAN I	0/14	0	BPTCP	0/21	0	NA					
ENDOSULFAN II	2/14	0.14	BPTCP	1/21	0.05	NA					
ENDOSULFAN SULFATE	0/14	0	BPTCP	0/21	0	NA					
ENDRIN	0/14	0	RMP, BPTCP	17/185	0.09	NA					
ENDRIN ALDEHYDE	0/14	0	none	0/0		NA					
GAMMA-BHC (LINDANE)	0/14	0	RMP, BPTCP	28/199	0.14	NA					
GAMMA-CHLORDANE	7/14	0.5	RMP	29/178	0.16	NA					
HEPTACHLOR	0/14	0	RMP, BPTCP	1/185	0.01	NA					
HEPTACHLOR EPOXIDE	0/14	0	RMP, BPTCP	4/199	0.02	NA					
PAHs – All 2005 Stations											
2-METHYLNAPHTHALENE	14/14	1	RMP, BPTCP	141/185	0.76	P	0.9836	0.9581	1		none
ACENAPHTHENE	14/14	1	RMP, BPTCP	139/185	0.75	P	0.5974	0.8269	1		none
ACENAPHTHYLENE	14/14	1	RMP, BPTCP	149/185	0.81	F	0.02609	0.1134	0.07035		none
ANTHRACENE	14/14	1	RMP, BPTCP	179/199	0.90	F	0.007217	0.04007	0.00403		none
BENZO(A)ANTHRACENE	14/14	1	RMP, BPTCP	196/199	0.98	F	0.02671	0.03583	0.06573		none
BENZO(A)PYRENE	14/14	1	RMP, BPTCP	192/199	0.96	F	0.0496	0.1265	0.06573		none
BENZO(B)FLUORANTHENE	14/14	1	RMP, BPTCP	194/199	0.97	P	0.2175	0.1165	1		none
BENZO(G,H,I)PERYLENE	14/14	1	RMP, BPTCP	196/199	0.98	P	0.2483	0.2884	1		none
BENZO(K)FLUORANTHENE	14/14	1	RMP, BPTCP	188/199	0.94	F	0.000981	0.008362	0.06573		none
CHRYSENE	14/14	1	RMP, BPTCP	193/199	0.97	F	0.004142	0.03583	0.00403		none
DIBENZO(A,H)ANTHRACENE	14/14	1	RMP, BPTCP	164/199	0.82	F	0.04766	0.03583	1		none
FLUORANTHENE	14/14	1	RMP, BPTCP	196/197	0.99	F	0.008275	0.03742	0.004107		none
FLUORENE	14/14	1	RMP, BPTCP	157/185	0.85	P	0.1046	0.1353	0.07035		none
INDENO(1,2,3-CD)PYRENE	14/14	1	RMP, BPTCP	196/199	0.98	P	0.1495	0.2884	1		none
NAPHTHALENE	14/14	1	RMP, BPTCP	143/160	0.89	P	0.9957	1	1		none
PHENANTHRENE	14/14	1	RMP, BPTCP	188/192	0.98	F	0.02542	0.1201	0.000254		none
PYRENE	14/14	1	RMP, BPTCP	196/197	0.99	F	0.03412	0.295	0.06635		none

Table C-7. Distribution Shift Test Results for Organics from 2005 at IR Site 20 (Oakland Inner Harbor) (continued)

Constituent	IR20 D/N	Detect Rate	Ambient Data Set[a]	Ambient D/N	Detect Rate	Test Results[b]	Gehan Test	Quantile Test	Slippage Test	t-Test	Common Distribution
Organotins - All 2005 Stations											
TRIBUTYL TIN	14/14	1	BPTCP	10/19	0.5263	F	0.000192	0.002711	5.10E-07		none
Totals, sum with nondetects=half detection limits - All 2005 Stations											
Total 4,4-DDx	14/14	1.00	RMP, BPTCP	189/199	0.95	F	0.02017	0.1165	1		none
Total DDx	14/14	1.00	Navy Ref	9/10	0.90	F	0.003859	0.0942	0.009916	0.008	logN
Total PCB	14/14	1.00	RMP, BPTCP	190/211	0.90	F	9.25E-05	0.000226	0.003611		none
Total HPAH (10)	14/14	1.00	RMP, BPTCP	197/197	1.00	F	0.03695	0.1204	0.06635		none
Total HPAH (6)	14/14	1.00	RMP, BPTCP	196/197	0.99	F	0.02063	0.03742	0.06635		none
Total LPAH (7)	14/14	1.00	RMP, BPTCP	156/160	0.98	F	0.07397	0.1111	0.000422		none
Total LPAH (6)	14/14	1.00	RMP, BPTCP	173/178	0.97	F	0.03667	0.1172	0.000313		none
Total PAH (12)	14/14	1.00	Navy Ref	10/10	1.00	F	0.01405	0.0942	0.02231	0.029	logN
Total PAH (13)	14/14	1.00	Navy Ref	5/5	1.00	P	0.07564	0.3756	0.1107	0.074	logN

D/N=number of detected results / number of samples
F=fail. One or more statistical tests indicate a shifted site distribution.
NA=not applicable; too few detects to run statistical tests (need Detect rate>0.5 for both sets).
Navy Ref=SF Bay Reference Locations sampled by the Navy in 1998 and 2001
RMP=(San Francisco Estuary Institute) Regional Monitory Program
a) BPTCP=Bay Protection and Toxic Cleanup Program
(b) P=pass. No statistically significant results for any of the distribution shift tests.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record¹
11	**index of the Administrative Record file**	**Section 2.8.3**	Alameda Point NAS Draft Administrative Record File Index. Pages 1 through 58.

ALAMEDA POINT NAS

DRAFT ADMINISTRATIVE RECORD FILE INDEX - UPDATE (SORTED BY RECORD DATE/RECORD NUMBER)

ADMINISTRATIVE RECORD INDEX FOR IR SITE 20

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 000212 NONE REPORT NONE 00215	11-24-1999 **08-01-1988** NONE 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT SAMPLING PLAN (SP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 1 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	

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BLDG. 41
BLDG. 410
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N00236 / 000214 NONE REPORT NONE 00066	11-24-1999 **08-01-1988** NONE 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT HEALTH AND SAFETY PLAN (HASP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 2 OF 8] {INCLUDES APPENDICES A THROUGH C} (***SEE COMMENTS). ***COMMENTS: [SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8]***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0011 41074200

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N00236 / 000787 NONE REPORT N62474-85-D-5620 00027	11-24-1999 **08-01-1988** DO 001 & DO 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT AIR SAMPLING PLAN, REMEDIAL INVESTIGASTION/FEASIBILITY STUDY (RI/FS) [VOLUME 1B OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0018 41074200

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
					CANS C-2 AREA YARD D-13		

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UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 000258 NONE REPORT N62474-85-D-5620 00027	11-24-1999 **09-01-1988** DO 001 & DO 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT AIR SAMPLING PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 1B OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0012 41074200

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N00236 / 000259 NONE REPORT N62474-85-D-5620 00038	11-24-1999 **11-01-1988** DO 005 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT PROJECT MANAGEMENT PLAN/SCHEDULE, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 5 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0012 41074200

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N00236 / 000260 NONE REPORT N62474-85-D-5620 00085	11-24-1999 **12-01-1988** DO 005 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT DATA MANAGEMENT PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 6 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0012 41074200

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N00236 / 000261 NONE REPORT NONE 00345	11-24-1999 **12-01-1988** NONE 00.0	CLEMENT ASSOCIATES NAVFAC - EFA WEST	FINAL DRAFT PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION PLAN (PHEE), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 7 OF 8] {MISSING SECTION 3} (***SEE COMMENTS). ***COMMENTS: [SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6 AND AR #262 - VOLUME 8]***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0013 41074200

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
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N00236 / 000262 NONE REPORT N62474-85-D-5620 00078	11-24-1999 **12-01-1988** DO 005 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL DRAFT FEASIBILITY STUDY (FS) PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 8 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #291 - VOLUME 1 DATED 1/1/89; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6 AND AR #261 - VOLUME 7)***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0013 41074200

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N00236 / 000274 NONE REPORT N62474-85-D-5620 00123	11-24-1999 **12-01-1988** DO 001 & DO 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL HEALTH AND SAFETY PLAN (HASP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 2 OF 8] {INCLUDES APPENDICES A THROUGH H} (***SEE COMMENTS). ***COMMENTS: [SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8]***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0013 41074200

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N00236 / 000275 NONE REPORT N62474-85-D-5620 00034	11-24-1999 **12-01-1988** DO 001 & 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL AIR SAMPLING PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 1B OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8) [SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM]***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 0140 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0013 41074200

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N00236 / 000291 NONE REPORT N62474-85-D-5620 00212	11-24-1999 **01-01-1989** DO 001 & DO 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	SAMPLING PLAN (SP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 1 OF 8] (REVISED VERSION) [***SEE COMMENTS]. ***COMMENTS: {SEE AR #212 - VOLUME 1 DATED 8/1/88; AR #807 - VOLUME 1A DATED 9/1/88; AR #257 - VOLUME 1A DATED 10/1/88; AR #787 - VOLUME 1B DATED 8/1/88; AR #258 - VOLUME 1B DATED 9/1/88; AR #214 - VOLUME 2; AR #213 - VOLUME 3; AR #263 - VOLUME 4 DATED 12/9/88; AR #788 - VOLUME 4 DATED 1/9/89; AR #259 - VOLUME 5; AR #260 - VOLUME 6; AR #261 - VOLUME 7 AND AR #262 - VOLUME 8}***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0013 41074200

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N00236 / 000322 NONE REPORT NONE 00045	11-24-1999 **02-01-1989** NONE 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL PROJECT MANAGEMENT PLAN/SCHEDULE, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 5 OF 8] (SEE AR #322 - EFAW TRANSMITTAL LETTER BY R. SERAYDARIAN) {***SEE COMMENTS}. ***COMMENTS: (SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8) {SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM}***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-01 IMAGED APNT_019	181-03-0179 BOX 0014 41074200

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N00236 / 000351 NONE REPORT N62474-85-D-5620 00154	11-24-1999 **05-01-1989** DO 001 & DO 002 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	REVISED FINAL HEALTH AND SAFETY PLAN (HASP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 2 OF 8] {INCLUDES APPENDICES A THROUGH J} (***SEE COMMENTS). ***COMMENTS: [SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8]***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0014 41074200

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N00236 / 000361 NONE REPORT NONE 00086	11-24-1999 **05-01-1989** NONE 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	DATA MANAGEMENT PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 6 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8) [SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM]***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0014 41074200

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N00236 / 000371 NONE REPORT NONE 00364	11-24-1999 **06-01-1989** NONE 00.0	CLEMENT ASSOCIATES NAVFAC - EFA WEST	FINAL PRELIMINARY PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION PLAN (PHEE), REMEDIAL INVESTIGATION FEASIBILITY STUDY (RI/FS) [VOLUME 7 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6 AND AR #783 - VOLUME 8) [SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM]***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0015 41074200

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N00236 / 000780 NONE REPORT N62474-85-D-5620 00178	11-24-1999 **11-01-1989** DO 008 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	REVISED FINAL HEALTH AND SAFETY PLAN (HASP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 2 OF 8] {INCLUDES APPENDICES A THROUGH K} (***SEE COMMENTS). ***COMMENTS: [SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8] {SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM}***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0018 41074200

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UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 000783 NONE REPORT N62474-85-D-5620 00093	11-24-1999 **01-01-1990** DO 005 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL FEASIBILITY STUDY PLAN (FS), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 8 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #785 - VOLUME 1; AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6 AND AR #371 - VOLUME 7) {SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM}***	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0018 41074200

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					CANS C-2 AREA YARD D-13		

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N00236 / 000785 NONE REPORT N62474-85-D-5620 00283	11-24-1999 **02-01-1990** DO 008 00.0	CANONIE ENVIRONMENTAL NAVFAC - EFA WEST	FINAL SAMPLING PLAN (SP), REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) [VOLUME 1 OF 8] {***SEE COMMENTS}. ***COMMENTS: (SEE AR #311 - VOLUME 1A DATED 2/1/89; AR #789 - VOLUME 1A DATED 12/1/89; AR #786 - VOLUME 1A DATED 2/1/90; AR #275 - VOLUME 1B; AR #274 - VOLUME 2 DATED 12/1/88; AR #351 - VOLUME 2 DATED 5/1/89; AR #780 - VOLUME 2 DATED 11/1/89; AR #341 - VOLUME 3 DATED 5/1/89; AR #782 - VOLUME 3 DATED 1/1/90; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7 AND AR #783 - VOLUME 8) {SEE AR #858 - DRAFT FINAL RI/FS WORK PLAN ADDENDUM}***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 AREA 97 BLDG. 10 BLDG. 114 BLDG. 14 BLDG. 162 BLDG. 301 BLDG. 360 BLDG. 389 BLDG. 400 BLDG. 41 BLDG. 410 BLDG. 459 BLDG. 5 BLDG. 530 BLDG. 547	SOUTHWEST DIVISION - BLDG. 1 SW061211-02 IMAGED APNT_019	181-03-0179 BOX 0018 41074200

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					CANS C-2 AREA YARD D-13		
N00236 / 000858 NONE REPORT N62474-88-D-5086 00303	11-24-1999 **09-29-1993** 00107 00.0	PRC ENVIRONMENTAL MGMT INC. NAVFAC - EFA WEST	DRAFT FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORK PLAN ADDENDUM (INCLUDES COMMENTS ON DRAFT RI/FS WORK PLAN ADDENDUM BY R. HOUGH {COMMUNITY ADVISOR COMMITTEE}) [MISSING APPENDIX F] {PORTION OF THE COMMENTS IS SENSITIVE} (***SEE COMMENTS). ***COMMENTS: [SEE AR #785 - VOLUME 1; AR #786 - VOLUME 1A; AR #275 - VOLUME 1B; AR #780 - VOLUME 2; AR #782 - VOLUME 3; AR #301 - VOLUME 4; AR #322 - VOLUME 5; AR #361 - VOLUME 6; AR #371 - VOLUME 7& AR #783 - VOLUME 8] {SEE AR #986 - EFA WEST TRANSMITTAL LETTER BY G. MUNEKAWA}***	ADMIN RECORD INFO REPOSITORY SENSITIVE	001 002 003 004 005 006 007A 007B 007C 008 009 010A 010B 011 012 013 014 015 016 017 018 019 020	SOUTHWEST DIVISION - BLDG. 1 SW061211-03 IMAGED APNT_019	181-03-0179 BOX 0027 41074200
N00236 / 001401 RESP N62474-88-D-5086 00100	11-24-1999 **04-29-1997** 00107 00.0	PRC NAVY BERNHARD, TERESA	RESPONSE TO COMMENTS FOR THE DRAFT REVISED 02 OPERABLE UNIT 4 (OU 4) ECOLOGICAL RISK ASSESSMENT (ERA) AND DRAFT OU 4 FOLLOW-ON ECOLOGICAL ASSESSMENT (EA) WORK PLAN/. ***COMMENTS: DOCUMENT IS MISSING AT SWDIV***	ADMIN RECORD	017 020 OU 4	SOUTHWEST DIVISION - BLDG. 1	

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)	
N00236 / 001381 RESP NONE 00005	11-24-1999 **04-30-1997** NONE 00.0	NAVY BERNHARD, TERESA DTSC LANPHAR, THOMAS	RESPONSE TO COMMENTS FOR THE DRAFT REVISED 02 OPERABLE UNIT 4 (OU 4) ECOLOGICAL ASSESSMENT (EA) AND DRAFT OPERABLE UNIT 4 (OU 4) FOLLOW-ON ECOLOGICAL ASSESSMENT (EA)	INFO REPOSITORY	017 020 OU 4	SOUTHWEST DIVISION - BLDG. 1 SW071207-01 IMAGED APNT_027	181-03-0179 41074200	BOX 0036
N00236 / 001400 EFAW SER 18311TB/7015 CORRESPONDENCE NONE 00003	11-24-1999 **04-30-1997** NONE 00.0	NAVFAC - EFA WEST T. BERNHARD DISTRIBUTION	SUBMISSION OF THE RESPONSE TO COMMENTS FOR THE DRAFT REVISED 02 OPERABLE UNIT (OU) 4 ECOLOGICAL ASSESSMENT (EA) AND DRAFT OPERABLE UNIT (OU) 4 FOLLOW-ON ECOLOGICAL ASSESSMENT WORK PLAN/FIELD SAMPLING PLAN (W/OUT ENCLOSURE). ***COMMENTS: [AR #1400 IS A DUPLICATE OF AR #1381; AR #1400 WILL BE DELETED FROM THE DATABASE]***	ADMIN RECORD	017 020 OU 4	SOUTHWEST DIVISION - BLDG. 110 BOX 37 - 03/28/06	181-03-0179 41074200	BOX 0037
N00236 / 000036 NONE REPORT N62474-94-D-7609 00091	11-20-2000 **08-06-1998** 00124	TETRA TECH EM INC. BOUCHER, P. NAVFAC - EFA WEST	DRAFT ECOLOGICAL RISK ASSESSMENT, QUALITY ASSURANCE PROJECT PLAN - BREAKWATER BEACH, PIER AREA AND THE SEAPLANE LAGOON (SEE ***COMMENTS). ***COMMENTS: ALL EVEN-NUMBERED PAGES ARE MISSING.***	ADMIN RECORD INFO REPOSITORY	OU 0004 SITE 00017 SITE 00020 SITE 00024	SOUTHWEST DIVISION - BLDG. 1 SW070917-01 IMAGED APNT_025		

This Administrative Record (AR) Index includes references to documents which cite bibliography sources. These bibliographic citations are considered to be part of this AR but may not be cited separately in the index.

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N00236 / 001679 NONE MM NONE 00029	01-21-2000 **08-03-1999** NONE 10.4	NAVFAC - WESTERN DIVISION NAVFAC - WESTERN DIVISION	3 AUGUST 1999 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, HANDOUTS AND SIGN-IN SHEETS) [PORTION OF THE SIGN-IN SHEET IS CONFIDENTIAL]	ADMIN RECORD SENSITIVE	001 002 003 004 005 009 010 013 014 017 019 020 021 022 023 024 025 1112 360 400 410 BLDG. 14 BLDG. 162 BLDG. 5 OU 1 OU 2 OU 3 OU 4	SOUTHWEST DIVISION - BLDG. 1 SW060504-02 IMAGED APNT_009	181-03-0179 BOX 0045 41074200

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N00236 / 001676 NONE MM NONE 00043	01-21-2000 **11-11-1999** NONE 10.4	NAVFAC - SOUTHWEST DIVISION VARIOUS AGENCIES	11 NOVEMBER 1999 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS AND SIGN-IN SHEETS). ***COMMENTS: MISSING ENCLOSURE 6 OF ATTACHMENT C***	ADMIN RECORD	001 002 004 006 007 008 010 012 015 016 017 018 020 024 025 BLDG. 400 BLDG. 5 OU 1 OU 2 OU 3 OU 4	SOUTHWEST DIVISION - BLDG. 1 SW070427-02 IMAGED APNT_025	181-03-0179 BOX 0045 41074200
N00236 / 000077 SWDIV SER 06CA.MB\0230 MEMO N62474-94-D-7609 00134	04-04-2001 **02-28-2001** DO084	BATTELLE NAVFAC - SOUTHWEST DIVISION	DRAFT DATA SUMMARY MEMORANDUM OAKLAND INNER HARBOR AND TODD SHIPYARD - INCLUDES SWDIV TRANSMITTAL LETTER BY M. BLOOM	ADMIN RECORD INFO REPOSITORY	020 028	SOUTHWEST DIVISION - BLDG. 1 SW061120-01 IMAGED APNT_023	181-03-0179 BOX 0002 41074200
N00236 / 000078 G477703 REPORT GS-10F-0275K 00159	04-04-2001 **03-07-2001** NONE	BATTELLE D. GUNSTER NAVFAC - SOUTHWEST DIVISION	FINAL FIELD SAMPLING PLAN - OAKLAND INNER HARBOR AND TODD SHIPYARD SEDIMENT SCREENING STUDY (PORTION OF THE MAILING LIST IS SENSITIVE)	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 028	SOUTHWEST DIVISION - BLDG. 1 SW061120-01 IMAGED APNT_023	181-03-0179 BOX 0002 41074200

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 000230 PROJECT NO. G477703 & SWDIV SER 06CA.MB/0839 REPORT GS-10F-0275K 00076	09-21-2001 **08-24-2001** NONE	BATTELLE NAVFAC - SOUTHWEST DIVISION	DRAFT TECHNICAL MEMORANDUM OAKLAND INNER HARBOR AND TODD SHIPYARD - INCLUDES SWDIV TRANSMITTAL LETTER BY M. BLOOM (A PORTION OF THE MAILING LIST IS SENSITIVE)	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 028	SOUTHWEST DIVISION - BLDG. 1 SW061106-01 IMAGED APNT_021	181-03-0179 BOX 0011 41074200
N00236 / 000608 TC.A021.10074 MM N68711-00-D-0005 00014	06-11-2003 **09-04-2001** DO 0021	TETRA TECH EM INC. NAVFAC - SOUTHWEST DIVISION	04 SEPTEMBER 2001 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA AND SIGN-IN SHEETS)	ADMIN RECORD	003 007 009 011 016 017 020 021 024 028 029	SOUTHWEST DIVISION - BLDG. 1 SW060629-01 IMAGED APNT_007	181-03-0188 BOX 0013 41031858
N00236 / 002427 NONE CORRESPONDENCE NONE 00002	08-22-2006 **10-26-2001** NONE	USEPA - SAN FRANCISCO A. COOK NAVFAC - SOUTHWEST DIVISION M. BLOOM	REVIEW AND COMMENTS ON DRAFT TECHNICAL MEMORANDUM, OAKLAND INNER HARBOR AND TODD SHIPYARD	ADMIN RECORD	020 028	SOUTHWEST DIVISION - BLDG. 1 SW061106-02 IMAGED APNT_021	
N00236 / 000279 PROJECT NO. G477703 MEMO N47408-95-D-0730 00082	11-30-2001 **11-28-2001** NONE	BATTELLE NAVFAC - SOUTHWEST DIVISION	FINAL TECHNICAL MEMORANDUM OAKLAND INNER HARBOR AND TODD SHIPYARD	ADMIN RECORD INFO REPOSITORY	020 028	SOUTHWEST DIVISION - BLDG. 1 SW060223-02 IMAGED APNT_012	181-03-0179 BOX 0013 41074200

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N00236 / 000367 SWDIV SER 06CA.AD/0624 CORRESPONDENCE NONE 00035	06-18-2002 **06-14-2002** NONE	NAVFAC - SOUTHWEST DIVISION A. DICK US EPA - SAN FRANCISCO A. COOK	TRANSMITTAL OF DRAFT SITE MANAGEMENT PLAN AMENDMENT (W/ ENCLOSURE) [INCLUDES DRAFT SITE MANAGEMENT PLAN]	ADMIN RECORD INFO REPOSITORY	001 002 006 007 008 009 013 014 015 016 017 019 020 022 023 024 025 026 027 028 029 AREA 1 AREA 2 AREA 3 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B OU 4C OU 5 OU 6	SOUTHWEST DIVISION - BLDG. 1 SW070413-01 IMAGED APNT_022	181-03-0188 BOX 0002 41031858

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N00236 / 000412 TC.0190.11423 - MOD. 2 REPORT N62474-94-D-7609 00417	08-29-2002 **08-16-2002** 00190	TETRA TECH EM INC. G. FOULK NAVFAC - SOUTHWEST DIVISION	DRAFT SUPPLEMENTAL ENVIRONMENTAL BASELINE SURVEY. ***COMMENTS: FINAL ENVIRONMENTAL BASELINE SURVEY/COMMUNITY ENVIRONMENTAL RESPONSE FACILITATION ACT REPORT, DATED OCTOBER 1994 WAS NOT SUBMITTED TO THE ADMINISTRATIVE RECORDS***	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 019 020 021 022 023 024 025 026 027 028 029 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B	SOUTHWEST DIVISION - BLDG. 1 SW071221-04 IMAGED APNT_027	181-03-0188 BOX 0004 41031858

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					OU 4C OU 5 OU 6		
N00236 / 000751 NONE MM NONE 00061	06-17-2003 **08-20-2002** NONE	TETRA TECH EM INC. NAVFAC - SOUTHWEST DIVISION	20 AUGUST 2002 FINAL BASE REALIGNMENT AND CLOSURE (BRAC) CLEANUP TEAM (BCT) MONTHLY TRACKING MEETING AFTER ACTION REPORT (INCLUDES AGENDA, SIGN-IN SHEET, AND VARIOUS HANDOUTS)	ADMIN RECORD INFO REPOSITORY	009 011 014 015 016 020 021 028 OU 5	SOUTHWEST DIVISION - BLDG. 1 SW060921-01 IMAGED APNT_005	181-03-0188 BOX 0014 41031858

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N00236 / 000436 DS.A033.10075 AND SWDIV SER 06CA.LO/0019 REPORT N68711-00-D-0005 00237	10-31-2002 **10-08-2002** DO A033	TETRA TECH EM INC. B. KELLY NAVFAC - SOUTHWEST DIVISION L. OCAMPO	DRAFT TECHNICAL MEMORANDUM: EVALUATION OF ISSUES RELATED TO THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA); FACILITY PERMIT EPA ID CA 2170023236, TIERED PERMITS, AND THE NONPERMITTED AREAS (INCLUDES SWDIV TRANSMITTAL LETTER BY L. OCAMPO). ***COMMENTS: [PORTION OF THE MAILING LIST IS CONFIDENTIAL]***	ADMIN RECORD INFO REPOSITORY SENSITIVE	001 002 003 004 006 007 008 009 013 014 015 016 019 020 022 023 026 027 028 BLDG. 13 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B OU 4C OU 5 OU 6	SOUTHWEST DIVISION - BLDG. 1 SW060601-02 IMAGED APNT_013	181-03-0188 BOX 0006 41031858

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N00236 / 000456 NONE CORRESPONDENCE NONE 00007	01-29-2003 **12-16-2002** NONE	DTSC - BERKELEY M. LIAO NAVFAC - SOUTHWEST DIVISION L. OCAMPO	COMMENTS ON THE DRAFT TECHNICAL MEMORANDUM: EVALUATION OF ISSUES RELATED TO THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY PERMIT EPA ID CA 217002323G TIERED PERMITS AND THE NONPERMITTED AREAS	ADMIN RECORD INFO REPOSITORY	001 002 003 004 006 007 008 009 013 014 015 016 019 020 022 023 027 028 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B OU 4C OU 5 OU 6	SOUTHWEST DIVISION - BLDG. 1 SW060615-02 IMAGED APNT_004	181-03-0188 BOX 0010 41031858

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N00236 / 000470 SWDIV SER 06CA.AD/0357 REPORT NONE 00031	02-06-2003 **01-16-2003** NONE	NAVFAC - SOUTHWEST DIVISION A. DICK U.S. EPA A. COOK	TRANSMITTAL OF SITE MANAGEMENT PLAN UPDATE (W/ ENCLOSURE)	ADMIN RECORD INFO REPOSITORY	017 020 024 025 029 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B OU 4C OU 5 OU 6	SOUTHWEST DIVISION - BLDG. 1 SW060615-02 IMAGED APNT_004	181-03-0188 BOX 0010 41031858
N00236 / 000995 TC.A021.10125 MM N68711-00-D-0005 00047	08-20-2003 **01-21-2003** DO 0021	TETRA TECH EM INC. NAVFAC - SOUTHWEST DIVISION	21 JANUARY 2003 FINAL BASE REALIGNMENT AND CLOSURE (BRAC) CLEANUP TEAM (BCT) MONTHLY TRACKING MEETING AFTER ACTION REPORT (INCLUDES AGENDA, SIGN-IN SHEET, AND HANDOUT MATERIALS) [PORTION OF THE SIGN-IN SHEET IS SENSITIVE]	ADMIN RECORD INFO REPOSITORY SENSITIVE	001 005 007 009 011 013 014 015 016 017 020 021 027 028 029 OU 5	SOUTHWEST DIVISION - BLDG. 1 SW061120-02 IMAGED APNT_023	

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N00236 / 000772 NONE PUB NOTICE NONE 00016	08-04-2003 **07-01-2003** NONE	NAVFAC - SOUTHWEST DIVISION M. MCCLELLAND PUBLIC INTEREST	JULY 2003 ALAMEDA POINT FOCUS ENVIRONMENTAL NEWSLETTER	ADMIN RECORD	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032	SOUTHWEST DIVISION - BLDG. 1 SW070112-01 IMAGED APNT_008	181-03-0188 BOX 0016 41031858

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 001757 SWDIV SER 06CA.AD/1416 REPORT NONE 00033	01-15-2004 **11-05-2003** NONE	NAVFAC - SOUTHWEST DIVISION M. MCCLELLAND US EPA - SAN FRANCISCO A. COOK	SITE MANAGEMENT PLAN UPDATE - [INCLUDES SWDIV TRANSMITTAL LETTER BY M. MCCLELLAND]	ADMIN RECORD INFO REPOSITORY	001 002 003 004 005 006 007 008 009 011 012 013 014 015 016 018 019 020 021 022 023 024 025 026 027 OU 1 OU 2A OU 2B OU 2C OU 3 OU 4A OU 4B OU 4C OU 5 OU 6	SOUTHWEST DIVISION - BLDG. 1 SW060814-01 IMAGED APNT_014	

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N00236 / 002535 FILE NO. 2199.9285(JCH) CORRESPONDENCE NONE 00004	09-19-2006 **07-09-2004** NONE	CRWQCB - OAKLAND J. HUANG NAVFAC - SOUTHWEST DIVISION T. MACCHIARELLA	REVIEW AND COMMENTS ON SCHEDULE CHANGES IN SITE MANAGEMENT PLAN (SMP) [PORTION OF THE MAILING LIST IS SENSITIVE]	ADMIN RECORD SENSITIVE	001 014 020 024 OU 11 OU 21 OU 2B OU 3 OU 4	SOUTHWEST DIVISION - BLDG. 1 SW070817-03 IMAGED APNT_025	
N00236 / 001877 PROJ. NO. G486085 & SWDIV SER. 06CA.DN/0998 CORRESPONDENCE N47408-01-D-8207 00352	10-04-2004 **09-29-2004** NONE	BATTELLE NAVFAC - SOUTHWEST DIVISION	DRAFT OFFSHORE SEDIMENT CORE STUDY WORK PLAN AT OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD AND WESTERN BAYSIDE [INCLUDES SWDIV TRANSMITTAL LETTER BY T. MACCHIARELLA] {PORTION OF MAILING LIST IS CONFIDENTIAL}. ***COMMENTS: (INSERT PAGE: PAGE 12 THROUGH PAGE 13 AND CD - 10/07/04 DATA ADDENDUM TO DRAFT OFFSHORE SEDIMENT CORE STUDY WORK PLAN)***	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024 028 OU 4B OU 4C	SOUTHWEST DIVISION - BLDG. 1 SW061027-02 IMAGED APNT_016	
N00236 / 002477 NONE CORRESPONDENCE NONE 00004	08-28-2006 **11-01-2004** NONE	U.S. FISH AND WILDLIFE SERVICE D. HARLOW NAVFAC - SOUTHWEST DIVISION T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT OFFSHORE SEDIMENT CORE STUDY WORK PLAN (WP)	ADMIN RECORD	020 024 028 OU 4B OU 4C	SOUTHWEST DIVISION - BLDG. 1 SW061027-04 IMAGED APNT_016	
N00236 / 002437 FILE NO. 2199.9285(JCH) CORRESPONDENCE NONE 00006	08-22-2006 **01-06-2005** NONE	CRWQCB - OAKLAND J. HUANG BRAC PMO WEST T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT OFFSHORE SEDIMENT CORE STUDY WORK PLAN (WP) AT OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE	ADMIN RECORD INFO REPOSITORY	020 024 028 OU 4B OU 4C	SOUTHWEST DIVISION - BLDG. 1 SW061027-04 IMAGED APNT_016	

UIC No. / Rec. No. Doc. Control No. Record Type Contr./Guid. No. Approx. # Pages	Prc. Date Record Date CTO No. EPA Cat. #	Author Affil. Author Recipient Affil. Recipient	Subject/Comments	Classification	Sites	Location SWDIV Box No(s) CD No.	FRC Accession No. FRC Warehouse FRC Box No(s)
N00236 / 002508 NONE CORRESPONDENCE NONE 00017	09-06-2006 **01-27-2005** NONE	DTSC - BERKELEY M. LIAO NAVFAC - SOUTHWEST DIVISION T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT OFFSHORE SEDIMENT CORE STUDY WORK PLAN AT OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE (INCLUDES HERD COMMENTS BY J. POLISINI DATED 1 DECEMBER 2004 AND DHS COMMENTS BY D. BAILEY DATED 30 NOVEMBER 2004)	ADMIN RECORD INFO REPOSITORY	020 024 028 OU 4B OU 4C	SOUTHWEST DIVISION - BLDG. 1 SW061027-04 IMAGED APNT_016	
N00236 / 002029 PROJ NO. G486085 & BRAC SER BPMOW.DN/0758 REPORT N47408-01-D-8207 00269	05-03-2005 **05-27-2005** NONE	BATTELLE BRAC PMO WEST	FINAL OFFSHORE SEDIMENT STUDY WORK PLAN (WP) AT OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD AND WESTERN BAYSIDE, [INCLUDES BRAC PMO WEST TRANSMITTAL LETTER BY T. MACCHIARELLA, SAMPLING AND ANALYSIS PLAN (SAP), QUALITY ASSURANCE PROJECT PLAN (QAPP). ***COMMENTS: REPLACEMENT PAGES WERE ISSUED ON 27 MAY 2005 CONVERTING THE DRAFT FINAL ISSUED ON 29 APRIL 2005 INTO A FINAL. ALSO INCLUDES FIELD SAMPLING PLAN (FSP) AND SITE-SPECIFIC HEALTH AND SAFETY PLAN (SHSP){PORTION OF THE MAILING LIST IS CONFIDENTIAL; CD COPY OF DOCUMENT AND ATTACHEMENTS TO APPENDIX A ENCLOSED}. (SEE AR #2496 - DRAFT ADDENDUM 1)***	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024 028 OU 4B OU 4C	SOUTHWEST DIVISION - BLDG. 110 SW061027-04 IMAGED APNT_022	
N00236 / 002348 BRAC SER BPMOW.MEP/0089 CORRESPONDENCE NONE 00005	06-20-2006 **02-02-2006** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	CD CONTAINING VALIDATED ANALYTICAL RESULTS FOR JUNE 2005 OFFSHORE SEDIMENT SAMPLING WITH FIGURE SHOWING SAMPLING LOCATIONS (SEE AR 2029 - FINAL OFFSHORE SEDIMENT STUDY WORK PLAN)	ADMIN RECORD INFO REPOSITORY	020 024 028 OU 4B	SOUTHWEST DIVISION - BLDG. 1 SW070817-03 IMAGED APNT_025	

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N00236 / 002232 PROJECT NO. G486085 REPORT N47408-01-D-8207/0085 01152	03-10-2006 **03-08-2006** NONE	BATTELLE BRAC PMO WEST	DRAFT REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA (CD COPY OF APPENDIX A ENCLOSED) [SEE AR #2233 - BRAC PMO WEST TRANSMITTAL LETTER BY T. MACCHIARELLA]. ***COMMENTS: {CONTRACTOR - N. BONNIE AND RPM - MARY PARKER ON 9/18/06 CONFIRMED THAT THE DOCUMENT IS A DRAFT. TYPO IN CONTRACTOR'S LETTER CORRECTED BY D. SILVA ON 9/21/06}***	ADMIN RECORD INFO REPOSITORY	020 024	SOUTHWEST DIVISION - BLDG. 1 SW061005-04 IMAGED APNT_018	
N00236 / 002233 BRAC SER BPMOW.MEP/0200 CORRESPONDENCE NONE 00004	03-10-2006 **03-09-2006** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	TRANSMITTAL OF THE DRAFT REMEDIAL INVESTIGATION (RI) REPORT, OAKLAND INNER HARBOR AND PIER AREA (W/OUT ENCLOSURE) [SEE AR #2232 - DRAFT REMEDIAL INVESTIGATION (RI) REPORT]. ***COMMENTS: {PORTION OF THE MAILING LIST IS SENSITIVE}***	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024	SOUTHWEST DIVISION - BLDG. 1 SW061005-04 IMAGED APNT_018	
N00236 / 002611 NONE CORRESPONDENCE NONE 00012	11-22-2006 **05-18-2006** NONE	US EPA - SAN FRANCISCO X. TRAN BRAC PMO WEST T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT REMEDIAL INVESTIGATION (RI) REPORT, OAKLAND INNER HARBOR, PIER AREA	ADMIN RECORD INFO REPOSITORY	020 024	SOUTHWEST DIVISION - BLDG. 1 SW071207-02 IMAGED APNT_028	
N00236 / 002612 NONE CORRESPONDENCE NONE 00015	11-22-2006 **05-22-2006** NONE	DTSC - SACRAMENTO D. LOFSTROM BRAC PMO WEST T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT REMEDIAL INVESTIGATION (RI) REPORT, OAKLAND INNER HARBOR, PIER AREA (INCLUDES GSU COMMENTS DATED 20 APRIL 2006 AND HERD COMMENTS DATED 8 MAY 2006) [PORTION OF THE MAILING LIST IS SENSITIVE]	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024	SOUTHWEST DIVISION - BLDG. 1 SW071207-02 IMAGED APNT_028	
N00236 / 002710 BRAC SER BPMOW.MEP/0675 CORRESPONDENCE NONE 00003	03-14-2007 **08-02-2006** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	REQUEST FOR EXTENSION ON SUBMITTAL OF FEASIBILITY STUDY (FS) REPORT, PROPOSED PLAN (PP), AND RECORD OF DECISION (ROD)	ADMIN RECORD INFO REPOSITORY	020 024	CHOICE IMAGING SOLUTIONS SW080118-02	

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N00236 / 002553 NONE CORRESPONDENCE NONE 00002	10-03-2006 **09-07-2006** NONE	USEPA - SAN FRANCISCO X. TRAN BRAC PMO WEST T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT ADDENDUM 1, OFFSHORE SEDIMENT STUDY WORK PLAN AT OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD AND WESTERN BAYSIDE	ADMIN RECORD INFO REPOSITORY	020 024 028 OU 4B	SOUTHWEST DIVISION - BLDG. 1 SW070511-02 IMAGED APNT_022	
N00236 / 002546 FILE NO. 2199.9285(JCH) CORRESPONDENCE NONE 00003	09-20-2006 **09-08-2006** NONE	CRWQCB - OAKLAND J. HUANG BRAC PMO WEST T. MACCHIARELLA	REVIEW AND CONCURRENCE WITH PROPOSED ADDITIONAL SAMPLING LOCATIONS AND ANALYSES FOR DRAFT ADDENDUM 1 TO FINAL OFFSHORE SEDIMENT STUDY WORK PLAN (WP), OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE. ***COMMENTS: (PORTION OF THE MAILING LIST IS SENSITIVE)***	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024 028	SOUTHWEST DIVISION - BLDG. 1 SW070511-02 IMAGED APNT_022	
N00236 / 002547 NONE CORRESPONDENCE NONE 00004	09-20-2006 **09-08-2006** NONE	DTSC - SACRAMENTO D. LOFSTROM BRAC PMO WEST T. MACCHIARELLA	REVIEW AND COMMENTS ON DRAFT ADDENDUM 1, OFFSHORE SEDIMENT STUDY WORK PLAN (WP), OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE (PORTION OF THE MAILING LIST IS SENSITIVE)	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024 028	SOUTHWEST DIVISION - BLDG. 1 SW070511-02 IMAGED APNT_022	
N00236 / 002544 BRAC SER BPMOW.MEP/0791 CORRESPONDENCE NONE 00006	09-20-2006 **09-18-2006** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	TRANSMITTAL OF FINAL ADDENDUM 1 TO FINAL OFFSHORE SEDIMENT STUDY WORK PLAN (WP), OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE (W/OUT ENCLOSURE) [SEE AR #2545 - FINAL ADDENDUM 1] {PORTION OF THE MAILING LIST IS SENSITIVE}	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024 028	SOUTHWEST DIVISION - BLDG. 1 SW070511-02 IMAGED APNT_022	
N00236 / 002545 PROJECT NO. G486085 REPORT N47408-01-D-8207 00094	09-20-2006 **09-19-2006** NONE	BATTELLE BRAC PMO WEST	FINAL ADDENDUM 1 TO OFFSHORE SEDIMENT STUDY WORK PLAN (WP), OAKLAND INNER HARBOR, PIER AREA, TODD SHIPYARD, AND WESTERN BAYSIDE (SEE AR #2544 - BRAC PMO WEST TRANSMITTAL LETTER BY T. MACCHIARELLA) [SEE AR #2029 - FINAL WP]. ***COMMENTS: (INCLUDES RESPONSE TO COMMENTS ON DRAFT ADDENDUM 1)***	ADMIN RECORD INFO REPOSITORY	020 024 028	SOUTHWEST DIVISION - BLDG. 1 SW070511-02 IMAGED APNT_022	

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N00236 / 002699 PROJECT NO. G486085 REPORT N47408-01-D-8207 01319	02-28-2007 **02-21-2007** 00085	BATTELLE H. THURSTON BRAC PMO WEST	DRAFT REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA, REVISION 1 (SEE AR #2698 - BRAC PMO WEST TRANSMITTAL LETTER AND AR #2232 - DRAFT REMEDIAL INVESTIGATION REPORT)	ADMIN RECORD INFO REPOSITORY	020 024	SOUTHWEST DIVISION - BLDG. 1 SW071207-04 IMAGED APNT_028	
N00236 / 002698 BRAC SER BPMOW.MEP/0373 CORRESPONDENCE NONE 00004	02-28-2007 **02-23-2007** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	TRANSMITTAL OF DRAFT REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA, REVISION 1 (W/OUT ENCLOSURE) [SEE AR #2699 - DRAFT REMEDIAL INVESTIGATION REPORT] {PORTION OF THE MAILING LIST IS SENSITIVE}	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024	SOUTHWEST DIVISION - BLDG. 1 SW071207-04 IMAGED APNT_028	
N00236 / 002767 NONE CORRESPONDENCE NONE 00035	05-22-2007 **02-27-2007** NONE	BRAC PMO WEST PARKER, M. VARIOUS AGENCIES	RESPONSE TO REGULATORY AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION (RI) REPORT	ADMIN RECORD INFO REPOSITORY	020 024	CHOICE IMAGING SOLUTIONS SW080104-03	
N00236 / 002860 NONE CORRESPONDENCE NONE 00005	09-20-2007 **04-27-2007** NONE	US EPA - SAN FRANCISCO TRAN, X. BRAC PMO WEST MACCHIARELLA, T.	REVIEW AND COMMENTS ON THE DRAFT REVISION 1 REMEDIAL INVESTIGATION REPORT, (OAKLAND INNER HARBOR), (PIER AREA) [SEE AR # 2699 - DRAFT REVISION 1 REMEDIAL INVESTIGATION REPORT]	ADMIN RECORD INFO REPOSITORY	SITE 00020 SITE 00024	CHOICE IMAGING SOLUTIONS SW080118-04	
N00236 / 002879 2199.9285(EWS) CORRESPONDENCE NONE 00001	10-04-2007 **04-27-2007** NONE	CRWQCB - OAKLAND SIMON, E. BRAC PMO WEST MACCHIARELLA, T.	REQUEST FOR A 30 DAY EXTENSION ON THE DRAFT REVISION 1, REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA	ADMIN RECORD INFO REPOSITORY	SITE 00020 SITE 00024	CHOICE IMAGING SOLUTIONS SW080204-02	

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N00236 / 002984 NONE CORRESPONDENCE NONE 00003	01-28-2008 **05-14-2007** NONE	FISH AND WILDLIFE SERVICE - SACRAMENTO HOOVER, M. BRAC PMO WEST MACCHIARELLA, T.	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA, REVISION 1 [SEE AR # 2699 – DRAFT REMEDIAL INVESTIGATION REPORT]	ADMIN RECORD INFO REPOSITORY	SITE 00020 SITE 00024	SOUTHWEST DIVISION - BLDG. 1	
N00236 / 002859 2199.9285(EWS) CORRESPONDENCE NONE 00005	09-20-2007 **05-29-2007** NONE	CRWQCB - OAKLAND SIMON, E. BRAC PMO WEST MACCHIARELLA, T.	REVIEW OF AND CONCURRENCE ON THE DRAFT REVISION 1 REMEDIAL INVESTIGATION REPORT, (OAKLAND INNER HARBOR), (PIER AREA) [SEE AR # 2699 - DRAFT REVISION 1 REMEDIAL INVESTIGATION REPORT]	ADMIN RECORD INFO REPOSITORY	SITE 00020 SITE 00024	CHOICE IMAGING SOLUTIONS SW080118-04	
N00236 / 002899 BRAC SER BPMOW.MEP/0705 CORRESPONDENCE NONE 00002	10-15-2007 **07-27-2007** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	TRANSMITTAL OF THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA (W/OUT ENCLOSURE) [PORTION OF THE MAILING LIST IS SENSITIVE] {SEE AR # 2900 - DRAFT FINAL CONVERTED TO FINAL ON 31 AUG 2007)	ADMIN RECORD INFO REPOSITORY SENSITIVE	020 024	CHOICE IMAGING SOLUTIONS SW080204-02	

This Administrative Record (AR) Index includes references to documents which cite bibliography sources. These bibliographic citations are considered to be part of this AR but may not be cited separately in the index.

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N00236 / 002840 SULT.5104.0130.0042 REPORT N68711-03-D-5104 00025	09-17-2007 **08-08-2007** 00130	SULTECH HUNTER, C. BRAC PMO WEST	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) TEMPLATE (CD COPY IS ENCLOSED)	ADMIN RECORD INFO REPOSITORY	OU 0001 SITE 00001 SITE 00002 SITE 00005 SITE 00006 SITE 00008 SITE 00010 SITE 00011 SITE 00012 SITE 00014 SITE 00015 SITE 00017 SITE 00020 SITE 00021 SITE 00024 SITE 00026 SITE 00027 SITE 00028 SITE 00029 SITE 00032 SITE 00034 SITE 00035	CHOICE IMAGING SOLUTIONS SW080215-03	
N00236 / 002830 NONE CORRESPONDENCE NONE 00002	09-12-2007 **08-22-2007** NONE	US EPA - SAN FRANCISCO X. TRAN BRAC PMO WEST T. MACCHIARELLA	COMMENTS AND CONCURRENCE ON THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA	ADMIN RECORD INFO REPOSITORY	020 024	CHOICE IMAGING SOLUTIONS SW080118-04	

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N00236 / 002900 PROJECT NUMBER G486085 REPORT N47408-01-D-8207 00700	10-15-2007 **08-30-2007** 00085	BATTELLE THURSTON, H. BRAC PMO WEST	FINAL REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA (INCLUDES CD, REPLACEMENT PAGES CONVERTING THE DRAFT FINAL DATED 24 JULY 2007 TO FINAL, AND RESPONSE TO COMMENTS ON THE DRAFT REPORT) [SEE AR # 2901 - BRAC TRANSMITTAL LETTER]. ***COMMENTS: [REPLACEMENT PAGES INCLUDE: COVER PAGE AND SIGNATURE PAGE] (PER D. SILVA, RECORD ACCEPTED WITHOUT A CORRECT DCN)***	ADMIN RECORD INFO REPOSITORY	SITE 00020 SITE 00024	CHOICE IMAGING SOLUTIONS SW080204-02	
N00236 / 002901 BRAC SER BPMOW.MEP/0807 CORRESPONDENC E NONE 00002	10-15-2007 **08-31-2007** NONE	BRAC PMO WEST T. MACCHIARELLA VARIOUS AGENCIES	TRANSMITTAL OF THE REPLACEMENT PAGES CONVERTING DRAFT FINAL REMEDIAL INVESTIGATION REPORT, OAKLAND INNER HARBOR AND PIER AREA DATED 07/24/07 TO FINAL RI REPORT (W/OUT ENCLOSURE) [SEE AR # 2900 - FINAL RI REPORT] {PORTION OF THE MAILING LIST IS SENSITIVE}. ***COMMENTS: REPLACEMENT PAGES WERE INSERTED IN THE DOCUMENT***	ADMIN RECORD INFO REPOSITORY SENSITIVE	SITE 000024 SITE 00020	CHOICE IMAGING SOLUTIONS SW080204-02	

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N00236 / 002968 SULT.5104.0130.005 2 MINUTES N68711-03-D-5104 00030	01-09-2008 **09-18-2007** 00130	SULTECH BRAC PMO WEST	18 SEPTEMBER 2007 FINAL BASE REALIGNMENT AND CLOSURE (BRAC) CLEANUP TEAM (BCT), MONTHLY TRACKING MEETING, AFTER ACTION REPORT (CD COPY ENCLOSED)	ADMIN RECORD INFO REPOSITORY	SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00016 SITE 00017 SITE 00019 SITE 00020 SITE 00021 SITE 00022 SITE 00023 SITE 00024 SITE 00025 SITE 00026 SITE 00027 SITE 00028 SITE 00030 SITE 00031 SITE 00032 SITE 00034 SITE 00035	CHOICE IMAGING SOLUTIONS SW080215-04	

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N00236 / 002914 BEI-7526-0087-0030 PUBLIC NOTICE N68711-95-D-7526 00008	11-02-2007 **10-01-2007** 00087	BRAC PMO WEST PUBLIC INTEREST	DRAFT PROPOSED PLAN AND NO FURTHER ACTION RECOMMENDATION FOR THE OFFSHORE, OAKLAND INNER HARBOR (SEE AR # 2913 - BRAC TRANSMITTAL LETTER)	ADMIN RECORD INFO REPOSITORY	020	CHOICE IMAGING SOLUTIONS SW080204-03	
N00236 / 002913 BRAC SER BPMOW.MEP/0050 CORRESPONDENCE NONE 00002	11-02-2007 **10-24-2007** NONE	BRAC PMO WEST MACCHIARELLA, T. VARIOUS AGENCIES	TRANSMITTAL OF THE DRAFT PROPOSED PLAN AND NO FURTHER ACTION RECOMMENDATION FOR THE OFFSHORE, OAKLAND INNER HARBOR (W/OUT ENCLOSURE) [SEE AR # 2914 - DRAFT PROPOSED PLAN] {PORTION OF THE MAILING LIST IS SENSITIVE}	ADMIN RECORD INFO REPOSITORY SENSITIVE	SITE 00020	CHOICE IMAGING SOLUTIONS SW080204-03	

Total Estimated Record Page Count: 8,473

Total - Administrative Records: 72

[UIC NUMBER]='N00236'
No Keywords
Sites=020;SITE 00020
No Classification

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
12	**meeting transcript**	**Section 3**	Public Meeting Transcript, March 12, 2008, Public Comment Period for Proposed Plan for IR Site 20, Former NAS Alameda, Alameda, California.

PROPOSED PLAN FOR

INSTALLATION RESTORATION

SITES 20 AND 31 AT ALAMEDA POINT

ALAMEDA POINT, CALIFORNIA

PUBLIC MEETING

Wednesday, March 12, 2008

Main Office Building
950 W. Mall Square
Community Conference Room 201
Alameda Point, California

Reported by: Valerie E. Jensen, CSR No. 4401

JAN BROWN & ASSOCIATES
CERTIFIED SHORTHAND REPORTERS
701 Battery Street, 3rd Floor
San Francisco, California 94111

P A R T I C I P A N T S

PRESENTERS:

THOMAS MACCHIARELLA, U.S. Navy
MARY PARKER, U.S. Navy

OTHER AGENCY, NAVY STAFF AND CONSULTANT REPRESENTATIVES:

BOB COLEMAN, Brown and Caldwell
LINDA HENRY, Brown and Caldwell
DOT LOFSTROM, Department of Toxic Substances Control
MARCUS SIMPSON, Department of Toxic Substances Control
ANNA-MARIE COOK, U.S. Environmental Protection Agency
XUAN-MAI TRAN, U.S. Environmental Protection Agency
JOHN WEST, RWQCB
DAN CARROLL, Kleinfelder

COMMUNITY MEMBERS AND INTERESTED PARTIES:

(None)

MARCH 12, 2008 6:48 P.M.

MR. MACCHIARELLA: We just concluded the posterboard viewing and informal discussion period. And since there are no community members present, we'll postpone the subsequent presentations until community members arrive. If none arrive by 7:30, we will conclude at that time.

Community members may provide written comments to the Navy through the end of the comment period.

In the event that no community members arrive, the view slides, rather than any verbatim transcript of the presentations, will be in the stenographer's report of this meeting and together will be placed in the administrative record and other places, as appropriate.

The stenographer will now stop recording while the Navy and regulatory agency representatives await the arrival of community members. Recording will resume when we return to the presentations or adjourn the meeting, whichever comes first.

(Off the record at 6:49 p.m.)

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(On the record at 7:30 p.m.)

MR. MACCHIARELLA: It's now 7:30. No community members arrived, and we are adjourning the meeting.

(Adjourned at 7:30 p.m.)

STATE OF CALIFORNIA)   SS.

I do hereby certify that the public meeting was held at the time and place therein stated; that the statements made were reported by me, a certified shorthand reporter and disinterested person, and were, under my supervision, thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the participants in said public meeting nor in any way personally interested or involved in the matters therein discussed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal of office this 26th day of March, 2008.

VALERIE E. JENSEN

Certified Shorthand Reporter