1 Declaration

1.1 Site Name and Location

This Record of Decision (ROD) addresses Operable Unit (OU)-2C at the former Naval Air Station (NAS) Alameda, now referred to as Alameda Point (Figure 1), in Alameda, California. OU-2C (Figure 2), which consists of Installation Restoration (IR) Sites 5, 10, and 12, is located in the middle of Alameda Point to the north of Seaplane Lagoon. The United States Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (referred to as CERCLIS) identification number for former NAS Alameda is CA2170023236.

1.2 Statement of Basis and Purpose

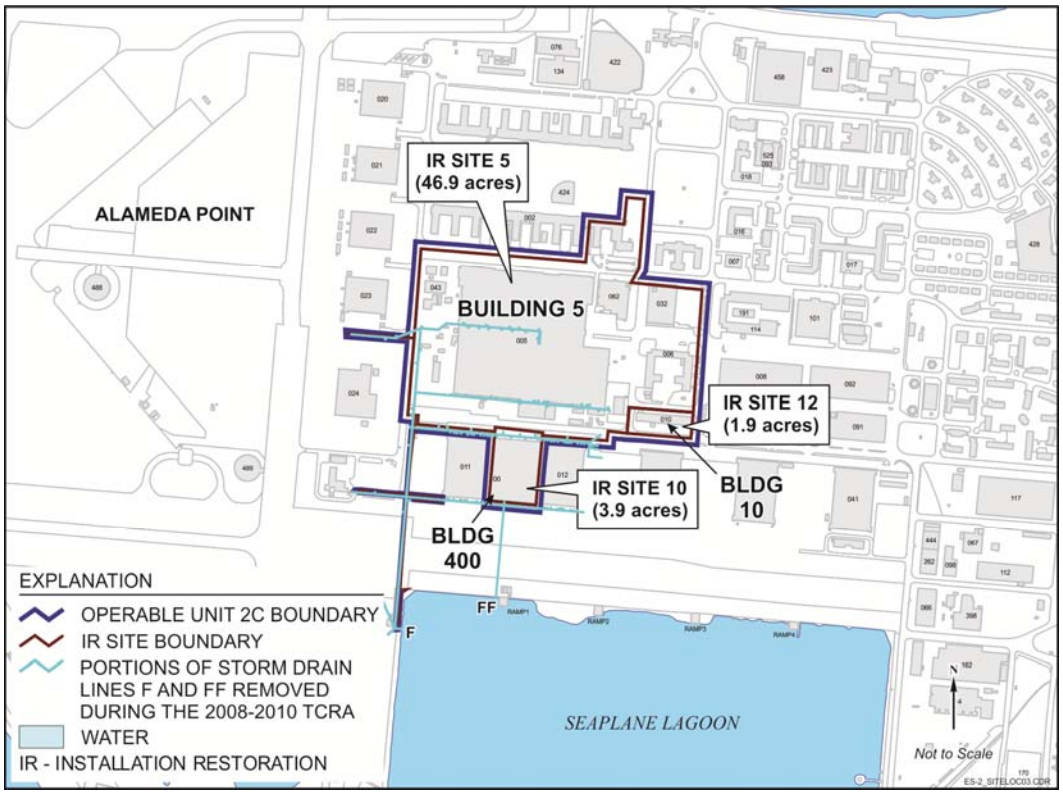
This document was developed in accordance with CERCLA (1980), as amended by the Superfund Amendments and Reauthorization Act of 1986 (Title 42 *United States Code* Section 9601, et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 *Code of Federal Regulations* Part 300). Decisions documented in this ROD are based on information contained in the **Administrative Record**[1] file (a site-specific Administrative Record Index is included as part of this ROD), as well as on extensive field investigations, laboratory analyses, data interpretation, evaluation of current and future land use conditions, thorough assessment of potential human health and ecological risks, and evaluation of potential remedial alternatives.

The purpose of this document is to present the selected remedies for OU-2C, as agreed upon with the regulatory agencies. Based on coordination with the regulatory agencies, some portions of OU-2C are not included in this ROD. This ROD presents the remedies for OU-2C IR Sites 5, 10, and 12, except for known or potentially radiologically-impacted drain lines originating in IR Site 5 Building 5 (referred to as Buildings 5/5A in some previous reports) and IR Site 10

[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. 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. The hyperlink will open a text box at the top of the screen. A blue box surrounds applicable information in the hyperlink.

FIGURE 1
Alameda Point Location Map

FIGURE 2
Layout of OU-2C



Building 400 that are located outside these buildings and were not addressed during a previous time-critical removal action (TCRA). The TCRA addressed the impacted portions of storm drain lines F and FF, except for some sections of these lines located under Buildings 5 and 400. Segments of storm drain lines F and FF, as well as segments of storm drain lines A, B, and G and soil associated with a previously removed segment of the industrial waste line, are located beneath Buildings 5 and 400 and are addressed in this ROD. Portions of storm drain lines A, B, and G and the industrial waste line that are located outside of Buildings 5 and 400 were evaluated in the OU-2C Feasibility Study (FS) Addendum (Figure 3); these line segments are excluded from this ROD and will be addressed in the future in a separate ROD.

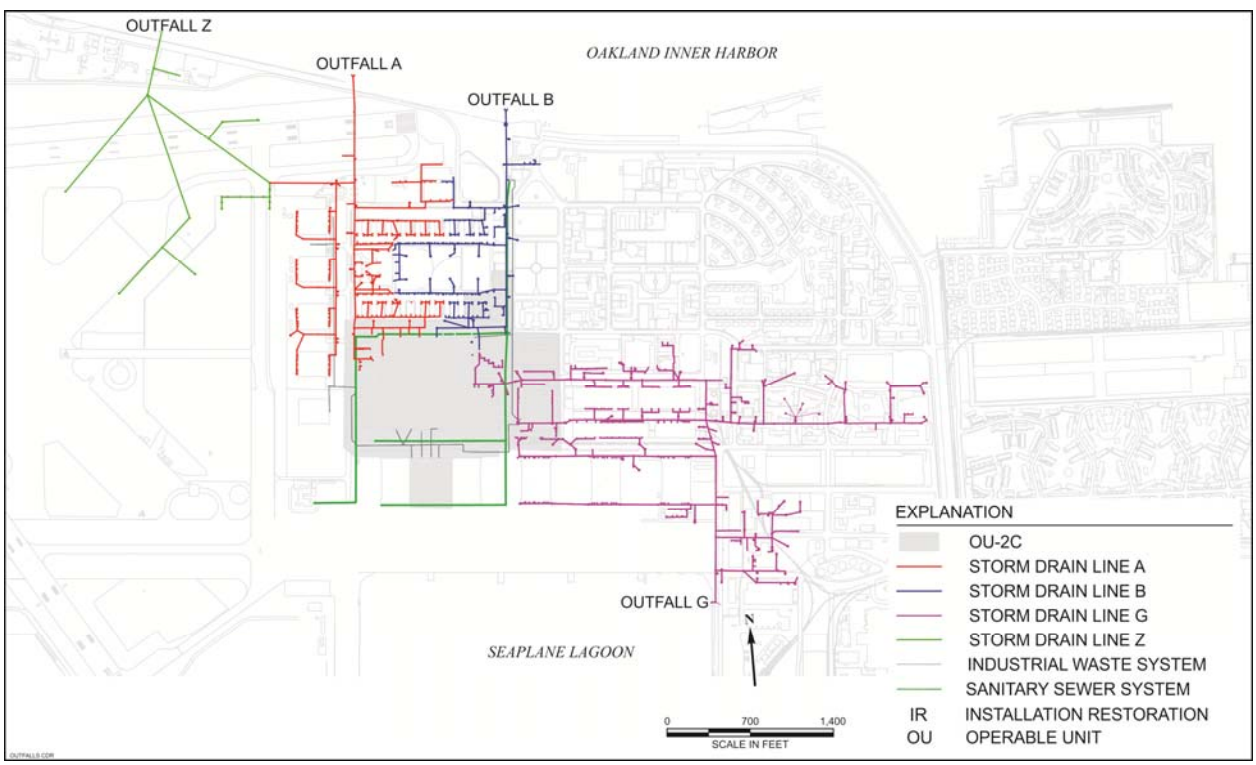
The Department of the Navy (DON) and EPA jointly selected the remedies for OU-2C. The DON, EPA, State of California Environmental Protection Agency Department of Toxic Substances Control (Cal/EPA DTSC), and San Francisco Bay Regional Water Quality Control Board (Water Board) concur on the selected remedies as presented in this ROD for the relevant portions of OU-2C.

1.3 Assessment of the Site

To protect human health and the environment, the DON, in coordination with the regulatory agencies, has concluded that the remedies at OU-2C are necessary based on the following:

- site history,

FIGURE 3
Locations of Drain Lines to be Addressed in the Future OU-2C Drain Line ROD



- field investigations,
- laboratory analytical results,
- previous removal actions,
- evaluation of potential ecological and human health risks, and
- current and reasonably anticipated future land use.

Results of investigations and risk assessments for OU-2C show that soil, drain lines, shallow first water bearing zone (FWBZ) groundwater, and deep FWBZ and second water bearing zone (SWBZ) groundwater in certain locations at IR Sites 5 and 10 require remedial action. Based on these assessments, actions are required for drain lines, soil, and shallow and deep groundwater at IR Site 5. At IR Site 10, action is required for drain lines beneath Building 400. Based on the Remedial Investigation (RI) Report risk assessment results for a residential scenario, no action is required for soil outside Building 400 and groundwater at IR Site 10. The RI Report documents that for the residential scenario, the carcinogenic risk at IR Site 12 (soil and groundwater) does not exceed 10^{-6} and the hazard index (HI) is less than 1, so no further action is required for IR Site 12. Therefore, the FS Report evaluated IR Sites 5 and 10 only, and for IR Site 10, only the drain lines beneath Building 400 were evaluated.

The contaminants, referred to as chemicals of concern (COCs), in soil are metals and volatile organic compounds (VOCs). The COCs in groundwater are VOCs. Radium-226 (^{226}Ra) is the only COC for the drain lines and sediment within the lines, as well as soil surrounding the lines.

A summary of the risk assessment results specific for each IR site is as follows:

- **IR Site 5** requires action for soil, shallow FWBZ groundwater, deep FWBZ and SWBZ groundwater, and specific drain lines beneath Building 5.
- **IR Site 10** requires action for specific drain lines beneath Building 400.
- **IR Site 12** requires no action for any media.
- Any drain lines outside of Buildings 5 and 400 are not part of this ROD and will be discussed in a separate ROD. Any potential downgradient impacts associated with drain lines (for instance, potential impacts to receiving waters) are part of separate Alameda Point CERCLA projects.

Table 1 summarizes the specific units found within OU-2C, including aboveground storage tanks (ASTs), petroleum corrective action areas (CAAs), generator accumulation points (GAPs), oil-water separators (OWSs), solid waste management units (SWMUs), and underground storage tanks (USTs), that will be closed by this ROD. The CERCLA remedy presented in this ROD addresses any residual contamination associated with these units.

Under existing and expected future site conditions, it is unlikely that ecological receptors are or would be present at the site or would be exposed to chemicals. Most of the site is covered by pavement or buildings, and unpaved areas are generally landscaped, which offers little habitat value. Through the ecological risk assessment (ERA) completed in the RI, no potentially unacceptable ecological risks were identified within OU-2C under current and anticipated future site use. Further evaluation of ecological risk at OU-2C is not required for the portions of the site covered under this ROD.

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
CAA 5A*	UST 5-2	JP-5	UST removed (in 1997); results from RI sampling show no further action/closure required
CAA 5A*	AST 005G**	waste oil	AST removed; results from RI sampling show no further action/closure required
CAA 5B***	UST 261-1 UST 261-2	kerosene	USTs removed (in 1994); RI concluded no additional sampling needed for characterization; CERCLA groundwater remediation in the area to address any unit contaminants, so these units are being closed
CAA 5B***	UST 261-3	solvent naphtha	UST removed (in 1994); RI concluded no additional sampling needed for characterization; CERCLA groundwater remediation in the area to address any unit contaminants, so this unit is being closed
AST 005A AST 005B AST 005C	AST 005A** AST 005B** AST 005C**	water and glycol	Operations using water and glycol never implemented; tanks never filled or used; no release to the environment; these units are being closed
AST 005D AST 261	AST 005D** AST 261**	liquid argon	AST removed; RI concluded no sampling needed for characterization; no further action/closure required based on AST removal, contents, and historical use; all indicate no release to the environment
AST 005E	AST 005E**	liquid nitrogen	RI concluded no sampling needed for characterization; no action/closure required based on contents and historical use indicating no release to the environment
AST 005F	AST 005F**	liquid nitrogen	AST removed; RI concluded no sampling needed for characterization; no further action/closure required based on AST removal, contents, and historical use; all indicate no release to the environment
AST 005H	AST 005H**	oil	AST removed; located inside Building 5, with concrete floor; RI concluded no sampling needed for characterization; no further action/closure required based on AST removal and location within building indicating no release to the environment
AST 032	AST 032**	propane	AST removed; located inside Building 32, on the second floor; RI concluded no sampling needed for characterization; no further action/closure required based on AST removal, contents, historical use, and location on second floor of building; all indicate no release to the environment
AST 500	AST 500**	propane	AST removed; RI concluded no sampling needed for characterization; no further action/closure required based on AST removal, contents, and historical use; all indicate no release to the environment

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD (CONTINUED)

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
AST 010L	AST 010L**	brine for water treatment	RI concluded no sampling needed for characterization; no action/closure required based on AST contents and historical use indicating no release to the environment
UST 615-1 UST 615-2	UST 615-1 UST 615-2	spill control/ emergency overflow for sprinklers	Two units located within SWMU 615/UST(R)-19 area; UST 615-3 OWS and UST 615-4 in this SWMU closed in 2006 and 2001, respectively; RI concluded no sampling needed for characterization; no further action/closure for these units required based on historical use indicating no release to the environment and closures of other USTs in this area
M-01 M-02	M-01 M-02	solvent distillation units	Located in Building 5; results from RI sampling show no action/closure required in combination with location inside Building 5 with no visible stains, no apparent sizable cracks, and no floor drains; all indicate no release to the environment
M-03 M-04	M-03 M-04	solvent distillation units (portable)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on being portable units inside Building 5 with no visible stains, no apparent cracks in the building floor, and no floor drains in those areas; all indicate no release to the environment
M-05	M-05	solvent distillation units (portable)	Located in Building 5; sampled during RI due to cracks in concrete and expansion joint nearby; results from RI sampling show no action/closure required in combination with location inside Building 5 with no visible stains and no floor drains; all indicate no release to the environment
M-08	M-08	solvent distillation units (portable)	Located in Building 400; no visible stains or apparent cracks in floor; sampled during RI due to nearby floor drain; results from RI sampling show no action/closure required in combination with location inside Building 400 with no visible stains or apparent cracks; all indicate no release to the environment
M-09	M-09	coolant recovery system (4 tanks)	Located in Building 5; sampled during RI to provide VOC analysis; results from RI sampling show no action/closure required in combination with tank location inside Building 5; all indicate no release to the environment
NADEP GAP 02	NADEP GAP 02	paint, thinner, naphtha	Located in Building 5, in the northern part of Building 5 in Shop 95532; sampled during RI because no previous nearby soil sampling had been completed; results from RI sampling show no action/closure required in combination with location inside Building 5; all indicate no release to the environment
NADEP GAP 03	NADEP GAP 03	methyl ethyl ketone, Freon, oil	Located in Building 5, in the northern part of Building 5 in Shop 95723; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent cracks in the building floor, and no floor drains in that area; all indicate no release to the environment

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD (CONTINUED)

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
NADEP GAP 04	NADEP GAP 04	battery acid, nickel-cadmium solution	Located in Building 5, in the northern part of Building 5 in Shop 93532; sampled during RI because there was etched and cracked concrete in the area; results from RI sampling show no action/closure required in combination with location inside Building 5, no visible stains, secondary containment, and no nearby floor drains; all indicate no release to the environment
NADEP GAP 05	NADEP GAP 05	paint, thinner, aerosol paint	Located in Building 5, in the northern part of Building 5 in Shop 95531; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 08	NADEP GAP 08	hydraulic fluid, JP-5, engine oil	Located in Building 5, in the northern part of Building 5 in Shop 95832; RI concluded no sampling needed for characterization; no action/closure required based on secondary containment and location inside building with no visible stains, no apparent sizable cracks, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 10	NADEP GAP 10	oil, methyl ethyl ketone, solvent naphtha	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 11	NADEP GAP 11	oils, Freon, JP-5, paint	RI concluded no sampling needed for characterization; no action/closure required based on secondary containment, no visible stains, no apparent sizable cracks, pre-RI soil sampling results, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 12	NADEP GAP 12	paint, thinner, methyl ethyl ketone	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 13	NADEP GAP 13	primer, thinner, acetone (in drums)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on materials in drums with secondary containment inside building, no visible stains, no apparent sizable cracks, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 14	NADEP GAP 14	hydraulic fluid, JP-5, stripper, oil, fuel (in drums)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on materials in drums with secondary containment located inside building with no apparent sizable cracks and no floor drains in that area; all indicate no release to the environment

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD (CONTINUED)

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
NADEP GAP 16	NADEP GAP 16	hydraulic oil, batteries, wash water	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on secondary containment and location inside building with no visible stains, no apparent sizable cracks, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 17	NADEP GAP 17	coolant with nickel, chromium, cadmium, aluminum oxide, silicon carbide (in drums)	Located in Building 5; sampled during RI because no previous nearby soil sampling; results from RI sampling show no action/closure required in combination with materials stored in drums located inside Building 5; all indicate no release to the environment
NADEP GAP 18	NADEP GAP 18	coolant, heavy metal grindings (in drums)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on materials in drums located inside building and pre-RI soil sampling results; all indicate no release to the environment
NADEP GAP 20	NADEP GAP 20	lead-contaminated items	Results from RI sampling show no action/closure required in combination with liquid wastes in secondary containment, documentation of adequately maintained drums by DTSC, no visible stains, no apparent sizable cracks, and no floor drains in the area; all indicate no release to the environment
NADEP GAP 21	NADEP GAP 21	lead dust	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks, and no floor drains; all indicate no release to the environment
NADEP GAP 22	NADEP GAP 22	asbestos (in drums)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on contents in drums and historical use inside building indicating no release to the environment
NADEP GAP 23	NADEP GAP 23	ethyl acetate (in drums)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on storage in drums and location inside building with no visible stains, no apparent sizable cracks, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 24, 26, and 27A	NADEP GAP 24, 26, and 27A	blasting grit (in bags)	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on contents and historical use inside building indicating no release to the environment
NADEP GAP 25	NADEP GAP 25	ethyl acetate, aluminum oxide, blasting grit, drums of unknown content	Located in Building 5; sampled during RI because of unknown drum content and no previous nearby soil sampling; results from RI sampling show no action/closure required in combination with location inside Building 5; all indicate no release to the environment
NADEP GAP 27	NADEP GAP 27	hydraulic oil (in drums)	Results from RI sampling show no action/closure required in combination with location on asphalt indicating no release to the environment

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD (CONTINUED)

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
NADEP GAP 29	NADEP GAP 29	aerosol paints	Located in Building 5; RI concluded no sampling needed for characterization; no further action/closure required based on contents and location on second floor of building; all indicate no release to the environment
NADEP GAP 30	NADEP GAP 30	hydraulic oil and Freon	Located in Building 5; RI concluded no sampling needed for characterization; no further action/closure required based on contents and location on second floor of building; all indicate no release to the environment
NADEP GAP 31	NADEP GAP 31	oils, solvents, paint (in drums)	Located in Building 5; sampled during RI because of cracks in the concrete nearby; results from RI sampling show no action/closure required in combination with location inside Building 5, no visible stains, and no nearby floor drains; all indicate no release to the environment
NADEP GAP 36	NADEP GAP 36	aerosol paint, solvents	Located in Building 400; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 37	NADEP GAP 37	aerosol paint, hydraulic and lube oils, 1,1,1-TCA and Freon	Located in Building 400; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 38	NADEP GAP 38	primer, paints, thinner, alcohol, and methyl ethyl ketone	Located in Building 400; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
NADEP GAP 39	NADEP GAP 39	paints, lacquer, Freon, stripper sludge, zinc chromate primer, oils, PD-680, naphtha, thinners	Located in Building 400; RI concluded no sampling needed for characterization; no further action/closure required based on location on second floor of building indicating no release to the environment
NADEP GAP 42	NADEP GAP 42	batteries, beryllium, paint, oils, PCBs, mercury, oil solvents, Freon, radioactive waste	Located in Building 400; RI concluded no sampling needed for characterization; no further action/closure required based on location on third floor of building indicating no release to the environment
NADEP GAP 57	NADEP GAP 57	plating and cadmium solutions	Located in Building 5; sampled during RI because no previous nearby soil sampling; results from RI sampling show no action/closure required in combination with location inside Building 5; all indicate no release to the environment
NADEP GAP 70	NADEP GAP 70	cyanide, chromic acid plating solutions, sulfuric acid, nickel chloride, Metex acid (in drums)	Located in Building 5; sampled during RI based on limited analytical data; results from RI sampling show no action/closure required in combination with location inside Building 5; all indicate no release to the environment

TABLE 1. TABLE FOR SPECIFIC UNITS BEING CLOSED IN ROD (CONTINUED)

Area Identifier	Specific Unit/Type	Unit Former Contents	Rationale for Closure
NAS GAP 01	NAS GAP 01	oily liquids	Results from RI sampling show no action/closure required based on no contaminants related to the SWMU
NAS GAP 02	NAS GAP 02	waste oil (in drums)	RI concluded no sampling needed for characterization; no action/closure required based on drums in secondary containment with no visible stains, and previous sampling results in that area; all indicate no release to the environment
NAS GAP 05	NAS GAP 05	perchloroethene and used dry cleaner filter elements	Located in Building 2; RI concluded no sampling needed for characterization; no action/closure required based on previous non-detect analytical results and use inside building; all indicate no release to the environment
OWS 005**	OWS 005**	unfiltered waste associated with IWTP 5	Results from RI sampling show no action/closure required based on no contaminants related to the SWMU
OWS 006A**	OWS 006A**	residue from steam cleaning bay	Results from RI sampling show no action/closure required based on no contaminants related to the SWMU
OWS 006B**	OWS 006B**	not specified	Results from RI sampling show no action/closure required based on no contaminants related to the SWMU
OWS 010**	OWS 010**	not specified	Located in Building 10; sampled during RI because soil and groundwater samples not previously collected; results from RI sampling show no action/closure required in combination with location inside building; all indicate no release to the environment
SWMU 005	SWMU 005	VV-L-800, rust remover, solvent naphtha, Freon, and alkaline solvent	Located in Building 5; RI concluded no sampling needed for characterization; no action/closure required based on location inside building with no visible stains, no apparent sizable cracks in the building floor, and no floor drains in that area; all indicate no release to the environment
SWMU 614 SWMU 615	SWMU 614 SWMU 615	acids, bases, adhesives, and paint	SWMU 614 located in Building 614; SWMU 615 located in Building 615; RI concluded no sampling needed for characterization; no action/closure required based on previous analytical results for both SWMUs, recommendation for no further action by DTSC for SWMU 614 and DTSC closure for SWMU 615 in July 2001, and use inside building; all indicate no release to the environment

Note: Unless otherwise identified in the table, units were identified as SWMUs under Resource Conservation and Recovery Act (RCRA) in historical documents; see OU-2C RI Report for further details and RCRA references; RI Report Table 4-34 provides a summary of key RI results for sampled units.

*All of Petroleum CAA 5A can be closed since remaining UST 5-3 contamination is being addressed as part of the OU-2C remedy.

** Identified as SWMU under CERCLA/RCRA in SulTech, 2005. Solid Waste Management Unit Evaluation Report for Operable Unit 2C (Sites 5, 10, and 12), Alameda Point, Alameda, CA, July.

*** All of Petroleum CAA 5B can be closed since all features in CAA 5B have been addressed.

1.4 Statutory Determinations

The DON and EPA have co-selected the following remedies for OU-2C:

- **Soil Alternative S2 -** Engineering controls and institutional controls (ICs) for areas of soil and specific drain lines (lines beneath buildings) in IR Sites 5 and 10 because of elevated concentrations of metals and VOCs in soil and the potential presence of ^{226}Ra in and around the drain lines.
- **Shallow FWBZ Groundwater Alternative GS2 –** At IR Site 5, in situ chemical oxidation (ISCO), enhanced bioremediation, groundwater monitoring, and ICs for shallow FWBZ (5 to 20 feet below ground surface [bgs]) groundwater because of elevated concentrations of VOCs.
- **Deep FWBZ and SWBZ Groundwater Alternative GD2 –** At IR Site 5, ICs for deep FWBZ (20 to 40 feet bgs) and SWBZ (40 to 70 feet bgs) groundwater because of elevated concentrations of VOCs.

No further remedial action is necessary for storm drain lines F and FF that were removed and replaced during the previous TCRA. Sections of lines F and FF located beneath Buildings 5/5A and 400 that were not removed and replaced during the TCRA are addressed in this ROD as part of Soil Alternative S2. Other lines located beneath Buildings 5/5A and 400 are also addressed in this ROD as part of Soil Alternative S2, including sections of storm drain lines A, B, and G and the industrial waste line.

Because there is no unacceptable risk to human health or the environment, no remedial action is necessary for the following components of OU-2C:

- IR Site 12 – Power Plant Facility. IR Site 12 is located between Saratoga and Lexington Streets, with the western site boundary just to the east of the industrial waste line.
- Specific units identified in Table 1.
- Portions of OU-2C IR Sites 5 and 10 that are located outside the remediation footprints in this ROD, excluding storm drain lines A, B, and G and the industrial waste line located outside of Buildings 5/5A and 400, which are being addressed in a separate ROD.

The selected remedies are protective of human health and the environment and comply with federal and state requirements. The selected remedies will satisfy any potentially applicable or relevant and appropriate requirements (ARARs). The ICs described in Sections 2.8.4, 2.8.10, and 2.8.16 will be legal and administrative mechanisms that limit the exposure of future landowners and users of the property to soil and groundwater and vapors from groundwater and maintain the integrity of the selected remedies. Pursuant to CERCLA Section 121 and the NCP, a five-year status review is required because this remedy involves contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

1.5 Data Certification Checklist

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

TABLE 2. DATA CERTIFICATION CHECKLIST

Checklist Item	Description
Identification of COCs and their respective concentrations.	COCs in soil and groundwater throughout OU-2C, and in drain lines beneath Buildings 5 and 400, were identified based on data from several historical investigations and other relevant site information. Descriptions of the historical investigations are provided in Section 2.3.
Risk assessments for COCs.	Risk assessments were conducted as part of the RI, and also as part of the FS, using data representative of current and future conditions at OU-2C. Results of the risk assessments are presented in Section 2.5.
Cleanup levels established for COCs and the basis for these levels.	Remedial goals (RGs) are the basis for determining remediation areas and measuring the success of active remediation at OU-2C. RGs are presented in Table 7.
Principle threat wastes.	There are no principal threat wastes at OU-2C, as described in Section 2.7.
Current and reasonably anticipated future land use assumptions.	OU-2C will be developed as commercial mixed-use. Current and anticipated future site uses are presented in Section 2.4.
Estimated capital costs and total costs and the number of years over which the remedy cost estimate is projected.	Table 10 provides a summary of the cost estimates for addressing soil throughout the site and drain lines beneath Buildings 5 and 400, Table 13 summarizes the shallow FWBZ groundwater remediation cost estimates, and Table 16 summarizes the deep FWBZ and SWBZ groundwater remediation cost estimates. This ROD identifies the selected remedies for all contaminated media at OU-2C, as described in Sections 2.8.4 (soil and drain lines beneath Buildings 5 and 400), 2.8.10 (shallow FWBZ groundwater), and 2.8.16 (deep FWBZ and SWBZ groundwater).
Key factors that led to selecting the remedy.	Descriptions of how the selected remedies meet the threshold criteria and provide the best balance with respect to the balancing and modifying criteria are presented in Sections 2.8.2 (soil and drain lines beneath Buildings 5 and 400), 2.8.8 (shallow FWBZ groundwater), and 2.8.14 (deep FWBZ and SWBZ groundwater).

1.6 Authorizing Signatures

This signature sheet documents the DON's and the EPA's co-selection of the remedies in this Alameda Point ROD to: a) address contamination in IR Site 5 soil, shallow FWBZ groundwater, deep FWBZ and SWBZ groundwater, and IR Sites 5 and 10 drain lines beneath Buildings 5 and 400; b) close OU-2C IR Site 12 where no action is required; and c) close units and/or portions of OU-2C where no action or no further action is necessary. No further action is necessary for storm drain lines F and FF located outside the footprint of Buildings 5/5A and 400. No remedial action is necessary for specific units identified in Table 1. No remedial action is necessary for portions of OU-2C IR Sites 5 and 10 that are located outside the remediation footprints in this OU-2C iROD, excluding storm drain lines A, B, and G and the industrial waste line located outside of Buildings 5/5A and 400, which are being addressed in a separate ROD. This signature sheet documents the concurrence of the State of California, through the Cal/EPA DTSC and the Water Board. The respective parties may sign this sheet in counterparts.

Signature — **Date** April 10, 2014

Mr. Derek Robinson
Base Realignment and Closure Environmental Coordinator
Base Realignment and Closure Program Management Office West
Department of the Navy

Signature — **Date** April 29, 2014

Ms. Angeles Herrera
Assistant Director
Federal Facilities and Site Cleanup Branch, Region 9
United States Environmental Protection Agency

Signature — **Date** 05/08/2014

Ms. Karen M. Toth, P.E.
Unit Chief
Brownfields and Environmental Restoration Program
California Environmental Protection Agency
Department of Toxic Substances Control

Signature — **Date** 5/9/14

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

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2 Decision Summary

2.1 Site Description and History

OU-2C is located at the **former NAS Alameda, now referred to as Alameda Point**; NAS Alameda ceased operations in 1997. When NAS Alameda was designated for closure, the Alameda Point Base Realignment and Closure (BRAC) Cleanup Team (BCT) became responsible for the environmental cleanup program at Alameda Point. The BCT consists of representatives from the DON, EPA, Cal/EPA DTSC, and Water Board.

Alameda Point is located on the western tip of Alameda Island, which is on the eastern side of San Francisco Bay (Figure 1). **OU-2C** is located in the middle of Alameda Point and contains IR Sites 5, 10, and 12. It is approximately 53 acres in size and includes buildings and largely paved open space (Figure 2). As a management tool to accelerate site investigation, cleanup, and reuse, a comprehensive operable unit strategy was developed for Alameda Point sites. This strategy separated the 34 CERCLA sites into a total of 10 operable units: OU-1, OU-2A, OU-2B, OU-2C, OU-3, OU-4A, OU-4B, OU-4C, OU-5, and OU-6.

2.2 Site Characteristics

IR Site 5 (approximately 47 acres in size) was the former Naval Air Rework Facility and contains Building 5 (approximately 910,382 square feet [sf], or 20.9 acres). Past uses for Building 5 include cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and specialty operations, such as the application of radioluminescent paint (containing ^{226}Ra) to aircraft dial faces and refurbishment of aircraft instrumentation. In addition, battery fluids were discharged into a sink in the Building 5 storage area, which discharged into the industrial waste system. Storm drain lines, industrial waste lines, a hazardous waste storage area, and an industrial waste treatment plant were also historically identified at IR Site 5. All activities ceased in Building 5 in 1993. The hazardous waste storage area and industrial waste treatment plant were closed in accordance with RCRA requirements.

IR Site 10 is approximately 4 acres in size and was the former missile rework facility. It is bounded to the north by IR Site 5 and the southern boundary is approximately 600 ft north of Seaplane Lagoon. Building 400 occupies approximately 85% of IR Site 10; the remaining portions consist of paved open space, parking lots, and roads. Past uses for IR Site 10 include paint stripping, construction of fiberglass airplane components, airplane parts cleaning and degreasing, silk screening, and photographic development. The radium paint shop facilities for painting of radioluminescent (^{226}Ra) aircraft instrument dials were moved from Building 5 to Building 400 in the late 1950s.

IR Site 12 is approximately 2 acres in size. Site features include Building 10 (20% of site), an unpaved area (10% of site), and roads and parking lots (70% of site). Building 10 was constructed in 1940 as a power plant and operated until base closure in 1997. Historical activities included generation of steam and air compression.

Drain lines that originate from OU-2C include storm drain lines, an industrial waste line, and a sanitary sewer line. Between 1940 and 1972, wastewaters from all Navy operations at former NAS Alameda were discharged directly into the nearest storm drain system, which in turn discharged to surface water. The storm drain lines and the industrial waste line originating from OU-2C have been investigated and are being addressed as part of OU-2C. Because of the historical radioluminescent painting operations, various drain lines associated with Buildings 5 and 400 are known to be or are potentially radiologically-impacted. The previous TCRA removed impacted portions of storm drain lines F and FF, except for some sections under Buildings 5 and 400 (Figure 2). The remaining lines that require action and are located beneath Buildings 5 and 400 are included in this ROD. Portions of storm drain lines A, B, and G and the industrial waste line located outside of Buildings 5 and 400 are being addressed in a separate ROD (Figure 3).

Groundwater at OU-2C is typically encountered at depths as shallow as 5 feet bgs. The shallow FWBZ, which extends to a depth of 20 feet bgs, is the uppermost groundwater-bearing zone, and is composed of fill and bay sediments and is separated in places from the deep FWBZ by clay layers one to several feet thick. The deep FWBZ extends from 20 to 40 feet bgs, and consists of bay sediments and is separated from the deeper SWBZ by a more continuous clay unit known as the Young Bay Mud. The SWBZ, comprised of coarse bay sediments and sands, extends from 40 to 70 feet bgs. The SWBZ is underlain by the regionally continuous Yerba Buena Mud, which prevents contamination at OU-2C from impacting the deeper Alameda Formation aquifer system. Groundwater flow in the shallow FWBZ at OU-2C is generally towards the northwest and west, while groundwater flow in the deep FWBZ is generally towards the west and southwest and in the SWBZ is from perimeter portions towards the central portion of the site.

Only urban and barren habitats are present within the OU-2C boundaries. Neither of these habitats offers appreciable value to wildlife except to potentially serve as a corridor between other habitats. Under existing conditions, it is unlikely that ecological receptors are present at OU-2C or would be exposed to chemicals of potential ecological concern (COPECs) in soil because most of the site is covered by pavement or buildings and most of the remaining area is landscaped and offers little habitat.

Building 5 is a “contributing element” of the NAS Alameda Historic District, which was listed as a historic property in the National Register of Historic Places (NRHP) on January 23, 2013. Building 400 is also located within the historic district boundary, but is a “non-contributing element” to the historic district. Figure 4 shows the NAS Alameda Historic District, as listed in the NRHP.

2.3 Previous Investigations and Removal Actions

A series of environmental **investigations and removal actions** were conducted at OU-2C to assess potential sources of chemicals in the environment, characterize the nature and extent of contamination, evaluate potential risk, and mitigate certain environmental concerns. The investigations are summarized in Table 3; the removal actions are summarized in Table 4.

FIGURE 4
NAS Alameda Historic District Map 2013

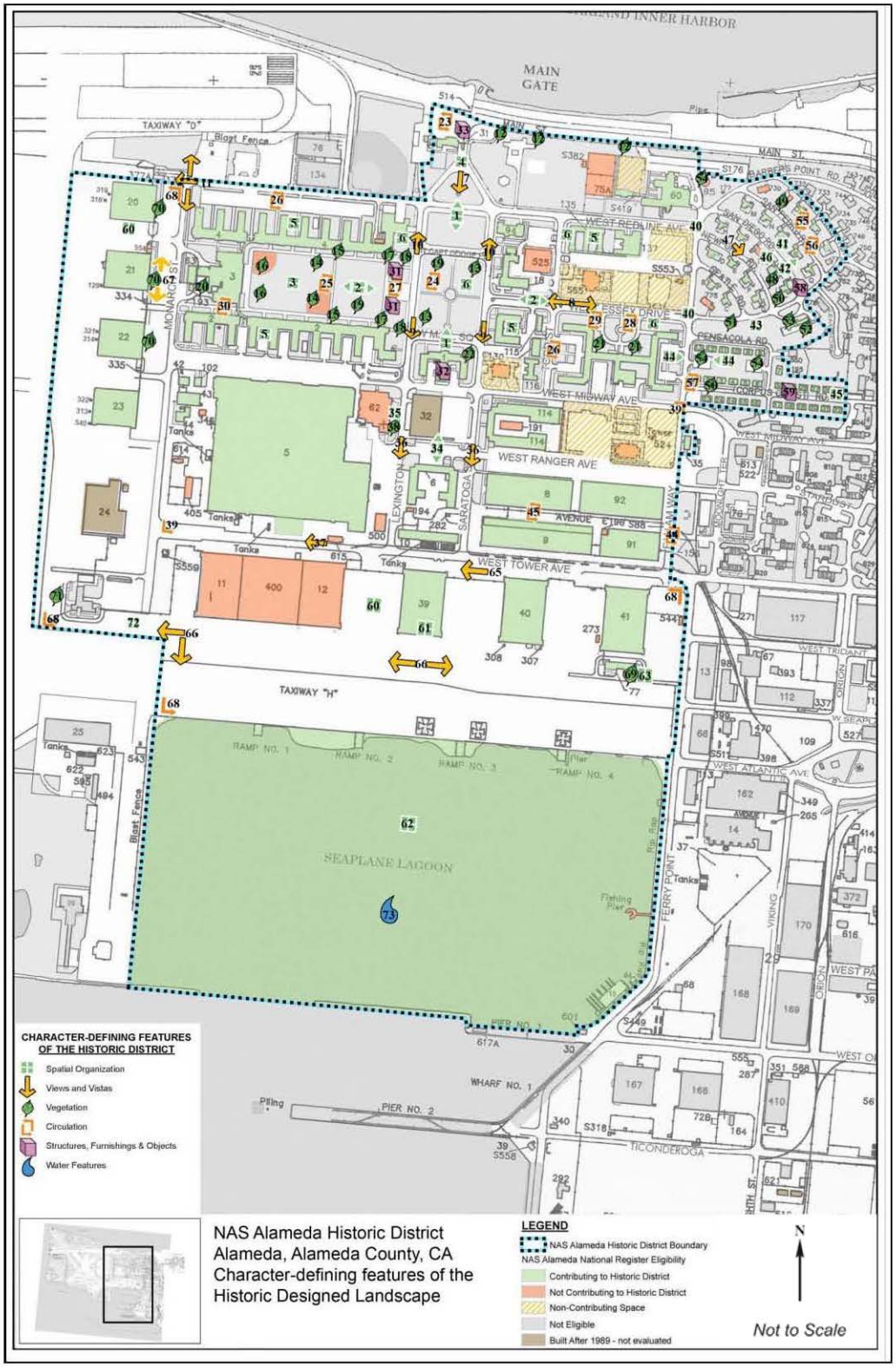


TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C

Previous Study/Investigation*	Date	Investigation Activities
Initial Assessment Study (IAS) of NAS Alameda	1982	An IAS was conducted for many sites at NAS Alameda, including OU-2C. The objective of this study was to identify, assess, and control environmental contamination from past hazardous materials storage, transfer, processing, and disposal operations. The study included records searches, on-site surveys, and interviews with long-term and former NAS Alameda employees. Although no soil or groundwater data were collected during the IAS, the study documented waste sources at NAS Alameda and the analytical results from previous sampling of wastewaters. The IAS documented the sources of wastes in two buildings at OU-2C, Building 5 and former Building 348.
RI/FS Phase 2B and 3 Investigation	1991	This investigation was conducted to determine whether soil and groundwater were contaminated in areas identified during the IAS. IR Sites 5, 10, and 12 (three of 14 IR sites comprising OU-2) were designated as OU-2 Central Area. The Phase 2B and 3 investigation focused on potential releases along the industrial wastewater drains, sanitary sewers, and storm drains, and included collecting soil and groundwater samples, installing groundwater monitoring wells, and performing groundwater monitoring.
Additional RI Sampling at IR Site 5	1992 and 1993	Additional sampling at IR Site 5 was conducted in 1992 and 1993 based on the results of the Phase 2B and 3 sampling at the perimeter of Building 5. This additional soil and groundwater sampling was conducted at five areas in or around Building 5 that were identified for further investigation: the plating shop, the selective plating shop, the wastewater pretreatment area, the former hazardous waste storage area, and the battery acid shop.
RCRA Investigation	1992 - 2004	A RCRA Facility Assessment was conducted at Alameda Point in 1992 to identify SWMUs and areas of concern (AOCs) and to evaluate the need for and scope of a RCRA Facility Investigation. Eighty-five SWMUs and AOCs were identified and were summarized in the Environmental Baseline Survey (EBS) Report. RCRA-permitted facilities at OU-2C included several hazardous waste storage facilities. Soil and groundwater sampling was conducted at the hazardous waste storage facilities as part of the NAS Alameda RI/FS and the EBS.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
EBS	1993 – 1999	The EBS program was initiated at Alameda Point in 1993 to facilitate property transfer. The entire property at Alameda Point was divided into 209 EBS parcels. During the EBS and after its completion, 53 EBS parcels were divided into subparcels and given alphanumeric identifiers (e.g., a portion of EBS Parcel 50 became EBS Parcel 50A). The EBS investigation was implemented in two phases. Phase 1 provided an assessment of the environmental impacts due to base operations and included site visits, employee interviews, historical research, and an inventory of all property on a parcel-by-parcel basis. Based on the results of the Phase 1 analysis, Phase 2 was conducted to further examine the potential environmental impacts at Alameda Point; this phase included the collection and analyses of environmental samples. Phase 2 of the EBS was conducted in three subphases: 2A, 2B, and 2C. An EBS basewide sewer investigation addressing the industrial, storm, and sanitary sewers was conducted in conjunction with the EBS Phase 2A investigation. The basewide sewer investigation was conducted in accordance with the Work Plan for Storm, Industrial, and Sanitary Sewer Sampling, NAS Alameda. Twenty-eight EBS parcels are located within the boundaries of OU-2C in IR Sites 5, 10, and 12. The EBS parcels located within IR Site 5 are EBS Parcels 23C, 28A, 29A, 30A, 45A, 46, 47, 48, 49, 50A, 50B, 51A, 51B, 53A, 54, 55, 56, 57, 58, 59, 66, 67, 68, 186, 190A, and 204A. IR Site 10 consists entirely of EBS Parcel 52; IR Site 12 consists entirely of EBS Parcel 69.
Follow-on RI/FS Sampling at IR Sites 5, 10, and 12	1994	The objective of the follow-on RI/FS investigation in 1994 was to fill data gaps from previous investigations by collecting additional chemical, geological, and hydrogeological information to assess the nature and extent of soil and groundwater contamination for an RI and an FS. Previous investigations indicated the presence of semi-volatile organic compounds (SVOCs) and VOCs in groundwater. Field activities consisted of collecting soil samples and nonpoint source (sediment) samples from storm drain catch basins; performing cone penetrometer testing (CPT); collecting direct-push groundwater samples and HydroPunch samples; installing wells, including deeper monitoring wells and a reference boring; and performing four quarters of groundwater monitoring. The objective of the CPT and direct-push groundwater sampling program was to evaluate the lithology and hydrogeologic characteristics below a depth of 15 feet, to assess the thickness of the SWBZ, and to obtain a groundwater sample from the permeable zone within the SWBZ at each location.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Storm Drain Investigations	1995 – 2000	Investigations of storm drain sediments and storm drain corridors occurred in 1995 in conjunction with the EBS Phase 2A and 2B sampling activities. These storm drain investigations were designed to address contaminants in and adjacent to the storm drain lines. Prior radiological characterization activities conducted at IR Sites 5 and 10 indicated the potential presence of ^{226}Ra contamination at these sites. Initial characterization of the drain lines, storm drain lines, and storm drain manholes associated with Buildings 5 and 400 was conducted in 1996. The characterization survey was performed by pulling a sodium iodide detector through the storm drain lines. Approximately 1,000 feet of the main storm drain line between Building 5 and Seaplane Lagoon were surveyed in August and September 1996. A storm drain sediment removal action was completed by the Navy between 1995 and 1997. A detailed investigation of the storm drains was conducted in December 1997. The survey included almost 6,000 feet of storm drain and sanitary drain piping. In addition, several solid samples were collected for gamma spectroscopy analyses. The samples were taken at the storm drain outfalls and from some of the manholes in the system. Removal and replacement or in-place decontamination of storm drain piping and manholes was performed during the period of November 1998 to October 1999. More than 700 feet of contaminated piping outside of Building 5 was removed. Approximately 700 feet of contaminated piping was decontaminated by hydroblasting. This included piping from both Buildings 5 and 400. Three contaminated manholes near Building 5 were removed and replaced. In 2000, the Navy conducted a storm drain study. The primary objective of this investigation was to identify storm drain sections that were damaged, located below the water table (submerged), and subject to infiltration of contaminated groundwater. Approximately 1,380 feet of line in the vicinity of IR Site 5 was identified as undamaged, nonpriority storm drain line. These lines were parts of systems that discharged to Outfalls F and G. In addition, approximately 1,785 feet of the storm drain system in the vicinity of IR Sites 5, 10, and 12 that discharges to Outfall F was identified as being within the chemical plumes. Several sections of the storm drains associated with Building 5 were below the water table. All of the storm drains located at IR Site 10 were below the groundwater table.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Radiological Surveys, Investigations, and Removals	1995 – 2009	Several radiation surveys and removal actions have been conducted at OU-2C. In 1995, the Navy contracted for a radiological survey to characterize radioactive contamination at several locations at NAS Alameda, which included Buildings 5 and 400, storm drains and sewer lines, and several other areas at OU-2C. The objective of the survey for areas within OU-2C was to survey rooms and their contents in Buildings 5 and 400 that were considered to be contaminated with ^{226}Ra; to remove or isolate surface contamination, if possible; and to survey building drain lines and storm drain and sewer lines associated with the affected room to identify areas which had activities significantly above site-specific background levels. Initial characterization of the drain lines, storm drain lines, and storm drain manholes associated with Buildings 5 and 400 was conducted in 1996. In addition, several manholes in the main storm drain line and the main branch lines were surveyed. Contamination was identified in the main storm drain line and in drain lines exiting Buildings 5 and 400. A detailed investigation of the storm drains was conducted in December 1997. The survey included almost 6,000 feet of storm drain and sanitary drain piping. Removal and replacement or in-place decontamination of storm drain piping and manholes was performed during the period of November 1998 through October 1999. From October 1998 through April 2000, the Navy performed a radiological closeout survey at Alameda Point for Buildings 5 and 400. This survey was performed to demonstrate that residual radioactive materials associated with Navy activities were present at low levels that satisfy criteria established by Radiological Affairs Support Office (RASO), the U.S. Nuclear Regulatory Commission (NRC), and the California Department of Health Services (DHS). Areas with residual radioactive contamination were removed or documented by the Navy. After decontamination, areas of the buildings were surveyed for alpha or beta-gamma surficial contamination or gamma radiation. Results of the radiological closeout survey demonstrated that no significant radioactive contamination remained in Buildings 5 and 400. Results of all final measurements taken during this survey were at or below applicable surface activity limits.
Geochemical Profiling Investigations	1997 – 1998	Two geochemical profiling investigations were conducted as part of the NAS Alameda RI/FS activities to define the vertical and lateral extent of chlorinated solvents that had been identified in groundwater beneath and around Building 5. The geochemical profiling investigations and concurrent quarterly groundwater sampling events were conducted in 1997 and 1998.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Electrokinetic Pilot-scale Treatability Study	1998	The primary objective of the electrokinetic pilot-scale treatability study was to treat chromium-contaminated soil at IR Site 5 to attain levels below EPA Region 9 preliminary remedial goals (PRGs) for residential soils. The technology was applied from December 1997 to June 1998 on chromium-contaminated soil located beneath Building 5 at the former aircraft rework facility plating shop. Previous investigations indicated that salts containing chromium and hexavalent chromium (e.g., chromic acid, dichromate, and chromate anions) had been deposited into the soil under the plating shop during chromium plating operations conducted at the site between 1942 and 1990. In October 1998, following completion of the pilot-scale study, soil samples were collected from 12 borings at depths of 1.5, 4.5, and 8.5 feet bgs and analyzed for metals, hexavalent chromium, and general chemistry parameters. Evaluation of the post-treatment data shows that for both total chromium and hexavalent chromium, the 95 percent upper confidence limit (UCL) concentrations for the total population were reduced to levels below their respective PRGs; however, the 95 percent UCL for total chromium in the samples from the 1.5-foot-bgs depth still exceeded the PRG.
RI Report and Background Determination	1999	The 1999 draft RI Report for OU-2 summarized investigations conducted between 1991 and 1998 for 14 IR sites (IR Sites 3, 4, 5, 9, 10, 11, 12, 13, 14, 19, 21, 22, 23, and 25). The RI Report also included the results of a background chemical concentration determination. The background determination consisted of a basewide assessment of metals in soil and groundwater, which was conducted at Alameda Point in support of site characterization and remediation efforts under CERCLA and in accordance with the background determination methodology presented in a letter report. Soil samples collected during NAS Alameda RI/FS activities were evaluated for appropriateness for inclusion in the background data set. All soil samples collected from IR sites with histories of potential metals contamination were excluded as background samples. Furthermore, soil samples that contained organic chemicals other than a polycyclic aromatic hydrocarbon (PAH) were excluded from consideration as background samples. Once a soil data set had been compiled, Alameda Point was divided into three geologically similar areas based on differing fill deposition dates. Iron and manganese data were statistically compared to confirm that these areas contained geologically similar soils. Fifty-five background soil samples analyzed for metals were collected from locations within and outside the OU-2C area. Seven of the 55 soil samples were collected inside the boundaries of what is now OU-2C. Analytical results for these seven samples are included in the data set for OU-2C. Samples from three borings located just south of OU-2C were also included in the background data set.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Chlorinated Solvent Treatability Studies	2000	Two treatability studies were conducted to address two areas with chlorinated VOCs at concentrations in excess of 10,000 micrograms per liter (µg/L). A surfactant-enhanced subsurface remediation treatability study was conducted at the northeastern corner of Building 5. Results indicated the treatment did not decrease VOC concentrations as predicted, therefore, this area underwent full-scale source area remediation in 2004, as described in the DNAPL Source Removal Action described in Table 4. A steam-enhanced extraction (SEE) remediation treatability study was conducted at the eastern margin of Building 5 between May 1999 and July 1999. The study concluded that SEE was a feasible in situ technique for removing the volatile fraction of a mixture of solvents and oils found in soils near the former waste oil and solvent tank.
Supplemental RI Data Gap Sampling	2001 – 2002	Supplemental data gap sampling was conducted at OU-1 and OU-2 in 2001 and 2002 to investigate chlorinated solvents in groundwater. Specific objectives of this sampling included the following: • delineation of chlorinated VOC plumes in groundwater • investigation of the potential for dense nonaqueous-phase liquid (DNAPL) in the saturated zone • investigation of storm drain bedding materials as potential pathways • characterization of hexavalent chromium and cyanide in groundwater in the vicinity of the former plating shop in Building 5 • collection of soil gas and soil samples to support vapor intrusion modeling in the baseline human health risk assessment (HHRA). A round of groundwater sampling from existing wells was also conducted during this investigation.
Chlorinated Solvent Plume Definition	2001 – 2002	From September 2001 through January 2002, an investigation was conducted to determine the vertical and lateral extent of potential plumes with VOC concentrations above 10,000 µg/L prior to preparation of final project plans to conduct a VOC source removal action at IR Site 5. Four plumes (5-1 through 5-4) were identified in the engineering evaluation and cost analysis. Samples were analyzed specifically for 10 VOCs.

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Basewide Groundwater Monitoring Program (BGMP)	2002 – 2007	The BGMP for IR sites at Alameda Point was implemented in 2002 and is ongoing as of November 2013. The portion of the BGMP for OU-2C (referred to as the IR Site 5 Group) was implemented with 10 of 42 existing wells in 2002, including seven FWBZ wells and three SWBZ wells. Two wells were selected as background wells. The remaining wells were selected to monitor known boundaries of the VOC plume beneath Building 5 and to provide data for monitored natural attenuation. Additionally, one monitoring well included in the IR Site 8 BGMP program is located within the boundaries of IR Site 5, which results in a total of 11 wells within OU-2C identified for sampling under the BGMP. Under the BGMP, groundwater samples are analyzed for VOCs, total petroleum hydrocarbons (TPH), metals (including hexavalent chromium), anions, sulfide, alkalinity, and dissolved gases. During the first 2 years of sampling under the BGMP, six wells were sampled quarterly and five wells were sampled semiannually. After eight quarters of sampling (summer 2002 through spring 2004), the BGMP schedule was reduced to sampling semiannually for all wells.
Basewide PAH Investigation	2003	A basewide investigation of PAHs in soil was conducted in 2003 at selected IR sites at Alameda Point to collect sufficient PAH data to calculate exposure point concentrations for risk assessments at CERCLA sites. Direct-push, continuous coring was used to collect soil to the total depth of 8 feet bgs. Each core was separated into four depth intervals (ground surface to 0.5 foot bgs, 0.5 foot to 2 feet bgs, 2 to 4 feet bgs, and 4 to 8 feet bgs). Soil collected from each depth interval was homogenized and samples were submitted for analysis of 16 PAH compounds. For OU-2C, a total of 552 samples (including duplicates) were collected from 138 boring locations; no sampling was conducted within existing buildings.
Supplemental RI Sampling	2007	Soil and groundwater samples were collected to complete the characterization of the nature and extent of contamination, and measurements of groundwater levels were performed to assess the direction of groundwater flow at OU-2C and the tidal influence between Seaplane Lagoon and OU-2C. Soil, groundwater, and sub-slab soil gas samples beneath Building 5 were also collected. The sub-slab soil gas samples were collected for use in the HHRA. The RI also includes detailed information about how specific AOCs have been investigated and addressed. As described in the OU-2C RI, metals and VOCs are the COCs at OU-2C. At IR Sites 10 and 12, only arsenic and iron in soil were found at concentrations above comparison criteria, but were consistent with background levels at Alameda Point. No COCs were detected above the maximum contaminant level (MCL) in groundwater from IR Sites 10 and 12. Only drain lines beneath

TABLE 3. TIMELINE SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS AT OU-2C (CONTINUED)

Previous Study/Investigation*	Date	Investigation Activities
Supplemental RI Sampling (continued)	2007	Building 400 require action for IR Site 10 and no action is required for any media at IR Site 12. RI sampling determined that 21 SWMUs required no further action. At IR Site 5, five VOCs were reported in one or more historical samples at concentrations above comparison criteria. For most locations, recent soil sampling has either found no VOCs at concentrations above comparison criteria or has provided better delineation of the extent of VOCs contamination. Four metals (arsenic, thallium, chromium, and lead) were identified as above background levels at IR Site 5. Arsenic and thallium were reported in a single soil sample from IR Site 5 collected in the mid-1990s at concentrations above background; more recent sampling for the OU-2C RI did not confirm these concentrations, but these metals were retained in the OU-2C risk assessment. Chromium was reported to be above federal industrial preliminary remediation goals in nine soil samples and above background in 39 of 695 samples, and was retained for further evaluation in the risk assessment. Lead concentrations at IR Site 5 were not statistically different from concentrations in the Alameda Point background data set; however, lead in soil beneath the northern portion of Building 5 appears to be related to former DON activities. Fourteen chlorinated VOCs in the shallow FWBZ, eight of 14 VOCs in the deep FWBZ, and seven of 14 VOCs in the SWBZ were reported at concentrations above comparison criteria in groundwater samples from IR Site 5. Ten of 14 VOCs were reported at concentrations above comparison criteria in groundwater samples collected in 2006 and 2007. Two fuel-related VOCs, benzene and methyl tertiary butyl ether (MTBE), in groundwater were reported above comparison criteria and almost exclusively in areas associated with Building 5; therefore, these chemicals were retained for further risk evaluation.
FS	2011	Remedial alternatives were evaluated for soil and groundwater at IR Site 5 and drain lines beneath Buildings 5 and 400.
Technical Memorandum	2011	Office worker remedial action footprints in the FS Report were re-evaluated based on EPA's September 2011 trichloroethene (TCE) inhalation toxicity value. The evaluation concluded that no changes to the remedial action footprints are required. The TCE soil and groundwater RGs were updated based on the September 2011 toxicity values.

* The documents listed above are available in the Administrative Record and provide detailed information used to support the remedy selection for soil and groundwater throughout OU-2C and drain lines beneath Buildings 5 and 400.

TABLE 4. TIMELINE SUMMARY OF REMOVAL ACTIONS AT OU-2C

Removal Actions*	Date	Removal Action Activities
TPH Removal Actions	1993 - 2000	The Petroleum Program has identified four CAAs entirely within the boundaries of OU-2C, a portion of another CAA crossing into the OU, 24 USTs, 27 ASTs, and five OWSs. The removal or in-place closure of USTs at IR Site 5 began in 1994 and continued through 1998. Removal work for the pipelines associated with the basewide fuel distribution system was conducted at Alameda Point from June 1998 to February 1999 and May to June 1999. During 1998 and 1999, 29,634 linear feet of fuel line was removed, and 23,788 linear feet of fuel line was abandoned in place by cleaning and grouting the lines. The removed and abandoned fuel lines included some fuel lines located at IR Site 5. No fuel lines were removed or abandoned at IR Sites 10 and 12.
Radiological Removal Actions	1998 - 2007	Removal and replacement or in-place decontamination of storm drain piping and manholes was performed. More than 700 feet of contaminated piping outside of Building 5 was removed. Approximately 700 feet of contaminated piping was decontaminated by hydroblasting. This included piping from both Building 5 and Building 400. Three contaminated manholes near Building 5 were removed and replaced.
Building 5 Plating Shop Removal Action	2001 - 2002	The Navy conducted a metals removal action at the former plating shop in Building 5 between December 2001 and February 2002. The concrete floor was removed and soil was extracted during an initial excavation and two subsequent step-out excavations. Approximately 1,750 cubic yards (yd^3) of soil was excavated. Confirmation samples were collected during the removal action to verify that concentrations in remaining soil were below action levels. The removal action report concluded that no further removal action was warranted. As part of the removal action, soil to 7 feet bgs was removed.
DNAPL Source Removal Actions	2004 - 2007	A full-scale DNAPL source removal action using six-phase heating with vapor extraction was completed at Plume 5-1 between July 2004 and November 2004. A full-scale DNAPL source removal action was also implemented in several phases at Plume 5-3 from 2006 through 2009. The objective of these removal actions was to remove sufficient contaminant mass to permanently reduce the total concentrations of COCs to below 10,000 μg/L within the horizontal extent of Plume 5-1 and Plume 5-3, to a maximum depth of 20 feet bgs. The removal action involved heating the subsurface using electrodes, capturing and treating volatilized chemicals using vapor extraction, and treating the vapors.

TABLE 4: TIMELINE SUMMARY OF REMOVAL ACTIONS AT OU-2C (CONTINUED)

Removal Actions*	Date	Removal Action Activities
Radiologically-impacted Lines F and FF TCRA	2008 - 2010	The TCRA removed radiologically-impacted storm drain lines associated with OU-2C IR Sites 5 (Buildings 5 and 5A) and 10 (Buildings 400 and 400A) that discharge into Seaplane Lagoon (IR Site 17) via Outfalls F and FF. The removal action removed the existing ^{226}Ra-impacted storm drain lines F and FF and surrounding soil contaminated with radionuclides of concern (ROCs) in excess of the release criteria, which were listed in the Action Memorandum. To accommodate drainage needs, new storm drain lines were installed to replace those that were removed. Radiologically-impacted soil and debris were characterized and disposed of at a fully permitted off-site disposal facility.

* The documents listed above are available in the Administrative Record and provide detailed information used to support the remedy selection for soil, groundwater, and drain lines at OU-2C.

2.4 Current and Potential Future Site Uses

OU-2C is located within the Civic Core (Figure 5) where the planned future land use is commercial mixed-use, which includes light industry, office, civic, residential, educational, recreational, commercial, and other uses.

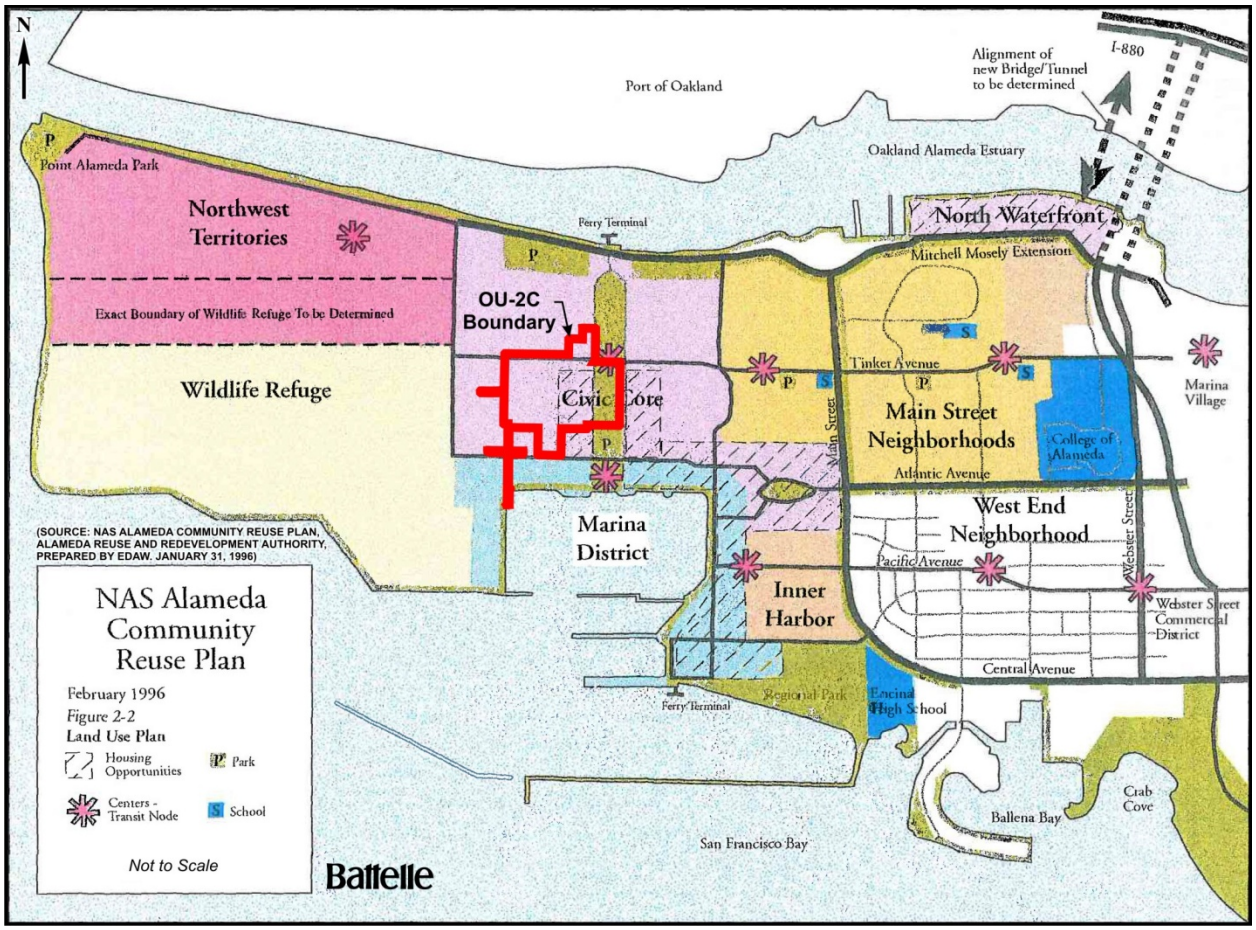
Groundwater beneath Alameda Point (including OU-2C) is not currently used for **drinking water**, irrigation, or industrial supply. Drinking water is supplied to Alameda Point by the East Bay Municipal Utilities District. Shallow groundwater at OU-2C is not considered a potential drinking water source by the DON or agencies based on factors including insufficient yield and saltwater intrusion, and deeper groundwater is characteristically unsuitable as a drinking water source based on factors including high natural levels of dissolved solids.

Under existing and expected future site conditions, it is unlikely that ecological receptors are present at the site or would be exposed to chemicals. Most of the site is covered by pavement or buildings, and unpaved areas are generally landscaped, which offers little habitat value.

2.5 Summary of Site Risks

Risk assessments were performed to assess current and potential future risk for human and ecological receptors at OU-2C. Risks were calculated using both historical data and data collected during the RI. The risk assessments are presented in the Final OU-2C RI Report issued in 2008 and the Final FS issued in 2011. The FS Addendum risk assessments are not summarized since those storm drain and industrial waste lines are not addressed in this ROD.

FIGURE 5
Community Reuse Plan

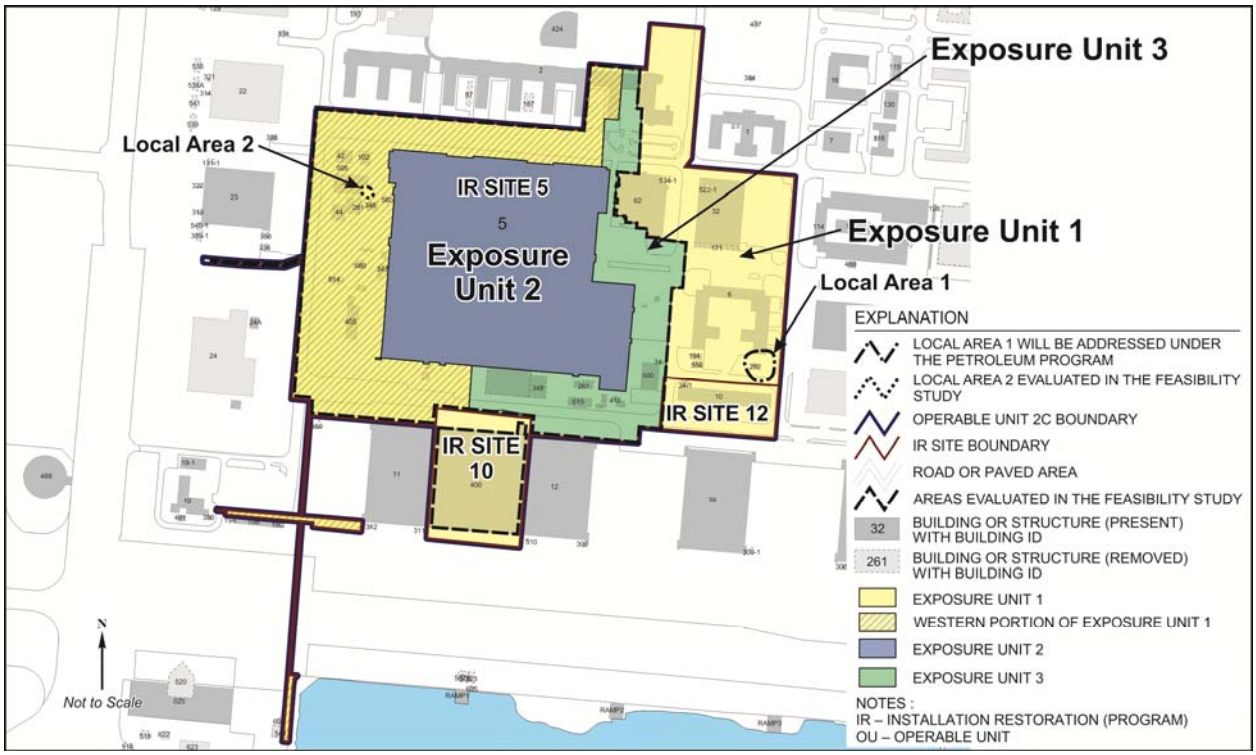


For the RI Report HHRA, OU-2C was divided into three subareas designated as Exposure Units 1, 2, and 3 for ease in assessing the large area of OU-2C (Figure 6). The HHRA assessed potential human exposures to chemicals in soil, groundwater, and soil gas. ^{226}Ra was not evaluated as part of the RI Report risk assessment. The exposure units were designated based on similarities in the known or presumed nature and extent of environmental impacts and historical site use:

- Exposure Unit 1 (approximately 30.3 acres) encompasses generally the perimeter of OU-2C. IR Sites 10 and 12 are contained within Exposure Unit 1, as are the northern, northwestern, western, southwestern, and eastern portions of IR Site 5.
- Exposure Unit 2 (approximately 20.9 acres) corresponds to Building 5 at IR Site 5.
- Exposure Unit 3 (approximately 7.2 acres) is located along the eastern and southern boundaries of Exposure Unit 2. Exposure Unit 3 is made up of portions of only IR Site 5.

In addition to these exposure units, isolated areas within Exposure Unit 1 at IR Site 5 defined as Local Area 1 (east of Building 5) and Local Area 2 (northwest of Building 5) were also identified in the RI Report to facilitate the characterization of risk (Figure 6).

FIGURE 6
Risk Assessment Subareas



An additional HHRA was conducted as part of the FS Report to further evaluate potential human exposures to chemicals in soil and groundwater within a portion of Exposure Unit 1 referred to as **Western Exposure Unit 1**. Figure 6 shows the location of Western Exposure Unit 1 (hatched yellow area located within IR Site 5 to the north, northwest, west, and southwest of Building 5 and excluding Local Area 2).

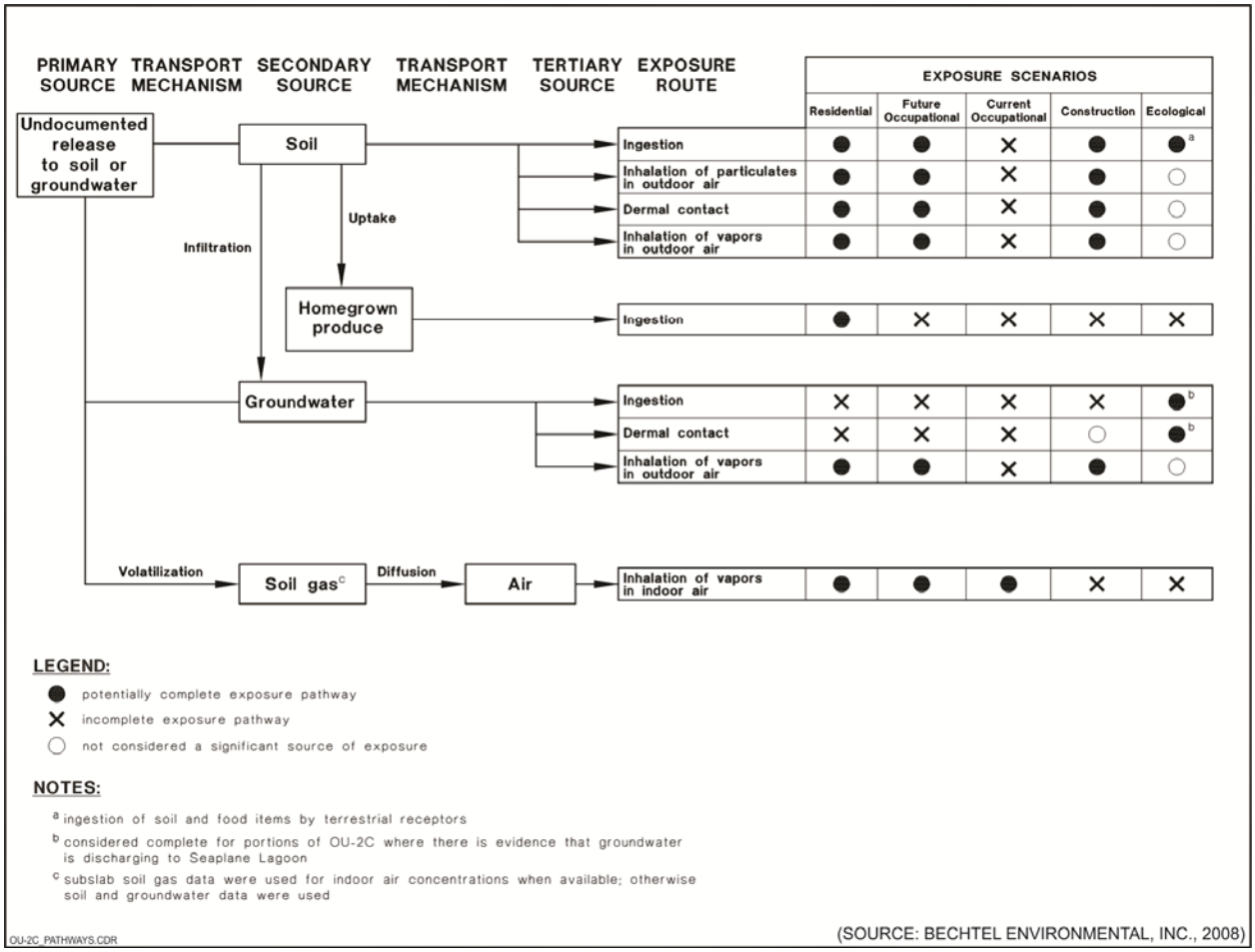
2.5.1 Human Health Risks from Exposures to Chemicals

The HHRAs were designed to provide a margin of safety to protect human health by using conservative assumptions so that risks are not underestimated. An example of a conservative assumption is that a person would ingest soil for 350 days per year for 30 years. The HHRAs were conducted in accordance with EPA and Cal/EPA DTSC guidance.

Exposure pathways in a risk assessment are based on current and reasonable future exposure scenarios. As shown on the conceptual site model (Figure 7) for OU-2C, potential exposure pathways for current and potential future human receptors include:

- direct contact with soil (ingestion, inhalation of dust, and skin absorption) for all human receptors,
- consumption of homegrown produce for potential future residents, and
- inhalation of vapors in indoor air from volatile chemicals in soil and groundwater for all human receptors.

FIGURE 7
Conceptual Site Model



Because groundwater is not a source of drinking water at OU-2C, the potential for exposure to chemicals in groundwater is limited to vapor migration from the shallow FWBZ. Vapor migration occurs when volatile chemicals in groundwater partition to the vapor phase at the groundwater surface; therefore, the exposure pathway for vapor migration from groundwater is incomplete other than the shallow FWBZ at OU-2C. Accordingly, there are no specific human health risks associated with chemicals in groundwater in the deep FWBZ and SWBZ.

The **HHRAs** for Exposure Units 1, 2, and 3 and Western Exposure Unit 1 evaluated current and future potential health risks based on the likelihood that exposure to any chemical in soil, shallow FWBZ groundwater, and/or air at OU-2C could pose a risk to human health. For these HHRAs, total cancer risks and non-cancer health hazards were calculated for three potentially exposed human receptor populations, as follows:

- **Current and future office workers** (i.e., a commercial and/or industrial worker category that encompasses work performed primarily inside a building) were assumed to be exposed to chemicals in soil from the ground surface to 8 feet bgs (approximately the water table) via the same pathways as residents with the exception

of ingestion of homegrown produce. Exposure was assumed to occur 250 days per year for a total of 25 years.

- **Future construction workers** were assumed to be exposed to chemicals in soil from the ground surface to 8 feet bgs (approximately the water table) via incidental soil ingestion, dermal contact with soil, inhalation of particulates from soil, and inhalation of vapors from soil and groundwater in outdoor air. Exposure was assumed to occur 20 days per year for a total of 7 years.
- **Hypothetical potential future residents (children and adults)** were evaluated to provide maximum conservativeness in the HHRAs. Hypothetical residents were assumed to be exposed to chemicals in soil from the ground surface to 8 feet bgs (approximately the water table) via incidental soil ingestion, dermal contact with soil, inhalation of particulates from soil, inhalation of vapors from soil and groundwater migrating into indoor and outdoor air, and ingestion of produce grown in local soil. Although the planned future use of OU-2C is not residential, the hypothetical future resident was evaluated to demonstrate risks under any potential future land use. Residential exposure was assumed to occur 350 days per year for a total of 30 years.

The toxicity assessment component of the HHRAs relied on numerical toxicity values to characterize cancer risks and non-cancer health hazards. A cancer slope factor is used for carcinogenic health effects and a reference dose (RfD) is used for non-cancer health effects. Two sets of cancer risks were calculated for chemicals: one set based on EPA toxicity values and the other set based on Cal/EPA toxicity values.

The final step in a HHRA is risk characterization. During this step, the estimated rate at which a person takes in a chemical is combined with information about the toxicity of that chemical to estimate the potential cancer risk and/or non-cancer health hazard posed by exposure.

Cancer risk is expressed as a statistical probability that an individual could have an increased risk of cancer incidence. A one in 10,000 chance is a risk of 1×10^{-4}. In this case, for every 10,000 people, one additional case of cancer may occur as a result of exposure. A one in 1,000,000 chance is expressed as 1×10^{-6}. In this case, for every 1,000,000 people, one additional case of cancer may occur as a result of exposure.

A HHRA does not predict actual health effects, but is a tool for making risk management decisions. In accordance with EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, 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 OSWER Directive 9355.0-30 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."*

Risks less than 10^{-6} are considered negligible. When risks are greater than 10^{-4}, action is generally required. Site-specific factors are typically considered when making decisions about whether action is required at sites where cancer risks are in the risk management range.

The non-cancer health risk associated with exposure is expressed as a HQ for risk from an individual chemical or a HI for cumulative risk from multiple chemicals. The target threshold level for an individual HQ and the cumulative HI is 1.

Risks for OU-2C soil and groundwater, calculated using EPA toxicity values, are provided below and summarized in Table 5. **Risks were re-calculated for Exposure Units 2 and 3** for the future office worker scenario based on EPA updated TCE toxicity values and are provided in Table 5.

TABLE 5. SUMMARY OF CANCER RISKS AND NON-CANCER HEALTH HAZARDS

Area/Subarea	Receptor	Total Cancer Risk	Non-cancer hazard [a]
Exposure Unit 1[b]	Future Office Worker Construction Worker Resident[c]	3×10^{-5} 7×10^{-7} 5×10^{-5}	0.3 0.1 1[d]
Western Exposure Unit 1 [e,f]	Resident	2×10^{-5}	1
Local Area 2	Future Office Worker Resident	2×10^{-5} 7×10^{-4}	0.3 2
IR Site 10 [e,g]	Resident	5×10^{-5}	1
IR Site 12 [e,h]	Resident	7×10^{-6}	0.4
Exposure Unit 2	Current Office Worker Future Office Worker Construction Worker Resident	1×10^{-6} 3×10^{-5}[i] 1×10^{-6} 2×10^{-3}	0.002 2[i] 0.2 86
Exposure Unit 3	Future Office Worker Construction Worker Resident	3×10^{-5}[i] 3×10^{-6} 1×10^{-2}	24[i] 3 3,100

This table presents the risk for soil and groundwater within OU-2C.

(a) The HI is the sum of individual HQs, unless otherwise noted.
(b) Includes IR Sites 10 and 12, as well as Local Areas 1 and 2; risks were also calculated separately for these areas, in addition to Western Exposure Unit 1. Potential residential and office worker risks were assessed for the Local Areas. Local Area 1 will be addressed under the petroleum program, so no risk values are shown.
(c) Excludes Local Areas 1 and 2.
(d) HQs for all chemicals are less than 1. Conservatively assuming additive effects, the HI was calculated as 2.
(e) For Western Exposure Unit 1 and for IR Sites 10 and 12, only potential residential risks were evaluated.
(f) Western Exposure Unit 1 does not include IR Site 10 or Local Area 2. Cancer risk within Western Exposure Unit 1 is driven by the presence of naphthalene at one soil sampling location.
(g) While cancer risk and non-cancer hazard are acceptable for IR Site 10, action is required for the drain lines beneath Building 400.
(h) No action is required for IR Site 12 for any media based on both cancer risk and non-cancer hazard within the risk management range.
(i) Revised cancer risk and noncancer hazard values based on the revised toxicity evaluation for TCE released by EPA in 2011.

Exposure Unit 1:

- **Future construction workers** – cancer risks below the risk management range (7×10^{-7}) and HI less than 1 (HI = 0.1).
- **Future office workers** – cancer risks within the risk management range (3×10^{-5}) and HI less than 1 (HI = 0.3).
- **Hypothetical future residents** – cancer risks above the risk management range (1×10^{-3}) and HI greater than 1 (HI = 11). These risks and hazard estimates include Local Area 1, Local Area 2, infrequently reported organic chemicals, and naturally occurring metals. When the data for Local Area 1, which is being remediated under a different program, Local Area 2, infrequently reported organics, and naturally occurring metals are removed, the adjusted cancer risk is within the risk management range (5×10^{-5}) and the HI is only slightly greater than 1 (HI = 2). HQs for individual chemicals of potential concern (COPCs) are all less than 1 and the concentrations are not evenly distributed.
- **Hypothetical future residents for Western Exposure Unit 1** – cancer risks within the risk management range (2×10^{-5}) and HI equals 1.
- **Hypothetical future residents for IR Sites 10 and 12** – cancer risks within the risk management range (IR Site 10 = 5×10^{-5}; IR Site 12 = 7×10^{-6}) and HIs equal to or less than 1 (IR Site 10 HI = 1; IR Site 12 HI = 0.4).
- **Hypothetical future residents for Local Area 2** – cancer risks above the risk management range (7×10^{-4}) and non-cancer HI only slightly greater than 1 (HI = 2).
- **Local Area 1** – Local Area 1 is being addressed through the Alameda Point basewide petroleum program.

Exposure Unit 2:

- **Future construction workers** – cancer risks at the lowest end of the risk management range (1×10^{-6}) and HI less than 1 (HI = 0.2).
- **Current office workers** – cancer risks at the lowest end of the risk management range (1×10^{-6}) and non-cancer HI less than 1 (HI = 0.002).
- **Future office workers** – cancer risks within the risk management range (3×10^{-5}) and non-cancer HI equals 2.
- **Hypothetical future residents** – cancer risks above the risk management range (2×10^{-3}) and HI greater than 1 (HI = 86); the risk drivers are primarily VOCs in groundwater and VOCs and metals in soil. Lead was identified as a primary risk driver under this scenario.

Exposure Unit 3:

- **Future construction workers** – cancer risks within the risk management range (3×10^{-6}) and non-cancer HI greater than 1 (HI = 3).
- **Future office workers** – cancer risks above the risk management range (3×10^{-5}) and non-cancer HI greater than 1 (HI = 24).
- **Hypothetical future residents** – cancer risks above the risk management range (1×10^{-2}) and HI greater than 1 (HI = 3,100). Risk drivers under this scenario were primarily VOCs in groundwater and VOCs and metals in soil.

2.5.2 Ecological Risk Assessment

A **screening-level ecological risk assessment** (SLERA) was conducted in association with the RI to estimate the potential ecological impacts of chemicals reported at concentrations above detection limits in soil and groundwater at OU-2C. Exposure pathways that include inhalation of vapors were not considered a significant source of exposure for ecological receptors. A SLERA encompasses Tier 1 (Steps 1 and 2) of the DON policy for conducting an ERA. The ERA process of the DON policy is substantially identical to the EPA's *Ecological Risk Assessment Guidance for Superfund* and functionally equivalent to the ERA guidance documents for the State of California.

Under existing and expected future conditions, it is unlikely that ecological receptors are present at the site or would be exposed to the COPECs in soil since most of the exposure units are covered by pavement or buildings and most of the remaining area is landscaped, which offers little habitat value.

Table 6 provides a summary of both the human health and ecological risk assessments conducted at OU-2C.

TABLE 6. SUMMARY OF OU-2C RISK ASSESSMENTS

Risk Assessment	Conclusion
Exposure Unit 1	No unacceptable risk to human health when risk associated with Local Areas 1 and 2 are considered separately.
Western Exposure Unit 1	No unacceptable risk to human health (risk determinations for Western Exposure Unit 1 exclude Local Area 2).
Exposure Unit 2	Unacceptable risk to human health is present primarily due to VOCs in groundwater, and VOCs and metals in soil.
Exposure Unit 3	Unacceptable risk to human health is present primarily due to VOCs in groundwater, and VOCs and metals in soil.
Ecological Receptors	No unacceptable risk to ecological receptors.

2.6 Remedial Action Objectives for OU-2C

To evaluate remedial alternatives for OU-2C, remedial action objectives (RAOs) were developed as part of the FS. RAOs are medium-specific (e.g., soil or groundwater specific) goals for protecting human health and the environment. RAOs provide a means of identifying areas for potential remedial action, for screening the types of appropriate remedial technologies, and for assessing whether a remedial alternative will achieve site cleanup. OU-2C is currently located in a reuse area indicated as commercial mixed use, which may include residential use. The OU-2C remedy, through ICs, restricts residential use. Restrictions will be detailed in the Land Use Control (LUC) Remedial Design (RD).

The RAOs for OU-2C are to:

- Protect future commercial human receptors (as represented by future office workers) within IR Site 5 from potentially unacceptable risks associated with the presence of COCs in soil and shallow groundwater that exceed occupational RGs;
- Minimize exposure within IR Sites 5 and 10 to radionuclides of concern associated with known or potentially radiologically-impacted drain lines/piping and surrounding soil present beneath Buildings 5 and 400; and
- Minimize human exposure associated with downgradient migration of contaminants in deep groundwater and potentially unacceptable risks to downgradient human receptors.

The RGs (Table 7) for soil and shallow FWBZ groundwater at OU-2C are risk-based concentrations (RBCs) derived to be protective when using a target cancer risk level of 1×10^{-6} and/or a target non-cancer HQ of 1. CERCLA guidance states that cleanup does not usually occur for concentrations below natural or anthropogenic background concentrations. Therefore, where background concentrations are higher than RBCs, background concentrations were selected as the RGs.

The RGs are protective for commercial/industrial use. There is no current risk associated with VOCs in deep FWBZ or SWBZ groundwater because there are no complete exposure pathways for either vapor intrusion or direct contact. However, if direct contact with deep FWBZ and/or SWBZ groundwater was to occur, then risk from the presence of VOCs may be an issue. Because of this potential future risk associated with deep groundwater at OU-2C, groundwater contaminant transport modeling was used to derive RGs for the deep FWBZ and SWBZ (Table 7) and to provide a context for potential remediation of these deeper groundwater intervals.

The RGs were used to identify areas requiring remediation and guide the evaluation of remedial technologies and alternatives. The RGs will also be the basis for measuring the success of active cleanup at OU-2C.

2.7 Principal Threat Waste

Principal threat wastes are hazardous or highly toxic source materials that result in ongoing contamination to surrounding media, generally cannot be reliably contained, or present a significant risk to human health or the environment should exposure occur. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a potential supply for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material. The area of highest COC concentrations in soil at OU-2C is localized under the current Building 5 and 400 slabs and does not extend into the other areas of OU-2C (as evidenced in historical sampling); therefore, the area of highest COC concentrations is not an ongoing source of contamination to other areas of OU-2C. Access to the remediation areas is limited, minimizing possible exposure. Human health risk is further minimized if Buildings 5 and 400 remain in place. In addition, there is no ecological risk. Therefore, there are no principal threat wastes at OU-2C.

TABLE 7. OCCUPATIONAL[(a)] RGs FOR SOIL, GROUNDWATER, AND DRAIN LINES

COC	Soil RGs [(b)] (milligram per kilogram [mg/kg])	Shallow FWBZ Groundwater RGs (µg/L)	Deep FWBZ and SWBZ Groundwater RGs (µg/L)
1,1-Dichloroethane	- [(c)]	1,260	-
1,2,4-Trimethylbenzene	12.8	-	-
Ethylbenzene	0.86	-	-
Tetrachloroethene	0.36	-	-
Trichloroethene	0.54	280	-
Vinyl chloride	-	75.7	163
Total VOCs	-	-	1,000
Arsenic	9.14[(d)]	-	-
Thallium	66	-	-
Lead	800	-	-
Chromium	1,400	-	-
^{226}Ra	1.0 plus background[(e)]	-	-

(a) Occupational includes commercial and industrial workers who primarily perform their work inside a building.
(b) RGs are RBCs derived using a target cancer risk level of 1×10^{-6} and/or non-cancer HQ of 1, unless otherwise indicated.
(c) "-" indicates that the COC was not a primary risk/hazard driver for the exposure scenario.
(d) Ambient background concentration.
(e) Reported in picocuries per gram (pCi/g); RG is for drain lines and surrounding soils.

2.8 Description and Evaluation of Remedial Alternatives at OU-2C

Remedial alternatives for soil, groundwater, and drain lines were developed and evaluated in the FS Report. The areas for which the alternatives apply for soil, shallow groundwater, deep groundwater, and drain lines located beneath the OU-2C buildings are referred to as footprint areas and are presented in Figures 8 through 10. Figure 11 shows the IC boundaries prior to start of the remediation. As the groundwater remedy progresses, ICs are no longer required in areas where RAOs have been achieved. Attainment of RAOs will be determined by evaluation of groundwater sampling results. The IC restrictions boundaries may be adjusted as RAOs are achieved for portions of the ROD IC areas. Several **general response actions (GRAs) and remedial approaches** were evaluated and screened to refine the remedy selection process, as detailed in the FS. The **preliminary remedial alternatives** were evaluated with respect to implementability, effectiveness, and cost (with relative measures of high/moderate/low for these criteria) for the following media:

- Six alternatives for soil, including drain lines beneath Buildings 5 and 400 (presented in Sections 2.8.1 to 2.8.6 of the ROD; remedial footprint in Figure 8),
- Five alternatives for shallow FWBZ groundwater (presented in Sections 2.8.7 to 2.8.12 of the ROD; remedial footprint in Figure 9), and
- Five alternatives for deep FWBZ and SWBZ groundwater (presented in Sections 2.8.13 to 2.8.18 of the ROD; remedial footprint in Figure 10).

FIGURE 8
Soil Footprint Areas, Including Drain Lines beneath Buildings 5 and 400

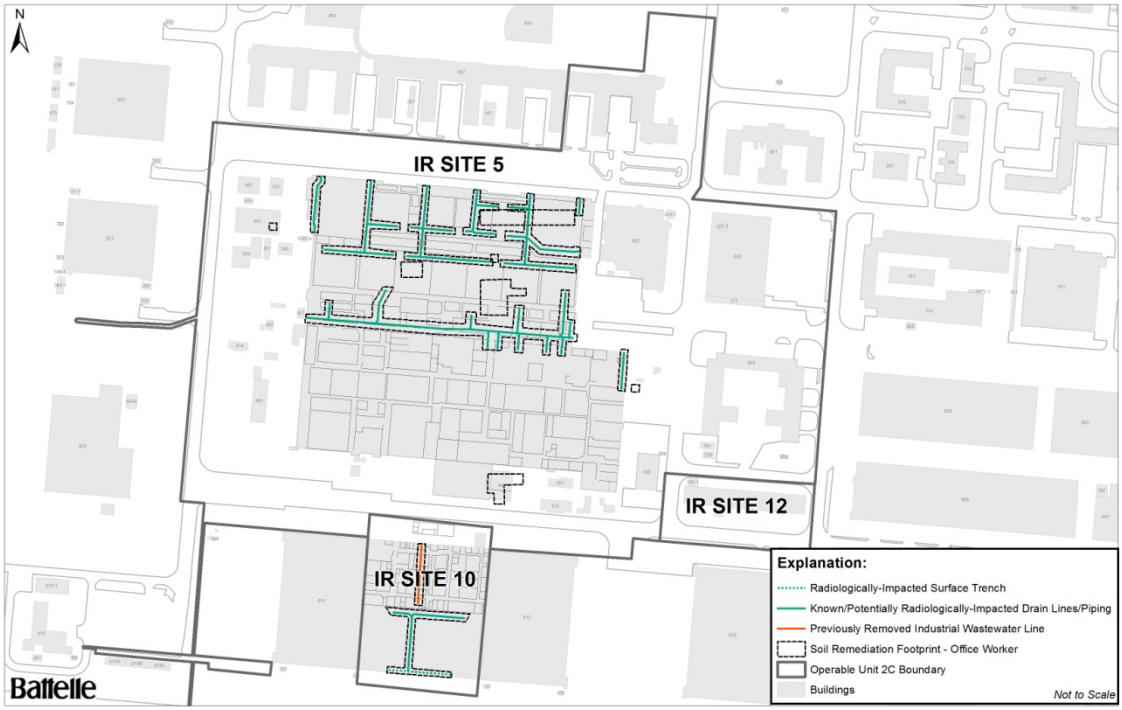
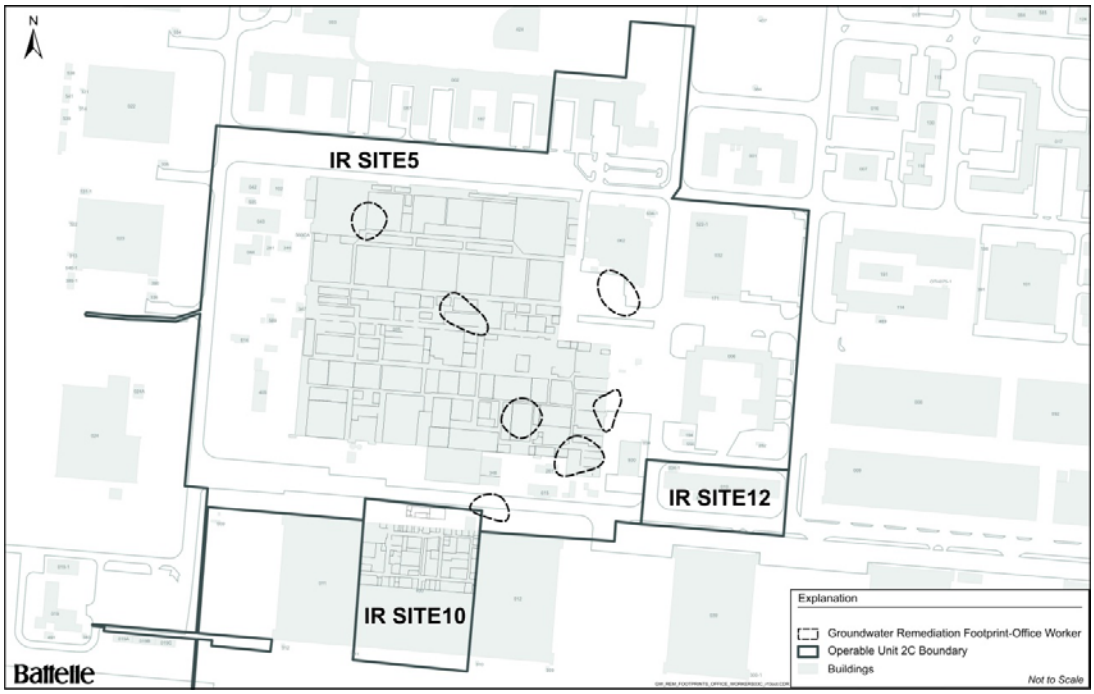
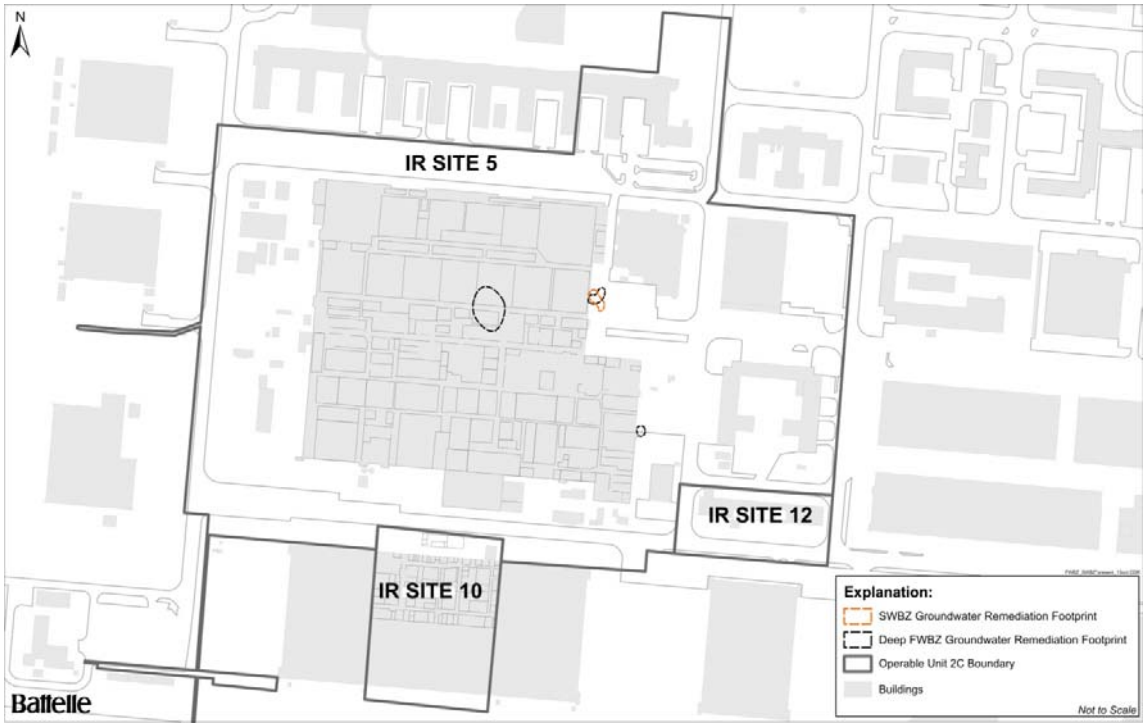


FIGURE 9
Shallow FWBZ Groundwater Footprint Areas Based on Commercial Use



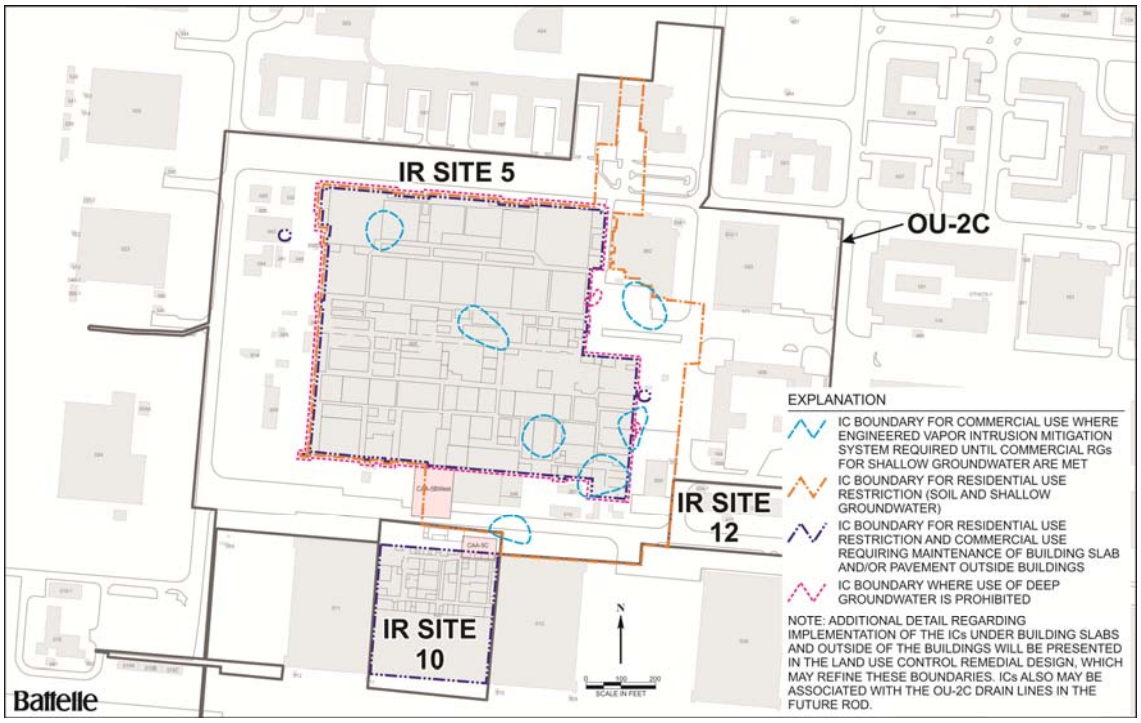
Note - Shallow FWBZ groundwater footprints are based on the following RGs for the COCs: 1,1-dichloroethane (1260 µg/L), trichloroethene (280 µg/L), and vinyl chloride (75.7 µg/L).

FIGURE 10
Deep FWBZ and SWBZ Groundwater Footprint Areas



Note - Deep FWBZ and SWBZ groundwater footprints are based on the following RGs for the COCs: vinyl chloride (163 µg/L) and total VOCs (1000 µg/L).

FIGURE 11
IC Boundary Areas



A detailed evaluation and comparative analysis was then conducted for the remedial alternatives retained from the initial evaluation. Consistent with the NCP criteria, a no action alternative was evaluated for each medium as a baseline for the comparative analysis.

2.8.1 Description of Remedial Alternatives for Soil, Including Drain Lines beneath Buildings 5 and 400

Table 8 provides the major components, details, and cost of each remedial alternative for soil, including the drain lines beneath Buildings 5 and 400.

2.8.2 Comparative Analysis of Remedial Alternatives for Soil, Including Drain Lines beneath Buildings 5 and 400

A comparative analysis of the six remedial alternatives for soil, including drain lines beneath Buildings 5 and 400, with respect to the **nine evaluation criteria** is presented in this section. Table 9 depicts a relative ranking of the alternatives compared to the two threshold criteria (including compliance with ARARs) and the five primary balancing criteria. The two modifying criteria are presented at the end of this section. Soil Alternative S1 is not considered protective of human health and the environment; therefore, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed.

Threshold Criteria

Overall Protection of Human Health and the Environment. The DON's evaluation indicates that all of the alternatives, except Soil Alternative S1, meet the threshold criterion of overall protection of human health and the environment through the implementation of ICs, engineering controls, and/or excavation and off-site disposal of soil with COCs that might pose unacceptable human health risk. Under Soil Alternative S1, impacted soil would be left in place without any engineering controls or ICs to restrict future land use or otherwise manage soil risk, and potentially unacceptable risks to humans would remain. Therefore, Soil Alternative S1 is not considered protective of human health and the environment. Because Soil Alternative S1 does not meet this criterion, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed. The no action alternative provides a basis of comparison and is required by the NCP.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a specific site, chemical, or action. Soil Alternatives S2 through S6 meet the threshold criterion of compliance with ARARs. Soil Alternative S1 does not trigger ARARs because there is no action for this alternative.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. The long-term effectiveness rating for Soil Alternatives S2 through S6 is high. Soil Alternatives S4 and S5 would permanently remove and

TABLE 8. SUMMARY OF REMEDIAL ALTERNATIVES FOR SOIL, INCLUDING DRAIN LINES BENEATH BUILDINGS 5 AND 400

Alternative	Description	Cost (millions)
S1. No Action	CERCLA requires that the no action alternative be evaluated to establish a baseline from which to compare the other alternatives. For this alternative, no actions would be performed.	$0
S2. Engineering Controls and ICs	Metals impacted soil beneath Building 5 and the known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400 would be left in place. The current building slabs would serve as an engineering control and provide adequate protection against the exposure pathways (direct contact and incidental ingestion). Metals and VOC-impacted soil located outside of Building 5 would also be left in place with the existing concrete or asphalt pavement functioning as an engineering control. The drain lines would be sealed in place with grout to enhance the engineering control provided by the building slabs. ICs would be established to restrict future site use/site conditions and would include maintenance of building slabs and pavement as engineering controls. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$0.80
S3. Partial Excavation, Engineering Controls, Off-Site Disposal, and ICs	Metals and VOC-impacted soil located outside of Building 5 would be excavated, including Local Area 2 (Local Area 2 would be remediated to achieve unrestricted land use). The total volume of excavated soil would be approximately 2,300 yd^3. The Building 5 and 400 slabs would be left in place to serve as engineering controls for the metals impacted soil beneath Building 5 and the known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400. In addition, the drain lines would be sealed in place with grout as part of the engineering controls. Excavated soil would be sampled and properly disposed. ICs would be established to restrict future site use/site conditions and would include maintenance of engineering controls (see Alternative S2). Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$1.98
S4. Excavation, Off-Site Disposal, and ICs	Metals and VOC-impacted soil throughout OU-2C, including Local Area 2, and the known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400, would be excavated (Local Area 2 would be remediated to achieve unrestricted land use). The total volume of excavated soil would be approximately 28,000 yd^3. Excavated soil would be sampled and properly disposed. ICs would be established to restrict future site use/site conditions. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$45.64

TABLE 8. SUMMARY OF REMEDIAL ALTERNATIVES FOR SOIL, INCLUDING DRAIN LINES BENEATH BUILDINGS 5 AND 400 (CONTINUED)

Alternative	Description	Cost (millions)
S5. Excavation, Soil Vapor Extraction (SVE), Off-Site Disposal, and ICs	Metals-impacted soil, VOC-impacted soil at Local Area 2, and the known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400 would be excavated (Local Area 2 would be remediated to achieve unrestricted land use). VOC-impacted soil in areas east and south of Building 5, which generally coincide with locations of VOC-impacted groundwater, would be addressed with in situ SVE. The total volume of excavated soil would be approximately 26,400 yd^3. Excavated soil would be sampled and properly disposed. ICs would be established to restrict future site use/site conditions. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$45.61
S6. Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-Site Disposal, and ICs	Known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400 would be excavated. Excavation and disposal of metals and VOC-impacted soil located outside of Building 5 would be completed identically to Alternative S3. The total volume of excavated soil would be approximately 2,300 in-place yd^3 from outside of the building, and approximately 20,700 in-place yd^3 associated with the known or potentially radiologically impacted drain lines/piping and surrounding soil. The Building 5 slab would be left in place to serve as an engineering control for metals-impacted soil beneath the building. Excavated soil would be sampled and properly disposed. ICs would be established to restrict future site use and site conditions and would include maintenance of engineering controls (see Alternative S2). Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$42.33

TABLE 9. RELATIVE RANKING OF REMEDIAL ALTERNATIVES FOR SOIL, INCLUDING DRAIN LINES BENEATH BUILDINGS 5 AND 400

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health and the Environment	Compli-ance with ARARs	Long-Term Effective-ness and Perma-nence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effective-ness	Imple-ment-ability	Cost[(a)]
S1 – No Action	No	NA	NA	NA	NA	NA	NA
S2 – Engineering Controls and ICs	Yes	Yes	High	Low	High	High	High
S3 – Partial Excavation, Engineering Controls, Off-site Disposal, and ICs	Yes	Yes	High	Low	High	Moderate	Moderate
S4 – Excavation, Off-site Disposal, and ICs	Yes	Yes	High	Low	Moderate	Moderate	Low
S5 – Excavation, SVE, Off-site Disposal, and ICs	Yes	Yes	High	High	Moderate	Moderate	Low
S6 – Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-site Disposal, and ICs	Yes	Yes	High	Low	Moderate	High	Low

NA: Not applicable. Soil Alternative S1 is not considered protective of human health and the environment; therefore, an evaluation against the remaining criteria is not necessary and was not performed.

(a) A lower cost receives a higher rating because the alternative would be more cost effective.

dispose offsite and/or treat all soil-associated COCs. Soil Alternative S6 would remove the potentially radiologically-impacted drain lines/piping and surrounding soil, while Soil Alternative S3 would remove and dispose offsite soil-associated COCs located outside of Building 5. Soil Alternatives S3 and S6 would manage some COCs and associated risk onsite using ICs in perpetuity. For Soil Alternative S2, all risks would be managed onsite using ICs. All alternatives are effective in achieving the RAOs.

Reduction of Toxicity, Mobility, or Volume through Treatment. Only Soil Alternative S5 would include treatment as a component of the remedy by incorporating SVE, which would capture and treat volatile chemicals. Soil Alternative S5 is rated high for this criterion (Soil Alternatives S2, S3, S4, and S6 are rated low for this criterion) because it would involve capture and treatment of volatile chemicals. Any treatment required to meet RCRA land disposal restrictions for those alternatives including off-site disposal would be performed at the disposal facility prior to disposal. Soil Alternatives S2, S3, S4, and S6 would not involve any treatment and are therefore rated low. The toxicity, mobility, or volume of COCs in the soil would be reduced with time through passive natural processes, but no active treatment would be conducted.

Short-Term Effectiveness. Overall, Soil Alternatives S2, S3, S4, S5, and S6 would be effective in the short term, and Soil Alternative S2 would have an incrementally greater level of short-term effectiveness. Soil Alternative S2 would also have a lower degree of sustainability impacts, based on a detailed green and sustainable remediation (GSR) evaluation performed to quantify environmental sustainability impacts, than Soil Alternatives S3, S4, S5, and S6. Soil Alternatives S3, S4, S5, and S6 would require excavation and off-site disposal and/or treatment of soil, which would involve short-term risk to workers and incrementally greater potential for disruption in traffic and other community impacts under these alternatives as compared to Soil Alternative S2.

Implementability. Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. Soil sampling has been conducted throughout OU-2C, including within Building 5, using various techniques. Based on this information, the excavation and off-site disposal and soil sampling components of Soil Alternatives S2, S3, S4, S5, and/or S6 would be implementable. Soil Alternative S2 would be most implementable from a technical perspective, followed by Soil Alternative S3, but less implementable from an administrative perspective. Soil Alternatives S4, S5, and S6 would be more implementable from an administrative perspective, but less technically implementable on the basis of uncertainty in the structural composition of Buildings 5 and 400 and the ability to execute soil excavation within the buildings, as well as the potential requirement for non-standard earthmoving equipment. An IC implementation plan would be required for Soil Alternatives S2, S3, S4, S5, and S6. This IC plan would be highly implementable for all alternatives.

Cost. All costs are estimated as the total cost (Table 10). Soil Alternative S2 is estimated to cost less than $1 million. Soil Alternative S3 is estimated to cost approximately $2 million. Soil Alternatives S4, S5, and S6 are estimated to cost between $42 million and $46 million.

TABLE 10. SUMMARY OF COST ESTIMATES FOR REMEDIAL ALTERNATIVES FOR SOIL, INCLUDING DRAIN LINES BENEATH BUILDINGS 5 AND 400

Alternative	Duration of Alternative	Capital Cost	Operation and Maintenance (O&M) Cost	Total Cost*
S2 – Engineering Controls and ICs	30 years	$184,100	$612,000	$796,100
S3 – Partial Excavation, Engineering Controls, Off-Site Disposal, and ICs	30 years	$1,088,300	$612,000	$1,983,300
S4 – Excavation, Off-Site Disposal, and ICs	30 years	$37,523,000	$612,000	$45,639,600
S5 – Excavation, SVE, Off-Site Disposal, and ICs	30 years	$37,347,000	$793,800	$45,610,300
S6 – Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-Site Disposal, and ICs	30 years	$34,766,000	$612,000	$42,331,300

*The total cost includes contingency allowances.

Modifying Criteria

State Agency Acceptance. The State of California (referring collectively to the Cal/EPA DTSC and Water Board), as a participant in the decision-making team, reviewed the Proposed Plan and supports the selected remedy for soil, including drain lines beneath Buildings 5 and 400.

Community Acceptance. A responsiveness summary (Section 3) in this ROD documents the responses to public comments made during the public meeting for the Proposed Plan and submitted in writing during the public comment period.

2.8.3 Rationale for Selected Remedy for Soil, Including Drain Lines beneath Buildings 5 and 400

The selected remedy for soil, including drain lines beneath Buildings 5 and 400, to address potential human health risks associated with chemicals in soil and the known or potentially radiologically-impacted drain lines and surrounding soil beneath Buildings 5 and 400 is Soil **Alternative S2** - Engineering Controls and ICs. This alternative meets the threshold criteria for overall protection of human health and the environment and for compliance with ARARs and is given a high rating for all NCP criteria except for "reduction of toxicity, mobility, or volume through treatment" because there is no active remediation for this alternative. The alternative is protective of human health and will achieve the project RAOs.

This alternative is considered effective and permanent because it will permanently prevent any possible exposure to contaminated soils. Compliance with the ICs is imperative to make this alternative successful.

No action is required for soil for any portion of OU-2C not identified as part of the soil footprint area. This determination is based on extensive field investigations, laboratory analysis, data

evaluations, review of current and future land use, and thorough assessment of potential human health and ecological risks. Results show that OU-2C soil and drain lines beneath Buildings 5 and 400 do not pose an unacceptable risk to human health if the engineering controls and ICs are implemented for the footprint areas.

2.8.4 Description of Selected Remedy for Soil, Including Drain Lines beneath Buildings 5 and 400

Under the Soil Alternative S2 remedy, the current building slabs (for Buildings 5, 5A, and 400) and pavement for the soil remedial footprints outside the buildings will remain in place and serve as engineering controls to provide protection against the possible exposure pathways. Drain lines beneath Buildings 5 and 400 will be grouted in place to enhance the performance of the engineering controls. The areas for which the selected remedy applies are referred to as footprint areas and are shown in Figure 8. ICs will be established to restrict future site use and site conditions, including prohibiting residential reuse, and to maintain building slabs and pavement as engineering controls. Figure 11 shows the IC boundaries. If, for any reason, the current building slabs or pavement in the soil footprints located outside the buildings are removed, the ICs will require that contaminated soil be addressed or suitable replacement engineering controls be implemented.

ICs are easily implementable and will ensure the long-term presence and protectiveness of engineering controls and restrict future site use and site conditions. The requirement to maintain building slabs and pavement outside buildings as engineering controls applies to the soil footprint areas for commercial use (Figure 11). In these areas, soil concentrations exceed the commercial use RGs. The restriction on residential use will apply to all of Exposure Units 2 and 3 as well as Local Area 2 in Western Exposure Unit 1 (Figure 6) due to the potential risk to residential receptors in these areas. The total residential cancer risks (2×10^{-3} for Exposure Unit 2, 1×10^{-2} for Exposure Unit 3, and 7×10^{-4} in Local Area 2, with noncancer HI of 1 exceeded for each [Table 5]) are due to the pathways of direct contact with soil and ingestion of homegrown produce, as well as indoor air (and exclude potable groundwater use).

The estimated timeframe for the implementation of remedy elements (developing the RD/LUC RD, rerouting roof drains to storm drain lines located outside the building, and grouting drain lines beneath Buildings 5 and 400) is 1.5 yr. The estimated time to reach RGs is indefinite (no soil removal or treatment; the FS assumed, for cost-estimating purposes, that the ICs would be maintained/monitored for 30 yr). Periodic monitoring and maintenance of the engineering controls will be conducted, as required. Five-year reviews will be conducted to evaluate the continued protectiveness of the remedy.

In summary, the remedy for soil is engineering controls and ICs (Alternative S2). The RAOs for soil are to protect commercial human receptors and minimize exposure to COCs. Because the RGs for commercial use are not currently met, building slabs or pavement for the soil footprints located outside the buildings are required to remain in place to serve as engineering controls to protect against the potential exposure pathways. In addition, chemical concentrations in soil do not meet unrestricted (residential) use requirements for Exposure Units 2 and 3 and Local Area 2. Therefore, the LUC performance objectives for the soil remedy are as follows (see Figure 11):

- Maintain current building slabs for Buildings 5, 5A, and 400
- Maintain pavement for soil remedial footprints located outside the buildings
- Prohibit residential and sensitive uses, including elementary and secondary schools, child care facilities and playgrounds, in Exposure Units 2 and 3 and Local Area 2.

The restrictions will be incorporated into both the federal deed(s) for the transfer of property within IR Sites 5 and 10 as well as the Covenants to Restrict the Use of Property which will be executed prior to the transfer of title to such property. A LUC RD will be prepared as part of the RD for this remedy and will be submitted pursuant to the Site Management Plan. Additional detail regarding implementation of the ICs under building slabs and outside of the buildings for commercial use will be presented in the LUC RD, which may refine the boundaries shown on Figure 11. The Navy shall be responsible for implementing, monitoring, maintaining, inspecting, reporting, and enforcing the ICs described in this ROD in accordance with approved RD reports. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, the Navy shall retain ultimate responsibility for remedy integrity. Should any of the ICs fail, the Navy shall ensure that appropriate actions are taken to reestablish protectiveness of the remedy and may initiate legal action to either compel action by a third party(ies) and/or recover the Navy's cost for mitigating any discovered IC violation(s). The ICs shall be maintained until such time as COC concentrations in the soil are at levels that allow for unrestricted use and unlimited exposure.

Further details for the implementation, monitoring, and enforcement of the ICs will be described in the LUC RD, which will include:

- Requirements for CERCLA five-year remedy review;
- Frequency and requirements for periodic monitoring or visual inspections;
- Reporting results from monitoring and inspections;
- Notification procedures to the regulators for planned property conveyance, corrective action required, and/or response to actions inconsistent with ICs for the remedy;
- Consultation with EPA, DTSC, Water Board, and other government agencies regarding wording for land use restrictions and parties to be provided copies of the deed language once executed;
- Identification of responsibilities for Navy, EPA, DTSC, Water Board, other government agencies, and new property owner for implementation, monitoring, reporting, and enforcement of ICs;
- A list of ICs with their expected duration; and
- Maps identifying where ICs are to be implemented

Reviews and Reporting

A completion report will be prepared following the completion of any remediation activities (i.e., implementing engineering controls). Reviews will be conducted in accordance with the LUC RD. Pursuant to CERCLA Section 121 and the NCP, a five-year status review is required because this remedy involves contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

2.8.5 Expected Outcome of the Selected Remedy for Soil, Including Drain Lines beneath Buildings 5 and 400

With implementation of engineering controls and ICs, there will be no risk to human health or the environment from soil contamination and drain lines beneath Buildings 5 and 400.

2.8.6 Statutory Determinations

In accordance with the NCP criteria, the selected remedy for soil at OU-2C, including drain lines beneath Buildings 5 and 400, meets the following statutory determinations.

- **Protection of Human Health and the Environment –** The selected remedy will reduce any possible risks to human health and the environment to acceptable levels.
- **Compliance with ARARs –** The selected remedy will comply with potential chemical-specific, location-specific, and action-specific ARARs.
- **Cost-Effectiveness –** The selected remedy is the most cost-effective alternative and represents the most reasonable value for the money. The costs are proportional to overall effectiveness by achieving long-term effectiveness and permanence within a reasonable timeframe, achieving containment of contaminated soil and drain lines beneath the buildings and pavement of OU-2C. Once the engineering controls and ICs are established, Soil Alternative S2 will ensure continued protectiveness at the site.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable –** The selected remedy does not employ any treatment technologies, but it does include in-place grouting of the drain lines that will permanently and significantly reduce mobility of hazardous substances. This alternative will include on-site management of soil COCs through engineering controls and ICs. Implementation of this alternative will result in the continued presence of all soil COCs under engineering controls.
- **Preference for Treatment as a Principal Element –** The selected remedy does not provide for treatment as a principle element. This remedy will eliminate the exposure to soil COCs through engineering controls and ICs.
- **Five-Year Review Requirements –** Five-year status reviews are required because this remedy results in contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

2.8.7 Description of Shallow FWBZ Groundwater Remedial Alternatives

Table 11 provides the major components, details, and cost of each shallow FWBZ groundwater remedial alternative.

TABLE 11. SUMMARY OF SHALLOW FWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Description	Cost (millions)
GS1. No Action	CERCLA requires that the no action alternative is evaluated to establish a baseline from which to compare the other alternatives. For this alternative, no actions are performed.	$0
GS2. ISCO, Enhanced Bioremediation, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the shallow FWBZ (5 to 20 ft bgs) would be treated. ISCO would be implemented to treat higher concentration areas; more dilute plume areas would be treated using enhanced bioremediation. Site use restrictions would address risks from vapor intrusion for future office workers until the RGs are met. Groundwater monitoring would be conducted to confirm that RGs have been achieved following treatment. ICs would be implemented to restrict future site use to commercial throughout Exposure Units 2 and 3 and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$2.46
GS3. In situ Chemical Reduction (ISCR), Enhanced Bioremediation, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the shallow FWBZ (5 to 20 ft bgs) would be treated. ISCR would be implemented to treat higher concentration areas; more dilute plume areas would be treated using enhanced bioremediation. Site use restrictions would address risks from vapor intrusion for future office workers until the RGs are met. Groundwater monitoring would be conducted to confirm that RGs have been achieved following treatment. ICs would be implemented to restrict future site use to commercial throughout Exposure Units 2 and 3 and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$7.14
GS4. Air Sparge-SVE (AS-SVE), Enhanced Bioremediation, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the shallow FWBZ (5 to 20 ft bgs) would be treated. AS-SVE would be implemented to treat higher concentration areas; more dilute plume areas would be treated using enhanced bioremediation. Site use restrictions would address risks from vapor intrusion for future office workers until the RGs are met. Groundwater monitoring would be conducted to confirm that RGs have been achieved following treatment. ICs would be implemented to restrict future site use to commercial throughout Exposure Units 2 and 3 and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$3.83

TABLE 11. SUMMARY OF SHALLOW FWBZ GROUNDWATER REMEDIAL ALTERNATIVES (CONTINUED)

Alternative	Description	Cost (millions)
GS5. Electrical Resistive Heating (ERH), ISCO/ISCR/AS-SVE, Enhanced Bioremediation, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the shallow FWBZ (5 to 20 ft bgs) would be treated. ERH would be implemented to treat areas where potential DNAPL may be present (total VOC concentrations at or greater than 10,000 μg/L). Following ERH treatment, either ISCO, ISCR, or AS-SVE would be implemented in remaining higher concentration areas. More dilute plume areas would be treated using enhanced bioremediation. Site use restrictions would address risks from vapor intrusion for future office workers until the RGs are met. Groundwater monitoring would be conducted to confirm that RGs have been achieved following treatment. ICs would be implemented to restrict future site use to commercial throughout Exposure Units 2 and 3 and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$4.56

2.8.8 Comparative Analysis of Shallow FWBZ Groundwater Remedial Alternatives

A comparative analysis of the five shallow FWBZ groundwater remedial alternatives with respect to the nine evaluation criteria is presented in this section. Table 12 depicts a relative ranking of the alternatives compared to the two threshold criteria and the five primary balancing criteria. The two modifying criteria are presented at the end of this section. Shallow FWBZ Groundwater Alternative GS1 is not considered protective of human health and the environment; therefore, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed.

Threshold Criteria

Overall Protection of Human Health and the Environment. The DON's evaluation indicates that all of the shallow FWBZ groundwater remedial alternatives, except Alternative GS1, meet the threshold criterion of overall protection of human health and the environment through the implementation of ICs or in situ treatment of groundwater with COCs that might pose unacceptable human health risk. Under Shallow FWBZ Groundwater Alternative GS1, no remedial action would be completed to reduce chemical concentrations in groundwater in the shallow FWBZ, and no ICs would be implemented to restrict future land and/or groundwater use. Therefore, potentially unacceptable risks to human receptors would remain, and Shallow FWBZ Groundwater Alternative GS1 is not considered protective of human health and the environment. Because Alternative GS1 does not meet this criterion, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed. The no action alternative provides a basis of comparison and is required by the NCP.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a

TABLE 12. RELATIVE RANKING OF SHALLOW FWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health and the Environ-ment	Compliance with ARARs	Long-Term Effective-ness and Perma-nence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effective-ness	Imple-ment-ability	Cost[(a)]
GS1 – No Action	No	NA	NA	NA	NA	NA	NA
GS2 – ISCO, Enhanced Bioremediation, Groundwater Monitoring, and ICs	Yes	Yes	High	High	High	High	High
GS3 – ISCR, Enhanced Bioremediation, Groundwater Monitoring, and ICs	Yes	Yes	High	High	High	High	Low
GS4 – AS-SVE, Enhanced Bioremediation, Groundwater Monitoring, and ICs	Yes	Yes	High	Moderate	High	High	Moderate
GS5 – ERH, ISCO/ ISCR/ AS-SVE, Enhanced Bioremediation, Groundwater Monitoring, and ICs	Yes	Yes	High	High	High	High	Moderate

NA: Not applicable. Shallow FWBZ Groundwater Alternative GS1 is not considered protective of human health and the environment; therefore, an evaluation against the remaining criteria is not necessary and was not performed.

(a) A lower cost receives a higher rating because the alternative is more cost effective.

specific site, chemical, or action. Shallow FWBZ Groundwater Alternatives GS2 through GS5 meet the threshold criterion of compliance with ARARs. Shallow FWBZ Groundwater Alternative GS1 does not trigger ARARs because there is no action for this alternative.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Implementation of Shallow FWBZ Groundwater Alternative GS2, GS3, GS4, or GS5 would result in adequately addressing risks in the shallow

FWBZ at OU-2C. Under Shallow FWBZ Groundwater Alternatives GS2, GS3, GS4, and GS5, chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods including ISCO and enhanced bioremediation (GS2), ISCR and enhanced bioremediation (GS3), AS-SVE (and vapor treatment) and bioremediation (GS4), and ERH with ISCO, ISCR, or AS-SVE and enhanced bioremediation (GS5), respectively. In the FS, groundwater modeling was conducted using the Analytical Transient 1-, 2-, 3-Dimensional Model (AT123D) to simulate groundwater flow and chemical transport at OU-2C. Based on the results of the modeling, remediating shallow FWBZ groundwater to the occupational preliminary RGs is expected to be conservatively protective of downgradient groundwater quality. ICs would be required for each alternative to prohibit the use of groundwater from the shallow FWBZ throughout OU-2C and restrict future residential site use outside the western portion of Exposure Unit 1. Monitoring and maintaining these ICs would ensure their long-term effectiveness.

Reduction of Toxicity, Mobility, or Volume through Treatment. Shallow FWBZ Groundwater Alternatives GS2, GS3, GS4, and GS5 would all address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility or volume of hazardous substances as their principal element. These alternatives would include ISCO, ISCR, AS-SVE (with vapor treatment) or ERH with ISCO, ISCR or AS-SVE treatment, respectively, in higher concentration areas to reduce chemical concentrations. Each also would include implementation of enhanced bioremediation treatment of lower concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of Shallow FWBZ Groundwater Alternatives GS2 and GS3 (ISCO and ISCR) would result in the greatest reduction in toxicity, mobility and volume of COCs, as these treatment technologies would completely destroy the COCs by converting them into nontoxic end products. Implementation of Shallow FWBZ Groundwater Alternative GS4 or GS5 (AS-SVE and ERH) would also reduce the toxicity, mobility, and volume of COCs in groundwater; however, the COCs would be transferred to an above ground treatment media such as activated carbon, which would require off-site disposal.

Short-Term Effectiveness. Overall, Shallow FWBZ Groundwater Alternatives GS2, GS3, GS4, and GS5 would be effective in the short term, with Alternative GS2 characterized by an incrementally lower short-term effectiveness on the basis of the worker risk associated with the treatment reagent, Alternative GS3 characterized by an incrementally lower short-term effectiveness on the basis of environmental sustainability impacts, and Alternative GS4 characterized by an incrementally lower short-term effectiveness on the basis of environmental sustainability impacts and its longer implementation time. The overall short-term effectiveness of Shallow FWBZ Groundwater Alternative GS5 would vary on the basis of which treatment technology were selected to follow ERH.

Implementability. Materials for implementation of ISCO, ISCR, AS-SVE, ERH, and enhanced bioremediation would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. An IC implementation plan would be required for Shallow FWBZ Groundwater Alternatives GS2, GS3, GS4, and GS5. This IC plan would be highly implementable for all alternatives. Implementation of the AS-SVE system under Shallow FWBZ Groundwater Alternative GS4 (and potentially Alternative GS5) would require on-going operation and maintenance (O&M) for

the remediation system. However, these activities are routine and would not pose any implementability concerns for this alternative.

Appropriate system monitoring would be required during injection activities beneath Building 5 to ensure that the building slab/foundation is not affected. This requirement would incrementally reduce the implementability of Shallow FWBZ Groundwater Alternative GS3 relative to Alternatives GS2 and GS4 based on the type of injection utilized for ISCR. If Shallow FWBZ Groundwater Alternative GS5 included ISCR, this same issue would incrementally reduce its implementability.

Cost. All costs are estimated as the total cost (Table 13). Shallow FWBZ Groundwater Alternative GS2 is estimated to cost approximately $2.5 million. Alternative GS3 is estimated to cost $7.1 million. Alternative GS4 is estimated to cost approximately $3.8 million and Alternative GS5 is estimated to cost $4.6 million.

Modifying Criteria

State Agency Acceptance. The State of California, as a participant in the decision-making team, reviewed the Proposed Plan and supports the selected alternative for shallow FWBZ groundwater at OU-2C.

TABLE 13. SUMMARY OF COST ESTIMATES FOR SHALLOW FWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Duration of Alternative	Capital Cost	O&M Cost	Total Cost*
GS2 –ISCO, Enhanced Bioremediation, Groundwater Monitoring, and ICs	30 years	$1,051,900	$1,057,800	$2,456,900
GS3 –ISCR, Enhanced Bioremediation, Groundwater Monitoring, and ICs	30 years	$4,561,400	$1,069,200	$7,135,800
GS4 –AS-SVE, Enhanced Bioremediation, Groundwater Monitoring, and ICs	30 years	$1,269,800	$2,144,800	$3,833,700
GS5 –ERH, ISCO/ISCR/AS-SVE, Enhanced Bioremediation, Groundwater Monitoring, and ICs	30 years	$2,622,800	$1,069,200	$4,557,500

*The total cost includes contingency allowances.

Community Acceptance. A responsiveness summary (Section 3) in this ROD documents the responses to public comments made during the public meeting for the Proposed Plan and submitted in writing during the public comment period.

2.8.9 Rationale for Selected Shallow FWBZ Groundwater Remedy

The selected remedy for shallow FWBZ groundwater at OU-2C is **Alternative GS2** - ISCO, Enhanced Bioremediation, Groundwater Monitoring, and ICs. ISCO will be implemented to

treat higher concentrations of VOC-impacted groundwater in the shallow FWBZ, while more dilute plume areas will be treated using enhanced bioremediation. This remedy was selected based on extensive field investigations, laboratory analysis, data evaluations, reviews of current and future land use, assessments of potential human health and ecological risk, and evaluations of potential remedial alternatives. This alternative will achieve the project RAOs by reducing chemical concentrations in shallow FWBZ groundwater to achieve the RGs and thereby addressing the risks associated with potential inhalation of vapors from chemicals in groundwater. This alternative meets the threshold criteria (Table 12) for overall protection of human health and the environment and for compliance with ARARs and was given a high rating for all of the balancing criteria. ICs will be implemented to restrict future site use and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews will be conducted to evaluate the continued protectiveness of the remedy.

No action is required for shallow FWBZ groundwater in any portion of OU-2C not identified as part of the shallow FWBZ groundwater footprint area. This determination is based on extensive field investigations, laboratory analysis, data evaluations, review of current and future land use, and thorough assessment of potential human health risks. Results show that shallow FWBZ groundwater at OU-2C does not pose an unacceptable risk to human health if the shallow FWBZ groundwater alternative for the footprint area is implemented.

2.8.10 Description of Selected Shallow FWBZ Groundwater Remedy

The selected remedy for shallow FWBZ groundwater at OU-2C consists of treating VOC-impacted groundwater in the shallow FWBZ (5 to 20 ft bgs), groundwater monitoring, and implementing ICs. ISCO will be implemented to treat higher concentration areas, while more dilute plume areas will be treated using enhanced bioremediation. The areas for which the selected remedy apply are referred to as footprint areas and are shown in Figure 9. In these footprint areas, groundwater concentrations do not meet the commercial use RGs. In addition, chemical concentrations in shallow groundwater do not permit unrestricted (residential) land use in Exposure Units 2 and 3 (Figure 6). Figure 11 shows the IC boundaries. The FS Report assumed four of the remedial action areas shown in Figure 9 would be treated by ISCO, but much of the remediation footprint is beneath Building 5, where there are few monitoring wells. The FS Report used the available concentration data to define the footprints, which are from one-time hydropunch-type sampling conducted between the 1990s and 2001 for most remediation areas. Therefore, as appropriate, the remedial design may propose groundwater sampling to determine the current boundary of each remediation area. The remedial design also may provide criteria for determining whether ISCO, bioremediation, or no action is required for each footprint shown in Figure 9 based on the proposed sampling, as appropriate.

Site use restrictions will address vapor intrusion risks for future office workers until the commercial RGs are met. Restrictions may include that any buildings to be constructed must install and operate an engineered vapor intrusion mitigation system. Groundwater monitoring will be conducted to confirm that RGs have been achieved following treatment. The IC boundaries shown in this iROD identify the areas for the ICs prior to start of the remediation (Figure 11). As the groundwater remedy progresses, the associated IC restricting commercial use is no longer required in areas where RAOs have been achieved. Attainment of RAOs for

commercial use will be determined by evaluation of groundwater sampling results. The IC restriction boundaries may be adjusted as RAOs are achieved for portions of the ROD IC areas.

The RAO for the shallow groundwater is achieved when the 95 UCL of each remediation area meets the RGs. After RAOs for commercial use are attained, ICs restricting future site use to commercial would be required until such time that groundwater concentrations reach a level acceptable for residential land use. ICs prohibiting groundwater use would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use. ICs will be implemented to restrict future site use to commercial throughout Exposure Units 2 and 3 (Figures 6 and 11) and prohibit the use of groundwater in the shallow FWBZ. Five-year reviews will be conducted to evaluate the continued protectiveness of the remedy.

The FS Report provides the estimated timeframe for this selected alternative. There is considerable uncertainty in the FS Report timeframe estimate due to the age of the shallow groundwater plume data and lack of time series data that precluded deriving a site-specific contaminant decay rate constant. Due to this uncertainty and to ensure reasonableness, the estimate in this iROD is longer than the FS Report estimated timeframe. The estimated timeframe for implementation is five years, and the estimated time to reach RGs is eight years.

In summary, the remedy for the shallow groundwater is ISCO in higher concentration areas, bioremediation in more dilute remediation areas, monitoring, and ICs (Alternative GS2). The RAO for shallow groundwater is to protect commercial human receptors within IR Site 5 from potentially unacceptable risks associated with COCs in the groundwater. Because the RGs for commercial use are not currently met, restrictions are required to address vapor intrusion risks for future office workers until the RGs are achieved. Therefore, the LUC performance objectives for the shallow groundwater remedy are as follows (see Figure 11):

- Restrict site use until the commercial RGs are met unless any buildings constructed install and operate an engineered vapor intrusion mitigation system
- Restrict future site use to commercial throughout Exposure Units 2 and 3
- Prohibit the use of shallow FWBZ groundwater

The restrictions will be incorporated into both the federal deed(s) for the transfer of property within IR Site 5 as well as the Covenants to Restrict the Use of Property which will be executed prior to the transfer of title to such property. A LUC RD will be prepared as part of the RD for this remedy and will be submitted pursuant to the Site Management Plan. Additional detail regarding implementation of the ICs under building slabs and outside of the buildings for commercial use will be presented in the LUC RD, which may refine the boundaries shown on Figure 11. The Navy shall be responsible for implementing, monitoring, maintaining, inspecting, reporting, and enforcing the ICs described in this ROD in accordance with approved RD reports. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, the Navy shall retain ultimate responsibility for remedy integrity. Should any of the ICs fail, the Navy shall ensure that appropriate actions are taken to reestablish protectiveness of the remedy and may initiate legal action to either compel action by a third party(ies) and/or recover the Navy's cost for mitigating any discovered IC violation(s). The ICs shall be maintained until such time as COC

concentrations in the groundwater have been reduced or remediated to levels that allow for unrestricted use and unlimited exposure.

Further details for the implementation, monitoring, and enforcement of the ICs will be described in the LUC RD, which will include:

- Requirements for CERCLA five-year remedy review;
- Frequency and requirements for periodic monitoring or visual inspections;
- Reporting results from monitoring and inspections;
- Notification procedures to the regulators for planned property conveyance, corrective action required, and/or response to actions inconsistent with ICs for the remedy;
- Consultation with EPA, DTSC, Water Board, and other government agencies regarding wording for land use restrictions and parties to be provided copies of the deed language once executed;
- Identification of responsibilities for Navy, EPA, DTSC, Water Board, other government agencies, and new property owner for implementation, monitoring, reporting, and enforcement of ICs;
- A list of ICs with their expected duration; and
- Maps identifying where ICs are to be implemented.

Reviews and Reporting

Reviews will be conducted in accordance with the LUC RD. A remedial action completion report will be prepared following the completion of the remediation activities. Pursuant to CERCLA Section 121 and the NCP, a five-year status review is required because this remedy involves contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

2.8.11 Expected Outcome of the Selected Shallow FWBZ Groundwater Remedy

After the remedial action is complete and ICs are in place, there will be no unacceptable human health risk from exposure to shallow FWBZ groundwater at OU-2C.

2.8.12 Statutory Determinations

In accordance with the NCP, the selected remedy of ISCO, enhanced bioremediation, groundwater monitoring, and ICs for shallow FWBZ groundwater at OU-2C meets the following statutory determinations.

- **Protection of Human Health and the Environment –** The selected remedy is needed to address shallow FWBZ groundwater exceeding the RGs. Chemical treatment and enhanced bioremediation for shallow FWBZ groundwater will reduce any possible risks to human health to acceptable levels, and ICs will ensure long-term protection of human health.
- **Compliance with ARARs –** The selected remedy will comply with potential chemical-specific, location-specific, and action-specific ARARs.

- **Cost-Effectiveness –** The selected remedy is the most cost-effective alternative and represents the most reasonable value for the money. The costs are proportional to overall effectiveness by achieving long-term effectiveness and permanence within a reasonable timeframe, achieving treatment of contaminated FWBZ groundwater in situ at OU-2C. Once the remedial action is completed and ICs are in place, this remedy will eliminate unacceptable risks associated with exposure to shallow FWBZ groundwater at OU-2C. Groundwater monitoring will be required.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable –** The selected remedy represents one of the alternative treatment technologies that can be used in a practicable manner for shallow FWBZ groundwater at OU-2C. Implementation of Shallow FWBZ Groundwater Alternative GS2 would result in the greatest reduction in toxicity, mobility and volume of COCs, as the treatment technologies would completely destroy the COCs by converting them into nontoxic end products.
- **Preference for Treatment as a Principal Element –** The selected remedy consists of treatment as a principle element to reduce the groundwater COCs to comply with the RGs.
- **Five-Year Review Requirements –** Five-year status reviews are required because this remedy results in hazardous substances, pollutants, or contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

2.8.13 Description of Deep FWBZ and SWBZ Groundwater Remedial Alternatives

Table 14 provides the major components, details, and cost of each deep FWBZ and SWBZ groundwater remedial alternative.

2.8.14 Comparative Analysis of Deep FWBZ and SWBZ Groundwater Remedial Alternatives

A comparative analysis of the five deep FWBZ and SWBZ groundwater remedial alternatives with respect to the nine evaluation criteria is presented in this section. Table 15 depicts a relative ranking of the alternatives compared to the two threshold criteria and the five primary balancing criteria. The two modifying criteria are presented at the end of this section. Deep FWBZ and SWBZ Groundwater Alternative GD1 is not considered protective of human health and the environment; therefore, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed.

Threshold Criteria

Overall Protection of Human Health and the Environment. The DON's evaluation indicates that all of the alternatives, except Deep FWBZ and SWBZ Groundwater Alternative GD1, meet the threshold criterion of overall protection of human health and the environment through the implementation of ICs or treatment of groundwater with COCs that might pose unacceptable human health risk. ICs for all alternatives would restrict the use of groundwater from the deep

TABLE 14. SUMMARY OF DEEP FWBZ AND SWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Description	Cost (millions)
GD1. No Action	CERCLA requires that the no action alternative is evaluated to establish a baseline from which to compare the other alternatives. For this alternative, no actions are performed.	$0
GD2. ICs	ICs prohibiting the use of groundwater from the deep FWBZ (20 to 40 ft bgs) and SWBZ (40 to 70 ft bgs) would be implemented. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$0.73
GD3. ISCO, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the deep FWBZ (20 to 40 ft bgs) and SWBZ (40 to 70 ft bgs) would be treated. ISCO would be implemented to treat all areas. Groundwater monitoring would be conducted to confirm that RGs have been achieved after treatment. ICs would be implemented to prohibit use of groundwater from the deep FWBZ and SWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$2.07
GD4. ISCR, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the deep FWBZ (20 to 40 ft bgs) and SWBZ (40 to 70 ft bgs) would be treated. ISCR would be implemented to treat all areas. Groundwater monitoring would be conducted to confirm that RGs have been achieved after treatment. ICs would be implemented to prohibit use of groundwater from the deep FWBZ and SWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$2.48
GD5. ERH, Groundwater Monitoring, and ICs	VOC-impacted groundwater in the deep FWBZ (20 to 40 ft bgs) and SWBZ (40 to 70 ft bgs) would be treated. ERH would be implemented to treat all areas. Vapor extraction wells would be used to extract steam and volatilized chemicals. All extracted vapors would be treated prior to atmospheric discharge. Groundwater monitoring would be conducted to confirm that RGs have been achieved after treatment. ICs would be implemented to prohibit use of groundwater from the deep FWBZ and SWBZ. Five-year reviews would be conducted to evaluate the continued protectiveness of the remedy.	$3.11

TABLE 15. RELATIVE RANKING OF DEEP FWBZ AND SWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost[(a)]
GD1 – No Action	No	NA	NA	NA	NA	NA	NA
GD2 – ICs	Yes	Yes	Moderate	Low	High	High	High
GD3 – ISCO, Groundwater Monitoring, and ICs	Yes	Yes	High	High	Moderate	Moderate	Moderate
GD4 – ISCR, Groundwater Monitoring, and ICs	Yes	Yes	High	High	Moderate	Moderate	Low
GD5 – ERH, Groundwater Monitoring, and ICs	Yes	Yes	High	High	Moderate	Moderate	Low

NA: Not applicable. Deep FWBZ and SWBZ Groundwater Alternative GD1 is not considered protective of human health and the environment; therefore, an evaluation against the remaining criteria is not necessary and was not performed.

(a) A lower cost receives a higher rating because the alternative would be more cost effective.

FWBZ and SWBZ. Monitoring of the ICs would ensure that unacceptable risks due to groundwater use would not occur. Under Deep FWBZ and SWBZ Groundwater Alternative GD1, no remedial action would be completed to reduce chemical concentrations in groundwater in the deep FWBZ or SWBZ, and no ICs would be implemented to restrict future groundwater use. Therefore, Alternative GD1 is not considered protective of human health and the environment. Because Alternative GD1 does not meet this criterion, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed. The no action alternative provides a basis of comparison and is required by the NCP.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a specific site, chemical, or action. Deep FWBZ and SWBZ Groundwater Alternatives GD2 through GD5 meet the threshold criterion of compliance with ARARs. Alternative GD1 does not trigger ARARs because there is no action.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Overall, Deep FWBZ and SWBZ Groundwater Alternative GD3, GD4, or GD5 would provide an effective long-term remedy for groundwater

containing COCs in the deep FWBZ and SWBZ at OU-2C. Alternative GD2 is rated moderate for this criterion because the long-term effectiveness of the ICs included in this alternative would depend on continued adherence to them. Under Alternatives GD3, GD4, and GD5, chemical concentrations in groundwater within the remedial footprints for the deep FWBZ and SWBZ identified would be permanently reduced through ISCO, ISCR, or ERH treatment, respectively. ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure their long-term effectiveness. Deep FWBZ and SWBZ Groundwater Alternatives GD3, GD4, and GD5 would reduce the potential for chemicals in groundwater to be transported downgradient through groundwater flow, while Alternative GD2 would not. However, groundwater modeling conducted to derive RGs for the deep FWBZ and SWBZ intervals demonstrated that a substantial amount of contamination would be required to impact downgradient groundwater quality (deep FWBZ) or that the likelihood of downgradient groundwater impact is low given very sluggish groundwater flow (SWBZ).

Reduction of Toxicity, Mobility, or Volume through Treatment. Deep FWBZ and SWBZ Groundwater Alternatives GD3, GD4, and GD5 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. These alternatives would include ISCO, ISCR, or ERH treatment, respectively, in deep FWBZ and SWBZ plume areas to reduce chemical concentrations to the RGs.

Alternative GD2 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element.

Short-Term Effectiveness. Implementation of Deep FWBZ and SWBZ Groundwater Alternative GD2 would not pose any risk to the community as a result of the remedy.

Implementation of Alternative GD3, GD4, or GD5 would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. These alternatives would not result in any adverse environmental impacts, as the treatment reagents/processes are designed to react with the chemicals in the groundwater, leaving behind non-toxic byproducts.

An evaluation of several sustainability metrics concluded that implementation of Groundwater Alternative GD5 would result in the greatest environmental impact for all metrics except collateral risk. Groundwater Alternative GD3 would result in the least greenhouse gas (GHG) emissions but highest collateral risk. Groundwater Alternative GD4 would result in the least energy used and air emissions. The high level of sustainability impacts associated with implementation of Groundwater Alternative GD5 is primarily associated with operation of the heating equipment.

The duration of remedial action would likely be shortest for Alternatives GD3 and GD5 because ISCO and ERH treatments are relatively instantaneous. Alternative GD4 would be slightly longer, as ISCR has a short implementation period but a longer monitoring period is required.

Implementability. Deep FWBZ and SWBZ Groundwater Alternative GD2 would rely exclusively on ICs, therefore this alternative would be highly implementable overall. Alternatives GD3, GD4, and GD5 are rated moderate for implementability because they would rely on the availability of materials and technologies. Materials for implementation of ISCO, ISCR, and ERH would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. An IC plan would also be required for Alternatives GD3, GD4, and GD5.

Cost. All costs are estimated as the total cost (Table 16). Deep FWBZ and SWBZ Groundwater Alternative GD2 is estimated to cost less than $1 million. Alternative GD3 is estimated to cost approximately $2 million. Alternatives GD4 and GD5 are estimated to cost $2.5 million and $3.1 million, respectively.

Modifying Criteria

State Agency Acceptance. The State of California, as a participant in the decision-making team, reviewed the Proposed Plan and supports the selected alternative for deep FWBZ and SWBZ groundwater at OU-2C.

Community Acceptance. A responsiveness summary (Section 3) in this ROD documents the responses to public comments made during the public meeting for the Proposed Plan and submitted in writing during the public comment period.

TABLE 16. SUMMARY OF COST ESTIMATES FOR DEEP FWBZ AND SWBZ GROUNDWATER REMEDIAL ALTERNATIVES

Alternative	Duration of Alternative	Capital Cost	O&M Cost	Total Cost*
GD2 – ICs	30 years	$120,000	$612,000	$732,000
GD3 – ISCO, Groundwater Monitoring, and ICs	30 years	$1,028,000	$612,000	$2,071,800
GD4 – ISCR, Groundwater Monitoring, and ICs	30 years	$1,404,800	$612,000	$2,480,400
GD5 – ERH, Groundwater Monitoring, and ICs	30 years	$1,881,000	$612,000	$3,113,800

*The total cost includes contingency allowances.

2.8.15 Rationale for Selected Deep FWBZ and SWBZ Groundwater Remedy

The selected remedy for deep FWBZ and SWBZ groundwater at OU-2C is **Alternative GD2** - ICs. This alternative meets the threshold criteria (Table 15) for overall protection of human health and the environment and for compliance with ARARs and satisfies the balancing criteria. Groundwater from these zones (deep FWBZ and SWBZ) is not a drinking water source and because there are no complete exposure pathways, there is no current human health risk associated with chemicals in the deep FWBZ and SWBZ groundwater. ICs prohibiting the use of groundwater from the deep FWBZ and SWBZ will be implemented under this alternative and

will ensure protection of human health. Five-year reviews will be conducted to evaluate the continued protectiveness of the remedy.

2.8.16 Description of Selected Deep FWBZ and SWBZ Groundwater Remedy

The selected remedy for deep FWBZ and SWBZ groundwater is GD2, ICs, which will prohibit the use of groundwater from the deep FWBZ and SWBZ. Five-year reviews will be conducted to evaluate the continued protectiveness of the remedy. There are currently no exposure pathways and no human health risk associated with chemicals in deep FWBZ and SWBZ groundwater, and ICs will effectively prevent any potential for risk in the future. The areas for which the selected remedy apply are referred to as footprint areas and are shown in Figure 10. The estimated time for implementation (developing the LUC RD) is one year. The estimated time to reach RGs is indefinite (no exposure pathway and no groundwater treatment); the FS assumed, for cost-estimating purposes, that the ICs would be maintained/monitored for 30 yr.

In summary, there are no current exposure pathways for the deep groundwater. The remedy is ICs (Alternative GD2). Figure 11 shows the IC boundaries. The RAO is to minimize human exposure associated with downgradient migration of contaminants in deep groundwater and potentially unacceptable risks to downgradient human receptors. As documented in the RI Report regarding the downgradient flow direction, the groundwater in the SWBZ generally flows toward Building 5. Therefore, the footprint of Building 5 is included in the ICs area shown on Figure 11. The LUC performance objective is to prohibit the use of the deep groundwater.

The restrictions will be incorporated into both the federal deed(s) for the transfer of property within IR Site 5 as well as the Covenants to Restrict the Use of Property which will be executed prior to the transfer of title to such property. A LUC RD will be prepared as part of the RD for this remedy and will be submitted pursuant to the Site Management Plan. Additional detail regarding implementation of the ICs under building slabs and outside of the buildings for commercial use will be presented in the LUC RD, which may refine the boundaries shown on Figure 11. The Navy shall be responsible for implementing, monitoring, maintaining, inspecting, reporting, and enforcing the ICs described in this ROD in accordance with approved RD reports. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, the Navy shall retain ultimate responsibility for remedy integrity. Should any of the ICs fail, the Navy shall ensure that appropriate actions are taken to reestablish protectiveness of the remedy and may initiate legal action to either compel action by a third party(ies) and/or recover the Navy's cost for mitigating any discovered IC violation(s). The ICs shall be maintained until such time as COC concentrations in the groundwater have been reduced to levels that allow for unrestricted use and unlimited exposure.

Further details for the implementation, monitoring, and enforcement of the ICs will be described in the LUC RD, which will include:

- Requirements for CERCLA five-year remedy review;
- Frequency and requirements for periodic monitoring or visual inspections;
- Reporting results from monitoring and inspections;

- Notification procedures to the regulators for planned property conveyance, corrective action required, and/or response to actions inconsistent with ICs for the remedy;
- Consultation with EPA, DTSC, Water Board, and other government agencies regarding wording for land use restrictions and parties to be provided copies of the deed language once executed;
- Identification of responsibilities for Navy, EPA, DTSC, Water Board, other government agencies, and new property owner for implementation, monitoring, reporting, and enforcement of ICs;
- A list of ICs with their expected duration; and
- Maps identifying where ICs are to be implemented.

Reviews and Reporting
Reviews will be conducted in accordance with the LUC RD. Pursuant to CERCLA Section 121 and the NCP, a five-year status review is required because this remedy involves contaminants remaining onsite at levels above those that allow for unrestricted use and unlimited exposure.

2.8.17 Expected Outcome of the Selected Deep FWBZ and SWBZ Groundwater Remedy

Implementation of the ICs alternative ensures future protection from exposure to deep FWBZ and SWBZ groundwater at OU-2C.

2.8.18 Statutory Determinations

In accordance with the NCP, the selected remedy of ICs for deep FWBZ and SWBZ groundwater at OU-2C meets the following statutory determinations.

- **Protection of Human Health and the Environment –** There are currently no exposure pathways and no human health risk associated with chemicals in deep FWBZ and SWBZ groundwater, and ICs will effectively prevent any potential for risk in the future.
- **Compliance with ARARs –** The selected remedy will comply with potential chemical-specific, location-specific, and action-specific ARARs.
- **Cost-Effectiveness –** The selected remedy is the most cost-effective alternative and represents the most reasonable value for the money. The costs are proportional to overall effectiveness by achieving long-term effectiveness and permanence within a reasonable timeframe. ICs will be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs will ensure their long-term effectiveness.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable –** The selected remedy does not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element.

- **Preference for Treatment as a Principal Element –** The selected remedy does not provide for treatment as a principle element.
- **Five-Year Review Requirements –** The Navy will conduct five-year status reviews for this site to evaluate the continued protectiveness of the remedy.

2.9 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 2006. 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.

2.9.1 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. RAB meetings occur every other month and are open to the public. Meetings are held in the evenings after normal working hours on the second Thursday of every other 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 OU-2C, 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 also maintains 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 Web site** at: http://www.bracpmo.navy.mil/.

2.9.2 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 OU-2C have been delivered to residents living near Alameda Point 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 ERA and HHRA results), present remedial alternatives for a site or group of sites, 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 OU-2C or basewide information are summarized in Table 17.

TABLE 17. SUMMARY OF ALAMEDA POINT FACT SHEETS, NEWSLETTERS, AND PROPOSED PLANS RELATED TO OU-2C

Date	Title
May 1995	Fact Sheet #5: Base Realignment and Closure Cleanup Plan
June 1996	Fact Sheet #7: History and Geology
July 2003	Alameda Point Focus Environmental Newsletter #1
Spring 2004	Alameda Point Focus Environmental Newsletter #2
Winter 2005	Alameda Point Focus Environmental Newsletter #3[(a)]
Fall 2005/Winter 2006	Alameda Point Focus Environmental Newsletter #4
Fall 2006/Winter 2007	Alameda Point Focus Environmental Newsletter #5[(a)]
Fall 2007	Alameda Point Focus Environmental Newsletter #6
October 2007	IR Sites 5 & 10 Removal Action Fact Sheet
Summer 2010	Alameda Point Focus Environmental Newsletter #7
Spring 2012	Alameda Point Focus Environmental Newsletter #8
September 2012	Proposed Plan for OU-2C, Installation Restoration Sites 5, 10, and 12, Former NAS Alameda
Spring 2013	Alameda Point Focus Environmental Newsletter #9

(a) OU-2C was not discussed in this document.

2.9.3 Community Participation for OU-2C

The RI Report for OU-2C was finalized in September 2008 and the FS Report was finalized in May 2011. The Proposed Plan for OU-2C was released to the public in September 2012. 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.

The public comment period for the OU-2C Proposed Plan extended from October 4 to November 13, 2012 to solicit public input on the DON's preferred remedy. On October 11, 2012, the RAB was briefed on the OU-2C Proposed Plan and then a public meeting was held that same night after the RAB briefing. A notice of the public comment period and public meeting were published in advance in the following newspapers: *East Bay Express*, *Alameda Sun*, and *Alameda Journal.*

At the public meeting, the BRAC Environmental Coordinator and DON Project Manager were available to discuss OU-2C and describe the selected remedies. Representatives from the DON and environmental regulatory agencies were available to answer questions. A court reporter prepared a transcript of the meeting. Comments on the OU-2C Proposed Plan were received during the public comment period and are summarized in the Responsiveness Summary at the end of this document.

3 Responsiveness Summary

The participants in the public meeting held on October 11, 2012, included representatives of the DON, EPA, Cal/EPA DTSC, and Water Board. The **meeting transcript** is included in the Administrative Record. Responses to comments received during the public meeting are included in the Responsiveness Summary as part of this ROD.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Federal Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Soil				
Resource Conservation and Recovery Act (42 U.S.C. ch. 82, §§ 6901–6991[i])[c]				
Defines RCRA hazardous waste.	Waste	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Wastes generated during the remedial action will be characterized prior to disposal offsite.

Notes:
(a) Many action-specific ARARs containing chemical-specific limitations are addressed in the action-specific ARAR tables.
(b) Only the substantive provisions of the requirements cited in this table are ARARs.
(c) Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.

§	Section	LDR	land disposal restrictions
§§	Sections	NTR	National Toxics Rule
ARAR	Applicable or relevant and appropriate requirement	RCRA	Resource Conservation and Recovery Act
BAAQMD	Bay Area Air Quality Management District	SWRCB	State Water Resources Control Board
Cal. Code Regs.	California Code of Regulations	tit	Title
CFR	Code of Federal Regulations	$\mu g/m^3$	micrograms/cubic meter
CTR	California Toxics Rule	U.S.C.	United States Code

Federal Location-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[(b)]	ARAR Determination	Comments
National Historic Preservation Act of 1966, as Amended (16 U.S.C. § 470–470x-6)[(c)]				
Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the National Register of Historic Places.	Properties included in or eligible for the National Register of Historic Places	16 U.S.C. § 470-470x-6, 36 C.F.R. pt. 800	Applicable	The DON is in compliance with this ARAR because none of the remedial alternatives evaluated will have an impact on any buildings that are eligible for the National Register of Historic Places.
Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712) [(c)]				
Protects almost all species of migrating birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds	16 U.S.C. § 703	Relevant and appropriate	Because migratory birds are known to be present near OU-2C, substantive provisions are relevant and appropriate.

Notes:
(a) Many action-specific ARARs containing chemical-specific limitations are addressed in the action-specific ARAR tables.
(b) Only the substantive provisions of the requirements cited in this table are ARARs.
(c) Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.

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Federal Action-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[(b)]	ARAR Determination	Comments
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])*				
Person who generates waste shall determine if that waste is a hazardous waste.	Generator of waste	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11	Applicable	Applicable for any operation where hazardous waste is generated. There is a potential for waste from OU-2C to be classified as RCRA hazardous waste. The determination of whether any waste is hazardous will be made after it is generated.
Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste	Cal. Code Regs. tit. 22, § 66264.13 (a) and (b)	Applicable	The determination of whether any waste constitutes hazardous waste will be made after it is generated. It is not anticipated that waste will be characterized as hazardous waste.
On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers in accordance with §66262.171–178 or in tanks, on drip pads, inside buildings, is labeled and dated, etc.	Accumulate hazardous waste	Cal. Code Regs. tit. 22, § 66262.34	Applicable	Applicable for any operation where hazardous waste is generated and transported in containers.
Containers of RCRA hazardous waste must be: • maintained in good condition, • compatible with hazardous waste to be stored, and • closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container	Cal. Code Regs. tit. 22, § 66264.171, 66264.172, and 66264.173	Applicable	If waste material has been characterized as hazardous waste and is to be stored in containers, this regulation would be applicable. It is not applicable to material which has been characterized as non-hazardous waste.
Inspect container storage areas weekly for deterioration.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or	Cal. Code Regs. tit. 22, § 66264.174	Applicable	If waste material has been characterized as hazardous waste and is to be stored in containers, this regulation would be applicable. It is not applicable to

Federal Action-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
	storage elsewhere, in a container			material which has been characterized as non-hazardous waste.
Place containers on a sloped, crackfree base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere	Cal. Code Regs. tit. 22, § 66264.175(a) and (b)	Applicable	If waste material has been characterized as hazardous waste and is to be stored in containers, this regulation would be applicable. It is not applicable to material which has been characterized as non-hazardous waste.
Keep containers of ignitable or reactive waste at least 50 feet from the facility property line.	Ignitable or reactive waste	Cal. Code Regs. tit. 22, § 66264.176	Applicable	Substantive provisions are applicable for remediation waste generated.
Keep incompatible materials separate. Separate, noncompatible materials stored near each other by a dike or other barrier.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere	Cal. Code Regs. tit. 22, § 66264.177	Applicable	If waste material has been characterized as hazardous waste and is to be stored in containers, this regulation would be applicable. It is not applicable to material which has been characterized as non-hazardous waste.
At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere	Cal. Code Regs. tit. 22, § 66264.178	Applicable	If waste material has been characterized as hazardous waste and is to be stored in containers, this regulation would be applicable. It is not applicable to material which has been characterized as non-hazardous waste.
Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	RCRA hazardous waste, noncontainerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage	Cal. Code Regs. tit. 22, § 66264.553 (b), (d), (e), and (f)	Applicable	Substantive requirements are applicable if waste is stored on-site in containers.

Federal Action-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Constituents of concern are the waste constituents, reaction products, and hazardous constituents that are reasonably expected to be in or derived from waste contained in the regulated unit.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.93	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.
The point of compliance is a vertical surface, located at the hydraulically downgradient limit of the waste management area that extends through the uppermost aquifer underlying the regulated unit.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.95(a) and (b)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.
Requirements for monitoring groundwater, surface water, and the vadose zone.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.97 (b)(1)(A), (b)(1)(B) and (C), 66264.97(b)(4)-(7), 66264.97(e)(6), 66264.97(e)(12)(A) and (B), 66264.97(e)(13), and 66264.97(e)(15)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.
Requirements for a detection monitoring program.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.98(e)(1-5), (i), (j), (k)(1-3), (4)(A) and (D),(5), (7)(C) and (D),(n)(1),(2)(B), and (C)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.
Requirements for an evaluation monitoring program.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 2, § 6264.99(b), (e)(1)–(6), (f)(3), and (g)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.
The owner or operator shall establish and implement, in conjunction with the	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.100(d)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.

Federal Action-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[(b)]	ARAR Determination	Comments
corrective action measures, a water quality monitoring program that will demonstrate the effectiveness of the corrective action program and be effective in determining compliance with the water quality protection standard and in determining the success of the corrective action measures.				
The corrective action program is complete when compliance with the water quality standard is demonstrated based on the results of sampling and analysis for all constituents of concern for a period of 1 year.	Hazardous waste treatment, storage, or disposal facility	Cal. Code Regs. tit. 22, § 66264.100(g)(1)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring.

Notes:
(a) Many action-specific ARARs containing chemical-specific limitations are addressed in the action-specific ARAR tables.
(b) Only the substantive provisions of the requirements cited in this table are ARARs.
(c) Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.

§	Section	LDR	land disposal restrictions
§§	Sections	NTR	National Toxics Rule
ARAR	Applicable or relevant and appropriate requirement	RCRA	Resource Conservation and Recovery Act
BAAQMD	Bay Area Air Quality Management District	SWRCB	State Water Resources Control Board
Cal. Code Regs.	California Code of Regulations	tit	Title
CFR	Code of Federal Regulations	$\mu g/m^3$	micrograms/cubic meter
CTR	California Toxics Rule	U.S.C.	United States Code

State Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Soil, Sediment, Surface Water and Groundwater				
California Environmental Protection Agency Department of Toxic Substances Control[c]				
State definitions of designated waste, nonhazardous waste, and inert waste.	Waste	Cal. Code Regs. tit. 27, §§ 20210, 20220(a), and 20230(a)	Applicable	Applicable for characterizing waste.
State definition of "non-RCRA hazardous waste."	Waste	Cal. Code Regs. tit. 22, § 66261.3(a)(2)(C) or 66261.3(a)(2)(F), 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), 66261.101	Applicable	Applicable for characterizing waste.
Concentration limits.	RCRA hazardous waste unit	Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e)	Relevant and appropriate	Substantive provisions are relevant and appropriate for setting groundwater cleanup levels.
State Water Quality Control Board and Regional Water Quality Control Board[c]				
Authorizes the SWRCB and RWQCB to establish in water quality control plans beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality. Authorizes regional water boards to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.		Cal. Water Code §§ 13241, 13243, 13263(a), 13269, and 13360	Applicable	Sections of the Porter-Cologne Act are applicable as enabling legislation as implemented through the beneficial uses and water quality objectives of the basin Plan for the San Francisco Bay Basin
Describes the water basins in San Francisco Bay, establishes beneficial uses of groundwater and surface water, establishes water quality objectives, including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.	Water quality	Water Quality Control Plan for the San Francisco Bay (Basin Plan) (Cal. Water Code § 13240) ; Chapter 2, Beneficial Uses, for San Francisco Bay Lower; Chapter 3, Water Quality Objectives, for turbidity and suspended sediment (with the exception of nuisance)	Applicable	Substantive requirements pertaining to beneficial uses for groundwater and surface water at OU-2C.
Establishes the policy that high-quality	Water quality	Statement of Policy With Respect to	Not an ARAR	Not an ARAR for setting

State Chemical-Specific[(a)] Applicable or Relevant and Appropriate Requirements Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[(b)]	ARAR Determination	Comments
waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." Provides that when existing quality of water is better than required by applicable water quality policies, the existing high-quality water will be maintained until it is demonstrated that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect beneficial use of such water, and will not result in water quality less than that prescribed in the policies. States that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste discharge requirements that will result in the best practicable treatment or control of the discharge.		Maintaining High Quality of Waters in California, SWRCB Res. 68-16		cleanup levels.
Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.		SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	Substantive provisions are applicable for determining whether groundwater at OU-2C is a potential drinking water source.

Notes:
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(c) Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.

State Chemical-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

§	Section	LDR	land disposal restrictions
§§	Sections	NTR	National Toxics Rule
ARAR	Applicable or relevant and appropriate requirement	RCRA	Resource Conservation and Recovery Act
BAAQMD	Bay Area Air Quality Management District	SWRCB	State Water Resources Control Board
Cal. Code Regs.	California Code of Regulations	tit	Title
CFR	Code of Federal Regulations	$\mu g/m^3$	micrograms/cubic meter
CTR	California Toxics Rule	U.S.C.	United States Code

State Location-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
No additional state location-specific ARARs were identified for the OU-2C remedial action.				

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(c) Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.

§	Section	LDR	land disposal restrictions
§§	Sections	NTR	National Toxics Rule
ARAR	Applicable or relevant and appropriate requirement	RCRA	Resource Conservation and Recovery Act
BAAQMD	Bay Area Air Quality Management District	SWRCB	State Water Resources Control Board
Cal. Code Regs.	California Code of Regulations	tit	Title
CFR	Code of Federal Regulations	$\mu g/m^3$	micrograms/cubic meter
CTR	California Toxics Rule	U.S.C.	United States Code

State Action-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
California Environmental Protection Agency Department of Toxic Substances Control[c]				
A land-use covenant imposing appropriate limitations on land use shall be executed and recorded when facility closure, corrective action, remedial or removal action, or other response actions are undertaken, and hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels that are not suitable for unrestricted use of the land.	Property transfer by federal government to nonfederal entity	Cal. Code Regs. tit. 22, § 67391.1	Relevant and appropriate	Substantive provisions are relevant and appropriate because the DON is transferring property to a nonfederal agency. Cal. Code Regs. tit. 22, §67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at the property at concentrations that are unsuitable for unrestricted use of the land. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON. EPA agrees that the substantive portions of the regulations referenced are ARARs. EPA specifically considers sections (a), (d), and (e) of Cal. Code Regs. Title 22 §67391.1 to be ARARs for this ROD. DTSC's position is that all of the state regulation is an ARAR.
"must have remained at or below its respective concentration limit during a proof period of at least one year . . . and . . . (2) each Monitoring Point must have been evenly distributed throughout the proof period and have consisted of no less than eight sampling events per year per Monitoring Point."	Waste discharged after 18 July 1997	Cal. Code Regs. tit. 27, § 20430(g)(1)	Relevant and appropriate	Substantive provisions are relevant and appropriate for monitoring since they are more stringent than federal ARARs.

State Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the DON to a nonfederal agency	Cal. Civ. Code § 1471	Relevant and appropriate	Substantive provisions are relevant and appropriate since the DON is transferring property to a nonfederal agency. Generally, Cal. Civ. Code §1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Cal. Health & Safety Code § 25260. Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Environmental Restriction and Covenant Agreement at the time of transfer.
Allows Cal EPA/DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the DON to a nonfederal agency	Cal. Health & Safety Code § 25202.5	Relevant and appropriate	Substantive provisions are relevant and appropriate since the DON is transferring property to a nonfederal agency. The substantive provisions of Cal. Health & Safety Code § 25202.5

State Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
				are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . ."
Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)–(E).	Transfer property from the DON to a nonfederal agency	Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C)	Relevant and appropriate	Substantive provisions are relevant and appropriate since the DON is transferring property to a nonfederal agency. Generally, Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the Cal EPA/DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code §25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property…" and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "…execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof , as appropriate, upon the present and future uses of the land."

State Chemical-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

Requirement	Prerequisite	Citation[(b)]	ARAR Determination	Comments
Prohibits certain uses of land containing hazardous waste without a specific variance.	Hazardous waste property	Cal. Health & Safety Code § 25232(b)(1)(A)–(E)	Relevant and appropriate	Substantive provisions are relevant and appropriate since the DON is transferring property to a nonfederal agency. Land-use restrictions will be used to prohibit the following activities at OU-2C: residential use, construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites.
Provides processes and criteria for obtaining written variances from a land use restriction and for removal of the land use restrictions.	Transfer property from the DON to a nonfederal agency	Cal. Health & Safety Code §§ 25233(c) and 25234	Relevant and appropriate	Substantive provisions are relevant and appropriate since the DON is transferring property to a nonfederal agency. Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "…the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

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State Chemical-Specific[(a)] Applicable or Relevant and Appropriate Requirements
Operable Unit (OU) 2C Record of Decision, Alameda, California (Continued)

§	Section
§§	Sections
ARAR	Applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
Cal. Code Regs.	California Code of Regulations
CFR	Code of Federal Regulations
CTR	California Toxics Rule
LDR	land disposal restrictions
NTR	National Toxics Rule
RCRA	Resource Conservation and Recovery Act
SWRCB	State Water Resources Control Board
tit	Title
µg/m3	micrograms/cubic meter
U.S.C.	United States Code

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Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
1	former NAS Alameda, now referred to as Alameda Point	Section 2.1	Final Remedial Investigation Report for Operable Unit 2C. Section 1.4.2, Pages 1-5 and 1-6. Bechtel Environmental Inc. 2008.
2	OU-2C	Section 2.1	Final Remedial Investigation Report for Operable Unit 2C. Section 1.4.3, Pages 1-6 through 1-10. Bechtel Environmental Inc. 2008.
3	investigations and removal actions	Section 2.3	Final Remedial Investigation Report for Operable Unit 2C. Section 1.5; Pages 1-16 through 1-74; Tables 4-8, 4-9, 4-10, 4-14; Table 7-2. Bechtel Environmental Inc. 2008. Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Figures 3-1 through 3-7. Battelle 2011.
4	drinking water	Section 2.4	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Appendix D, Attachment D-1. Battelle 2011.
5	Western Exposure Unit 1	Section 2.5	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Appendix A. Battelle 2011.
6	HHRAs	Section 2.5.1	Final Remedial Investigation Report for Operable Unit 2C. Section 6.1, Figures 6-1 through 6-5, Tables 6-1 through 6-7. Bechtel Environmental Inc. 2008.
7	Risks were re-calculated for Exposure Units 2 and 3	Section 2.5.1	Draft Final OU-2C iROD, Reference Link. Comparison of TCE Toxicity Values and Updated Risk Assessment Results for Exposure Units 2 and 3 at OU-2C, Alameda Point, prepared by Battelle. January 2014. Final Remedial Investigation Report for Operable Unit 2C. Table M2-6 and Table M5-11.
8	screening-level ecological risk assessment	Section 2.5.2	Final Remedial Investigation Report for Operable Unit 2C. Section 6.2, Figures 6-6 and 6-7, Tables 6-8 through 6-37. Bechtel Environmental Inc. 2008.
9	general response actions (GRAs) and remedial approaches	Section 2.8	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Sections 4.1 and 4.2, Pages 4-1 and 4-2. Battelle 2011.
10	preliminary remedial alternatives	Section 2.8	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.0, Pages 6-1 through 6-71. Battelle 2011.
11	nine evaluation criteria	Section 2.8.2	Proposed Plan for Operable Unit 2C, IR Sites 5, 10, and 12, Alameda Point. Table 8.
12	Alternative S2	Section 2.8.3	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.0, Pages 6-5 through 6-8. Battelle 2011.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
13	**Alternative GS2**	**Section 2.8.9**	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.3.2, Pages 6-38 through 6-42; Pages 2-32 through 2-34. Battelle 2011.
14	**Alternative GD2**	**Section 2.8.15**	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.4.2, Pages 6-60 and 6-61. Battelle 2011.
15	**Administrative Record**	**Section 2.9.1**	Alameda Point NAS Draft Administrative Record File Index. Pages 1-148.
16	**DON BRAC Program Management Office website**	**Section 2.9.1**	http://www.bracpmo.navy.mil/
17	**meeting transcript**	**Section 3**	Public Meeting Transcript, October 11, 2012, Public Comment Period for Proposed Plan for Operable Unit 2C, 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: Ms. Diane Silva, NARA Certified Command Records Manager, NAVFAC Southwest, 1220 Pacific Highway, Code EV33, NBSD Bldg. 3519, San Diego, CA 92132, phone: (619) 556-1280.

AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirement
AS-SVE	Air Sparge-Soil Vapor Extraction
AST	aboveground storage tank
BCT	BRAC Cleanup Team
BGMP	Basewide groundwater monitoring program
bgs	below ground surface
BRAC	Base Realignment and Closure
CAA	corrective action area
Cal/EPA	State of California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	CERCLA Information System
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CPT	cone penetrometer testing
DHS	Department of Health Services
DNAPL	dense nonaqueous-phase liquid
DON	Department of the Navy
DTSC	Department of Toxic Substances Control
EBS	Environmental Baseline Survey
EPA	(United States) Environmental Protection Agency
ERA	ecological risk assessment
ERH	electrical resistive heating
FS	Feasibility Study
FWBZ	first water bearing zone (groundwater)
GAP	generator accumulation point
GHG	greenhouse gas
GRA	General Response Action
GSR	green and sustainable remediation

HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IC	institutional control
IR	Installation Restoration
ISCO	in situ chemical oxidation
ISCR	in situ chemical reduction
LUC	land use control
MCL	maximum contaminant level
mg/kg	milligram per kilogram
MTBE	methyl tertiary butyl ether
NADEP	Naval Aviation Depot
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response Directive
OU	Operable Unit
OWS	oil-water separator
PAH	polycyclic aromatic hydrocarbon
pCi/g	picocurie per gram
PRG	preliminary remedial goal
Ra	radium
RAB	Restoration Advisory Board
RAO	remedial action objective
RASO	Radiological Affairs Support Office
RBC	risk-based concentrations
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RfD	reference dose
RG	remedial goals
RI	Remedial Investigation
ROC	radionuclide of concern
ROD	Record of Decision
SEE	steam-enhanced extraction
sf	square feet

SLERA	Screening-level Ecological Risk Assessment
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWBZ	second water bearing zone (groundwater)
SWMU	solid waste management unit
TCE	trichloroethene
TCRA	time-critical removal action
TPH	total petroleum hydrocarbon
UCL	upper confidence limit
UST	underground storage tank
µg/L	micrograms per liter
VOC	volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board
yd^3	cubic yards

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Number	Comment	Response
Comments by Mr. William Smith, at Public Meeting on October 11, 2012		
1.	I would just like to give a broad overview of my reaction to the suitability of the remedial plan here, the proposed plan for Operable Unit 2C, Installation Restoration Sites 5, 10 and 12 of the former NAS Alameda. The plan is a good synthesis of the RI, the RA and the FS, but it still is incomplete for -- especially for evaluating the community acceptance criteria and, in particular, it doesn't provide the information we need to identify increased subsequent costs for reusing the land and replacing old structures.	The purpose of the public meeting held on October 11, 2012 and the public review and comment period for the Operable Unit (OU) 2C Proposed Plan is to address the community acceptance component of the proposed remedy for Installation Restoration (IR) Sites 5, 10, and 12 at former NAS Alameda. The responses to public comments provided herein are intended to form the basis of satisfying the community acceptance criterion. It is beyond the purpose and scope of the FS and Proposed Plan to consider specific future construction activities that are not associated directly with implementing the remedy. Costs included as part of the Proposed Plan are for comparison of the costs of the alternatives for remediating the site, not to provide potential costs for future development.
2.	And, for example, Building 5, the preferred alternative would leave metals in place under the concrete slab. So, if we ever tear that building down and tear up the concrete slab, then the construction costs will increase, and we'll have to pay for the disposal of the metal soil.	The Proposed Plan includes summary-level costs for excavation, and the Final OU-2C FS Report provides the detailed cost breakdown. Using relative differences between various remedial alternatives considered in the OU-2C FS Report and the FS cost assumptions, the cost of addressing metals-impacted soil beneath Building 5 (via excavation of approximately 5,100 cubic yards of soil and off-site disposal of this material as a hazardous waste based on

Number	Comment	Response
		existing analytical data from this area of the site, followed by backfilling), including design, would be approximately $2.4 million. This cost assumes that Building 5, including the building slab, would already have been removed, and therefore does not include the cost for removing the building or building slab (nor does it include the replacement of any slab or structure).
3.	Another cost that we have -- another concern -- even bigger concern -- is the cost of removing RAD from around the piping, especially under the street. That's a cost that will come up very shortly along West Tower Avenue. The RAD is proposed to be left in place there. And as soon as the street movers come in and the -- street construction and utility layers come in to put in the infrastructure needed for the street, they're going to have to deal with that RAD, potentially.	The Proposed Plan includes summary-level costs for excavation, and the Final OU-2C FS Report provides the detailed cost breakdown. The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that ROD.
4.	So, in short, we need additional financial information to judge whether or not a alternative is acceptable. And I think it's important, because from my talking with a knowledgeable fellow in the community about this, he thinks that the metal-contaminated soil under Building 5 is probably a small cost -- a few hundred thousand dollars -- to dispose of, but the RAD along the long pipelines is a much more -- could cost millions to get rid of. So that would suggest that, if it's a higher cost, we should look harder at the higher-cost alternatives which leave the site in a better condition for the longer term, and we can't do that because we don't have that information in this report.	Please also see the responses to comments #2 and #3 from Mr. William Smith above. The Proposed Plan provided the costs for excavation of radiologically-impacted lines. For additional reference, based on cost assumptions provided in the OU-2C FS Report, the total cost to remove and dispose the buried drain lines and surrounding soil beneath Building 5 to address potential radiological contamination, including backfilling, would be approximately $35.5 million (assuming the building and building slab were already removed and therefore not including such costs in the overall cost estimate) to $40 million (if the building remained in place, requiring engineering supports to excavate beneath the building, and assuming the building slab required partial removal and replacement). To consider a less conservative scenario based on input during the public review period, the FS cost estimate of 35% radiologically-impacted soil (based on the data for pipelines remediated at the time of the Final

Number	Comment	Response
		FS Report) could be revised to 10% radiologically-impacted soil (based on these lines being less impacted than Line F). Such a change would result in an approximately $9 M cost reduction. Factoring in the costs associated with non-radiological components, Alternative S4 would be $36,581,800, Alternative S5 would be $36,552,600, and Alternative S6 would be $33,273,600. The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that ROD.
5.	Another thing that we need to assess the alternatives is to get a sense of what they actually physically accomplish in terms of contaminant reduction. The report presents the remedial goals for it which presents final concentration of contaminants have to be less than; it does not present the initial concentration of the contaminants. We need the initial concentration of the contaminants presented. That information is available in the Remedial Investigation, but I don't have the time to go back and dig up that huge, long document.	Data that form the basis of the OU-2C FS and Proposed Plan are provided in detail in the Remedial Investigation (RI) Report, and it is impossible to summarize that volume of data in the Proposed Plan or in response to this comment. However, the "initial" concentrations of various chemicals at specific locations that will be addressed by the OU-2C remedy based on comparison to risk-based cleanup goals are presented in Tables 3-8 (soil) and 3-9 (shallow groundwater) in the FS Report, as well as on Figures 3-1 (soil) and 3-3 (shallow groundwater). In addition, Appendix C of the OU-2C FS Report provides the "initial" data for those sampling locations that are excluded from the remediation footprints (Figure C-1 for soil, and Table C-7 and Figure C-2 for shallow groundwater) along with the protectiveness evaluation of the site remedy in the context of the defined footprints. For the deeper groundwater intervals at OU-2C, Figures 3-5, 3-6, and 3-7 show the specific sampling locations with "initial" concentrations that are of potential consequence relative to cleanup goals

Number	Comment	Response
		derived for these aquifer intervals.
6.	The other thing which would be very useful is if we can compare -- the community could compare the residential goals with -- the remedial goals for occupational use versus the remedial goals for residential use. Again, that would be useful for determining community acceptance, which is a criteria. So that would give us a sense of how much additional work would be required to meet the residential goals instead of just the occupational goals. So, to reiterate, the alternatives that leave the RAD in place are unacceptable. It's a questionable alternative to leave the metals in place. The petroleum hydrocarbons are less of a concern. And I see they're not addressed, anyway, in this remedial plan; they're in another program. That's fine. So, all in all, the plan was helpful, fairly easy to read; it just lacks a little information to really formulate the community acceptance. Thank you.	Tables 3-5 (soil) and 3-6 (shallow groundwater) in the OU-2C FS Report show both the occupational and residential cleanup goals. Figure 3-2 in the OU-2C FS Report shows the soil remediation footprint in the hypothetical case of applying the residential soil cleanup levels (as compared to Figure 3-1, which shows the soil footprint for the commercial reuse scenario), and Figure 3-4 shows the shallow groundwater remediation footprint in the hypothetical case of applying the residential groundwater cleanup levels (as compared to Figure 3-3, which shows the shallow groundwater footprint for the commercial reuse scenario). Appendix G of the OU-2C FS Report provides descriptions, including cost estimates, for applying the various remedies considered in the FS, but in the context of attaining residential cleanup levels (note that one residential remediation scenario is discussed in Section 6 of the FS Report for soil and shallow groundwater at OU-2C). The basis of remediation specific to radiological contamination (i.e., application of a cleanup goal based on background and a footprint based on the presence of buried pipelines) would be identical regardless of site reuse being commercial or residential. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Comments by Mr. James Leach, at Public Meeting on October 11, 2012		
1.	I have three major comments. The first one is I believe that the industrial waste lines should be removed rather than just plugged with concrete. The second thing is they should -- if	Please see the responses to comments #2 through #4 from Mr. William Smith above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After

Number	Comment	Response
	Building 5 is not contaminated itself, then it should be removed, because it's an eyesore and the metal is valuable enough that it might be economical to get. The third thing is institutional controls, as a remedy, have not worked in the past, and I object to any remediation that relies on institutional controls.	discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Comment by Ms. Carol Gottstein, at Public Meeting on October 11, 2012		
1.	On Page 3 in the Removal Action, the bottom paragraph, beginning "approximately 700 feet," the text states that a great deal of radiologically-impacted drain line was removed by 2000, and then it jumps to the Time Critical Removal Action that was completed between 2008 and 2010, but there really isn't a good explanation as to why -- it's something that was always there -- it became time critical in 2008. Because it's been there. I was just talking to the Navy representative, Derek. He said, yes, they could put a line in there about how the detection methods improved dramatically between the year 2000 and the year 2008 as well as the threshold for radiological contamination that affects human health. I think there should be some kind of explanation why over that eight-year period -- what happened to suddenly mandate the media addressing of the problem in 2008 that they should have found earlier. I don't know if that came out clearly or not.	The information summarized under "Removal Actions" in the OU-2C Proposed Plan is provided in greater detail in Section 2.1.6 of the FS Report. With respect to radiological removal actions at OU-2C, it is important to understand that statutory requirements associated with addressing radiological contamination have changed over time, as have cleanup and survey criteria, as have instrument detection capabilities. In addition, the objective of various radiological removal actions conducted at OU-2C has evolved from first focusing on interior surfaces with direct potential for human exposure (e.g., floors, walls, and ventilation ducts) and then focusing on substantially less direct exposures (i.e., buried drain lines). Buried drain lines are extensive beneath former NAS Alameda, and additional detail regarding the presence and interconnectedness of various lines is discovered occasionally. Not all sites are in a concurrent remediation phase and it is prudent to not address certain issues until "upstream" or nearby concerns are better understood. Moreover, specific concerns (e.g., petroleum or radiological) have at times been handled through basewide rather than site-specific programs. The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be

Number	Comment	Response
		addressed in a separate ROD. This comment will be addressed in that ROD. In short, the Navy has previously addressed certain radiological contamination associated with OU-2C, and continues to address related/remaining radiological contamination in consultation with the regulatory agencies, in accordance with statutory requirements, and in an efficient and practical manner.
Comment by Ms. Francis McIlveen and Mr. Solvejg Rose, dated October 29, 2012		
1.	We are residents in Alameda, about ¼ of a mile from the former NAS, and thus are quite concerned about the cleanup efforts there. We have two small children (a 5 year and a nine-month old). And we actively garden and grow food in our yard. Thus, as any thinking person would, we are highly concerned about what happens just down the road from us and *upwind* of us and the rest of this densely populated island of 70,000 people. We are writing you, because we are deeply concerned about the very short-sighted approach to the clean up proposed for OU2C, IR 5, 10 & 12---essentially an attempt to just cap & leave in place a likely radioactively contaminated site. A site which will continue to be radioactive for *millennia!* Ingesting or inhaling radium dust is *extremely* dangerous. No one, not even the very powerful United States Navy can guarantee that future generations will not dig up and expose this very dangerous material to our descendents. It is impossible, and thus more than likely, that at some point, the soil & plumbing of concern will see the light of day, and cause further damage to our immediate environment, and to the health of anyone in proximity or who comes in contact with it. We are writing to you as citizens, exhorting the Navy to take a moral position. The	During clean-up, engineering controls will be in place and wind monitoring will be conducted to ensure that no contaminants become wind-borne. For the OU-2C remediation, these controls will be specified in the future Remedial Action Work Plan, which will be reviewed and approved by the regulatory agencies prior to the start of the field work. With respect to characterizing OU-2C, IR Sites 5, 10, and 12 have been investigated and environmental conditions have been characterized through a number of historical sampling events, all of which are noted in the FS Report and otherwise summarized in detail in other site-specific summary documents. A comprehensive and extensive RI Report was ultimately developed that summarized the nature and extent of contamination at OU-2C based on the available historical dataset and the collection and analysis of hundreds of samples of soil, groundwater, and soil gas. Investigations have targeted specific features that may have contributed to site contamination as well as the site overall. The comprehensive and extensive site dataset was used to develop risk assessments (ecological and human health) to determine if potentially unacceptable risks exist for various receptors through reasonable exposure pathways. The RI Report, which was finalized and approved

Number	Comment	Response
	contamination is the Navy's. It is the Navy's mess. And we are asking the Navy to clean it up---if not to standards of its original state, at least to the point where it is reasonable to assume that it will pose a miniscule risk to our descendents. That would mean, not just leaving the contamination under a concrete slab (basically, under the rug) for future generations to puzzle over. We have heard concerns here in Alameda about asking the Navy to undertake options which are 'too expensive'. (in fact I've seen the letter from the City of Alameda regarding this issue, mainly focusing on what they see as inaccurate cost projections). We are unimpressed. If the Navy has caused such long term damage, it is the Navy's moral duty, as a branch of our elected government, to do right by us. The Navy has spent little over $500 million at the Point. That's not even half of the cost of a B-1 bomber. It is 3/10th of a percent of what the Navy spends in just *one year*. But we are talking about a cleanup effort which will have an impact for centuries, or perhaps millennia. If is not a question of cost, but rather of priorities. We urge the Navy to fully characterize the sites in question, and to conduct a comprehensive cleanup which doesn't short change our future generations.	by the regulatory agencies, presented recommendations for those issues that should be addressed through the FS Report. The FS Report, in turn, addressed the recommendations from the approved Final RI Report (and included additional risk assessments and integrated yet further data available from OU-2C), and the Proposed Plan documents the proposed remedy to mitigate identified site risks and leave the site in a usable condition relative to those risks. Sampling will also be conducted at OU-2C, as needed, prior to start of the cleanup to further verify the remediation footprint areas for cleanup. Please also see the responses to comments #2 through #4 from Mr. William Smith above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Comment by Liza, an Alamedan Resident, dated October 29, 2012		
1.	I am a resident of Alameda, and I'm very concerned about the level of cleanup the Navy plans to take at the heart of Alameda Point. I feel the Navy needs to conduct a further and more extensive investigation to better design the specifics of removal, ESPECIALLY radiological contamination, regardless of cost, to insure there is no human health risk nor environmental health risk…that is, further investigating the former center of operation, including the	During the RI at OU-2C, the Navy sampled soil and groundwater from within and outside the site to determine generally where contamination was located and to delineate the nature and extent of the contamination. Sampling outside of the site was conducted to ensure that on-site contamination did not extend beyond the site boundaries, and this reflects a more thorough characterization as opposed to a less thorough characterization of the site.

Number	Comment	Response
	building where the Navy cleaned and maintained its airplanes of West Tower Ave., the missile rework facility, and a former power plant. A more extensive cleanup is needed for removal of contaminated soil and more extensive treatment of groundwater, cleaned up to RESIDENTIAL cleanup standards, not commercial standards. Soil samples were taken outside the site to determine what mitigation efforts should be made, which reflects a lack of thorough site characterization, and thus an inadequate ability to select the best and safest cleanup remedy. All in all, I highly request a more thorough investigation of the Alameda Point area to produce a better design for the specifics of the continuing cleanup.	The current use, as well as planned future use, is commercial, so the cleanup would be to commercial standards. Please see the responses to comments #2 through #4 from Mr. William Smith and comment #1 from Ms. Francis McIlveen and Mr. Solvejg Rose above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Comments by the Restoration Advisory Board members, dated November 3, 2012		
1.	We have commented extensively on this site over the years. It is an area of great importance to the future wellbeing of Alameda and figured prominently in US EPA's strategy with respect to using six-phase heating to remove chlorinated solvents. We are, as a result, disappointed in the preferred alternatives chosen by the Navy, that seem to be driven almost exclusively by cost in almost every instance and by the Navy's own standards are not "rated the highest overall in satisfying the balancing criteria." None of the treatments recognize the impact of an earthquake on the movement of contaminants through soil and into the atmosphere or workplace. Nor do they recognize the impact of impending sea-level rise; while various scientific and research communities differ on how much sea level will rise, the majority agree sea level will affect the bay shoreline and Bay Area.	In a broad sense, the Navy recognizes the significance of global climate change and also recognizes the potential importance of earthquake activity. With respect to earthquake activity, there is no evidence to suggest the preferred remedial alternative would be ineffective in the event of an earthquake in proximity to Alameda Point, particularly in light of documented remedial action objectives (RAOs) and long-term monitoring and maintenance requirements (including periodic reviews). With respect to global climate change, it is well beyond the scope or ability of the CERCLA program at OU-2C to reasonably forecast the actual future outcome of changing climatic conditions, including the potential mitigating effects of policy and regulatory changes in the United States and/or globally. Please also see the responses to comments #2 through #4 from Mr. William Smith above. The BCT has considered all comments

Number	Comment	Response
		received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
2.	**Soils** The reply to our comments on our preferred alternative (Restoration Advisory Board Comments on OU-2C Revised Draft Feasibility Study, February 3, 2011) did not address the concern that "ICs would have to be maintained for thousands of years" because of the radiologically-impacted soils under buildings 5 and 5A. "Institutional controls have diminishing effectiveness with time". By selecting Institutional Controls as the alternative, two assumptions have been made: 1. development of the property will never occur and 2. if it does, the developer or landowner will assume liability in perpetuity. The RAB prefers either alternative S5 or S6, assuming that soil vapor extraction is equally effective as excavation in removing the soil contamination in areas east and south of Building 5. Excavation of the radioactively-contaminated drain lines under buildings 5 and 400 is necessary because institutional controls cannot be guaranteed to be effective for thousands of years. The soil surrounding these lines must be sampled and any radioactively-contaminated soil removed. Grouting these lines, as suggested in alternative S3, is unacceptable because it will not take care of radium in the surrounding contaminated soil. The Navy's preferred alternative S2 does not even mandate maintenance of the building slabs because the wording is that ICs "may" include such maintenance or engineering controls. This comment also	The OU-2C FS Report indicates the following with respect to institutional controls (ICs) under Soil Alternative S2: "Soil Alternative S2 would…include implementation of ICs to accomplish the following: • Restrict future site use to commercial throughout Exposure Units 2 and 3 and Local Area 2 in Western Exposure Unit 1 (i.e., Western Exposure Unit 1 outside of Local Area 2 is not characterized by potentially unacceptable soil risks to a hypothetical future residential receptor); • Require that the Building 5 and 400 slabs and the areas of pavement that currently cover soil footprint areas be maintained as engineering controls over the footprint areas; • Require that another suitable engineering control (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) be installed in any footprint area where the existing control is demolished; and • Require that impacted soil that would remain in footprint areas be excavated and disposed off-site…if the existing engineering controls…are demolished and other suitable engineering controls…are not constructed in their place. Following selection of the remedy, site use restrictions would be determined in the detailed land use control remedial design

Number	Comment	Response
	applies to alternative S3 that does not make such maintenance mandatory.	(LUC RD), which is reviewed by the regulatory agencies. The requirements/restrictions surrounding the presence and maintenance of the engineering controls would be required indefinitely unless the soil footprints in these areas were directly addressed through removal or treatment." The OU2C ROD will indicate the IC provisions "will be required" instead of "may be required." The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
3.	**Shallow Groundwater** The Navy's preferred alternative and all alternatives rely on enhanced bioremediation as treatment. However, the feasibility study only mentions natural attenuation as bioremediation, i.e., pollution dilution. Again, the Navy's preferred alternative is the cheapest and does not effectively protect human health if the property is developed. The RAB prefers alternative GS5 because GS5 uses ERH that would be more effective in removing dense non-aqueous phase liquids (DNAPLs), the remediation actually remediates the site and reliance on pollution dilution is minimized.	The OU-2C FS Report indicates that wherever enhanced bioremediation is a component of a shallow groundwater remedial alternative, it would be accomplished actively through the injection of an aerobic bioremediation amendment (in the FS Report, the ORC® product from Regenesis is documented as "assumed to be representative of technologies for accomplishing enhanced aerobic bioremediation") and not passively through natural attenuation. Notably, Shallow Groundwater Alternative GS5 would include an identical enhanced bioremediation element (i.e., through active introduction of an aerobic treatment amendment) compared to the preferred alternative GS2. In addition, the more aggressive in situ treatment element of the preferred shallow groundwater alternative (GS2), in situ chemical oxidation (ISCO), is effective relative to the observed concentrations of chemicals in shallow groundwater, and the conceptual approach documented in the OU-2C FS Report

Number	Comment	Response
		specifically assumes that multiple ISCO injection events would be implemented to achieve the remedy objectives. The OU-2C ROD will describe the active nature of any enhanced bioremediation element for the shallow groundwater remedy. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
4.	**Deep Groundwater** The Navy's proposed alternative is the cheapest of all alternatives and does not meet the Navy's stated criteria of being the highest overall in satisfying the balancing criteria. The RAB continues to prefer alternative GD5 because it is likely the most effective for DNAPLs at depth.	Deep Groundwater Alternative GD2 best satisfies the balancing criteria, being ranked "high" relative to the highest number of these criteria compared to any other alternative. It is critically important to understand that there are no actual risks posed by chemicals in deeper groundwater at OU-2C. Municipal water is provided from a separate source, not groundwater beneath Alameda Point. As documented in the FS Report: "The RI concluded that there are no unacceptable ecological risks associated with OU-2C…, groundwater at OU-2C is not considered a likely drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. Because no current human health or ecological risks are present, implementation of ICs to restrict use of groundwater from the deep FWBZ and SWBZ would be protective of human health and the environment". The FS Report also documents for Deep Groundwater Alternative GD2:

Number	Comment	Response
		"ICs would be required under Groundwater Alternative GD2 to accomplish the following: • Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C."
5.	**Drain Lines** Drain lines were not considered in the final Feasibility Study and as a result the RAB did not comment on them. Dr. Peter Russell requested the Navy investigate radiological contamination in the drain lines under and outside buildings 5, 5A, and 400. The Navy again has selected an inexpensive solution to a problem that will saddle the city with health issues far beyond any of our lives or those of our children. If industrial drain lines are in a "deteriorated" condition, it is reasonable to believe that soil surrounding them is contaminated with RA^{-226}. Our choice of clean up is not offered in the Navy's menu. We prefer hydro-jetting all storm drain lines to the point at which no contamination is detected and the excavation and disposal of the industrial waste lines and all soils around those lines that are contaminated radioactively.	The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that ROD.

Number	Comment	Response
6.	What epidemiological studies have been conducted of mortality rates of former base employees who worked painting radium dials to determine mortality rates from cancers or other diseases? Please share those studies with the RAB.	The purpose of the CERCLA program at OU-2C has been to conduct a thorough site assessment by characterizing the nature and extent of contamination, complete detailed and thorough risk assessments, and perform an FS to determine a suitable remediation strategy to mitigate site risks. The Navy is not required under CERCLA to evaluate epidemiological studies of former base employees. The Navy has relied on historical base information as appropriate (e.g., site history) in executing the project and has integrated toxicological and epidemiological information from appropriate sources and as it directly relates to developing the site risk assessments. All such information is summarized in the RI and the FS Report for OU-2C.
General Comments from Mr. George B. Humphreys, P.E., dated November 2, 2012		
1.	Thank you for the opportunity to comment on the subject document. The following comments are organized into general and specific categories.	This comment is acknowledged.
2.	The preferred alternatives presented in the proposed plan place excessive reliance on institutional controls. This is particularly true with regard to soil and drain lines contaminated with radium-226, which has a half-life of 1620 years. Institutional memory is notoriously unreliable and short-lived. This can be illustrated by the recent "discovery" of the foundations for the original San Francisco City Hall during excavation work in front of the Federal Building. No one in San Francisco remembered where the original building had been located prior to its destruction in the 1906 earthquake. Another example is the San Bruno pipeline failure and the later revelation that P.G. & E's maintenance records were missing or had been falsified. Another problem is the survival of the institutions themselves. To my knowledge, no government has survived for the millennia needed to protect future	Please see the responses to comments #2 through #4 from Mr. William Smith and comments #1 and #2 from Restoration Advisory Board members above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.

Number	Comment	Response
	generations. There also is the problem of maintaining institutional controls in a retrievable format. With the rapid technological changes in computers and information storage, today's records will likely become irretrievable unless continually transferred from one format to another. The engineered barriers (paving and slabs) and the building structures themselves are not likely to survive future seismic and other natural events (e.g. sea level rise, cataclysmic storms, tidal waves) for the thousands of years necessary to maintain containment of the radiologically contaminated materials. It is quite likely that within 50 or 100 years either or both Buildings 5 and 400 will suffer major seismic damage and will have to be demolished. In such an event, there may be pressure to convert usage to residential and there will be no institutional memory of why the area was restricted to commercial/industrial use. The calls into question whether the selected alternatives are truly "protective of human health and the environment" as stated in the Proposed Plan. As you know, the rationale for engineering registration in California is the protection of public safety, not the enhanced prestige or earning potential of the individual designated as a professional engineer. That professional duty of protecting the public surpasses loyalty to one's employer, even if speaking out threatens the security of one's employment.	
3.	Another general deficiency in the Proposed Plan is its lack of disclosure regarding the location and disposition of radioactive contamination. Although the presence of radium-226 is discussed with regard to drain lines under and outside Building 5 and in the storm drain lines, no mention is made of possible radioactive contamination within the building structure itself. During the January 6, 2011 RAB meeting, I again	As indicated in the OU-2C FS Report (Section 2.1.6) with respect to structures themselves at OU-2C: "Although radiological surveys have been performed for Buildings 5 and 400 and cleanup was conducted in accordance with the criteria at that time, the criteria for radiological free release from historic removals do not meet current criteria. In

Number	Comment	Response
	raised the question of possible radium contamination in the Building 5 mezzanine rooms and ventilation ductwork. Mary Parker and Andrew Bullard responded that there had been radium spills in these rooms and that demolition of the rooms and removal of the contaminated ductwork already had occurred. The minutes of that meeting only states that the radiological concerns would be addressed in an FS addendum or in the Basewide radiological report. I believe that the OU-2C Proposed Plan should have addressed this subject of radiological contamination within Building 5 itself (and probably Building 400). Certainly the City and any future lessee/commercial tenant deserve to have full disclosure about such radiological contamination and specifically what was done to remedy the situation. There may even be a legal obligation to disclose pre-existing conditions. Neither the City nor future commercial tenant will have the resources or know-how to decontaminate properly and dispose of such radiological debris at an out-of-state site.	some cases, final status surveys were not completed following decontamination efforts. Therefore, radiological free release has not been requested to date. The DON will conduct additional radiological surveys for these buildings. Based on the results of these surveys, the DON will either request free release or conduct any necessary cleanup, re-surveying, and closeout reporting as part of a future removal action. The DON will compile survey data and the details of any required cleanup activities performed in Removal Action Report(s) or Final Status Survey Report(s). The DON expects that all necessary action will be taken to request and obtain radiological free release." In addition to Buildings 5 and 400, and as noted in the FS Report, further radiological clearance activities will also be undertaken at OU-2C for Buildings 42, 44, and 346. The ROD will document the status of these in-progress activities at that time. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
4.	Another radiological concern was raised by me regarding radiologically contaminated liquids that were discharged through storm drain lines via outfalls A and B into the Oakland estuary and inner harbor. Sediments dredged from these areas were used to fill large portions of Alameda Point and possibly areas on the Oakland side of the estuary. Have these fill areas ever been adequately surveyed for radiological contamination? Are radiation levels in these areas being used to establish	Oakland Inner Harbor was sampled for radium-226 during the OU-2C remedial investigation and again in 2010 at locations closer to the outfalls. A risk assessment for the radium-226 data was conducted as part of the OU-2C FS Addendum finalized in January 2012. Results of the risk assessment showed no unacceptable risks; therefore, no action is required for Oakland Inner Harbor. A No Action ROD was issued for Oakland Inner Harbor (IR Site 20).

Number	Comment	Response
	"background" levels for OU-2C cleanup? The proposed plan should clearly state what background levels of radium-226 are being used and where those background levels were measured. It is possible that the Navy also has contaminated the so-called background areas.	
5.	It seems to me that the entire subject of radiological contamination has been treated with unnecessary mystique and secrecy. This mindset seems to go back to an era when development of nuclear weapons was occurring and national security was involved. Certainly, there can no longer be any valid reason for withholding information from the public. Such a policy only exacerbates public fears and imagined dangers.	The Navy makes all reports related to radiological contamination available to the public through the Alameda Point Information Repository, Alameda Public Library, and Navy Administrative Record. No information is being withheld from the public.
Specific Comments from Mr. George B. Humphreys, P.E., dated November 2, 2012		
1.	Soils. The Navy's preferred alternative, S2, is unacceptable because it relies on institutional controls, as discussed above. The preferred alternative should be either S4 or S5. These alternatives are similar, except that S5 uses soil vapor extraction to remediate soil contaminated with volatile organic compounds in areas east and south of Building 5.	Please see the responses to comments #2 through #4 from Mr. William Smith and comment #2 from Restoration Advisory Board members above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
2.	Shallow Groundwater. The preferred alternative should be GS5 because it uses electrical resistance heating (ERH) that has already been demonstrated as highly effective for areas within Building 5.	Please see the responses to comments #2 through #4 from Mr. William Smith and comment #3 from Restoration Advisory Board members above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.

Number	Comment	Response
3.	Deep Groundwater. The Navy's preferred alternative, GD 2, is not viable because it relies exclusively on institutional controls. The preferred alternative should be GD 5 because it uses ERH that has been demonstrated as effective in removing dense non-aqueous phase liquids.	Deep Groundwater Alternative GD2 best satisfies the balancing criteria, being ranked "high" relative to the highest number of these criteria compared to any other alternative. It is critically important to understand that there are no actual risks posed by chemicals in deeper groundwater at OU-2C. Municipal water is provided from a separate source, not groundwater beneath Alameda Point. As documented in the FS Report: "The RI concluded that there are no unacceptable ecological risks associated with OU-2C…, groundwater at OU-2C is not considered a likely drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. Because no current human health or ecological risks are present, implementation of ICs to restrict use of groundwater from the deep FWBZ and SWBZ would be protective of human health and the environment". The FS Report also documents for Deep Groundwater Alternative GD2: "ICs would be required under Groundwater Alternative GD2 to accomplish the following: • Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C."
4.	Drain Lines. The Navy's preferred Alternative D5 is unacceptable because it leaves the "deteriorated" industrial drain lines in place and relies on institutional controls to protect future generations. If the industrial drain lines are in deteriorated condition, radioactively contaminated	The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that

Number	Comment	Response
	material has almost certainly contaminated the soil surrounding these industrial drain lines. Therefore, my preference would be Alternative D6, hydro jetting of the main trunk of storm drain lines A, B, and G and excavation and disposal of the industrial drain lines. However, the alternative should be expanded to include excavation and offsite disposal of radioactively contaminated soil surrounding excavated sections of the main trunk storm drains and the industrial drain lines.	ROD. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Conclusions from Mr. George B. Humphreys, P.E., dated November 2, 2012		
1.	In general, the Navy and regulators have endorsed less costly remedial alternatives and those relying extensively on institutional memory. This is unacceptable. Further, regarding costs the Navy's cost estimates are expressed to a degree of accuracy not merited by the actual detail that went into building up the estimates. Finally, cost comparisons are made on the basis of the "present value" of future costs. This approach assumes that the government would invest a sum of money at the present time, which with interest earned, would be sufficient to cover future costs. This approach has the effect of making future costs beyond 30 years negligible. As you know, this is not the way governments operate. Present moneys are spent and deficits are run and nothing is set aside. As a result, when the need for future expenditures arises they must be met out of future revenues or borrowings at inflated costs. These future costs could go on for millennia. While I can understand the Navy's motivation to reduce costs and keep expenditures within budgetary constraints, these budgets were set in compliance with the Navy's 5-year budgeting process. This means that the budget for the cleanup of OU-2C was established 5 years ago, based on assumed remedial alternatives that were selected before the feasibility studies and	Comparison of alternative costs in an FS via present value is standard practice and is in direct accordance with CERCLA guidance from EPA. The level of accuracy expressed by the cost estimates in the OU-2C FS Report is entirely typical of an FS, and the overall intent of an FS-level cost estimate in terms of accuracy is supported by EPA CERCLA guidance (i.e., FS-level cost estimates for the detailed analysis of alternatives are expected to be accurate to within -30 to +50%). Please also see the responses to comments #2 through #4 from Mr. William Smith and comments #2 and #4 from Restoration Advisory Board members above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.

Number	Comment	Response
	proposed plan were written, i.e. a predetermined conclusion. Again, thank you for the opportunity to comment on the OU-2C proposed plan.	
General Comment from Mr. William J. Smith, Ph.D., P.E., dated November 5, 2012		
1.	I am writing to document and supplement the oral comments on the proposed plan that I made at the public hearing on October 11. My oral comments primarily consisted of suggestions to make the already excellent summary of the proposed plan for Operable Unit 2C Installation Restoration (IR) sites 5, 10, and 12 (IR 5, 10, and 12 Proposed Plan) even better. My comments supplement my oral remarks and convey my strong preference for alternatives that permanently eliminate the hazards at sites rather than propose remedial measures that are heavily dependent on institutional controls. Institutional controls manage the remaining hazards in place after partial remediation of soil and groundwater, and if they fail, can harm people, flora, and fauna.	This comment is acknowledged.
Comments on Summary Content and Format from Mr. William J. Smith, Ph.D., P.E., dated November 5, 2012		
1.	The summary of the IR 5, 10 and 12 Proposed Plan provided an excellent overview of the chemicals of concern, the remedial investigation, the feasibility study, and the human health risk assessment that serve as the basis for the proposed plan. The description of the site and summary of past investigations, removal actions, and present and future uses were a much appreciated and useful summary of dozens of studies and thousands of pages and enabled me to put the proposed plan in context. From the summary of the IR 5, 10, and 12 Proposed Plan, I was unable, though, to quickly assess the cost differential of remediating to enable unrestricted use rather than occupational use. After comparing the total cancer risk or non-cancer hazard listed in Table 2 "Total Risk for Soil and Groundwater" I am	The costs associated with each remedial alternative in the context of attaining an unrestricted future site use are not included in the OU-2C Proposed Plan, as the future reuse scenario is commercial. However, these costs can be found for each alternative in Appendix G of the OU-2C FS Report. For soil, the preferred alternative (Soil Alternative S2) does not incorporate addressing Local Area 2, which is the only portion of Exposure Unit 1 that is characterized by potentially unacceptable risk to a residential receptor. Based on the cost assumptions included in the OU-2C FS Report, addressing Local Area 2 (i.e., through excavating approximately 100 cubic yards of soil and disposing off-site as non-hazardous waste based on existing data from this area of the site, followed by backfilling), including design, would cost

Number	Comment	Response
	hopeful that the incremental costs of cleaning to allow unrestricted use rather than solely occupational use may not be significant for some areas, most notably Exposure Unit 1. The ratio between both the total cancer risk and the non-cancer hazard for limited use and unrestricted use for this unit is small, about 3. This suggests that the incremental costs of remediating to allow unrestricted use may be small, especially if the ratio between the starting concentration and final concentration after remediation to allow unrestricted use exceeds ten.	approximately $125,000.
2.	To enable readers to estimate the ratio between starting and final concentrations I suggest that you include a table that presents the changes in absolute concentrations of chemicals of concern at the site if the site were to be remediated to levels set by remedial goals that require no institutional controls. Such a table would always include, in adjacent columns, absolute concentrations of chemicals of concern in environmental media for current conditions and those after remediation, the remedial goals (RG). Such a table could have been created in the IR 5, 10, and 12 Proposed Plan simply by inserting after each of the three RG columns in Table 3 "Occupational RGs for Soil, Groundwater, and Drain Lines," a column listing either the average concentration of the corresponding chemical of concern, or a range of concentrations.	Maximum concentrations and preliminary RGs are in the Final FS Report. Please also see the response to comment #1 above.
3.	For comparing concentrations of chemicals of concern before and after remediation, though, I suggest that you always use either residential remedial goals or remedial goals set by the most sensitive and vulnerable receptor determined in an ecological risk assessment. By comparing this table to a table based on more limited remedial goals, such as the occupational goals used in Table 3, the reader will quickly get a sense	Please see the responses to comments from Mr. William J. Smith above.

Number	Comment	Response
	of whether or not the limited or unrestricted remedial goals are comparatively close to each other in comparison to the initial concentration of contaminants. If they are comparatively close, as noted above, the additional cost for remediating to satisfy the requirements for unrestricted use may well be incremental, rather than budget breaking.	
4.	Local governments and citizens have a preference for alternatives that minimize institutional controls. For those familiar with costing remedial alternatives, the IR 5, 10 and 12 Proposed Plan does provide the information required to estimate the cost of minimizing such controls. The cost can be estimated by identifying the alternative in a table of remedial alternatives, that is Tables 4 through 7, then from the cost of that alternative, subtracting the cost of the preferred alternative. The resulting difference is an estimate of the cost of minimizing institutional controls. To make that cost easily accessible to those unfamiliar with costing remedial alternatives, I suggest that you add a cell to each of the remedial alternatives displaying the result of the calculation that I just described.	ICs are a component of all remedial alternatives summarized in the Proposed Plan for OU-2C, other than the No Action alternatives. The degree (i.e., the aerial extent covered) of ICs does vary to some degree between soil alternatives, but is identical for groundwater alternatives within the same zone (i.e., shallow groundwater and deeper groundwater). Appendix G of the OU-2C FS Report describes the same alternatives, along with cost estimates, if implemented in the context of achieving unrestricted future site use (i.e., no ICs). The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Supplemental Comments on the Selection of Alternatives from Mr. William J. Smith, Ph.D., P.E., dated November 5, 2012		
1.	For every remedial unit I prefer a different alternative than you show as the preferred alternative in Tables 4 through 7 of the IR 5, 10 and 12 Proposed Plan. The basis for my preference is my guiding principle that after remediation all environmental media initially containing chemicals of concern be suitable for unrestricted use. The use of any other principle to guide remediation transfers future hidden costs from the Navy to the next owner of the land, in this case the City of Alameda. These hidden costs include obvious ones like the reduction in the value of future uses for the site until the	Please see the responses to comments #2 through #4 from Mr. William Smith above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.

Number	Comment	Response
	land or water is suitable for unrestricted use.	
2.	Although I would prefer that the Navy pay all costs associated with remediation of land and water to allow unrestricted use of a site, I recognize that the Navy may not be in a position to do so. When the Navy can't commit to the full costs of complete remediation, a Record of Decision (ROD) specifying the "final" remedial action for a site, must include a plan to ultimately remediate that site for unrestricted use, or at least be supplemented by such a plan. That plan must be agreed to, at least informally, by the Navy, the future land owner the City, and a broad cross-section of the community. Such a plan may extend for decades and include limits on new construction at a site until remedial action is complete. Unless such a plan is included in, or supplements, the IR 5, 10 and 12 Proposed Plan, I will be unable to support a ROD for any of the remedial units as none of the preferred alternatives proposes to restore the sites for unrestricted use.	Under CERCLA, there is no statutory requirement that a ROD include a plan or be supplemented by a plan to ultimately remediate a site to unrestricted site use. The purpose of an FS, PP, and ROD is to document the assessment, preference, and selection of a remedy that accomplishes the RAOs for a particular site, with the RAOs in turn being established to mitigate site risks for appropriate receptors in an appropriate future use condition. Please also see the responses to comments #2 through #4 from Mr. William Smith above.
3.	There are alternatives to the preferred plan that come closer, some much closer, to restoring the site for unrestricted use. The costs for these more preferable alternatives, however, appear to be systematically overestimated. As the City of Alameda has noted in its comments on the IR 5, 10 and 12 Proposed Plan, many sections of the drain lines are unlikely to be contaminated and thus may be left in place. The Navy has estimated that all sections of the drain lines will require removal, however, which may increase the cost estimate several times above the actual cost. If the Navy had a more realistic cost estimate of the alternatives that I prefer, perhaps it would choose one of them as its preferred alternative.	Cost estimates in the OU-2C FS Report were constructed from available costing resources, vendor quotes, and/or appropriate estimates based on professional experience, and were supplemented directly with supporting information from similar projects conducted at Alameda Point. With specific respect to alternatives that rely on removal of buried drain lines under Buildings 5 and 400, the OU-2C FS Report assumes that all lines would need to be unearthed and radiologically scanned along with surrounding soil (which would require the removal of all pipe segments), regardless of the ultimate disposition of the piping and soil removed. This is based on requirements of past radiological work conducted at Alameda Point. Please also

Number	Comment	Response
		see the responses to your comments above and conclusion #1 from Mr. George B. Humphreys above. The BCT has considered all comments received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
4.	I appreciate the range of alternatives, from minimal cost to maximal reduction in chemicals of concern using new and innovative technologies, such as ERH (Electrical Resistance Heating), described for each remedial unit. By working together to develop improved estimates of the costs of remediation and to develop innovative multi-party remedial agreements, the Navy, the City, and the community can both speed up the transfer and reuse of sites containing residual chemicals of concern at Alameda Point and continue to be a model of effective innovation for remediation of military facilities to facilitate civilian reuse.	This comment is acknowledged.
General Comment from Mr. John Russo, City Manager, City of Alameda, dated November 13, 2012		
	The City of Alameda (City) appreciates the opportunity to comment on the Navy's September 2012 *Proposed Plan for Operable Unit 2C, Installation Restoration Sites 5, 10, and 12, Former NAS Alameda (PP).* The *PP* recommends clean-up alternatives for contaminated soil, groundwater and drain lines in Operable Unit 2C (OU-2C), an area of about fifty acres near the center of Alameda Point. The City's comments in this letter are directed toward the soil and drain-line proposed alternatives only, both of which concern radiological contamination of drain lines. The *PP*'s recommended alternatives for these two issues are:	Please see the responses to Mr. William Smith's comments above. Please also note that the controls associated with Soil Alternative S2 would also require pavement in areas outside of Buildings 5 and 400 to serve as physical barriers, or that underlying contamination be addressed in any area where the controls are removed and not sufficiently replaced. The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that ROD. The BCT has considered all comments

Number	Comment	Response
	• Soil alternative S2 – Engineering Controls and Institutional Controls (ICs) would preserve and maintain the floor slabs of Buildings 5 and 400 to serve as physical barriers, deterring access to the radiological contamination. • Storm-drain alternative D5 would prohibit excavation in the vicinity of 3,000 feet of abandoned industrial waste line that is radiologically contaminated. The City requests removal of all radiological contamination in OU-2C. Please select soil remedial alternative S6 and drain-line remedial alternative D6 in the Record of Decision, instead of the PP's preferred alternatives. In support of this request, the City offers the following nine comments.	received from the public during the public review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.
Specific Comments from Mr. John Russo, City Manager, City of Alameda, dated November 13, 2012		
1.	**Comment 1. The estimated cost of removing drain lines beneath Building 5 is overly conservative, because it assumes all drain lines flowing into <u>line F</u> are contaminated.** The 800-foot-long main trunk of drain line F under Building 5 drained wastewater from a room on the second floor (and other places). The room was used for painting with radium paint, and the main trunk of drain line F likely became radiologically contaminated as a result. However, the *PP* assumes the many side branches of line F, which drained water into the main trunk line from other parts of Building 5, also are radiologically contaminated. The *PP*'s cost estimate to excavate the drain lines assumes all of line F's tributary drain lines are contaminated and once excavated would require off-site disposal. Taken together, these tributaries of line F are as long as line F itself, virtually doubling line F's contribution to the cost. The *PP*'s cost	Please see the responses to Mr. Smith's comments #3 and #4 at the public meeting and conclusion #1 from Mr. George B. Humphreys above. With specific respect to alternatives that rely on removal of buried drain lines, the OU-2C FS Report assumes that all lines would need to be unearthed and radiologically scanned along with surrounding soil (which would require the removal of all pipe segments), regardless of the ultimate disposition of the piping and soil removed. This is based on requirements of past radiological work conducted at Alameda Point. In the particular case of Line F beneath Building 5, this section of Line F piping is most directly and closely connected to radiological sources. Accordingly, a conservative cost estimate was prepared, and the costs are within the range of certainty as guided by CERCLA (please see the response to conclusion #1 from Mr. George B. Humphreys above) relative to the assumptions made. Even if some portion of

Number	Comment	Response
	estimate is overly conservative for three reasons. First, the tributaries drain lines flowing into line F drained no known radiological materials handling areas. Second, the remedial investigation did not determine that any of these tributary drain lines are contaminated. Third, in an analogous situation outside of Building 5, the Navy's investigation found that the closest upstream sampling points on tributaries of radiologically contaminated drain lines (A, B, and G) had no contamination. Some or all of line F's tributaries under Building 5 could be clean, too. These assumptions introduce conservatism to the removal alternative's cost estimate, which has the effect of disfavoring it in comparison to other alternatives.	Line F beneath Building 5 were not radiologically-impacted, the cost of investigation and action would be significantly high.
2.	**Comment 2. The estimated cost of removing drain lines beneath Building 5 is overly conservative, because it assumes all drain lines within the networks of lines A and B are contaminated.** Drain lines A and B both begin beneath Building 5, and both drain northward into Oakland Inner Harbor. Immediately downstream of the building, sediment in both lines' catch basins contained low-level radioactivity. The Navy is currently cleaning, rather than removing, the portions of both lines that are outside Building 5. However, the *PP* proposes to use institutional controls to deter access to the portions of these lines under Building 5, instead of either cleaning or removing them. The *PP*'s cost estimate to remove the drain lines beneath Building 5 assumes all branches of lines A and B are contaminated and once removed would require off-site disposal. The *PP*'s assumption – both drain lines need complete excavation – is overly conservative for several reasons. First, none of the branches of either of these lines	Please see the responses to Mr. Smith's comments #3 and #4 at the public meeting and conclusion #1 from Mr. George B. Humphreys, and the response above and to comment #3 that follows.

Number	Comment	Response
	drained any known radiological materials handling area. Second, the Navy's investigation did not sample either of these lines or the soil around them to evaluate whether they are contaminated. Third, the low-level contamination outside the building suggests that probably only a few portions of lines A and B have radiological involvement. These portions likely are very limited, given the low levels of contamination observed. It is likely that most of these networks are free of radiological contamination and do not require removal. The effect of making this overly conservative assumption is to disfavor the removal alternative in comparison to other alternatives.	
3.	**Comment 3. The estimated cost of removing drain lines beneath Building 5 is overly conservative, because the cost savings of an incremental-excavation approach are not considered.** The remedial investigation of OU-2C included sampling of neither drain lines nor the soils around them. Assuming the worst case, the *PP*'s costs estimates for drain-line removal include costs to remove entire drain-line networks. In responses to prior comments, the Navy justified this conservative assumption on the basis of the infeasibility of remedial investigation to reliably characterize the status of drain lines and associated soil. A better cost-estimating approach would be to assume removal would first excavate obviously contaminated main trunk lines, and then remove branch lines only if they are found to be contaminated. The decision of whether to remove a tributary drain line would be made based on testing at the point it drains into the main line. Removal cost estimates should assume that only a fraction of the drain-line networks must be removed. The *PP* currently assumes 100	The Navy believes its approach in the FS is the most feasible and appropriate given the following: 1) the lack of historical drawings for the lines and uncertainty regarding locations where former drains may have been a direct point source for radiological contamination; 2) the multiple cross-connections found in piping outside the building and expected in the lines under the building; and 3) the inability to hydrojet much of these lines due to small size and/or difficult geometry. For these reasons, it is difficult to identify the lines under Building 5 as main trunk or lateral lines and what contamination may be within the piping without excavating the lines. Please also see the response to specific comment #1 from Mr. John Russo above.

Number	Comment	Response
	percent need removal, which causes the cost estimate to be overly conservative and the *PP* to disfavor the removal alternative in comparison to other alternatives.	
4.	**Comment 4. The estimated cost of removing drain lines beneath Buildings 5 and 400 is overly conservative, because it is based on excavation costs the Navy experienced while removing drain lines outside the buildings.** The Navy has already removed the portion of drain line F that drains from Building 5 to Seaplane Lagoon. Water in drain lines flows by gravity, continuously downhill. Thus, drain lines must continually slope downward, which means they usually become progressively deeper in the ground. To minimize construction and maintenance costs associated with deep excavation, the upstream ends of drain lines are buried as shallow as possible. Aside from the effort of digging a deep trench, another factor that makes working on deep drain lines relatively expensive is the presence of shallow groundwater. Alameda Point has shallow groundwater. The Navy's line F excavations outside buildings were generally below the water level, adding to costs because of sloughing of soil from trench walls and the need to treat water pumped from the excavation. In addition, it costs more to radiologically screen wet soil for disposal than dry soil. All of the drain lines beneath the buildings are shallower than the external lines the *PP* bases its cost estimates on. Most drain lines under the buildings are above or at the water table, at least seasonally. The *PP*'s removal cost estimate should have adjusted the Navy's experienced costs to account for this reduction in effort. Ignoring the relative shallowness of the under-building lines makes the removal alternative's cost estimate overly conservative, which tends	The factors suggested in this comment were in fact evaluated during the FS. The FS Report assumes an overall depth of eight feet for the excavation of the buried lines beneath Buildings 5 and 400, which is appropriate given the information available regarding pipe inverts and the requirement to assess surrounding and underlying soils. Given the shallow water table at OU-2C, the lines are expected to be at least partially submerged. Additionally, lines beneath the buildings would be more difficult to uncover due to the presence of the building slabs and underlying/adjacent support structures. Cost estimates in the OU-2C FS Report were constructed from available costing resources, vendor quotes, and/or appropriate estimates based on professional experience, and were supplemented directly with supporting information from similar projects conducted at Alameda Point.

Number	Comment	Response
	to disfavor it in comparison to other alternatives.	
5.	**Comment 5. The estimated cost of removing drain lines beneath Buildings 5 and 400 is a worst-case estimate, rather than a most-likely estimate that would be consistent with CERCLA guidance.** The *PP*'s cost estimate is based on inferences and overly conservative assumptions. In the absence of sampling data from the remedial investigation, the cost estimating process employed an err-on-the-side-of-caution approach, perhaps because radiological contamination is involved. This is not the approach used for the other soil alternatives. The CERCLA process requires that a site be characterized sufficiently to estimate the costs of remedial alternatives within a range of -30 percent to +50 percent. The *PP* follows this guidance for all alternatives, except sub-slab drain-line removal, whose cost is the result of multiple worst-case assumptions. Thus, the *PP*'s alternatives comparison (Table 4) is unbalanced. The effect of this unbalanced comparison is to disfavor the removal alternative.	Please see the response to specific comments #1, #3, and #4 from Mr. John Russo above. The estimates in the Final FS Report are not worst-case estimates, but reasonable estimates, consistent with CERCLA guidance, based on data available at the time of issuance of these documents. Assumptions made in the OU-2C FS Report and related cost estimates were based on reasonable expectations for the level of effort associated with all remedial alternatives, as informed by site-specific information, professional experience, and relevant similar projects conducted at Alameda Point.
6.	**Comment 6. The *PP* should rate the recommended soil alternative (S2) "moderate" for "long-term effectiveness and permanence".** CERCLA requires that remediation alternatives be compared in terms of "long-term effectiveness and permanence". The *PP* rates its recommended alternative, S2 – Engineering Controls and ICs, "high" for this CERCLA comparison criterion. This is the same rating the *PP* gives to the drain-line removal alternative (S6). However, completely removing radiological contamination is always more permanent and effective in the long term than relying on administrative controls. Alternative S2	This ranking is consistent with guidance for ranking alternatives and is consistent with previous input from the regulatory agencies.

Number	Comment	Response
	is subject to failure, because future construction in Buildings 5 and 400 might occur without a permit. Drain-line removal is not subject to such failures. The *PP* itself recognizes the superior "long-term effectiveness and permanence" of removal over administrative controls. For the radiologically contaminated industrial waste line, *PP* Table 12 compares an administrative-controls alternative (D2) with a removal alternative (D6). Table 12 appropriately rates administrative controls "moderate" for "long-term effectiveness and permanence", but "high" for removal of the industrial waste line. If the *PP* used the same relative rating for the soil alternatives, the removal alternative would be judged superior to administrative-controls alternative. Please revise the rating of "long-term effectiveness and permanence" to "moderate" for soil alternative S2.	
7.	**Comment 7. The estimated cost of removing the industrial waste line beneath West Tower Avenue is overly conservative, because it assumes all of the industrial waste line must be removed.** The OU-2C remedial investigation included sampling of neither the industrial waste line nor the soils around it. Essentially all that is known of the industrial waste line derives from inspection of the very limited portions of it that are visible from man holes. These inspections found that some portions of the industrial waste line are in poor condition and not amenable to cleaning. However, some portions of the industrial waste line are not too deteriorated. The remedial investigation should have included snaking a camera through the industrial waste line to better inspect it. This may not have been possible in some segments, but in some segments it is possible. It is likely that	The drain lines located outside of Buildings 5 and 400 that were not addressed in the previous TCRA removal of storm drain lines F and FF, which include storm drain lines A, B, and G and the industrial waste line, will be addressed in a separate ROD. This comment will be addressed in that ROD.

Number	Comment	Response
	some portions of the industrial waste line can be cleaned using the same process that the Navy is using on drain lines A, B, and G. In the absence of an investigation, the *PP* assumes the entirety of the industrial waste line must be removed. This assumption results in an overly conservative cost estimate, which disfavors the removal alternative in comparison to other alternatives. Further, it is inconsistent with CERCLA guidance that cost estimates be within the range of -30 percent and +50 percent, rather than worst case.	
8.	**Comment 8. The estimated costs of removing lines beneath buildings and under West Tower Avenue are overly conservative, because the cost savings of in-place cleaning some portions of the lines is not considered.** The Navy currently is cleaning drain lines outside of Buildings 5 and 400, instead of removing them. This option should be factored into the "removal" alternatives to lower estimated costs. In some segments of the lines needing remediation, small pipe diameters or deteriorated conditions may prevent in-place cleaning, but in other segments, cleaning likely is feasible. However, the remedial investigations of both the under-building drain lines and the industrial waste line are inadequate to evaluate which segments are not amenable to cleaning. The PP's cost estimates assume the lines must be completely removed, without cleaning some segments instead. This overly conservative assumption for the excavation alternatives disfavors them in comparison to other alternatives.	Please see the response to the comment above.
9.	**Comment 9. The *PP* should recommend removing radiologically contaminated drain lines to avoid future adverse consequences of leaving them in place.**	Please see the responses to the City's comments above. The BCT has considered all comments received from the public during the public

Number	Comment	Response
	The branch of state government that regulates radiological contamination, the California Department of Public Health or CDPH, has stated repeatedly that if radiological contamination is not remediated for unrestricted use, then the City would be required to obtain to a radiological facility license. Possibly, a license exemption could be obtained instead. Even if OU-2C avoids being formally licensed, it may be stigmatized by tenants, customers, visitors, and neighbors, as well as by buyers and lenders in property transactions. The industrial waste line under West Tower Avenue poses special challenges. Despite diligent efforts to avoid encountering this radiologically contaminated industrial waste line, digging to maintain or construct utility lines could reach it (or contaminated soil associated with it) at some point in the future. With or without a license from CDPH, the City would bear the costs of programs to monitor compliance with administrative controls and to maintain pavement and building slabs. These costs would continue in perpetuity. These costs are not included in the *PP*'s cost estimates, which makes the incremental cost of removal appear greater than it really is.	review period of the Proposed Plan. After discussion amongst all the BCT members, the selected alternatives were agreed upon as originally proposed in the OU-2C Proposed Plan.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
1	former NAS Alameda, now referred to as Alameda Point	Section 2.1	Final Remedial Investigation Report for Operable Unit 2C. Section 1.4.2, Pages 1-5 and 1-6. Bechtel Environmental Inc. 2008.

Department of Toxic Substances Control (DTSC) and the San Francisco Bay Regional Water Quality Control Board (Water Board) also providing regulatory oversight.

RI activities documented in this report were conducted concurrently with base closure activities at Alameda Point. In September 1993, the United States Congress and Base Realignment and Closure (BRAC) Commission designated NAS Alameda for closure.

The Navy's Petroleum Program and Resource Conservation and Recovery Act (RCRA) program are being conducted separately from CERCLA Program activities at Alameda Point. These programs address petroleum fuel sites and RCRA sites, respectively.

Radiological studies and actions performed within OU-2C are described in this report for completeness (see Section 1.5.2.1). Although included in the CERCLA Program, general radioactive materials (any radioactive materials used by the Navy and Navy contractors not associated with the Naval Nuclear Propulsion Program) are evaluated and remediated following a process that differs slightly from the traditional CERCLA process. The U.S. EPA, the Department of Defense, the Department of Energy, and the Nuclear Regulatory Commission worked together to create a consensus document called the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), which provides detailed guidance for investigation of radiologically impacted sites. MARSSIM was developed to be consistent with CERCLA and is being implemented by the Navy at Alameda Point under the direction of the Navy's Radiological Affairs Support Office (RASO).

1.4.2 Base Description and History

Alameda Point is located at the west end of Alameda Island, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of the San Francisco Bay on the west. In 1930, the U.S. Army acquired the original base property from the City of Alameda and began construction activities in 1931. In 1936, the Navy acquired title to the land from the Army and began building an air station in response to the military buildup in Europe before World War II. Construction of the base included several iterations of filling tidelands, marshlands, and sloughs with dredge materials from San Francisco Bay. NAS Alameda was operated as an active naval facility from 1940 to 1997.

Operations conducted by the Navy at Alameda Point included aircraft, engine, gun, and avionics maintenance; engine overhaul and repair; fueling activities; and plating, stripping, and painting activities (including radium-dial painting). The Navy Public Works Center (PWC) also operated two power plants, a transportation shop, and a pesticide shop at Alameda Point. Historical aviation and jet engine test activities at Alameda Point were supported by a network of fuel delivery pipelines that transported aviation and other fuels to various areas of Alameda Point (IT 2001a). In addition, the base operated a deepwater port capable of berthing aircraft carriers. The port was used primarily for minor carrier maintenance and ship overhaul. The following tenants also used Alameda Point during its tenure as an active military base:

- Construction Battalion Unit 416
- Commander Naval Air Force, U.S. Pacific Fleet Material Representative

- Defense Property Disposal Office
- Navy Disease Vector Ecology Control Center
- Alameda Detachment, Explosive Ordnance Disposal Group One
- Marine Air Group 42
- Naval Air Reserve Unit
- Naval Regional Dental Center Branch Clinic
- Naval Regional Medical Center Branch Clinic
- Pacific Fleet Audio-Visual Facility Component
- Shore Intermediate Maintenance Activity
- Supervisor of Shipbuilding, Conversion, and Repair

1.4.3 Operable Unit 2C Description

As a management tool to accelerate site investigation, cleanup, and reuse at Alameda Point, the Navy developed a comprehensive OU strategy, which separates CERCLA sites into ten OUs (OU-1, -2A, -2B, -2C, -3, -4A, -4B, -4C, -5, and -6). OU-2C, located in the central portion of Alameda Point, is an approximate 53-acre area consisting of IR Sites 5, 10, and 12, and includes the SWMUs within these three IR sites. Most of OU-2C is covered by buildings, and the remaining portions are largely paved. IR Sites 5, 10, and 12 are described below. Buildings and historical uses at OU-2C are summarized in Table 1-1. Underground storage tanks (USTs) and aboveground storage tanks (ASTs) at OU-2C are listed in Tables 1-2 and 1-3, respectively. SWMUs located in OU-2C are listed in Table 1-4; the SWMUs where supplemental sampling has been conducted are described in Section 1.4.3.4.

1.4.3.1 IR SITE 5 – AIRCRAFT REWORK FACILITY

IR Site 5 is located in the central portion of Alameda Point approximately 975 feet north of Seaplane Lagoon. The site is about 47 acres in size and roughly rectangular in shape (Figure 1-3). The most prominent site feature is Building 5, which covers approximately 32 percent of the site. IR Site 5 also includes several smaller buildings and paved and unpaved open space. Previous investigations of Building 5 identified a chlorinated VOC plume at OU-2C that is generally located within IR Site 5.

Prior to 1930, the area of OU-2C was completely covered by the waters of San Francisco Bay (Appendix A, Figure A-2). The northern portion of IR Site 5 was filled by 1936 (Appendix A, Figure A-3) and filling in the southern portion of the IR site was completed by 1940 (Appendix A, Figure A-5).

Building 5, the aircraft rework facility, is the largest feature at IR Site 5. It was erected in two stages: the southern portion (Building 5) was erected by 1940, with the northern portion completed by 1947 (Building 5A). For the purpose of this report, the combined portions are identified as Building 5. Operations in the building ceased in 1993 and it is

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
2	OU-2C	Section 2.1	Final Remedial Investigation Report for Operable Unit 2C. Section 1.4.3, Pages 1-6 through 1-10. Bechtel Environmental Inc. 2008.

- Defense Property Disposal Office
- Navy Disease Vector Ecology Control Center
- Alameda Detachment, Explosive Ordnance Disposal Group One
- Marine Air Group 42
- Naval Air Reserve Unit
- Naval Regional Dental Center Branch Clinic
- Naval Regional Medical Center Branch Clinic
- Pacific Fleet Audio-Visual Facility Component
- Shore Intermediate Maintenance Activity
- Supervisor of Shipbuilding, Conversion, and Repair

1.4.3 Operable Unit 2C Description

As a management tool to accelerate site investigation, cleanup, and reuse at Alameda Point, the Navy developed a comprehensive OU strategy, which separates CERCLA sites into ten OUs (OU-1, -2A, -2B, -2C, -3, -4A, -4B, -4C, -5, and -6). OU-2C, located in the central portion of Alameda Point, is an approximate 53-acre area consisting of IR Sites 5, 10, and 12, and includes the SWMUs within these three IR sites. Most of OU-2C is covered by buildings, and the remaining portions are largely paved. IR Sites 5, 10, and 12 are described below. Buildings and historical uses at OU-2C are summarized in Table 1-1. Underground storage tanks (USTs) and aboveground storage tanks (ASTs) at OU-2C are listed in Tables 1-2 and 1-3, respectively. SWMUs located in OU-2C are listed in Table 1-4; the SWMUs where supplemental sampling has been conducted are described in Section 1.4.3.4.

1.4.3.1 IR SITE 5 – AIRCRAFT REWORK FACILITY

IR Site 5 is located in the central portion of Alameda Point approximately 975 feet north of Seaplane Lagoon. The site is about 47 acres in size and roughly rectangular in shape (Figure 1-3). The most prominent site feature is Building 5, which covers approximately 32 percent of the site. IR Site 5 also includes several smaller buildings and paved and unpaved open space. Previous investigations of Building 5 identified a chlorinated VOC plume at OU-2C that is generally located within IR Site 5.

Prior to 1930, the area of OU-2C was completely covered by the waters of San Francisco Bay (Appendix A, Figure A-2). The northern portion of IR Site 5 was filled by 1936 (Appendix A, Figure A-3) and filling in the southern portion of the IR site was completed by 1940 (Appendix A, Figure A-5).

Building 5, the aircraft rework facility, is the largest feature at IR Site 5. It was erected in two stages: the southern portion (Building 5) was erected by 1940, with the northern portion completed by 1947 (Building 5A). For the purpose of this report, the combined portions are identified as Building 5. Operations in the building ceased in 1993 and it is

currently vacant; however, its past uses included cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and specialty operations, such as the application of radioluminescent paint to aircraft dial faces (Canonie Environmental 1990). The building contained a main paint shop that consisted of two paint bays and several smaller paint spray booths. In addition, Building 5 housed a plating shop with operations involving degreasing; caustic and acid etching; metal stripping and cleaning; and chrome, nickel, silver, cadmium, and copper plating. According to the EBS (IT 2001a), shops in southern portion of Building 5 used the following chemicals: zinc chromate, sulfuric acid, potassium hydroxide, heavy metals, methyl ethyl ketone (MEK), halogenated and nonhalogenated organic chemicals, corrosives, solvents, paints, waste oils, hydraulic fluids, antifreeze, beryllium, and mercury. Shops in the northern portion of Building 5 were reported to have used the following chemicals: lubricating oil, hydraulic fluid, MEK, zinc chromate, paint, sulfuric acid, potassium hydroxide, petroleum products, halogenated organic chemicals, paint, corrosives, and heavy metals.

Table 1-4 lists the generator accumulation points (GAPs) and other SWMUs that are located in Building 5. A hazardous waste storage area, which was closed in 1988, was located outside Building 5 in the southeastern corner of the site. Drummed wastes formerly stored in the hazardous waste storage area included spent solvents, waste paints, and waste oils. The area also stored drummed hydraulic fluid and lubricating oils.

Between 1940 and 1972, wastewaters from all Navy operations at Alameda Point were discharged directly into the nearest surface waters through the storm drain system. From the early 1940s through the early 1960s, radioluminescent painting operations on the second floor of Building 5 discharged paint containing radium-226 into the storm drain system leading from Building 5 into the Seaplane Lagoon at Outfall F (NWT 1998). This storm drain system, including lines leading from IR Site 26 and Petroleum Program Corrective Action Area (CAA) 10, are included in IR Site 5. After 1972, an industrial wastewater collection and treatment system (industrial waste treatment plant [IWTP] 5) was installed and operated until 1991, when plating operations were discontinued in Building 5. During this time, wastewater from the plating shops was split into two waste streams: one for alkaline tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to a pretreatment plant located near the southwestern corner of the building.

Lead-acid and nickel-cadmium batteries were serviced in the battery acid shop located in the northeastern portion of Building 5. The battery fluids were discharged into a sink in the storage area, and the piping associated with the sink discharged into the industrial sewer system (IT 2001a). Base personnel have indicated that the corrosive fluids deteriorated the piping in the sink and drain connected to the sewer system that discharged to Outfall G (ERM-West 1994a).

During past radiological surveys (Section 1.5.2.1), radioactive contamination was detected in the Building 5 drain piping that discharged into the storm drain. Leaks from the storm drain piping inside the building contaminated several indoor areas, including the first floor spray booths and rooms on the second floor. In 2000, removal of the contaminated

piping and associated storm drain pipelines was completed, and rooms on the first and second floors were decontaminated. The removal action also included removing radiological contamination from the storm drain lines outside of Building 5 west to manhole 5F, which drains to Outfall F. Results of the radiological closeout survey indicated that no significant radioactive contamination remained in Building 5. All final measurements taken during this survey were at or below applicable surface activity limits. As a result, Building 5 was considered for radiological release by the Navy for unrestricted public use, as specified by applicable federal and state guidance and policies (U.S. Nuclear Regulatory Commission 1974, 1992; DHS 1988).

Numerous other buildings (existing and demolished) at IR Site 5 were used for various purposes, including engineering laboratories, storage, woodworking shops, electrical substations, barracks, dry cleaning facilities, and a cafeteria, as summarized in Table 1-1 and shown on Figure 1-4.

Other physical features at IR Site 5 include USTs (Tables 1-2 and 1-4), ASTs (Tables 1-3 and 1-4), oil/water separators (OWSs) (005, 006A, 006B, and 615) (Table 1-4), other locations designated as SWMUs (Table 1-4), sanitary sewer lines, storm drain lines, and industrial waste sewer lines (Figure 1-4).

Three CAAs for petroleum are located within IR Site 5. CAA 5A is located west of Building 5, and CAA 5B and CAA 5B West are located south of Building 5.

1.4.3.2 IR SITE 10 – MISSILE REWORK FACILITY

IR Site 10 is approximately 4 acres in size and is located south of West Tower Avenue (previously named Avenue F) between Buildings 11 and 12. The site is approximately 600 feet north of Seaplane Lagoon, and is bordered on the north by IR Site 5 (Figure 1-3). IR Site 10 contains Building 400 along with an area that supported the activities that occurred in the building. Building 400 covers approximately 85 percent of the site, with 126,000 square feet of floor space. The remaining 15 percent of IR Site 10 comprises paved open space, roads, and parking lots.

Between 1937 and 1940, the area now known as IR Site 10 was filled (Appendix A, Figures A-3 through A-5). Before 1930, this area was completely inundated by San Francisco Bay. Prior to construction of Building 400, IR Site 10 was open space used for aircraft parking and maneuvering. Building 400 was constructed in two phases. The southern portion, a high-bay hangar, was completed by 1957; the northern portion, consisting of three floors, was completed by 1959. Building 400 was operated as a missile rework facility from 1957 to 1972 and as an avionic component rework facility from 1966 to the closure of the base in 1997. Only guidance systems were handled in the building; no explosives were stored there (DeLong, pers. com. 2006). The building is not currently in use.

Past operations at Building 400 included paint stripping, construction of fiberglass airplane components, airplane parts cleaning and degreasing, silk screening, photographic development, and painting of aircraft dial faces. Industrial wastewater produced at Building 400 was discharged into Seaplane Lagoon before 1972. After 1972, wastewater was discharged to an off-site wastewater treatment facility, and used chemicals were

collected at five collection points throughout the building. Wastes generated at Building 400 included paint sludges, metal shavings, paint strippers, cleaning solvents (such as trichloroethene [TCE] and carbon tetrachloride), testing fluids, and miscellaneous oil and grease (IT 2001a).

During Navy operations at Alameda Point from the 1950s to the base closing in the 1990s, radioluminescent aircraft instrument dials were refurbished with radium-226 in Building 400. Site history indicates that radium-226 was used and stored on the second floor of the building, where radium paint was washed down sink drains that led from Building 400 into the storm drain, through the main storm drain line, and out to Seaplane Lagoon (TtEMI 2001d).

In 1996, the second floor of Building 400 was extensively surveyed for radiological materials. Equipment found to be contaminated was removed, and hot spots found on the floors were identified and also removed (TtEMI 2001d). Additionally, because radiological contamination was identified in the storm drains that service Building 400, the piping was removed in 1999 and 2000. A radiological closeout survey was performed in 2001 to determine whether any radiological contamination still existed at Building 400. The survey demonstrated that no significant contamination remained in the building (TtEMI 2001d).

IR Site 10 includes Building 400 as well as seven SWMUs (one a former UST) (Table 1-4), sanitary sewer lines, storm drain lines, and industrial waste sewer lines (Figure 1-4). Because of possible contamination from floating petroleum product, a portion of IR Site 10 is designated as CAA 5C (Figure 1-3).

1.4.3.3 IR SITE 12 – POWER PLANT FACILITY

IR Site 12 is located north of West Tower Avenue between Saratoga and Lexington Streets (formerly named Second and Third Streets), approximately 1,050 feet north of Seaplane Lagoon (Figure 1-3). The site is approximately 2 acres in size and rectangular in shape. Site features include Building 10, which covers approximately 20 percent of the site. Surrounding areas supported activities within Building 10. Ten percent of IR Site 12 is unpaved and the remaining 70 percent is paved and consists of roads and parking lots.

Between 1937 and 1940, the area now covered by IR Site 12 was filled (Appendix A, Figures A-3 through A-5). Prior to 1930, that area was completely inundated by San Francisco Bay. Building 10, approximately 21,000 square feet in size, was constructed in 1940 as a power plant and operated until base closure in 1997. Activities at the site included the generation of steam and air compression. Although little documentation exists on past storage in Building 10, some storage of petroleum products, laboratory chemicals, water plant treatment chemicals, microbiocides, waste oils, morpholine, and corrosives has been documented in this building (IT 2001a). Boilers at the power plant were designed to generate power by using fuel oil. In the early 1970s, the use of fuel oil was discontinued and replaced by natural gas with diesel fuel as a backup fuel supply. Currently, Building 10 is vacant.

In addition to Building 10, Building 34-1 was formerly present at IR Site 12. These buildings and their uses are summarized in Table 1-1. Other present and historical physical features at IR Site 12 include 6 USTs (1 has been removed), 12 ASTs (1 was identified as AST 010L and 1 has been removed), 16 transformers (6 have been removed), two additional SWMUs (OWS 010 and NAS GAP 02), sanitary sewer lines, storm drain lines, and industrial waste drain lines (Figure 1-4).

1.4.3.4 SOLID WASTE MANAGEMENT UNIT LOCATIONS AND HISTORY

OU-2C includes 69 SWMUs (Table 1-4). During the preparation of the Work Plan (BEI 2007) for supplemental sampling, the Navy held a site walk on April 18, 2006, to review each of the 69 SWMUs located within the boundaries of OU-2C (BEI 2007). Meetings were held with regulatory agency representatives on May 16 and June 15, 2006, to reach concurrence on the status of each SWMU. As a result of the site walk and subsequent meetings, concurrence on the status and/or need for further sampling for each of the 69 SWMUs was achieved; 22 of the 69 SWMUs were designated for further sampling as part of the OU-2C RI supplemental sampling activities.

This subsection provides location and description information for the 22 SWMUs that were investigated during the RI supplemental sampling at OU-2C (Figure 1-4). These SWMUs included the following:

- SWMUs at IR Site 5
  - 3 OWSs (005, 006A, and 006B)
  - 1 AST (005G, removed)
  - 3 portable solvent distillation units (M-01, M-02, and M-05)
  - 1 coolant recovery system (M-09)
  - 9 Naval Aviation Depot (NADEP) GAPs (02, 04, 17, 20, 25, 27, 31, 57, 70)
  - 1 NAS GAP (01)
  - 1 RCRA area of concern (AOC) (AOC 005; also known as USTs 5-2 and 5-3, both removed)
  - 1 RCRA UST (UST[R]-02, also known as USTs 6-1 and 6-2; both removed)
- SWMU at IR Site 10 – portable solvent distillation unit M-08 (removed)
- SWMU at IR Site 12 – OWS 010

The locations of these 22 SWMUs are shown on Figure 1-4 and described below.

OWS 005

OWS 005 is located in environmental baseline survey (EBS) Parcel 54, south of Building 5. OWS 005 was associated with the former cyanide destruction and plating wastewater pretreatment area. The SWMU Report indicates that the OWS has not been removed (SulTech 2005b). Because no previous sampling locations targeted OWS 005, this SWMU location was identified for sampling.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
3	investigations and removal actions	Section 2.3	Final Remedial Investigation Report for Operable Unit 2C. Section 1.5; Pages 1-16 through 1-74; Tables 4-8, 4-9, 4-10, 4-14; Table 7-2. Bechtel Environmental Inc. 2008. Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Figures 3-1 through 3-7. Battelle 2011.

The storm drain and sewer lines in the vicinity of IR Site 10 are below the groundwater table. The 24-inch reinforced concrete sewer line that parallels the northern side of Building 400, as well as the 15-inch sewer line parallel to the southern side of Building 400, have been identified as radiologically contaminated. Additionally, a reinforced concrete sewer line discharges south from the middle of Building 400 to Outfall FF.

Storm drains are located on the northern and southern sides of Building 10 at IR Site 12. The storm drains drain to the east and discharge to Seaplane Lagoon at Outfall G. The catch basin located west of Building 10 is connected to the storm drain system associated with Building 5 and drains to Outfall F. The storm drain lines located north and south of Building 10 were not associated with any painting and aircraft maintenance activities and are not expected to have contamination similar to those located adjacent to Buildings 5 and 400. All water that enters the storm drain system at IR Sites 10 and 12 eventually flows into Seaplane Lagoon.

1.5 REMOVALS AND INVESTIGATIONS

This subsection discusses the removals that have been and are being conducted at OU-2C as well as previous and ongoing environmental investigations associated with this OU. The purpose, scope and results of each environmental investigation conducted under CERCLA are summarized. Radiological investigations and removals, total petroleum hydrocarbons (TPH) investigations and corrective actions, and investigations under RCRA are also briefly discussed. The results of tidal studies conducted at OU-2C are summarized in Section 2.

Historical sampling locations for soil and groundwater are shown on Figures 1-5 and 1-6, respectively. Analytical results for historical soil and groundwater samples are presented in Appendix B. The analytical results are described in detail in Section 4 along with the results of the RI supplemental sampling conducted in 2007.

1.5.1 CERCLA Removals and Investigations

Discussions of the removals and investigations conducted at OU-2C under CERCLA over the past 25 years are presented chronologically in this subsection. The removal actions, which are integrated into the chronological discussions below, include the following projects:

- electrokinetic pilot-scale treatability study in 1998 (TtEMI 1999c)
- chlorinated solvent treatability studies in 2000 (Surbec-Art Environmental 2000; BERC 2000)
- plating shop soil removal action in 2001 and 2002 (IT 2002h)
- DNAPL treatability studies conducted between 2001 and 2004 (Shaw 2003a, 2003c; TtEMI 2001a; IT 2002a, 2002b, 2002c, 2002e, 2002f, 2002g)
- ongoing DNAPL source removal actions from 2004 to the present (Shaw 2006)

1.5.1.1 INITIAL ASSESSMENT STUDY IN 1982

As the first phase of the NACIP program, an initial assessment study was conducted at NAS Alameda in 1982 (Ecology & Environment, Inc. 1983). The objective of this study was to identify, assess and control environmental contamination from past hazardous materials storage, transfer, processing, and disposal operations. The study included records searches, on-site surveys, and interviews with long-term and former NAS Alameda employees. Although no soil or groundwater data were collected during the initial assessment study, the study documented waste sources at NAS Alameda and the analytical results from previous sampling of wastewaters. The initial assessment study documented the sources of wastes in two buildings at OU-2C, Building 5 and former Building 348, as follows:

- plating shop wastes (Building 5):
  - sewerable wastes (cyanide rinsewaters, cooling water, and condensate) discharged to the industrial wastewater system
  - nonsewerable wastes (spent process baths and sludge from process baths) containerized for off-site disposal
- paint-stripping and conversion-coating (Building 348 south of Building 5) wastewaters discharged to the IWTP
- painting shop wastes (Building 5):
  - sewerable water from water curtain discharged to the industrial wastewater system
  - nonsewerable wastes (spent paint and solvent, and sludge from water curtain) containerized for off-site disposal
- cleaning shop wastes (Building 5):
  - sewerable wastes (rinse waters and cooling water and condensate) discharged to the industrial wastewater system
  - nonsewerable wastes (spent process baths and spent solvents) containerized for off-site disposal or recovered with on-site solvent distillation units
- wastes from the IWTP 5 (located south of Building 5):
  - sewerable IWTP effluent discharged to the East Bay Municipal Utility District via the industrial wastewater system
  - nonsewerable wastes (IWTP sludge, paint skins, and oil) containerized for off-site disposal

Analyses from previous sampling of wastewaters documented the following.

- Building 5 plating shop wastewaters contained cyanide, silver, cadmium, chromium (total and hexavalent), copper, iron, nickel, lead, zinc, and surfactants.

- Building 348 paint-stripping wastewaters contained cadmium, chromium (total and hexavalent), zinc, phenol, surfactants, methylene chloride, and oil and grease.
- Building 348 conversion-coating wastewaters contained chromium (total and hexavalent), iron, and surfactants.
- Building 5 painting shop wastewaters (collected from the west paint bay in the northern portion of Building 5) contained chromium (total), iron, lead, zinc, and phenol.
- Building 5 cleaning shop wastewaters contained chromium (total), iron, phenol, surfactants, and oil and grease.

The initial assessment study concluded that 12 sites warranted further study; none of these sites included areas within the boundaries of the area subsequently designated as OU-2C.

1.5.1.2 PHASE 2B AND 3 INVESTIGATION IN 1991

Initial RI/FS activities for NAS Alameda began in 1991. These activities were performed as described in the RI/FS Work Plan and Sampling Plan (Canonie Environmental 1990) to determine whether soil and groundwater were contaminated in areas identified as potential waste release sites during the initial assessment study conducted in 1982 (Ecology & Environment, Inc. 1983).

During Phases 2B and 3 of the initial RI/FS, IR Sites 5, 10, and 12 (3 of 14 IR sites comprising OU-2) were designated as OU-2 Central Area. The Phase 2B and 3 investigation focused on potential releases along the industrial wastewater drains, sanitary sewers, and storm drains, and included collecting soil and groundwater samples, installing groundwater monitoring wells, and performing groundwater monitoring (PRC and JMM 1992). Figure 1-7 shows soil and groundwater sampling locations for the RI/FS activities, including the borings and wells installed during the Phase 2B and 3 investigation.

Soil Sampling

Soil samples were collected from 26 borings including five monitoring well borings (M05-01 through M05-05) and eight additional borings (B05-06 through B05-13) around the perimeter of Building 5 (IR Site 5), three monitoring well borings (M10-01 through M10-03) and one additional boring (B10-04) north and south of Building 400 (IR Site 10), and four monitoring well borings (M12-01 through M12-04) and five additional borings (B12-05 through B12-09) around the perimeter of Building 10 (IR Site 12) (Figure 1-7). Soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, total organic carbon, and pH. Soil samples from IR Site 5 were also analyzed for cyanide. Soil samples from IR Site 12 were also analyzed for total recoverable petroleum hydrocarbons (TRPH), pesticides, and polychlorinated biphenyls (PCBs). Samples were collected at four or five depths between 0 and 14 feet bgs. The shallowest samples were not analyzed for VOCs and the samples collected below 6 feet bgs were likely within the saturated zone.

Analytes reported in soil at concentrations above detection limits included VOCs, SVOCs, and metals. Cyanide was not reported at concentrations above detection limits in soil samples from IR Site 5. TRPH and the pesticide aldrin were reported at concentrations above detection limits in some soil samples from IR Site 12.

VOCs reported in soil at concentrations above detection limits included the following:

- chloroethane; 1,1-dichloroethane (DCA); ethylbenzene; toluene; and total xylenes from locations south of Building 5
- 1,1,1-trichloroethane (TCA); 1,1-DCA; tetrachloroethene (PCE); and TCE from locations east of Building 5
- vinyl chloride from a boring west of Building 5
- acetone from one location in IR Site 12

The only SVOCs reported in soil at concentrations above detection limits were polycyclic aromatic hydrocarbons (PAHs). PAH concentrations above residential preliminary remediation goals (PRGs) were reported only in samples collected at depths greater than 10 feet bgs.

Only two metals were reported in soil at concentrations above the residential PRGs: arsenic and iron. Arsenic concentrations were below the Alameda Point background 95th percentile concentration. Iron concentrations exceeded the PRG for samples from five borings at IR Site 12, and from one boring each south and west of Building 5 at IR Site 5. Sixteen metals exceeded the Alameda Point background 95th percentile concentration in one or more samples. Cobalt was the only metal reported at concentrations above the background concentration in more than 10 percent of the samples analyzed.

Groundwater Sampling

Twelve groundwater monitoring wells were installed during the Phase 2B and 3 investigation, including five wells at IR Site 5 (M05-01 through M05-05), three wells at IR Site 10 (M10-01 through M10-03), and four wells at or near IR Site 12 (M12-01 through M12-04) (Figure 1-7). Groundwater samples collected from these wells were analyzed for VOCs, SVOCs, metals, total organic carbon, and general chemistry parameters (alkalinity, chloride, fluoride, nitrate/nitrite, and sulfate). At IR Site 5, groundwater samples were also analyzed for cyanide, total dissolved solids (TDS), pH, and acidity. At IR Site 12, samples were also analyzed for TRPH, pesticides, and TDS (PRC and JMM 1992).

Analytes reported in groundwater at concentrations above detection limits included VOCs, SVOCs, and metals. Cyanide was reported at concentrations above detection limits in groundwater from IR Site 5. No TRPH, pesticides, or PCBs were reported at concentrations above detection limits in groundwater samples from IR Site 12 wells.

VOCs reported at concentrations above detection limits in groundwater at IR Site 5 included chlorinated VOCs (chloroethane, 1,2-DCA; 1,1-dichloroethene [DCE]; 1,2-DCE; 1,1,1-TCA; TCE; and vinyl chloride) and fuel constituents (ethylbenzene, toluene, and xylenes). The highest concentrations (36 to 760 micrograms per liter [µg/L])

and six of the seven chlorinated VOCs were reported in groundwater from well M05-04 located at the east of Building 5 adjacent to Lexington Street. No fuel constituent VOCs or SVOCs were reported in groundwater from well M05-04. Seven SVOCs (1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene (DCB); 2,4-dimethylphenol; bis[2-chloroethyl]ether; 2-methylnaphthalene; and naphthalene) and cyanide were also reported in groundwater from IR Site 5.

VOCs reported at concentrations above detection limits in groundwater at IR Site 10 included chlorinated VOCs (1,1-DCA; 1,2-DCE; 1,2-dichloropropane; and TCE) and chloroform. SVOCs (pyrene, bis[2-chloroisopropyl]ether, and bis[2-chloroethyl]ether) were reported in groundwater samples from one well at IR Site 10 (M10-01).

One VOC, 1,2-DCE, was reported at a concentration (1.6 µg/L) above detection limits in groundwater collected from well M12-02 at IR Site 12. Low concentrations (1.2 to 5.9 µg/L) of PAHs (acenaphthene, fluoranthene, phenanthrene, and pyrene) and the SVOC bis(2-chloroethyl)ether were reported in groundwater from wells M12-02, M12-03, and M12-04.

Cyanide was reported at a concentration (13.8 µg/L) above detection limits in groundwater from one monitoring well (M05-03).

Metals reported in groundwater at concentrations above Alameda Point background 95th percentile comparison criteria included arsenic and manganese in groundwater from monitoring well M05-03, vanadium and zinc in groundwater from monitoring well M10-02, and vanadium in groundwater from monitoring well M10-03.

1.5.1.3 ADDITIONAL SAMPLING AT IR SITE 5 IN 1992 AND 1993

Additional sampling at IR Site 5 was conducted in 1992 and 1993 based on the results of the Phase 2B and 3 sampling at the perimeter of Building 5. This additional soil and groundwater sampling was conducted at five areas in or around Building 5 that were identified for further investigation: the plating shop, the selective plating shop, the wastewater pretreatment area, the former hazardous waste storage area, and the battery acid shop (PRC and MW 1995). These investigations are discussed in the following subsections. Figure 1-7 shows soil and groundwater locations for the additional sampling at IR Site 5.

Building 5 Plating Shop

This investigation evaluated the plating shop located in the central area of the southern portion of Building 5 (Figure 1-7). Five borings (B05PS-01 through B05PS-05) were installed through the floor of the chromium processing area in 1992 and five additional borings (B05PS-06 through B05PS-10) were installed through the floor of the cyanide processing area in 1993 (PRC and MW 1995).

Soil samples were collected from two or three depths from each of the ten borings at the plating shop and analyzed for VOCs, metals, hexavalent chromium, cyanide, and total organic carbon. Most samples were collected from the vadose zone (0 to 6 feet bgs). Three samples were collected from the saturated zone (17.5 to 22 feet bgs). Chemicals

reported at concentrations above detection limits included VOCs, metals, hexavalent chromium, and cyanide.

VOCs reported at concentrations above detection limits in soil samples included acetone; 2-butanone; chloroethane; 1,1-DCA; methylene chloride; 1,1,1-TCA; and TCE. Maximum concentrations (2.2 and 4.3 milligrams per kilogram [mg/kg]) were reported for samples collected in the saturated zone at 22 feet bgs.

Soil beneath the plating shop contained cadmium, chromium, and iron concentrations above PRGs. Ten samples had cadmium concentrations between 38.6 and 570 mg/kg (compared to the PRG of 37 mg/kg). Eight samples with elevated cadmium concentrations were collected at depths of less than 3 feet bgs; additionally, one sample was collected at 4.5 bgs and one at 18 feet bgs. Two samples with chromium concentrations of 244 and 850 mg/kg (compared to the PRG of 210 mg/kg) were collected at 2 feet bgs and 18 feet bgs. Four samples had iron concentrations between 23,800 and 35,400 mg/kg (compared to the PRG of 23,000 mg/kg). Arsenic concentrations were also above the PRG (0.39 mg/kg) but were comparable to Alameda Point background concentrations; the maximum arsenic concentration was 4.7 mg/kg.

In addition, hexavalent chromium (0.059 to 3.55 mg/kg) and cyanide (0.202 to 23.7 mg/kg) were reported in soil samples from beneath the plating shop.

One discrete groundwater sample was collected from each of five borings and analyzed for VOCs, metals (including hexavalent chromium), and cyanide. Analytes reported at concentrations above detection limits included VOCs, metals, hexavalent chromium, and cyanide. A subsequent round of discrete groundwater sampling was conducted in 1993 at the five additional borings and samples were analyzed for VOCs.

Groundwater beneath the plating shop contained the VOCs chloroethane; 1,1-DCA; 1,1-DCE; 1,1,1-TCA; and vinyl chloride at concentrations of 5.9 to 790,000 µg/L. These VOCs are common industrial solvents and their degradation products. These VOCs were also reported in wells previously installed around the perimeter of Building 5 during the Phase 2B and 3 investigation (PRC and JMM 1992).

Sixteen metals were reported in groundwater at concentrations above the Alameda Point background 95th percentile concentrations (or the maximum in the background data set) in one or more samples collected from beneath the plating shop. In addition, hexavalent chromium (1,020 to 7,010 µg/L) and cyanide (342 to 4,550 µg/L) were reported in groundwater collected from these samples. The presence of solvents, metals, and cyanide in groundwater beneath the plating shop was consistent with a release associated with past plating activities.

Selective Plating Shop

One soil sample was collected from a location (B05SP-01) adjacent to a floor drain in the selective plating shop located east of the main plating shop in Building 5 (Figure 1-7). The soil sample was collected at 6 inches below the concrete floor and analyzed for VOCs, metals, hexavalent chromium, cyanide, and total organic carbon. No VOCs or cyanide were reported.

Soil beneath the selective plating shop contained cadmium at 113 mg/kg, above the PRG (37 mg/kg). Hexavalent chromium was reported at a concentration of 2.17 mg/kg. The arsenic concentration also exceeded the PRG, but was comparable to Alameda Point background concentrations.

Wastewater Pretreatment Area

The Phase 2B and 3 investigation in this area included the installation of two boreholes (B05WT-01 and B05WT-02) adjacent to the sumps used to hold wastewater from the plating shop prior to pretreatment. The sumps were located north of the pretreatment units on the south side of Building 5 (Figure 1-7). Soil samples were collected from 10 feet bgs (within the saturated zone) from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and total organic carbon. Analytes reported at concentrations above detection limits included SVOCs, metals, and hexavalent chromium.

One discrete groundwater sample was collected from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and pH. Analytes reported at concentrations above detection limits included VOCs, metals, hexavalent chromium, and cyanide.

Groundwater at the wastewater treatment sump area contained common industrial solvents and their degradation products (chlorobenzene; chloroethane; 1,1-DCA; 1,2-DCE; methylene chloride; and vinyl chloride at concentrations of 12 to 210 μg/L) and fuel constituents (ethylbenzene, toluene, and xylenes at concentrations of 30 to 660 μg/L). Many of these VOCs were also reported in groundwater from nearby well M05-03 during the Phase 2B and 3 investigation.

SVOCs (di-n-butyl phthalate; 1,4-DCB; 2,4-dimethylphenol; 4-methylphenol; and naphthalene at concentrations of 2.1 to 380 μg/L) were reported in groundwater below the wastewater treatment sump area. In addition, cyanide (24.3 to 39.6 μg/L) and hexavalent chromium (2,830 to 9,350 μg/L) were reported in groundwater collected from this area. Metals reported at elevated concentrations included chromium, cobalt, lead, nickel, vanadium, and zinc. These compounds may have been related to releases from wastewater treatment area sumps or to other sources (PRC and MW 1995).

Former Hazardous Waste Storage Area

Investigation in this area included two soil borings (M05HW-01 and B05HW-02) installed north and south of the former hazardous waste storage area at the southeastern corner of Building 5 (Figure 1-7). Soil samples were collected from depths of 0, 5, 10, and 15 feet bgs from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and total organic carbon. Analytes reported at concentrations above detection limits included VOCs, SVOCs, metals, and hexavalent chromium. Only arsenic and PAHs were reported at concentrations above PRGs, and arsenic concentrations were comparable to background.

A monitoring well (M05HW-01) was constructed in the boring located at the northern side of the area. The groundwater sample collected from the well was analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and TDS.

Groundwater in the former hazardous waste storage area contained common industrial solvents and their degradation products (chlorobenzene, 1,1-DCA; 1,1-DCE; 1,2-DCE; PCE; TCE; and vinyl chloride at concentrations of 2.1 to 97 µg/L). The SVOCs pyrene; bis(2-chloroisopropyl) ether; 1,2-DCB; 1,3-DCB; and 1,4-DCB) were reported at relatively low levels (1.4 to 34 µg/L) (PRC and MW 1995).

Battery Acid Shop

Investigation in the battery acid shop area at the northeastern corner of Building 5 included two boreholes (B05BS-01 and B05BS-02) (Figure 1-7). One borehole was drilled outside the battery acid shop area where a former sink discharged to the storm drain sewer. Another borehole was drilled inside the battery acid shop area, immediately adjacent to where the piping from the sink entered the floor.

Soil samples were collected at the ground surface from both borings and from 2, 5, and 15 feet bgs from the boring outside the building. All soil samples were analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and pH. One soil sample was analyzed for total organic carbon. Analytes reported at concentrations above detection limits included acetone, one PAH, metals, and hexavalent chromium.

No analytes had concentrations above residential PRGs, with the exception of arsenic at concentrations comparable to background. One lead concentration (94.8 mg/kg) exceeded the background level (37.66 mg/kg) in a sample from the boring outside Building 5. No metals were reported at concentrations above Alameda Point background from the location within Building 5 (PRC and MW 1995).

The borehole outside the building was converted to a monitoring well (M05BS-01) and the groundwater sample was analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and TDS.

Groundwater in the vicinity of the battery acid shop area contained common industrial solvents and their degradation products (1,1,-DCA; 1,1-DCE; 1,2-DCE; TCE; and vinyl chloride at concentrations from 1.2 to 98 µg/L) and the fuel constituent benzene (1.5 µg/L). The SVOC bis(2-chloroethyl)ether was reported at low levels (4.7 µg/L). No hexavalent chromium or cyanide was reported at concentrations above detection limits in groundwater samples from the battery acid shop. Metals were not reported at concentrations above background levels. The solvents and SVOCs identified in groundwater have been reported in numerous wells at IR Site 5 and are probably not related to past practices in the battery storage area (PRC and MW 1995).

1.5.1.4 FOLLOW-ON INVESTIGATION UNDER CTO-260 IN 1994

The objective of the follow-on RI/FS investigation in 1994 under CTO-260 was to fill data gaps from previous investigations by collecting additional chemical, geological, and hydrogeologic information in order to assess the nature and extent of soil and

groundwater contamination for an RI and an FS (PRC and MW 1996a). Previous investigations indicated the presence of SVOCs and VOCs in groundwater. Field activities consisted of collecting soil samples and nonpoint source (sediment) samples from storm drain catch basins; performing cone penetrometer testing (CPT); collecting direct-push groundwater samples and HydroPunch samples; installing wells, including deeper monitoring wells and a reference boring; and performing four quarters of groundwater monitoring.

The objective of the CPT and direct-push groundwater sampling program was to evaluate the lithology and hydrogeologic characteristics below a depth of 15 feet, to assess the thickness of the SWBZ, and to obtain a groundwater sample from the permeable zone within the SWBZ at each location. Figure 1-7 shows soil and groundwater sampling locations for the borings and wells installed during the follow-on investigation under CTO-260.

IR Site 5

During the 1994 follow-on investigation at IR Site 5, soil samples for geotechnical analysis were collected from seven CPT locations (CPT-S05-01 through CPT-S05-07) spaced around Building 5, which were advanced near monitoring wells where elevated levels of VOCs had been reported or adjacent to existing sewer lines (Figure 1-7). A reference boring (REF-S05-01) was located at the northwestern corner of Building 5; this boring was advanced to 117 feet bgs and terminated after penetrating into approximately 5 feet of the Yerba Buena Mud. HydroPunch samples (DHP-S05-01, HP-S05-02 through HP-S05-07) were located approximately 5 feet away from each CPT location and advanced to the top of the SWBZ, underlying the Young Bay Mud. Five additional FWBZ monitoring wells (M05-06 through M05-10) were installed at IR Site 5 to further characterize the VOC and metals concentrations in the FWBZ (Figure 1-7). An additional monitoring well (M08-07) that was located within the IR Site 5 boundaries was installed in conjunction with activities at adjacent IR Site 8 (TtEMI 2004). Three deep wells (D05-01 through D05-03) were installed at IR Site 5 to assess the lateral extent of VOCs in the SWBZ.

Soil samples for chemical analysis were collected from three soil borings (B05-14, B05-14A, and B05-15) and six monitoring well borings (M05-06 through M05-10, and M08-07). Three nonpoint source sediment samples (NPS-S05-01 through NPS-S05-03) were collected from catch basins in storm drains receiving discharge from within IR Site 5 (PRC and MW 1996a). Four quarters of groundwater monitoring were conducted at IR Site 5 using FWBZ wells M05-01 through M05-10, M05BS-01, M05HW-01, and M08-07, and SWBZ wells D05-01 through D05-03. FWBZ wells M05-11 and M05-12 were included for one quarter and temporary well points B05-11 and B05-12 (located to the northwest of Building 5) were include for one and two quarters, respectively.

Soil samples were analyzed for VOCs, total organic carbon, pH, and percent moisture only. Low levels of VOCs were reported at concentrations above detection limits in soil samples from borings located to the east of Building 5 (B05-14, B05-15, M05-07); these VOCs were 1,1,1-TCA; 1,1-DCA; 1,1-DCE; TCE; benzene; toluene; xylenes; and carbon disulfide. Similar compounds at higher concentrations were reported at concentrations above

detection limits during the initial Phase 2B and 3 investigation. Low levels of benzene and 1,1-DCE were reported at concentrations above detection limits in soil samples from one boring west of Building 5 (M05-06). Fuel constituent VOCs were reported in soil samples from M08-07, which was consistent with the chemicals of concern for adjacent IR Site 8 (TtEMI 2004). No VOCs were reported in soil samples from borings north of Building 5 (M05-01 and M05-09) or at a distance to the east of Building 5 (M05-08).

HydroPunch groundwater samples collected from the SWBZ were analyzed for VOCs, SVOCs, metals, total organic carbon, TDS, chemical oxygen demand, and general chemistry parameters (acidity, alkalinity, chloride, fluoride, nitrate/nitrite, and sulfate). The analytes reported at concentrations above detection limits in the HydroPunch samples at IR Site 5 were VOCs, SVOCs, and metals (PRC and MW 1996a). VOCs reported in the HydroPunch samples were 1,1,1-TCA; 1,1-DCA; 1,1-DCE; 1,2-DCE; chloroethane; ethylbenzene; PCE; toluene; TCE; vinyl chloride; and xylenes. SVOCs reported at concentrations above detection limits included 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene (B[a]P), bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenzofuran, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, N-nitrosodiphenylamine, pyrene, and phenanthrene. Metals reported at concentrations above detection limits in the HydroPunch samples included cadmium, chromium, copper, lead, mercury, and silver (PRC and MW 1996a).

Quarterly monitoring groundwater samples were obtained from nine FWBZ wells (M05-01 through M05-09) and three deep groundwater wells (D05-01 through D05-03) around the outside of Building 5, and one FWBZ well (M05-10) inside Building 5. Additionally, quarterly groundwater monitoring samples were obtained from FWBZ well M08-07 at the boundary of IR Site 5 with IR Site 8. The FWBZ groundwater samples were analyzed for VOCs, SVOCs, metals, cyanide, and TDS. The primary VOCs reported from the wells in the FWBZ at IR Site 5 were chlorinated VOCs 1,1-DCA; 1,1-DCE; 1,2-DCE; PCE; 1,1,1-TCA; TCE; and vinyl chloride and fuel constituent VOCs benzene, toluene, and xylenes. Of the five wells (M05-01 through M05-05) that were sampled previously as part of the Phase 2B and 3 investigation, three wells showed similar VOC concentrations during this investigation. Well M05-03 showed an increase in VOC concentrations and well M05-01, in which no VOCs were previously reported, had low concentrations of several VOCs. The highest VOC concentrations were reported in newly installed well M05-07 located on the eastern side of Building 5. Cyanide was reported at concentrations above detection limits in groundwater samples from well M05-10 (located inside Building 5 adjacent to the plating shop), well M05-03 (located south of Building 5), and well M05HW-01 (located outside the southeastern corner of Building 5) (PRC and MW 1996a).

Groundwater samples from the SWBZ wells were analyzed for VOCs, metals, cyanide, and general chemistry parameters. The primary analytes reported from the SWBZ wells were carbon disulfide and chloroform; however, samples from SWBZ well D05-02 had reported concentrations of TCE (42 µg/L) and vinyl chloride (1 µg/L). No cyanide was reported at concentrations above detection limits in any of the SWBZ wells (PRC and MW 1996a).

The primary analytes reported at concentrations above detection limits in the catch basin sediment samples at IR Site 5 were VOCs, TPH, SVOCs, and metals (PRC and MW 1996a). The sampling points were located along storm drains receiving discharges from Building 5 on the eastern (NPS-S05-01), western (NPS-S05-02) and southern (NPS-S05-03) sides of the building. VOCs were reported only in samples from the catch basins east and west of Building 5 and consisted of 1,1,1-TCA; 1,1-DCA; 1,1-DCE; 1,2-DCE; chloroethane; ethylbenzene; PCE; toluene; TCE; vinyl chloride; and xylenes. TPH as motor oil and gasoline were also reported in samples from all three locations. SVOCs reported at concentrations above detection limits in the catch basin samples included 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, B(a)P, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenzofuran, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, N-nitrosodiphenylamine, pyrene, and phenanthrene. Metals reported in the catch basin samples included cadmium, chromium, copper, lead, mercury, and silver, as well as common soil elements such as aluminum and iron (PRC and MW 1996a).

IR Site 10

At IR Site 10, soil samples for geotechnical analysis were collected from four CPT locations (CPT-S10A-01 through CPT-S10A-04) advanced near the four corners of the site to further evaluate lithology and hydrogeologic characteristics in the vicinity of IR Site 10. HydroPunch samples (HP-S10A-01 through HP-S10A-04) were located approximately 5 feet away from each CPT location; borings were advanced to the top of the SWBZ underlying the Young Bay Mud. HydroPunch groundwater samples were analyzed for VOCs, metals, and general chemistry parameters. A reference boring (REF-S10A-01) was located at the southeastern corner of Building 400. The boring was drilled to a depth of 98 feet bgs and terminated after penetrating into approximately 9 feet of the Yerba Buena Mud. One deep well (D10A-01) was installed at IR Site 10 to assess the deep groundwater gradient in conjunction with nearby deep wells at IR Sites 5 and 12. Two nonpoint-source sediment samples (NPS-S10A-01 and NPS-S10A-02) were collected from catch basins on IR Site 10 (PRC and MW 1996a). No soil samples were collected at IR Site 10 during these follow-on activities. Four quarters of groundwater samples were obtained from FWBZ wells M10-01 through M10-03 and SWBZ well D10A-01. Groundwater samples from FWBZ monitoring wells were analyzed for VOCs, SVOCs, metals, and general chemistry parameters. Groundwater samples from the SWBZ well were analyzed for VOCs, metals, and general chemistry parameters; additionally, these samples were analyzed for TPH and SVOCs during one round of sampling.

Low concentrations of benzene, carbon disulfide, and chloroform were reported above detection limits in the SWBZ HydroPunch samples at IR Site 10 (PRC and MW 1996a). Cobalt, lead, manganese, mercury, and vanadium were reported at concentrations greater than Alameda Point background levels in one or more HydroPunch samples.

VOCs reported at concentrations above detection limits in FWBZ wells included chloroform; TCE; 1,2-DCE; 1,1-DCA; and 1,1-DCE in the northern and southwestern wells (M10-01 and M10-03) Low levels of the SVOCs bis(2-chloroethyl)ether and 2,2′-oxybis(1-chloropropane) were reported in the FWBZ wells. Previous groundwater

sampling events reported VOCs and SVOCs in the only monitoring well (M10-01) north of the building. Metals reported in the FWBZ wells were similar to those in previous sampling events (PRC and MW 1996a). VOCs reported in the SWBZ well included carbon disulfide, chloroform, benzene, ethylbenzene, and toluene. Two SVOCs were also reported in samples from the SWBZ well. Metals reported at concentrations above Alameda Point background levels included beryllium, chromium, cobalt, iron, manganese, selenium, vanadium, and zinc in FWBZ wells, and cadmium, cobalt, iron, manganese, mercury, nickel, selenium, and zinc in the SWBZ well.

The primary analytes reported at concentrations above detection limits in the catch basin sediment samples at IR Site 10 consisted mainly of VOCs, TPH, SVOCs, and metals. The sampling points were located along storm drains receiving discharge from Building 400 on the south (NPS-S10A-01) and north (NPS-S10A-02) sides of the building. VOCs reported at concentrations above detection limits in the catch basin sediment samples included 1,1,1-TCA; 1,1-DCA; 1,2-DCA; 1,2-DCE; carbon disulfide; ethylbenzene; PCE; toluene; TCE; vinyl chloride; xylenes (all from the north side of the building); and chloroform. TPH as motor oil was reported at concentrations above detection limits at both IR Site 10 sampling locations; TPH as gasoline and as kerosene were reported only from the location south of Building 400. SVOCs reported at concentrations above detection limits included 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, B(a)P, chrysene, fluoranthene, N-nitrosodiphenylamine, naphthalene, phenanthrene, and pyrene. Metals reported at concentrations above detection limits at IR Site 12 were cadmium, copper, lead, mercury, and zinc as well as common soil elements such as aluminum and iron (PRC and MW 1996a).

IR Site 12

At IR Site 12, soil samples for geotechnical analysis were collected from four CPT locations (CPT-S12-01 through CPT-S12-04) to further evaluate lithology and hydrogeologic characteristics in the vicinity of IR Site 12. HydroPunch samples (HP-S12-01 through HP-S12-04) were located approximately 5 feet away from each CPT location; borings were advanced to the top of the SWBZ underlying the Young Bay Mud. Groundwater samples from HydroPunch locations were analyzed for VOCs, SVOCs, metals, and general chemistry parameters. One sample was also analyzed for TPH. A reference boring at IR Site 12 (REF-S12-01) was located south of Building 10. The boring was drilled to 94 feet bgs and terminated after penetrating into approximately 8 feet of the Yerba Buena Mud. One deep well (D12-01) was installed at IR Site 12 to assess the deep groundwater gradient in conjunction with nearby deep wells. Three nonpoint-source sediment samples (NPS-S12-01 through NPS-S12-03) were collected from catch basins on-site (PRC and MW 1996a). Four quarters of groundwater samples were obtained from four previously existing FWBZ wells (M12-01 through M12-04) and the newly installed SWBZ well (D12-01) at IR Site 12. Groundwater samples from FWBZ monitoring wells were analyzed for VOCs, TPH, SVOCs, metals, and general chemistry parameters. Groundwater samples from the SWBZ well were analyzed for VOCs, metals, and general chemistry parameters.

Low concentrations of TCE and N-nitrosodiphenylamine were reported in the SWBZ HydroPunch samples at IR Site 12 (PRC and MW 1996a). Iron and manganese were reported at concentrations above Alameda Point background levels in one or more HydroPunch samples.

Low levels of PCE, benzene, and toluene were reported at concentrations above detection limits in the FWBZ wells. During the previous investigation, only 1,2-DCE was reported in samples from the IR Site 12 wells. Low levels of SVOCs (PAH compounds) were also reported at concentrations above detection limits in the FWBZ wells northeast and south of Building 10. The types and concentrations of SVOCs are consistent with previous data. Chromium, aluminum, and lead were reported at concentrations above detection limits during the 1991 investigation; however, neither aluminum nor lead was reported at concentrations similar to those previously reported during the follow-on investigation. Low concentrations of TPH were reported in samples collected north of Building 10.

Low concentrations of 1,1,1-TCA; carbon disulfide; and chloroform were reported in the samples from D12-01 (PRC and MW 1996a).

The primary analytes reported at concentrations above detection limits in the catch basin sediment samples consisted of TPH, SVOCs, and metals (PRC and MW 1996a). The sampling points were located along storm drains receiving discharge from Building 10 on the east (NPS-S12-01 and NPS-S12-03) and south (NPS-S12-02) sides of the building. TPH as motor oil was reported at concentrations above detection limits from all three catch basins; TPH as gasoline was reported from one location on the east side of the building. SVOCs were reported at concentrations above detection limits in the catch basin samples from the east side of the building and included benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, B(a)P, chrysene, and fluoranthene. Metals reported at concentrations above detection limits in the IR Site 12 catch basin sediment samples included barium, chromium, copper, lead, and zinc as well as common soil elements such as aluminum and iron (PRC and MW 1996a).

1.5.1.5 FOLLOW-ON INVESTIGATION UNDER CTO-280 IN 1994

During the 1994 follow-on investigation under CTO-280, additional fieldwork was conducted at IR Sites 5 and 10 to further assess the nature and extent of chemicals in soil and groundwater reported at concentrations above detection limits during winter and spring 1994 (PRC and MW 1996b). The fieldwork included performing CPTs, collecting HydroPunch samples and shallow soil samples, installing shallow monitoring wells, collecting quarterly groundwater samples, and installing piezometers. Figure 1-7 shows soil and groundwater sampling locations for the borings and wells installed during the follow-on investigation under CTO-280.

IR Site 5

Additional fieldwork conducted at IR Site 5 consisted of three shallow geoprobe sampling points (05GB001 through 05GB003 located around the plating shop) and four additional CPT sampling points inside Building 5 (CPT-S05-08 and CPT-S05-09 west and east of the plating shop, respectively; CPT-S05-11 and CPT-S05-12 adjacent to the

overspray trenches in the northwestern and northeastern corners of the building, respectively). The geoprobe sampling was used to collect groundwater samples from the FWBZ; soil samples were also collected at one of these locations (05GB003). The CPT was used to evaluate lithology and hydrogeologic characteristics below a depth of 15 feet and to locate the SWBZ. HydroPunch groundwater samples from the SWBZ (DHP-S05-08, DHP-05-09, DHP-S05-11, DHP-S05-12) were obtained from each of the CPT locations. HydroPunch groundwater samples from the FWBZ were also collected at the two CPT locations (SHP-S05-11 and SHP-S05-12) in the northern portion of Building 5. Subsequently, two shallow groundwater monitoring wells (M05-11 and M05-12) were installed at CPT locations CPT-S05-11 and CPT-S05-12. An additional monitoring well (M117-E) was installed at the southwestern corner of Building 11, which is within the storm drain corridor that forms part of IR Site 5. Vadose-zone soil samples were collected at three depths from the two CPT borings and at four depths from the three monitoring well borings. Three piezometers (PEZ-S05-08 through PEZ-S05-10) were installed around the plating shop to ascertain groundwater flow direction in the FWBZ.

Soil samples from geoprobe, CPT, and monitoring well borings were analyzed for VOCs, TPH, SVOCs, and metals. Analytes reported at concentrations above detection limits included primarily SVOCs and metals. For the samples collected from boring 05GB003, only arsenic and iron had concentrations above residential PRGs; arsenic concentrations were comparable to background concentrations. For soil samples collected in the northern portion of Building 5, only lead was reported at concentrations above the residential PRG (150 mg/kg). Lead concentrations ranged from 161 to 190 mg/kg in five samples collected between 0 foot and 5.5 feet bgs from borings CPT-S05-12 and M05-12 (PRC and MW 1996b).

Groundwater samples were analyzed for VOCs, TPH, SVOCs, metals, total organic carbon, and general chemistry parameters. Groundwater samples collected from SWBZ locations and from FWBZ locations 05GB003, SHP-S05-11, and SHP-S05-12 were also analyzed for cyanide. The analytes reported at concentrations above detection limits in the FWBZ samples consisted of 1,1-DCA; 1,2-DCE; carbon disulfide; and vinyl chloride; and TPH. Cyanide was reported in samples from 05GB003 (3,520 µg/L) located in the plating shop area. In the SWBZ, the analytes reported were TPH and carbon disulfide (PRC and MW 1996b).

IR Site 10

Additional fieldwork conducted at IR Site 10 included one additional CPT sampling point (CPT-S10A-05) used to evaluate the lithology and hydrogeologic characteristics below the depth of 15 feet and to identify the thickness of the SWBZ. This sampling point was installed beneath Building 12 to the east of Building 400, and outside the OU-2C boundary. Two shallow HydroPunch groundwater samples (SHP-S10A-02 and SHP-S10A-05) were also collected. The results of the HydroPunch samples were used to assess the need for the SWBZ wells. One SWBZ HydroPunch groundwater sample (DHP-S10A-05) was collected. Two piezometers (PEZ-S10A-02 and PEZ-S10A-05) were installed on the north side and in the middle of Building 400.

The two FWBZ and one SWBZ groundwater samples were analyzed for VOCs, TPH, SVOCs, metals, pH, total organic carbon, and general chemistry parameters. At the location north of Building 400 (SHP-S10A-02), analytes reported at concentrations above detection limits in the FWBZ included acetone, 2-butanone, chloroform, naphthalene, diesel, and metals. At the location east of Building 400 (SHP-S10A-05) analytes reported included VOCs bromodichloromethane, chloroform, and TCE (0.8 µg/L); and the SVOC phenol. No chlorinated VOCs or SVOCs were reported in the SWBZ groundwater sample (PRC and MW 1996b).

1.5.1.6 GEOCHEMICAL PROFILING INVESTIGATIONS IN 1997 AND 1998

Two geochemical profiling investigations were conducted as part of the NAS Alameda RI/FS activities to define the vertical and lateral extent of chlorinated solvents (primarily 1,1,1-TCA; 1,1-DCE; 1,1-DCA; 1,2-DCE; chloroethane; and TCE) that had been identified in groundwater beneath and around Building 5. The geochemical profiling investigations and concurrent quarterly groundwater sampling events were conducted in 1997 and 1998. Figure 1-8 shows groundwater sampling locations for the geochemical profiling investigations.

1997 Groundwater Investigation

Discrete groundwater samples were collected and analyzed for VOCs from 26 sampling locations (S05-1B-A, S05-1B/2B-A, S05-2A-A, S05-2A-B, S05-2A-C, S05-2B-A, S05-2B-B, S05-2B-C, S05-3A-A, S05-3A-B, S05-3A-C, S05-3A-D, S05-3A-E, S05-3B-A, S05-3B-B, S05-3B-C, S05-3B-D, S05-4A-A, S05-4B-A, S05-4B-B, S05-4B-C, S05-4B-D, S05-5B-A, S05-5B-B, S05-SB-1, and S05-SB-2) along nine transect lines across the eastern one-third of Building 5 and the area east of the building. Groundwater samples were collected from various depths down to 20 feet bgs (OGISO Environmental 1997). During late 1997 and early 1998, additional discrete groundwater samples were also collected and analyzed for VOCs. These groundwater samples were collected from 29 additional locations (S05-2-1 through S05-2-4, S05-3-1 through S05-3-5, S05-4-1 through S05-4-6, S05-5-1 through S05-5-5, S05-6-1 through S05-6-5, and S05-7-1 through S05-7-4) along six transect lines across the central and eastern portion of Building 5, including sampling east of Building 5 and south of Building 5; and at two locations (S05-1-2 and S05-1-3), located outside of OU-2C, in a transect that crossed Building 12 and EBS Parcel 53 (located east of IR Site 10 and south of IR Site 5). Samples were collected from various depths down to 30 feet bgs (TtEMI and EFW 1998).

Results from these discrete groundwater samples confirmed the presence of chlorinated VOCs at elevated concentrations in groundwater beneath the plating shop (S05-3A-D), south of Building 5, and in the area east of the northern portion of Building 5 in the vicinity of monitoring well M05-07. Elevated VOC concentrations were also found in the area east of the southern portion of Building 5.

The data evaluated for the 1997 investigation reported benzene, toluene, ethylbenzene, and xylenes (BTEX) and 12 additional chlorinated VOCs. Chlorinated VOCs with the highest concentrations were the following:

- 1,1,1-TCA up to 100,000 µg/L, 1,1-DCE up to 65,000 µg/L, and carbon tetrachloride up to 4,600 µg/L (S05-4B-C at 10 feet bgs, east of Building 5, adjacent to the foundry)
- 1,1-DCA up to 29,000 µg/L and 1,2-DCE up to 4,600 µg/L (S05-2A-A at 13.5 feet bgs, east of Building 5, adjacent to the southern portion of the aircraft maintenance line area)
- chloroethane up to 43,000 µg/L (S05-2B-B at 14 feet bgs, east of Building 5 and south of Building 62)
- vinyl chloride up to 5,500 µg/L (S05-2B-A at 15 feet bgs, northwestern portion of Building 5 in aircraft maintenance line area)
- TCE up to 320 µg/L (S05-3B-C at 10 feet bgs, east of Building 5)

The report characterized VOCs in groundwater extending from 4.5 feet to 14 feet bgs and concluded that these solvents appeared to be ponded on the top of the BSU (approximately 15 feet bgs), with minimal downward migration, as few VOCs were reported in samples collected at 20 feet bgs. A large solvent plume was delimited at the eastern side of Building 5, south of Building 62 and north of Building 500 (now referred to as Plume 5-1). A possible second plume (Plume 5-2) was identified along the south side of Building 5 and a possible third plume (Plume 5-3) was identified within Building 5 and was thought to be migrating away from the former plating shop near the center of the building. The report concluded that solvents were dispersed throughout IR Site 5, but confined by the BSU (OGISO Environmental 1997).

1998 Groundwater Investigation

The data evaluated for the 1998 groundwater investigation reported BTEX and 16 additional chlorinated VOCs. Chlorinated VOCs with the highest concentrations were the following:

- 1,1-DCA up to 40,000 µg/L and 1,1-DCE up to 2,000 µg/L (S05-4-5 at 11.5 feet bgs, northwest of the former plating shop inside Building 5)
- 1,2-DCE up to 1,100 µg/L (S05-5-3 at 11.5 feet bgs, in the eastern central portion of Building 5)
- chloroethane up to 1,100 µg/L (S05-3-4 at 11.5 feet bgs, south of Building 5)
- vinyl chloride up to 490 µg/L (S05-3-2 at 11.5 feet bgs, south of Building 5)

The report characterized the presence of VOCs in groundwater extending from 4.5 feet to 15.5 feet bgs and also concluded that the assorted solvents appeared to be ponded on the top of the BSU (at approximately 15 feet bgs), with minimal downward migration, because few VOCs were reported in samples collected at and below 20 feet bgs (TtEMI and EFW 1998).

For samples collected to the south of OU-2C (S05-1-2 and S05-1-3), no chlorinated VOCs were reported at concentrations above detection limits (TtEMI and EFW 1998).

Quarterly Groundwater Sampling

Concurrent with the geochemical profiling activities, four quarters of groundwater sampling were conducted at Alameda Point in 1997 and 1998 using existing shallow FWBZ monitoring wells (M05-01 through M05-12, M05BS-01, M05HW-01, M10-01, and M12-01) and one SWBZ well (D05-02) in OU-2C. Groundwater samples were analyzed for VOCs, metals, and general chemistry parameters. The analytes reported in the FWBZ wells consisted of chlorinated VOCs in most well samples and BTEX compounds in several wells. In the SWBZ, the analytes reported were benzene and toluene (0.6 to 2 μg/L), chloroform (1 to 10 μg/L), and vinyl chloride (0.5 μg/L).

1.5.1.7 REMEDIAL INVESTIGATION REPORT AND BACKGROUND DETERMINATION, 1999

The 1999 draft RI Report for OU-2 (TtEMI 1999a) summarized investigations conducted between 1991 and 1998 for 14 IR sites (IR Sites 3, 4, 5, 9, 10, 11, 12, 13, 14, 19, 21, 22, 23, and 25). For IR Sites 5, 10, and 12, the RI Report for OU-2 summarized the results of the investigations described in the previous sections.

The RI Report for OU-2 also included the results of a background chemical concentration determination. The background determination consisted of a basewide assessment of metals in soil and groundwater, which was conducted at Alameda Point in support of site characterization and remediation efforts under CERCLA and in accordance with the background determination methodology presented in a letter report (PRC 1997b). The background study was later published as a stand-alone document (TtEMI 2001e) and the data were later reevaluated and 95th percentile concentrations were calculated (TtEMI 2003b).

Soil samples collected during NAS Alameda RI/FS activities were evaluated for appropriateness for inclusion in the background data set. All soil samples collected from IR sites with histories of potential metals contamination were excluded as background samples. Furthermore, soil samples that contained organic chemicals other than PAHs were excluded from consideration as background samples. Once a soil data set had been compiled, Alameda Point was divided into three geologically similar areas based on differing fill deposition dates. Iron and manganese data were statistically compared to confirm that these areas contained geologically similar soils. The three areas designated at Alameda Point were: 1) the runway area and central portion (pink area), 2) the southeastern portion (blue area), and 3) the far western portion (yellow area) (PRC 1997b). OU-2C is located in the pink area. Fifty-five background soil samples analyzed for metals were collected from locations within the pink area.

Seven of the 55 soil samples included in the pink background data were collected inside the boundaries of what is now OU-2C, including samples from borings B10-04 (B10-04-000 and B10-04-005), B12-08 (B12-08-000, B12-08-005, and B12-08-010), and M117-E (280-RA-048 through 280-RA-050) (Figure 1-7). Analytical results for these seven samples are included in the data set for OU-2C. Samples from three borings located just south of OU-2C (M111-A, M115-E, and M116-E; not shown on figures) were also included in the pink background data set.

1.5.1.8 ENVIRONMENTAL BASELINE SURVEY INVESTIGATIONS, 1993 TO 1999

The EBS program was initiated at Alameda Point in 1993 to facilitate property transfer. Initially, the entire property at Alameda Point was divided into 214 EBS parcels. Subsequently, the total number of EBS parcels was revised to 209. During the EBS and after its completion, 53 EBS parcels were divided into subparcels and given alphanumeric identifiers (e.g., a portion of EBS Parcel 50 became EBS Parcel 50A). For purposes of this discussion, both EBS parcels and EBS subparcels are referred to as EBS parcels.

The EBS investigation was implemented in two phases. Phase 1 provided an assessment of the environmental impacts due to base operations and included site visits, employee interviews, historical research, and an inventory of all property on a parcel-by-parcel basis (ERM-West 1994a). Based on the results of the Phase 1 analysis, Phase 2 was conducted to further examine the potential environmental impacts at Alameda Point; this phase included the collection and analyses of environmental samples.

Phase 2 of the EBS was conducted in three subphases: 2A, 2B, and 2C. Activities conducted during these subphases were as follows:

- Phase 2A – collection and analysis of soil samples from selected parcels
- Phase 2B – collection and analysis of groundwater samples and additional soil samples from selected parcels
- Phase 2C – collection and analysis of additional soil and groundwater samples from selected parcels

An EBS basewide sewer investigation addressing the industrial, storm, and sanitary sewers was conducted in conjunction with the EBS Phase 2A investigation. The basewide sewer investigation was conducted in accordance with the Work Plan for Storm, Industrial, and Sanitary Sewer Sampling, NAS Alameda (IT 1994).

Twenty-eight EBS parcels are located within the boundaries of OU-2C in IR Sites 5, 10, and 12 (Figure 1-9). The EBS parcels located within IR Site 5 are EBS Parcels 23C, 28A, 29A, 30A, 45A, 46, 47, 48, 49, 50A, 50B, 51A, 51B, 53A, 54, 55, 56, 57, 58, 59, 66, 67, 68, 186, 190A, and 204A. IR Site 10 consists entirely of EBS Parcel 52; IR Site 12 consists entirely of EBS Parcel 69. The following subsections provide details on the sampling conducted during the EBS in each of the EBS parcels within the boundaries of OU-2C; the source for the information presented in these subsections is the EBS data evaluation survey (IT 2001a).

EBS Parcel 23C

EBS Parcel 23C is a 5-foot-wide strip running north-south across EBS Parcel 23 along the Storm Sewer F line segment between EBS Parcel 50 and EBS Parcel 28. EBS Parcel 23C was included in IR Site 5 due to radiological contamination in Storm Sewer F associated with Building 5.

During Phase 2A of the EBS, three subsurface soil samples were collected at locations 023-SS-001 and 023-SS-002, adjacent to the storm drain line in EBS Parcel 23A

(Figure 1-9). Samples were analyzed for VOCs, TPH, SVOCs, PCBs, butyltin, metals, reactivity, and oil and grease. The VOCs hexane and toluene, TPH as gasoline, and the PAHs B(a)P, fluoranthene, phenanthrene, and pyrene were reported in one sample each. Metals and oil and grease were reported above detection limits in these samples. Butyltin and PCBs were not reported. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 28A

EBS Parcel 28A is a 5-foot-wide narrow strip on the northeastern side of EBS Parcel 28, adjacent to Seaplane Lagoon; this parcel includes the Storm Sewer F line segment from the northern boundary of EBS Parcel 28 to an outfall into Seaplane Lagoon. EBS Parcel 28A was created because of radiological contamination in the storm drain. The contamination is associated with IR Site 5, where the storm drain originates.

During Phase 2A of the EBS, one subsurface soil sample was collected from this storm drain corridor at location 028-SS-001 (Figure 1-9). The sample was analyzed for VOCs, TPH, SVOCs, PCBs, butyltin, metals, oil and grease, and reactivity. Only low concentrations of di-n-butyl phthalate, oil and grease, and nickel were reported above detection limits. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 29A

EBS Parcel 29A is a 5-foot-wide band representing a section of radiologically contaminated storm drain line originating from IR Site 5 and crossing the southern portion of EBS Parcel 29. This storm drain line segment runs parallel to a sanitary sewer line. During Phase 2A, one subsurface soil sample was collected at location 029-SN-001 (Figure 1-9) from the sanitary sewer corridor (coincident with the storm drain corridor). This sample was analyzed for VOCs, TPH, SVOCs, and metals. Only low levels of diethylphthalate, pyrene, nickel, and zinc were reported above detection limits. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 30A

EBS Parcel 30A is a 5-foot-wide band representing a section of radiologically contaminated storm drain line originating from IR Site 5 and extending across part of the northern portion of EBS Parcel 30 into IR Site 26. This storm drain corridor traverses the open space east of Hangar 24, in which widespread staining from aircraft fueling and maintenance activities had been observed in historical aerial photographs. EBS Parcel 30A was part of Target Area 1 in Zone 6, which targeted these stained areas. During Phase 2A, one subsurface soil sample and one duplicate sample were collected from location 030-Z06-028 (Figure 1-9) and analyzed for VOCs, TPH, SVOCs, and metals. Both samples were reported to contain only low levels of metals and phthalates. Additionally, two subsurface samples were collected from the storm drain corridor at locations 030-SS-001 and 030-SS-002 (Figure 1-9) and analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, metals, oil and grease, and reactivity. Both samples were

reported to contain only low concentrations of nickel and oil and grease. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 45A

EBS Parcel 45A is the eastern one-third of EBS Parcel 45; it has been included in OU-2C, IR Site 5, due to the presence of chlorinated VOCs in groundwater. EBS Parcel 45A includes the eastern end of Building 2, which housed a dry cleaning plant. A satellite dish yard, storm drain lines, and two SWMUs (NAS GAP 05 and AOC 002) (Figure 1-4) are also located in this parcel.

During Phase 2A, two surface and four subsurface soil samples were collected at locations 045-002-003, 045-002-004, 045-002-005, 045-002-006, and 045-002-007 (Figure 1-9) to address possible contamination related to improper disposal of degreasers and chlorinated solvents used in the dry cleaning operations and the area under the air compressor. Sampling locations 045-002-005 and 045-002-007 were located adjacent to NAS GAP 05. All soil samples were analyzed for TPH and the subsurface samples were also analyzed for VOCs. Low concentrations of TPH as motor oil were reported in three samples; the VOC PCE was reported in one sample. One subsurface soil sample was also collected at location 045-SS-003 in the storm drain corridor in the eastern part of the parcel and analyzed for VOCs, TPH, SVOCs, pesticides/PCBs, butyltin, metals, oil and grease, and reactivity. Results for this soil sample showed several SVOCs, oil and grease, and the metals chromium, nickel, and zinc present at concentrations above detection limits.

Because two targeted locations for VOC analysis in Building 2 could not be accessed for subsurface sampling during Phase 2A due to physical barriers, additional groundwater sampling at Building 2 was recommended for Phase 2B. During Phase 2B sampling, four HydroPunch groundwater samples (10 to 12 feet bgs) were collected around Building 2 at locations 045-003-008, 045-003-009, 045-003-010, and 045-003-011 (Figure 1-9). Samples were analyzed for VOCs; 1,2-DCE and vinyl chloride were reported above detection limits in two of these samples. In addition, one groundwater sample had reported concentrations of PCE and chloroethane, compounds commonly associated with dry cleaning operations.

EBS Parcel 46

Located in the northwestern corner of OU-2C, EBS Parcel 46 contains Buildings 42 and 102, a storm drain line, and a sanitary sewer line. Sampling was performed only along the sanitary sewer line corridor in this parcel during Phase 2A. Two subsurface soil samples were collected from the sanitary sewer corridor at locations 046-SN-001 and 046-SN-002 (Figure 1-9). Samples were analyzed for TPH, SVOCs, and metals. Only low concentrations of a phthalate compound and three metals (copper, nickel, and zinc) were reported above detection limits. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 47

EBS Parcel 47 contains Buildings 43 and 505. No sampling was performed at this parcel during the EBS, including Phases 2A, 2B, and 2C.

EBS Parcel 48

EBS Parcel 48 is the site of Buildings 44 and 346 and former Building 281; part of the storm drain system is also present in the southern portion of the parcel. EBS sampling was performed only in the storm drain corridor during Phase 2A. Two subsurface soil samples (locations 048-SS-001 and 048-SS-002) (Figure 1-9) were collected from the storm drain corridor. Samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, butyltin, metals, oil and grease, and reactivity. Low concentrations of naphthalene, several phthalates, Aroclor 1260, the metals chromium, lead, nickel, and zinc, and oil and grease were reported above detection limits. Based on these data, no further sampling was recommended for this EBS parcel.

EBS Parcel 49

EBS Parcel 49 contains Buildings 405 and 614 and three SWMUs (NADEP GAP 11, NADEP GAP 28, and AST 614-1). Before the buildings were constructed, much of this parcel was used for aircraft storage. Building 405 was used as a ground support and aircraft engine rework facility; Building 614 was used for paint storage. Storm drain lines and industrial sewer lines, including an underground pumping facility known as Building 589 or Industrial Waste Pump Station #4 (IWPS4), were also present at this parcel. Sampling was conducted during Phase 2A in three target areas and in the storm drain and industrial sewer corridors (Figure 1-9).

Target Areas 1 and 2 were associated with Building 405. Target Area 1 consisted of the northern portion of Building 405, the open space immediately north of the building, and the stained area adjacent to Building 405. Sampling at Target Area 1 included the collection of six surface soil samples from locations 049-001-001 through 049-001-006, and eight subsurface soil samples from locations 049-001-007 through 049-001-014. This sampling was to address extensive staining in a trench at the west end of the building and near the north side of the building. Samples were analyzed for VOCs, TPH, SVOCs, and metals. Low levels of TPH as motor oil and several phthalate compounds were reported.

Target Area 2 at EBS Parcel 49 consisted of the soil beneath NADEP GAP 11. Target compounds included lubricating oil, hydraulic fluid, and diesel-range fuels. Two surface samples were collected from locations 049-002-015 and 049-002-016 and analyzed for TPH; low concentrations of TPH as motor oil were reported.

Target Area 3 at EBS Parcel 49 consisted of soil in the open space surrounding Building 614, which covered approximately 1,000 square feet. Target compounds included VOCs, lubricating oil, hydraulic fluid, fuels, SVOCs, and metals. Two subsurface soil samples were collected from sampling locations 049-003-017 and 049-003-018 and analyzed for VOCs, TPH, SVOCs, and metals. Low concentrations of SVOCs and metals were reported above detection limits.

Phase 2A sampling at EBS Parcel 49 also included the collection of soil samples in the storm drain corridor and the industrial sewer corridor. In the storm drain corridor, three subsurface soil samples were collected at sampling locations 049-SS-001 through 049-SS-003. These samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, butyltin, metals, oil and grease, and reactivity. Low levels of TPH as diesel, phthalate compounds, metals, and oil and grease were reported above detection limits.

In the industrial sewer corridor, three subsurface soil samples were collected during Phase 2A at sampling locations 049-IW-001, 049-IW-003, and 049-IWPS4-001 (the underground pumping station). Samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, herbicides, butyltin, organic lead, metals, oil and grease, and reactivity. The VOCs TCE; 1,1-DCE; acetone; and methylene chloride were reported above detection limits in individual samples. Several SVOCs and metals, as well as oil and grease, were also reported at low concentrations.

Based on these data, no further sampling was recommended for EBS Parcel 49.

EBS Parcels 50A and 50B

EBS Parcel 50A consists of a rectangular area to the northeast of EBS Parcel 50 and a thin strip extending north-south along the line of Storm Sewer F from the southern boundary of EBS Parcel 49 to the northern boundary of EBS Parcel 50B. EBS Parcel 50B consists of a rectangular area to the south of EBS Parcel 50, extending east-west along a storm drain line lateral connected to Storm Sewer F. EBS Parcels 50A and 50B were created due to the presence of radiologically contaminated storm drain lines originating in IR Sites 5 and 10.

During Phase 2A, two subsurface storm drain corridor samples were collected from EBS Parcel 50A at locations 050-SS-001 and 050-SS-002 (Figure 1-9). The samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, butyltin, metals, oil and grease, and reactivity. Only low concentrations of SVOCs (primarily phthalate compounds), metals, and oil and grease were reported above detection limits in these samples. No samples were collected from EBS Parcel 50B in Phase 2A. Based on these data, no further sampling was recommended for these EBS parcels.

EBS Parcels 51A and 51B

EBS Parcel 51A consists of a rectangular area to the north of EBS Parcel 51. A storm drain line from IR Site 5 runs east-west along the northern border of EBS Parcel 51A. EBS Parcel 51B consists of a rectangular area along the southern edge of EBS Parcel 51, extending east from EBS Parcel 50 along a storm drain lateral connected to Storm Sewer F. EBS Parcels 51A and 51B were created due to the presence of radiological contamination in the storm drain lines associated with IR Sites 5 and 10.

During Phase 2A of the EBS, a subsurface sanitary sewer corridor sample was collected at location 051-SN-001 at EBS Parcel 51A (Figure 1-9) and analyzed for SVOCs. Only low concentrations of phthalates were reported above detection limits in this sample. During Phase 2A of the EBS, four subsurface storm drain corridor samples were collected at locations 051-SS-001 and 051-SS-006 at EBS Parcel 51A and locations

051-SS-003 and 051-SS-004 at EBS Parcel 51B (Figure 1-9). Samples were analyzed for VOCs, TPH, SVOCs, PCBs, organic lead, butyltin, metals, and oil and grease. Only low concentrations of SVOCs, metals (chromium, nickel, and zinc), and oil and grease were reported above detection limits in these samples. Based on these data, no further sampling was recommended for these EBS parcels.

EBS Parcel 52

EBS Parcel 52 is coincident with IR Site 10, and includes Building 400, which occupies 85 percent of this parcel. Building 400 formerly served as a missile armament and avionics rework facility and an airplane hangar. Past operations at this parcel are described in Section 1.4.3.2.

Phase 2A at EBS Parcel 52 included sampling at three target areas. Target Area 1 addressed the fiberglass shop in the northwestern corner section of Building 400. Target Area 2 addressed impacts of operations of the motor test and cleaning room, and of a paint shop located south of the motor test room in the northeastern section of Building 400. Target Area 3 consisted of the main hangar floor in the southern half of Building 400, also known as Building 400A.

For Target Area 1, floor staining was noted in the Phase 1 EBS site inspection, and was thought to result from paint and fiberglass operations. Two soil gas samples (locations 052-001-001 and 052-001-002) were collected at 2 to 2.5 feet bgs and one subsurface soil sample (location 052-001-001) was collected from this target area (Figure 1-9); all three samples were analyzed for VOCs. Low concentrations of acetone and chlorobenzene were reported in the subsurface soil sample. No other compounds were reported above detection limits in samples from Target Area 1.

Target Area 2 sampling addressed impacts of operations of the motor test and cleaning room and a paint shop, both located in the northeastern section of Building 400. Two soil gas samples were collected at locations 052-002-004 and 052-002-005 and one subsurface soil sample was collected from location 052-002-003 at this target area (Figure 1-9); all were analyzed for VOCs. 1,1-DCE was reported in the soil gas sample collected at 052-002-004. However, the subsurface soil sample collected less than 20 feet to the north of this sample was not reported to contain VOCs. Nor were VOCs reported in the second soil gas sample. The EBS report recommended additional sampling for VOCs at three locations surrounding location 052-002-004 (Figure 1-9). The proposed sampling in this area was to include one dual HydroPunch/soil sample collection point (with a soil and water sample collected near the water table and a second water sample collected deeper within the FWBZ), one soil gas sample, and a single HydroPunch/subsurface soil sample.

For Target Area 3, four soil gas samples were collected at depths between 2.5 and 3.5 feet bgs. Subsurface soil samples were collected at six locations (052-003-007, 052-003-008, 052-003-010, 052-003-013, 052-003-014, and 052-003-017) (Figure 1-9). Subsurface soil and soil gas samples were all analyzed for VOCs. Two of the soil gas samples and one subsurface soil sample were collected from locations south of Building 400. The VOC 1,1-DCE was reported in three of the four soil gas samples. PCE and TCE were also

identified in one soil gas sample. The VOC detections were found in soil gas samples from the central floor region of Building 400A. No VOCs were reported in any of the subsurface soil samples, even though they were collected at locations in close proximity to soil gas samples with high VOC concentrations.

Additionally, two subsurface soil samples (locations 052-002-003 and 052-002-018) (Figure 1-9) were collected within 50 feet of SWMU M-08, a distillation unit in Building 400 during Phase 2A. These two samples were analyzed for VOCs, which were not reported at concentrations above detection limits.

One subsurface soil sample was also collected in the storm drain corridor north of Building 400 from location 052-SS-001 (Figure 1-9). This sample was analyzed for VOCs, TPH, SVOCs, PCBs, metals, oil and grease, and reactivity. The only analytes reported above detection limits in this storm drain corridor sample were a few metals.

Because of the widespread detections of DCE reported in the hangar floor area and in a sample from the motor test room during Phase 2A sampling, Phase 2B consisted of further sampling for VOC analysis. Ten subsurface soil samples (locations 052-004-016 and 052-004-018 through 052-004-026), 1 soil gas sample (location 052-004-017), and 12 groundwater samples (locations 052-004-016 and 052-004-019 through 052-004-026) were collected (Figure 1-9). DCE was not reported in any of the samples. Soil samples were reported to contain low concentrations of benzene, toluene, methylene chloride, and carbon disulfide. Groundwater samples were reported with chloroform (in eight samples), TCE (in four samples) and carbon disulfide (in one sample). The soil gas sample was reported to contain detectable concentrations of chloroform, DCA, dichlorodifluoromethane, TCA, TCE, and trichlorotrifluoroethane. The Navy recommended incorporating these data into future studies at Building 400 in IR Site 10.

EBS Parcel 53A

EBS Parcel 53A consists of a rectangular area located between EBS Parcels 57 and 53. A storm drain line from IR Site 5 runs east-west along the northern border of EBS Parcel 53A. EBS Parcel 53A was created due to the presence of radiological contamination in the storm drain lines associated with IR Site 5.

During Phase 2A, one subsurface soil sample (location 053-IW-001) was collected adjacent to an industrial waste sewer line in EBS Parcel 53A (Figure 1-9). This sample was analyzed for VOCs and metals. A duplicate sample was analyzed for VOCs, TPH, SVOCs, pesticides, PCBs, herbicides, butyltin, metals, organic lead, oil and grease, and reactivity. Only metals were reported, at low concentrations. Analytical results from the duplicate sample also reported low concentrations of TPH and oil and grease. Based on these data, no further sampling was recommended at this EBS parcel.

EBS Parcel 54

EBS Parcel 54 occupies approximately 22.1 acres and includes Building 5 and surrounding open spaces, several SWMUs, and storm drain, sanitary sewer, and industrial sewer lines. Building 5 housed the aircraft maintenance line and the former battery acid shop and

paint-mixing area, the former plating shops, and various parts-painting, degreasing, heat treatment, and foundry operations.

Samples were collected during EBS Phase 2A at six target areas in EBS Parcel 54; most of these samples were collected within Building 5. Nineteen surface soil samples and 15 subsurface soil samples were collected. Soil samples were also collected in storm drain corridors, sanitary sewer corridors, and industrial sewer corridors.

Target Area 1 consisted of the aircraft maintenance line in the north central portion of Building 5. Four surface soil samples and three subsurface soil samples were collected from locations 054-001-001 through 054-001-007 (Figure 1-9). Surface samples were analyzed for TPH, SVOCs, and metals; subsurface samples were analyzed for these constituents and also for VOCs. Analytical results revealed elevated concentrations of lead, arsenic, and thallium. Lead concentrations were elevated at three sampling locations (054-001-003, 054-001-005, and 054-001-006) in the central part of the target area. Arsenic and thallium were reported at elevated concentrations at one location (054-001-007). Low levels of TPH as motor oil were also reported. These data indicated that this target area may have been impacted by lead, arsenic, and thallium, possibly associated with operations previously located in this area, and further investigation of metals in this target area was recommended.

Target Area 2 consisted of the area in the southeastern corner of Building 5 that included heat treatment, pattern, metal manufacturing, foundry, rubber manufacturing, and welding shops; these shop areas may have been impacted by the use of chemicals containing VOCs, TPH, SVOCs, and metals. Surface and subsurface soil samples were collected from nine locations (054-002-008 through 054-002-016) (Figure 1-9). Surface soil samples were analyzed for TPH, SVOCs, and metals. Subsurface soil samples were analyzed for these constituents as well as for VOCs. TPH as motor oil, SVOCs, and metals were reported above detection limits. Metals were reported in many of these samples, including iron, lead, thallium, and vanadium. On the basis of these data, it appeared that Target Area 2 may have been impacted by operations in Building 5. Further sampling under the IR Program was recommended to define the extent of the metals.

Target Area 3 included the shop areas for rigging, electrical work, overhaul, and metal rework and finishing located in the northeastern portion of the southern half of Building 5; these shop areas were potentially impacted by use of chemicals containing VOCs, TPH, SVOCs, and metals. Surface soil and subsurface soil samples were collected from seven locations (054-003-017 through 054-003-023) (Figure 1-9). Surface soil samples were analyzed for TPH, SVOCs, and metals, while the subsurface samples were analyzed for these constituents as well as for VOCs. SVOCs and metals were reported at concentrations above detection limits. No further sampling in this area was recommended.

Target Area 4 consisted of the small-parts painting, in-flight refueling, landing gear, and cryogenics shops located in the southern portion of Building 5. Analytes that could have potentially impacted the target area included VOCs, TPH, SVOCs, and metals. Surface and subsurface soil samples were collected from six locations (054-004-024 through

054-004-029) in this area (Figure 1-9). All samples were analyzed for TPH, SVOCs, and metals. Subsurface samples were also analyzed for VOCs. VOCs, SVOCs, and metals were reported at concentrations above detection limits. No additional EBS sampling was recommended at this target area.

Target Area 5 at EBS Parcel 54 was a stained area in the vicinity of IWTP 5, located to the south of Building 5. Industrial wastewater treatment processes involving VOCs, SVOCs, metals-contaminated water, and cyanide may have potentially impacted this area. Subsurface soil samples were collected at two locations (054-005-0030 and 054-005-0031) (Figure 1-9) and analyzed for VOCs, TPH, SVOCs, metals, and cyanide (Figure 1-9). Analytical results revealed detectable concentrations of one SVOC and several metals. No additional EBS sampling was recommended at this target area.

Target Area 6 included the stained area located to the east of Building 5 and south of Building 62. This area may have been impacted by fuels, oils, and metals. Surface soil samples at three locations (054-006-032 through 054-006-034) were collected in this area and analyzed for TPH, SVOCs, and metals (Figure 1-9). TPH as motor oil, SVOCs, and metals were reported above detection limits. On the basis of these analyses, it did not appear that Target Area 6 had been affected by constituents associated with IR Site 5, and no additional EBS sampling was recommended at this target area.

Subsurface soil samples were also collected from sewer corridors in EBS Parcel 54; these included three samples collected from the industrial sewer corridor at locations 054-IW-002 through 054-IW-004, four samples from collected from the storm drain lines at locations 054-SS-001 through 054-SS-003 and 054-SS-005, and five samples from sanitary sewer corridors collected from locations 054-SN-001 through 054-SN-005 (Figure 1-9). The samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, herbicides, butyltin, organic lead, metals, oil and grease, and reactivity. Results from these analyses showed only a few analytes present above detection limits at low concentrations. On the basis of these data, no further sampling was recommended at the industrial sewer corridor, storm drain lines, or sanitary sewer corridors in EBS Parcel 54.

EBS Parcel 55

EBS Parcel 55 is located adjacent to the south wall of Building 5 near the southeastern corner; the parcel is less than 1 acre in size and is completely paved. Building 261 occupies approximately 30 percent of the parcel and the rest is open space. Historically, this open space was used as a driveway for Buildings 5 and 261. Soil sampling at EBS Parcel 55 consisted of one target area that included the bermed area of Building 261 and encompassed approximately 100 square feet; target compounds in this area were petroleum-based fuels. The Phase 1 EBS site inspection noted a concrete bermed area at the south wall of Building 261 that was thought to be representative of a spill.

Surface and subsurface soil samples were collected at two locations (055-001-001 and 055-001-002) (Figure 1-9). Surface samples were analyzed for TPH and the subsurface samples were also analyzed for VOCs. Only low levels of PCE and TPH as motor oil were reported. On the basis of these data, no additional EBS sampling was recommended at this target area.

EBS Parcel 56

EBS Parcel 56, located adjacent to the south wall of Building 5, is less than 1 acre in size. Building 500, which was used as an administration office area, occupies approximately 15 percent of the parcel. Paved open space formerly used for vehicle and equipment parking covers approximately 85 percent of EBS Parcel 56. Railroad tracks cross the open space from east to west on the south side of the parcel. A large fenced enclosure is located in the open space south of Building 500.

According to the EBS, NADEP GAP 20 was located in EBS Parcel 56, east of Building 5 and north of Building 500 (RI supplemental field activities indicated that this GAP was in adjacent EBS Parcel 58). The EBS reported that NADEP GAP 20 was located on concrete outside Building 500 and consisted of 55-gallon storage drums containing lead-contaminated items. The EBS identified a drum of MEK and a 55-gallon drum of shop debris mixed with oil at this location. The EBS concluded that NADEP GAP 20 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors.

Only one sample was collected in EBS Parcel 56 during Phase 2A: a subsurface soil sample from the storm sewer corridor collected from location 056-SS-001 (Figure 1-9). The sample was analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, butyltin, metals, oil and grease, and reactivity. Results of the metals analysis revealed detectable concentrations of nickel, and oil and grease. On the basis of these results, no further EBS sampling was recommended for EBS Parcel 56.

EBS Parcel 57

EBS Parcel 57 is located to the south of Building 5 and occupies approximately 1.3 acres. Buildings 415 and 615 occupy approximately 20 percent of the parcel. Building 415 was used for hazardous waste accumulation storage. Building 615 was formerly used for electrical equipment storage, and at the time of the EBS, was also used for hazardous waste storage. Building 348 was formerly located on this parcel but was demolished. Historically, Building 348 was used as a corrosion control shop; activities conducted included steam cleaning of aircraft outer surfaces and parts using methylene chloride. Three SWMU sites (former USTs 261-1, 261-2, and 261-3) are also located at this parcel. Sampling was conducted at EBS Parcel 57 during Phases 2A, 2B, and 2C and sampling locations are shown on Figure 1-9.

Phase 2A Sampling. Phase 2A sampling at EBS Parcel 57 included five target areas and one zone-specific area. No sewer corridor samples were collected in this parcel.

Target Area 1 included former Building 348 and covered approximately 5,100 square feet. Target compounds included VOCs, TPH, and metals. Surface soil and subsurface samples were collected at three locations (057-001-001 through 057-001-003). Surface samples were analyzed for TPH and metals. Subsurface samples were analyzed for VOCs. Concentrations of the VOCs ethylbenzene, PCE, and TCE; TPH as diesel; and the metals arsenic and chromium were reported above detection limits. However, arsenic concentrations were comparable to Alameda Point background levels. Chromium

was reported at elevated concentrations in two samples (locations 057-001-001 and 057-001-003). The Navy recommended additional sampling.

Target Area 2 at EBS Parcel 57 consisted of the soil beneath the stains in the former hazardous waste storage area that included Building 415. Potential contaminants included VOCs, TPH, and metals. Surface and subsurface soil samples were collected at three locations (057-002-004 through 057-002-006). The surface soil samples were analyzed for TPH and metals. The subsurface soil samples were analyzed for VOCs. VOCs, TPH as motor oil, and the metals arsenic and iron were reported above detection limits at low concentrations. On the basis of these data, no additional sampling was recommended at Target Area 2.

Target Area 3 at EBS Parcel 57 included the stained soil surrounding a dip tank located between Buildings 5 and 348. Surface and subsurface soil samples were collected at two locations (057-003-007 and 057-003-008). Surface soil samples were analyzed for TPH, metals, and cyanide. Subsurface soil samples were analyzed for VOCs. VOCs, TPH as motor oil, and arsenic were reported at low concentrations. On the basis of these data, no additional sampling was recommended at Target Area 3.

Target Area 4 at EBS Parcel 57 included the area south of Building 615 where stored chemicals included flammable materials and other petroleum products. Surface and subsurface soil samples were collected at locations 057-004-009 and 057-004-010. Surface soil samples were analyzed for TPH, and the subsurface soil samples were analyzed for VOCs. Low concentrations of methylene chloride were reported at the site. On the basis of these data, no additional sampling was warranted at Target Area 4.

Target Area 5 at EBS Parcel 57 consisted of the area surrounding the grease interceptor located on the north side of Avenue F, near the southeastern corner of the parcel. The targeted sampling area corresponds to the former location of UST 615-4, which was part of the spill control system for Building 615. Subsurface soil samples were collected from two locations (057-005-011 and 057-005-012). Samples were analyzed for VOCs, TPH, and metals. TPH as diesel and as gasoline were reported at concentrations above detection limits. VOCs and arsenic were also reported at low concentrations. On the basis of these data, no additional sampling was recommended at Target Area 5.

The zone-specific target area at EBS Parcel 57 included current and former railroad track areas within or adjacent to Building 5. These areas may have been impacted by historical releases of TPH, SVOCs, PCBs, or lead from railroad operations. One surface soil sample was collected at location 057-Z10-013, just south of Building 615, and analyzed for TPH, SVOCs, pesticides and PCBs, lead, and other metals. SVOCs, Aroclor 1260, and lead were reported above detection limits at low concentrations. Based on these results, the EBS concluded that no additional zonewide samples were warranted in the parcel.

Phase 2B Sampling. The intent of the additional sampling at EBS Parcel 57 during Phase 2B was to determine whether the elevated chromium and VOC concentrations reported in samples from Target Area 1 (Building 348) resulted from activities at EBS Parcel 57, or whether these chemicals had migrated to the parcel from off-site sources.

One surface soil sample and three additional subsurface soil samples were collected during Phase 2B at three locations (057-006-014 through 057-006-016). The subsurface soil samples were analyzed for VOCs and metals; the surface soil sample was analyzed for metals only. Chromium concentrations were generally lower in the Phase 2B soil samples than previously reported in the Phase 2A samples. Combined Phase 2A and 2B data indicated a need for additional characterization and potential remediation to be addressed under the IR Program.

In addition to follow-on soil sampling, Phase 2B also included collection of groundwater samples in EBS Parcel 57 at three locations (057-006-014, 057-006-015, and 057-006-016) within or south of the footprint of former Building 348. Phase 2B groundwater samples contained several VOCs reported at concentrations above comparison criteria, including carbon tetrachloride; 1,1-DCA; 1,2-DCA; 1,1-DCE; 1,1,1-TCA; TCE; and vinyl chloride; additional VOCs were reported at concentrations below comparison criteria. Phase 2B groundwater samples contained metals at concentrations above comparison criteria, including aluminum, arsenic, beryllium, chromium, lead, manganese, mercury, nickel, and vanadium.

Phase 2C Sampling. EBS Phase 2A analytical results indicated that soil at EBS Parcel 57 had been impacted with VOCs and chromium. Phase 2B analytical results indicated that groundwater at EBS Parcel 57 had been impacted with VOCs, aluminum, arsenic, chromium, lead, manganese, mercury, nickel, vanadium, and possibly beryllium. The primary goal of the Phase 2C EBS investigation at EBS Parcel 57 was to investigate the impact of these chemicals on subsurface soil and groundwater related to former USTs 261-1, 261-2, and 261-3, located south of Building 5 near Building 261. Phase 2C samples were located across EBS Parcel 57 and near the former locations of the USTs and fuel lines.

Ten subsurface soil samples (locations 057-0033, 057-0035, 057-0037, 057-0039, 057-0041, 057-0043, 057-0045, 057-0047, 057-0049, and 057-0051) were collected and analyzed for VOCs, TPH, and metals. Three of these subsurface soil samples (locations 057-0035, 057-0037, and 057-0045) were also analyzed for SVOCs. TPH and metals were reported at low concentrations in these samples. Diethyl phthalate was the only SVOC reported. No VOCs were reported in these soil samples.

Ten groundwater samples (locations 057-0034, 057-0036, 057-0038, 057-0040, 057-0042, 057-0044, 057-0046, 057-0048, 057-0050, and 057-0052) were also collected and analyzed for VOCs, TPH, and metals. Three of these groundwater samples (locations 057-0036, 057-0038, and 057-0044) were also analyzed for SVOCs. VOCs and TPH were reported above detection limits in every groundwater sample. Low concentrations of SVOCs and metals were also reported.

EBS Parcel 58

EBS Parcel 58 is located adjacent to the eastern wall of Building 5. The parcel is less than 1 acre in size and consists of paved open space and Building 34, a former electrical substation. The open space, which covers approximately 95 percent of the parcel, was historically used for material storage, small-scale drum storage, and equipment and vehicle parking. Although the EBS report did not indicate any hazardous waste storage

or accumulation points within EBS Parcel 58, NADEP GAP 20, located northwest of Building 500, was identified as being in this parcel during the RI supplemental field investigation. Phase 2A at EBS Parcel 58 included soil sampling beneath hazardous-materials lockers in the southern portion of the open space.

Surface and subsurface soil samples were collected at two locations (058-001-001 and 058-001-002) (Figure 1-9) during Phase 2A. Surface samples were analyzed for TPH and SVOCs. Subsurface samples were also analyzed for VOCs. Low levels of 1,1,1-TCA, TPH as motor oil, and phthalates were reported.

One sanitary sewer line location (058-SN-001) (Figure 1-9) within EBS Parcel 58 was also sampled during Phase 2A. Subsurface soil samples were collected and analyzed for VOCs, TPH, SVOCs, metals, and cyanide. These samples were reported to contain 1,1,1-TCA, a phthalate, and metals. On the basis of these data, no additional sampling was recommended in this parcel.

EBS Parcel 59

EBS Parcel 59 is located near the northeastern corner of Building 5. Building 62, a former cafeteria and credit union, occupies nearly one-half the area of this parcel.

Two subsurface soil samples were collected from the sanitary sewer corridor at locations 059-SN-001 and 059-SN-002 (Figure 1-9) during Phase 2A and analyzed for TPH, SVOCs, and metals. Low concentrations of SVOCs and metals were reported. On the basis of these data, no additional sampling was recommended along the sanitary sewer corridor in this parcel.

Two subsurface soil samples were collected from the storm drain corridor at locations 059-SS-001 and 059-SS-002 (Figure 1-9) in EBS Parcel 59 during Phase 2A. Samples were analyzed for VOCs, TPH, SVOCs, pesticides/PCBs, butyltin, metals, oil and grease, and reactivity. Aroclor 1260 was reported above detection limits, along with several SVOCs, metals, and oil and grease. On the basis of these data, the concentration of Aroclor 1260 was proposed for further investigation.

During the Phase 2B investigations, the storm drain corridor was further investigated for pesticides and PCBs. A soil sample and a groundwater sample were collected from locations 059-SS-003 and 059-SS-004 (Figure 1-9); these four samples were analyzed for pesticides and PCBs. No pesticides or PCBs were reported above detection limits.

EBS Parcel 66

EBS Parcel 66 is located in the northeastern corner of OU-2C, adjacent to EBS Parcel 59. Approximately one-third of EBS Parcel 66 is covered by Building 32; the remaining area of the parcel is open space, which is predominantly paved. Building 32 was used as a metal treatment shop, and the open space was the associated parking lot.

One subsurface soil sample (location 066-IW-001) (Figure 1-9) was collected during Phase 2A from the industrial sewer corridor at EBS Parcel 66 and analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, herbicides, butyltin, organic lead, metals, oil and

grease, and reactivity. TPH as motor oil, metals, and oil and grease were reported above detection limits. Based on these results, no additional sampling was recommended.

Two subsurface soil samples (locations 066-SN-001 and 066-SN-002) (Figure 1-9) were collected from the sanitary sewer corridor at EBS Parcel 66. The samples were analyzed for VOCs, TPH, SVOCs, PCBs, metals, and reactivity. SVOCs and nickel were reported at low concentrations. Based on these data, no additional sampling was recommended.

EBS Parcel 67

EBS Parcel 67 is a small, completely paved parcel immediately south of EBS Parcel 66 that occupies less than 1 acre. No sampling was conducted at this parcel during the EBS.

EBS Parcel 68

EBS Parcel 68 is located along the eastern border of OU-2C. The U-shaped Building 6 covers approximately one-third of the parcel, and the remaining area of the parcel is open space. The building has been used as a repair shop, steam cleaning facility, electric motor shop, storage area, and most recently, as a fire station for the City of Alameda. The building was formerly used as the NAS Alameda fire station and as a vehicle maintenance and repair facility and was referred to as the PWC transmission shop garage.

Phase 2A at EBS Parcel 68 included sampling the soil beneath the shop areas of Building 6, which may have been impacted by documented spills. Soil beneath Building 6 was analyzed to investigate the potential presence of TPH (primarily lubricating oils) from within the vehicle maintenance and repair shop. Surface and subsurface soil samples were collected at eight locations (068-001-001 through 068-001-008) (Figure 1-9) and analyzed for TPH and metals. Low levels of TPH as motor oil were reported in only one of the eight samples, and low concentrations of metals were reported in most of the samples. On the basis of these data, no additional sampling was recommended.

At two locations (068-002-009 and 068-002-010) south of Building 6 (Figure 1-9), surface and subsurface soil samples were collected. The surface samples were analyzed for TPH and the subsurface soil samples analyzed for VOCs. Low concentrations of methylene chloride were reported in the subsurface samples. On the basis of these data, no additional sampling was recommended in this parcel.

One subsurface soil sample was collected adjacent to a storm sewer line (068-SS-001) at a depth of approximately 4.5 feet. This sample was analyzed for TPH, pesticides and PCBs, metals, VOCs, SVOCs, and oil and grease. Low concentrations of 4,4′-dichlorodiphenyltrichloroethane, Aroclor 1260, and phthalates were reported in this sample. On the basis of these data, no additional sampling was recommended in this parcel

EBS Parcel 69

EBS Parcel 69, located in the southeastern corner of OU-2C, is a 2-acre parcel coincident with IR Site 12. Building 10 occupies approximately 20 percent of the parcel; the remainder of the parcel is open space. Building 10 was used as the PWC power plant;

activities in this building included steam generation and air compression. Details of past operations at EBS Parcel 69 are described in Section 1.4.3.3.

One surface soil sample was collected at location 069-Z13-001 (Figure 1-9) during Phase 2A to assess historical releases of TPH, SVOCs, PCBs, and lead from railroad cars and engines. TPH as motor oil, and lead were reported at a low concentrations. Based on these data, no additional sampling was recommended.

EBS Parcel 186

EBS Parcel 186 is located along the eastern border of OU-2C, between EBS Parcels 68 and 69. One building (Buildings 194 a maintenance storage structure) and one structure (a pump station) occupy less than 5 percent of the parcel; the remainder of the parcel is open space. Former Building 282 served as a diesel and gasoline station.

Four subsurface soil samples were collected from the industrial sewer corridors at EBS Parcel 186 during Phase 2A at locations 186-IW-001, 186-IW-002, 186-IW-003, and 186-IWPS1-001 (Figure 1-9). The samples were analyzed for VOCs, TPH, SVOCs, pesticides and PCBs, herbicides, butyltin, organic lead, metals, oil and grease, and reactivity. Low levels of acetone, TPH, several SVOCs, and tributyltin were reported above detection limits. Based on the low concentrations of the detected analytes, no additional sampling was recommended.

EBS Parcel 190A

Subparcel 190A is a 5-foot-wide strip representing a section of storm drain line (F-Line) that was historically designated to investigate radiological contaminants. This strip originated from the western border of IR Site 5 and crossed east-west through the middle of EBS Parcel 190. The radiological storm drain line was cleaned and regulators concurred upon a closure recommendation and reintegration into EBS Parcel 190. No sampling was conducted at the portion of storm drain line within EBS Parcel 190A during the EBS.

EBS Parcel 204A

Subparcel 204A is a 5-foot-wide strip representing a section of storm drain line (F-Line) that was historically designated to investigate radiological contaminants. This strip originated from the western border of IR Site 5 and crossed east-west through the middle of EBS Parcel 204. The radiological storm drain line was cleaned and regulators concurred upon a closure recommendation and reintegration into EBS Parcel 204. No sampling was conducted at the portion of storm drain line within EBS Parcel 204A during the EBS.

1.5.1.9 STORM DRAIN INVESTIGATIONS, 1995 TO 2000

Investigations of storm drain sediments and storm drain corridors occurred in 1995 in conjunction with the EBS Phases 2A and 2B sampling activities (IT 2001a). These storm drain investigations were designed to address contaminants in and adjacent to the storm

drain lines. Results of soil and groundwater sampling activities along storm drains conducted as part of the EBS are included in Section 1.5.1.8.

Prior radiological characterization activities conducted at IR Sites 5 and 10 have indicated the potential presence of radium-226 contamination at these sites. The storm drain lines and the sewer lines within and around Buildings 5 and 400 (NWT 1998) that flow toward Seaplane Lagoon via the two outfalls located on the western and eastern corners of Seaplane Lagoon (Outfalls F and G) are of specific concern.

Initial characterization of the drain lines, storm drain lines, and storm drain manholes associated with Buildings 5 and 400 was conducted in 1996. The characterization survey was performed by pulling a sodium iodide detector through the storm drain lines. Approximately 1,000 feet of the main storm drain line between Building 5 and Seaplane Lagoon were surveyed in August and September 1996.

A storm drain sediment removal action was completed by the Navy between 1995 and 1997 (IT 1997; TtEMI and MK 1998). The Navy conducted Phase 1 of the CERCLA time-critical removal action (TCRA) by vacuum-cleaning sediment and debris from storm drain catch basins and manholes associated with Outfalls A, B, E, G, H, I, J, K, L, and R. Of these, only storm drains discharging to Outfalls A, B, and G have segments within OU-2C (Figure 1-10).

A detailed investigation of the storm drains was conducted in December 1997 (NWT 1998, TtECI 2007b). The survey included almost 6,000 feet of storm drain and sanitary drain piping. In addition, several solid samples were collected for gamma spectroscopy analyses. The samples were taken at the storm drain outfalls and from some of the manholes in the system. Approximately 4,000 feet of storm and sanitary drain piping contained radium activities above the detection limits.

Removal and replacement or in-place decontamination of storm drain piping and manholes was performed during the period of November 1998 to October 1999. More than 700 feet of contaminated piping outside of Building 5 was removed. Approximately 700 feet of contaminated piping was decontaminated by hydroblasting. This included piping from both Buildings 5 and 400. Three contaminated manholes near Building 5 were removed and replaced.

In 2000, the Navy conducted a storm drain study (TtEMI 2000d, 2001b, 2001e). The primary objective of this investigation was to identify storm drain sections that were damaged, located below the water table (submerged), and subject to infiltration of contaminated groundwater (TtEMI 2000d). The data collected would be used to prioritize storm drain sections for repair to minimize infiltration of contaminated groundwater and its subsequent transport to San Francisco Bay. Approximately 1,380 feet of line in the vicinity of IR Site 5 was identified as undamaged, nonpriority storm drain line. These lines were part of systems that discharged to Outfalls F and G. In addition, approximately 1,785 feet of the storm drain system in the vicinity of IR Sites 5, 10, and 12 that discharges to Outfall F was identified as being within the chemical plumes.

Sections of the storm drain between the eastern margin of Building 5 at Lexington Street and from east of Lexington Street north of the building that discharge to Outfall G were

below the groundwater table. Additionally, short sections of the storm drain that discharge to Seaplane Lagoon via Outfall F were below the water table at locations along the south side of Building 5 and along the south border of IR Site 5 (north of Buildings 12 and 400). Sections of the storm drain north of Building 5 between were also below the water table. All of the storm drains located at IR Site 10 were below the groundwater table.

1.5.1.10 ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY IN 1998

The primary objective of the electrokinetic pilot-scale treatability study was to treat chromium-contaminated soil at IR Site 5 (TtEMI 1999c) to attain levels below U.S. EPA Region 9 PRGs for residential soils. The technology was applied from December 1997 to June 1998 on chromium-contaminated soil located beneath Building 5 at the former aircraft rework facility plating shop. The plating shop was constructed with a raised wooden floor about 3 feet above a concrete subfloor. A dividing wall was present in the concrete subfloor to separate the cadmium-cyanide processing section from the chrome processing section. Two 15-inch-diameter by 18-foot-deep sumps were located on either side of the dividing wall and were used to collect wastewater discharged from the plating process lines. Previous investigations indicated that salts containing chromium and hexavalent chromium (e.g., chromic acid, dichromate, and chromate anions) had been deposited into the soil under the plating shop during chromium plating operations conducted at the site between 1942 and 1990. The pilot-scale treatment area was located in an area approximately 20 by 30 feet on the chromium processing side of the plating shop just north of the sump and drainage trough.

In October 1998, following completion of the pilot-scale study, soil samples were collected from 12 borings (C1 through C12) at depths of 1.5, 4.5, and 8.5 feet bgs and analyzed for metals, hexavalent chromium, and general chemistry parameters. Figure 1-11 shows the location of the pilot-scale study confirmation soil sampling points. Metals reported at concentrations above comparison criteria included arsenic (up to 2.8 mg/kg), cadmium (up to 269 mg/kg), chromium (up to 759 mg/kg) and hexavalent chromium (up to 47.7 mg/kg), and iron (up to 80,400 mg/kg). However, arsenic concentrations were comparable to background concentrations.

Evaluation of the post-treatment data shows that for both total chromium and hexavalent chromium, the 95th UCL concentrations for the total population were reduced to levels below their respective PRGs; however, the 95th UCL for total chromium in the samples from the 1.5-foot-bgs depth still exceeded the PRG.

1.5.1.11 CHLORINATED SOLVENT TREATABILITY STUDIES IN 2000

Two treatability studies were conducted to address two areas with chlorinated VOCs at concentrations in excess of 10,000 µg/L. A surfactant-enhanced subsurface remediation treatability study was conducted at the northeastern corner of Building 5 (Plume 5-1) (Surbec-Art Environmental 2000). A steam-enhanced extraction (SEE) remediation treatability study was conducted at the eastern margin of Building 5 (Plume 5-4) between May 1999 and July 1999 (BERC 2000).

Surfactant-Enhanced Treatability Study

The purpose of the treatability study conducted at the Plume 5-1 location was to demonstrate enhanced removal of VOC concentrations above 10,000 µg/L by injection of a surfactant. A site investigation was conducted to finalize the location of the treatability study cell test area and to determine the pretest volume of VOCs above 10,000 µg/L using soil coring and the Pre-Partitioning Interwell Tracer Test. Soil core samples were collected throughout the study area and a volume of VOCs was estimated using the measured core properties as the basis of the calculation. Following the site investigation, the Navy conducted surfactant-enhanced subsurface remediation for VOC removal. After the surfactant injection, a site investigation was conducted to determine the post-test VOC volume using post-test soil coring and the Post-Partitioning Interwell Tracer Test. The post-test soil cores were drilled within 2 feet of the selected prestudy soil sampling locations at depth intervals identical to the pre-coring locations. The Post-Partitioning Interwell Tracer Test was conducted using the same protocol as the Pre-Partitioning Interwell Tracer Test to determine the post-test VOC mass.

The report of the study indicated that soil coring and Post-Partitioning Interwell Tracer Test results showed excellent mass reduction (over 97 percent) and that the results exceeded the project goal of 95 percent VOC removal (Surbec-Art Environmental 2000). However, the evaluation of the results of the surfactant-enhanced treatability study was based on inadequate horizontal and vertical subsurface characterization and used monitoring well sampling results rather than HydroPunch groundwater samples collected from discrete intervals to characterize post-test concentrations of VOCs in groundwater. This resulted in an apparent effectiveness that was much greater than the actual effectiveness of surfactant-enhanced mass removal. The conclusions based on post-test soil sampling and the Post-Partitioning Interwell Tracer Test (which indicated that the mass removal was excellent and exceeded 97 percent) were in error. VOC concentrations in groundwater were actually two to three orders of magnitude greater than those used to evaluate the Surbec study (Cook, pers. com. 2007). This area underwent full-scale source area remediation in 2004 as described below, under DNAPL Source Removal Actions.

Steam-Enhanced Extraction Treatability Study

The purpose of the treatability study conducted at the Plume 5-4 location was to test the feasibility of using SEE technology developed in the late 1980s at the University of California at Berkeley (BERC 1998) to remove chlorinated hydrocarbons from a nonaqueous-phase liquid (NAPL) waste oil source in shallow fill soils.

The study was conducted to remove NAPL waste oil containing chlorinated VOCs from the subsurface at IR Site 5. The treatment was intended to reduce chlorinated solvent (i.e., TCE) concentrations in the groundwater treatment zone to levels comparable to the upgradient groundwater concentrations and to reduce TPH concentrations in soil to levels that minimize migration potential. Steam was injected via wells surrounding the NAPL source zone, with injections and extractions occurring cyclically. Groundwater and soil samples were collected prior to, during, and after application of SEE.

Soil samples were collected both before and after application of steam and analyzed for total microbial populations and active microbial populations. The data indicated that four days after the soil cooled to ambient temperatures, both the total and active microbial populations had rebounded significantly. There was less rebound in microbial populations in the samples with fewer volatile residual hydrocarbon components. Rebound of active microbial populations was observed in each location where there was significant hydrocarbon residual, particularly those with more mobile volatile fractions. It was concluded that natural attenuation processes can be expected to be active at the site after the application of SEE.

The goals of reducing the groundwater TCE concentrations to values typical of upgradient concentrations and reducing soil hydrocarbon concentrations to values below 1,000 mg/kg were generally met. After the application of SEE at Building 5, the concentrations of extractable petroleum hydrocarbons in groundwater and soil in the treatment zone were reduced by an order of magnitude compared with the upgradient plume area. The results showed that SEE is capable of removing the volatile fraction of a mixture of solvents and oils found in soils near the former waste oil and solvent tank. The removal of TCE was nearly complete. The study concluded that SEE was a feasible *in situ* technique for IR Site 5 (BERC 2000).

1.5.1.12 SUPPLEMENTAL REMEDIAL INVESTIGATION DATA GAP SAMPLING IN 2001 AND 2002

Supplemental data gap sampling was conducted by the Navy at OU-1 and OU-2 in 2001 and 2002 (TtEMI 2001c, 2002c) to investigate chlorinated solvents in groundwater. Specific objectives of this sampling included the following:

- delineation of chlorinated VOC plumes in groundwater
- investigation of the potential for DNAPL in the saturated zone
- investigation of storm drain bedding materials as potential pathways
- characterization of hexavalent chromium and cyanide in groundwater in the vicinity of the former plating shop in Building 5
- collection of soil gas and soil samples to support vapor intrusion modeling in the baseline HHRA

A round of groundwater sampling from existing wells was also conducted during this investigation. The data gap sampling activities for soil and groundwater for areas within OU-2C (Figure 1-12) are described in the subsections below.

Dissolved-Phase VOC Groundwater Sampling

The overall objective of data gap sampling at IR Site 5 was to investigate chlorinated VOCs in groundwater at Building 5. To verify the vertical extent of VOC contamination in the FWBZ, discrete groundwater samples were collected from the top of the FWBZ and at the base of the fill soil at 34 locations (S05-DGS-DP01, S05-DGS-DP06 through S05-DGS-DP08, S05-DGS-DP10 through S05-DGS-DP12, S05-DGS-DP14 through

S05-DGS-DP16, S05-DGS-DP21 through S05-DGS-DP25, S05-DGS-DP34 through S05-DGS-DP49, and S10-DGS-DP01 through S10-DGS-DP03). On the basis of initial analytical results, step-out sampling was conducted at shallow groundwater locations to characterize the extent of the chlorinated VOC plume. The interval targeted for sampling was the top of the FWBZ.

The delineation of VOC plumes addressed chlorinated VOCs underlying Building 5, east of Building 5, and extending south of Building 5 to beneath Building 400 in IR Site 10. The lateral extent of the VOC plumes was defined as the area containing VOC concentrations above maximum contaminant levels (MCLs); the lateral extent of the VOC plume was not fully delimited in the northwestern corner of IR Site 5. VOCs reported at concentrations above MCLs in the northwestern area at 0 to 15 feet bgs included benzene; cis-1,2-DCE; trans-1,2-DCE; TCE; and vinyl chloride. At 16 feet bgs, only benzene (up to 5.8 µg/L) and vinyl chloride (up to 2 µg/L) were reported at concentrations above MCLs. Below 20 feet bgs, no VOCs were reported at concentrations above detection limits.

TPH plumes were characterized as commingled with chlorinated VOCs; therefore, TPH contamination would be managed under the CERCLA Program. Step-out sampling was recommended to define the lateral extent of TPH plume west of well M05-03, located between IR Sites 5 and 10 (TtEMI 2002c).

Characterization of Dense Nonaqueous-Phase Liquids in Soil

In areas where previous VOC-specific analysis of groundwater samples had identified VOCs at concentrations above 1 percent solubility, two sampling techniques were used to attempt to assess the limits of DNAPL in soil: passive diffusion bag (PDB) samplers and ribbon nonaqueous-phase liquid (NAPL) samplers (RNSs). PDB samples were analyzed using standard U.S. EPA methods that quantify individual VOC concentrations, while the RNS technique provided a visual indication of whether NAPL was present (VOC concentrations were not quantified and individual analytes were not identified).

Multilevel PDB samplers were used to collect depth-discrete samples from the screened zone in monitoring wells M05-04 and M05-07. The PDBs (filled with deionized water) were left in place for 14 days to allow full exchange between formation water and the deionized water. Laboratory analysis of water from the PDBs reported discrete chlorinated VOC analytes at concentrations below 1 percent solubility. The maximum reported value in samples collected from well M05-04 was 150 µg/L for TCE at 5 to 7 feet bgs and the maximum reported value in samples from M05-07 was 470 µg/L for chloroethane at 15 to 17 feet bgs. No further investigation of DNAPL in soil was conducted under the Data Gap Sampling investigation at these locations.

RNSs were installed in borings at 13 locations (S05-DGS-DP01, S05-DGS-DP05 through S05-DGS-DP16) in potential source areas where no monitoring wells were located. Prior to installation of the RNSs, soil samples collected from the borings were tested for DNAPL using a phase-separation shake test and visual inspection for DNAPL; no visible signs of DNAPL were observed. RNSs were installed through the hollow stem of a direct-push drill rod at depths between 0 and 30 feet bgs and left in place for several hours. NAPL, if present, would have stained a colored dye in the RNS material.

No evidence of NAPL was observed. After removal of the RNSs, groundwater samples were collected from each boring and either analyzed at the on-site mobile laboratory (S05-DGS-DP05, S05-DGS-DP09, S05-DGS-DP13) or sent to an off-site laboratory (S05-DGS-DP01, S05-DGS-DP06 through S05-DGS-DP08, S05-DGS-DP10 through S05-DGS-DP12, and S05-DGS-DP-14 through S05-DGS0-DP16). At three of the RNS sampling locations (S05-DGS-DP11, S05-DGS-DP14, S05-DGS-DP16), concentrations in the subsequently collected groundwater samples were above 10,000 µg/L for one or more chlorinated VOCs (1,1-DCA; 1,1-DCE; and/or 1,1,1-TCA) (TtEMI 2002c).

Storm Drain Bedding Investigation

During the storm drain investigation, storm drain bedding material samples were collected from locations S05-DGS-VE-01 and S05-DGS-VE-02 (Figure 1-12) to determine the potential infiltration of contaminated groundwater into the storm drains and to evaluate the bedding material as a potential pathway. Samples were analyzed at an on-site mobile laboratory. Based on this investigation, the hydraulic conductivities of the bedding material samples were comparable to the offset soil samples; therefore, the bedding material pathways were not evaluated further.

Building 5 Plating Shop Sampling

Objectives for the investigation of inorganic chemical contamination in soil and groundwater beneath the plating shop in Building 5 included determining whether hexavalent chromium and cyanide were present in groundwater, documenting cadmium and chromium concentrations, and collecting data to support potential removal actions.

Subsurface soil samples were collected at the plating shop using direct-push technology from depths of 0 to 8.5 feet bgs. Soil samples were collected from 19 locations (S05-DGS-DP14, S05-DGS-DP17 through S05-DGS-DP20, S05-DGS-DP31 through S05-DGS-DP33, and S05-DGS-DP50 through S05-DGS-DP60) (Figure 1-12). Samples were submitted to a fixed laboratory for analysis of cadmium. Locations S05-DGS-DP50 through S05-DGS-DP60 represent confirmation samples collected after the metals removal action (Section 1.5.1.13) to verify that concentrations in remaining soil were below action levels. Cadmium concentrations in samples collected prior to the removal action ranged from nondetect to 266 mg/kg. Cadmium concentrations for samples collected following excavation were below the comparison criteria with the exception of one sample collected at 8 feet bgs from location S05-DGS-DP55.

Groundwater samples were collected using a direct-push drill rig at five locations within the former plating shop (S05-DGS-DP14, S05-DGS-DP17 through S05-DGS-DP20), two locations south of Building 5 adjacent to the plating wastewater holding tanks (S05-DGS-DP26 and S05-DGS-DP27), and five locations around the periphery of the former plating shop (S05-DGS-DP61 through S05-DGS-DP66) (Figure 1-12). Samples were submitted to a fixed laboratory for analysis of cadmium, total chromium, hexavalent chromium, and cyanide, and measurement of pH.

In discrete groundwater samples collected from within the boundaries of the former plating shop prior to the soil removal action, cadmium concentrations were 7.8 to 189 µg/L, total

chromium concentrations were 12.6 to 138 µg/L, hexavalent chromium concentrations were below the detection limit (10 µg/L), and cyanide concentrations ranged from below the detection limit to 480 µg/L. Concentrations of cadmium and total chromium in groundwater samples collected outside the plating shop area were much lower, with cadmium concentrations below the detection limit and total chromium concentrations ranging from below the detection limit to 17 µg/L. However, cyanide concentrations were higher and ranged from below the detection limit to 1,090 µg/L (TtEMI 2002c).

Soil Gas Sampling

Soil gas samples were collected from the vadose zone in groundwater contaminant plume areas. Soil gas samples were collected using a direct-push, soil vapor probe and a slow-purge, vacuum-monitored induction system. Soil gas samples were collected from seven locations (S05-DGS-SG03, S05-DGS-SG06, S05-DGS-SG09, S05-DGS-SG12, S05-DGS-SG15, S05-DGS-SG18, and S05-DGS-SG21) and analyzed for chlorinated VOCs, BTEX, and TRPH to support vapor intrusion modeling in the baseline HHRA for IR Site 5. Measurable concentrations of VOCs were reported in soil gas above the contaminant plume in groundwater (TtEMI 2002c).

Monitoring Well Sampling

A round of water level measurements and groundwater sampling and analysis was conducted for all existing wells at IR Sites 5, 10, and 12 to determine current conditions (D05-01 through D05-03, M05-01, M05-02, M05-04 through M05-12, M05BS-01, M05HW-01, D10A-01, M10-01 through M10-03, D12-01, and M12-01 through M12-04). The groundwater samples were analyzed for VOCs and TPH using a mobile laboratory, and for SVOCs including PAHs.

1.5.1.13 BUILDING 5 PLATING SHOP REMOVAL ACTION, 2001 TO 2002

The Navy conducted a metals removal action at the former plating shop in Building 5 between December 2001 and February 2002 (IT 2002h). The concrete floor was removed and soil was extracted during an initial excavation and two subsequent step-out excavations. Approximately 1,750 cubic yards (yd^3) of soil was excavated. Confirmation samples were collected during the removal action to verify that concentrations in remaining soil were below action levels (Figure 1-11).

For the initial excavation, 20 confirmation samples were collected at the perimeter of the excavation at depths of 3.5 or 7 feet bgs (S05-EXC-SWE1, SWE2, SWN1, SWN2, SWS1, SWS2, SWW1, and SWW2) and beneath the excavation at a depth of 7 feet bgs (S05-EXC-X1Y1, X1Y2, X1Y3, X2Y1, X2Y2, X2Y3, X3Y1, X3Y2, X3Y3, X4Y1, X4Y2, AND X4Y3). Confirmation samples were collected after clean fill soil was placed in the excavation. Borings for collection of confirmation samples were advanced through the clean fill material to a depth of 7 feet. Confirmation samples were analyzed for cadmium, chromium, lead, and hexavalent chromium. All cadmium, lead, and hexavalent chromium concentrations were below comparison criteria. Two samples from beneath the excavation (S05-EXC-X2Y2 and X4Y2) had chromium concentrations above

the comparison criterion. Sample S05-EXC-X4Y2 also had a cadmium concentration of 31.2 mg/kg, approaching the PRG of 37 mg/kg; therefore, a step-out excavation to the south was conducted.

Upon completion of the first step-out excavation, seven confirmation samples were collected (S05-EXC-SWE3, SWW3, SWS1-1, SWS2-1, X5Y1, X5Y2, and X5Y3) and analyzed for cadmium only. Cadmium concentrations were above the comparison criteria in three samples and a third step-out and hot spot excavation round was conducted.

For the third round of excavation, nine confirmation samples were collected (S05-EXC-SWB1 and SWB2 west of the excavated area; S05-EXC-SWS1-2, X4Y2-1, X5Y2-1, X5Y3-1, X5Y4, X6Y2, and X6Y3) and analyzed for cadmium. Elevated concentrations were reported in samples S05-EXC-SWB1 and S05-EXC-X4Y2-1. Following additional hot spot excavation, three confirmation samples were collected (S05-EXC-SWB1-1, SWB2-1, and X4Y2-2). All cadmium concentrations for these final three samples were below comparison criteria.

The removal action report concluded that no further removal action was warranted (IT 2002h). As part of the removal action, soil to 7 feet bgs was removed at locations of previous sampling points 05GB003, B05PS-01 through B05PS-05, C1 through C12, S05-DGS-DP14, S05-DGS-DP18, S05-DGS-DP20, S05-DGS-DP55, and S05-DGS-DP57. The excavation was also intended to remove soil at the locations of previous sampling points B05PS-06 through B05PS-10, but due to an error in the reported locations of these sampling points, the excavation did not extend far enough south to include these locations. (Note that the locations of sampling points B05PS-01 through B05PS-10 are correctly shown on Figure 1-7). Additionally, one location with concentrations above comparison criteria was under the south plating shop wall (sample S05-EXC-SWS1-1) and could not be excavated without compromising the structural integrity of the building (IT 2002h).

1.5.1.14 CHLORINATED SOLVENT PLUME DEFINITION, 2001 TO 2002

From September 2001 through January 2002, an investigation was conducted to determine the vertical and lateral extent of potential plumes with VOC concentrations above 10,000 µg/L prior to preparation of final project plans to conduct a VOC source removal action at IR Site 5. Four plumes (5-1, 5-2, 5-3, and 5-4) were identified in the engineering evaluation and cost analysis (TtEMI 2001a). Samples were analyzed specifically for ten VOCs: 1,1-DCA; 1,2-DCA; 1,1-DCE; cis-1,2-DCE; trans-1,2-DCE; 1,1,1-TCA; 1,1-2-TCA; PCE; TCE; and vinyl chloride. VOC concentrations were summed for each sample and compared the a screening criterion of 10,000 µg/L being used as an indicator of the possible presence of DNAPL. Figure 1-13 shows groundwater sampling locations for DNAPL characterization activities and monitoring wells in the plume areas.

For Plume 5-1 (east of Building 5 and south of Building 62), 33 borings (5-1-ADD2 through 5-1-ADD10, 5-1-ADD12 through 5-1-ADD17, 5-1-ADD19 through 5-1-ADD21, 5-1-ADD23, 5-1-ADD24, and 5-1-ADD26 through 5-1-ADD38) were installed and discrete groundwater samples were collected at 5-foot intervals to depths of up to 60 feet bgs.

Figure 1-14 shows the analytical results of these discrete groundwater sampling points and the configuration of the plume before six-phase heating (SPH). The sum of concentrations for the ten VOCs were above 10,000 µg/L at 12 locations and at depths up to 60 feet bgs (IT 2002c); these samples were collected in the deepest sampling depths at three locations (5-1-ADD8 at 46 to 50 feet bgs, 5-1-ADD12 at 56 to 60 feet bgs, and 5-1-ADD27 at 45 to 49 feet bgs). During the plume delineation activities at Plume 5-1, mobile DNAPL was discovered in a sample collected from 40 to 44 feet bgs. Sample results indicated the DNAPL was approximately 62 percent TCE; 31 percent 1,1,1-TCA; 3.2 percent 1,2-DCE; and 3.8 percent hydrocarbons (jet-fuel range and lighter) (IT 2002c). Remediation of the DNAPL source area was recommended.

Prior to implementation of the SPH removal action, the discovery of mobile DNAPL within the Plume 5-1 triggered the implementation of a physical DNAPL removal. A series of 42 temporary well points (WP1 through WP42), with 3-foot well screens at 41 to 44 feet bgs, were installed in a triangular grid encompassing approximately 900 square feet and centered around boring location 5-1-ADD12. DNAPL was removed periodically from the bottom of the well points. The physical removal of DNAPL resulted in the removal of 173 pounds of DNAPL and was discontinued in April 2003.

For Plume 5-2 (east of Building 5), six borings (5-2-ADD2, 5-2-ADD5, 5-2-ADD6, 5-2-ADD8, 5-2-ADD10, and 5-2-ADD13) were advanced in the area where Plume 5-2 was expected. Groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 25 feet bgs. The sum of concentrations for the ten VOCs at any location was not above 10,000 µg/L (Figure 1-15). The highest sum for the ten VOC concentrations measured during delineation activities was 3,070 µg/L. Except at location 5-2-ADD5, the deeper FWBZ concentrations were lower.

For Plume 5-3, 84 borings (5-3-ADD1 through 5-3-ADD9, 5-3-ADD11 through 5-3-ADD24, 5-3-ADD26 through 5-3-ADD51, 5-3-ADD53, 5-3-ADD55 through 5-3-ADD59, 5-3-ADD63, 5-3-ADD71 through 5-3-ADD72, 5-3-ADD74 through 5-3-ADD76, 5-3-ADD80 through 5-3-ADD83, 5-3-ADD85 through 5-3-ADD87, 5-3-ADD89, 5-3-ADD91, 5-3-ADD93 through 5-3-ADD95, 5-3-ADD98, 5-3-ADD101 through 5-3-ADD103, 5-3-ADD107 through 5-3-ADD107, and 5-3-ADD109 through 5-3-ADD110) were advanced in the central portion of Building 5. Groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 35 feet bgs. The sum of concentrations for the ten VOCs were above 10,000 µg/L at approximately 40 locations (at depths to 35 feet bgs); at one of these locations (5-3-ADD107 at 23 to 26 feet bgs), these concentrations were all reported in the deepest sampling interval (IT 2002g). Figure 1-16 presents the analytical results of the plume delineation efforts that document conditions in the plume area prior to remediation. Remediation of the DNAPL source area was recommended.

For Plume 5-4 (east of Building 5), 14 borings (5-4-ADD1 through 5-4-ADD9, 5-4-ADD10 through 5-4-ADD12, and 5-4-ADD20 through 5-4-ADD21) were advanced in the area where Plume 5-4 was expected. Groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 25 feet bgs. The sum of concentrations for the 10 VOCs was not above 10,000 µg/L (Figure 1-17) in any sample. This investigation

was conducted following SEE (Section 1.5.1.11) and the results presented on Figure 1-17 represent groundwater conditions following remediation. The highest sum for the ten VOC concentrations measured during delineation activities was 4,600 µg/L. The vertical extent of VOCs was defined to below detection limits in all discrete sample borings (detection limits were typically 250 µg/L but were as low as 5 µg/L). The report noted concentrations totaling 47,360 µg/L in a sample near but outside Plume 5-4 at location S05-DGS-DP11 (at 9 feet bgs).

The data generated from these investigations led to the following conclusions (Shaw 2003c).

- The lateral extent of the DNAPL plume northeast of Building 5 (Plume 5-1) was smaller and the vertical extent greater than originally thought.
- Mobile DNAPL was present in a limited area within the plume northeast of Building 5 (Plume 5-1).
- Plume 5-2 was not considered a plume that would require a source removal action (IT 2002e).
- The lateral extent of the DNAPL plume beneath Building 5 (Plume 5-3) was larger than originally estimated. The vertical extent of the plume was greater than originally estimated in a small area under the former plating shop.
- Plume 5-4 was not considered a plume that would require a source removal action (IT 2002f). However, a sample collected by Tetra Tech EM Inc. near Plume 5-4 within Building 5 at 9 feet bgs in June 2001 had a concentration of 47,360 µg/L for the sum of the ten VOCs.

1.5.1.15 REMEDIAL INVESTIGATION ACTIVITIES FOR IR SITE 26, 2002

During the RI field activities for IR Site 26 in 2002, one sampling point (26B27) was located near a storm drain line that has been included as part of IR Site 5 because of radiological contamination (Figure 1-6). Two discrete groundwater samples from this location, collected at depths of 5 and 15 feet bgs, were analyzed for VOCs. No VOCs were reported at concentrations above detection limits in these samples (BEI 2003).

1.5.1.16 BASEWIDE GROUNDWATER MONITORING PROGRAM, 2002 TO 2007

The BGMP for IR sites at Alameda Point was implemented in 2002 under a revised draft Work Plan (IT 2001c) and is ongoing under the finalized Work Plan (Shaw 2004). The portion of the BGMP for OU-2C (referred to as the IR Site 5 Group) was implemented with 10 of 42 existing wells in 2002, including seven FWBZ wells (M05-01, M05-05, M05-06, M05-08, M05-09, M05-10, and M12-04) and three SWBZ wells (D05-01, D05-03, and D12-01). Wells M12-04 and D12-01 were selected as background wells. The remaining wells were selected to monitor known boundaries of the VOC plume beneath Building 5 and to provide data for monitored natural attenuation (Shaw 2004). Additionally, one monitoring well included in the IR Site 8 BGMP program is located within the boundaries of IR Site 5, which results in a total of 11 wells within OU-2C identified for sampling under the BGMP in the finalized Work Plan (Shaw 2004) (Figure 1-18).

Under the BGMP, groundwater samples are analyzed for VOCs, TPH, metals (including hexavalent chromium), anions, sulfide, alkalinity, and dissolved gases.

During the first 2 years of sampling under the BGMP, six wells were sampled quarterly and five wells were sampled semiannually. After eight quarters of sampling (summer 2002 through spring 2004), the BGMP schedule was reduced to sampling semiannually for all wells. In fall 2003, well M05-10, located in the plating shop area, was abandoned to facilitate DNAPL removal activities and replaced with the new FWBZ well 2MW8S. In summer 2004, FWBZ well M05-02 and five newly installed SWBZ wells (D05-04 through D05-08) were added to the BGMP. In spring 2006, six FWBZ wells (M05-04, M05-11, M05HW-01, M10-01, M10-02, and M117-E) were added to the BGMP and two SWBZ wells (D05-07 and D05-08) were removed from the program. Figure 1-18 shows locations of monitoring wells within OU-2C that are being or have been sampled under the BGMP. Appendix C includes hydrographs for the wells at OU-2C that incorporate depth-to-water measurements collected as part of the BGMP.

1.5.1.17 BASEWIDE PAH INVESTIGATION, 2003

A basewide investigation of PAHs in soil was conducted in 2003 at selected IR sites at Alameda Point to collect sufficient PAH data to calculate exposure point concentrations for risk assessments at CERCLA sites (BEI 2004). Samples were collected to characterize PAH concentrations to 8 feet bgs, a depth representing typical potential future exposure scenarios for risk calculations (BEI 2002, 2004). Direct-push, continuous coring was used to collect soil to the total depth of 8 feet bgs. Each core was separated into four depth intervals (ground surface to 0.5 foot bgs, 0.5 foot to 2 feet bgs, 2 to 4 feet bgs, and 4 to 8 feet bgs). Soil collected from each depth interval was homogenized and samples were submitted for analysis of 16 PAH compounds by U.S. EPA Method 8270C with selected ion monitoring (SIM). To determine the appropriate number of samples to collect at each site, the study used historical PAH data collected at IR Sites 5, 10, and 12 to estimate the mean and standard deviation of B(a)P equivalent concentrations. For IR Site 5, 123 soil borings were advanced (C3S005B001 through C3S005B040, C3S005B042 through C3S005B055, C3S005B057 through C3S005B120, and C3S005B122 through C3S005B126). For IR Site 10, six soil borings were advanced (C3S010B001 through C3S010B006) and for IR Site 12, nine soil borings were advanced (C3S012B001 through C3S012B009). Figure 1-19 shows soil sampling locations for the PAH study. Three sampling locations designed to characterize IR Site 10 (C3010B001 and C3010B002) or IR Site 12 (C3S012B001) fell within the boundaries of IR Site 5. For OU-2C, a total of 552 samples (including duplicates) were collected from 138 boring locations; no sampling was conducted within existing buildings.

At IR Site 5, PAHs were reported at concentrations (expressed as B[a]P equivalent concentrations) above detection limits in 475 of the 558 soil samples collected within the IR Site 5 boundary. Soil samples from four locations had B(a)P equivalent concentrations that exceeded the Alameda Point screening level of 620 micrograms per kilogram (µg/kg) (DON 2001d) used in the report (BEI 2002, 2004). At IR Site 10, PAHs were reported at concentrations (expressed as B[a]P equivalent concentrations)

above detection limits in 4 of the 19 soil samples collected at the site; none of the samples had a B(a)P equivalent concentration above 620 µg/kg. At IR Site 12, PAHs were reported at concentrations (expressed as B[a]P equivalent concentrations) above detection limits in all 36 soil samples collected at the site; none of these 36 soil samples had a B(a)P equivalent concentration above 620 µg/kg.

1.5.1.18 DNAPL SOURCE REMOVAL ACTIONS BETWEEN 2004 AND 2007

A full-scale DNAPL source removal action using SPH with vapor extraction was completed at Plume 5-1 between July 8, 2004 and November 5, 2004. A full-scale DNAPL source removal action was begun for Plume 5-3 in 2006, with Phase I of this source removal completed in December 2006 and subsequent phases to follow (Shaw 2006). The objective of these removal actions was to remove sufficient contaminant mass to permanently reduce the total concentrations of COCs to below 10,000 parts per billion (ppb) within the horizontal extent of Plume 5-1 and Plume 5-3, to a maximum depth of 20 feet bgs. The removal action was conducted in accordance with the final Removal Action Project Plans (RAPP) for IR Sites 4 and 5 DNAPL and Dissolved Source Removal Action (IT 2002a), the Amendment to the RAPP for installation of well points for DNAPL extraction (IT 2002b), and the RAPP Addendum (Shaw 2003c).

The project plans described the removal action as heating the subsurface using electrodes, capturing and treating volatilized chemicals using vapor extraction, and treating the vapors. The treatment depth extends to a maximum depth of 20 feet bgs as a layer that appears to be retarding downward migration is encountered at depths ranging from 13 to 20 feet bgs. Installation of electrodes was planned so not to further compromise the integrity of this sensitive layer. Cross sections showing the sensitive layer found in the Plume 5-1 area were prepared as part of the removal action (IT 2002c) and are presented in Appendix C, Section C4.

The DNAPL at Plume 5-1 was addressed first and then equipment was relocated to address Plume 5-3. Due to the size of the plumes, the heating must proceed in phases. Each phase, or heating sequence, would heat an area between 8,000 and 14,000 square feet. Five or six heating cells are expected to be required for each heating sequence. Each heating cell consists of six electrodes arranged in a hexagonal pattern with an additional electrode at its center. Each heating sequence would continue until an interpretation of the data obtained during the operation indicates that it is prudent to terminate the stage (Shaw 2003c). Schematics of the removal action at Plumes 5-1 and 5-3 are shown in Figures 1-20 and 1-21, respectively.

The SPH technology was proven effective in pilot-scale testing at Plume 5-1 (Shaw 2003a). A pilot test performed at Plume 5-1 achieved the mass removal objectives within its perimeter (reduce total contaminants of ten VOCs, used as screening analytes, to below 10,000 ppb by mass). A limited-temperature SPH pilot-scale test at IR Site 4 was not successful within the allotted time frame, so this approach was not implemented for the full-scale removal action.

Prior to implementation of the SPH activity at Plume 5-1, mobile DNAPL was encountered and triggered the implementation of an additional task referred to as physical

DNAPL removal. This task consisted of installing a series of 42 temporary well points (WP1 through WP42) in a triangular grid spaced 16 feet apart and periodically removing DNAPL from those wells. The driven steel well points were screened in the 41-to-44-foot depth interval, where mobile DNAPL had been found during the refinement of the lateral and vertical plume definition activities (described in Section 1.5.1.14). The physical DNAPL removal was discontinued April 30, 2003, after removing 173 pounds of DNAPL.

The application of SPH was successful in treating the targeted Plume 5-1 area of approximately one-third acre. The COCs (predominantly 1,1,1-TCA, TCE, and the degradation products from these compounds) were mobilized into the vadose zone as a vapor by heating the soil and groundwater via SPH and were then removed by vapor extraction. More than 3,000 pounds of VOCs were recovered over the 15-week SPH treatment. Groundwater concentrations in the treatment zone above 20 feet bgs were reduced from an average initial total COC concentration (sum of concentrations of ten chlorinated VOCs: 1,1-DCA; 1,2-DCA; 1,1-DCE; cis-1,2-DCE; trans-1,2-DCE; PCE; 1,1,1-TCA; 1,1,2-TCA; TCE; and vinyl chloride) of approximately 49,000 µg/L to less than 120 µg/L.

Prior to the full-scale SPH application, the total COC concentrations in seven treatment-zone monitoring wells ranged from an average of 300 µg/L to 240,000 µg/L. The highest concentrations were for 1,1,1-TCA (205,000 µg/L). Four months after completion of the SPH operation, the highest COC concentrations in treatment-zone monitoring wells was 1,414 µg/L in well 1MW6S, while concentrations in all other wells were either below the detection limit of 1 µg/L or less than 20 µg/L. All monitoring wells sampled during the SPH application showed total COC concentration reductions to values well below the removal action goal of 10,000 ppb and therefore met the removal action objective (Shaw 2006).

The bulk of the equipment from the Plume 5-1 removal action was reinstalled in the Plume 5-3 area. SPH treatment for the Plume 5-3 area began in 2006 and Phase I was completed in December 2006 (Shaw 2006).

1.5.2 Non-CERCLA Removals and Investigations

Discussions of the removals and investigations at OU-2C other than those conducted under CERCLA are presented chronologically in this subsection. The removal actions, which are integrated into the chronological discussions below, include the following activities:

- Radiological removal actions between 1998 and 2007 (NWT 1998; TtECI 2007b; TtEMI 1998a, 1998b, 2001d, 2002a, 2002b)
- TPH removal actions between 1993 and 2000 and ongoing removal action (TtEMI 1997a, 1999d, 1999e, 1999f, 2000a, 2000b, 2003a, 2003c; IT 2002d; SulTech 2004)

1.5.2.1 RADIOLOGICAL REMOVALS AND INVESTIGATIONS

The use of radioactive materials at Alameda Point began in the 1940s and included operations in Building 5, where radioluminescent aircraft dials were refurbished with radium-226. Radium-226 is an ingredient in radioluminescent paint and is a source of ionizing radiation. Refurbishing of radioluminescent devices in Building 5 ended in the late 1950s to early 1960s (the exact date is unknown). Wastewaters from radium dial painting operations were emptied into industrial waste sinks that discharged to drain lines from paint booths inside Building 5. These drain lines discharged into the storm drain lines that discharge to Outfall F at Seaplane Lagoon. At Building 400, radiumluminescent dials were stored or used in Rooms 203, 204, 210, and 213.

Several radiation surveys and removal actions have been conducted or are being conducted at OU-2C.

Radiological Surveys for Buildings 5 and 400

In 1995, the Navy contracted for a radiological survey to characterize radioactive contamination at several locations at NAS Alameda, which included Buildings 5 and 400, storm drains and sewer lines, and several other areas at OU-2C. The objective of the survey for areas within OU-2C was to survey rooms and their contents in Buildings 5 and 400 that were considered to be contaminated with radium-226; to remove or isolate surface contamination, if possible; and to survey building drain lines and storm drain and sewer lines associated with the affected room to identify areas which had activities significantly above site-specific background levels. For Building 400, the surveys were designed as final status surveys for releasing the property for unrestricted use. Limited clean-up of radium-affected rooms in Building 400 had been conducted in 1980; however, no previous assessment of Building 5 had been conducted (PRC 1997d).

For areas where activities indicated the presence of radium, the radiation survey report made the following recommendations for removal actions or isolation.

- Removal actions:
  - should be taken where there is a high potential for human contact and with intact radium sources or with contaminated soil or storm drain sediments, and
  - should be considered where personnel may be exposed to surface activities that may result in radiation doses that exceed a specified action level.
- Isolation of structures may be appropriate where:
  - radioactivity is not producing detectable radiation exposure in normally occupied areas,
  - deed or lease restrictions are appropriate, and
  - excavation or exposure to activity is unlikely and can be minimized by engineering measures.

For Building 5, the radiation survey report identified areas above radiation limits and recommended decontamination of Room 227C of the bearing shop (former radium paint use area located on the second floor above the small parts paint shop). It also recommended limiting access to the drain lines inside the building that discharged to Outfall F from the west side of the building and removal of exposed sections of the storm drain, and suggested removal of subterranean portions of the storm drain. The report could not rule out radium contamination under floor coverings in the bearing shop and recommended further surveys after floor coverings were removed.

For Building 400, the radiation survey report identified areas above radiation limits and recommended decontamination of Rooms 204 and 210 and additional surveys after removal of floor coverings in Rooms 203, 210, and 213, as well as removal of exposed sections of contaminated drain lines within the building and removal of a subterranean line leading from the building to sanitary sewer manhole R112. The report also recommended investigation of soil surrounding the line leading from the building to the manhole (PRC 1997d).

For storm drains and manholes outside of Building 5, the radiation survey report identified several sections of the storm drain line that discharges to Outfall F that had elevated levels of gamma radiation. The report recommended remediation of the storm drains and investigation of surrounding soil (PRC 1997d).

Radiological Surveys of Storm Drains at OU-2C

Initial characterization of the drain lines, storm drain lines, and storm drain manholes associated with Buildings 5 and 400 was conducted in 1996. The characterization survey was performed by pulling a sodium iodide detector through the storm drain lines. Approximately 1,000 feet of the main storm drain line between Building 5 and Seaplane Lagoon were surveyed in August and September 1996. In addition, several manholes in the main storm drain line and the main branch lines were surveyed. Contamination was identified in the main storm drain line and in drain lines exiting Buildings 5 and 400. The report of the survey concluded that the branch lines may have become contaminated due to backflow from Seaplane Lagoon during high tide events (PRC 1997a).

A detailed investigation of the storm drains was conducted in December 1997. The survey included almost 6,000 feet of storm drain and sanitary drain piping. Approximately 4,000 feet of storm and sanitary drain piping contained radium-226 above detection limits (NWT 1998). Removal and replacement or in-place decontamination of storm drain piping and manholes was performed during the period of November 1998 through October 1999. More than 700 feet of contaminated piping outside of Building 5 was removed. Approximately 700 feet of contaminated piping was decontaminated by hydroblasting. This included piping from both Building 5 and Building 400. Three contaminated manholes near Building 5 were removed and replaced (NWT 2002).

During the removal action, a paint-booth drainpipe connected to an abandoned storm drain line was discovered. Between February 1999 and August 1999, additional work was completed to characterize the extent of the abandoned line and the remaining radioactive contamination. A record search revealed that Building 5 had been expanded

and the concrete floor of the new portion of the building had been placed above the abandoned storm drain line. The abandoned line ran from 60 feet west (outside) of Building 5, beneath the western wall, to the eastern wall. Four manholes were discovered under the concrete flooring inside Building 5, trending eastward, and identified as 7F, 8F, 9F, and 10F (Figure 1-7). A survey of this line revealed radioactive contamination (TtEMI 2002b). The approximate location of this abandoned line and the location of a formerly active storm drain line and laterals are shown on Figure 1-4. A cursory survey revealed radioactive contamination in the abandoned line to be approximately one order of magnitude higher than radioactivity in the outside storm drain lines. The higher radioactivity in the abandoned line is consistent with its proximity to the former paint booths and their drainage laterals into the abandoned storm drain. The radioactivity in the abandoned line appears to decrease west (manhole 7F) to east. The survey also found that manhole 10F was not intact and the line between manhole 9F and 10F was not continuous.

Radiological Closeout Survey for Buildings 5 and 400

From October 1998 through April 2000, the Navy performed a radiological closeout survey at Alameda Point for Buildings 5 and 400 in accordance with a Technical Work Document/Removal Action Plan (TtEMI 1998a). The radiological closeout survey was performed to demonstrate that residual radioactive materials associated with Navy activities were present at low levels that satisfy criteria established by RASO, the U.S. Nuclear Regulatory Commission, and the California Department of Health Services. Based on their history and operations, Buildings 5 and 400 were not subject to license requirements under the Atomic Energy Act; therefore, they were not subject to former license termination procedures. However, the field measurement data were compared to residual radioactivity contamination criteria established by the U.S. Nuclear Regulatory Commission and the California Department of Health Services Radiological Health Branch for decommissioning licensed facilities (NRC 1974; DHS 1988). Methods used in the radiological closeout survey were consistent with guidance described in the Manual for Conducting Radiological Surveys in Support of License Termination (NRC 1992) and the MARSSIM (U.S. EPA 2000c), as modified in the Final Status Radiation Survey and Field Sampling Work Plan by Tetra Tech EM Inc. (TtEMI 1998b) and Addendum Confirmation Radiation Survey and Field Sampling Work Plan (TtEMI 2002a). The surveys were designed with the assumption that the radionuclides of interest were radium-226 or strontium-90, for which the most restrictive limits have been established (TtEMI 2001d).

Areas with residual radioactive contamination were removed or documented by the Navy. After decontamination, areas of the buildings were surveyed for alpha or beta-gamma surficial contamination or gamma radiation. Areas previously identified with radioactive contamination exceeding established limits underwent Class I surveys. Adjacent areas underwent Class 2 surveys. Class 3 area surveys for gamma emissions proceeded in the other areas of Building 5 to ensure that no Class 1 or Class 2 areas had been missed in the previous classification of areas of the building. In addition, swipe tests for removal

radioactivity were performed in Building 5 in Rooms 4, 223, 227, 234, and under the spray booths on the first floor.

Results of the radiological closeout survey demonstrated that no significant radioactive contamination remained in Buildings 5 and 400. Results of all final measurements taken during this survey were at or below applicable surface activity limits.

Although the radiological closeout survey for Buildings 5 and 400 was intended to document that these buildings may be considered for release by the Navy for unrestricted public use, as specified by applicable federal and state guidance and polices (U.S. Nuclear Regulatory Commission 1974, 1992; DHS 1988), final acceptance was never received from the U.S. EPA or California DHS. The Historical Radiological Assessment continues to list these buildings as impacted and requiring further surveys or investigations (Weston Solutions, Inc. 2007).

Ongoing Remediation of Radium-Contaminated Storm Drains and Sewer Lines

As described in the 2007 Action Memorandum (TtECI 2007a), removal and replacement of storm drain and sewer lines are planned for OU-2C. The draft Work Plan for the TCRA at IR Sites 5 and 10 (Buildings 5 and 400) (TtECI 2007b) describes the scope and approach for removal of storm drains and sewer lines containing radioactive contaminants external to Buildings 5 and 400, the abandoned line between Buildings 5 and 5A, and any sections of the pipelines at IR Sites 5 and 10 removed and replaced during the 1998-1999 removal that do not meet the release criteria. All existing nonradiological impacted and abandoned lines will be capped at the buildings.

The primary objectives of the removal action are 1) to research and investigate all previous storm and sewer line removal work in OU-2C, including IR Site 5 and Building 400 and storm drain lines from Building 5 to Seaplane Lagoon, which was done by New World Technology in the fall of 1998 and spring of 1999 (NWT 2002), and 2) to complete removal of the storm and sewer lines with radiological contamination in the OU and reconstruct the storm drain system.

The removal action objectives are to protect public health and welfare and the environment by physically removing and disposing of radioactive contamination in excess of 1 picocurie per gram (pCi/g) of radium-226 above background levels, thus preventing potential migration of contaminated material within or outside of the storm drain and sewer systems.

Figure 1-22 shows the storm drain and sewer lines planned for removal during the TCRA (TtEC 2007b). Over 4,000 linear feet of sewer line and over 9,000 linear feet of storm drain lines are planned for removal.

At completion of the TCRA, a final status survey document will be prepared, which will provide the documentation needed to confirm that radiological contamination has been remediated to levels that satisfy criteria established by the Navy RASO, U.S. EPA, and the California DHS.

1.5.2.2 TOTAL PETROLEUM HYDROCARBON REMOVALS AND INVESTIGATIONS

The Alameda Point Petroleum Program is an ongoing program that evaluates all property that is potentially contaminated with petroleum at Alameda Point by applying the Navy's Alameda Point Preliminary Remediation Criteria and Closure Strategy (DON 2001c). Under this program, TPH CAAs have been identified for OU-2C, USTs and ASTs have been identified and characterized, removal actions have been planned and conducted, and closure reports have been prepared. The Petroleum Program has identified four CAAs entirely within the boundaries of OU-2C, a portion of another CAA crossing into the OU, 24 USTs, 27 ASTs, and 5 OWSs. This subsection summarizes previous investigations and results of soil and groundwater sampling and analyses associated with removal of USTs and fuel pipelines, closure of USTs, and TPH removal actions at OU-2C.

Under the Petroleum Program, soil and groundwater samples have been collected at various locations across OU-2C and analyzed for TPH, which includes all TPH fractions (TPH as diesel, gasoline, jet fuel, or motor oil), and the TPH-associated BTEX constituents, methyl tert-butyl ether (MTBE), and lead. Figures 1-23 through 1-25 show the soil and groundwater sampling locations for TPH investigations at IR Sites 5, 10, and 12, respectively.

Underground Storage Tank Investigations

The UST Summary Report (TtEMI 2003c), which was prepared to provide a single, concise reference document for USTs at Alameda Point, identified USTs containing fuels or waste oil that were present or formerly present at each of the IR sites within OU-2C. Seventeen USTs (2-1, 5-1, 5-2, 5-3, 6-1, 6-2, 62-1, 261-1 through 261-3, 282-1, 282-2, 614-1, and 615-1 through 615-4) were located at IR Site 5. One UST (400-1) was located at IR Site 10 and six USTs (10-1 through 10-6) were located at IR Site 12. Each of the USTs at OU-2C has been removed, closed in place, or determined to be exempt from closure (Table 1-2). The removal or in-place closure of USTs at Alameda Point began in 1986 and continued until 1998 (TtEMI 2003c).

UST removal actions were generally conducted by first excavating soil overlying and surrounding the UST, then removing the UST and piping from the excavation and sending the UST and contaminated soil off-site for proper disposal. Following removal of the UST, soil and groundwater (if present) within the excavation were tested for contamination. Overexcavation was conducted when contamination was identified. Confirmation samples were collected following overexcavation (TtEMI 2003c).

IR Site 5. The following paragraphs describe the removal activities and confirmation samples collected for each UST at IR Site 5. The removal or in-place closure of USTs at IR Site 5 began in 1994 and continued through 1998 (TtEMI 2003c).

<u>UST 2-1</u>. A 500-gallon tank used to store diesel was located east of Building 2 near Lexington Street (PWC 1996a, TtEMI 2003c). UST 2-1 was removed on August 25, 1994, and the former tank location was overexcavated. No groundwater was encountered. Four confirmation soil samples (2-C1, 2P-1, 2P-2, and 2-SOUTH) were

collected following the excavation. Samples were analyzed for BTEX and TPH. All results for these samples were below detection limits.

UST 5-1. A 250-gallon tank used to store waste oil was located west of Building 5 near Building 347 (TtEMI 2003c, PWC 1996c). UST 5-1 was installed in 1940 and removed on October 25, 1994; TPH-contaminated soil was excavated. One confirmation soil sample (5-C1) was collected following the excavation and analyzed for BTEX, TPH, and lead. All results were below detection limits except for TPH as diesel, jet propellant grade 5 (JP-5), and motor oil, which were reported at concentrations up to 38 mg/kg. One monitoring well (M05-02, installed in 1991) is located near the tank. Analysis of groundwater from this well indicated the presence of VOCs and TPH at concentrations up to 230 µg/L.

UST 5-2. A 4,000-gallon steel tank used to store jet fuel was located east of Building 5 (TtEMI 1997, 2003c). UST 5-2 was removed on June 24, 1997. Soil samples (NAS05-01-S-07-E and -W, and NAS05-01-S-09-E) and a groundwater sample were collected following the UST removal (TtEMI 1997). The groundwater sample (NAS05-01-W-07) contained benzene at a 7 µg/L and TPH as diesel at 864,000 µg/L. As part of the TPH data gap investigation in 2000, two groundwater samples were collected near the former location of this UST (CA05-01 and CA05-02). Samples were analyzed for VOCs, TPH, lead, and general chemistry. Several VOCs were reported in the groundwater samples, with the highest concentration being 35 µg/L for 1,1-DCA. TCE was reported in both groundwater samples at a maximum concentration of 15 µg/L.

Two monitoring wells (FWBZ well M05-07 and SWBZ well D05-02) near the former location of UST 5-2 were sampled for TPH in 2001. Groundwater samples collected from M05-07 contained TPH as diesel and TPH as gasoline, and samples from D05-02 contained TPH as motor oil. The former location of UST 5-2, along with the location of UST 5-3, are designated as AOC 005 and are located within CAA 5A (Figure 1-3).

UST 5-3. A 320-gallon steel tank used to store waste oil and solvents was located east of Building 5 (TtEMI 1999d, 2003d). A preliminary site characterization performed in 1996 using the site characterization and analysis penetrometer system (SCAPS) investigated the presence of NAPL in the vicinity of waste oil and solvent tank UST 5-3 (Constanza 1998; Stettler 1997). Four soil samples were collected from two locations in the vicinity subsequently designated as Plume 5-4 to confirm SCAPS data. One sample was collected from 35 feet bgs at location IR5-01 and three samples were collected from 8, 9, and 30 feet bgs at location IR5-02; these samples were analyzed for VOCs and SVOCs. High levels of VOCs including 1,1,1-TCA and TCE were detected in the samples collected from the 8- and 9-foot depth intervals. SVOCs were not present above detection limits in any of the samples.

UST 5-3 was removed on December 8, 1998. Contaminated soil was removed. The product line was reported to have a 3-inch hole (TtEMI 1999d). Soil samples collected after the UST removal (locations 030-MOD1-283, -284, and -285) contained chlorinated VOCs and TPH. Lead was reported at a concentration above the Alameda Point background level in one sample. No groundwater samples were collected at the time of UST removal. As part of the TPH data gap investigation in 2000, one groundwater

sample (CA05-03) was collected near the former location of this UST. Samples were analyzed for VOCs, TPH, lead, and general chemistry. The VOC reported at the highest concentration in that sample was 1,1-DCE at 780 µg/L. Only TPH as motor oil was reported above the detection limit at a concentration of 670 µg/L. A groundwater sample collected from nearby well M05-04 in 2001 was analyzed for TPH and contained TPH as gasoline at a concentration of 220 µg/L. As described above, the former location of UST 5-3 is part of AOC 005 and is located within CAA 5A.

UST 6-1 and UST 6-2. Two 2,500-gallon steel tanks that were used to store petroleum solvents were located in the courtyard at Building 6 (PWC 1996d, TtEMI 2003c). The two USTs were removed on February 16, 1995, in unknown condition, and contaminated soil was removed. Soil samples and a groundwater sample were collected and analyzed for TPH, BTEX, and lead. Soil samples (T6-E, T6-N, T6-S, T6-W, T6-W1, and 6-1-T) collected after the UST removal contained TPH concentrations up to 60 mg/kg, and the groundwater sample (6-L) contained TPH concentrations up to 1,200 µg/L and lead at 100 µg/L. Monitoring wells were not installed. The former location of the two USTs has been designated UST(R)-02.

UST 62-1. A 2,000-gallon fiberglass tank used to store diesel was located south of Building 62 near Building 5 (TtEMI 1999f, 2003c). UST 62-1 was removed on November 20, 1998. Contaminated soil was removed. Two soil samples (030-MOD1-201 and 030-MOD1-202) were collected and analyzed for VOCs, TPH, SVOCs, and metals. Only TPH as motor oil, two PAH compounds, and metals were reported at concentrations above detection limits.

UST 261-1 and UST 261-2. Two 800-gallon steel tanks used to store kerosene were located near Building 261, south of Building 5 (PWC 1996b, TtEMI 2003c). Both tanks were installed in 1943 and removed on December 8, 1994. Soil was not removed and samples were not collected because tanks were housed in a concrete vault. The vault was filled with concrete during the demolition of Building 261 (PWC 1996b). Soil samples were collected from the excavation for the piping that led from these USTs to the Building 5 extension. Samples collected at 261-S1 through S61-S10 were analyzed for BTEX; chlorinated hydrocarbons; lead; metals; TRPH; and TPH as gasoline, motor oil, diesel, and jet fuel.

UST 261-3. A 1,500-gallon steel tank used to store the solvent PD-680 (solvent naphtha) was located near Building 261, south of Building 5 (PWC 1996b, TtEMI 2003c). UST 261-3 was installed in 1943 and removed on December 8, 1994. Soil samples (261-3E, 261-3N; 261-3S; 261-3W and 261-3-T) were collected from the excavation and analyzed for BTEX (other than cadmium, thallium and selenium), chlorinated hydrocarbons, lead, metals, TRPH, and TPH as gasoline, motor oil, diesel, and jet fuel. Low concentrations of lead, metals, and TPH as diesel and jet fuel were reported in the samples. Concentrations of TPH as motor oil ranged from 54 to 290 mg/kg. Concentrations of cadmium, thallium and selenium were above Alameda Point background.

One groundwater sample was collected from the excavation (261-3L) and analyzed for BTEX and TPH. Analytes reported at concentrations above detection limits included TPH as diesel, gasoline, and jet fuel. TPH concentrations (2,500 to 15,000 µg/L) exceeded comparison criteria. Additionally, in 1999, groundwater samples were collected from three geoprobe sampling locations (057-001, 057-002, and 057-008) and analyzed for VOCs and TPH. COPCs reported included the VOCs 1,1-DCA; 1,1-DCE; ethylbenzene; TCE; vinyl chloride; xylenes; and TPH as diesel, gasoline, and jet fuel (TtEMI 2003c). As part of the TPH data gap investigation in 2000, one groundwater sample (CA05-04) was collected near the former location of UST 261-3. Samples were analyzed for VOCs, TPH, lead, and general chemistry. Fuel constituent 1,2,4-trimethylbenzene was reported at a concentration of 98 µg/L, which was the highest VOC concentration; TPH as gasoline was reported at 2,600 µg/L, which was the highest concentration of the fuel fractions.

UST 282-1 and UST 282-2. Two 7,500-gallon steel tanks were located near Building 282. UST 282-1 stored diesel fuel and UST 282-2 stored unleaded gasoline (IT 1998, TtEMI 2003c). Both tanks were removed on October 29, 1998, in good condition. Contaminated soil was excavated. Soil and groundwater samples were collected and analyzed for TPH and BTEX. Soil samples collected from monitoring well borings (282-MW1 through 282-MW3) after the UST removal contained TPH concentrations up to 33 mg/kg; discrete groundwater samples collected at 14 locations (282-1-ERM through 282-14-ERM) contained BTEX and TPH concentrations up to 4,234 µg/L. Three monitoring wells (282-MW1 through 282-MW3) were installed, and monitoring well groundwater samples contained TPH concentrations up to 310 µg/L (TtEMI 2003c).

UST 614-1**.** A 20,000-gallon steel tank was located near Building 614, to the west of Building 5. This tank was designed for use as an emergency overflow tank in the event that chemical offloading in Building 614 resulted in a spill. No spill occurred in Building 614, and the UST did not contain hazardous materials. This UST remains in place (TtEMI 2003c).

UST 615-1 and UST 615-2. Two steel tanks with capacities of 10,000 gallons and 5,000 gallons, respectively, were associated with Building 615, located south of Building 5. These USTs were designed for use as emergency overflow tanks in the event that chemical offloading in Building 615 resulted in a spill. No spills occurred and the USTs did not contain hazardous materials. These tanks remain in place and have been identified as exempt from regulatory closure (TtEMI 2003c).

UST 615-3. A 50-gallon steel tank used to store oil and water, and also known as OWS 615, was located near Building 615, south of Building 5 (PWC 1997b, TtEMI 2003c). The tank was removed on December 20, 1994. One soil sample (615-3C) was collected during tank excavation and analyzed for BTEX, TPH, and lead. Only TPH as diesel, jet fuel, and motor oil were reported at low concentrations. A discrete groundwater sample (615-001) was collected and analyzed as part of the UST MTBE investigation in 1999 and contained several chlorinated VOCs and MTBE. One VOC (4-methyl-2-pentanone) was reported at a concentration of 1,300 µg/L

(TtEMI 2003dc). A no further action Closure Report was submitted to the Water Board in February 2000 and the Water Board approved closure on July 27, 2001 (TtEMI 2003a).

UST 615-4. An 80-gallon steel tank used to store waste oil was located near Building 615 (TtEMI 1999e, 2003c). The tank was removed on December 9, 1998. One soil sample was collected (030-MOD1-181) and analyzed for VOCs, TPH, SVOCs, and metals. The maximum TPH concentration was for TPH as gasoline at a concentration of 6,100 mg/kg. Several SVOCs were reported at concentrations above residential PRGs. As part of the TPH data gap investigation in 2000, four soil samples (CA05-06 through CA05-09) were collected around the former location of this UST. Samples were analyzed for TPH and SVOCs. TPH as diesel and as gasoline were reported at maximum concentrations of 1,200 mg/kg and 230,000 mg/kg, respectively. No groundwater sampling was conducted.

IR Site 10. The following paragraphs describe the removal activities and confirmation samples collected for the UST at IR Site 10.

UST 400-1. A 250-gallon steel tank used to store diesel fuel was located on the north side of Building 400 (PWC 1997c, TtEMI 2003c). UST 400-1 was installed in the mid-1940s and was removed on January 26, 1995, in good condition; TPH-contaminated soil was excavated. As part of the UST removal, four soil samples (400-E, 400-N, 400-S, and 400-W), one from each side of the tank, were collected from the bottom of the excavation. Soil samples contained TPH concentrations up to 14,000 mg/kg. No groundwater was observed in the excavation.

Three phases of investigation were conducted to assess soil and groundwater in the vicinity of this former UST. Soil and discrete groundwater samples were collected at fifteen locations (400-1-MOJ through 400-14-MOJ and 400-17-MOJ) inside and outside Building 400 in 1997 and were analyzed for BTEX; MTBE; and TPH as gasoline, diesel, jet fuel, and motor oil. Additionally, one soil sample was collected from 400-15-MOJ and one groundwater sample was collected at 400-16-MOJ; they were analyzed for the same compounds. TPH as gasoline and TPH as diesel were reported in soil samples from 400-8-MOJ and 400-11-MOJ at concentrations up to 2,200 mg/kg. TPH as motor oil was reported only in the sample collected at 400-17-MOJ at a concentration of 74 mg/kg. Discrete groundwater samples (400-1-MOJ, 400-2-MOJ, 400-3-MOJ, 400-16-MOJ, and 400-17-MOJ) contained TPH at concentrations up to 48,000 µg/L.

Three monitoring wells (400MJ-MW1, 400MJ-MW2, 400MJ-MW3) were installed in 1997, and sampled in 1997, 1998, and 1998 (TtEMI 2003c). Groundwater samples from these wells contained TPH concentrations up to 1,600 µg/L. A discrete groundwater sample (400-001) was collected as part of the UST MTBE investigation in 1999 and contained several chlorinated VOCs and MTBE. Only 1,1-DCA was reported at a concentration above the screening criterion for that investigation (MCL of 5 µg/L). As part of the TPH data gap investigation in 2000, one groundwater sample (CA05-05) was collected near the former location of this UST. Samples were analyzed for VOC, TPH, and SVOCs. The chlorinated VOC 1,1-DCA was reported at a concentration of 3.3 µg/L, and TPH as diesel and motor oil were reported at concentrations of 6,400 and 3,000 µg/L,

respectively. The former location of UST 400-1 is within CAA 5C, which is being addressed under the Petroleum Program.

IR Site 12. The following paragraphs describe the removal activities and confirmation samples collected for each UST at IR Site 12. The removal or in-place closure of USTs at IR Site 12 was completed by 1993 (TtEMI 2003c).

UST 10-1, UST 10-2, UST 10-3, UST 10-4, and UST 10-5. Four 17,000-gallon steel tanks and one 24,000-gallon l tank (UST 10-5) used to store fuel oil were located on the northeastern side of Building 10 (PRC 1996; TtEMI 2003c). The tanks were installed between 1960 and 1970, and closed before 1987. Each UST was closed in place and filled with sand. Soil and groundwater samples were collected in the vicinity of the USTs in 1993 (borings SB10-01 through SB10-10) and additional discrete groundwater samples were collected at three locations (010-001 through 010-003) as part of the UST MTBE investigation in 1999. Only TPH as motor oil was reported in soil samples collected near these USTs. Discrete groundwater samples collected after the UST closure contained BTEX compounds at concentrations of up to 3 µg/L and TPH as motor oil at concentrations up to 3,700 µg/L. In 1999, TCE was reported at a concentration of 0.9 µg/L (boring 010-002) (TtEMI 2003c).

UST 10-6. A 2,500-gallon steel tank used to store unleaded gasoline was located on the southwest side of Building 10 (PRC 1996d; TtEMI 2003c). UST 10-6 was installed between 1960 and 1970, and removed on July 06, 1993, in good condition with no holes. Four soil samples (TP106-01-S through TP106-04-S) were collected from the sides of the excavation (locations NSTP, ESTP, SSTP, WSTP) and one groundwater sample (TP106-07-W at location TP) was collected from the center of the excavation. Total xylenes (16 mg/kg) and TPH as motor oil (60 mg/kg) were the only analytes reported in soil. The groundwater samples collected from the excavation did not contain any TPH or BTEX compounds at concentrations above detection limits. One groundwater sample (location 010-005) was collected near the former location of UST 10-6 as part of the UST MTBE investigation in 1999. No VOCs were reported at concentrations above detection limits in this sample (TtEMI 2003c).

The five monitoring wells installed at IR Site 12 (M12-01 through M12-04 and D12-01) provided data for groundwater in the vicinity of the six USTs at IR Site 12. Some groundwater samples collected from the four shallow wells contained VOCs at low concentrations (up to 6.0 µg/L for cis-1,2-DCE). A no further action application for all six USTs was submitted to the Water Board in February 2000 (TtEMI 2003c).

Aboveground Storage Tanks

The Petroleum AST Assessment and Closure Request (SulTech 2004) was prepared to address former and existing ASTs at Alameda Point that had been used to store and dispense petroleum products. ASTs at OU-2C addressed by this report included ASTs 405A and 405B at IR Site 5 and ASTs 010A through 010K at IR Site 12. This report did not address ASTs that did not contain petroleum products or that were within the boundaries of TPH CAAs, commingled CERCLA plumes, or RCRA permitted units, which includes ASTs 005A through 005H, 032C, 261, and 500 at IR Site 5 and

AST 010L at IR Site 12. No ASTs were identified at IR Site 10. Each of these 25 ASTs at OU-2C has been removed, closed in place, or requires further investigation (Table 1-3). Two additional ASTs, one located at Building 2 (AST 002) and one at Building 32 (AST 032), were installed by building tenants and are not Navy property.

The only previous soil and groundwater sampling that has been conducted to address ASTs were collected as part of the EBS in 1995 and as part of the UST MTBE investigation in 1999. One groundwater sample (location 010-005) was collected near the former location of AST 010J. No VOCs were reported at concentrations above detection limits in this sample (TtEMI 2003c).

Fuel Line Summary

Removal work for the pipelines associated with the basewide fuel distribution system was conducted at Alameda Point from June 1998 to February 1999 and May to June 1999 (TtEMI 2000b). During 1998 and 1999, 29,634 linear feet of fuel line was removed, and 23,788 linear feet of fuel line was abandoned in place by cleaning and grouting the lines. The removed and abandoned fuel lines included some fuel lines located at IR Site 5. Additional fuel pipeline removal activities conducted from September to December 2001 included plans to address fuel pipelines suspected to be located along Monarch Street (northwest of Building 5) and West Tower Avenue (south of Buildings 5 and 10 and north of Building 400); however, additional pipelines could not be located within the boundaries of OU-2C and likely do not exist (IT 2001b, 2002d). Therefore, no fuel lines were removed or abandoned at IR Sites 10 and 12 (IT 2002d).

Pipeline removal activities were divided into nine areas, two of which (Areas 1 and 2) were located partially within OU-2C. Confirmation soil and groundwater samples were collected from fuel pipeline trenches after pipeline removal and overexcavation. Samples were analyzed for VOCs, TPH, SVOCs, metals, and pH.

The portion of Area 1 within OU-2C consisted of the portion of an east-west pipeline extending from Monarch Street to the west side of Building 5 and the portion of a north-south pipeline extending along Monarch Street from the east-west pipeline to the southern OU-2C boundary at West Tower Avenue. All of these pipelines were removed. Groundwater was not encountered during removal of pipelines, which were at depths of approximately 2.5 to 3.5 feet bgs. Soil samples were collected at eight locations along the excavation trench (030-S05-001 through 030-S05-006, 030-S05-009, and 030-FLI-038). Analytical results indicated low concentrations of BTEX compounds in one sample (030-S05-009). TPH as diesel and gasoline were reported in one sample (030-S05-009); TPH as motor oil was reported in four additional samples. SVOCs were reported in approximately half of the soil samples. Only the sample from location 030-S05-009 had PAH concentrations above the Alameda Point B(a)P equivalent screening level. With the exception of vanadium in one sample (030-S05-005), metals concentrations were below Alameda Point background levels (TtEMI 2000b).

The portion of Area 2 within OU-2C consisted of two parallel pipelines extending east from the east side of Building 5 to the western boundary of OU-2C. These pipelines were removed. Groundwater was encountered at the western end of the pipeline, which was as

deep as 9 feet bgs. Soil samples were collected at six locations along the excavation trench (030-S05-007, 030-S05-008, 030-S05-010, 030-S08-008, 030-S08-009, and 030-FLI-039) and a groundwater sample was collected at the western end of the trench (030-S05-011) next to Building 5. No VOCs were reported in soil samples at concentrations above detection limits. TPH as gasoline and/or JP-5 were reported in several soil samples and TPH as motor oil was reported in four soil samples. TPH concentrations were above 100 mg/kg at four locations (120 to 395 mg/kg), which was the criterion for determining whether TPH contamination needed further action under the pipeline removal program. SVOCs were reported in most of the soil samples, but no soil samples had B(a)P equivalent concentrations above the Alameda Point screening level. Metals concentrations were below Alameda Point background levels (TtEMI 2000b).

Two groundwater samples were collected at location 030-S05-011. Chlorinated VOCs consistent with those previously reported in this area were reported in these samples at concentrations up to 110 µg/L. TPH as gasoline, JP-5, and motor oil was reported in these samples with JP-5 reported at a concentration of 106 mg/L. Several metals, including antimony, arsenic, cadmium, chromium, and lead, were reported at concentrations above groundwater comparison criteria (TtEMI 2000b).

For the portion of Area 1 within OU-2C, no significant TPH contamination along the former fuel pipe lines was identified and no further action under the Petroleum Program was required. For Area 2, significant TPH contamination (greater than 100 mg/kg in soil and greater than 100 mg/L in groundwater) in several localized areas was identified following pipeline removal. Area 2 has been designated part of TPH Former Fuel Line CAA B (TtEMI 2000b, 2003c).

Petroleum Program Corrective Action Areas

Five areas within OU-2C have been identified as CAAs under the Alameda Point Petroleum Program (Figure 1-4). CAA 5A is located on the east side of Building 5 within IR Site 5. CAA 5B and CAA 5B West are located south of Building 5 within IR Site 5. CAA 5C is located north of Building 400 at the former location of UST 400-1, within IR Site 10. A portion of CAA B, a former fuel line, extends from the eastern side of Building 5 to the eastern margin of IR Site 5. Other portions of fuel line CAA B cross parts of the storm drain extensions of IR Site 5 between West Tower Avenue and Seaplane Lagoon.

Former Fuel Line Corrective Action Area B. Petroleum Program former fuel line CAA B consists of a series of three parallel east-west fuel lines with cross-connecting north-south lines beneath the parking apron south of OU-2C and north of Seaplane Lagoon plus the former fuel pipeline corridor extending north from Seaplane Lagoon that connects to an east-west line extending east from Building 5. For the most part, only the western portion of the former pipeline corridor extending east of Building 5 is within OU-2C. There is also a small portion of CAA B that intersects the storm drain corridor on the western side of OU-2C south of West Tower Avenue. TPH is present in soil and groundwater and metals are present in groundwater along the CAA B corridor east of Building 5. Because chlorinated VOCs are also present in this area, the portion of

CAA B within OU-2C east of Building 5 is being addressed under the CERCLA Program for further action as part of OU-2C (TtEMI 2003a).

Corrective Action Area 5A. Petroleum Program CAA 5A is the area east of Building 5 in the vicinity of the former locations of USTs 5-2 and 5-3 where soil and groundwater were contaminated with TPH and lead. Because chlorinated VOCs are also present in this area, CAA 5A is being addressed under the CERCLA Program for further action as part of OU-2C (TtEMI 2003a).

Corrective Action Area 5B. Petroleum Program CAA 5B is the area south of Building 5 in the vicinity of the former locations of Buildings 261, 348, and 415, and associated USTs 261-1 through 261-3 and 615-1 through 615-4. This is an area where soil and groundwater were contaminated with TPH and lead. Because chlorinated VOCs are also present in this area, CAA 5B is being addressed under the CERCLA Program for remediation as part of OU-2C (TtEMI 2003a).

Corrective Action Area 5B West. Petroleum Program CAA 5B West is the area south of Building 5 in the vicinity of monitoring well M05-03 and the former plating shop wastewater pretreatment facility. This is an area where soil and groundwater were contaminated with TPH as gasoline.

Evidence of floating product (based on a groundwater TPH concentration that exceeded the Alameda TPH Strategy indicator value of 20 mg/L) was reported in monitoring well M05-03, screened at a depth of 4 to 12 feet bgs. Well M05-03 is located in the paved area between Building 5 and Building 400, and at the southeastern corner of the vault the that formerly contained the cyanide destruction and plating wastewater pretreatment units. A groundwater sample collected from this well in 2001 contained TPH as gasoline at a concentration of 486,000 mg/L. In order to verify the presence or absence and evaluate the extent of floating product, temporary piezometers were installed in the target areas and monitored for floating product (Figure 1-26). The piezometers were developed, sampled, and monitored for a period that included the expected seasonal high and seasonal low groundwater elevations. Soil and groundwater samples were collected from the temporary piezometers and analyzed for TPH-related constituents. Analytical results were compared to the floating product comparison criteria published in the Alameda TPH Strategy.

Indications of floating product in the initial round of piezometers installed (CAA-5B-TMP-001 through CAA-5B-TMP-004) led to the selection of six step-out locations (CAA-5B-TMP-005, CAA-5B-TMP-006, CAA-5B-TMP-007, CAA-5B-TMP-008, CAA-5B-TMP-009, and CAA-5B-TMP-010) to further evaluate the extent of floating product south of Building 5. One additional round of piezometer installation was conducted in the CAA 5B floating product investigation area in October 2005, when three piezometers (CAA-5B-TMP-011, CAA-5B-TMP-012, and CAA-5B-TMP-013) were installed to investigate the northward extent of floating product south of Building 5. There were numerous indications of free product, with six borings yielding positive indications for one or more of the free-product indicators. The northern margin of free product may extend beneath Building 5. The southern, eastern, and western margins appear fairly well delineated (Figure 1-26).

The area surrounding well M05-03 has been designated CAA 5B West and a corrective action is planned in accordance with the Final Project Plan for Petroleum CAA 5B West (Shaw 2007). A dual vacuum extraction (DVE) will be used to remove free product, which will be treated at the CAA 3 Treatment Plant. CAA 5B West is being addressed under the Petroleum Program.

Corrective Action Area 5C. Petroleum Program CAA 5C is the area north of Building 400 in the vicinity of the former location of UST 400-1, where soil and groundwater were contaminated with TPH. CAA 5C is still being addressed under the Petroleum Program.

1.5.2.3 RESOURCE CONSERVATION RECOVERY ACT INVESTIGATIONS

A RCRA Facility Assessment was conducted at Alameda Point in 1992 to identify SWMUs and areas of concern and to evaluate the need and scope of a RCRA facility investigation. Eighty-five SWMUs and AOCs were identified in the RCRA Facility Assessment (DTSC 1992). Many results of the RCRA Facility Assessment and RCRA facility investigation–related activities at Alameda Point are summarized in the EBS report (IT 2001a).

RCRA-permitted facilities at OU-2C included a hazardous waste storage facility (identified at M-12) located at the southeastern corner of Building 5 in formerly fenced area containing former Building 415, IWTP 5 (HW-05) located south of Building 5, and IWTP 32 (HW-02) located in Building 32 (Figure 1-23). All three units have been closed, with closure approved by DTSC on July 27, 2001, for M-12 and on October 12, 1999, for IWTP 5 (DTSC 1999a, 2001). Operations at Building 32, which contained IWTP 32, were discontinued at time of base closure and a RCRA Part B Permit Closure report was issued in February 2000 (IT 2000).

Previous soil and groundwater sampling at hazardous waste storage facility M-12 and IWTP 5 was conducted as part of the NAS Alameda RI/FS (locations M05HW-01 and B05HW-02) and the EBS.

Soil and groundwater samples were collected at Building 32 as part of RCRA closure actions for IWTP 32. Subsurface soil samples and groundwater samples were collected in 1999 at seven locations (066-IWTP-001 through 066-IWTP-007) beneath the northern and western perimeter of Building 32. Samples were analyzed for VOCs, SVOCs, metals including hexavalent chromium, and pH. Several VOCs and PAHs were reported at low concentrations in soil and groundwater. Metals were reported at concentrations consistent with background levels and hexavalent chromium was reported at a low concentrations in soil samples from two locations (066-IWTP-003 and 066-IWTP-007) (IT 2000, Shaw 2003b). In 2004, soil samples were collected at four additional locations (IWTP32-SB008 through IWTP32-SB011) beneath the western and southern perimeter of Building 32. Samples were collected at three depths (0 to 0.5 foot and 4 to 4.5 feet bgs, and at the groundwater interface) and analyzed for VOCs, metals including hexavalent chromium, and cyanide. Two VOCs were reported at low concentrations and metals were reported at concentrations comparable to background. Hexavalent chromium or cyanide was not reported at concentrations above detection limits. Locations of soil and groundwater sampling at Building 32 are shown on Figure 1-23.

Table 4-8
Organic and Inorganic Analytes Reported in Soil Samples at IR Site 5[a]

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda Point–Specific Comparison Criteria[e]
Volatile Organic Compounds (mg/kg)													
acetone	635	221	35	0.0033	0.61	NA	0	—[f]	14,000	—	54,000	—	—
benzene	683	64	9.4	0.00065	6	NA	3	—	0.64	—	1.4	—	—
bromochloromethane	399	5	1.3	0.0012	0.0034	NA	0	—	—	—	—	—	—
bromomethane	612	14	2.3	0.0019	0.04	NA	0	—	3.9	—	13	—	—
2-butanone	668	156	23	0.00077	1.2	NA	0	—	22,000	—	110,000	—	—
n-butylbenzene	432	10	2.3	0.0007	77	NA	0	—	240	—	240	—	—
sec-butylbenzene	432	13	3	0.0021	59	NA	0	—	220	—	220	—	—
tert-butylbenzene	421	4	0.95	0.0041	10	NA	0	—	390	—	390	—	—
carbon disulfide	634	83	13	0.0011	0.019	NA	0	—	360	—	720	—	—
chlorobenzene	615	49	8	0.00052	0.012	NA	0	—	150	—	530	—	—
chloroethane	645	4	0.62	0.016	0.031	NA	0	—	3	—	6.5	—	—
chloroform	612	2	0.33	0.001	0.002	NA	0	—	0.22	0.94	0.47	2	—
chloromethane	612	12	2	0.002	0.048	NA	0	—	47	—	160	—	—
1,2-dichlorobenzene	686	15	2.2	0.00067	1.0	NA	0	—	600	—	600	—	—
1,3-dichlorobenzene	653	1	0.15	0.00081	0.00081	NA	0	—	530	—	600	—	—
1,4-dichlorobenzene	653	2	0.31	0.0026	0.0041	NA	0	—	3.4	—	7.9	—	—
1,1-dichloroethane	645	26	4	0.0006	4.3	NA	1	—	510	2.8	1,700	6	—
1,2-dichloroethane	646	4	0.62	0.00039	0.0096	NA	0	—	0.28	—	0.6	—	—
1,1-dichloroethene	679	12	1.8	0.0012	0.26	NA	0	—	120	—	410	—	—
cis-1,2-dichloroethene	619	31	5	0.0003	3.1	NA	0	—	43	—	150	—	—
trans-1,2-dichloroethene	540	6	1.1	0.00039	0.0016	NA	0	—	69	—	230	—	—
1,2-dichloropropane	612	1	0.16	0.0039	0.0039	NA	0	—	0.34	—	0.74	—	—
ethylbenzene	720	24	3.3	0.00097	27	NA	0	—	400	—	400	—	—
hexachlorobutadiene	662	2	0.3	0.00084	0.0037	NA	0	—	6.2	—	22	—	—
2-hexanone	601	37	6.2	0.00046	0.26	NA	0	—	—	—	—	—	—
isopropylbenzene	432	9	2.1	0.0071	39	NA	0	—	570	—	2,000	—	—
p-isopropyltoluene	420	19	4.5	0.00058	81	NA	0	—	—	—	—	—	—
methyl tert-butyl ether	389	1	0.26	0.0012	0.0012	NA	0	—	17	—	36	—	—
methylene chloride	647	39	6	0.0005	1.7	NA	0	—	9.1	—	21	—	—
4-methyl-2-pentanone	634	128	20	0.00099	0.035	NA	0	—	5,300	—	47,000	—	—
n-propylbenzene	432	14	3.2	0.00061	77	NA	0	—	240	—	240	—	—
tetrachloroethene	679	65	9.6	0.0006	33	NA	4	—	0.48	—	1.3	—	—
toluene	719	127	18	0.0007	84	NA	0	—	520	—	520	—	—
1,2,3-trichlorobenzene	387	3	0.78	0.0024	0.0059	NA	0	—	—	—	—	—	—
1,2,4-trichlorobenzene	653	3	0.46	0.0011	0.0035	NA	0	—	62	—	220	—	—

Table 4-8 (continued)

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda Point–Specific Comparison Criteria[e]
Volatile Organic Compounds (mg/kg) (continued)													
1,1,1-trichloroethane	679	29	4.3	0.00046	7.6	NA	0	—	1,200	—	1,200	—	—
trichloroethene	679	78	11	0.0011	20	NA	11	—	0.053	2.9	0.11	6.5	—
1,2,4-trimethylbenzene	432	23	5.3	0.0018	550	NA	3	—	52	—	170	—	—
1,3,5-trimethylbenzene	432	16	3.7	0.0016	180	NA	3	—	21	—	70	—	—
2,2,4-trimethylpentane	376	3	0.8	0.016	2.5	NA	0	—	—	—	–	—	—
vinyl chloride	679	3	0.44	0.0064	0.08	NA	1	—	0.079	—	0.75	—	—
xylenes, total	720	57	7.9	0.00182	240	NA	0	—	270	—	420	—	—
Total Petroleum Hydrocarbons (mg/kg)													
diesel	375	75	20	1.6	15,000	NA	NA	—	—	—	—	—	—
gasoline	330	26	7.9	0.21	230,000	NA	NA	—	—	—	—	—	—
JP-5	217	16	7.4	1.1	14,000	NA	NA	—	—	—	—	—	—
motor oil	345	117	34	2	16,000	NA	NA	—	—	—	—	—	—
oil and grease	34	27	79	121	883	NA	NA	—	—	—	—	—	—
petroleum hydrocarbons, total recoverable	23	9	39	31.1	4,020	NA	NA	—	—	—	—	—	—
Semivolatile Organic Compounds other than PAHs (µg/kg)													
benzoic acid	270	1	0.37	290	290	NA	0	—	100,000,000	—	100,000,000	—	—
bis(2-chloroethyl)ether	436	1	0.23	400	400	NA	1	—	220	—	580	—	—
bis(2-ethylhexyl)phthalate	444	52	12	19	44,000	NA	1	—	35,000	—	120,000	—	—
butyl benzyl phthalate	436	14	3.2	18	35	NA	0	—	12,000,000	—	100,000,000	—	—
carbazole	332	4	1.2	45	1,300	NA	0	—	24,000	—	86,000	—	—
4-chloro-3-methylphenol	436	5	1.1	19	40	NA	0	—	—	—	—	—	—
2-chlorophenol	436	1	0.23	29	29	NA	0	—	63,000	—	240,000	—	—
di-n-butyl phthalate	436	35	8	20	200	NA	0	—	6,100,000	—	62,000,000	—	—
dibenzofuran	436	3	0.69	120	4,400	NA	0	—	150,000	—	1,600,000	—	—
diethyl phthalate	436	10	2.3	18	110	NA	0	—	49,000,000	—	100,000,000	—	—
dimethyl phthalate	436	1	0.23	44	44	NA	0	—	100,000,000	—	100,000,000	—	—
di-n-octyl phthalate	436	1	0.23	18	18	NA	0	—	2,400,000	—	25,000,000	—	—
1,4-dioxane	170	1	0.59	31	31	NA	0	—	44,000	—	160,000	—	—
4-nitrophenol	436	2	0.46	77	110	NA	0	—	—	—	—	—	—
N-nitroso-di-n-propylamine	436	2	0.46	23	23	NA	0	—	69	—	250	—	—
pentachlorophenol	435	2	0.46	37	190	NA	0	—	3,000	—	9,000	—	—
phenol	444	7	1.6	32	2,800	NA	0	—	18,000,000	—	100,000,000	—	—

Table 4-8 (continued)

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda Point–Specific Comparison Criteria[e]
Polycyclic Aromatic Hydrocarbons (µg/kg)													
acenaphthene	629	92	15	0.2	180	NA	0	—	3,700,000	—	29,000,000	—	—
acenaphthylene	629	135	21	0.2	280	NA	0	—	—	—	—	—	—
anthracene	629	193	31	0.2	720	NA	0	—	22,000,000	—	100,000,000	—	—
benz(a)anthracene	629	374	59	0.2	1,200	NA	1	—	620	—	2,100	—	620
benzo(b)fluoranthene	629	464	74	0.2	1,000	NA	3	—	620	—	2,100	—	620
benzo(k)fluoranthene	629	366	58	0.2	970	NA	3[g]	—	6,200	380	21,000	1,300	620
benzo(g,h,i)perylene	629	441	70	0.1	1,200	NA	0	—	—	—	—	—	—
benzo(a)pyrene	629	438	70	0.2	1,500	NA	28	—	62		210	—	620
chrysene	629	429	68	0.2	1,500	NA	0[g]	—	62,000	3,800	210,000	13,000	620
dibenz(a,h)anthracene	629	225	36	0.2	180	NA	4	—	62	—	210	—	620
fluoranthene	629	423	67	0.2	3,800	NA	0	—	2,300,000	—	22,000,000	—	—
fluorene	629	113	18	0.2	250	NA	0	—	2,700,000	—	26,000,000	—	—
indeno(1,2,3-cd)pyrene	629	369	59	0.2	1,200	NA	2	—	620	—	2,100	—	620
2-methylnaphthalene	629	195	31	0.2	1,400	NA	0	—	—	—	—	—	—
naphthalene	641	288	45	0.2	3,500	NA	1	—	56,000	1,700	190,000	4,200	—
phenanthrene	629	391	62	0.2	4,100	NA	0	—	—	—	—	—	—
pyrene	629	471	75	0.1	4,300	NA	0	—	2,300,000	—	29,000,000	—	—
Polychlorinated Biphenyls (µg/kg)													
Aroclor 1260	237	7	3	15	1,900	NA	1	—	220	—	740	—	—
Organochlorine Pesticides (µg/kg)													
aldrin	53	1	1.9	8.3	8.3	NA	0	—	29	—	100	—	—
beta-BHC	53	1	1.9	1.5	1.5	NA	0	—	320	—	1300	—	—
delta-BHC	53	1	1.9	2.8	2.8	NA	0	—	—	—	—	—	—
alpha-chlordane	53	2	3.8	1.3	1.8	NA	0	—	1,600	—	6,500	—	—
gamma-chlordane	53	1	1.9	2.3	2.3	NA	0	—	1,600	—	6,500	—	—
4,4'-DDT	53	2	3.8	2.6	3.9	NA	0	—	1,700	—	7,000	—	—
endrin aldehyde	32	1	3.1	3.6	3.6	NA	0	—		—		—	—
heptachlor	53	1	1.9	1.7	1.7	NA	0	—	110	—	380	—	—
Organophosphorus Pesticides (µg/kg)[h]	0	0	0	0	NA		0	—	Various	—	Various	—	—
Cyanide (µg/kg)	202	5	2.5	360	6,300	NA	0	—	1,200,000	—	12,000,000	—	—
Butyltins (µg/kg)													
tributyltin	34	1	2.9	2	2	NA	0	—	18,000	—	180,000	—	—
Organic Lead (µg/kg)	13	1	7.7	630	630	NA	1	—	6.1	—	62	—	—

Table 4-8 (continued)

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda Point–Specific Comparison Criteria[e]
Metals (mg/kg)													
aluminum	520	519	100	2,080	29,900	19	0	13,960	76,000	—	100,000	—	—
antimony	570	106	19	0.24	28	11	0	8.6[i]	31	—	410	—	—
arsenic	561	425	76	0.44	329	4	425	9.14	0.39	0.062	1.6	0.25	—
barium	571	569	100	6.6	758	25	0	93.68	5,400	—	67,000	—	—
beryllium	578	369	64	0.056	2.29	4	0	1.27	150	—	1,900	—	—
cadmium	640	203	32	0.013	133	44	1	1.72	37	—	450	—	—
chromium	629	596	95	0.57	1800	37	9	54.84	210	—	450	—	—
chromium, hexavalent	132	41	31	0.033	1.3	NA	0	—	30	—	64	—	—
cobalt	571	558	98	2.1	180	45	0	14.3	900	—	1,900	—	—
copper	619	580	94	0.77	170	32	0	39.14	3,100	—	41,000	—	—
iron	532	532	100	1.7	55,300	49	47	22,280	23,000	—	100,000	—	—
lead	632	578	91	0.15	4,310	56	26[j]	37.66	400	150	800	—	197/346
manganese	520	519	100	49.1	1,420	37	0	383	1,800	—	19,000	—	—
mercury	612	159	26	0.011	18.9	9	0	0.52	23	—	310	—	—
molybdenum	162	15	9.3	0.2	11.3	2	0	5.2	390	—	5,100	—	—
nickel	620	611	99	1.0	98.6	20	0	55.72	1,600	—	20,000	—	—
selenium	544	174	32	0.224	320	40	0	1.78	390	—	5,100	—	—
silver	592	174	29	0.042	23.6	90	0	2.22	390	—	5,100	—	—
thallium	545	84	15	0.12	335	75	6	0.5	5.2	—	67	—	—
vanadium	571	570	100	10.1	159	41	13	47.34	78	—	1,000	—	—
zinc	620	601	97	7.8	699	29	0	67.48	23,000	—	100,000	—	—
Essential Nutrients (mg/kg)													
calcium	240	239	100	1,090	39,000	3	0	16,800	—	—	—	—	—
magnesium	241	240	100	1,350	19,600	13	0	7,304	—	—	—	—	—
potassium	241	235	98	247	3,910	23	0	1,232	—	—	—	—	—
sodium	241	192	80	70.7	9,430	31	0	1,230	—	—	—	—	—
chloride	12	12	100	48	1,030	NA	0	—	—	—	—	—	—
nitrate	12	9	75	3	5	NA	0	—	—	—	—	—	—
nitrite	12	5	42	0.06	0.11	NA	0	—	—	—	—	—	—
sulfate	12	12	100	31	323	NA	0	—	—	—	—	—	—
Sulfide (mg/kg)	42	1	2.4	29.3	29.3	NA	0	—	—	—	—	—	—
Total Organic Carbon (mg/kg)	44	40	91	330	49,000	NA	0	—	—	—	—	—	—

Table 4-8 (continued)

Notes:

[a] individual analytical results presented in Appendix B (historical and ongoing investigations) and Appendix K (OU-2C RI supplemental sampling)
[b] minimum concentration reported above detection limit
[c] maximum concentration reported above detection limit
[d] U.S. EPA 2004d
[e] risk-based criteria for lead in soil including/excluding the homegrown produce pathway, Alameda Point residential B(a)P equivalent screening level of 620 μg/kg used for comparison criterion for the aggregate of seven PAHs
[f] dash indicates a background or regulatory comparison criterion has not been developed for the analyte
[g] the number above regulatory comparison criteria does not include concentrations above the Alameda Point–specific comparison criterion of 620 μg/kg
[h] analyte or parameter group analyzed, but not reported at concentrations above detection limits; included for completeness
[i] the maximum reported concentration, which is less than the calculated 95th percentile concentration (9.5 mg/kg) and therefore provides a more conservative comparison criterion
[j] includes nine samples with concentrations greater than the California PRG, but less than the Alameda Point–specific residential level (with homegrown produce)

Acronyms/Abbreviations:

B(a)P – benzo(a)pyrene
BHC – benzenehexachloride
DDT – dichlorodiphenyltrichloroethane
IR – Installation Restoration (Program)
JP-5 – jet propellant grade 5
μg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
NA – not applicable
OU – operable unit
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RI – remedial investigation
SVOC – semivolatile organic compound
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table 4-9
Organic and Inorganic Analytes Reported in Soil Samples at IR Site 10[a]

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda–Point Specific Comparison Criteria[e]
Volatile Organic Compounds (mg/kg)													
acetone	57	11	19	0.0038	0.08	NA	0	—[f]	14,000	—	54,000	—	—
benzene	84	2	2.4	0.002	0.005	NA	0	—	0.64	—	1.4	—	—
2-butanone	63	11	17	0.0013	0.0027	NA	0	—	22,000	—	110,000	—	—
carbon disulfide	57	3	5.3	0.0021	0.013	NA	0	—	360	—	720	—	—
chlorobenzene	57	12	21	0.00067	0.0039	NA	0	—	150	—	530	—	—
cis-1,2-dichloroethene	54	3	5.6	0.0011	0.028	NA	0	—	43	—	150	—	—
trans-1,2-dichloroethene	48	1	2.1	0.0017	0.0017	NA	0	—	69	—	230	—	—
ethylbenzene	84	2	2.4	0.0013	0.69	NA	0	—	400	—	400	—	—
2-hexanone	57	5	8.8	0.00063	0.001	NA	0	—	—	—	—	—	—
methylene chloride	63	6	9.5	0.006	0.043	NA	0	—	9.1	—	21	—	—
4-methyl-2-pentanone	57	25	44	0.0011	0.009	NA	0	—	5,300	—	47,000	—	—
tetrachloroethene	63	10	16	0.00059	0.054	NA	0	—	0.48	—	1.3	—	—
toluene	84	20	24	0.00067	0.75	NA	0	—	520	—	520	—	—
trichloroethene	63	7	11	0.0023	0.032	NA	0	—	0.053	2.9	0.11	6.5	—
xylenes, total	83	5	6	5.64	3,100	NA	0	—	270	—	420	—	—
Total Petroleum Hydrocarbons (mg/kg)													
diesel	49	12	24	3.5	14,000	NA	NA	—	—	—	—	—	—
gasoline	49	6	12	5.4	1,300	NA	NA	—	—	—	—	—	—
JP-5	44	4	9.1	3,500	8,500	NA	NA	—	—	—	—	—	—
motor oil	44	13	30	9.6	9,400	NA	NA	—	—	—	—	—	—
oil and grease	2	2	100	337	456	NA	NA	—	—	—	—	—	—
Semivolatile Organic Compounds other than PAHs (µg/kg)													
bis(2-ethylhexyl)phthalate	41	1	2.4	3,000	3,000	NA	0	—	35,000	—	120,000	—	—
Polycyclic Aromatic Hydrocarbons (µg/kg)													
benz(a)anthracene	19	1	5.3	2	2	NA	0	—	620	—	2,100	—	620
benzo(b)fluoranthene	19	2	11	1.8	3.4	NA	0	—	620	—	2,100	—	620
benzo(g,h,i)perylene	19	1	5.3	1.8	1.8	NA	0	—	—	—	—	—	—
benzo(a)pyrene	19	1	5.3	2.9	2.9	NA	0	—	62	—	210	—	620
chrysene	19	1	5.3	2.4	2.4	NA	0[g]	—	62,000	3,800	210,000	13,000	620
fluoranthene	19	1	5.3	2	2	NA	0	—	2,300,000	—	22,000,000	—	—
pyrene	19	4	21	1.8	2.8	NA	0	—	2,300,000	—	29,000,000	—	—
Polychlorinated Biphenyls (µg/kg)[h]	29	0	0	0	0	NA	0	—	220	—	740	—	—
Cyanide (µg/kg)[h]	2	0	0	0	0	NA	0	—	1,200,000	—	12,000,000	—	—
Butyltins (µg/kg)[h]	2	0	0	0	0	NA	0	—	18,000	—	180,000	—	—

Table 4-9 (continued)

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda–Point Specific Comparison Criteria[e]
Metals (mg/kg)													
aluminum	42	42	100	3,000	7,290	0	0	13,960	76,000	—	100,000	—	—
antimony	44	9	20	0.46	0.79	0	0	8.6[i]	31	—	410	—	—
arsenic	42	24	57	1.4	11.2	2	24	9.14	0.39	0.062	1.6	0.25	—
barium	42	42	100	12.1	72.6	0	0	93.68	5,400	—	67,000	—	—
beryllium	44	40	91	0.1	1.05	0	0	1.27	150	—	1,900	—	—
cadmium	44	24	55	0.038	3	1	0	1.72	37	—	450	—	—
chromium	44	42	95	4.6	42	0	0	54.84	210	—	450	—	—
cobalt	42	42	100	3.3	43.2	3	0	14.3	900	—	1,900	—	—
copper	44	42	95	3.4	24.1	0	0	39.14	3,100	—	41,000	—	—
iron	42	42	100	4,180	25,900	1	1	22,280	23,000	—	100,000	—	—
lead	44	43	98	1.68	38	1	0	37.66	400	150	800	—	197/346
manganese	42	42	100	47.4	497	1	0	383	1,800	—	19,000	—	—
mercury	44	5	11	0.099	0.14	0	0	0.52	23	—	310	—	—
nickel	44	44	100	4.5	31.9	0	0	55.72	1,600	—	20,000	—	—
selenium	42	6	14	0.33	2.2	2	0	1.78	390	—	5,100	—	—
silver	44	10	23	0.32	9.3	6	0	2.22	390	—	5,100	—	—
thallium	42	3	7.1	0.32	0.39	0	0	0.5	5.2	—	67	—	—
vanadium	42	42	100	11.2	36.8	0	0	47.34	78	—	1,000	—	—
zinc	44	43	98	11.4	78	1	0	67.48	23,000	—	100,000	—	—
Essential Nutrients (mg/kg)													
calcium	12	12	100	2,190	6,100	0	0	16,800	—	—	—	—	—
magnesium	12	12	100	1,260	2,950	0	0	7,304	—	—	—	—	—
potassium	12	12	100	575	892	0	0	1,232	—	—	—	—	—
sodium	12	12	100	113	739	0	0	1,230	—	—	—	—	—
Total Organic Carbon (mg/kg)	2	2	100	5,000	6,000	NA	0	—	—	—	—	—	—

Table 4-9 (continued)

Notes:

[a] individual analytical results presented in Appendix B (historical and ongoing investigations) and Appendix K (OU-2C RI supplemental sampling)
[b] minimum concentration reported above detection limit
[c] maximum concentration reported above detection limit
[d] U.S. EPA 2004d
[e] risk-based criteria for lead in soil including/excluding the homegrown produce pathway, Alameda Point residential B(a)P equivalent screening level of 620 μg/kg used for comparison criterion for the aggregate of seven PAHs
[f] dash indicates a background or regulatory comparison criterion has not been developed for the analyte
[g] the number above regulatory comparison criteria does not include concentrations above the Alameda Point–specific comparison criterion of 620 μg/kg
[h] analyte or parameter group analyzed, but not reported at concentrations above detection limits; included for completeness
[i] the maximum reported concentration, which is less than the calculated 95th percentile concentration (9.5 mg/kg) and therefore provides a more conservative comparison criterion

Acronyms/Abbreviations:

B(a)P – benzo(a)pyrene
IR – Installation Restoration (Program)
JP-5 – jet propellant grade 5
μg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
NA – not applicable
OU – operable unit
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RI – remedial investigation
SVOC – semivolatile organic compound
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table 4-10
Organic and Inorganic Analytes Reported in Soil Samples at IR Site 12[a]

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda–Point Specific Comparison Criteria[e]
Volatile Organic Compounds (mg/kg)													
acetone	18	5	28	0.0072	0.25	NA	0	—[f]	14,000	—	54,000	—	—
carbon disulfide	18	1	5.6	0.0013	0.0013	NA	0	—	360	—	720	—	—
4-methyl-2-pentanone	18	3	17	0.0017	0.01	NA	0	—	5,300	—	47,000	—	—
tetrachloroethene	18	1	5.6	0.0013	0.0013	NA	0	—	0.48	—	1.3	—	—
toluene	30	4	13	0.0014	0.0017	NA	0	—	520	—	520	—	—
trichloroethene	18	1	5.6	0.0052	0.0052	NA	0	—	0.053	2.9	0.11	6.5	—
1,2,4-trimethylbenzene	4	1	25	0.0015	0.0015	NA	0	—	52	—	170	—	—
xylenes, total	30	2	6.7	0.00574	0.016	NA	0	—	270	—	420	—	—
Total Petroleum Hydrocarbons (mg/kg)													
diesel	18	2	11	5.3	44	NA	NA	—	—	—	—	—	—
gasoline	10	1	10	0.97	0.97	NA	NA	—	—	—	—	—	—
motor oil	18	8	44	8.9	170	NA	NA	—	—	—	—	—	—
petroleum hydrocarbons, total recoverable	30	11	37	0.33	10,700	NA	NA	—	—	—	—	—	—
Semivolatile Organic Compounds other than PAHs (µg/kg)													
bis(2-ethylhexyl)phthalate	24	1	4.2	1,100	1,100	NA	0	—	35,000	—	120,000	—	—
di-n-butyl phthalate	24	2	8.3	22	32	NA	0	—	6,100,000	—	62,000,000	—	—
diethyl phthalate	24	1	4.2	23	23	NA	0	—	49,000,000	—	100,000,000	—	—
Polycyclic Aromatic Hydrocarbons (µg/kg)													
acenaphthene	36	6	17	0.4	12	NA	0	—	3,700,000	—	29,000,000	—	—
acenaphthylene	36	16	44	0.2	5.7	NA	0	—	3,700,000	—	29,000,000	—	—
anthracene	36	20	56	0.2	11	NA	0	—	22,000,000	—	100,000,000	—	—
benz(a)anthracene	36	23	64	0.2	57	NA	0	—	620	—	2,100	—	620
benzo(b)fluoranthene	36	32	89	0.3	83	NA	0	—	620	—	2,100	—	620
benzo(k)fluoranthene	36	31	86	0.3	73	NA	0	—	6,200	380	21,000	1,300	620
benzo(g,h,i)perylene	36	35	97	0.2	170	NA	0	—	—	—	—	—	—
benzo(a)pyrene	36	32	89	0.3	140	NA	2	—	62	—	210	—	620
chrysene	36	36	100	0.2	71	NA	0[g]	—	62,000	3,800	210,000	13,000	620
dibenz(a,h)anthracene	36	19	53	0.2	13	NA	0	—	62	—	210		620
fluoranthene	36	31	86	0.2	130	NA	0	—	2,300,000	—	22,000,000		—
fluorene	36	7	19	0.2	4.1	NA	0	—	2,700,000	—	26,000,000		—
indeno(1,2,3-cd)pyrene	36	33	92	0.3	160	NA	0	—	620	—	2,100		620
2-methylnaphthalene	36	18	50	0.2	1.2	NA	0	—	—	—	—		—
naphthalene	36	32	89	0.3	4.7	NA	0	—	56,000	1,700	190,000	4,200	—
phenanthrene	36	35	97	0.3	23	NA	0	—	—	—	—	—	—
pyrene	36	32	89	0.2	170	NA	0	—	2,300,000	—	29,000,000	—	—

Table 4-10 (continued)

Analyte	Total Number of Samples	Number Reported Above Detection Limit	Percent Reported Above Detection Limit	Minimum[b]	Maximum[c]	Number Above Background	Number Above Regulatory Comparison Criteria	Alameda Point Background	Federal Residential PRG[d]	California Residential PRG[d]	Federal Industrial PRG[d]	California Industrial PRG[d]	Alameda–Point Specific Comparison Criteria[e]
Polychlorinated Biphenyls (µg/kg)[h]	24	0	0	0	0	NA	0	220	740	—	—	—	—
Organochlorine Pesticides (µg/kg)													
aldrin	18	1	5.6	6.1	6.1	NA	0	—	29	—	100	—	—
Metals (mg/kg)													
aluminum	22	22	100	1,930	22,300	2	0	13,960	76,000	—	100,000	—	—
antimony	22	6	27	2.7	8.3	0	0	8.6[i]	31	—	410	—	—
arsenic	22	18	82	1.03	8.8	0	18	9.14	0.39	0.062	1.6	0.25	—
barium	22	22	100	8.59	143	2	0	93.68	5,400	—	67,000	—	—
beryllium	22	19	86	0.13	0.845	0	0	1.27	150	—	1,900	—	—
cadmium	22	9	41	0.038	0.659	0	0	1.72	37	—	450	—	—
chromium	22	22	100	10.60	85.8	2	0	54.84	210	—	450	—	—
cobalt	22	22	100	2.6	16.7	3	0	14.3	900	—	1,900	—	—
copper	22	22	100	3.47	50.7	2	0	39.14	3,100	—	41,000	—	—
iron	22	22	100	3,820	33,800	5	4	22,280	23,000	—	100,000	—	—
lead	24	24	100	1.82	48.3	3	0	37.66	400	150	800	—	194/324
manganese	22	22	100	46	620	2	0	383	1,800	—	19,000	—	—
mercury	22	6	27	0.035	0.804	1	0	0.52	23	—	310	—	—
nickel	22	22	100	9.31	87.5	3	0	55.72	1,600	—	20,000	—	—
selenium[h]	22	0	0	0	0	0	0	1.79	390	—	5,100	—	—
silver	22	4	18	0.23	0.659	0	0	2.22	390	—	5,100	—	—
thallium[h]	22	0	0	0	0	0	0	0.50	5.2	—	67	—	—
vanadium	22	22	100	9.51	73	3	0	47.34	78	—	1,000	—	—
zinc	22	22	100	10.70	122	3	0	67.48	23,000	—	100,000	—	—
Essential Nutrients (mg/kg)													
calcium	18	18	100	1,310	12,900		0	16,800	—	—	—	—	—
magnesium	18	18	100	1,090	10,500	3	0	7,304	—	—	—	—	—
potassium	18	18	100	457	4,020	4	0	1,232	—	—	—	—	—
sodium	18	18	100	101	3,540	4	0	1,230	—	—	—	—	—
Total Organic Carbon (mg/kg)	5	5	100	2,000	11,000	NA	0	—	—	—	—	—	—

Table 4-10 (continued)

Notes:

[a] individual analytical results presented in Appendix B (historical and ongoing investigations) and Appendix K (OU-2C RI supplemental sampling)
[b] minimum concentration reported above detection limit
[c] maximum concentration reported above detection limit
[d] U.S. EPA 2004d
[e] risk-based criteria for lead in soil including/excluding the homegrown produce pathway, Alameda Point residential B(a)P equivalent screening level of 620 μg/kg used for comparison criterion for the aggregate of seven PAHs
[f] dash indicates a background or regulatory comparison criterion has not been developed for the analyte
[g] the number above regulatory comparison criteria does not include concentrations above the Alameda Point–specific comparison criterion of 620 μg/kg
[h] analyte or parameter group analyzed, but not reported at concentrations above detection limits; included for completeness
[i] the maximum reported concentration, which is less than the calculated 95th percentile concentration (9.5 mg/kg) and therefore provides a more conservative comparison criterion

Acronyms/Abbreviations:

B(a)P – benzo(a)pyrene
IR – Installation Restoration (Program)
μg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
NA – not applicable
OU – operable unit
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RI – remedial Investigation
SVOC – semivolatile organic compound
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table 4-14
Metals Above Both PRGs and Background in Soil[a]

IR Site	Station ID	Sample ID	Collected	Depth (feet bgs)	Analyte	Result (mg/kg)	Alameda Point Background[b]	Federal Residential PRG[c]	California Residential PRG[c,d]	Federal Industrial PRG[c]	California Industrial PRG[c]
IR5	030-S05-005	030-S05-005	Aug 1998	0 to 5	iron	30,300	22,280	23,000	—[e]	100,000	—
IR5	054-001-003	054-0003	Apr 1995	0 to 0.5	lead	1,770 J	37.66	400	197/346	800	—
IR5	054-001-005	054-0005	Apr 1995	0 to 0.5	lead	251 J	37.66	400	197/346	800	—
IR5	054-001-006	054-0006	Apr 1995	4 to 4.5	lead	361 J	37.66	400	197/346	800	—
IR5	054-001-007	054-0007	Apr 1995	0 to 0.5	arsenic	329	9.14	0.39	0.062	1.6	0.25
IR5	054-001-007	054-0007	Apr 1995	0 to 0.5	thallium	335	0.5	5.20	—	67	—
IR5	054-002-011	054-0011	Apr 1995	0 to 0.5	lead	527 J	37.66	400	197/346	800	—
IR5	054-002-012	054-0012	Apr 1995	0 to 0.5	iron	37,100 J	22,280	23,000	—	100,000	—
IR5	054-002-012	054-0012	Apr 1995	0 to 0.5	thallium	5.9	0.5	5.2	—	67	—
IR5	054-002-012	054-0012	Apr 1995	0 to 0.5	vanadium	95.3	47.34	78	—	1,000	—
IR5	054-002-014	054-0014	Apr 1995	0 to 0.5	iron	29,300	22,280	23,000	—	100,000	—
IR5	054-002-014	054-0036	Apr 1995	0 to 0.5	iron	26,400	22,280	23,000	—	100,000	—
IR5	054-003-020	054-0020	Apr 1995	0 to 0.5	iron	37,600 J	22,280	23,000	—	100,000	—
IR5	054-003-020	054-0020	Apr 1995	0 to 0.5	vanadium	85.1	47.34	78	—	1,000	—
IR5	054-003-022	054-0022	Apr 1995	0 to 0.5	iron	23,200	22,280	23,000	—	100,000	—
IR5	054-004-027	054-0027	Apr 1995	0 to 0.5	iron	30,600	22,280	23,000	—	100,000	—
IR5	057-001-001	057-0014	May 1995	0 to 0.5	chromium	408 J	54.84	210	—	450	—
IR5	057-001-003	057-0016	May 1995	0 to 0.5	chromium	876 J	54.84	210	—	450	—
IR5	057-002-006	057-0019	May 1995	0 to 0.5	arsenic	12.6 J	9.14	0.39	0.062	1.6	0.25
IR5	057-002-006	057-0019	May 1995	0 to 0.5	iron	26,700 J	22,280	23,000	—	100,000	—
IR5	068-001-002	068-0002	May 1995	6 to 6.5	thallium	5.5	0.5	5.2	—	67	—
IR5	261-3E	261-3E	Dec 1994	5 to 5	thallium	6.5	0.5	5.2	—	67	—
IR5	261-3N	261-3N	Dec 1994	5 to 5	thallium	8.8	0.5	5.2	—	67	—
IR5	261-S5	261-S5	Apr 1995	2 to 2	chromium	1,600	54.84	210	—	450	—
IR5	261-S7	261-S7	Apr 1995	2 to 2	chromium	1,600	54.84	210	—	450	—
IR5	261-S8	261-S8	Apr 1995	2 to 2	chromium	1,800	54.84	210	—	450	—
IR5	B05PS-01	B-05PS-01-018	Jun 1992	18 to 18.5	cadmium	133	1.72	37	—	450	—
IR5	B05PS-01	B-05PS-01-018	Jun 1992	18 to 18.5	chromium	850	54.84	210	—	450	—
IR5	B05PS-08	O8220	Sep 1993	22 to 22	iron	35,400	22,280	23,000	—	100,000	—
IR5	B12-08	B12-08-000	Jul 1991	0.5 to 1	iron	26,900 J	22,280	23,000	—	100,000	—
IR5	DG282SB01	C093S240	Mar 2007	0.6 to 1.33	iron	30,400	22,280	23,000	—	100,000	—
IR5	DG347SB01	C093S243A	May 2007	0.8 to 1.3	iron	29,900	22,280	23,000	—	100,000	—
IR5	DG347SB01	C093S243A	May 2007	0.8 to 1.3	vanadium	90.7 J	47.34	78	—	1,000	—
IR5	DG347SB03	C093S249A	May 2007	0.5 to 1.3	iron	31,700	22,280	23,000	—	100,000	—
IR5	DG347SB03	C093S249A	May 2007	0.5 to 1.3	vanadium	95.7 J	47.34	78	—	1,000	—
IR5	EA3SB17	C093S048	Apr 2007	1 to 1.5	iron	33,200	22,280	23,000	—	100,000	—
IR5	EA3SB17	C093S049	Apr 2007	3 to 3.5	iron	30,600	22,280	23,000	—	100,000	—
IR5	EA3SB18	C093S050	May 2007	0.5 to 1	iron	38,700	22,280	23,000	—	100,000	—
IR5	EA3SB18	C093S051	May 2007	2.5 to 3	iron	34,000	22,280	23,000	—	100,000	—
IR5	EA3SB20	C093S054	May 2007	0.5 to 1	iron	31,800 J	22,280	23,000	—	100,000	—
IR5	EA3SB22	C093S058	May 2007	0.4 to 0.9	iron	48,200 J	22,280	23,000	—	100,000	—
IR5	EA3SB22	C093S058	May 2007	0.4 to 0.9	vanadium	159 J	47.34	78	—	1,000	—
IR5	EA3SB24	C093S062	May 2007	1 to 1.5	iron	33,000 J	22,280	23,000	—	100,000	—
IR5	EA3SB26	C093S066	May 2007	0.5 to 1	iron	44,300	22,280	23,000	—	100,000	—
IR5	EA3SB26	C093S066	May 2007	0.5 to 1	vanadium	119	47.34	78	—	1,000	—
IR5	EA3SB28	C093S070	Apr 2007	0.8 to 1.3	iron	52,800	22,280	23,000	—	100,000	—
IR5	EA3SB28	C093S070	Apr 2007	0.8 to 1.3	vanadium	140 J	47.34	78	—	1,000	—

Table 4-14 (continued)

IR Site	Station ID	Sample ID	Collected	Depth (feet bgs)	Analyte	Result (mg/kg)	Alameda Point Background[b]	Federal Residential PRG[c]	California Residential PRG[d,e]	Federal Industrial PRG[c]	California Industrial PRG[d]
IR5	EA3SB29	C093S072	Apr 2007	0.75 to 1.5	iron	33,300 J	22,280	23,000	—	100,000	—
IR5	EA3SB30	C093S074	Apr 2007	0.75 to 1.5	iron	34,600 J	22,280	23,000	—	100,000	—
IR5	EA3SB31	C093S076	Apr 2007	0.75 to 1.5	iron	31,200 J	22,280	23,000	—	100,000	—
IR5	EA3SB33	C093S080	Apr 2007	0.75 to 1.5	iron	27,600 J	22,280	23,000	—	100,000	—
IR5	EA3SB34	C093S082	Apr 2007	0.75 to 1.5	iron	41,700 J	22,280	23,000	—	100,000	—
IR5	EA3SB34	C093S082	Apr 2007	0.75 to 1.5	vanadium	106 J	47.34	78	—	1,000	—
IR5	EA3SB35	C093S084	May 2007	1 to 1.5	iron	30,600	22,280	23,000	—	100,000	—
IR5	EA3SB36	C093S086	May 2007	0.7 to 1.2	iron	47,000	22,280	23,000	—	100,000	—
IR5	EA3SB36	C093S086	May 2007	0.7 to 1.2	vanadium	94.5	47.34	78	—	1,000	—
IR5	EA3SB40	C093S094	Apr 2007	0.8 to 1.6	iron	40,800	22,280	23,000	—	100,000	—
IR5	EA3SB40	C093S095	Apr 2007	2 to 2.6	lead	320	37.66	400	197/346	800	—
IR5	EA3SB41	C093S096	Apr 2007	0.8 to 1.6	iron	28,600 J	22,280	23,000	—	100,000	—
IR5	EA4SB02	C093S103	May 2007	0.7 to 1.2	lead	309	37.66	400	197/346	800	—
IR5	EA4SB04	C093S107	May 2007	0.8 to 1.3	lead	441	37.66	400	197/346	800	—
IR5	EA4SB06	C093S111	May 2007	0.8 to 1.3	lead	762	37.66	400	197/346	800	—
IR5	EA4SB07	C093S114	May 2007	2 to 2.8	iron	24,200	22,280	23,000	—	100,000	—
IR5	EA4SB10	C093S120	May 2007	0.8 to 1.3	lead	3,070	37.66	400	197/346	800	—
IR5	EA4SB12	C093S125	May 2007	3.5 to 4	lead	1,000 J	37.66	400	197/346	800	—
IR5	EA4SB14	C093S128	May 2007	0.8 to 1.3	lead	4,310 J	37.66	400	197/346	800	—
IR5	EA4SB15	C093S130	May 2007	0.8 to 1.3	iron	33,800	22,280	23,000	—	100,000	—
IR5	EA4SB17	C093S134	May 2007	0.8 to 1.3	lead	1,100 J	37.66	400	197/346	800	—
IR5	EA4SB18	C093S137	May 2007	1.5 to 2.5	lead	320 J	37.66	400	197/346	800	—
IR5	EA4SB21	C093S142	Apr 2007	0.25 to 1.25	lead	386	37.66	400	197/346	800	—
IR5	EA4SB23	C093S146	May 2007	0.8 to 1.3	lead	877 J	37.66	400	197/346	800	—
IR5	EA4SB28	C093S156	May 2007	0.8 to 1.3	lead	1,410 J	37.66	400	197/346	800	—
IR5	EA5SB13	C093S182	Apr 2007	0.8 to 1.6	iron	55,300	22,280	23,000	—	100,000	—
IR5	EA5SB17	C093S190	Apr 2007	0.8 to 1.6	chromium	447	54.84	210	—	450	—
IR5	M05-02	B05-02-015	Jul 1991	14.5 to 15.3	iron	25,200 J	22,280	23,000	—	100,000	—
IR5	M05-03	B05-03-014	Jul 1991	14 to 15.5	iron	25,700 J	22,280	23,000	—	100,000	—
IR5	M12-02	B12-02-010	Jul 1991	9.5 to 11	iron	25,800 J	22,280	23,000	—	100,000	—
IR5	S05-EXC-X2Y2	386-S05-005	Dec 2001	7 to 7	chromium	295	55	210	—	450	—
IR5	S05-EXC-X3Y2	386-S05-008	Dec 2001	7 to 7	chromium	220	54.84	210	—	450	—
IR5	SAST5SB01	C093S329	Apr 2007	0.83 to 1.58	iron	26,600	22,280	23,000	—	100,000	—
IR5	SM01SB01	C093S332A	Apr 2007	0.8 to 1.6	iron	27,700	22,280	23,000	—	100,000	—
IR5	SND25SB01	C093S368	Apr 2007	0.83 to 1.42	iron	25,400	22,280	23,000	—	100,000	—
IR5	SND27SB01	C093S371	Mar 2007	0.5 to 1	iron	34,500 J	22,280	23,000	—	100,000	—
IR5	SND27SB01	C093S371	Mar 2007	0.5 to 1	vanadium	112 J	47.34	78	—	1,000	—
IR5	SND27SB02	C093S374	Mar 2007	0.25 to 1	iron	26,500 J	22,280	23,000	—	100,000	—
IR5	SND27SB02	C093S374	Mar 2007	0.25 to 1	vanadium	87.5 J	47.34	78	—	1,000	—
IR5	SND27SB05	C093S422	May 2007	0.5 to 1	iron	25,700 J	22,280	23,000	—	100,000	—
IR5	SND31SB02	C093S380A	Apr 2007	0.8 to 1.6	lead	242	37.66	400	197/346	800	—
IR5	SNS01SB01	C093S389	Apr 2007	0.25 to 1	iron	31,000	22,280	23,000	—	100,000	—
IR5	SOW6ASB01	C093S310	Apr 2007	0.25 to 1	arsenic	9.9	9.14	0.39	0.062	1.6	0.25
IR5	SOW6ASB01	C093S310	Apr 2007	0.25 to 1	iron	50,200	22,280	23,000	—	100,000	—
IR5	SOW6ASB05	C093S432	May 2007	0.5 to 1	arsenic	9.9	9.14	0.39	0.062	1.6	0.25
IR5	SOW6ASB05	C093S432	May 2007	0.5 to 1	iron	42,800 J	22,280	23,000	—	100,000	—

Table 4-14 (continued)

IR Site	Station ID	Sample ID	Collected	Depth (feet bgs)	Analyte	Result (mg/kg)	Alameda Point Background[b]	Federal Residential PRG[c]	California Residential PRG[d,e]	Federal Industrial PRG[c]	California Industrial PRG[d]
IR5	SUSTSB01	C093S322	Apr 2007	0.25 to 1	iron	47,700	22,280	23,000	—	100,000	—
IR5	SUSTSB01	C093S322	Apr 2007	0.25 to 1	vanadium	79.4	47.34	78	—	1,000	—
IR5	SUSTSB02	C093S428	May 2007	0.5 to 1	iron	33,100 J	22,280	23,000	—	100,000	—
IR5	SUSTSB02	C093S428	May 2007	0.5 to 1	vanadium	84.4	47.34	78	—	1,000	—
IR5	T6-S	T6-S	Feb 1995	7 to 7	thallium	8.5	0.5	5.2	—	67	—
IR10	DG400SB06	C093S269	Mar 2007	4 to 4.75	arsenic	9.9	9.14	0.39	0.062	1.6	0.25
IR10	DG400SB09	C093S426	May 2007	2 to 2.5	arsenic	11.2	9.14	0.39	0.062	1.6	0.25
IR10	DG400SB09	C093S426	May 2007	2 to 2.5	iron	25,900 J	22,280	23,000	—	100,000	—
IR12	SOW10SB01	C093S318	Apr 2007	0.5 to 1.25	iron	28,300	22,280	23,000	—	100,000	—
IR12	M12-03	B12-03-000	Jul 1991	0 to 0.5	iron	25,100	22,280	23,000	—	100,000	—
IR12	M12-03	B12-03-011	Jul 1991	11 to 12.5	iron	33,800	22,280	23,000	—	100,000	—
IR12	M12-04	B12-04-010	Jul 1991	9.5 to 11	iron	32,900	22,280	23,000	—	100,000	—

Review Qualifier:
J – an estimated value

Notes:
[a] all results presented in Appendix B (historical and ongoing investigations) and Appendix K (OU-2C RI supplemental sampling)
[b] value is 95th percentile concentration except for antimony for which maximum value is used
[c] U.S. EPA 2004d
[d] for lead, Alameda Point specific residential level (including homegrown produce pathway) used as comparison criterion
[e] dash indicates a regulatory comparison criterion has not been developed for the analyte

Acronyms/Abbreviations:
bgs – below ground surface
IR – Installation Restoration (Program)
μg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
OU – operable unit
PRG – preliminary remediation goal
RI – remedial investigation
U.S. EPA – United States Environmental Protection Agency

Table 7-2
Recommendations for 22 SWMUs Sampled at OU-2C During RI Supplemental Activities

SWMU	Location	Substances Stored at SWMU	Navy Recommendation
AOC 005 (IR Site 5)	east of Building 5	UST 5-2 (JP-5) and UST 5-3 (waste oil and solvents)	Address remaining impacted soil and groundwater associated with the portion of AOC 005 at former UST 5-3, along with other impacted areas at IR Site 5 recommended for further evaluation in an FS under CERCLA NFA for UST 5-2
AST 005G (IR Site 5)	east of Building 5	waste oil (40-gal tank)	NFA
M-01 (IR Site 5)	Building 5	50-gal solvent distillation unit	NFA
M-02 (IR Site 5)	Building 5	50-gal solvent distillation unit	NFA
M-05 (IR Site 5)	Building 5	portable 15-gal solvent distillation unit	NFA
M-08 (IR Site 10)	Building 400	portable 15-gal solvent distillation unit	NFA
M-09 (IR Site 5)	Building 5	coolant recovery system (4 500-gal tanks)	NFA
NADEP GAP 02 (IR Site 5)	Building 5 (northern section of Building in shop 95532)	poly paint, thinner, naptha	NFA
NADEP GAP 04 (IR Site 5)	Building 5 (northern section of building; shop 93532)	battery acid, nickel-cadmium solution	NFA

Table 7-2 (continued)

SWMU	Location	Substances Stored at SWMU	Navy Recommendation
NADEP GAP 17 (IR Site 5)	Building 5	coolant with nickel, chromium, cadmium, aluminum oxide, silicon carbide (55- and 30-gal drums)	NFA
NADEP GAP 20 (IR Site 5)	northwest of Building 500	lead-contaminated items	NFA
NADEP GAP 25 (IR Site 5)	Building 5	ethyl acetate, aluminum oxide, blasting grit, 55-gal drums of unknown waste	NFA
NADEP GAP 27 (IR Site 5)	west of Building 5	Hydraulic oil (55-gal drums)	NFA
NADEP GAP 31 (IR Site 5)	Building 5	various oils, solvents, paint (55- and 30-gal drums)	NFA
NADEP GAP 57 (IR Site 5)	Building 5	plating and cadmium solutions	NFA
NADEP GAP 70 (IR Site 5)	Building 5	cyanide, chromic acid plating solutions, sulfuric acid, nickel chloride	NFA
NAS GAP 01 (IR Site 5)	south of Building 6	oily liquids	NFA
OWS 005 (IR Site 5)	south of Building 5, associated with IWTP 5	unfiltered waste	NFA
OWS 006A (IR Site 5)	south of Building 6	residue from steam cleaning bay	NFA
OWS 006B (IR Site 5)	northwest of Building 6	unspecified	NFA
OWS 010 (IR Site 12)	Building 10	unspecified	NFA
UST(R)-02 (IR Site 5)	Building 6	Texaco petroleum solvents	NFA

Table 7-2 (continued)

Acronyms/Abbreviations:

AOC – area of concern
AST – aboveground storage tank
gal – gallon
GAP – generator accumulation point
IR – Installation Restoration (Program)
IWTP – industrial wastewater treatment plant
NADEP – Naval Aviation Depot
NAS – Naval Air Station
NFA – no further action
OU – operable unit
OWS – oil/water separator
RI – remedial investigation
SWMU – solid waste management unit
UST – underground storage tank
UST(R) – RCRA-identified underground storage tank

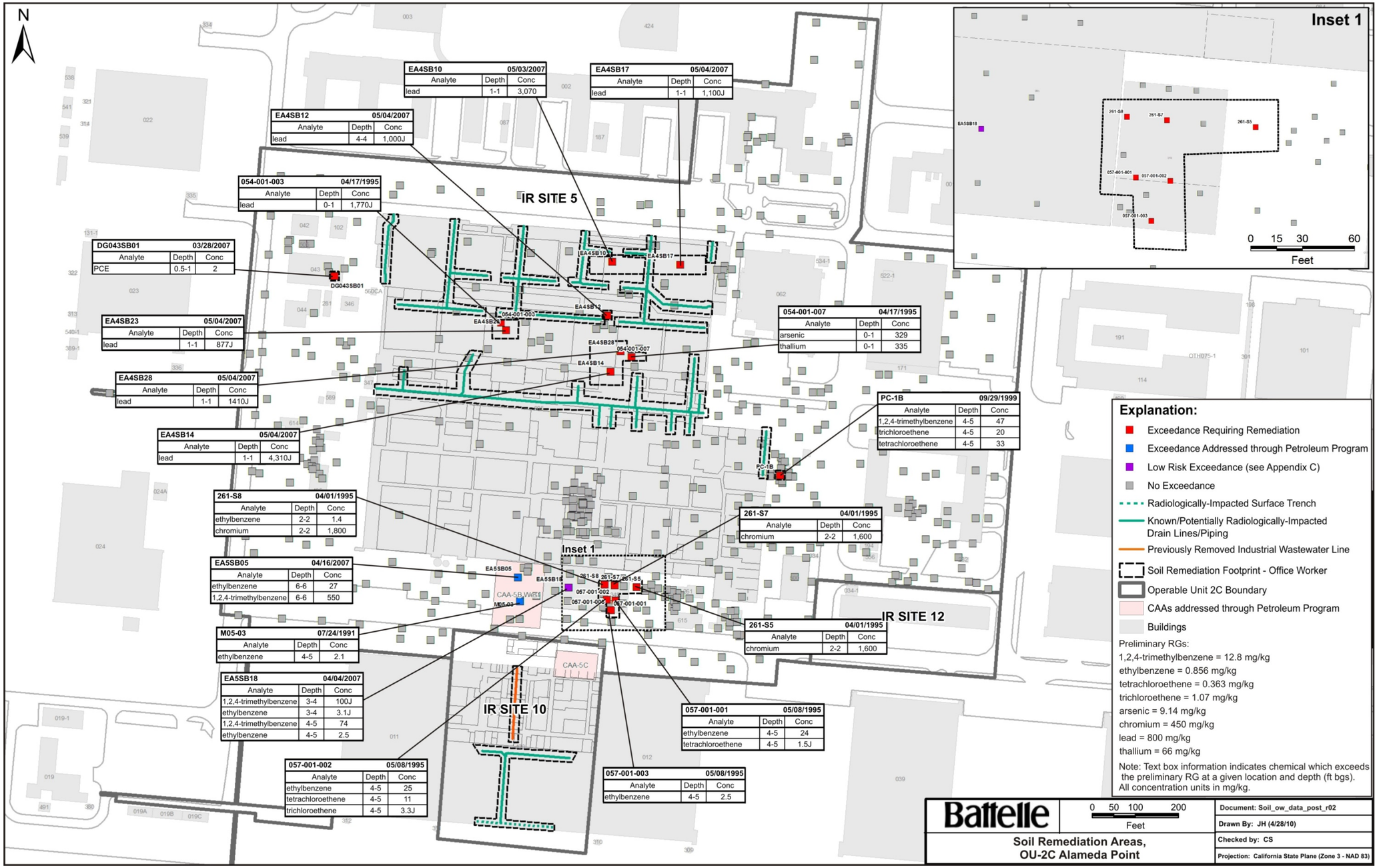

Figure 3-1. Soil Remediation Footprints with Soil Concentrations Exceeding Preliminary RGs for Office Workers

Figure 3-2. Locations of Soil Concentrations Exceeding Residential RBCs

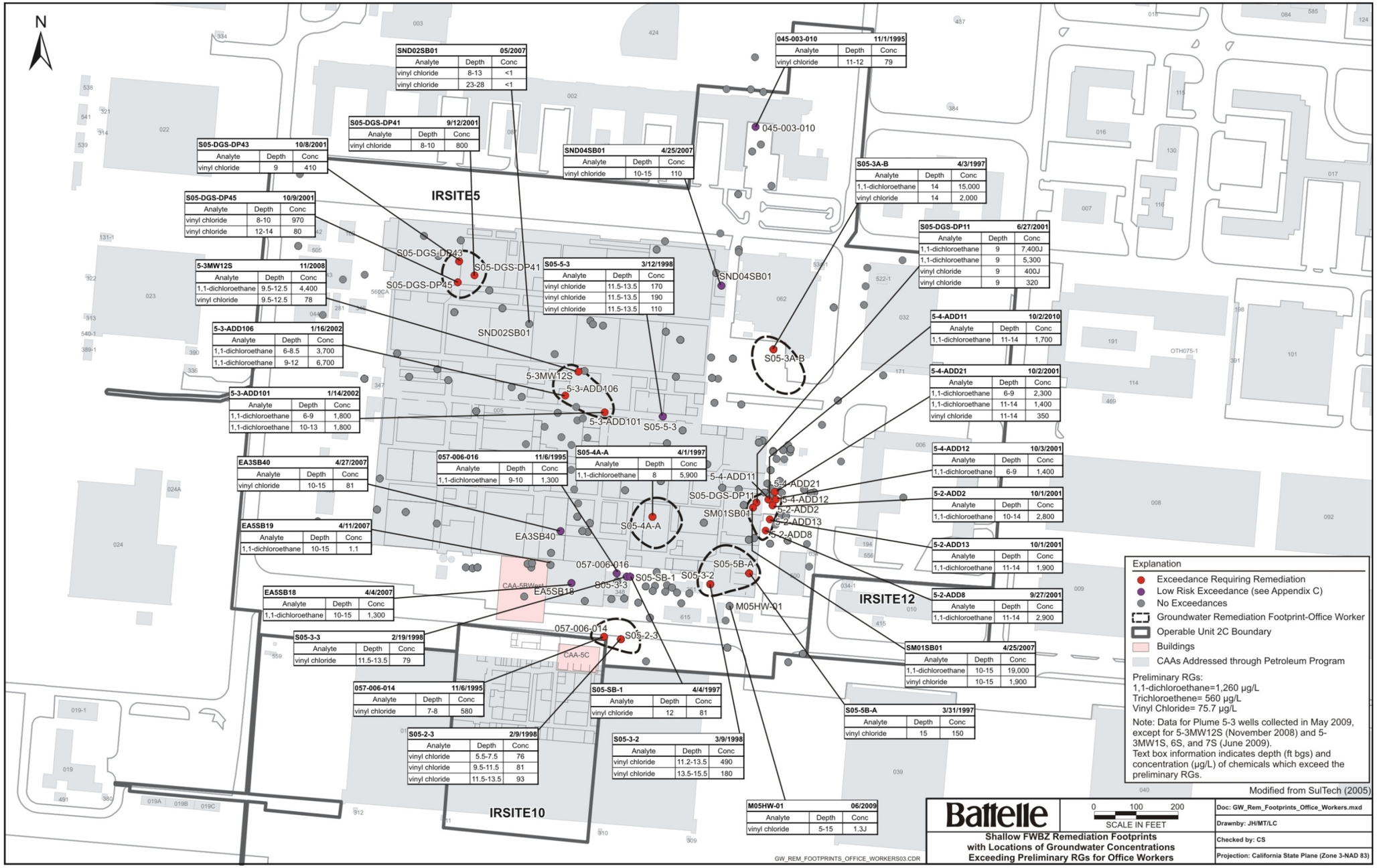

Figure 3-3. Shallow FWBZ Remediation Footprints with Locations of Groundwater Concentrations Exceeding Preliminary RGs for Office Workers

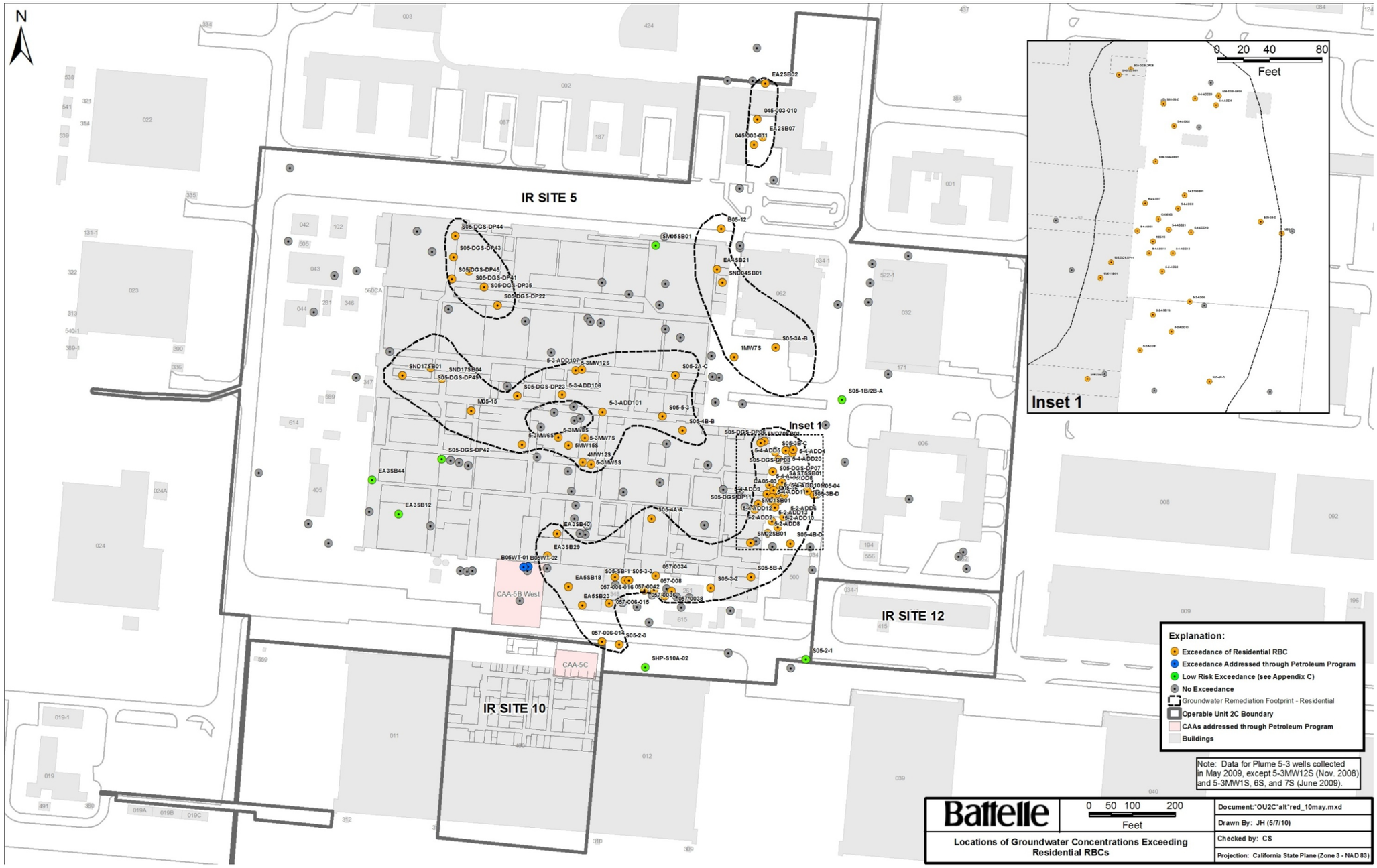

Figure 3-4. Locations of Groundwater Concentrations Exceeding Residential RBCs

Figure 3-5. Deep FWBZ Remediation Footprint with Total VOC Concentrations Exceeding Preliminary RG of 1,000 µg/L

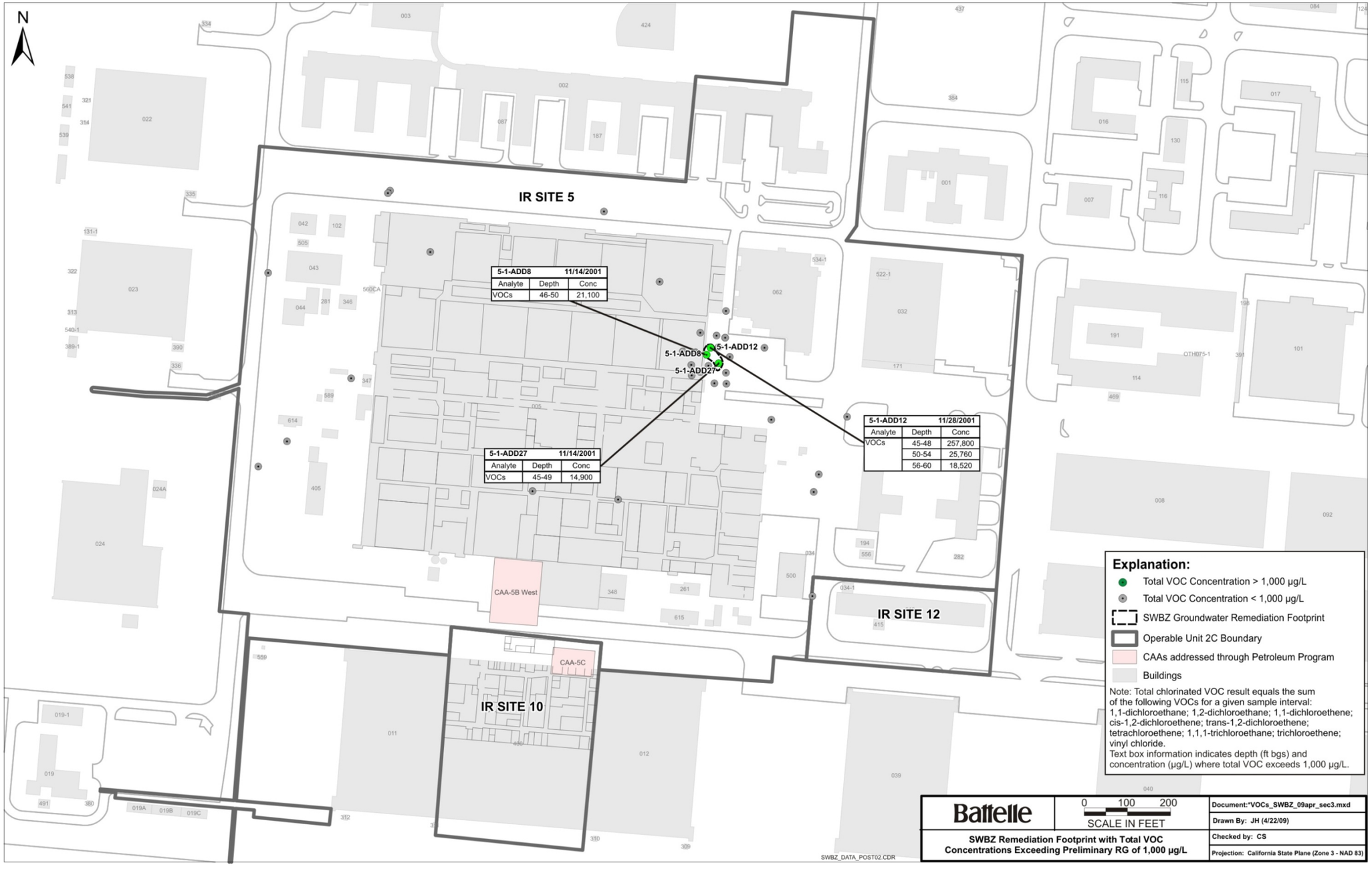

Figure 3-6. SWBZ Remediation Footprint with Total VOC Concentrations Exceeding Preliminary RG of 1,000 µg/L

Figure 3-7. Total VOC Concentrations Exceeding 10,000 µg/L in the Shallow FWBZ, Deep FWBZ and SWBZ

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
4	drinking water	Section 2.4	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Appendix D, Attachment D-1. Battelle 2011.

NAS ALAMEDA
SSIC No. 5090.3

Cal/EPA

November 13, 1996

Department of Toxic Substances Control

700 Heinz Avenue
Suite 200
Berkeley, CA
94710-2737

Commander
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Camille Garibaldi
900 Commodore Drive
San Bruno, California 94066-2402

Pete Wilson
Governor

James M. Strock
Secretary for
Environmental
Protection

Dear Ms. Garibaldi:

APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE NAVAL AIR STATION, ALAMEDA

The California Department of Toxic Substances Control (DTSC), is in receipt of the Navy's September 12, 1996 letter requesting Applicable or Relevant and Appropriate Requirements (ARARs) from the State of California for the Remedial Investigation and Feasibility Study of the Naval Air Station, Alameda. Enclosed in this document are State laws and regulations that California State Agencies believe may apply to the environmental remediation of Naval Air Station (NAS) Alameda.

As lead regulatory agency and a partner with the Navy and the United States Environmental Protection Agency (EPA) in conducting the remediation of NAS Alameda, we propose that a workshop be scheduled with all responsible State and Federal agencies to establish the ARARs for the NAS Alameda remediation. We also encourage the participation of the Restoration Advisory Board in the workshop. The invitation to participate in the workshop shall include a new solicitation for ARARs from the invited agencies.

We hope you are in agreement with us on this proposal. We anticipate the process to establish ARARs to be a consensual process based on our mutual goals and our partnership as lead agencies responsible for the protection of human health and the environment at NAS Alameda.

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If you wish to discuss this letter, the enclosures, or the proposal, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosures

cc's:

Ms. Gina Kathuria
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Steve Edde
Base Environmental Coordinator
Alameda Naval Air Station
Building 1, Code 52
Alameda, California 94501

Mr. James Ricks
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Mr. George Kikugawa
Engineering Field Activity, West
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-2402

Ms. Ardella Dailey
Community Co-Chair
Restoration Advisory Board
2200 Central Avenue
Alameda, California 94501

California Laws, Regulations and Policies
for Potential Application at the
Naval Air Station, Alameda
November 12, 1996

I. Generation, Storage and Treatment of Hazardous Waste

A. California Code of Regulations (CCR), Title 22, Chapter 11, Identification and listing of hazardous wastes. Chapter identifies those waste that are subject to regulations hazardous waste and are subject to the notification requirements of Health and Safety Code section 25153.6.

1. Article 1: General; purpose and scope, definition of waste and hazardous waste, exclusions, requirements for recyclable materials and contaminated containers. (66261.1 - 66261.7)

2. Article 2: Criteria for identifying Characteristics of Hazardous Waste. (66261.10)

3. Article 3: Characteristics of Hazardous Waste. (66261.20 - 66261.35)

4. Article 4: List RCRA Hazardous Waste. (66261.30 - 66261.35)

5. Article 5: Categories of Hazardous Waste. (66261.100 - 66261.126)

B. CCR, Title 22, Chapter 12, Standards Applicable to generator of hazardous waste

1. Article 1: Applicability. A generator of a waste must determine if waste is hazardous, and if so obtain an identification number. (66262.10 - 66262.12)

2. Article 2: A generator who transports, or offers for transportation, hazardous waste for off-site transfer, treatment, storage or disposal shall prepare a Manifest. (66262.20 - 66262.23)

3. Article 3: Pre-transport Requirements include packaging, labeling, marking, and placarding. Article also identifies maximum accumulation time for hazardous waste prior to transport to permitted hazardous waste facility.

4. Article 4: Record keeping and Reporting. Establishes requirements for the generator to keep records of manifests and other hazardous waste generation activities.

5. Article 5: Export of Hazardous Waste. This article establishes requirements applicable to exports of hazardous waste to a foreign country from the State. Except to the extent 40 CFR section 262.58 provides otherwise, a primary exporter of hazardous waste shall comply with the requirements of this article.

C. CCR, Title 22, Chapter 14, Standards for Owners and operators of hazardous wastes transfer, treatment, storage and disposal facilities.

1. Article 2: Requirements apply to the owners and operators of hazardous waste facilities. These requirements are for inspection, Personal Training, General Requirements, Location Standards, Construction Quality Assurance Program, Seismic and precipitation design standards. (66264.13 - 66264.25)

2. Article 3: Preparedness and prevention apply to of hazardous waste facility. These are related to design and operation, required equipment, testing and maintenance of equipment, access to communication or alarm system, required aisle space and informing the local authorities. 66264.30 - 66264.37

3. Article 4: Contingency and emergency procedures apply to the owners and operators of hazardous waste facilities. The owners and operators shall have contingency plan for the facility. 66264.52 - 66264.56

4. Article 5: Manifest System, Recordkeeping, and Reporting. The regulations in this article apply to owners and operators of both on-site and off-site facilities. 66264.71 - 66264.77

5. Article 6: Water Quality Monitoring and Response Programs for Permitted Facilities.

6. Article 7: Closure and Post-Closure. Requirements apply to the owners and operators of hazardous waste management facilities. 66264.111 through 66264.120

7. Article 9: Use and management of containers.

8. Article 10: Requirements that apply to the owners and operators of facilities that use Tank Systems[66264.190 - 66264.199]

9. Article 11: Regulations in this article apply to owners and operators of facilities that use surface impoundment to treat, store or dispose of hazardous waste. 66264.221 through 66264.231

10. Article 12: Regulations in this article apply to owners and operators of facilities that store or treat hazardous waste in piles unless exempt. 66264.251 through 66264.259.

11. Article 13: Land Treatment. Applies to treatment or disposal of hazardous waste in land treatment units. Requires demonstration of treatment of waste prior to application. 66264.270 - 66264.283

12. Article 14: This article applies to disposal of hazardous waste in Landfills. 66264.300 - 66264.318

13. Article 15.5: The regulations in this article apply to the construction of Corrective Action Management Units for the management of remediation waste. The DTSC may designate one or more CAMUs. Placement of remediation waste does not constitute land disposal. Temporary units may also be designated for the storage or treatment of remediation waste. 66264.500 - 66264.553

14. Article 27: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste by process vents associated with distillation, fraction, thin-film evaporation, solvent extraction, or air steam stripping. 66264.1030 through 1035

15. Article 28: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste, unless exempt. 66264.1052 through 66264.1065

D. CCR, Title 22, Chapter 16, Recyclable Materials (Recyclable hazardous waste)

1. Article 1: Identifies recyclable hazardous waste types including: solvents, petroleum products, pickling liquor, unspent acids, unspent alkalis, unrinsed empty containers. 66266.1 - 66266.2

2. Article 2. This article applies to the generation,

transportation, and facility operation requirements. A generator of a recyclable hazardous material shall comply with all of the hazardous waste requirements except for the Extremely Hazardous Waste Disposal Permit requirements. 66266.3 - 66266.5

E. CCR, Title 22, Chapter 18, Land Disposal Restrictions

1. Article 1: Identifies hazardous waste that are restricted from land disposal. 66268.1 - 66268.9

2. Article 2: Contains schedule for land disposal prohibition and establishment of treatment standards. 66268.10 - 66268.29

3. Article 3: Contains prohibitions on Land Disposal. 66268.30 - 66268.38

4. Article 4: This article identifies treatment standards. 66268.40 - 66268.48

5. Article 5: Identifies prohibitions on storage of waste restricted from land disposal. 66268.50

6. Article 10: Identifies land disposal prohibitions of non-RCRA hazardous waste. 66268.100

7. Article 11: Contains treatment standards for non-RCRA waste categories. 66268.105 - 66268.114

II. Investigation and Remediation of Hazardous Substance Release Sites

A. California Health and Safety Code, Chapter 6.5. Hazardous Substance Account

1. Section 25187: Authorizes the Department to issue corrective action orders.

a. Remedial Action Order, Issued 1988 by the DTSC to the Naval Air Station, Alameda

B. California Health and Safety Code, Chapter 6.8. Hazardous Substance Account

1. Article 2: Definitions

a. 25319.5 "Preliminary Endangerment Assessment". Activity which is performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous

substances which pose a threat to public health or the environment. 8-3-89

b. 25323.1 "Removal Action Workplan" A workplan approved by the DTSC or RWQCB to carry out a removal action. Includes: detailed engineering plan, description of onsite contamination, goals, and alternatives removal options that were considered and rejected and the basis for that rejection.

2. Article 5, Section 25355: Authorizes the Department to take over remedial actions at a hazardous substance release site if the Responsible Parties are not in compliance.

3. Article 5, Section 25355.5(a)(1)(B): Identifies requirements

4. Article 5, Section 25356.1, Remedial Action Plans and Removal Action Workplans

   a. Section 25356.1(d): All RAPs must be based upon Section 25350, Subpart F of the NCP and upon factors identified in this subsection.

   b. Section 25356.1(e): Identifies community involvement requirements as they relate to a RAP.

   c. Section 25356.1(f): Authorizes the DTSC to issue the final RAP.

   d. Section 25356.1(h): Exemptions to the RAP requirements.

      (1) Section 25356.1(h)(1): Authorizes the DTSC to prepare a Removal Action Workplan if the estimated cost of the removal action is less than $1,000,000. Identifies community involvement requirements for a RAW.

      (2) Section 25356.1(h)(2): A RAP is not required if the site listed on the National Priority List by the EPA.

      (3) Section 25356.1(h)(3): Authorizes DTSC to waive the RAP requirements in subdivision (d) if certain conditions apply, including estimated costs for remedial action below $2,000,000.

5. Article 5, Section 25358.1: Rights of the DTSC to

take actions at known or suspected hazardous substance release sites.

a. Section 25358.1(b)(1): The DTSC may require any potentially responsible party to furnish information on materials generated, stored, treated or disposed of at a hazardous substance release site

b. Section 25358.1(b)(2) The DTSC may require any potentially responsible party to furnish information on the nature or extent of a release or a threatened release of a hazardous substance at a hazardous substance release site.

6. Article 5, Section 25358.3(a): Authorizes the DTSC to take action in situations posing an imminent and substantial endangerment.

7. Article 5, Section 25358.3(b),(c): Authorizes the DTSC to undertake investigations whenever there has been a release or threat of a release of hazardous substances to the environment.

8. Article 5, Section 25358.4: Requires that all analysis of material to determine if it is hazardous must be done by a state certified and accredited laboratory.

9. Article 5, Section 25358.7: Identifies the right of any interested party who may be affected by remedial actions at a site to become involved in the DTSC decision making process.

10. Article 5, Section 25358.9: Authorizes the DTSC, to the extent consistent with RCRA, to exclude any portion of a response action conducted entirely onsite from the hazardous waste facility permit requirements of Section 25201 if both the following apply:

    a. The removal or remedial action is carried out pursuant to a removal action workplan or a remedial action plan approved by the DTSC.

    b. The RAW or RAP complies with all substantive requirements.

11. Article 5, Section 25359: Authorizes the DTSC to access punitive damages on Responsible Parties who fail to comply with clean-up and remediation orders.

12. Article 5, Section 25359.5: Authorizes the DTSC to issue 'Fence and Post' Orders and establishes their requirements.

13. Article 5, Section 25359.7: Requires a property owner to inform buyers of unmitigated hazardous substance releases on that property.

14. Article 6, Section 25367: Establishes penalties for the making of false claims and misrepresentations related to the release of hazardous substances to the environment.

C. California Health and Safety Code, Chapter 6.6: Safe Drinking Water and Toxic enforcement Act of 1986 (Prop. 65).

1. Section 25249.5: Prohibits the release, to drinking water, of hazardous substances which cause cancer or which have reproductive toxicity.

D. Preliminary Endangerment Assessment Guidelines, January 1995

III. Protection of Air Quality

A. Bay Area Air Quality Management District(BAQMD), Regulation 8, Rule 40, "Aeration of Contaminated Soil and Removal of Underground Storage Tanks:

B. BAAQMD, Regulation 8, Rule 47 "Air Stripping and Soil Vapor Extraction Operations"

IV. Soil Storage

A. Assembly Bill 1060, Richter (Chapter 627, Statutes of 1995): allow generators to hold contaminated soil from site cleanup projects in waste pile for up to one year or 18 months for purposes of offsite transportation, subject to certain conditions.

V. Sediment and Wetland Remediation

A. Endangered and Rare Species Protection

1. California Endangered Species Act of 1973

a. Fish and Game Code Section 2050; 2065

2. Requirements for endangered or rare species: Fish and Game Code Section 1900 et seq.; 2050 et seq. to 2068; 2070; 2080; 2090 et seq. to 2096;

3. Federal Endangered Species Act of 1973

B. Protection of fish and wildlife resources and their habitats

1. Designation of the Department of Fish and Game as trustee for State fish and wildlife resources: fish and Game Code Section 711.7;

2. Possession permit for scientific purposes, etc.: Fish and Game code Section 1002

3. Requirements for releasing substances deleterious to fish and wildlife: fish and Game Code Section 5650 (a)(b),(f): 5651; and 12016;

4. Illegal take of birds and mammals: Fish and Game Code Section 3003;

5. Relevant policies for the general protection and conservation of fish and wildlife resources: fish and Game Code Section 1600; 1700; 1750; 1801; and 2014; Water Code Section 1243

C. Federal Coastal Zone Management Act (16 USC 1456(c)(3)(A)): federal actions or federally funded or approved actions that affect the coastal zone must be consistent with the policies of the San Francisco Bay Conservation and Development Commission's federally approved coastal management program.

1. Elements of the BCDC's coastal management program:

a. McAteer-Petris Act

b. BCDC regulations

c. SF Bay Plan

d. SF Bay Area Seaport Plan: NAS Alameda designated as port priority

2. SFBCDC policies:

a. Fish and Wildlife: to the greatest extent feasible, remaining marshes and mudflats around the Bay, the remaining water volume and surface area of the Bay, and adequate freshwater inflow to the Bay should be maintained. Specific habitats that are needed to prevent the extinction of any species, or to maintain or increase any species that would provide substantial public benefits should be protected, whether in the

Bay or on the shoreline.

b. Water Quality: follow State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board. Bay marshes, mudflats, and water surface area and volume should be maintained and, wherever possible, increased.

c. Marshes and Mudflats: Marshes and mudflats are integral part of the Bay tidal system and, therefore, should be protected in the same manner as open water area. Filling and diking should only be allowed for purposes providing substantial public benefits and only if there is no reasonable alternative.

d. Mitigation: Mitigation should consist of measures to compensate for the adverse impacts of Bay fill to the natural resources of the Bay, such as to water surface area, volume, or circulation, and to fish and wildlife habitat or marshes or mudflats. Mitigation is no a substitute for meeting the other requirements of the McAteer-Petris Act concerning fill.

VI. Protection and Remediation of Groundwater

A. CCR, Title 23, Division 3, Chapter 15

1. Governs the discharge of waste to land for treatment, storage, and disposal and establish siting, containment, monitoring, and closure requirements

B. State Water Resources Control Board Resolution Number 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California), October 28, 1968

1. Requires the continued maintenance of high quality waters of the state even where that quality is better than needed to protect beneficial uses, unless specific findings are made.

2. Chemical-specific and action-specific

3. Beneficial uses of groundwater must be defined for NAS Alameda

C. State Water Resources Control Board Resolution 88-63 (Adoption of Policy Entitled "Sources of Drinking

Water"), May 19, 1988

1. The Resolution states that, with few specific exceptions, all surface and groundwaters of the state are to be considered existing drinking water sources except where the TDS is greater than 3000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal

D. State Water Resources Control Board Resolution 92-49 (As Amended on April 21, 1994), (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), July 8, 1994

E. Water Quality Control Plan, San Francisco Bay Basin Region, December 1986; and September 29, 1992 Basin Plan Amendments

F. California Code of Regulations, Title 22, Chapter 15, Domestic Water Quality Criteria and Monitoring

1. Article 4: Primary Standard - Inorganic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64431.0 - - 64437.0

2. Article 4.5: Primary Standard - Organic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64444.0 - - 64445.2

G. Title 3, Food and Agriculture; Division 6, Pesticides and Pest Control Operations; Chapter 4, Environmental Protection; Subchapter 1, Groundwater; Article 1, Pesticide Contamination Prevention.

1. Lists of pesticides labeled for agricultural, outdoor institutional or outdoor industrial use that contain chemicals designated as having the potential to pollute groundwater.

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17766 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Emergency Response Plan (ERP): potential emergency conditions that may cause the design of the site and could endanger the public health or environment must be anticipated. Response procedures for these conditions must be addressed in the RD/RA plans.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17767 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Security at Closed Sites: all points of access to the site must be restricted, except permitted entry points. All monitoring, control, and recovery systems shall be protected from unauthorized access.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17773 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Cover: the design and construction of the final cover must meet specific prescriptive standards of 23 CCR 2581(f). These include minimum thickness and quality of the construction material. If the prescriptive standard is not feasible then an engineered alternative that meets the performance goals (i.e. limiting infiltration, controlling gas emissions, compatibility with reuse) can be proposed.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17774 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Construction Quality Assurance (CQA): a CQA program must be designed and implemented. It must include specific parameters (and for some components specific testing methods) for each component of the final cover.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17776 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Grades: the final grades for the covered landfill must meet grading standards provided in 23 CCR 2581, they must be appropriate to control runoff and erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17777 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Site Face: the design of the final site face must provide for the integrity of the final cover both under static and dynamic conditions	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17778 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Drainage: the design of the final cover must control runon and runoff produced by a 100 year 24 hour storm event and must be prepared according to CQA requirements.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17779 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Slope Protection and Erosion Control: the design and construction of the slopes must protect the integrity of the final cover and minimize soil erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17781 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Leachate Control During Closure and Post Closure: leachate must be monitored, collected, treated, and discarded appropriately.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760. The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17783 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Gas Monitoring and Control During Closure and Post Closure: landfill gases must be collected and analyzed; the concentration of combustible gas at the landfill boundary must be 5% or less, trace gases must not be at levels that cause adverse health or environmental impacts.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 41020	14 CCR 17781 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Maintenance: the landfill must be maintained and monitored for no less than 30 years following closure.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 41020	14 CCR 17796 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Land Use: Site Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space. Changes in postclosure land use must be approved by the appropriate State agency prior to implementation.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 41509	14 CCR 18261.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 41509	14 CCR 18265.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 41509	14 CCR 18275 Chapter 5, Article 3.4 Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal site has closed pursuant to state standards.	Applies to solid waste disposal sites that received waste after January 1, 1988 Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites

14 CCR - California Code of Regulations, Title 14 ARAR - applicable or relevant and appropriate requirement ROD - Record of Decision RD/RA - remedial design/remedial action

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
5	Western Exposure Unit 1	Section 2.5	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Appendix A. Battelle 2011.

FINAL

FEASIBILITY STUDY REPORT
OPERABLE UNIT 2C
IR SITES 5 AND 10, ALAMEDA POINT
ALAMEDA, CALIFORNIA

APPENDIX A

HUMAN HEALTH RISK ASSESSMENT FOR THE WESTERN PORTION OF EXPOSURE UNIT 1

Contract No. N62473-07-D-4013
Task Order No. 0037
Project No. G922037

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May 2011

The vendors and products, including the equipment, system components, and other materials identified in this report, are primarily for information purposes only. Although Battelle may have used some of these vendors and products in the past, mention in this report does not constitute Battelle's recommendation for using these vendors or products.

CONTENTS

FIGURES ..... A-iii
TABLES ..... A-iii
ACRONYMS AND ABBREVIATIONS ..... A-iv

A1: HHRA for Western Portion of Exposure Unit 1 ..... A-1
A1.1 Data A-1
A1.2 Toxicity Assessment A-2
A1.3 Exposure Concentrations A-2
A1.4 Risk Characterization A-2
A1.5 Conclusions A-4

FIGURES

Figure A-1. Western Exposure Unit 1 Soil and Groundwater Risk Locations
Figure A-2. Naphthalene Concentrations in Soil

TABLES

Table A-1. Sampling Information for Soil
Table A-2. Sampling Information for Groundwater
Table A-3. Occurrence, Distribution, and Selection of Chemicals of Potential Concern, Exposure Unit 1 West, Soil (0–8 feet bgs)
Table A-4. Occurrence, Distribution, and Selection of Chemicals of Potential Concern, Exposure Unit 1 West, Groundwater
Table A-5. Chemicals of Potential Concern in Soil and Groundwater, Exposure Unit 1 West
Table A-6. Toxicity Values
Table A-7. Surrogate Chemicals for COPCs Without Toxicity Criteria
Table A-8. Summary of Location-Specific Total Risks
Table A-9. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident)
Table A-10. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, Cal/EPA (Resident)
Table A-11. Summary of Receptor Hazards for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident)

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
COPC	chemical of potential concern
EPC	exposure point concentration
FS	feasibility study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
J&E	Johnson & Ettinger
RI	remedial investigation
RSL	Regional Screening Level
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

A1: HHRA for Western Portion of Exposure Unit 1

The human health risk assessment (HHRA) conducted in the remedial investigation (RI) evaluated risks associated with chemicals in soil and groundwater within the entire Exposure Unit 1, but not solely the western portion of Exposure Unit 1. Therefore, additional risk calculations were conducted as part of this feasibility study (FS) for the western portion of Exposure Unit 1. The area outlined in orange on Figure A-1 is the western portion of Exposure Unit 1. The HHRA for the western portion of Exposure Unit 1 incorporated the same residential exposure assumptions and used a similar risk assessment methodology as that in the RI Report. Differences between the FS HHRA and the RI HHRA included the use of toxicity values that were updated to reflect the most recent changes in United States Environmental Protection Agency (U.S. EPA) toxicity factors and metals consistent with ambient background were not selected as chemicals of potential concern (COPCs). Note that the western portion of Exposure Unit 1 (as shown on Figure A-1) does not include Buildings 5 and 400, so the radiologically-impacted and potentially radiologically-impacted soil and groundwater beneath these buildings were not evaluated as part of this HHRA. Furthermore, radiological exposure from potentially radiologically-impacted areas outside the buildings are not included in this HHRA because the IR Sites 5 and 10 Storm Drain Time-Critical Removal Action has removed all radiologically-impacted drain lines/piping and soil such that no radiological exposure is present. A summary of the risk assessment process and the results for the western portion of Exposure Unit 1 HHRA are provided below.

A1.1 Data

The dataset for the western portion of Exposure Unit 1 was comprised of the soil and groundwater data collected from sample locations within the orange outlined area of Figure A-1, except for sample location DG043SB01, which is located within Local Area 2 (in the vicinity of Building 43). Local Area 2 was excluded from the dataset for the western portion of Exposure Unit 1 because the RI Report recommended evaluation of remedial alternatives for soil in Local Area 2, which is presented in this FS. The samples included in this western Exposure Unit 1 risk assessment are presented in Tables A-1 and A-2 for soil and groundwater, respectively.

Table A-3 provides justification as to why chemicals were or were not selected as COPCs in soil for this evaluation. Similar to how the HHRA was conducted in the RI, data for organic COPCs in soil that were infrequently reported above detection limits (i.e., <5%) were not included in the risk calculations. Chemicals eliminated based on low frequency of detection included Aroclor 1260 (detected in one of 45 samples) and n-nitroso-di-n-propylamine (detected in one of 89 samples).

Metals present at concentrations consistent with background are called “ambient” metals. Although the HHRA conducted during the RI evaluated all metals as COPCs, data for metals consistent with ambient concentrations or rarely reported above background values (95th Quantile from Tetra Tech EM Inc., 2004) were not selected as COPCs in the risk evaluation for the western portion of Exposure Unit 1 in order to represent incremental risk only. Ambient metals not selected as COPCs include arsenic, cadmium, iron, manganese, thallium, and vanadium. None of the ambient metals eliminated as COPCs were identified as primary risk drivers in the RI HHRA.

Table A-4 provides justification as to why chemicals were or were not selected as COPCs in groundwater for this evaluation. For groundwater, any volatile organic compound (VOC) detected at least once was selected as a COPC (Table A-4). Summary statistics of the data are presented on Tables A-3 and A-4 for soil and groundwater, respectively. The COPCs are listed on Table A-5.

A1.2 Toxicity Assessment

Two sets of cancer risks were calculated: one set based on U.S. EPA toxicity values obtained from the Regional Screening Levels (RSLs)[1] and the other set based on California EPA (Cal/EPA) toxicity values. Toxicity values are summarized on Table A-6. Note that U.S.EPA RSL toxicity values may be the same as the Cal/EPA toxicity values for some of the chemicals. For example, the inhalation cancer toxicity values (i.e., "CSFi" on Table A-6) for naphthalene are now the same. Surrogate chemicals assigned to COPCs without toxicity values are shown on Table A-7.

A1.3 Exposure Concentrations

The exposure point concentrations (EPCs) for all pathways except indoor air are based on an upper bound estimate of the average concentration of all data, as was done in the RI. Indoor air concentrations were estimated using the U.S. EPA Johnson & Ettinger (J&E) Models (i.e., Soil-Advanced and Groundwater Advanced) for Subsurface Vapor Intrusion into Buildings (version 3.1)[2] based on the maximum concentrations detected in soil and groundwater.

A1.4 Risk Characterization

To estimate the total excess cancer risks from all carcinogens, cancer risks from each COPC were summed across all exposure pathways. The hazard index (HI) was calculated by summing all hazard quotients (HQs) for all COPCs and exposure pathways.

Calculation of the indoor air risk was performed a little differently in this assessment than in the RI Report. Rather than determining the indoor air risk based on maximum soil and groundwater concentrations that are associated with sampling locations located some distance away from each other, a maximum indoor air risk was determined based on first identifying locations with the highest total (soil and groundwater) indoor air risk as follows:

1. The location with the highest indoor air risk associated with concentrations in soil in conjunction with the indoor air risk associated with the concentrations of chemicals from the nearest groundwater sampling location, and
2. The location with the highest indoor air risk associated with concentrations in groundwater in conjunction with the indoor air risk associated with the concentrations of chemicals in soil from the nearest soil sampling location.

Two locations, C3S005B089 and C3S005B029 located in the southern and northern portions of the western unit, respectively (refer to Figure A-1), were identified as having the highest soil to indoor air risk primarily due to the presence of naphthalene. Similarly, two locations, S05-7-3 and M05-02 (refer to Figure A-1), were identified as having the highest groundwater to indoor air risks due to the presence of vinyl chloride. Total (soil and groundwater) indoor air risks were then calculated for these four locations as described in bullets 1 and 2 above. Of the four locations identified as potentially having the highest location-specific indoor air risk, only three of these locations were selected for calculation of a total site risk (i.e., sum of all exposure pathways for all media) as explained below:

---

[1] United States Environmental Protection Agency (U.S. EPA). 2010. Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. RSL Table Update. November. http://www.epa.gov/region09/superfund/prg/index.html.

[2] United States Environmental Protection Agency (U.S. EPA). 2004. Software Implementation of Johnson and Ettinger Model. Version 3.1. February.

- Soil location C3S005B089 in conjunction with the groundwater data from M05-06 was identified as having a higher total (soil and groundwater) indoor air risk (refer to Figure A-1) than soil location C3S005B029. Therefore, soil location C3S005B089, in conjunction with the groundwater data from M05-06, was selected for calculation of total site risk.
- Groundwater locations S05-7-3 and M05-02, in conjunction with soil sample locations M05-09 and DG347SB01, respectively (refer to Figure A-1), were both selected because sample S05-7-3 had a higher total indoor air risk based on U.S. EPA toxicity, while groundwater location M05-02 had a higher total indoor air risk based on Cal/EPA toxicity.

Next, total risks were determined for these three locations (C3S005B089, S05-7-3, and M05-02) by adding the soil and groundwater indoor air risks with the risks associated with all of the other residential exposure pathways, including incidental ingestion of soil, dermal contact with soil, inhalation of soil particulates and vapors in outdoor air, inhalation of vapors from groundwater in outdoor air, and ingestion of produce. This approach provides a more realistic exposure for the potential receptor that may be more likely to reside in one general location for an exposure duration, rather than assume that one receptor can reside on opposite ends of the site for maximum exposure. Note that the indoor air risks were calculated based on the maximum concentrations detected in soil and groundwater, while the other exposure pathways for soil were calculated using an upper bound estimate of the average concentration of all data associated with the western portion of Exposure Unit 1. Total risks for the western portion of Exposure Unit 1 are summarized on Table A-8 for all three locations.

The results show that the highest location-specific total risk of 2×10^{-5} and HI of 2 is associated with chemicals detected in soil sample location C3S005B089 and associated groundwater data from M05-06. For risks calculated using U.S. EPA and Cal/EPA toxicity, the primary chemical and pathway contributing to this risk estimate is naphthalene in soil and inhalation of indoor air (at 2×10^{-5} for U.S. EPA and Cal/EPA). This estimate of indoor air risk for naphthalene is most likely overestimated. The model assumes that naphthalene is present throughout the soil column at the maximum concentration from the surface to groundwater under a future residence. In fact, the maximum naphthalene concentration (0.54 mg/kg) was detected in the surface soil sample (0 to 0.5 ft below ground surface [bgs]) at C3S005B089. Three additional soil samples between 0.5 and 8 ft bgs were collected at C3S005B089. The maximum naphthalene concentration detected in these three samples was less than 0.001 mg/kg, which would result in a cancer risk well below 1×10^{-6} (Figure A-2 shows the naphthalene concentrations in the soil). This indicates that the source of naphthalene present in soil is substantially less than the indoor air modeling assumes. In addition, the frequency and distribution of naphthalene detected in soil supports that concentrations present in the soil will not pose unacceptable indoor air risks to potential future residents in the Western Portion of Exposure Unit 1. This conclusion is based on the fact that naphthalene was detected in 88 of 228 soil samples, and the highest naphthalene concentration in Western Exposure Unit 1 was detected at C3S005B089 (0.54 mg/kg). The next highest naphthalene concentration in soil was detected at C3S005B029 (0.48 mg/kg). These two concentrations as well as all other concentrations of naphthalene are below the November 2010 U.S. EPA residential screening level (RSL) of 3.6 mg/kg. The RSL of 3.6 mg/kg is based on standard default exposure assumptions associated with incidental ingestion of soil, dermal contact, and inhalation of ambient vapors released from exposed soils; however this value does not include exposure through migration from subsurface soil. Uncertainties associated with the risk estimate for migration from subsurface soil to indoor air are presented in Appendix A.

For the HI of 2, naphthalene and cobalt in soil are the primary contributors. Naphthalene has an HQ of 0.8 based on the inhalation route of exposure, and cobalt has an HQ of 0.9 due to incidental ingestion. Generally, contaminant-specific HQs are summed to derive pathway-specific HI values. This approach may result in a situation where HI values exceed unity (i.e., one), even when no contaminant-specific HQs exceed one, indicating adverse systemic health effects would be expected to occur only if

the receptor was exposed to multiple contaminants simultaneously. In this case, contaminants can be segregated by effect and mode of action on a target organ, resulting in separate HI values for each effect.[3] For naphthalene, hyperplasia and metaplasia in the respiratory and olfactory epithelium is the adverse effect, whereas thyroid toxicity is the critical effect for cobalt. Because the critical effects and modes of action are different for naphthalene and cobalt, the HQs should be considered non-additive and the resulting HI less than 1.

The two locations with the highest groundwater indoor air risks have lower site risks. The location around groundwater sample S05-7-3 has total cancer risks of 4×10^{-6} and 8×10^{-6} for U.S. EPA and Cal/EPA, respectively, and an HI of 1. The other location around groundwater sample M05-02 has total cancer risks of 3×10^{-6} and 1×10^{-5} for U.S. EPA and Cal/EPA, respectively, and an HI of 1.

Individual chemical cancer risk summaries are presented on Table A-9 for U.S. EPA, Table A-10 for Cal/EPA cancer risk and Table A-11 for non-cancer hazard.

A1.5 Conclusions

Total risk estimated for the residential receptor in the western portion of Exposure Unit 1 is 2×10^{-5} for U.S. EPA and Cal/EPA and the non-cancer HI is less than 1. Naphthalene in soil was the primary risk driver and exposure to indoor air was the primary exposure pathway contributing to excess risk. Cancer risk for the western portion of Exposure Unit 1 is within the risk management range and the HI is below 1. In addition, as stated previously, the risk is overestimated because:

- The naphthalene concentration, which was detected in the surface soil sample collected from C3S005B089 and used as the EPC for calculating indoor air risk, is 0.54 mg/kg; however, the concentration of naphthalene immediately beneath this surface sample at 0.5 feet bgs is 0.0006 J mg/kg (Figure A-2 shows the naphthalene concentrations in the soil), indicating that there is not an infinite source of naphthalene present in soil as the indoor air modeling assumes; and
- Because the presence of naphthalene was limited to the surface soil, there would be no on-going subsurface source for vapor intrusion after construction activities were completed in this area.

Therefore, based on the results and discussion of the residential scenario risk assessment conducted for the western portion of Exposure Unit 1 presented above, no further action is required for soil or groundwater.

[3] United States Environmental Protection Agency (U.S. EPA). 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final*. EPA/540/1-89/002. Office of Emergency and Remedial Response. Washington, DC. December.

FIGURES

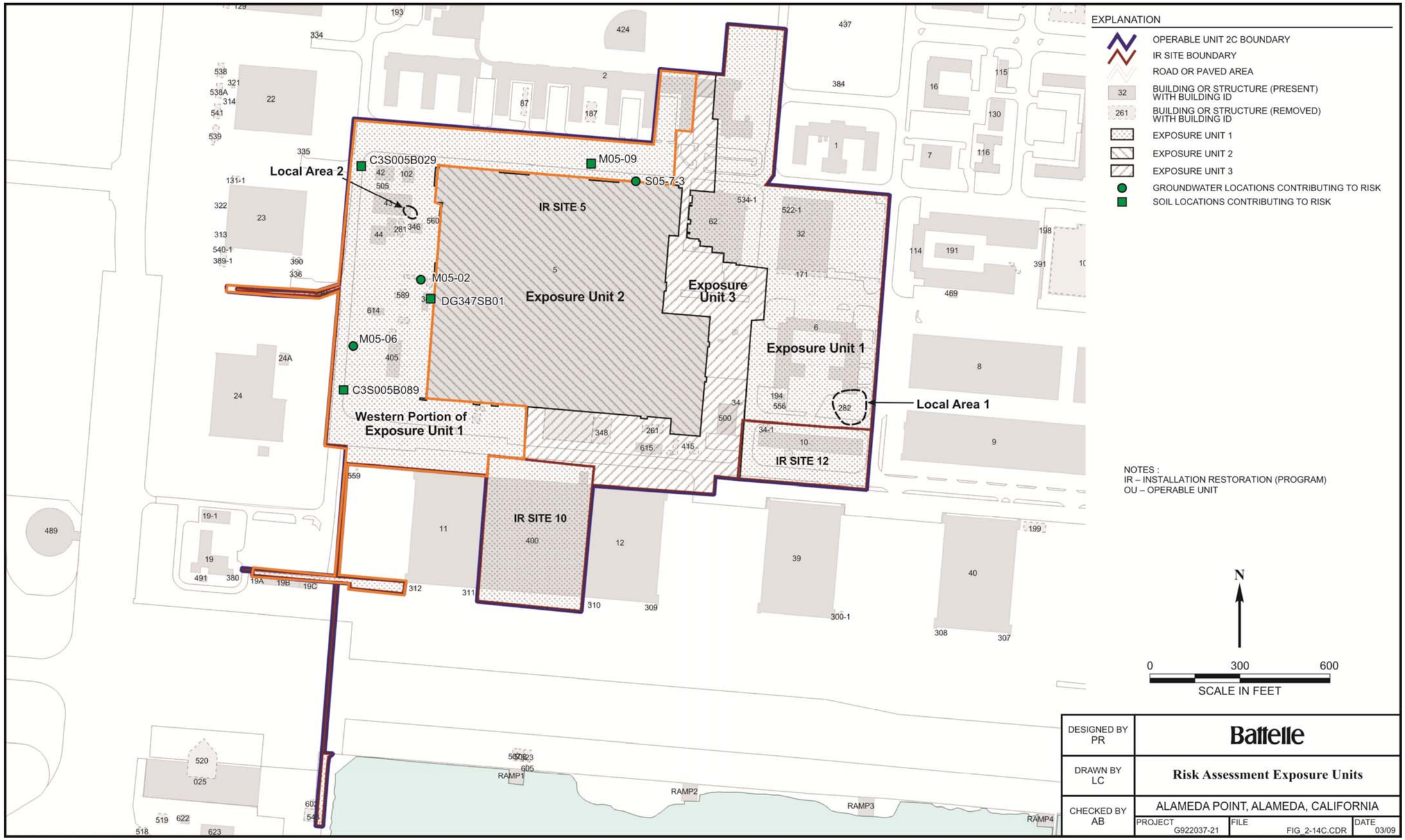


Figure A-1. Western Exposure Unit 1 Soil and Groundwater Risk Locations

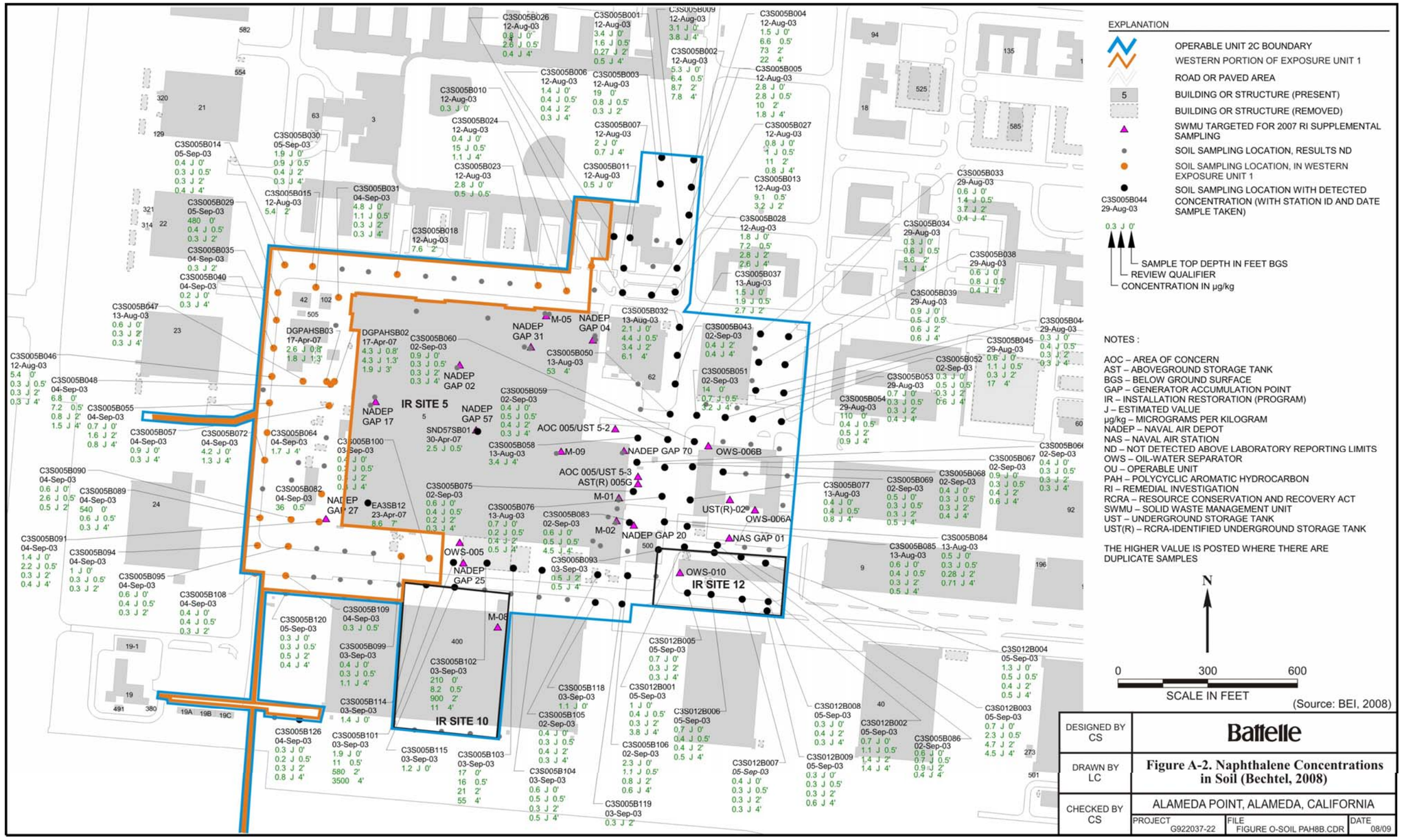


Figure A-2. Naphthalene Concentrations in Soil[4]

[4] Bechtel Environmental, Inc (BEI). 2008. *Final Remedial Investigation Report for Operable Unit 2C, Alameda Point, Alameda, California*. Volumes 1 through 3. September.

TABLES

Table A-1. Sampling Information for Soil

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
030-FLI-038	030-FLI-038	0	3.5	REG	09/11/98
030-S05-001	030-S05-001	0	5.5	REG	08/17/98
030-S05-002	030-S05-002	0	5.5	REG	08/17/98
030-S05-003	030-S05-003	0	5.5	REG	08/17/98
030-S05-004	030-S05-004	0	5.5	REG	08/17/98
030-S05-005	030-S05-005	0	5	REG	08/19/98
030-S05-006	030-S05-006	0	5.5	REG	08/19/98
030-S05-009	030-S05-009	0	7.5	REG	09/11/98
030-Z06-028	030-0035	3	3.5	REG	03/21/95
030-Z06-028	030-0036	3	3.5	FD	03/21/95
048-SS-001	048M-001M	7	7.5	REG	02/08/95
048-SS-001	048M-001	7	7.5	REG	02/08/95
048-SS-002	048M-002M	4	5	REG	02/01/95
048-SS-002	048M-012	4	5	FD	02/01/95
048-SS-002	048M-002	4	5	REG	02/01/95
049-001-001	049-0001	0.8	1.3	REG	05/03/95
049-001-002	049-0002	1	2	REG	05/04/95
049-001-002	049-0019	1	2	FD	05/04/95
049-001-003	049-0003	1	1.5	REG	05/02/95
049-001-004	049-0004	0.5	1	REG	05/03/95
049-001-005	049-0005	1	1.5	REG	05/02/95
049-001-006	049-0006	1	1.5	REG	05/02/95
049-001-007	049-0007	3	3.5	REG	05/02/95
049-001-008	049-0008	3	3.5	REG	05/02/95
049-001-009	049-0009	3	3.5	REG	05/01/95
049-001-010	049-0010	3	3.5	REG	05/03/95
049-001-011	049-0011	3	3.5	REG	06/01/95
049-001-012	049-0012	3	3.5	REG	06/01/95
049-001-013	049-0013	3	3.5	REG	06/01/95
049-001-014	049-0014	3	3.5	REG	05/01/95
049-003-017	049-0017	4	5	REG	05/04/95
049-003-017	049-0020	4	5	FD	05/04/95
049-003-018	049-0018	4	4.5	REG	05/04/95
049-IW-003	049I-003	3	4	REG	02/13/95
049-IW-003	049I-003M	3	4	REG	02/13/95
049-SS-002	049M-002M	6.5	7	REG	02/03/95
049-SS-002	049M-002	6.5	7	REG	02/03/95
049-SS-003	049M-003M	4.5	5	REG	02/21/95
049-SS-003	049M-003	4.5	5	REG	02/21/95
051-SN-001	051S-001M	5	5.5	REG	02/28/95
051-SN-001	051S-001	5	5.5	REG	02/28/95
051-SS-004	051M-004M	5	5.5	REG	02/27/95
051-SS-004	051M-004	5	5.5	REG	02/27/95
054-005-030	054-0030	4	4.5	REG	07/05/95
054-005-031	054-0031	4	4.5	REG	07/05/95
054-IW-003	054I-003	5.5	7.5	REG	12/06/94

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
054-IW-003	054I-003M	5.5	7.5	REG	12/06/94
054-SN-004	054S-004M	7.5	8	REG	12/20/94
054-SN-004	054S-004	7.5	8	REG	12/20/94
054-SN-004	054S-014M	7.5	8	FD	12/20/94
054-SN-005	054S-005M	6.5	7	REG	12/20/94
054-SN-005	054S-005	6.5	7	REG	12/20/94
054-SS-002	054M-012M	4	5.5	FD	05/24/95
054-SS-002	054M-002M	4.5	5	REG	05/24/95
054-SS-002	054M-002	4	5.5	REG	05/24/95
5-C1	5-C1	6	6	REG	05/21/95
B05-06	B05-06-000	1	1.5	REG	07/12/91
B05-06	B05-06-002	2	3.5	REG	07/12/91
B05-07	B05-07-000	1	1.5	REG	07/12/91
B05-07	B05-07-002	2	3.5	REG	07/12/91
B05-13	B05-13-002	2	3	REG	07/11/91
B05-13	B05-13-000	1	1.5	REG	07/11/91
B10-04	B10-04-005	5	6	REG	08/02/91
B10-04	B10-04-000	0.5	1	REG	08/02/91
C3S005B010	C0592206	0.5	2	REG	08/12/03
C3S005B010	C0592208	4	8	REG	08/12/03
C3S005B010	C0592207	2	4	REG	08/12/03
C3S005B010	C0592205	0	0.5	REG	08/12/03
C3S005B014	C0592222	0	0.5	REG	09/05/03
C3S005B014	C0592226	4	8	REG	09/05/03
C3S005B014	C0592225	2	4	REG	09/05/03
C3S005B014	C0592224	0.5	2	FD	09/05/03
C3S005B014	C0592223	0.5	2	REG	09/05/03
C3S005B015	C0592228	0.5	2	REG	08/12/03
C3S005B015	C0592230	4	8	REG	08/12/03
C3S005B015	C0592227	0	0.5	REG	08/12/03
C3S005B015	C0592229	2	4	REG	08/12/03
C3S005B016	C0592232	0.5	2	REG	08/12/03
C3S005B016	C0592235	4	8	REG	08/12/03
C3S005B016	C0592231	0	0.5	REG	08/12/03
C3S005B016	C0592234	2	4	FD	08/12/03
C3S005B016	C0592233	2	4	REG	08/12/03
C3S005B017	C0592239	4	8	REG	08/12/03
C3S005B017	C0592238	2	4	REG	08/12/03
C3S005B017	C0592236	0	0.5	REG	08/12/03
C3S005B017	C0592237	0.5	2	REG	08/12/03
C3S005B018	C0592243	4	8	REG	08/12/03
C3S005B018	C0592240	0	0.5	REG	08/12/03
C3S005B018	C0592241	0.5	2	REG	08/12/03
C3S005B018	C0592242	2	4	REG	08/12/03
C3S005B019	C0592248	4	8	REG	08/12/03
C3S005B019	C0592246	0.5	2	REG	08/12/03
C3S005B019	C0592247	2	4	REG	08/12/03

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
C3S005B019	C0592245	0	0.5	REG	08/12/03
C3S005B020	C0592252	4	8	REG	08/12/03
C3S005B020	C0592249	0	0.5	REG	08/12/03
C3S005B020	C0592251	2	4	REG	08/12/03
C3S005B020	C0592250	0.5	2	REG	08/12/03
C3S005B021	C0592256	2	4	REG	08/12/03
C3S005B021	C0592255	0.5	2	REG	08/12/03
C3S005B021	C0592253	0	0.5	REG	08/12/03
C3S005B021	C0592257	4	8	REG	08/12/03
C3S005B022	C0592261	4	8	REG	08/12/03
C3S005B022	C0592259	0.5	2	REG	08/12/03
C3S005B022	C0592260	2	4	REG	08/12/03
C3S005B022	C0592258	0	0.5	REG	08/12/03
C3S005B023	C0592266	4	8	REG	08/12/03
C3S005B023	C0592262	0	0.5	REG	08/12/03
C3S005B023	C0592264	0.5	2	FD	08/12/03
C3S005B023	C0592265	2	4	REG	08/12/03
C3S005B023	C0592263	0.5	2	REG	08/12/03
C3S005B024	C0592268	0.5	2	REG	08/12/03
C3S005B024	C0592267	0	0.5	REG	08/12/03
C3S005B024	C0592270	4	8	REG	08/12/03
C3S005B024	C0592269	2	4	REG	08/12/03
C3S005B029	C0592289	0	0.5	REG	09/05/03
C3S005B029	C0592290	0.5	2	REG	09/05/03
C3S005B029	C0592291	2	4	REG	09/05/03
C3S005B029	C0592292	4	8	REG	09/05/03
C3S005B030	C0592294	0	0.5	FD	09/05/03
C3S005B030	C0592295	0.5	2	REG	09/05/03
C3S005B030	C0592296	2	4	REG	09/05/03
C3S005B030	C0592297	4	8	REG	09/05/03
C3S005B030	C0592293	0	0.5	REG	09/05/03
C3S005B031	C0592298	0	0.5	REG	09/04/03
C3S005B031	C0592299	0.5	2	REG	09/04/03
C3S005B031	C0592300	2	4	REG	09/04/03
C3S005B031	C0592301	4	8	REG	09/04/03
C3S005B035	C0592319	4	8	REG	09/04/03
C3S005B035	C0592317	0.5	2	REG	09/04/03
C3S005B035	C0592316	0	0.5	REG	09/04/03
C3S005B035	C0592318	2	4	REG	09/04/03
C3S005B036	C0592320	0	0.5	REG	09/04/03
C3S005B036	C0592321	0.5	2	REG	09/04/03
C3S005B036	C0592322	2	4	REG	09/04/03
C3S005B036	C0592323	4	8	REG	09/04/03
C3S005B040	C0592339	0.5	2	REG	09/04/03
C3S005B040	C0592340	2	4	REG	09/04/03
C3S005B040	C0592338	0	0.5	REG	09/04/03
C3S005B040	C0592341	4	8	REG	09/04/03

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
C3S005B046	C0592367	2	4	REG	08/12/03
C3S005B046	C0592366	0.5	2	REG	08/12/03
C3S005B046	C0592365	0	0.5	REG	08/12/03
C3S005B046	C0592368	4	8	REG	08/12/03
C3S005B047	C0592369	0	0.5	REG	08/13/03
C3S005B047	C0592372	4	8	REG	08/13/03
C3S005B047	C0592371	2	4	REG	08/13/03
C3S005B047	C0592370	0.5	2	REG	08/13/03
C3S005B048	C0592377	4	8	REG	09/04/03
C3S005B048	C0592375	0.5	2	REG	09/04/03
C3S005B048	C0592374	0	0.5	FD	09/04/03
C3S005B048	C0592376	2	4	REG	09/04/03
C3S005B048	C0592373	0	0.5	REG	09/04/03
C3S005B055	C0592406	0.5	2	REG	09/04/03
C3S005B055	C0592407	2	4	REG	09/04/03
C3S005B055	C0592408	4	8	REG	09/04/03
C3S005B055	C0592405	0	0.5	REG	09/04/03
C3S005B057	C0592415	0.5	2	REG	09/04/03
C3S005B057	C0592416	2	4	REG	09/04/03
C3S005B057	C0592413	0	0.5	REG	09/04/03
C3S005B057	C0592417	4	8	REG	09/04/03
C3S005B057	C0592414	0	0.5	FD	09/04/03
C3S005B064	C0592445	0	0.5	REG	09/04/03
C3S005B064	C0592446	0.5	2	REG	09/04/03
C3S005B064	C0592447	2	4	REG	09/04/03
C3S005B064	C0592448	4	8	REG	09/04/03
C3S005B065	C0592451	2	4	REG	09/04/03
C3S005B065	C0592450	0.5	2	REG	09/04/03
C3S005B065	C0592449	0	0.5	REG	09/04/03
C3S005B065	C0592452	4	8	REG	09/04/03
C3S005B072	C0592480	0	0.5	REG	09/04/03
C3S005B072	C0592481	0.5	2	REG	09/04/03
C3S005B072	C0592482	2	4	REG	09/04/03
C3S005B072	C0592483	4	8	REG	09/04/03
C3S005B073	C0592485	0	0.5	REG	09/04/03
C3S005B073	C0592488	4	8	REG	09/04/03
C3S005B073	C0592487	2	4	REG	09/04/03
C3S005B073	C0592486	0.5	2	REG	09/04/03
C3S005B074	C0592489	0	0.5	REG	09/04/03
C3S005B074	C0592490	0.5	2	REG	09/04/03
C3S005B074	C0592491	2	4	REG	09/04/03
C3S005B074	C0592492	4	8	REG	09/04/03
C3S005B080	C0592516	0	0.5	REG	09/04/03
C3S005B080	C0592519	4	8	REG	09/04/03
C3S005B080	C0592517	0.5	2	REG	09/04/03
C3S005B080	C0592518	2	4	REG	09/04/03
C3S005B081	C0592522	2	4	REG	09/04/03

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
C3S005B081	C0592523	4	8	REG	09/04/03
C3S005B081	C0592520	0	0.5	REG	09/04/03
C3S005B081	C0592521	0.5	2	REG	09/04/03
C3S005B081	C0592524	4	8	FD	09/04/03
C3S005B082	C0592527	2	4	REG	09/04/03
C3S005B082	C0592526	0.5	2	REG	09/04/03
C3S005B082	C0592525	0	0.5	REG	09/04/03
C3S005B082	C0592528	4	8	REG	09/04/03
C3S005B089	C0592558	2	4	REG	09/04/03
C3S005B089	C0592556	0	0.5	REG	09/04/03
C3S005B089	C0592557	0.5	2	REG	09/04/03
C3S005B089	C0592559	4	8	REG	09/04/03
C3S005B090	C0592563	4	8	REG	09/04/03
C3S005B090	C0592560	0	0.5	REG	09/04/03
C3S005B090	C0592561	0.5	2	REG	09/04/03
C3S005B090	C0592562	2	4	REG	09/04/03
C3S005B091	C0592568	4	8	REG	09/04/03
C3S005B091	C0592566	0.5	2	REG	09/04/03
C3S005B091	C0592565	0	0.5	REG	09/04/03
C3S005B091	C0592567	2	4	REG	09/04/03
C3S005B094	C0592581	4	8	REG	09/04/03
C3S005B094	C0592578	0	0.5	REG	09/04/03
C3S005B094	C0592580	2	4	REG	09/04/03
C3S005B094	C0592579	0.5	2	REG	09/04/03
C3S005B095	C0592584	0.5	2	FD	09/04/03
C3S005B095	C0592582	0	0.5	REG	09/04/03
C3S005B095	C0592585	2	4	REG	09/04/03
C3S005B095	C0592586	4	8	REG	09/04/03
C3S005B095	C0592583	0.5	2	REG	09/04/03
C3S005B096	C0592587	0	0.5	REG	09/03/03
C3S005B096	C0592589	2	4	REG	09/03/03
C3S005B096	C0592590	4	8	REG	09/03/03
C3S005B096	C0592588	0.5	2	REG	09/03/03
C3S005B097	C0592595	4	8	REG	09/03/03
C3S005B097	C0592591	0	0.5	REG	09/03/03
C3S005B097	C0592592	0.5	2	REG	09/03/03
C3S005B097	C0592593	2	4	REG	09/03/03
C3S005B098	C0592596	0	0.5	REG	09/03/03
C3S005B098	C0592597	0.5	2	REG	09/03/03
C3S005B098	C0592598	2	4	REG	09/03/03
C3S005B098	C0592599	4	8	REG	09/03/03
C3S005B099	C0592603	4	8	REG	09/03/03
C3S005B099	C0592601	0.5	2	REG	09/03/03
C3S005B099	C0592600	0	0.5	REG	09/03/03
C3S005B099	C0592602	2	4	REG	09/03/03
C3S005B099	C0592604	4	8	FD	09/03/03
C3S005B100	C0592607	2	4	REG	09/03/03

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
C3S005B100	C0592605	0	0.5	REG	09/03/03
C3S005B100	C0592606	0.5	2	REG	09/03/03
C3S005B100	C0592608	4	8	REG	09/03/03
C3S005B108	C0592643	4	8	REG	09/04/03
C3S005B108	C0592644	0	0.5	REG	09/04/03
C3S005B108	C0592641	0.5	2	REG	09/04/03
C3S005B108	C0592642	2	4	REG	09/04/03
C3S005B109	C0592648	4	8	REG	09/04/03
C3S005B109	C0592646	0.5	2	REG	09/04/03
C3S005B109	C0592645	0	0.5	REG	09/04/03
C3S005B109	C0592647	2	4	REG	09/04/03
C3S005B110	C0592652	4	8	REG	09/03/03
C3S005B110	C0592651	2	4	REG	09/03/03
C3S005B110	C0592649	0	0.5	REG	09/03/03
C3S005B110	C0592650	0.5	2	REG	09/03/03
C3S005B111	C0592654	0	0.5	REG	09/03/03
C3S005B111	C0592657	4	8	REG	09/03/03
C3S005B111	C0592656	2	4	REG	09/03/03
C3S005B111	C0592655	0.5	2	REG	09/03/03
C3S005B112	C0592661	4	8	REG	09/03/03
C3S005B112	C0592659	0.5	2	REG	09/03/03
C3S005B112	C0592660	2	4	REG	09/03/03
C3S005B112	C0592662	0	0.5	FD	09/03/03
C3S005B113	C0592666	4	8	REG	09/03/03
C3S005B113	C0592665	2	4	REG	09/03/03
C3S005B113	C0592664	0.5	2	REG	09/03/03
C3S005B113	C0592663	0	0.5	REG	09/03/03
C3S005B114	C0592669	2	4	REG	09/03/03
C3S005B114	C0592671	0	0.5	FD	09/03/03
C3S005B114	C0592670	4	8	REG	09/03/03
C3S005B114	C0592668	0.5	2	REG	09/03/03
C3S005B120	C0592695	0.5	2	REG	09/05/03
C3S005B120	C0592696	2	4	REG	09/05/03
C3S005B120	C0592694	0	0.5	REG	09/05/03
C3S005B120	C0592697	4	8	REG	09/05/03
C3S005B122	C0592703	0	0.5	REG	09/03/03
C3S005B122	C0592706	4	8	REG	09/03/03
C3S005B122	C0592704	0.5	2	REG	09/03/03
C3S005B122	C0592705	2	4	REG	09/03/03
C3S005B123	C0592707	0	0.5	REG	09/03/03
C3S005B123	C0592709	2	4	REG	09/03/03
C3S005B123	C0592708	0.5	2	REG	09/03/03
C3S005B123	C0592710	4	8	REG	09/03/03
C3S005B123	C0592711	0	0.5	FD	09/03/03
C3S005B124	C0592713	0	0.5	REG	09/03/03
C3S005B124	C0592712	0.5	2	REG	09/03/03
C3S005B124	C0592715	4	8	REG	09/03/03

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
C3S005B124	C0592714	2	4	REG	09/03/03
C3S005B125	C0592719	4	8	REG	09/05/03
C3S005B125	C0592720	0	0.5	REG	09/05/03
C3S005B125	C0592717	0.5	2	REG	09/05/03
C3S005B125	C0592718	2	4	REG	09/05/03
C3S005B126	C0592723	4	8	REG	09/04/03
C3S005B126	C0592724	0	0.5	REG	09/04/03
C3S005B126	C0592722	2	4	REG	09/04/03
C3S005B126	C0592721	0.5	2	REG	09/04/03
DG043SB01	C093S600	5	5.5	REG	03/28/07
DG043SB01	C093S235	1.5	2	REG	03/28/07
DG043SB02	C093S396	2	2.5	REG	05/07/07
DG043SB02	C093S395	0.8	1.3	REG	05/07/07
DG043SB03	C093S398	0.8	1.3	REG	04/19/07
DG043SB03	C093S399	3	3.5	REG	04/19/07
DG043SB04	C093S401	0.8	1.3	REG	05/07/07
DG043SB04	C093S402	2.5	3	REG	05/07/07
DG044SB01	C093S236	0.5	1	REG	04/23/07
DG044SB01	C093S237	3	3.5	REG	04/23/07
DG102SB01	C093S238	0.2	0.8	REG	03/26/07
DG102SB01	C093S239	2.5	3	REG	03/26/07
DG347SB01	C093S243A	0.8	1.3	REG	05/04/07
DG347SB01	C093S609A	2	2.5	REG	05/09/07
DG347SB01	C093S245A	7	7.75	REG	04/23/07
DG347SB01	C093S244A	4	4.75	REG	04/23/07
DG347SB02	C093S246A	0.5	1.3	REG	05/04/07
DG347SB02	C093S247A	3.2	4	REG	05/04/07
DG347SB02	C093S248A	6.2	7	REG	05/04/07
DG347SB03	C093S249A	0.5	1.3	REG	05/04/07
DG347SB03	C093S251A	6.2	7	REG	05/04/07
DG347SB03	C093S250A	2	2.8	REG	05/04/07
DG405SB01	C093S276	0.5	1.25	REG	03/27/07
DG405SB01	C093S277A	4	4.75	REG	03/27/07
DG405SB01	C093S278A	4.75	5.5	REG	03/27/07
DG405SB01	C093S276A	0.5	1.25	REG	03/27/07
DG405SB02	C093S280A	4	4.75	REG	03/27/07
DG405SB02	C093S281A	4.75	5.5	REG	03/27/07
DG405SB02	C093S279A	0.5	1.25	REG	03/27/07
DG505SB01	C093S292A	2.3	3	REG	03/26/07
DG505SB01	C093S291A	1	1.75	REG	03/26/07
DG505SB02	C093S293A	7.25	8	REG	04/04/07
DG505SB02	C093S293	7.25	8	REG	04/04/07
DG505SB03	C093S392	0.7	1.2	REG	04/19/07
DG505SB03	C093S393	3	3.5	REG	04/19/07
DG505SB04	C093S405	3	3.5	REG	04/19/07
DG505SB04	C093S404	0.3	0.8	REG	04/19/07
DG505SB05	C093S407	0.3	0.8	REG	04/19/07

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
DG505SB05	C093S408	3	3.5	REG	04/19/07
DGPAHSB01	C093S294	1	1.5	REG	04/17/07
DGPAHSB01	C093S297	6	7.5	REG	04/17/07
DGPAHSB01	C093S295	1.5	2.5	REG	04/17/07
DGPAHSB01	C093S296	3	4.75	REG	04/17/07
DGPAHSB02	C093S298	0.8	1.3	REG	04/17/07
DGPAHSB02	C093S301	6	8	REG	04/17/07
DGPAHSB02	C093S300	3	5	REG	04/17/07
DGPAHSB02	C093S299	1.3	2	REG	04/17/07
DGPAHSB03	C093S304	3	5	REG	04/17/07
DGPAHSB03	C093S302	0.8	1.3	REG	04/17/07
DGPAHSB03	C093S305	6	8	REG	04/17/07
DGPAHSB03	C093S303	1.3	2	REG	04/17/07
EA2SB01	C093S001	0	0.5	REG	03/22/07
EA2SB01	C093S002	2.5	3	REG	03/22/07
EA5SB01	C093S158	0.6	1.1	REG	04/16/07
EA5SB01	C093S159	3	3.5	REG	04/16/07
EA5SB02	C093S160	0.6	1.1	REG	04/16/07
EA5SB02	C093S161	3	3.5	REG	04/16/07
EA5SB03	C093S162	0.6	1.1	REG	04/16/07
EA5SB03	C093S163	3	3.5	REG	04/16/07
EA5SB04	C093S164	0.6	1.1	REG	04/16/07
EA5SB04	C093S165	3	3.5	REG	04/16/07
EA5SB08	C093S172	0.5	1.25	REG	04/16/07
EA5SB08	C093S173	3	3.5	REG	04/16/07
M05-01	B05-01-000	1	1.3	REG	07/16/91
M05-01	B05-01-003	2	3	REG	07/16/91
M05-02	B05-02-000	1	1.5	REG	07/16/91
M05-02	B05-02-003	2.5	3.5	REG	07/16/91
M05-02	B05-02-000-DUP	1	1.5	FD	07/16/91
M05-06	260-S05-014	5	5.5	REG	03/31/94
M05-06	260-S05-012	0.5	1.5	REG	03/31/94
M05-06	260-S05-013	2.5	3.5	REG	03/31/94
M05-09	260-S05-023	5	5.5	REG	03/28/94
M05-09	260-S05-021	1	1.5	REG	03/28/94
M05-09	260-S05-022	2.5	3	REG	03/28/94
M117-E	280-RA-049	2.5	3.5	REG	08/18/94
M117-E	280-RA-048	0	1.5	REG	08/18/94
M117-E	280-RA-050	5	6	REG	08/18/94
SND27SB01	C093S371	0.5	1	REG	03/27/07
SND27SB01	C093S372	2	2.75	REG	03/27/07
SND27SB01	C093S373	6.7	7.4	REG	03/27/07
SND27SB01	C093S373A	6.7	7.4	REG	03/27/07
SND27SB01	C093S371A	0.5	1	REG	03/27/07
SND27SB01	C093S372A	2	2.75	REG	03/27/07
SND27SB02	C093S374	0.25	1	REG	03/27/07
SND27SB02	C093S375	2.25	3	REG	03/27/07

Table A-1. Sampling Information for Soil (Continued)

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
SND27SB02	C093S376	5.5	6.25	REG	03/27/07
SND27SB03	C093S416	0.5	1	REG	05/09/07
SND27SB03	C093S417	2	3	REG	05/09/07
SND27SB03	C093S418	3.5	4	REG	05/09/07
SND27SB04	C093S420	2	2.5	REG	05/09/07
SND27SB04	C093S419	0.5	1	REG	05/09/07
SND27SB04	C093S421	5	5.5	REG	05/09/07
SND27SB05	C093S422	0.5	1	REG	05/09/07
SND27SB05	C093S424	6.5	7	REG	05/09/07
SND27SB05	C093S423	2	2.5	REG	05/09/07

* The maximum detection or lowest detection limit was used between samples and duplicates
REG – regular sample
FD – field duplicate sample

Table A-2. Sampling Information for Groundwater

Station ID	Sample ID	Top Depth (feet)	Bottom Depth (feet)	Sample Type*	Collection Date
045-003-008	045-0010	11	12	REG	11/01/95
045-003-009	045-0011	11	12	REG	11/02/95
26B27	C014G021	5	5	REG	02/27/02
DG043SB01	C093G063A	10	15	REG	03/28/07
DG044SB01	C093G065A	10	15	REG	04/23/07
DG102SB01	C093G067A	10	15	REG	03/26/07
DG505SB02	C093G070A	10	15	REG	04/05/07
EA2SB01	C093G029	10	15	REG	04/09/07
EA2SB03	C093G033	10	15	REG	04/10/07
EA2SB04	C093G035	10	15	REG	04/11/07
EA2SB09	C093G118	8	13	REG	05/08/07
EA2SB09	C093G909	8	13	FD	05/08/07
M05-01	M05-01-A2005	4	14	REG	03/09/05
M05-01	M05-01-D4681	4	14	REG	08/29/05
M05-01	C093G015	10	15	REG	05/01/07
M05-02	M05-02-A2005	4	14	REG	03/10/05
M05-02	M05-02-D4682	4	14	REG	08/29/05
M05-02	M05-02-A5131	4	14	REG	04/13/06
M05-02	M05-02-C5614	4	14	REG	10/02/06
M05-02	C093G005	10	15	REG	05/03/07
M05-06	M05-06-D4684	3	13	REG	08/29/05
M05-06	M05-06-A5134	3	13	REG	04/13/06
M05-06	M05-06-C5616	3	13	REG	10/02/06
M05-06	C093G008	10	15	REG	05/02/07
M05-09	M05-09-A2005	5	15	REG	03/10/05
M05-09	M05-09-D4687	5	15	REG	08/30/05
M05-09	M05-09-A5136	5	15	REG	04/13/06
M05-09	M05-09-C5619	5	15	REG	10/03/06
M05-09	C093G016	10	15	REG	05/01/07
M05-13	C093G001	10	15	REG	05/02/07
M05-14	C093G006	10	15	REG	05/03/07
M05-14	C093G911	10	15	FD	05/03/07
M05-18	C093G028	10	15	REG	05/07/07
M117-E	M117-E-A5142	8	18	REG	04/17/06
M117-E	M117-E-C5626	8	18	REG	10/02/06
M117-E	M117-E-A6241	8	18	REG	04/04/07
S05-3-5	122-S05-154	5.5	7.5	REG	03/17/98
S05-7-3	122-S05-075	13.5	15.5	REG	02/18/98
S05-7-4	122-S05-152	5.5	7.5	REG	03/17/98
S05-DGS-DP25	385-S05-071	9	9	REG	07/25/01
S05-DGS-DP39	385-S05-189	11	13	REG	08/24/01
S05-DGS-DP46	385-S05-215	8	10	REG	10/17/01
SM05SB03	C093G139	10	15	REG	05/25/07
SND27SB01	C093G099A	10	15	REG	03/27/07

* The maximum detection or lowest detection limit was used between samples and duplicates.
REG – regular sample
FD – field duplicate sample

Table A-3. Occurrence, Distribution, and Selection of Chemicals of Potential Concern, Exposure Unit 1 West, Soil (0–8 feet bgs)

Chemical	Number	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Background Value[b]	Included as COPC (Y/N)
Volatile Organic Compounds												
acenaphthene	83-32-9	3.00E-04	J	1.40E-02		mg/kg	C0592556	12/228	0.0002 - 0.0259	1.40E-02	NA	Y
acenaphthylene	208-96-8	2.00E-04	J	4.20E-02		mg/kg	C0592526	30/228	0.0002 - 0.0281	4.20E-02	NA	Y
acetone	67-64-1	3.40E-03	J	6.60E-02	J	mg/kg	C093S298	28/99	0.0029 - 0.064	6.60E-02	NA	Y
anthracene	120-12-7	2.00E-04	J	3.50E-02		mg/kg	C0592526	48/228	0.0002 - 0.0238	3.50E-02	NA	Y
benzene	71-43-2	6.50E-04	J	2.80E-03	J	mg/kg	C093S404	9/109	0.0006 - 0.019	2.80E-03	NA	Y
benzo(g,h,i)perylene	191-24-2	1.00E-04	J	5.50E-01		mg/kg	C0592526	143/228	0.0001 - 0.0324	5.50E-01	NA	Y
2-butanone	78-93-3	9.70E-04	J	8.40E-03	J	mg/kg	C093S298	19/107	0.00073 - 0.064	8.40E-03	NA	Y
carbon disulfide	75-15-0	1.10E-03	J	8.10E-03	J	mg/kg	C093S276A	13/99	0.0011 - 0.019	8.10E-03	NA	Y
chlorobenzene	108-90-7	5.80E-04	J	5.00E-03		mg/kg	C093S600	7/99	0.0005 - 0.019	5.00E-03	NA	Y
chloroform	67-66-3	1.00E-03	J	1.00E-03	J	mg/kg	280-RA-050	1/99	0.0015 - 0.019	1.00E-03	NA	Y
chloromethane	74-87-3	2.60E-03	J	4.90E-03	J	mg/kg	C093S609A	2/99	0.0019 - 0.019	4.90E-03	NA	Y
1,1-dichloroethene	75-35-4	3.00E-03	J	3.00E-03	J	mg/kg	260-S05-013	1/107	0.00078 - 0.019	3.00E-03	NA	Y
cis-1,2-dichloroethene	156-59-2	5.20E-04	J	1.80E-02	J	mg/kg	C093S280A	5/73	0.00023 - 0.0064	1.80E-02	NA	Y
trans-1,2-dichloroethene	156-60-5	3.90E-04	J	1.20E-03	J	mg/kg	C093S280A	2/79	0.00035 - 0.0064	1.20E-03	NA	Y
ethylbenzene	100-41-4	6.00E-03	J	6.00E-03	J	mg/kg	030-S05-009	1/109	0.0006 - 0.019	6.00E-03	NA	Y
fluorene	86-73-7	2.00E-04	J	6.60E-02		mg/kg	C0592289	25/228	0.0002 - 0.022	6.60E-02	NA	Y
2-hexanone	591-78-6	5.60E-04	J	2.00E-03	J	mg/kg	C093S228	4/99	0.00016 - 0.064	2.00E-03	NA	Y
methylene chloride	75-09-2	6.30E-03	J	1.30E-02		mg/kg	0545-005M	5/107	0.0045 - 0.019	1.30E-02	NA	Y
2-methylnaphthalene	91-57-6	2.00E-04	J	4.20E-01		mg/kg	C0592556	47/228	0.0002 - 0.0173	4.20E-01	NA	Y
4-methyl-2-pentanone	108-10-1	9.90E-04	J	3.90E-03	J	mg/kg	C093S172	26/99	0.00096 - 0.064	3.90E-03	NA	Y
naphthalene	91-20-3	2.00E-04	J	5.40E-01		mg/kg	C0592556	88/228	0.0002 - 0.022	5.40E-01	NA	Y
phenanthrene	85-01-8	2.00E-04	J	2.00E-01		mg/kg	C0592289	127/228	0.0002 - 0.0367	2.00E-01	NA	Y
pyrene	129-00-0	1.00E-04	J	7.90E-01		mg/kg	C0592526	154/228	0.0001 - 0.0346	7.90E-01	NA	Y
tetrachloroethene	127-18-4	6.30E-04	J	2.70E-02		mg/kg	C093S376	15/107	0.00055 - 0.019	2.70E-02	NA	Y
toluene	108-88-3	7.20E-04	J	2.10E-02		mg/kg	030-S05-009	18/109	0.0002 - 0.019	2.10E-02	NA	Y
trichloroethene	79-01-6	4.30E-03	J	8.00E-02		mg/kg	C093S291A	2/107	0.00097 - 0.019	8.00E-02	NA	Y
m,p-xylene	7816-60-0	5.00E-04	J	2.20E-02		mg/kg	054S-005M	2/71	0.00044 - 0.00093	2.20E-02	NA	Y
total xylenes	1330-20-7	4.10E-02		4.10E-02		mg/kg	030-S05-009	1/40	0.0012 - 0.019	4.10E-02	NA	Y
Semivolatile Organic Compounds												
benz(a)anthracene	56-55-3	2.00E-04	J	6.20E-01		mg/kg	C0592377	116/228	0.0001 - 0.0389	6.20E-01	NA	Y
benzo(b)fluoranthene	205-99-2	2.00E-04	J	8.00E-01		mg/kg	C0592377	156/228	0.0002 - 0.0281	8.00E-01	NA	Y
benzo(k)fluoranthene	207-08-9	2.00E-04	J	6.30E-01		mg/kg	C0592377	100/228	0.0002 - 0.0389	6.30E-01	NA	Y
benzo(a)pyrene	50-32-8	2.00E-04	J	8.30E-01		mg/kg	C0592377	143/228	0.0002 - 0.0302	8.30E-01	NA	Y
bis(2-ethylhexyl)phthalate	117-81-7	2.00E-02	J	7.80E-01		mg/kg	048M-002	15/89	0.014 - 2.1	7.80E-01	NA	Y
butyl benzyl phthalate	85-68-7	1.80E-02	J	1.80E-02	J	mg/kg	049-0002	1/89	0.035 - 2.1	1.80E-02	NA	Y
carbazole	86-74-8	3.40E-01	J	3.40E-01	J	mg/kg	030-S05-009	1/77	0.035 - 1.5	3.40E-01	NA	Y
4-chloro-3-methylphenol	59-50-7	3.00E-02	J	3.00E-02	J	mg/kg	049-0018	1/89	0.035 - 3	3.00E-02	NA	Y
chrysene	218-01-9	2.00E-04	J	6.50E-01		mg/kg	C0592377	139/228	0.0002 - 0.0367	6.50E-01	NA	Y
dibenz(a,h)anthracene	53-70-3	2.00E-04	J	1.30E-01		mg/kg	C0592377	70/228	0.0002 - 0.0302	1.30E-01	NA	Y
di-n-butyl phthalate	84-74-2	2.30E-02	J	1.10E-01	J	mg/kg	049-0012	18/89	0.035 - 1.7	1.10E-01	NA	Y
diethyl phthalate	84-66-2	2.00E-02	J	2.50E-02	J	mg/kg	049-0002	3/89	0.035 - 1.7	2.50E-02	NA	Y
dimethyl phthalate	131-11-3	4.40E-02	J	4.40E-02	J	mg/kg	048M-002	1/89	0.035 - 1.7	4.40E-02	NA	Y
fluoranthene	206-44-0	2.00E-04	J	6.60E-01		mg/kg	C0592526	136/228	0.0002 - 0.041	6.60E-01	NA	Y
hexachlorobutadiene	87-68-3	8.40E-04	J	8.40E-04	J	mg/kg	C093S376	1/113	0.00062 - 3	8.40E-04	NA	Y

Table A-3. Occurrence, Distribution, and Selection of Chemicals of Potential Concern, Exposure Unit 1 West, Soil (0–8 feet bgs) (Continued)

Chemical	Number	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Background Value[b]	Included as COPC (Y/N)
indeno(1,2,3-cd)pyrene	193-39-5	2.00E-04	J	5.80E-01		mg/kg	C0592377	109/228	0.0002 - 0.0432	5.80E-01	NA	Y
n-nitroso-di-n-propylamine	621-64-7	2.30E-02	J	2.30E-02	J	mg/kg	049-0018	1/89	0.035 - 2.1	2.30E-02	NA	N
phenol	108-95-2	2.70E+00		2.80E+00		mg/kg	030-S05-003	2/89	0.035 - 3	2.80E+00	NA	Y
Pesticides/Polychlorinated Biphenyls												
Aroclor-1260	11096-82-5	5.10E-02		5.10E-02		mg/kg	048M-012	1/45	0.0037 - 0.039	5.10E-02	NA	N
Metals												
aluminum	7429-90-5	3.19E+03	J	2.45E+04		mg/kg	C093S294A	74/75	2.54 - 92	2.45E+04	1.40E+04	Y
antimony	7440-36-0	2.60E-01	J	4.60E+00		mg/kg	B05-13-002	11/85	0.2 - 3.1	4.60E+00	9.50E+00	Y[c]
arsenic	7440-38-2	7.04E-01		7.70E+00		mg/kg	C093S245A	56/77	0.17 - 12	7.70E+00	9.14E+00	N[d]
barium	7440-39-3	1.88E+01		2.10E+02	J	mg/kg	C093S281A	77/78	0.047 - 2	2.10E+02	9.37E+01	Y
beryllium	7440-41-7	6.10E-02	J	7.99E-01		mg/kg	B05-13-002	43/85	0.042 - 0.24	7.99E-01	1.27E+00	Y[c]
cadmium	7440-43-9	4.30E-02	J	2.40E+00		mg/kg	C093S249A	25/85	0.028 - 1.2	2.40E+00	1.72E+00	N[d]
chromium	7440-47-3	4.20E+00	J	7.55E+01		mg/kg	030-S05-005	80/86	0.029 - 5.9	7.55E+01	5.48E+01	Y
cobalt	7440-48-4	3.20E+00		1.80E+02	J	mg/kg	C093S249A	74/78	0.051 - 1.3	1.80E+02	1.43E+01	Y
copper	7440-50-8	4.03E+00		1.05E+02	J	mg/kg	C093S371	77/86	0.094 - 5.9	1.05E+02	3.91E+01	Y
iron	7439-89-6	1.70E+00		3.45E+04	J	mg/kg	C093S371	75/75	0.508 - 37	3.45E+04	2.23E+04	N[d]
lead	7439-92-1	1.00E+00	J	6.26E+01		mg/kg	030-S05-009	76/86	0.092 - 12	6.26E+01	3.77E+01	Y
manganese	7439-96-5	7.46E+01		5.30E+02		mg/kg	C093S371	74/75	0.074 - 3	5.30E+02	3.83E+02	N[d]
mercury	7439-97-6	1.80E-02	J	1.90E+00		mg/kg	C093S238	21/85	0.017 - 0.24	1.90E+00	5.20E-01	Y
nickel	7440-02-0	2.70E+00	J	9.30E+01		mg/kg	030-S05-005	85/86	0.068 - 5.9	9.30E+01	5.57E+01	Y
selenium	7782-49-2	3.40E-01	J	1.80E+00		mg/kg	C093S416	33/77	0.182 - 0.985	1.80E+00	1.78E+00	Y
silver	7440-22-4	7.00E-02	J	2.36E+01	J	mg/kg	C093S249A	43/85	0.036 - 5.9	2.36E+01	2.22E+00	Y
thallium	7440-28-0	3.60E-01	J	3.60E+00		mg/kg	049-0018	13/77	0.2 - 0.47	3.60E+00	5.00E-01	N[d]
vanadium	7440-62-2	1.43E+01		1.12E+02	J	mg/kg	C093S371	77/78	0.056 - 1.4	1.12E+02	4.73E+01	N[d]
zinc	7440-66-6	1.21E+01		7.28E+01	J	mg/kg	049-0017	83/86	0.188 - 2.4	7.28E+01	6.75E+01	Y

(a) Minimum and maximum detected concentrations
(b) 95th quantile from Tetra Tech EM, Inc. 2004. *Remedial Investigation Report, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California*. Final. November 18.
(c) Although this chemical was found to be below background levels through statistical evaluation, it was retained as a COPC at the direction of U.S. EPA.
(d) Data for metals consistent with ambient concentrations or rarely reported above background were removed to represent incremental risk.

Acronyms/Abbreviations:
bgs – below ground surface
BHC – hexachlorocyclohexane
CAS – Chemical Abstract Service
COPC – chemical of potential concern
DDT – dichlorodiphenyltrichloroethane
mg/kg – milligrams per kilogram
NA – not applicable
U.S. EPA – United States Environmental Protection Agency
(Y/N) – yes/no

Review Qualifiers:
J – indicates a value estimated by the laboratory

The following chemicals were not detected in Exposure Unit 1 West:

dibenzofuran	gamma-chlordane
1,2,4-trimethylbenzene	4,4'-DDT
aldrin	endrin aldehyde
beta-BHC	heptachlor
delta-BHC	molybdenum
alpha-chlordane	

Table A-4. Occurrence, Distribution, and Selection of Chemicals of Potential Concern, Exposure Unit 1 West, Groundwater

Chemical	CAS Number	Minimum Concentration[a] (Qualifier)		Maximum Concentration[a] (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Background Value[b]	Included as COPC (Y/N)
Volatile Organic Compounds												
acenaphthene	83-32-9	1.80E-04	J	4.00E-04		mg/L	C093G001	2/3	0.0000612 - 0.01	4.00E-04	NA	Y
acetone	67-64-1	2.30E-03		3.20E-03	J	mg/L	C093G028	2/33	0.0002 - 0.1	3.20E-03	NA	Y
benzene	71-43-2	1.70E-04	J	1.60E-03		mg/L	M05-02-A5131	10/41	0.00003 - 0.005	1.60E-03	NA	Y
2-butanone	78-93-3	2.00E-04	J	1.10E-03	J	mg/L	C093G070A	4/33	0.00008 - 0.1	1.10E-03	NA	Y
n-butylbenzene	104-51-8	1.90E-04	J	1.90E-04	J	mg/L	C093G070A	1/29	0.00005 - 0.005	1.90E-04	NA	Y
tert-butylbenzene	98-06-6	3.40E-04	J	3.40E-04	J	mg/L	C093G070A	1/29	0.00004 - 0.005	3.40E-04	NA	Y
carbon disulfide	75-15-0	3.10E-04	J	1.00E-02		mg/L	C093G099A	8/33	0.00004 - 0.005	1.00E-02	NA	Y
chloroethane	75-00-3	4.10E-04	J	4.10E-04	J	mg/L	C093G070A	1/38	0.0001 - 0.005	4.10E-04	NA	Y
chloroform	67-66-3	3.30E-04	J	3.30E-04	J	mg/L	C093G029	1/33	0.00003 - 0.005	3.30E-04	NA	Y
1,2-dichlorobenzene	95-50-1	1.80E-03		2.20E-03		mg/L	C093G070A	2/35	0.00006 - 0.01	2.20E-03	NA	Y
1,4-dichlorobenzene	106-46-7	1.00E-04	J	1.00E-04	J	mg/L	M05-02-C5614	1/35	0.00007 - 0.01	1.00E-04	NA	Y
1,1-dichloroethane	75-34-3	2.20E-04	J	1.50E-02		mg/L	122-S05-154	10/41	0.00005 - 0.005	1.50E-02	NA	Y
1,2-dichloroethane	107-06-2	2.00E-03		2.00E-03		mg/L	385-S05-189	1/41	0.00006 - 0.005	2.00E-03	NA	Y
1,1-dichloroethene	75-35-4	9.00E-04		6.80E-03		mg/L	C093G005	3/41	0.00006 - 0.005	6.80E-03	NA	Y
cis-1,2-dichloroethene	156-59-2	1.70E-04	J	2.50E-02		mg/L	M05-02-C5614	12/38	0.00008 - 0.005	2.50E-02	NA	Y
trans-1,2-dichloroethene	156-60-5	2.00E-04	J	1.30E-03		mg/L	C093G005	5/38	0.00009 - 0.005	1.30E-03	NA	Y
1,4-dioxane	123-91-1	1.50E-02	J	2.70E-02		mg/L	C093G005	2/16	0.00013 - 0.00097	2.70E-02	NA	Y
2-hexanone	591-78-6	1.70E-03	J	1.70E-03	J	mg/L	C093G070A	1/33	0.00005 - 0.01	1.70E-03	NA	Y
p-isopropyltoluene	99-87-6	1.40E-04	J	1.40E-04	J	mg/L	C093G070A	1/29	0.00004 - 0.005	1.40E-04	NA	Y
methylene chloride	75-09-2	3.00E-04	J	9.90E-04	J	mg/L	C0936005	2/35	0.00009 - 0.005	9.90E-04	NA	Y
2-methylnaphthalene	91-57-6	8.50E-05	J	8.50E-05	J	mg/L	C093G006	1/3	0.00006 - 0.01	8.50E-05	NA	Y
naphthalene	91-20-3	4.30E-04		4.30E-04		mg/L	C093G006	1/21	0.00005 - 0.01	4.30E-04	NA	Y
phenanthrene	85-01-8	8.20E-05	J	1.10E-04	J	mg/L	C093G001	2/3	0.0000788 - 0.01	1.10E-04	NA	Y
n-propylbenzene	103-65-1	2.20E-04	J	2.20E-04	J	mg/L	C093G070A	1/29	0.00005 - 0.005	2.20E-04	NA	Y
pyrene	129-00-0	1.30E-04	J	8.40E-04	J	mg/L	C093G911	3/3	0.0000845 - 0.01	8.40E-04	NA	Y
tetrachloroethene	127-18-4	1.60E-04	J	1.40E-03		mg/L	M05-02-C5614	6/41	0.00009 - 0.005	1.40E-03	NA	Y
toluene	108-88-3	2.00E-04	J	2.00E-03		mg/L	122-S05-154	6/41	0.00005 - 0.005	2.00E-03	NA	Y
trichloroethene	79-01-6	1.90E-04	J	7.30E-03		mg/L	M05-02-A5131	9/41	0.00007 - 0.005	7.30E-03	NA	Y
1,2,4-trimethylbenzene	95-63-6	2.70E-03		2.70E-03		mg/L	C093G070A	1/29	0.00007 - 0.005	2.70E-03	NA	Y
1,3,5-trimethylbenzene	108-67-8	7.60E-04		7.60E-04		mg/L	C093G070A	1/29	0.00005 - 0.005	7.60E-04	NA	Y
vinyl chloride	75-01-4	2.40E-04	J	1.10E-03		mg/L	M05-02-A5131	5/41	0.00004 - 0.005	1.10E-03	NA	Y
m,p-xylene	7816-60-0	1.90E-04	J	6.40E-04		mg/L	C093G070A	2/35	0.0001 - 0.003	6.40E-04	NA	Y
o-xylene	95-47-6	4.70E-04	J	4.70E-04	J	mg/L	C093G070A	1/35	0.00008 - 0.003	4.70E-04	NA	Y

(a) Minimum and maximum detected concentrations

(b) 95th quantile from Tetra Tech EM, Inc. 2004. *Remedial Investigation Report, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California*. Final. November 18.

Acronyms/Abbreviations:
- CAS – Chemical Abstracts Service
- COPC – chemical of potential concern
- mg/L – milligrams per liter
- NA – not applicable
- (Y/N) – yes/no

Review Qualifiers:
J – indicates a value estimated by the laboratory

The following chemicals were not detected in Exposure Unit 1 West:

1,2-dichloropropane	1,1,1-trichloroethane
ethylbenzene	total xylenes
methyl tert-butyl ether	

Table A-5. Chemicals of Potential Concern in Soil and Groundwater, Exposure Unit 1 West

Chemical	CAS Number	Vadose Zone Soil (0-8 feet bgs)	Groundwater
Volatile Organic Compounds			
acenaphthene	83-32-9	✔	✔
acenaphthylene	208-96-8	✔	
acetone	67-64-1	✔	✔
anthracene	120-12-7	✔	
benzene	71-43-2	✔	✔
benzo(g,h,i)perylene	191-24-2	✔	
2-butanone	78-93-3	✔	✔
n-butylbenzene	104-51-8		✔
tert-butylbenzene	98-06-6		✔
carbon disulfide	75-15-0	✔	✔
chlorobenzene	108-90-7	✔	
chloroethane	75-00-3		✔
chloroform	67-66-3	✔	✔
chloromethane	74-87-3	✔	
1,2-dichlorobenzene	95-50-1		✔
1,4-dichlorobenzene	106-46-7		✔
1,1-dichloroethane	75-34-3		✔
1,2-dichloroethane	107-06-2		✔
1,1-dichloroethene	75-35-4	✔	✔
cis-1,2-dichloroethene	156-59-2	✔	✔
trans-1,2-dichloroethene	156-60-5	✔	✔
1,4-dioxane	123-91-1		✔
ethylbenzene	100-41-4	✔	
fluorene	86-73-7	✔	
2-hexanone	591-78-6	✔	✔
p-isopropyltoluene	99-87-6		✔
methylene chloride	75-09-2	✔	✔
2-methylnaphthalene	91-57-6	✔	✔
4-methyl-2-pentanone	108-10-1	✔	
naphthalene	91-20-3	✔	✔
phenanthrene	85-01-8	✔	✔
n-propylbenzene	103-65-1		✔
pyrene	129-00-0	✔	✔
tetrachloroethene	127-18-4	✔	✔
toluene	108-88-3	✔	✔
trichloroethene	79-01-6	✔	✔
1,2,4-trimethylbenzene	95-63-6		✔
1,3,5-trimethylbenzene	108-67-8		✔
vinyl chloride	75-01-4		✔
m,p-xylene	7816-60-0	✔	✔
o-xylene	95-47-6		✔
total xylenes	1330-20-7	✔	
Semivolatile Organic Compounds			
benz(a)anthracene	56-55-3	✔	
benzo(b)fluoranthene	205-99-2	✔	
benzo(k)fluoranthene	207-08-9	✔	
benzo(a)pyrene	50-32-8	✔	
bis(2-ethylhexyl)phthalate	117-81-7	✔	
butyl benzyl phthalate	85-68-7	✔	
carbazole	86-74-8	✔	

Table A-5. Chemicals of Potential Concern in Soil and Groundwater, Exposure Unit 1 West (Continued)

Chemical	CAS Number	Vadose Zone Soil (0-8 feet bgs)	Groundwater
4-chloro-3-methylphenol	59-50-7	✔	
chrysene	218-01-9	✔	
dibenz(a,h)anthracene	53-70-3	✔	
di-n-butyl phthalate	84-74-2	✔	
diethyl phthalate	84-66-2	✔	
dimethyl phthalate	131-11-3	✔	
fluoranthene	206-44-0	✔	
hexachlorobutadiene	87-68-3	✔	
indeno(1,2,3-cd)pyrene	193-39-5	✔	
n-nitroso-di-n-propylamine	621-64-7		
phenol	108-95-2	✔	
Pesticides/Polychlorinated Biphenyls			
Aroclor-1260	11096-82-5		
Metals			
aluminum	7429-90-5	✔	
antimony	7440-36-0	✔	
arsenic	7440-38-2		
barium	7440-39-3	✔	
beryllium	7440-41-7	✔	
cadmium	7440-43-9		
chromium	7440-47-3	✔	
cobalt	7440-48-4	✔	
copper	7440-50-8	✔	
iron	7439-89-6		
lead	7439-92-1	✔	
manganese	7439-96-5		
mercury	7439-97-6	✔	
nickel	7440-02-0	✔	
selenium	7782-49-2	✔	
silver	7440-22-4	✔	
thallium	7440-28-0		
vanadium	7440-62-2		
zinc	7440-66-6	✔	

bgs – below ground surface
CAS – Chemical Abstracts Service

Table A-6. Toxicity Values

CAS Number	Chemical	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
Volatile Organic Compounds														
83-32-9	acenaphthene	NA	—		—		—		—		6.0E-02	I	—	
208-96-8	acenaphthylene	D	—		—		—		—		6.0E-02	S*	—	
67-64-1	acetone	NP	—		—		—		—		9.0E-01	I	8.9E+00	A
120-12-7	anthracene	D	—		—		—		—		3.0E-01	I	—	
71-43-2	benzene	A	5.5E-02	I	2.7E-02	I	1.0E-01	C	1.0E-01	C	4.0E-03	I	8.6E-03	I
191-24-2	benzo(g,h,i)perylene	D	—		—		—		—		3.0E-02	S*	—	
78-93-3	2-butanone	NP	—		—		—		—		6.0E-01	I	1.4E+00	I
104-51-8	n-butylbenzene	Not in IRIS	—		—		—		—		1.0E-01	S*	1.1E-01	S*
98-06-6	tert-butylbenzene	Not in IRIS	—		—		—		—		1.0E-01	S*	1.1E-01	S*
75-15-0	carbon disulfide	NA	—		—		—		—		1.0E-01	I	2.0E-01	I
108-90-7	chlorobenzene	D	—		—		—		—		2.0E-02	I	1.4E-02	P
75-00-3	chloroethane	NA	—		—		—		—		—		2.9E+00	I
67-66-3	chloroform	B2	3.1E-02	C	8.1E-02	I	3.1E-02	C	1.9E-02	C	1.0E-02	I	2.8E-02	A
74-87-3	chloromethane	D	1.3E-02	H	6.3E-03	H	1.3E-02	H	6.3E-03	H	—		2.6E-02	I
95-50-1	1,2-dichlorobenzene	D	—		—		—		—		9.0E-02	I	5.7E-02	H
106-46-7	1,4-dichlorobenzene	NA	5.4E-03	C	4.0E-02	C	5.4E-03	C	4.0E-02	C	—		2.3E-01	I
75-34-3	1,1-dichloroethane	C	5.7E-03	C	5.7E-03	C	5.7E-03	C	5.7E-03	C	2.0E-01	P	—	
107-06-2	1,2-dichloroethane	B2	9.1E-02	I	9.1E-02	I	4.7E-02	C	7.2E-02	C	2.0E-02	P	6.9E-01	A
75-35-4	1,1-dichloroethene	C	—		—		—		—		5.0E-02	I	5.7E-02	I
156-59-2	cis-1,2-dichloroethene	D	—		—		—		—		1.0E-02	P	—	
156-60-5	trans-1,2-dichloroethene	NA	—		—		—		—		2.0E-02	I	1.7E-02	P
123-91-1	1,4-dioxane	B2	1.1E-02	I	—		2.7E-02	C	2.7E-02	C	—		1.0E+00	A
100-41-4	ethylbenzene	D	1.1E-02	C	8.7E-03	C	1.1E-02	C	8.7E-03	C	1.0E-01	I	2.9E-01	I
86-73-7	fluorene	D	—		—		—		—		4.0E-02	I	—	
591-78-6	2-hexanone	Not in IRIS	—		—		—		—		6.0E-02	S*	2.0E-01	S*
99-87-6	p-isopropyltoluene	D	—		—		—		—		1.0E-01	S*	1.1E-01	S*
75-09-2	methylene chloride	B2	7.5E-03	I	1.6E-03	I	1.4E-02	C	3.5E-03	C	6.0E-02	I	3.1E-01	A
91-57-6	2-methylnaphthalene	NP	—		—		—		—		4.0E-03	I	—	
108-10-1	4-methyl-2-pentanone	NP	—		—		—		—		8.0E-02	H	8.6E-01	I
91-20-3	naphthalene	C	—		1.2E-01	C	1.2E-01	C	1.2E-01	C	2.0E-02	I	8.6E-04	I

Table A-6. Toxicity Values (Continued)

CAS Number	Chemical	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
85-01-8	phenanthrene	D	—		—		—		—		3.0E-01	S*	—	
103-65-1	n-propylbenzene	Not in IRIS	—		—		—		—		1.0E-01	S*	1.1E-01	S*
129-00-0	pyrene	D	—		—		—		—		3.0E-02	I	—	
127-18-4	tetrachloroethene	NA	5.4E-01	C	2.1E-02	C	5.4E-01	C	2.1E-02	C	1.0E-02	I	7.7E-02	A
108-88-3	toluene	D	—		—		—		—		8.0E-02	I	1.4E+00	I
79-01-6	trichloroethene	NA	1.3E-02	C	7.0E-03	C	1.3E-02	C	7.0E-03	C	—		—	
95-63-6	1,2,4-trimethylbenzene	Not in IRIS	—		—		—		—		—		2.0E-03	P
108-67-8	1,3,5-trimethylbenzene	Not in IRIS	—		—		—		—		5.0E-02	P	1.7E-03	P
75-01-4a	vinyl chloride	A	7.2E-01	I	1.5E-02	I	2.7E-01	C	2.7E-01	C	3.0E-03	I	2.9E-02	I
7816-60-0	m,p-xylene	Not in IRIS	—		—		—		—		2.0E-01	S*	2.0E-01	S*
95-47-6	o-xylene	Not in IRIS	—		—		—		—		2.0E+00	H	2.0E-01	C
1330-20-7	xylenes, total	NP	—		—		—		—		2.0E-01	I	2.9E-02	I
Semivolatile Organic Compounds														
56-55-3	benz(a)anthracene	B2	7.3E-01	*	3.9E-01	C	1.2E+00	C	3.9E-01	C	3.0E-01	S*	—	
205-99-2	benzo(b)fluoranthene	B2	7.3E-01	*	3.9E-01	C	1.2E+00	C	3.9E-01	C	4.0E-02	S*	—	
207-08-9	benzo(k)fluoranthene	B2	7.3E-02	*	3.9E-01	C	1.2E+00	C	3.9E-01	C	4.0E-02	S*	—	
50-32-8	benzo(a)pyrene	B2	7.3E+00	I	3.9E+00	C	1.2E+01	C	3.9E+00	C	3.0E-02	S*	—	
117-81-7	bis(2-ethylhexyl)phthalate	B2	1.4E-02	I	—		3.0E-03	C	8.4E-03	C	2.0E-02	I	—	
85-68-7	butyl benzyl phthalate	C	1.9E-03	P	—		—		—		2.0E-01	I	—	
86-74-8	carbazole	Not in IRIS	—		—		—		—		2.5E-02	S*	—	
59-50-7	4-chloro-3-methylphenol	Not in IRIS	—		—		—		—		5.0E-02	S*	—	
218-01-9	chrysene	B2	7.3E-03	*	3.9E-02	C	1.2E-01	C	3.9E-02	C	3.0E-01	S*	—	
53-70-3	dibenz(a,h)anthracene	B2	7.3E+00	*	4.2E+00	C	4.1E+00	C	4.1E+00	C	3.0E-01	S*	—	
84-74-2	di-n-butyl phthalate	D	—		—		—		—		1.0E-01	I	—	
84-66-2	diethyl phthalate	D	—		—		—		—		8.0E-01	I	—	
131-11-3	dimethyl phthalate	D	—		—		—		—		8.0E-01	S*	—	
206-44-0	fluoranthene	D	—		—		—		—		4.0E-02	I	—	
87-68-3	hexachlorobutadiene	C	7.8E-02	I	7.7E-02	I	7.8E-02	I	7.7E-02	I	1.0E-03	P	—	
193-39-5	indeno(1,2,3-cd)pyrene	B2	7.3E-01	*	3.9E-01	C	1.2E+00	C	3.9E-01	C	4.0E-02	S*	—	

Table A-6. Toxicity Values (Continued)

CAS Number	Chemical	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
621-64-7	N-nitroso-di-n-propylamine	B2	7.0E+00	I	—		7.0E+00	C	7.0E+00	C	2.5E-02	S	—	
108-95-2	phenol	D	—		—		—		—		3.0E-01	I	5.7E-02	C
Pesticides/Polychlorinated Biphenyls														
11096-82-5	Aroclor-1260	B2	2.0E+00	I	2.0E+00	I	5.0E+00	C	2.0E+00	C	2.0E-05	S	—	
Metals														
7429-90-5	aluminum	Not in IRIS	—		—		—		—		1.0E+00	P	1.4E-03	P
7440-36-0	antimony	NA	—		—		—		—		4.0E-04	I	—	
7440-38-2	arsenic	A	1.5E+00	I	1.5E+01	I	9.5E+00	C	1.2E+01	C	3.0E-04	I	8.6E-06	C
7440-39-3	barium	D	—		—		—		—		2.0E-01	I	1.4E-04	H
7440-41-7	beryllium	B1	—		8.4E+00	I	—		8.4E+00	C	2.0E-03	I	5.7E-06	I
7440-43-9	cadmium	B1	—		6.3E+00	I	—		1.5E+01	C	5.0E-04	I	—	
7440-47-3	chromium[b]	A	—		4.2E+01	I	—		7.4E+01	C	3.0E-03	S*	2.3E-06	S*
7440-48-4	cobalt	Not in IRIS	—		3.2E+01	P	—		3.2E+01	P	3.0E-04	P	1.7E-06	P
7440-50-8	copper	D	—		—		—		—		4.0E-02	H	—	
7439-89-6	iron	Not in IRIS	—		—		—		—		7.0E-01	P	—	
7439-92-1	lead	B2	—		—		—		—		—		—	
7439-96-5	manganese	D	—		—		—		—		2.4E-02	I	1.4E-05	I
7439-97-6	mercury	C	—		—		—		—		3.0E-04	I	8.6E-05	I
7440-02-0	nickel	A	—		8.4E-01	I	—		9.1E-01	C	2.0E-02	I	—	
7782-49-2	selenium	D	—		—		—		—		5.0E-03	I	—	
7440-22-4	silver	D	—		—		—		—		5.0E-03	I	—	
7440-28-0	thallium	D	—		—		—		—		6.5E-05	S	—	
7440-62-2	vanadium	Not in IRIS	—		—		—		—		5.0E-03	S	—	
7440-66-6	zinc	D	—		—		—		—		3.0E-01	I	—	

Table A-6. Toxicity Values (Continued)

Note:

(a) A dash indicates that a toxicity value is not available.

(b) The Cal/EPA inhalation slope factor for total chromium was calculated per U.S. EPA guidance.

Acronyms/Abbreviations:

ATSDR – Agency for Toxic Substances and Disease Registry
Cal/EPA – California Environmental Protection Agency
CAS – Chemical Abstracts Service number
CSFi – inhalation cancer slope factor
CSFo – oral cancer slope factor
HEAST – Health Effects Assessment Summary Table
IRIS – Integrated Risk Information System
$(mg/kg\text{-}day)^{-1}$ – kilogram-day per milligrams
mg/kg-day – milligrams per kilogram-day
PPRTV – Provisional Peer Reviewed Toxicity Values
RfDi – inhalation reference dose
RfDo – oral reference dose
U.S. EPA – United States Environmental Protection Agency

Reference:

* – CSFo is calculated relative to benzo(a)pyrene
A – ATSDR as listed in U.S. EPA 2010. Regional Screening Levels. November
C – California website source, http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H – HEAST as listed in U.S. EPA 2010. Regional Screening Levels. November
I – IRIS, http://www.epa.gov/iris/subst/index.html
P – PPRTV as listed in U.S. EPA 2010. Regional Screening Levels. November
S – Surrogate as selected in U.S. EPA 2010. Regional Screening Levels. November
S* – values based on a surrogate chemical (see Table A-7)

Cancer class:

A – human carcinogen
B1 – probable human carcinogen with limited human data
B2 – probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans
C – possible human carcinogen
D – not classifiable as to human carcinogenicity
NA – not assessed
NP – not applicable (not assessed using the 1986 U.S. EPA cancer guidelines)

Table A-7. Surrogate Chemicals for COPCs Without Toxicity Criteria

COPC	CSF Surrogate	RfD Surrogate
Volatile Organic Compounds		
acenaphthylene	NA	acenaphthene
benzo(g,h,i)perylene	NA	pyrene
n-butylbenzene	NA	cumene (isopropylbenzene)
tert-butylbenzene	NA	cumene (isopropylbenzene)
2-hexanone	NA	n-hexane
p-isopropyltoluene	NA	cumene (isopropylbenzene)
phenanthrene	NA	anthracene
n-propylbenzene	NA	cumene (isopropylbenzene)
m-, p-xylene	NA	xylenes
Semivolatile Organic Compounds		
benz(a)anthracene	NA	anthracene
benzo(b)fluoranthene	NA	fluoranthene
benzo(k)fluoranthene	NA	fluoranthene
benzo(a)pyrene	NA	pyrene
carbazole	NA	diphenylamine
4-chloro-3-methylphenol	NA	cresol, m-
chrysene	NA	anthracene
dibenz(a,h)anthracene	NA	anthracene
dimethyl phthalate	NA	diethyl phthalate
indeno(1,2,3-cd)pyrene	NA	fluoranthene
Metals		
chromium	NA	hexavalent chromium

COPC – chemical of potential concern
CSF – cancer slope factor
NA – not applicable
RfD – reference dose

Table A-8. Summary of Location-Specific Total Risks

Residential Exposure Pathways	Exposure Unit 1 West[a,b]		
	U.S. EPA Cancer	**Cal/EPA Cancer**	**U.S. EPA Hazard**
Soil Location C3S005B089 plus Groundwater Location M05-06			
Direct Contact with Soil	1E-06	1E-06	1
Indoor Air (soil)	2E-05	2E-05	0.8
Indoor Air (groundwater)	3E-07	2E-06	0.2
Outdoor Air (soil and groundwater)	2E-07	5E-07	0.02
Homegrown Produce (soil)	2E-07	2E-07	0.04
LOCATION-SPECIFIC TOTAL RISK[c]	**2E-05**	**2E-05**	**1[d]**
Groundwater Location S05-7-3 plus Soil Location M05-09			
Direct Contact with Soil	1E-06	1E-06	1
Indoor Air (soil)	2E-06	2E-06	0.02
Indoor Air (groundwater)	4E-07	4E-06	0.006
Outdoor Air (soil and groundwater)	2E-07	5E-07	0.02
Homegrown Produce (soil)	2E-07	2E-07	0.04
LOCATION-SPECIFIC TOTAL RISK	**4E-06**	**8E-06**	**1**
Groundwater Location M05-02 plus Soil Location DG347SB01			
Direct Contact with Soil	1E-06	1E-06	1
Indoor Air (soil)	1E-06	1E-06	0.01
Indoor Air (groundwater)	1E-06	7E-06	0.2
Outdoor Air (soil and groundwater)	2E-07	5E-07	0.02
Homegrown Produce (soil)	2E-07	2E-07	0.04
LOCATION-SPECIFIC TOTAL RISK	**3E-06**	**1E-05**	**1**

(a) IR Sites 10 and 12, Exposure Unit 1 East and sample DG043SB01 (0.5-1 foot bgs) from Local Area 2 excluded.
(b) Two infrequently reported organic chemicals and ambient metals excluded.
(c) Total risk is the sum of all COPCs and all exposure pathways, including soil and groundwater.
(d) The health effects of naphthalene and cobalt are not additive. Therefore, in accordance with U.S. EPA guidance, the final HI is 1.

Cal/EPA – California Environmental Protection Agency
U.S. EPA – United States Environmental Protection Agency

Table A-9. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident)

Exposure Medium	Chemical	EPC		CANCER RISK							Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	Exposure Route Total	
0–8 feet bgs	***Volatile Organic Compounds***										
Soil	acenaphthene	4.96E-03	—	—	—		—	—	—	—	--
	acenaphthylene	5.20E-03	—	—	—		—	—	—	—	--
	acetone	4.09E-02	—	—	—		—	—	—	—	--
	anthracene	5.39E-03	—	—	—		—	—	—	—	--
	benzene	2.80E-03	—	3E-10	8E-11		—	4E-09	—	5E-09	0%
	benzo(g,h,i)perylene	3.12E-02	—	—	—		—	—	—	—	--
	2-butanone	8.40E-03	—	—	—		—	—	—	—	--
	carbon disulfide	8.10E-03	—	—	—		—	—	—	—	--
	chlorobenzene	3.82E-03	—	—	—		—	—	—	—	--
	chloroform	1.00E-03	—	4E-11	2E-11		—	5E-09	—	5E-09	0.02%
	chloromethane	4.90E-03	—	1E-10	3E-11		—	4E-09	—	4E-09	0.02%
	1,1-dichloroethene	3.00E-03	—	—	—		—	—	—	—	--
	cis-1,2-dichloroethene	3.64E-03	—	—	—		—	—	—	—	--
	trans-1,2-dichloroethene	1.20E-03	—	—	—		—	—	—	—	--
	ethylbenzene	6.00E-03	—	1E-10	3E-11		—	1E-09	—	2E-09	0.01%
	fluorene	6.02E-03	—	—	—		—	—	—	—	--
	2-hexanone	2.00E-03	—	—	—		—	—	—	—	--
	methylene chloride	1.30E-02	—	2E-10	5E-11		—	1E-09	—	1E-09	0.01%
	2-methylnaphthalene	1.80E-02	—	—	—		—	—	—	—	--
	4-methyl-2-pentanone	3.90E-03	—	—	—		—	—	—	—	--
	naphthalene	2.74E-02	1.01E-03	—	—		2E-05	1E-08	—	2E-05	77.32%
	phenanthrene	1.57E-02	—	—	—		—	—	—	—	--
	pyrene	4.87E-02	—	—	—		—	—	—	—	--
	tetrachloroethene	5.03E-03	—	4E-09	1E-09		—	6E-09	—	1E-08	0.05%
	toluene	4.63E-03	—	—	—		—	—	—	—	--
	trichloroethene	5.67E-03	—	1E-10	3E-11		—	2E-09	—	2E-09	0.01%

Table A-9. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK							Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	Exposure Route Total	
Soil (Continued)	m,p-xylene	5.44E-03	—	—	—		—	—	—	—	--
	total xylenes	9.91E-03	—	—	—		—	—	—	—	--
	Semivolatile Organic Compounds										
	benz(a)anthracene	3.24E-02	—	4E-08	2E-08	1E-12			5E-09	6E-08	0.28%
	benzo(b)fluoranthene	4.39E-02	—	6E-08	2E-08	2E-12			6E-09	9E-08	0.39%
	benzo(k)fluoranthene	2.71E-02	—	3E-09	2E-09	1E-12			4E-10	5E-09	0.02%
	benzo(a)pyrene	4.41E-02	—	6E-07	2E-07	2E-11			6E-08	9E-07	3.88%
	bis(2-ethylhexyl)phthalate	1.93E-01	—	4E-09	1E-09	—			7E-08	7E-08	0.33%
	butyl benzyl phthalate	1.80E-02	—	6E-11	2E-11	—			4E-09	4E-09	0.02%
	carbazole	2.90E-01	—	—	—	—			—	—	--
	4-chloro-3-methylphenol	3.00E-02	—	—	—	—			—	—	--
	chrysene	4.02E-02	—	4E-10	2E-10	2E-13			6E-11	6E-10	0.00%
	dibenz(a,h)anthracene	7.77E-03	—	9E-08	5E-08	4E-12			1E-08	2E-07	0.69%
	di-n-butyl phthalate	1.10E-01	—	—	—	—			—	—	--
	diethyl phthalate	2.50E-02	—	—	—	—			—	—	--
	dimethyl phthalate	4.40E-02	—	—	—	—			—	—	--
	fluoranthene	3.87E-02	—	—	—	—			—	—	--
	hexachlorobutadiene	8.40E-04	—	1E-10	3E-11	7E-15			7E-09	7E-09	0.03%
	indeno(1,2,3-cd)pyrene	2.98E-02	—	3E-08	2E-08	1E-12			6E-09	5E-08	0.24%
	phenol	3.98E-01	—	—	—	—			—	—	--
	Metals										
	aluminum	1.01E+04	—	—	—	—			—	—	--
	antimony	4.13E+00	—	—	—	—			—	—	--
	barium	6.38E+01	—	—	—	—			—	—	--
	beryllium	7.99E-01	—	—	—	8E-10			—	8E-10	0.00%
	chromium	2.91E+01	—	—	—	1E-07			—	1E-07	0.63%
	cobalt	2.05E+01	—	—	—	7E-08			—	7E-08	0.33%
	copper	2.54E+01	—	—	—	—			—	—	--
	lead	1.19E+01	—	—	—	—			—	—	--

Table A-9. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK							Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	Exposure Route Total	
Soil (Continued)	mercury	1.90E+00	—	—	—	—			—	—	--
	nickel	3.31E+01	—	—	—	3E-09			—	3E-09	0.01%
	selenium	7.81E-01	—	—	—	—			—	—	--
	silver	5.53E+00	—	—	—	—			—	—	--
	zinc	2.93E+01	—	—	—	—			—	—	--
		Total Risk Across Soil		**8E-07**	**3E-07**	**2E-07**	**2E-05**	**3E-08**	**2E-07**	**2E-05**	
Groundwater	***Volatile Organic Compounds***										
	acenaphthene	—	—				—	—		—	--
	acetone	—	1.72E-03				—	—		—	--
	benzene	—	5.85E-03				3E-08	9E-10		3E-08	0%
	2-butanone	—	1.64E-03				—	—		—	--
	n-butylbenzene	—	8.01E-03				—	—		—	--
	tert-butylbenzene	—	7.82E-03				—	—		—	--
	carbon disulfide	—	3.89E-02				—	—		—	--
	chloroethane	—	5.36E-02				—	—		—	--
	chloroform	—	4.62E-03				6E-08	1E-09		6E-08	0%
	1,2-dichlorobenzene	—	1.43E-03				—	—		—	--
	1,4-dichlorobenzene	—	1.83E-03				1E-08	8E-11		1E-08	0%
	1,1-dichloroethane	—	5.20E-03				5E-09	2E-09		7E-09	0%
	1,2-dichloroethane	—	1.23E-03				2E-08	8E-10		2E-08	0%
	1,1-dichloroethene	—	2.97E-02				—	—		—	--
	cis-1,2-dichloroethene	—	—				—	—		—	--
	trans-1,2-dichloroethene	—	8.35E-03				—	—		—	--
	1,4-dioxane	—	—				—	—		—	--
	2-hexanone	—	7.35E+01				—	—		—	--
	p-isopropyltoluene	—	6.65E-03				—	—		—	--
	methylene chloride	—	5.55E-02				2E-08	5E-11		2E-08	0%
	2-methylnaphthalene	—	—				—	—		—	--
	naphthalene	—	1.33E-03				2E-08	2E-10		2E-08	0%
	phenanthrene	—	—				—	—		—	--
	n-propylbenzene	—	6.97E-03				—	—		—	--

Table A-9. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK							Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	Exposure Route Total	
Groundwater (Continued)	pyrene	—	—				—	—		—	--
	tetrachloroethene	—	1.51E-02				5E-08	2E-09		6E-08	0%
	toluene	—	6.65E-03				—	—		—	--
	trichloroethene	—	9.63E-03				1E-08	3E-09		1E-08	0%
	1,2,4-trimethylbenzene	—	4.02E-03				—	—		—	--
	1,3,5-trimethylbenzene	—	3.83E-03				—	—		—	--
	vinyl chloride	—	3.76E-02				7E-08	3E-10		7E-08	0%
	m,p-xylene	—	6.57E-03				—	—		—	--
	o-xylene	—	4.99E-03				—	—		—	--
	Total Risk Across Groundwater			**0E+00**	**0E+00**	**0E+00**	**3E-07**	**1E-08**	**0E+00**	**3E-07**	
Total Sitewide Risk Across All Media and All Exposure Routes				**8E-07**	**3E-07**	**2E-07**	**2E-05**	**4E-08**	**2E-07**	**2E-05**	

(a) Units for soil concentrations are milligrams per kilogram (mg/kg) and units for groundwater concentrations are milligrams per liter (mg/L).
(b) Units for vapor phase are milligrams per cubic meter (mg/m³).
bgs – below ground surface
COPC – chemical of potential concern
EPC – exposure point concentration
U.S. EPA – United States Environmental Protection Agency
The following chemicals were eliminated from soil in Exposure Unit 1 West because they were infrequently detected or at ambient concentrations: Aroclor 1260, n-nitroso-di-n-propylamine, arsenic, cadmium, iron, manganese, thallium, vanadium.

Table A-10. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, Cal/EPA (Resident)

Exposure Medium	Chemical	EPC		CANCER RISK						Exposure Route Total	Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce		
0–8 feet bgs	***Volatile Organic Compounds***										
Soil	acenaphthene	4.96E-03	—	—	—		—	—	—	—	--
	acenaphthylene	5.20E-03	—	—	—		—	—	—	—	--
	acetone	4.09E-02	—	—	—		—	—	—	—	--
	anthracene	5.39E-03	—	—	—		—	—	—	—	--
	benzene	2.80E-03	—	4E-10	1E-10		—	2E-08	—	2E-08	0.07%
	benzo(g,h,i)perylene	3.12E-02	—	—	—		—	—	—	—	--
	2-butanone	8.40E-03	—	—	—		—	—	—	—	--
	carbon disulfide	8.10E-03	—	—	—		—	—	—	—	--
	chlorobenzene	3.82E-03	—	—	—		—	—	—	—	--
	chloroform	1.00E-03	—	4E-11	2E-11		—	1E-09	—	1E-09	0.01%
	chloromethane	4.90E-03	—	1E-10	3E-11		—	4E-09	—	4E-09	0.02%
	1,1-dichloroethene	3.00E-03	—	—	—		—	—	—	—	--
	cis-1,2-dichloroethene	3.64E-03	—	—	—		—	—	—	—	--
	trans-1,2-dichloroethene	1.20E-03	—	—	—		—	—	—	—	--
	ethylbenzene	6.00E-03	—	1E-10	3E-11		—	1E-09	—	2E-09	0.01%
	fluorene	6.02E-03	—	—	—		—	—	—	—	--
	2-hexanone	2.00E-03	—	—	—		—	—	—	—	--
	methylene chloride	1.30E-02	—	3E-10	9E-11		—	3E-09	—	3E-09	0.01%
	2-methylnaphthalene	1.80E-02	—	—	—		—	—	—	—	--
	4-methyl-2-pentanone	3.90E-03	—	—	—		—	—	—	—	--
	naphthalene	2.74E-02	1.01E-03	6E-09	3E-09		2E-05	1E-08	—	2E-05	77.36%
	phenanthrene	1.57E-02	—	—	—		—	—	—	—	--
	pyrene	4.87E-02	—	—	—		—	—	—	—	--
	tetrachloroethene	5.03E-03	—	4E-09	1E-09		—	6E-09	—	1E-08	0.05%
	toluene	4.63E-03	—	—	—		—	—	—	—	--

Table A-10. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, Cal/EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK						Exposure Route Total	Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce		
Soil (Continued)	trichloroethene	5.67E-03	—	1E-10	3E-11		—	2E-09	—	2E-09	0.01%
	m,p-xylene	5.44E-03	—	—	—		—	—	—	—	--
	total xylenes	9.91E-03	—	—	—		—	—	—	—	--
	Semivolatile Organic Compounds										
	benz(a)anthracene	3.24E-02	—	6E-08	3E-08	1E-12			8E-09	1E-07	0.45%
	benzo(b)fluoranthene	4.39E-02	—	8E-08	3E-08	2E-12			1E-08	1E-07	0.55%
	benzo(k)fluoranthene	2.71E-02	—	6E-08	2E-08	1E-12			6E-09	9E-08	0.39%
	benzo(a)pyrene	4.41E-02	—	8E-07	3E-07	2E-11			1E-07	1E-06	5.45%
	bis(2-ethylhexyl)phthalate	1.93E-01	—	9E-10	3E-10	2E-13			1E-08	1E-08	0.06%
	butyl benzyl phthalate	1.80E-02	—	—	—	—			—	—	--
	carbazole	2.90E-01	—	—	—	—			—	—	--
	4-chloro-3-methylphenol	3.00E-02	—	—	—	—			—	—	--
	chrysene	4.02E-02	—	7E-09	3E-09	2E-13			1E-09	1E-08	0.05%
	dibenz(a,h)anthracene	7.77E-03	—	4E-08	2E-08	3E-12			6E-09	7E-08	0.30%
	di-n-butyl phthalate	1.10E-01	—	—	—	—			—	—	--
	diethyl phthalate	2.50E-02	—	—	—	—			—	—	--
	dimethyl phthalate	4.40E-02	—	—	—	—			—	—	--
	fluoranthene	3.87E-02	—	—	—	—			—	—	--
	hexachlorobutadiene	8.40E-04	—	1E-10	3E-11	8E-15			6E-09	6E-09	0.03%
	indeno(1,2,3-cd)pyrene	2.98E-02	—	6E-08	3E-08	1E-12			1E-08	1E-07	0.45%
	phenol	3.98E-01	—	—	—	—			—	—	--
	Metals										
	aluminum	1.01E+04	—	—	—	—			—	—	--
	antimony	4.13E+00	—	—	—	—			—	—	--
	barium	6.38E+01	—	—	—	—			—	—	--
	beryllium	7.99E-01	—	—	—	8E-10			—	8E-10	0.00%
	chromium	2.91E+01	—	—	—	3E-07			—	3E-07	1.32%

Table A-10. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, Cal/EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK						Exposure Route Total	Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce		
Soil (Continued)	cobalt	2.05E+01	—	—	—	8E-08			—	8E-08	0.36%
	copper	2.54E+01	—	—	—	—			—	—	--
	lead	1.19E+01	—	—	—	—			—	—	--
	mercury	1.90E+00	—	—	—	—			—	—	--
	nickel	3.31E+01	—	—	—	3E-09			—	3E-09	0.01%
	selenium	7.81E-01	—	—	—	—			—	—	--
	silver	5.53E+00	—	—	—	—			—	—	--
	zinc	2.93E+01	—	—	—	—			—	—	--
		Total Risk Across Soil		**1E-06**	**4E-07**	**4E-07**	**2E-05**	**4E-08**	**2E-07**	**2E-05**	
Groundwater	***Volatile Organic Compounds***										
	acenaphthene	—	—				—	—		—	--
	acetone	—	1.72E-03				—	—		—	--
	benzene	—	5.85E-03				9E-08	3E-09		1E-07	0.44%
	2-butanone	—	1.64E-03				—	—		—	--
	n-butylbenzene	—	8.01E-03				—	—		—	--
	tert-butylbenzene	—	7.82E-03				—	—		—	--
	carbon disulfide	—	3.89E-02				—	—		—	--
	chloroethane	—	5.36E-02				—	—		—	--
	chloroform	—	4.62E-03				1E-08	3E-10		1E-08	0.06%
	1,2-dichlorobenzene	—	1.43E-03				—	—		—	--
	1,4-dichlorobenzene	—	1.83E-03				1E-08	8E-11		1E-08	0.06%
	1,1-dichloroethane	—	5.20E-03				5E-09	2E-09		7E-09	0.03%
	1,2-dichloroethane	—	1.23E-03				1E-08	6E-10		1E-08	0.07%
	1,1-dichloroethene	—	2.97E-02				—	—		—	--
	cis-1,2-dichloroethene	—	—				—	—		—	--
	trans-1,2-dichloroethene	—	8.35E-03				—	—		—	--
	1,4-dioxane	—	—				—	8E-11		8E-11	0.00%
	2-hexanone	—	7.35E+01				—	—		—	--
	p-isopropyltoluene	—	6.65E-03				—	—		—	--

Table A-10. Summary of Receptor Risks for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, Cal/EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		CANCER RISK						Exposure Route Total	Percent Contribution to Total Risk
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce		
Groundwater (Continued)	methylene chloride	—	5.55E-02				3E-08	9E-11		3E-08	0.14%
	2-methylnaphthalene	—	—				—	—		—	--
	naphthalene	—	1.33E-03				2E-08	2E-10		2E-08	0.11%
	phenanthrene	—	—				—	—		—	--
	n-propylbenzene	—	6.97E-03				—	—		—	--
	pyrene	—	—				—	—		—	--
	tetrachloroethene	—	1.51E-02				5E-08	2E-09		6E-08	0.25%
	toluene	—	6.65E-03				—	—		—	--
	trichloroethene	—	9.63E-03				1E-08	3E-09		1E-08	0.06%
	1,2,4-trimethylbenzene	—	4.02E-03				—	—		—	--
	1,3,5-trimethylbenzene	—	3.83E-03				—	—		—	--
	vinyl chloride	—	3.76E-02				1E-06	5E-09		1E-06	6.22%
	m,p-xylene	—	6.57E-03				—	—		—	--
	o-xylene	—	4.99E-03				—	—		—	--
	Total Risk Across Groundwater			**0E+00**	**0E+00**	**0E+00**	**2E-06**	**2E-08**	**0E+00**	**2E-06**	
Total Sitewide Risk Across All Media and All Exposure Routes				**1E-06**	**4E-07**	**4E-07**	**2E-05**	**6E-08**	**2E-07**	**2E-05**	

(a) Units for soil concentrations are milligrams per kilogram (mg/kg) and units for groundwater concentrations are milligrams per liter (mg/L).
(b) Units for vapor phase are milligrams per cubic meter (mg/m³).
The following chemicals were eliminated from soil in Exposure Unit 1 West because they were infrequently detected or at ambient concentrations: Aroclor 1260, n-nitroso-di-n-propylamine, arsenic, cadmium, iron, manganese, thallium, vanadium.
bgs – below ground surface; EPC – exposure point concentration
COPC – chemical of potential concern; U.S. EPA – United States Environmental Protection Agency

Table A-11. Summary of Receptor Hazards for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident)

Exposure Medium	Chemical	EPC		HAZARD INDEX						Exposure Route Total
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	
0–8 feet bgs	***Volatile Organic Compounds***									
Soil	acenaphthene	4.96E-03	—	1E-06	4E-07		—	—	—	1E-06
	acenaphthylene	5.20E-03	—	1E-06	5E-07		—	—	—	2E-06
	acetone	4.09E-02	—	6E-07	2E-07		—	2E-07	—	1E-06
	anthracene	5.39E-03	—	2E-07	1E-07		—	—	—	3E-07
	benzene	2.80E-03	—	9E-06	3E-06		—	8E-05	—	9E-05
	benzo(g,h,i)perylene	3.12E-02	—	1E-05	6E-06		—	—	—	2E-05
	2-butanone	8.40E-03	—	2E-07	5E-08		—	2E-07	—	4E-07
	carbon disulfide	8.10E-03	—	1E-06	3E-07		—	2E-05	—	2E-05
	chlorobenzene	3.82E-03	—	2E-06	7E-07		—	3E-05	—	3E-05
	chloroform	1.00E-03	—	1E-06	4E-07		—	9E-06	—	1E-05
	chloromethane	4.90E-03	—	—	—		—	1E-04	—	1E-04
	1,1-dichloroethene	3.00E-03	—	8E-07	2E-07		—	2E-05	—	2E-05
	cis-1,2-dichloroethene	3.64E-03	—	5E-06	1E-06		—	—	—	6E-06
	trans-1,2-dichloroethene	1.20E-03	—	8E-07	2E-07		—	2E-05	—	2E-05
	ethylbenzene	6.00E-03	—	8E-07	2E-07		—	3E-06	—	4E-06
	fluorene	6.02E-03	—	2E-06	8E-07		—	—	—	3E-06
	2-hexanone	2.00E-03	—	4E-07	1E-07		—	5E-06	—	5E-06
	methylene chloride	1.30E-02	—	3E-06	8E-07		—	1E-05	—	1E-05
	2-methylnaphthalene	1.80E-02	—	6E-05	2E-05		—	—	—	8E-05
	4-methyl-2-pentanone	3.90E-03	—	6E-07	2E-07		—	1E-07	—	9E-07
	naphthalene	2.74E-02	1.01E-03	2E-05	7E-06		8E-01	5E-04	—	8E-01
	phenanthrene	1.57E-02	—	7E-07	3E-07		—	—	—	1E-06
	pyrene	4.87E-02	—	2E-05	9E-06		—	—	—	3E-05
	tetrachloroethene	5.03E-03	—	6E-06	2E-06		—	2E-05	—	2E-05
	toluene	4.63E-03	—	7E-07	2E-07		—	5E-07	—	1E-06
	trichloroethene	5.67E-03	—	—	—		—	—	—	—

Table A-11. Summary of Receptor Hazards for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		HAZARD INDEX						Exposure Route Total
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	
Soil (Continued)	m,p-xylene	5.44E-03	—	3E-07	1E-07		—	3E-06	—	3E-06
	total xylenes	9.91E-03	—	6E-07	2E-07		—	4E-05	—	4E-05
	Semivolatile Organic Compounds									
	benz(a)anthracene	3.24E-02	—	1E-06	6E-07	—			5E-08	2E-06
	benzo(b)fluoranthene	4.39E-02	—	1E-05	6E-06	—			5E-07	2E-05
	benzo(k)fluoranthene	2.71E-02	—	9E-06	4E-06	—			3E-07	1E-05
	benzo(a)pyrene	4.41E-02	—	2E-05	8E-06	—			7E-07	3E-05
	bis(2-ethylhexyl)phthalate	1.93E-01	—	1E-04	3E-05	—			6E-04	7E-04
	butyl benzyl phthalate	1.80E-02	—	1E-06	3E-07	—			2E-05	2E-05
	carbazole	2.90E-01	—	1E-04	4E-05	—			5E-03	5E-03
	4-chloro-3-methylphenol	3.00E-02	—	8E-06	2E-06	—			—	1E-05
	chrysene	4.02E-02	—	2E-06	7E-07	—			6E-08	3E-06
	dibenz(a,h)anthracene	7.77E-03	—	3E-07	1E-07	—			1E-08	4E-07
	di-n-butyl phthalate	1.10E-01	—	1E-05	4E-06	—			3E-04	3E-04
	diethyl phthalate	2.50E-02	—	4E-07	1E-07	—			3E-05	3E-05
	dimethyl phthalate	4.40E-02	—	7E-07	2E-07	—			2E-04	2E-04
	fluoranthene	3.87E-02	—	1E-05	5E-06	—			1E-06	2E-05
	hexachlorobutadiene	8.40E-04	—	1E-05	3E-06	—			2E-04	2E-04
	indeno(1,2,3-cd)pyrene	2.98E-02	—	1E-05	4E-06	—			5E-07	1E-05
	phenol	3.98E-01	—	2E-05	5E-06	3E-09			—	3E-05
	Metals									
	aluminum	1.01E+04	—	1E-01	4E-03	3E-03			—	1E-01
	antimony	4.13E+00	—	1E-01	4E-03	—			—	1E-01
	barium	6.38E+01	—	4E-03	1E-04	2E-04			—	4E-03
	beryllium	7.99E-01	—	5E-03	1E-04	7E-05			—	5E-03
	chromium	2.91E+01	—	1E-01	3E-03	6E-03			—	1E-01
	cobalt	2.05E+01	—	9E-01	2E-02	6E-03			—	9E-01
	copper	2.54E+01	—	8E-03	2E-04	—			—	8E-03

Table A-11. Summary of Receptor Hazards for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		HAZARD INDEX						Exposure Route Total
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	
Soil (Continued)	lead	1.19E+01	—	—	—	—			—	—
	mercury	1.90E+00	—	8E-02	2E-03	1E-05			2E-02	1E-01
	nickel	3.31E+01	—	2E-02	6E-04	—			7E-03	3E-02
	selenium	7.81E-01	—	2E-03	6E-05	—			6E-04	3E-03
	silver	5.53E+00	—	1E-02	4E-04	—			—	1E-02
	zinc	2.93E+01	—	1E-03	4E-05	—			2E-03	3E-03
	Hazard Index Across Soil			**1E+00**	**3E-02**	**2E-02**	**8E-01**	**8E-04**	**4E-02**	**2E+00**
	Soil Hazard Index Segregated for Critical Effects/Target Organs for Primary Contributors (Naphthalene and Cobalt)									1E+00[c]
Groundwater	***Volatile Organic Compounds***									
	acenaphthene	—	—				—	—		—
	acetone	—	1.72E-03				1E-07	1E-09		1E-07
	benzene	—	5.85E-03				5E-04	2E-05		5E-04
	2-butanone	—	1.64E-03				9E-07	3E-09		9E-07
	n-butylbenzene	—	8.01E-03				5E-05	7E-07		5E-05
	tert-butylbenzene	—	7.82E-03				4E-05	8E-07		4E-05
	carbon disulfide	—	3.89E-02				1E-04	2E-05		1E-04
	chloroethane	—	5.36E-02				1E-05	2E-07		1E-05
	chloroform	—	4.62E-03				8E-05	2E-06		8E-05
	1,2-dichlorobenzene	—	1.43E-03				1E-05	8E-07		1E-05
	1,4-dichlorobenzene	—	1.83E-03				5E-06	4E-08		5E-06
	1,1-dichloroethane	—	5.20E-03				—	—		—
	1,2-dichloroethane	—	1.23E-03				1E-06	5E-08		1E-06
	1,1-dichloroethene	—	2.97E-02				3E-04	3E-05		4E-04
	cis-1,2-dichloroethene	—	—				—	—		—
	trans-1,2-dichloroethene	—	8.35E-03				4E-04	8E-06		4E-04
	1,4-dioxane	—	—				0E+00	1E-08		1E-08
	2-hexanone	—	7.35E+01				2E-01	1E-03		2E-01
	p-isopropyltoluene	—	6.65E-03				4E-05	5E-05		9E-05
	methylene chloride	—	5.55E-02				1E-04	4E-07		1E-04

Table A-11. Summary of Receptor Hazards for COPCs - Highest Risk Soil Location C3S005B089 and Associated Groundwater M05-06, U.S. EPA (Resident) (Continued)

Exposure Medium	Chemical	EPC		HAZARD INDEX						Exposure Route Total
		Direct Contact[a]	Indoor Vapor[b]	Ingestion	Dermal Contact	Inhalation of Dust	Inhalation of Indoor Air	Inhalation of Outdoor Air	Ingestion of Homegrown Produce	
Groundwater (Continued)	2-methylnaphthalene	—	—				—	—		—
	naphthalene	—	1.33E-03				9E-04	8E-06		9E-04
	phenanthrene	—	—				—	—		—
	n-propylbenzene	—	6.97E-03				5E-05	7E-07		5E-05
	pyrene	—	—				—	—		—
	tetrachloroethene	—	1.51E-02				1E-04	6E-06		1E-04
	toluene	—	6.65E-03				3E-06	1E-07		3E-06
	trichloroethene	—	9.63E-03				—	—		—
	1,2,4-trimethylbenzene	—	4.02E-03				9E-04	2E-04		1E-03
	1,3,5-trimethylbenzene	—	3.83E-03				1E-03	3E-05		1E-03
	vinyl chloride	—	3.76E-02				9E-04	3E-06		9E-04
	m,p-xylene	—	6.57E-03				2E-05	6E-07		2E-05
	o-xylene	—	4.99E-03				2E-05	4E-07		2E-05
	Hazard Index Across Groundwater			**0E+00**	**0E+00**	**0E+00**	**2E-01**	**1E-03**	**0E+00**	**2E-01**
Sitewide Hazard Index Across All Media and All Exposure Routes				**1E+00**	**3E-02**	**2E-02**	**1E+00**	**2E-03**	**4E-02**	**2E+00**
Sitewide Hazard Index Segregated for Critical Effects/Target Organs for Primary Contributors (Naphthalene and Cobalt)										**1E+00[c]**

(a) Units for soil concentrations are milligrams per kilogram (mg/kg) and units for groundwater concentrations are milligrams per liter (mg/L).
(b) Units for vapor phase are milligrams per cubic meter (mg/m³).
(c) The health effects of naphthalene and cobalt are not additive for hazards associated with soil. Therefore, in accordance with U.S. EPA guidance, the final sitewide HI is 1.

bgs – below ground surface
COPC – chemical of potential concern
EPC – exposure point concentration
U.S. EPA – United States Environmental Protection Agency

The following chemicals were eliminated from soil in Exposure Unit 1 West because they were infrequently detected or at ambient concentrations: Aroclor-1260; n-nitroso-di-n-propylamine; arsenic; manganese; cadmium; thallium; iron; vanadium.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
6	HHRAs	Section 2.5.1	Final Remedial Investigation Report for Operable Unit 2C. Section 6.1, Figures 6-1 through 6-5, Tables 6-1 through 6-7. Bechtel Environmental Inc. 2008.

Section 6

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

An HHRA, a Tier 1 screening-level ERA (consisting of Steps 1 and 2 of Navy policy for conducting ERAs), and an evaluation of refined exposure estimates for ecological risk (Step 3a of Navy policy) were performed to assess potential impacts on human health and environmental receptors from exposure to chemicals at OU-2C. The supplemental ecological risk evaluation using refined exposure estimates (Step 3a of Navy policy) is provided in addition to the screening-level ERA as an aid to the risk managers. The HHRA and ERA methodologies and their results are presented in Appendices M and N, respectively.

The HHRA and the ERA evaluate current and future potential human health risks and ecological impacts with the assumption that concentrations of chemicals in soil and groundwater remain unchanged from current conditions. The results of the risk assessments provide information for making decisions concerning actions to reduce exposure, if needed.

6.1 HUMAN HEALTH RISK ASSESSMENT

The HHRA for OU-2C consists of three individual HHRAs for Exposure Units 1, 2, and 3. These HHRAs were conducted in accordance with guidelines published by the United States Environmental Protection Agency (U.S. EPA) in the Risk Assessment Guidance for Superfund Part A (U.S. EPA 1989), Part B (U.S. EPA 1991), and Part E (U.S. EPA 2004c) and supporting documents and guidelines published by Cal/EPA (DTSC 1993, 1994, 1999c, 2005a). The purpose of the HHRAs is to evaluate current and future potential health risks based on current conditions to determine the likelihood that exposure to any chemical in soil, groundwater, or air at OU-2C could pose a concern to human health.

The results of the HHRA are summarized in the following sections.

- Section 6.1.1 presents an overview of the HHRA methodology and information common to all three exposure units at OU-2C.
- Sections 6.1.2 through 6.1.4 present the results of the HHRA for each exposure unit.
- Section 6.1.5 presents the uncertainty analysis.
- Section 6.1.6 presents the conclusions.

6.1.1 Overview of Risk Assessment Methodologies

The methods for the HHRAs are presented in this section along with information common to the three exposure units. The subsections include data evaluation, exposure assessment, toxicity assessment, risk characterization, and evaluation of local areas.

6.1.1.1 DATA EVALUATION

The identification of COPCs is based on a compilation of usable data for soil, soil gas, and groundwater. All data considered usable from previous investigations and the current RI supplemental investigation were included.

Data from samples collected at locations that have been the subject of a removal action are not included in the HHRA. The results from two soil samples for radium-226 and radium-228 collected during a focused sampling effort at Building 44 had activity levels below background (Section 4) and were also excluded. In addition, PAH data for soil samples collected prior to 2003 were excluded because of elevated reporting limits. These data are not essential because a substantial amount of PAH data (more than 600 samples) has been included in these risk assessments.

The identification of COPCs in soil was based on the results from analyses of samples collected from 0 to 8 feet bgs (the vadose zone) because the groundwater table generally occurs at approximately 8 feet bgs or shallower. All chemicals reported in at least one soil sample collected from the upper 8 feet of OU-2C were included as HHRA COPCs, except calcium, magnesium, potassium, and sodium, which are known to be required human nutrients. All metals were included in the list of COPCs regardless of whether the reported concentrations were above or below Alameda Point background levels. Metals present at concentrations consistent with background are called "ambient" metals.

For COPCs in groundwater, all volatile COPCs reported in the shallower FWBZ were considered in the HHRA with the following exceptions. If more than one sample was collected in the shallower FWBZ from a discrete groundwater sampling location, only the shallowest sample from each location was used in the HHRA. Additionally, only data collected during 2005 and later from monitoring well locations were included in the HHRA data set.

The classification of a chemical as a VOC for risk assessment purposes is based on the U.S. EPA Region 9 guidelines (U.S. EPA 2004a). Some chemicals listed on the tables in Section 4 as SVOCs were considered VOCs in the HHRA.

1,4-Dioxane is not considered a VOC by U.S. EPA Region 9 (U.S. EPA 2004d). However, 1,4-dioxane was reported in the soil gas samples collected beneath the slab at Building 5 and so this chemical is treated as a volatile in this HHRA when reported in soil gas, soil, or groundwater.

6.1.1.2 EXPOSURE ASSESSMENT

The objective of exposure assessment is to evaluate the ways in which people may come into contact with COPCs at the site currently or in the future. An exposure assessment is a multistage process. First, the receptors (i.e., individuals using the site) are identified. Second, the complete exposure pathways by which these human receptors may be exposed are identified. Finally, the chemical concentration at the point of exposure (exposure point concentration [EPC]), and the daily intake rates associated with each exposure pathway are quantified. The following subsections describe the receptors, pathways, and the methodology used to calculate EPCs and daily intake.

Receptor Analysis

Nineteen buildings are present within OU-2C and ten of these buildings are currently used for commercial and industrial activities. OU-2C is located primarily within the area of Alameda Point identified for future reuse as a "Civic Core" in the NAS Alameda

Community Reuse Plan. The following uses are allowed within the Civic Core area: business park, office, civic, residential, public/institutional, parks and public open space, commercial, and other supporting uses.

The receptors included in the HHRAs are future residents (children and adults), commercial or industrial workers, and construction workers. Commercial and industrial workers are called "office workers" in the HHRAs. This category covers all industrial or commercial work that is done largely inside a building.

The risk evaluation for a current office worker includes the assumption that existing buildings at OU-2C might be refurbished and divided into smaller subunits for office use. The risk evaluation for a future office worker assumes the presence of commercial or industrial workers in future buildings after current structures are demolished.

Exposure Pathways

An exposure pathway describes the way that a receptor could come into contact with a COPC. An exposure pathway is considered complete when there is a reasonable opportunity for contact between a receptor and the COPC now or in the future. For example, VOCs in soil or groundwater could potentially migrate as vapor into the indoor air in buildings. Vapor migration to indoor air is considered a completed exposure pathway in all areas of OU-2C, including areas that do not currently have buildings.

Most of OU-2C is covered in hardscape, either buildings or pavement, except for limited landscaped and bare soil areas. There is only limited opportunity for direct contact between current receptors and nonvolatile COPCs in soil. However, in the future, deeper soil could be brought to the surface during construction activities. Future residents, office workers, or construction workers could potentially come into contact with COPCs in vadose zone soil. Future residents, office workers, or construction workers could be exposed to COPCs in soil via ingestion of soil, dermal contact with soil, and/or inhalation of vapors and particulates.

The exposure pathways at OU-2C that are considered complete for this risk assessment (Figure 6-1) include the following:

- incidental ingestion of soil, dermal contact with soil, and inhalation of soil particulates and vapors from soil in outdoor air (all receptors except current office workers in Exposure Unit 2 [Building 5])
- inhalation of vapors from soil, soil gas (only for current office workers in Building 5), and groundwater that might migrate to indoor air (residents and future office workers)
- inhalation of vapors from groundwater that might migrate to outdoor air (residents, future office and construction workers)
- ingestion of produce grown in local soil (residents only)

Groundwater is not a source of drinking water; therefore, the potential for exposure to COPCs in groundwater is limited to vapor migration.

Identification of Exposure Units

Because of its large size, OU-2C was divided into three exposure units for the HHRA (Figure 6-2) based on similarities in the nature and extent of impacts of chemicals (Section 4) and historical use. A separate and complete HHRA was conducted for each exposure unit. The descriptions of the exposure units are as follows.

- Exposure Unit 1 is an approximate 30.3-acre area around the perimeter of OU-2C where fewer impacts were noted, which is consistent with historical use.
- Exposure Unit 2 is Building 5, which occupies approximately 15.2 acres.
- Exposure Unit 3 is an approximate 7.2-acre strip of land along the eastern boundary of Exposure Unit 2 that extends north and south to the boundaries of OU-2C and includes areas of higher impacts.

Quantification of Exposure

Quantification of exposure is a two-step process that involves estimating EPCs and daily intake rates. In accordance with U.S. EPA guidance, exposure is based on average concentrations. However, uncertainty exists because any set of samples may or may not be representative of all the concentrations found at a site. To address this uncertainty, U.S. EPA recommends using the 95 percent upper confidence limit (UCL) of the arithmetic mean of the average chemical concentration as the EPC (or the maximum concentration, whichever is lower). The 95 percent UCL represents an upper bound average such that the true average will be lower. EPCs were calculated using the U.S. EPA software ProUCL (U.S. EPA 2007a), which selects the lower of the appropriate UCL based on the distribution of the data and the maximum concentration.

For estimating the EPC in indoor air, the maximum concentration in soil, groundwater, or soil gas (Exposure Unit 2 only) was used.

Daily intake is the daily amount of chemical to which a child or adult is exposed over the period of exposure. Daily intake is estimated for reasonable maximum exposure (RME). RME is intended to represent the upper end of exposure so that any actual exposure will not be underestimated.

Standard U.S. EPA and Cal/EPA exposure assumptions were used for all the exposure pathways except the ingestion of homegrown produce. The homegrown produce scenario does not have standard assumptions; therefore, site-specific assumptions were developed. The residential scenario for ingestion of homegrown produce was evaluated assuming that all future residents would have gardens and would routinely eat food grown in the soil that is currently present at the site.

6.1.1.3 TOXICITY ASSESSMENT

The toxicity for COPCs except lead is estimated from published toxicity values. The toxicity of lead is evaluated by comparison with site-specific risk-based levels.

Cancer and Noncancer Toxicity Assessment

Toxicological effects fall into two categories: those that could potentially cause cancer (carcinogens) and those that cause other types of harmful health effects (noncarcinogens). The toxicity value for carcinogenic effects is called a cancer slope factor (CSF), and the toxicity value for noncarcinogenic effects is called a reference dose (RfD). Chemicals that show a potential for both carcinogenic and noncarcinogenic health effects are assigned both CSFs and RfDs.

The toxicity values used in this risk assessment were obtained from the table of PRGs published by U.S. EPA Region 9 (U.S. EPA 2004e) and confirmed by a review of the U.S. EPA Integrated Risk Information System database (U.S. EPA 2007b).

Lead Toxicity Assessment

Exposures to lead in soil were evaluated using Cal/EPA's Lead Risk Assessment Spreadsheet Version 7 to calculate a site-specific risk-based level for lead (DTSC 1999c). Site-specific risk-based concentrations for lead in soil of 346 mg/kg (without ingestion of homegrown produce) and 197 mg/kg (including ingestion of homegrown produce) were calculated using local concentrations for lead in ambient air and in the municipal water supply.

Office worker and construction worker exposure to lead was evaluated using the U.S. EPA Region 9 industrial PRG of 800 mg/kg (U.S. EPA 2004e).

6.1.1.4 RISK CHARACTERIZATION

The final step in this risk assessment combines daily intake and toxicity values to calculate the potential for adverse health effects. Risk assessment is designed so that any actual risk, if present, will be less than that calculated in the risk assessment, and could be zero.

The risk estimate for potential carcinogenic effects is an individual excess cancer risk. This represents the probability that an individual could have an increased risk of cancer above the background risk. A risk of 10^{-6} means that each individual has a one in one million probability that his/her risk of incurring cancer over his/her lifetime will increase above the baseline or normal cancer rate.

In accordance with U.S. EPA and Cal/EPA regulation and guidance, the risk management range for unrestricted use sites is between 10^{-6} and 10^{-4}. Cancer risks below 10^{-6} are considered insignificant and are therefore acceptable. Cancer risks within the risk management range (10^{-6} to 10^{-4}) can be acceptable, based on site-specific factors when making decisions about whether action to reduce exposure is required. The site-specific information that could be considered by risk managers is discussed in the Uncertainty Analysis, Section 6.1.5.

Noncancer health effects are expressed as hazard quotients (HQs) for individual COPCs and as hazard indexes (HIs) for the sum of the HQs. Noncancer hazard values are added together for chemicals that affect the same target organs. An HI value of 1 or less means that it is unlikely that there will be any adverse health effects at this level of exposure over a lifetime. HI values above 1 are evaluated more closely.

For lead in soil, the EPC for a resident is compared to the site-specific risk-based levels of 197 mg/kg including homegrown produce and 346 mg/kg without homegrown produce. The lead EPC in soil for office and construction workers is compared to the U.S. EPA industrial PRG of 800 mg/kg.

6.1.1.5 EVALUATION OF LOCAL AREAS

An evaluation of local areas was conducted for residents and office workers to determine whether there are small areas of elevated risk within the exposure units that would need to be considered separately when making risk management decisions.

The evaluation of local areas was based on calculation of risk using the maximum concentration at every location and the same assumptions and equations used for the risk characterization. Every location within an exposure unit that had one or more COPC with an individual cancer risk above 1×10^{-6} or an HQ greater than 1 was identified (local area risk drivers).

The evaluation of local areas was conducted for all COPCs except PAHs. PAHs have been discussed in detail in Section 4. PAHs were included in the risk characterization.

The risk characterization results for an exposure unit were adjusted if the findings of the evaluation of local areas indicated that risks above the risk management range were restricted to small areas that could be isolated for further evaluation. The risk characterization was also adjusted to remove risk drivers that were rarely reported and metals at concentrations consistent with background (incremental risk). Based on this evaluation, adjusted risks were calculated for Exposure Unit 1; adjusted risks were not calculated for Exposure Units 2 and 3. The local area risk evaluations performed for all three exposure units are presented in Appendix M; however, only the local area risk evaluation for Exposure Unit 1 is discussed in this section.

6.1.2 Exposure Unit 1

This section presents the risk characterization results and the evaluation of local areas for Exposure Unit 1 (the areas of OU-2C that were less impacted by historical activities).

6.1.2.1 RISK CHARACTERIZATION FOR EXPOSURE UNIT 1

The risk characterization is presented by receptor for residents, office workers and construction workers for cancer risk, noncancer hazard, and the evaluation of lead. The results of the risk characterization are presented in Tables 6-1 and 6-2 and risk drivers are presented in Table 6-3.

Total cancer risks (including metals at ambient concentrations) are presented in this section. Incremental residential cancer risks (without ambient metals) are identical to total residential cancer risks.

Risk Characterization for Residents

The total cancer risks for residents are 1×10^{-3} for both U.S. EPA and Cal/EPA. The principal U.S. EPA risk drivers are found in soil, including TCE (7×10^{-4}), N-nitroso-di-n-

propylamine (3×10^{-4}), and benzene (2×10^{-4}). Other COPCs in soil with risks above 1×10^{-6} include PCE, B(a)P, carbazole, aldrin, a PCB (Aroclor 1260), and arsenic. In groundwater, chloroform and TCE have U.S. EPA risks of 1×10^{-5} and 2×10^{-5}, respectively. Other COPCs in groundwater with risks above 1×10^{-6} include vinyl chloride.

The principal Cal/EPA risk drivers are also found in soil, including benzene (8×10^{-4}) and N-nitroso-di-n-propylamine (3×10^{-4}). Other Cal/EPA COPCs in soil with risks above 1×10^{-6} include PCE, TCE, B(a)P, carbazole, ethylbenzene, naphthalene, aldrin, Aroclor 1260, arsenic, and cadmium.

In groundwater, Cal/EPA risk drivers include chloroform, ethylbenzene, and vinyl chloride.

The total noncancer HI for residents is 11, largely due to an HI of 9 associated with inhalation of COPCs from soil to indoor air. The principal risk driver is benzene in soil (36 percent) with an HI of 4.

The EPC of 9.9 mg/kg for lead at Exposure Unit 1 is well below the most stringent site-specific lead level of 197 mg/kg (which includes ingestion of homegrown produce).

Risk Characterization for Office Workers

The total cancer risk for office workers is 3×10^{-5} for both U.S. EPA and Cal/EPA. The risk drivers are similar to those for residents except that there are no risk drivers in groundwater.

Because the total noncancer HI value for office workers of 0.3 is below the risk management level, no noncancer risk drivers were identified in soil or groundwater.

The EPC of 9.9 mg/kg for lead at Exposure Unit 1 is well below the industrial U.S. EPA PRG of 800 mg/kg.

Risk Characterization for Construction Workers

The total cancer risks for construction workers are 7×10^{-7} and 2×10^{-6} for U.S. EPA and Cal/EPA, respectively. There were no COPCs with individual Cal/EPA risks above 1×10^{-6}.

Because the total noncancer HI value for office workers of 0.1 is below the risk management level, no noncancer risk drivers were identified in soil or groundwater.

6.1.2.2 EVALUATION OF LOCAL AREAS FOR EXPOSURE UNIT 1

The evaluation of local areas evaluates the risk at individual locations for residents and office workers in Exposure Unit 1, as presented on Tables 6-4 and 6-5, respectively. Local area risk drivers are COPCs with a cancer risk above 1×10^{-6} or an HQ above 1 based on the maximum concentration. The locations of the local area risk drivers are presented on Figures 6-3 and 6-4 for residents and office workers, respectively.

Local Area Risk Evaluation For Residents

Sixteen COPCs for Exposure Unit 1 were identified as local area risk drivers. Based on distribution of local area risk drivers and associated cancer risk above the risk

management range, two areas with concentrations of organic COPCs were identified for evaluation (Local Areas 1 and 2) (Figure 6-3). IR Sites 10 and 12 are also evaluated.

Local Area 1. Local Area 1 includes three sampling locations south of Building 6 where benzene concentrations were reported in soil samples collected from monitoring well borings in 1995 as part of a UST removal and investigation in the vicinity of the former fueling station at Building 282 (ERM-West 1996). However, other sampling (groundwater) data collected in 1995 in this area and subsequent sampling (2007 soil and groundwater) data suggest that the 1995 data were questionable. The highest residential risk for benzene at a location is 8×10^{-4}, due primarily to inhalation of indoor air.

Local Area 2. Local Area 2 includes two sampling locations with TCE and PCE in soil southeast and northwest of Building 43. The highest cancer risk for residents is 7×10^{-4} due to indoor air. In both samples, the reported TCE concentrations are in the upper 2 feet of soil; TCE was not reported in the deeper samples from these locations.

Local Area Risk Evaluation For Office Workers

Four local area risk drivers were identified for office workers in Exposure Unit 1, including three organic COPCs (Local Areas 1 and 2) and arsenic. The maximum cancer risk for benzene of 3×10^{-5} is located in Local Area 1 and there is a cancer risk for TCE of 2×10^{-5} in Local Area 2. Arsenic concentrations are consistent with ambient levels.

6.1.2.3 ADJUSTED RISK CHARACTERIZATION FOR EXPOSURE UNIT 1

The risk characterization results for residents (Table 6-1) in Exposure Unit 1 were adjusted, based on the findings of the evaluation of local areas. The adjusted cancer risks are 5×10^{-5} and 4×10^{-5} for U.S. EPA and Cal/EPA, respectively, and the HI is 2. The adjustment included removing data for local areas as well as data for COPCs that were infrequently reported or that represented ambient metals, as follows.

- Data for Local Areas 1 and 2 were removed. These areas contain sampling locations with risks above the risk management range due to VOCs in soil and the potential for vapor migration to indoor air. Risks may be overestimated for Local Area 1 due to questionable benzene data from 1995. It is likely that Local Area 2 warrants further evaluation.
- Data for organic COPCs infrequently reported (i.e., in less than 5 percent of the samples collected throughout all OU-2C) were removed. Aldrin, Aroclor 1260, and N-nitroso-di-n-propylamine were identified as local area risk drivers in only a few locations or samples. These chemicals were reported as follows.
  - Aldrin was reported in 2 of 32 samples that were located approximately 250 feet apart.
  - Aroclor 1260 was reported in 2 of 128 samples that were located approximately 1,600 feet apart. Only one sample had a concentration of Aroclor with a risk level above 1×10^{-6}.
  - N-nitroso-di-n-propylamine was reported in 1 of 180 samples.

- Data for metals with concentrations consistent with ambient concentrations (arsenic, manganese, and vanadium as discussed in Appendix L), co-located with other rock-forming minerals (iron), or rarely reported above background (cadmium and thallium) were removed to represent incremental risk. These metals were reported as follows.
  - Arsenic was reported in 4 of 194 samples (within Exposure Unit 1) at concentrations above the 95th percentile of 9.1 mg/kg but below the maximum concentration of 15.6 mg/kg in the Alameda Point background data set. Three of these concentrations co-occurred in samples with iron and manganese at concentrations above background. The maximum concentration of arsenic of 11.2 mg/kg co-occurred with iron and manganese above background.
  - Cadmium was reported above background in less than 2 percent of the samples. Four of 204 samples (within Exposure Unit 1) had concentrations above background for cadmium. The maximum concentration of cadmium at Exposure Unit 1 of 3.0 mg/kg is below the maximum concentration of 3.19 mg/kg in the background data set.
  - Thallium was reported above the noncancer risk target level in approximately 1 percent of the samples. Thallium was reported in 2 of 183 samples above the risk target level of 4.15 mg/kg, which equates to an HQ of 1. The maximum concentration of thallium was 8.5 mg/kg, resulting in an HQ of 2.
  - Although not risk drivers, manganese and vanadium were reported at ambient concentrations and were also removed.
  - Iron was reported above background in 17 samples; manganese or aluminum was also reported above background in 16 of these samples. The co-location of these three common rock-forming minerals along with arsenic and vanadium suggests that the concentrations of iron above background are from natural sources.

For residents, the U.S. EPA and Cal/EPA adjusted cancer risks are within the risk management range and the HI is above 1 (HI = 2) for Exposure Unit 1 (Table 6-1). However, HQs for individual COPCs were all less than 1. The highest HQs (all for inhalation of chemicals in indoor air) were 0.6 for naphthalene in soil, 0.4 for 2-methylnaphthalene in soil, and 0.3 for 2-hexanone in groundwater (infrequently reported, in 1 of 89 samples). The model used to estimate concentrations in indoor air uses maximum soil and groundwater concentrations and assumes that the maximum concentration is evenly distributed throughout the vadose zone, both laterally and vertically. However, this does not represent the distribution of concentrations at Exposure Unit 1. The maximum naphthalene and 2-methylnaphthalene concentrations were co-located in a sample collected from 0 to 0.5 feet bgs; however, concentrations of naphthalene and 2-methylnaphthalene in the deeper samples were three orders of magnitude lower than the maximum concentration. Also, the maximum xylene concentration was not co-located with naphthalene and 2-methylnaphthalene; it was

located approximately 800 feet from this area, in CAA 5C, an area included under the Petroleum Program.

Risks were not adjusted for office and construction workers because the U.S. EPA and Cal/EPA cancer risks and local area cancer risks are within the risk management range and the HI values are below 1.

6.1.2.4 ADJUSTED RISK CHARACTERIZATION FOR IR SITES 10 AND 12

Separate adjusted risk calculations were prepared for IR Sites 10 and 12 using only the data from each respective IR site. The risks were adjusted by removing the three infrequently reported organic chemicals from the incremental risk (risk without metals found at concentrations consistent with background).

IR Site 10

The adjusted cancer risks for IR Site 10 are 5×10^{-5} and 1×10^{-5}, respectively, for U.S. EPA and Cal/EPA. The noncancer HI is 1. The cancer risks are associated with inhalation of TCE and chloroform from soil or groundwater in indoor air.

IR Site 12

The adjusted cancer risks for IR Site 12 are 7×10^{-6} and 5×10^{-6}, respectively, for U.S. EPA and Cal/EPA. The noncancer HI is 0.4. The cancer risks are associated with inhalation of indoor air due to migration of TCE and vinyl chloride, each reported in a single location in groundwater.

6.1.2.5 ADJUSTED RISK UNCERTAINTY

There are several lines of evidence to suggest that adjusted risks discussed for Exposure Unit 1 and for IR Sites 10 and 12 calculated for this HHRA likely overestimate any actual risk.

- Most (greater than 99 percent) of the risk is associated with migration of VOCs to indoor air; this indoor air risk is based on the maximum concentration for every VOC in soil and groundwater, regardless of the location.
- For U.S. EPA, the risks calculated using the most current toxicity factors would likely be lower than those calculated in this HHRA. In May 2008, U.S. EPA Region 9 changed from using toxicity factors published with the 2004 PRGs (used in this HHRA) to U.S. EPA regional screening levels (RSLs) which are a joint list for U.S. EPA Regions 3, 6 and 9. For example, if the risk associated with the risk drivers for IR Site 10 were recalculated using toxicity values from the RSLs, the cancer risk would decrease from 5×10^{-5} to 2×10^{-5} and the noncancer HI would decrease from 2 to 0.03.
- The Cal/EPA risk drivers are not co-located, so the Exposure Unit 1 sitewide composite risk for indoor air based on the maximum concentration is not representative of actual conditions. For Cal/EPA risk drivers, naphthalene (2×10^{-5}) in soil and chloroform (3×10^{-6}) and vinyl chloride (6×10^{-6}) in groundwater represent over 70 percent of the risk. However, these chemicals

are found at widely disparate locations (Figure 6-3). Therefore, it is unlikely that these three chemicals would impact indoor air in the same building.

6.1.3 Exposure Unit 2

This section presents the risk characterization results for Exposure Unit 2 (Building 5). The results of the risk characterization are presented in Tables 6-1 and 6-2, and the risk drivers are presented in Table 6-6.

Total cancer risks (including metals at ambient concentrations) are presented in this section. Incremental residential cancer risks (without ambient metals) are identical to total residential cancer risks.

6.1.3.1 CANCER RISK CHARACTERIZATION FOR RESIDENTS

The total cancer risks are 2×10^{-3} and 1×10^{-2} for U.S. EPA and Cal/EPA, respectively, including all COPCs in soil and groundwater for residents. For both U.S. EPA and Cal/EPA, the pathway with the highest risks is inhalation of indoor air from COPCs in groundwater.

The principal U.S. EPA risk drivers are in groundwater, including vinyl chloride (1×10^{-3}), TCE (3×10^{-4}), carbon tetrachloride (2×10^{-4}) and chloroethane (1×10^{-4}). In soil, the U.S. EPA cancer risk is 4×10^{-4} principally due to N-nitroso-di-n-propylamine (3×10^{-4}), arsenic (6×10^{-5}), and TCE (5×10^{-5}). Carbon tetrachloride has not been reported in groundwater since 1997, and is therefore not considered representative of current conditions. N-nitroso-di-n-propylamine was reported infrequently in soil (one of 119 samples in Exposure Unit 2). Arsenic and thallium in soil are considered ambient except for one location in Exposure Unit 2. 2-Hexanone was also reported infrequently in groundwater (2 of 44 samples in Exposure Unit 2), although it was co-located with other risk drivers. Other VOCs in groundwater with risks above 1×10^{-6} include benzene, 1,4-DCB, and 1,2-DCA.

The principal Cal/EPA risk drivers are in groundwater and include vinyl chloride (1×10^{-2}), carbon tetrachloride (5×10^{-4}), and 1,1-DCA (3×10^{-4}). Other VOCs in groundwater with risks at or above 10^{-6} include benzene; 1,4-DCB; 1,2-DCA; and TCE.

In soil, the Cal/EPA cancer risk is 6×10^{-4}, primarily due to arsenic (3×10^{-4}) and N-nitroso-di-n-propylamine (3×10^{-4}). Other Cal/EPA risk drivers include PCE, Aroclor 1260, and cadmium.

6.1.3.2 NONCANCER AND LEAD RISK CHARACTERIZATION FOR RESIDENTS

The total noncancer HI is 86 with the majority (over 90 percent) associated with COPCs in groundwater migrating to indoor air. The primary hazard risk drivers in groundwater include 2-hexanone (30), carbon tetrachloride (22), 1,1-DCE (15), and vinyl chloride (6). 2-Hexanone was reported infrequently in groundwater (2 of 44 samples in Exposure Unit 2). Other noncancer risk drivers in groundwater include 1,1-DCA; 1,2-DCA; and 1,1,1-TCA.

In soil, the HI is 4, largely due to thallium with an HQ of 2. Arsenic, iron, and vanadium each contribute to the soil HI, all with HQs below 1. With the exception of arsenic and thallium in one sample, the concentrations of the metals are consistent with ambient concentrations.

The EPC of 279 mg/kg for lead at Exposure Unit 2 is above the lowest site-specific lead concentration of 197 mg/kg (for the pathway including ingestion of homegrown produce) but below the site-specific lead concentration of 346 mg/kg (for the pathway not including ingestion of homegrown produce).

6.1.3.3 RISK CHARACTERIZATION FOR OFFICE WORKERS

Office worker risk for current site conditions (with Building 5 present) is based only on migration of COPCs in sub-slab soil gas to indoor air. Future office worker risk, assuming that Building 5 has been demolished and replaced by a new building, is based on COPCs in soil and groundwater for all exposure pathways.

Office Workers Under Current Site Conditions

The total cancer risks for office workers under current site conditions are 1×10^{-6} and 3×10^{-7} for U.S. EPA and Cal/EPA, respectively. The cancer risk is associated with migration of soil gas into indoor air in Building 5 (Exposure Unit 2). The U.S. EPA cancer risk is due to TCE.

The total noncancer HI for office workers under current site conditions is 0.002.

Future Office Workers

The total cancer risks for future office workers are 3×10^{-5} and 2×10^{-4} for U.S. EPA and Cal/EPA, respectively. The risk drivers are similar to those for residents.

Because the total noncancer HI value for office workers is 1, there are no noncancer risk drivers in soil or groundwater.

The 95 percent UCL concentration of lead at Exposure Unit 2 is 279 mg/kg, which is below the industrial PRG for lead of 800 mg/kg.

It is noteworthy that the highest risk based on soil gas data (1×10^{-6}) in this evaluation for current office workers is substantially lower than that based on groundwater data (2×10^{-5}) for future office workers. All other assumptions remained the same for U.S. EPA cancer risk; the difference is more substantial for Cal/EPA cancer risk. This suggests that using groundwater data tends to overestimate vapor migration compared to using actual soil gas data. Also, groundwater data do not accurately predict which VOCs will be present in soil gas. For example, there are three VOCs identified as local area risk drivers based on results from the groundwater model, compared to no VOCs identified as local area risk drivers based on soil gas data.

6.1.3.4 RISK CHARACTERIZATION FOR CONSTRUCTION WORKERS

The total cancer risks for construction workers are 1×10^{-6} and 5×10^{-6} for U.S. EPA and Cal/EPA, respectively, including all COPCs in soil and groundwater. The Cal/EPA risk drivers include arsenic and chromium in soil.

Because the total noncancer HI value for construction workers is 0.2; there are no noncancer risk drivers in soil or groundwater.

6.1.4 Exposure Unit 3

This section presents the risk characterization results for Exposure Unit 3, the area adjacent to the eastern side of Building 5 and most affected by historical releases. The results of the risk characterization are presented in Tables 6-1 and 6-2. The risk drivers are presented in Table 6-7.

Total cancer risks (including metals at ambient concentrations) are presented in this section. Incremental residential cancer risks (without ambient metals) are identical to total residential cancer risks.

6.1.4.1 CANCER RISK CHARACTERIZATION FOR RESIDENTS

The total cancer risks for residents are 1×10^{-2} and 5×10^{-3} for U.S. EPA and Cal/EPA, respectively, including all COPCs in soil and groundwater.

The principal U.S. EPA risk drivers for residents include TCE in soil (1×10^{-2}), TCE in groundwater (3×10^{-3}), PCE in soil (9×10^{-4}), vinyl chloride in groundwater (2×10^{-4}), and carbon tetrachloride in groundwater (1×10^{-4}). However, carbon tetrachloride has not been reported in groundwater since 1997. Other VOCs in groundwater with risks at or above 1×10^{-6} include chloroethane; chloroform; 1,4-DCB; 1,2-DCA; and PCE. Other COPCs in soil with risks above 1×10^{-6} include benzene, bis(2-ethylhexyl)phthalate, carbazole, 1,2-DCA, methylene chloride, Aroclor 1260, and arsenic.

The principal Cal/EPA risk drivers for residents include vinyl chloride in groundwater (3×10^{-3}), PCE in soil (9×10^{-4}), carbon tetrachloride in groundwater (3×10^{-4}), ethylbenzene in soil (3×10^{-4}), TCE in soil (2×10^{-4}), and naphthalene in soil (1×10^{-4}). Other VOCs in groundwater with risks above 1×10^{-6} include benzene; chloroform; 1,4-DCB; 1,1-DCA; 1,2-DCA; ethylbenzene; naphthalene; PCE; and TCE. Other COPCs in soil with risks above 1×10^{-6} include benzene; 1,1-DCA; methylene chloride; Aroclor 1260; arsenic; cadmium; and chromium.

6.1.4.2 NONCANCER AND LEAD RISK CHARACTERIZATION FOR RESIDENTS

The total noncancer HI is 3,100. The primary risk drivers include organic lead in soil (2,150); 1,2,4-trimethylbenzene in soil (727); and total xylenes (44) in soil. The organic lead risk is based on one detection which was not speciated.

The maximum concentration of 170 mg/kg for lead at Exposure Unit 3 is below the two site-specific lead concentrations for residents of 197 and 346 mg/kg.

6.1.4.3 RISK CHARACTERIZATION FOR OFFICE WORKERS

The total cancer risks for office workers are 4×10^{-4} and 1×10^{-4} for U.S. EPA and Cal/EPA, respectively, including all COPCs in soil and groundwater. For both U.S. EPA and Cal/EPA, the risks above 1×10^{-4} are associated with inhalation of indoor air. The principal U.S. EPA and Cal/EPA risk drivers are similar to those for residents.

For office workers, the HI of 20 is due predominantly to 1,2,4-trimethylbenzene (HQ 7) in soil.

The maximum concentration of 170 mg/kg for lead at Exposure Unit 3 in soil is below the industrial PRG of 800 mg/kg.

6.1.4.4 RISK CHARACTERIZATION FOR CONSTRUCTION WORKERS

The total cancer risks for construction workers are 3×10^{-6} and 6×10^{-6} for U.S. EPA and Cal/EPA, respectively. The risk driver is chromium in soil.

The total noncancer HI value for construction workers is 3, due to organic lead in soil.

6.1.5 Uncertainty Analysis

Varying degrees of uncertainty exist in each step of the risk assessment process. To compensate for these uncertainties, the U.S. EPA has developed risk assessment protocols that are designed so that potential risks are not underestimated.

Risk managers take uncertainty into consideration when making decisions on cancer risks within the risk management range (10^{-6} to 10^{-4}) and HI values above 1. When little information exists for a site or the toxicity of the COPCs, and uncertainty exists concerning exposure, risk managers may tend to assign a target risk at the lower end of the risk management range (e.g., 10^{-6}). When there is a higher level of confidence that 1) the site has been adequately characterized, 2) there is a sufficient understanding of the toxicology of the risk drivers, and 3) exposure has not been underestimated, then risk managers may choose a higher target risk level (e.g., 10^{-4}) as appropriate for the site. Therefore, it is important to understand the adequacy of the data and any uncertainty associated with exposure or toxicity before making risk management decisions.

6.1.5.1 DATA ADEQUACY

The validity of any risk assessment is dependent on the adequacy of the site characterization. The data must be considered adequate to support the risk assessment and make risk management decisions. The data set used in the RI to characterize the nature and extent of contamination at OU-2C consisted of soil samples and both discrete groundwater samples and monitoring well groundwater samples collected from locations throughout OU-2C. Sample collection at OU-2C was generally biased to areas known or suspected to have chemical impacts.

Groundwater samples were collected from the shallower FWBZ (4 to 20 feet bgs), the deeper FWBZ (20 to 40 feet bgs), and the SWBZ (40 to 70 feet bgs). The RI data set includes analytical results from 1,770 soil samples (93,367 analytical results) and 1,357

groundwater samples (77,917 analytical results) collected between 1991 and 2007, as well as sub-slab soil gas data collected from beneath Building 5 in 2007 from 87 sampling points (6,019 analytical results).

6.1.5.2 EXPOSURE ASSESSMENT

Uncertainties are also associated with the parameters presented as exposure and in the quantification of exposure. Each exposure assumption is designed to estimate the potential risk to assure that any actual risk will be less than the estimated risk. In this risk assessment, for example, it was assumed that residents would engage regularly in activities that would result in exposure to site COPCs over 30 years. It was also assumed that the individual would be exposed for 24 hours per day for the entire 30-year duration. These assumptions provide a protective estimate of exposure that is designed to assure that any actual exposure will be lower.

The risks (including adjusted risks for Exposure Unit 1 and for IR Sites 10 and 12) calculated for this HHRA likely overestimate any actual risk because of the conservative nature of the calculations. Most of the risk is associated with migration of VOCs to indoor air; this indoor air risk is based on the maximum concentration for every VOC in soil and groundwater, regardless of the location. Using this conservative approach, over 99 percent of the risk calculated in the HHRA is based on the use of a maximum concentration for each COPC and the assumption that these concentrations would be present throughout the soil and groundwater beneath a future residence.

There is uncertainty associated with estimation of vapor migration from groundwater to indoor air. U.S. EPA and Cal/EPA guidance state that soil gas data are the preferred data to estimate vapor migration and that groundwater data can be used if soil gas data are not available. Risk results based on soil gas are lower than those based on groundwater data for Exposure Unit 2.

There is a higher level of uncertainty associated with vapor risks estimated from soil than from soil gas or groundwater. Neither U.S. EPA nor Cal/EPA recommends the use of soil data. In the model for vapor intrusion of volatile COPCs in soil, it was assumed that the concentration in the sample with the highest concentration was present from the surface to the groundwater table at 8 feet bgs. Also, the model assumes that this concentration would be present evenly below a residence. In fact, most locations only have reported values of VOCs at one sampling depth. Also, the high spatial variability of the data indicates that there are no areas the size of a residence that are evenly contaminated. For example, in Exposure Unit 1, the adjusted HI above 1 (HI = 2) is due to naphthalene and 2-methylnaphthalene in soil for the vapor pathway to indoor air. Methyl naphthalene does not have a toxicity factor, so naphthalene is used as a surrogate. Naphthalene was only found in 4 of 488 samples at a concentration above the cancer risk screening level, which is lower than the noncancer hazard screening level. Therefore, it is unlikely that either chemical poses a noncancer hazard concern.

For ingestion of locally grown produce, the uptake of organic chemicals (except PAHs) was estimated from theoretical equations rather than from field studies; therefore, uptake may be overestimated. PAH uptake is based on field studies that show that uptake is

minimal. Alameda Point–specific studies presented by U.S. EPA found no uptake of PAHs in homegrown produce (U.S. EPA 2005a).

6.1.6 Conclusions

The results of the HHRAs for Exposure Units 1, 2, and 3 are summarized below.

6.1.6.1 EXPOSURE UNIT 1

For residents, the risk characterization results are above the cancer risk management range and above an HI of 1 for Exposure Unit 1 (areas with less impact). The adjusted cancer risks for IR Sites 10 and 12 are within the risk management range and the HIs are equal to or less than 1. Most of the risk is associated with indoor air risks using the maximum concentrations found in any sample. An evaluation of local areas indicated that there are two locations within Exposure Unit 1 with risks above the risk management range that might warrant future action. In addition, some risk drivers were rarely reported and some were metals at concentrations consistent with background. The adjusted U.S. EPA and Cal/EPA cancer risks for Exposure Unit 1 without data from these locations or from ambient metals or infrequently reported COPCs are within the risk management range, and the HI is slightly above 1 (HI = 3). The adjustments to the risk characterization for Exposure Unit 1 included removal of data as follows.

- Data for Local Areas 1 and 2 were removed. These areas contain sampling locations with risks above the risk management range due to VOCs in soil and the potential for vapor migration to indoor air. Risks may be overestimated for Local Area 1 due to questionable units for the benzene data from 1995. It is likely that Local Area 2 warrants further evaluation.
- Data from COPCs that were infrequently reported above detection limits were not included in the risk (aldrin, Aroclor, and N-nitroso-di-n-propylamine were only reported in one or two soil samples).
- Data from metals that are considered ambient or were rarely reported above background or the target risk level were excluded from the adjusted risk (arsenic, cadmium, iron, manganese, thallium, and vanadium) to represent an incremental risk.

For office and construction workers, the cancer risks are within the risk management range and the HI values are below 1 without adjusting the risks.

6.1.6.2 EXPOSURE UNIT 2

For residents, the cancer risks are above the risk management range and the HI is above 1 for Exposure Unit 2 (Building 5). The risk drivers include primarily VOCs in groundwater and soil and metals in soil. The risk results were not adjusted because local areas or COPCs that warranted exclusion were not identified.

For office workers under current site conditions, the cancer risk and hazard values are insignificant, based on soil gas data. The future office worker risks are above the risk management range only for Cal/EPA cancer risk.

For construction workers, the cancer risks are within the risk management range and the HI is less than 1.

6.1.6.3 EXPOSURE UNIT 3

For residents, the cancer risks are above the risk management range and the HI is above 1 for Exposure Unit 3 (areas with more impact). The local area residential risk drivers include primarily VOCs in groundwater and soil, and metals in soil. The risk results were not adjusted because local areas or COPCs that warranted exclusion were not identified.

For office workers, the U.S. EPA cancer risks are above the risk management range and the Cal/EPA cancer risks are at 1×10^{-4}. The noncancer HI is above 1.

For construction workers, the cancer risks are within the risk management range and the HI is above 1.

6.2 ECOLOGICAL RISK ASSESSMENT

A screening-level ERA was conducted by the Navy in association with the RI to estimate the potential impacts of chemicals reported at concentrations above detection limits in soil and groundwater at OU-2C. Soil gas data are not used in the ERA because exposure pathways that include inhalation of vapors are not considered a significant source of exposure for ecological receptors (Figure 6-1). A screening-level ERA is Tier 1 (Steps 1 and 2) of the Navy policy for conducting ERAs (DON 1999, 2001a). The ERA process of the Navy policy is substantially identical to the U.S. EPA's ERA Guidance for Superfund and functionally equivalent to the ERA guidance documents for the state of California.

This risk assessment also includes an evaluation of refined exposure estimates described by U.S. EPA guidance (U.S. EPA 1997) and Step 3a of Navy policy (DON 1999, 2001a). The supplemental refined evaluation is presented in addition to the screening-level ERA (rather than as part of the screening-level ERA) and as an aid to the risk managers.

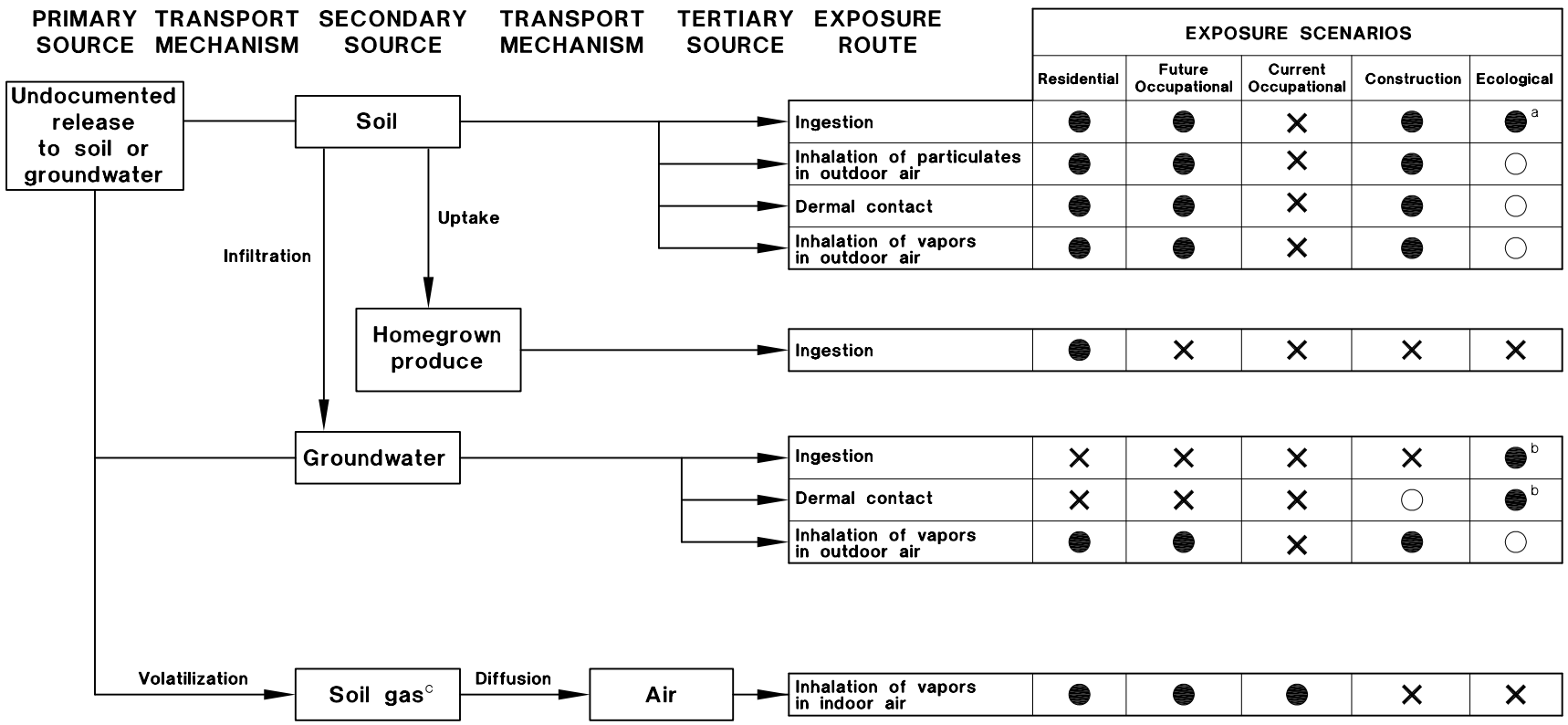
A summary of the ERA is presented in this subsection and complete details of the ERA are presented in Appendix N.

6.2.1 Screening-Level Ecological Risk Assessment

The screening-level ERA employs existing data and conservative assumptions regarding contaminant exposure to evaluate whether additional assessment is warranted. Step 1 develops the screening-level conceptual model through problem formulation and toxicity evaluation. Step 2 prepares the exposure estimates and risk calculations.

6.2.1.1 PROBLEM FORMULATION

The problem formulation evaluates potential exposure pathways between COPECs and ecological receptors based on considerations of site characteristics, COPECs, and representative organisms.



LEGEND:

- ● potentially complete exposure pathway
- ✕ incomplete exposure pathway
- ○ not considered a significant source of exposure

NOTES:

[a] ingestion of soil and food items by terrestrial receptors

[b] considered complete for portions of OU-2C where there is evidence that groundwater is discharging to Seaplane Lagoon

[c] subslab soil gas data were used for indoor air concentrations when available; otherwise soil and groundwater data were used

Remedial Investigation Report for OU-2C

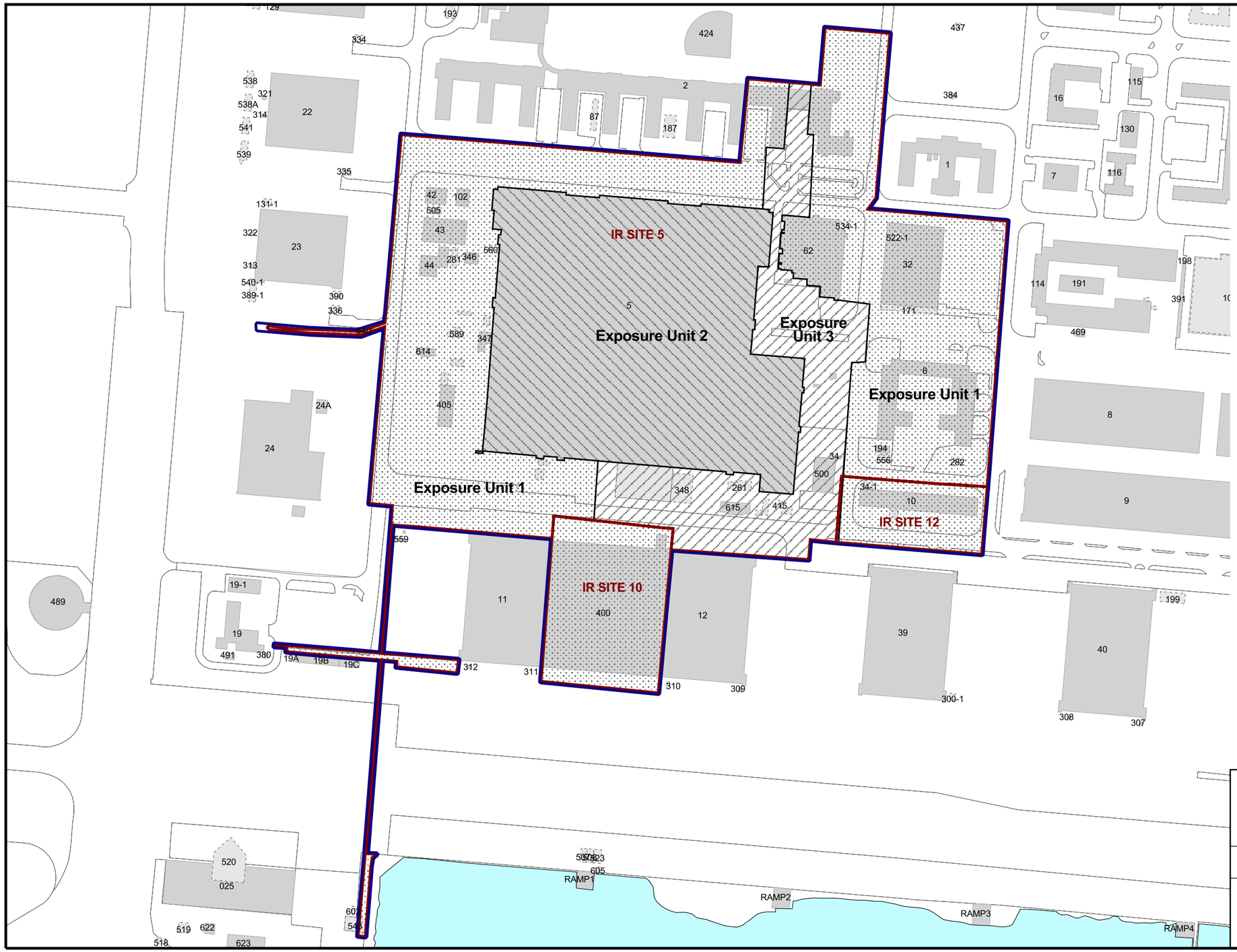
Figure 6-1

Exposure Pathway Conceptual Site Model for Risk Assessment

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 8/14/08
File No: 093C15698
Job No: 23818-093
Rev No: E



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- 32 — BUILDING OR STRUCTURE (PRESENT) WITH BUILDING ID
- 261 — BUILDING OR STRUCTURE (REMOVED) WITH BUILDING ID
- EXPOSURE UNIT 1
- EXPOSURE UNIT 2
- EXPOSURE UNIT 3

NOTES :
IR – INSTALLATION RESTORATION (PROGRAM)
OU – OPERABLE UNIT

N

300 0 300 Feet

Remedial Investigation Report for OU-2C

Figure 6-2

Risk Assessment Exposure Units

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/31/08
File No.: 093L15857
Job No.: 23818-093
Rev No.: F

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT) WITH BUILDING ID
- BUILDING OR STRUCTURE (REMOVED)
- EXPOSURE UNIT 1
- EXPOSURE UNIT 2
- EXPOSURE UNIT 3

LOCATION OF SAMPLE USED IN HUMAN HEALTH RISK ASSESSMENT

- SOIL SAMPLING LOCATION
- GROUNDWATER SAMPLING LOCATION
- SOIL AND GROUNDWATER SAMPLING LOCATION
- CANCER RISK EQUAL TO OR GREATER THAN 2E-06 IN GROUNDWATER
- CANCER RISK EQUAL TO OR GREATER THAN 1E-05 IN GROUNDWATER
- CANCER RISK EQUAL TO OR GREATER THAN 2E-06 IN SOIL
- CANCER RISK EQUAL TO OR GREATER THAN 1E-05 IN SOIL
- CANCER RISK EQUAL TO OR GREATER THAN 1E-04 IN SOIL

NOTES :
IR – INSTALLATION RESTORATION (PROGRAM)
OU – OPERABLE UNIT
PCE – TETRACHLOROETHENE
TCE – TRICHLOROETHENE

N

250 0 250 Feet

Remedial Investigation Report for OU-2C

Figure 6-3

Locations of Local Area Risk Drivers for Residents in Soil and Groundwater at Exposure Unit 1

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/16/08
File No.: 093L15985
Job No.: 23818-093
Rev No.: C

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- 32 BUILDING OR STRUCTURE (PRESENT) WITH BUILDING ID
- BUILDING OR STRUCTURE (REMOVED)
- EXPOSURE UNIT 1
- EXPOSURE UNIT 2
- EXPOSURE UNIT 3

LOCATION OF SAMPLE USED IN HUMAN HEALTH RISK ASSESSMENT

- SOIL SAMPLING LOCATION
- GROUNDWATER SAMPLING LOCATION
- SOIL AND GROUNDWATER SAMPLING LOCATION
- CANCER RISK EQUAL TO OR GREATER THAN 1E-05 IN SOIL

NOTES :

ALL LOCATIONS WITH CANCER RISK EQUAL TO OR GREATER THAN 2E-06 ARE SHOWN ON THIS FIGURE

IR – INSTALLATION RESTORATION (PROGRAM)
OU – OPERABLE UNIT
PCE – TETRACHLOROETHENE
TCE – TRICHLOROETHENE

N

250 0 250 Feet

Remedial Investigation Report for OU-2C

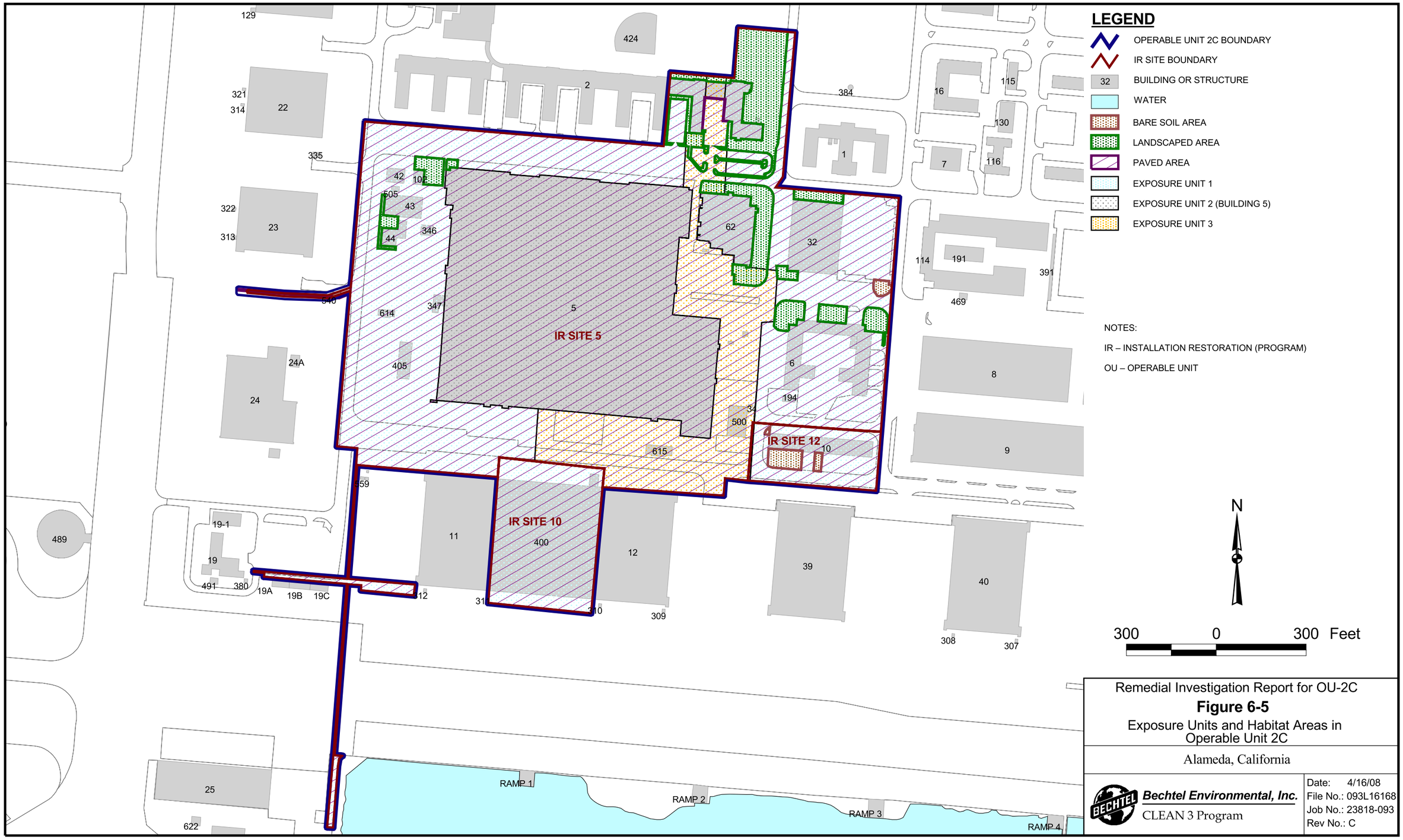
Figure 6-4

Locations of Local Area Risk Drivers for Office Workers in Soil and Groundwater at Exposure Unit 1

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 12/6/07
File No.: 093L16138
Job No.: 23818-093
Rev No.: A



Remedial Investigation Report for OU-2C

Figure 6-5

Exposure Units and Habitat Areas in Operable Unit 2C

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/16/08
File No.: 093L16168
Job No.: 23818-093
Rev No.: C

Table 6-1
Summary Results for Total Risk by Exposure Unit

Exposure Unit/Receptor	U.S. EPA Cancer[a]	Cal/EPA Cancer	Noncancer Hazard
Exposure Unit 1			
Resident	1E-03	1E-03	11
Resident (adjusted)[b,c]	5E-05	4E-05[d]	2[e]
Future Office Worker	3E-05	3E-05	0.3
Construction Worker	7E-07	2E-06	0.1
Exposure Unit 2			
Resident	2E-03	1E-02	86
Current Office Worker	1E-06	3E-07	0.002
Future Office Worker	3E-05	2E-04	1
Construction Worker	1E-06	5E-06	0.2
Exposure Unit 3			
Resident	1E-02	5E-03	3100
Future Office Worker	4E-04	1E-04	20
Construction Worker	3E-06	6E-06	3
IR Sites 10 and 12[f] (adjusted)[c]			
Resident (IR Site 10)	5E-05	1E-05	1
Resident (IR Site 12)	7E-06	5E-06	0.4

Notes:
[a] the toxicity values for key U.S. EPA risk drivers have recently changed (Regional Screening Levels July 2008), which would result in lower risks
[b] two local areas excluded
[c] ambient metals and three infrequently reported organic chemicals excluded
[d] the risk is based on the assumption that the maximum concentrations of all volatile chemicals are located under a hypothetical residence; however, risk drivers are found at widely dispersed locations so this risk is likely an overestimation
[e] based on three chemicals with HQ values below 1 and the assumption of additive effects; additionally, one chemical does not have a toxicity factor and a surrogate was used, and one chemical was rarely reported in groundwater
[f] IR Sites 10 and 12 risks were included in Exposure Unit 1, but risks are also shown here separately

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
IR – Installation Restoration (Program)
U.S. EPA – United States Environmental Protection Agency

Table 6-2
Detailed Results for Total Risk[a] by Exposure Unit

Receptor/Pathway	EXPOSURE UNIT 1			EXPOSURE UNIT 2			EXPOSURE UNIT 3		
	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Noncancer Hazard	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Noncancer Hazard	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Noncancer Hazard
Resident									
Direct contact with soil	8E-06	4E-05	2	3E-05	2E-04	4	7E-06	3E-05	100
Indoor air	9E-04	9E-04	9	2E-03	1E-02	81	1E-02	5E-03	920
Outdoor air	1E-06	2E-06	0.04	1E-05	8E-05	0.6	3E-05	1E-05	2
Homegrown produce	3E-04	3E-04	0.3	3E-04	4E-04	0.4	1E-05	6E-05	2050
TOTAL	**1E-03**	**1E-03**	**11**	**2E-03**	**1E-02**	**86**	**1E-02**	**5E-03**	**3100**
Current Office Worker[b]									
Indoor air	—[c]	—	—	1E-06	3E-07	0.002	—	—	—
TOTAL	—	—	—	**1E-06**	**3E-07**	**0.002**	—	—	—
Future Office Worker									
Direct contact with soil	2E-06	1E-05	0.2	8E-06	6E-05	0.4	3E-06	9E-06	10
Indoor air	3E-05	2E-05	0.1	2E-05	1E-04	0.6	4E-04	1E-04	10
Outdoor air	2E-07	3E-07	0.004	2E-06	1E-05	0.06	4E-06	2E-06	0.2
TOTAL	**3E-05**	**3E-05**	**0.3**	**3E-05**	**2E-04**	**1**	**4E-04**	**1E-04**	**20**
Construction									
Direct contact with soil	2E-07	1E-06	0.04	6E-07	4E-06	0.09	2E-07	7E-07	3
Outdoor air	5E-07	9E-07	0.1	7E-07	1E-06	0.1	3E-06	5E-06	0.4
TOTAL	**7E-07**	**2E-06**	**0.1**	**1E-06**	**5E-06**	**0.2**	**3E-06**	**6E-06**	**3**

Notes:
[a] including ambient metals
[b] soil gas data used to evaluate Exposure Unit 2
[c] "—" indicates risk in this exposure unit is the same as the risk for the future office worker from the indoor air pathway because the only completed exposure pathway for current office worker is inhalation of indoor air

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
U.S. EPA – United States Environmental Protection Agency

Table 6-3
Risk Drivers[a] for Exposure Unit 1

Chemical[b]	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Principal Exposure Pathway Contributing to Risk
Soil				
benzene[c]	2E-04	8E-04	4	inhalation of indoor air
ethylbenzene		8E-06	—[d]	inhalation of indoor air
naphthalene		2E-05	—	inhalation of indoor air
tetrachloroethene[c]	5E-05	5E-05	1	inhalation of indoor air
trichloroethene[e]	7E-04	1E-05	—	inhalation of indoor air
benzo(a)pyrene	1E-06	2E-06	—	ingestion of soil
carbazole	1E-06	1E-06	—	ingestion of homegrown produce
N-nitroso-di-n-propylamine	3E-04	3E-04	—	ingestion of homegrown produce
aldrin	2E-06	2E-06	—	ingestion of homegrown produce
Aroclor 1260	2E-06	5E-06	—	ingestion of homegrown produce
arsenic[c,f]	1E-05	7E-05	—	ingestion of soil and homegrown produce
cadmium[f]	—	1E-05	—	ingestion of soil and homegrown produce
Groundwater				
chloroform	1E-05	3E-06	—	inhalation of indoor air
ethylbenzene		5E-06	—	inhalation of indoor air
trichloroethene	2E-05	—	—	inhalation of indoor air
vinyl chloride	—	6E-06	—	inhalation of indoor air

Notes:
[a] risk drivers listed are for the residential exposure scenario and include metals present below Alameda Point background; risks for the construction worker exposure scenario were below or within the risk management range (Table 6-1)
[b] only chemicals with a cancer risk above 1E-06, using either U.S. EPA or Cal/EPA toxicity information, or an HQ above 1, are listed
[c] also U.S. EPA and Cal/EPA cancer risk driver for the office worker exposure scenario
[d] "—" indicates chemical does not contribute significantly to risk
[e] also U.S. EPA cancer risk driver for the office worker exposure scenario
[f] italic type indicates metal considered ambient

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
HQ – hazard quotient
U.S. EPA – United States Environmental Protection Agency

Table 6-4
Evaluation of Local Areas for Residents
Exposure Unit 1

Local Area Risk Drivers	RISK CHARACTERIZATION RESULTS				EVALUATION OF LOCAL AREAS							
	Exposure Point Concentration[a]	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Maximum Concentration[a]	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Screening Level[a,b]	Frequency of Detection	Samples above Screening Level	Basis for Screening Level
GROUNDWATER												
Volatile Organic Compounds												
chloroform	5.50E-02	1E-05	3E-06		5.50E-02	1E-05	3E-06		4.18E-03	15/86	4	cancer end point
ethylbenzene	1.27E-01		5E-06		1.27E-01		5E-06		2.50E-02	4/143	1	cancer end point
trichloroethene	9.00E-03	2E-05			9.00E-03	2E-05			4.92E-04	22/104	17	cancer end point
vinyl chloride	1.10E-03		6E-06		1.10E-03		6E-06		1.83E-04	6/104	6	cancer end point
SOIL												
Volatile Organic Compounds												
benzene	6.00E+00	2E-04	8E-04	4	6.00E+00	2E-04	8E-04	4	7.19E-03	17/274	3	cancer end point
ethylbenzene	6.90E-01		8E-06		6.90E-01		8E-06		8.43E-02	7/274	2	cancer end point
naphthalene	5.40E-01		2E-05	0.8	5.40E-01		2E-05	0.8	3.11E-02	223/448	4	cancer end point
tetrachloroethene	2.00E+00	5E-05	5E-05	1	2.00E+00	5E-05	5E-05	1	3.67E-02	29/223	3	cancer end point
trichloroethene	1.30E+00	7E-04	1E-05	0.7	1.30E+00	7E-04	1E-05	0.8	1.79E-03	13/223	13	cancer end point
Semivolatile Organic Compounds												
N-nitroso-di-n-propylamine	2.30E-02	3E-04	3E-04		2.30E-02	3E-04	3E-04		7.66E-05	1/180	1	cancer end point
Pesticides/Polychlorinated Biphenyls												
aldrin	2.91E-03	2E-06	2E-06		8.30E-03	6E-06	6E-06		1.29E-03	2/32	2	cancer end point
Aroclor-1260	5.10E-02	2E-06	5E-06		5.10E-02	2E-06	5E-06		9.32E-03	2/128	1	cancer end point
Metals												
arsenic	2.72E+00	1E-05	7E-05	0.1	1.12E+01	5E-05	3E-04	0.6	9.14E+00	144/194	4	background
cadmium	2.02E+00		1E-05	0.2	3.00E+00		1E-05	0.3	1.72E+00	71/204	4	background
iron	1.46E+04			0.6	5.02E+04			2	2.23E+04	191/191	17	background
thallium	1.41E+00			0.3	8.50E+00			2	4.15E+00	30/183	2	noncancer end point

Notes:
[a] units for groundwater concentrations are in milligrams per liter and soil concentrations are in milligrams per kilogram
[b] concentration associated with a cancer risk of 1×10^{-6} or an HQ of 1 for all exposure pathways combined; lowest concentration based on U.S. EPA and Cal/EPA cancer risks was used unless below background

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
EPC – exposure point concentration
HQ – hazard quotient
U.S. EPA – United States Environmental Protection Agency

Table 6-5
Evaluation of Local Areas for Office Workers
Exposure Unit 1

Local Area Risk Drivers	RISK CHARACTERIZATION RESULTS				EVALUATION OF LOCAL AREAS							
	Exposure Point Concentration (mg/kg)	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Maximum Concentration (mg/kg)	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Screening Level* (mg/kg)	Frequency of Detection	Samples above Screening Level	Basis for Screening Level
SOIL												
Volatile Organic Compounds												
benzene	6.00E+00	6E-06	2E-05		6.00E+00	8E-06	3E-05		2.36E-01	17/274	3	cancer end point
tetrachloroethene	2.00E+00	2E-06	2E-06		2.00E+00	3E-06	3E-06		6.71E-01	29/223	1	cancer end point
trichloroethene	1.30E+00	2E-05			1.30E+00	2E-05			5.42E-02	13/223	2	cancer end point
Metals												
arsenic	2.72E+00	1E-06	1E-05		1.12E+01	7E-06	5E-05		9.14E+00	144/194	4	background

Note:
* concentration associated with a cancer risk of 1 x 10^{-6} or an HQ of 1 for all exposure pathways combined; lowest concentration based on U.S. EPA and Cal/EPA cancer risks was used unless below background

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
EPC – exposure point concentration
HQ – hazard quotient
mg/kg – milligrams per kilogram
U.S. EPA – United States Environmental Protection Agency

Table 6-6
Risk Drivers[a] for Exposure Unit 2

Chemical[b]	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Principal Exposure Pathway Contributing to Risk
Soil				
tetrachloroethene	4E-06	4E-06	—[c]	inhalation of indoor air
trichloroethene[d]	5E-05	—	—	inhalation of indoor air
N-nitroso-di-n-propylamine	3E-04	3E-04	—	ingestion of homegrown produce
Aroclor 1260	3E-06	7E-06	—	ingestion of homegrown produce
arsenic[e,f]	6E-05	3E-04	—	ingestion of soil and homegrown produce
cadmium	—	6E-06	—	ingestion of homegrown produce
thallium			2	ingestion of soil and dermal contact
chromium[f]	—	—	—	inhalation of dust
Groundwater				
benzene	1E-06	5E-06	—	inhalation of indoor air
carbon tetrachloride[e]	2E-04	5E-04	22	inhalation of indoor air
chloroethane[e]	1E-04	1E-04	—	inhalation of indoor air
1,4-dichlorobenzene	2E-06	3E-06	—	inhalation of indoor air
1,1-dichloroethane[g]		3E-04	2	inhalation of indoor air
1,2-dichloroethane	3E-05	2E-05	1	inhalation of indoor air
1,1-dichloroethene			15	inhalation of indoor air
2-hexanone			30	inhalation of indoor air
1,1,1-trichloroethane			2	inhalation of indoor air
trichloroethene[d]	3E-04	6E-06	—	inhalation of indoor air
vinyl chloride[e]	1E-03	1E-02	6	inhalation of indoor air

Notes:
[a] risk drivers listed are for the residential exposure scenario and include metals present below Alameda Point background
[b] only chemicals with a cancer risk above 1E-06, using either U.S. EPA or Cal/EPA toxicity information, or an HQ above 1, are listed
[c] dash indicates chemical does not contribute significantly to risk
[d] also U.S. EPA cancer risk driver for the future office worker exposure scenario
[e] also U.S. EPA and Cal/EPA cancer risk driver for the future office worker exposure scenario
[f] also Cal/EPA cancer risk driver for the construction worker exposure scenario
[g] also Cal/EPA cancer risk driver for the future office worker exposure scenario

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
HQ – hazard quotient
U.S. EPA – United States Environmental Protection Agency

Table 6-7
Risk Drivers[a] for Exposure Unit 3

Chemical[b]	U.S. EPA Cancer Risk	Cal/EPA Cancer Risk	Hazard Quotient	Principal Exposure Pathway Contributing to Risk
Soil				
benzene	2E-06	8E-06	—[c]	inhalation of indoor air
tert-butylbenzene			1	ingestion of soil
1,1-dichloroethane		1E-05	—	inhalation of indoor air
1,2-dichloroethane	1E-06	—	—	inhalation of indoor air
1,2-dichloroethene			2	inhalation of indoor air
ethylbenzene[d]		3E-04	—	inhalation of indoor air
isopropylbenzene			2	inhalation of indoor air
p-isopropyltoluene			4	inhalation of indoor air
2-methylnaphthalene			1	inhalation of indoor air
methylene chloride	3E-06	8E-06	—	inhalation of indoor air
naphthalene		1E-04	5	inhalation of indoor air
n-propylbenzene			11	inhalation of indoor air
tetrachloroethene[e]	9E-04	9E-04	19	inhalation of indoor air
trichloroethene[e]	1E-02	2E-04	11	inhalation of indoor air
1,2,4-trimethylbenzene[f]			727	inhalation of indoor air
1,3,5-trimethylbenzene			26	inhalation of indoor air
m,p-xylene			28	inhalation of indoor air
o-xylene			9.9	inhalation of indoor air
total xylenes			44	inhalation of indoor air
bis(2-ethylhexyl)phthalate	2E-06	—	—	ingestion of homegrown produce
carbazole	3E-06	3E-06	—	ingestion of homegrown produce
Aroclor-1260	2E-06	6E-06	—	ingestion of homegrown produce
arsenic[e]	8E-06	6E-05	—	ingestion of soil and homegrown produce
cadmium[g]	—	3E-05	—	ingestion of homegrown produce
chromium[h]	—	2E-06	—	inhalation of dust
organic lead[f,i]			2,150	ingestion of homegrown produce
Groundwater				
benzene	—	3E-06	—	inhalation of indoor air
carbon tetrachloride[e]	1E-04	3E-04	14	inhalation of indoor air
chloroethane	3E-05	3E-05	—	inhalation of indoor air
chloroform	2E-05	5E-06	—	inhalation of indoor air
1,4-dichlorobenzene	1E-06	3E-06	—	inhalation of indoor air
1,1-dichloroethane		5E-05	—	inhalation of indoor air
1,2-dichloroethane	3E-06	3E-06	—	inhalation of indoor air
1,1-dichloroethene			3	inhalation of indoor air
ethylbenzene		3E-06	—	inhalation of indoor air
naphthalene		9E-06	—	inhalation of indoor air
tetrachloroethene	1E-05	1E-05	—	inhalation of indoor air
trichloroethene[f]	3E-03	5E-05	3	inhalation of indoor air
1,2,4-trimethylbenzene			3	inhalation of indoor air
vinyl chloride[e]	2E-04	3E-03	2	inhalation of indoor air

Table 6-7 (continued)

Notes:

[a] risk drivers listed are for the residential exposure scenario and include metals present below Alameda Point background; risks for the construction worker exposure scenario were below or within the risk management range (Table 6-1)

[b] only chemicals with a cancer risk above 1E-06, using either U.S. EPA or Cal/EPA toxicity information, or an HQ above 1, are listed

[c] dash indicates chemical does not contribute significantly to risk

[d] also Cal/EPA cancer/hazard risk driver for the future office worker exposure scenario

[e] also U.S. EPA and Cal/EPA cancer/hazard risk driver for the future office worker exposure scenario

[f] also U.S. EPA cancer/hazard risk driver for the future office worker exposure scenario

[g] italic type indicates metal is ambient

[h] also U.S. and Cal/EPA risk driver for the construction worker scenario

[i] also hazard risk driver for the construction worker scenario

Acronyms/Abbreviations:

Cal/EPA – California Environmental Protection Agency
HQ – hazard quotient
U.S. EPA – United States Environmental Protection Agency

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
7	**Risks were re-calculated for Exposure Units 2 and 3**	**Section 2.5.1**	Draft Final OU-2C iROD, Reference Link. Comparison of TCE Toxicity Values and Updated Risk Assessment Results for Exposure Units 2 and 3 at OU-2C, Alameda Point, prepared by Battelle. January 2014 Final Remedial Investigation Report for Operable Unit 2C. Table M2-6 and Table M5-11.

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Comparison of TCE Toxicity Values and Updated Risk Assessment Results for Exposure Units 2 and 3 at OU-2C, Alameda Point
January 2014

This OU-2C Record of Decision link presents the results of the comparison that Battelle conducted to assess the effect that changes in toxicity values for trichloroethene (TCE) and other chemicals of potential concern (COPCs) identified in soil and groundwater at Exposure Units 2 and 3 have on the calculated cancer risks and noncancer health hazards for the future office worker that were provided in the Remedial Investigation (RI) human health risk assessment (HHRA)[1]. The results of this evaluation indicate that the total cancer risk for the future office worker at Exposure Unit 2 remains the same as the 2008 RI (risk = 3×10^{-5}). The noncancer hazard index (HI) for the future office worker at Exposure Unit 2 is slightly higher (HI increases from 1 to 2). For the the future office worker at Exposure Unit 3, the total cancer risk decreased, while the noncancer HI slightly increased (i.e., risk decreases from 4×10^{-4} to 3×10^{-5}; HI increased from 20 to 24).

This evaluation is divided into the following sections:
Section I. Background
Section II. Toxicity Comparison
Section III. Risk Results

I. Background

The Final RI report for Operable Unit 2C (OU-2C) was issued in September 2008, and its HHRA divided OU-2C into three exposure units. The Final RI report recommended that Exposure Units 2 and 3 be addressed in a feasibility study (FS), but for Exposure Unit 1, only the western portion of the exposure unit be carried through for evaluation in a feasibility study. The Final Feasibility Study (FS)[2] report was issued in May 2011, and results of its HHRA for Western Exposure Unit 1 showed that only Local Area 2 requires remedial action for soil. Based on the results of the RI/FS, remedial action objectives specifically associated with commercial land use were established for chemicals of concern (COCs) in soil and shallow groundwater in Exposure Units 2 and 3. TCE was one of the COCs identified in soil and groundwater, and therefore as part of the FS, risk-based concentrations (RBCs) for vapor intrusion were calculated for TCE based on the then current 2010 toxicity values for TCE. However, in September 2011, the U.S. Environmental Protection Agency (U.S. EPA) issued a final health assessment for TCE with conclusions suggesting that TCE is far more toxic and carcinogenic than was previously assumed. Therefore, Battelle revised the preliminary remedial goals (RGs) by incorporating the more conservative inhalation toxicity value and issued a Technical Memorandum to the Navy in October 2011 documenting the revised RGs and the conclusion that no changes to the remedial footprints shown in the FS report were warranted based on the updated preliminary RGs.

Since the HHRA conducted for the RI was completed prior to U.S. EPA's release of the final health assessment for TCE and in order to be consistent with current U.S. EPA recommended toxicity values, a comparison was made of toxicity values used in the RI HHRA to toxicity values presented in the November 2013 U.S. EPA regional screening level (RSL) table[3]. The objective of the comparison was to assess the effect that changes in toxicity values for TCE and other chemicals of potential concern

[1] Bechtel, 2008. Final Remedial Investigation Report For Operable Unit 2C, Alameda Point, Alameda, California
[2] Battelle, 2011. Final Feasibility Study Report Operable Unit 2C, IR Sites 5 and 10, Alameda Point, Alameda, California.
[3] United States Environmental Protection Agency Regions 3, 6, and 9 (accessed January 24, 2013). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.

(COPCs) identified in soil and groundwater at Exposure Units 2 and 3 have on the calculated cancer risks and noncancer health hazards for the future office worker that were provided in the RI HHRA. No other exposure pathways were evaluated because the Final FS report identified commercial use RGs.

II. Toxicity Comparison

Toxicity values for all of the COPCs identified in soil, groundwater, and/or soil gas in Exposure Units 2 and 3 (Appendix M of the 2008 RI report, Table M2-6) were compared to toxicity values provided in the November 2013 RSL table. The results of the toxicity comparison identified 12 of the COPCs as having toxicity values that are no longer current. Table 1 summarizes all of the COPCs where toxicity values differed and provides a comparison of the toxicity values used in the RI HHRA along with the most recent U.S. EPA recommended toxicity values (e.g., 2013 RSL values). For the RI HHRA, two sets of cancer risks were calculated: one set based on U.S. EPA toxicity values and the other set based on California EPA (Cal/EPA) toxicity values. Note that Cal/EPA toxicity values also are included in Table 1 for additional information, but the actual comparison conducted here was primarily between U.S. EPA toxicity values. In addition, please note that inhalation toxicity values are provided as inhalation slope factors $(mg/kg\text{-}day)^{-1}$ and reference doses (mg/kg-day), rather than inhalation unit risks $(ug/m^3)^{-1}$ and reference concentrations (mg/m^3), to be consistent with the RI HHRA values.

The results of the toxicity comparison (U.S. EPA toxicity only) are as follows:

- Ethylbenzene and 1,1-dichloroethane now have inhalation and oral cancer slope factors, but these values were not available for the RI HHRA.
- Chloroform now has an oral cancer slope factor, but this value was not available for the RI HHRA.
- Naphthalene now has an inhalation slope factor, but did not have one during the RI HHRA.
- Oral and inhalation cancer slope factors for 1,4-dioxane, TCE, carbon tetrachloride, methylene chloride and trichloroethene have changed since the RI HHRA.
- Oral and inhalation noncancer toxicity values (i.e., reference doses) for all COPCs, except ethylbenzene and naphthalene, have changed since the RI HHRA (increasing or decreasing depending on the COPC).

TCE is of particular interest because for Exposure Unit 3 (Appendix M of the 2008 RI report, Table M5-11), TCE in soil and groundwater contribute 86% of the future office worker risk. Both the oral and inhalation cancer slope factors used in the RI HHRA were 0.40 per mg/kg-day. The current oral and inhalation slope factors are 0.046 per mg/kg-day and 0.014 per mg/kg-day, which are less than the RI HHRA toxicity value by factors of 9 and 29, respectively. Because TCE is of special interest for OU-2C, comparison of the RSL inhalation cancer toxicity value to Cal/EPA-recommended[4] inhalation toxicity also has been provided here:

- 2013 U.S. EPA RSL inhalation slope factor is 0.014 $(mg/kg\text{-}day)^{-1}$, or inhalation unit risk of 4×10^{-6} $(ug/m^3)^{-1}$.
- Current Cal/EPA inhalation slope factor is 0.007 $(mg/kg\text{-}day)^{-1}$, or inhalation unit risk of 2×10^{-6} $(ug/m^3)^{-1}$.

The U.S. EPA cancer inhalation toxicity value is higher than the Cal/EPA toxicity value and is the value used by California Department of Toxic Substances Control (DTSC) in its Johnson & Ettinger screening-level models (version 3.0[5]) to assess vapor intrusion risks.

[4] Cal/EPA-recommended toxicity values obtained from California's Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database accessed January 24, 2014.
[5] Vapor intrusion models from DTSC available at http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm.

Based on the linear nature of calculating cancer risks, cancer slope factors that are lower than the RI HHRA slope factors would produce cancer risks lower than those in the RI HHRA; conversely, cancer slope factors that are higher than those used in the RI HHRA would produce higher cancer risks. For noncancer toxicity where hazard quotients are determined by dividing by the reference dose, the results would be opposite. Lower reference doses would produce higher hazard quotients, while higher reference doses would produce lower hazard quotients. As such, given that the TCE inhalation toxicity values used in the RI HHRA are higher than the current U.S. EPA toxicity values (as shown on Table 1), the inhalation cancer risks presented in the RI HHRA would be higher than cancer risks calculated today.

III. Risk Results

Cancer risks and noncancer health hazards were recalculated for TCE along with all of the other COPCs listed in Table 1 using the same methodology, exposure point concentrations, exposure assumptions, and exposure parameters for the future office worker that were used in the RI HHRA[6] along with most current toxicity values listed in Table 1. Revised exposure route totals for each of these COPCs were calculated. Old exposure route totals for these COPCs were obtained from the RI HHRA along with medium totals and RI totals. Medium totals were recalculated by removing the old exposure route totals and inserting the revised exposure route totals. Revised site-wide totals were then calculated by summing the revised pathway totals.

Attachment A contains the detailed risk and hazard calculations. Table 2 summarizes the results of the recalculations for Exposure Unit 2 and Table 3 summarizes the results of the recalculations for Exposure Unit 3. The results of the 2014 recalculation indicate that the total cancer risk for the future office worker at Exposure Unit 2 remains the same as the 2008 RI (risk = 3×10^{-5}). The noncancer hazard index (HI) for the future office worker at Exposure Unit 2 is slightly higher (HI increases from 1 to 2). For the office worker based on the soil gas results, the cancer risk decreased from 1×10^{-6} to 3×10^{-7}, while the noncancer HI increased to 0.01 from 0.002 (due to the inhalation toxicity change for TCE).

For the the future office worker at Exposure Unit 3, the total cancer risk decreased, while the noncancer HI slightly increased (i.e., risk decreases from 4×10^{-4} to 3×10^{-5}; HI increased from 20 to 24) primarily because of the inhalation toxicity change for TCE.

[6] Refer to Section M2.2 of Appendix M from the 2008 RI (Bechtel, 2008).

Table 1. Chemicals of Potential Concern and Comparison of Toxicity Values

CAS Number	Toxicity Value[a]:	Cancer Slope Factor$_{oral}$ (mg/kg-day)$^{-1}$			Cancer Slope Factor$_{inh}$ (mg/kg-day)$^{-1}$			Reference Dose$_{oral}$ (mg/kg-day)		Reference Dose$_{inh}$ (mg/kg-day)	
	Source of Value:	RI Report 2008		Regional Screening Levels November 2013	RI Report 2008		Regional Screening Levels November 2013	RI Report 2008	Regional Screening Levels November 2013	RI Report 2008	Regional Screening Levels November 2013
	Chemical	USEPA	Cal/EPA[b]	RSL	USEPA	Cal/EPA[b]	RSL	USEPA and Cal/EPA[b]	RSL	USEPA and Cal/EPA[b]	RSL
100-41-4	Ethylbenzene	—	1.1E-02	1.1E-02	—	8.7E-03	8.8E-03	1.0E-01	1.0E-01	2.9E-01	2.9E-01
103-65-1	Propylbenzene	—	—	—	—	—	—	4.0E-02	1.0E-01	4.0E-02	2.9E-01
107-06-2	Dichloroethane, 1,2-	9.1E-02	4.7E-02	9.1E-02	9.1E-02	7.2E-02	9.1E-02	2.0E-02	6.0E-03	1.4E-03	2.0E-03
123-91-1	Dioxane, 1,4-	1.1E-02	2.7E-02	1.0E-01	1.1E-02	2.7E-02	1.8E-02	—	3.0E-02	—	8.6E-03
127-18-4	Tetrachloroethene	5.4E-01	5.4E-01	2.1E-03	2.1E-02	2.1E-02	9.1E-04	1.0E-02	6.0E-03	1.0E-02	1.1E-02
56-23-5	Carbon Tetrachloride	1.3E-01	1.5E-01	7.0E-02	5.3E-02	1.5E-01	2.1E-02	7.0E-04	4.0E-03	7.0E-04	2.9E-02
591-78-6	Hexanone, 2-	—	—	—	—	—	—	1.1E+01	5.0E-03	5.7E-02	8.6E-03
67-66-3	Chloroform	—	3.1E-02	3.1E-02	8.1E-02	1.9E-02	8.1E-02	1.0E-02	1.0E-02	1.4E-02	2.8E-02
75-09-2	Methylene Chloride	7.5E-03	1.4E-02	2.0E-03	1.6E-03	3.5E-03	3.5E-05	6.0E-02	6.0E-03	6.0E-02	1.7E-01
75-34-3	Dichloroethane, 1,1-	—	5.7E-03	5.7E-03	—	5.7E-03	5.6E-03	1.0E-01	2.0E-01	1.4E-01	—
79-01-6	Trichloroethene	4.0E-01	1.3E-02	4.6E-02	4.0E-01	7.0E-03	1.4E-02	3.0E-04	5.0E-04	2.0E-02	5.7E-04
91-20-3	Naphthalene	—	1.2E-01	—	—	1.2E-01	1.2E-01	2.0E-02	2.0E-02	8.6E-04	8.6E-04

Notes: Red text indicates U.S. EPA toxicity values used in the RI HHRA differ from the current toxicity value provided in the November 2013 RSL table.
A dash indicates that a toxicity value was not available.

(a) Inhalation toxicity values are provided as inhalation slope factors (mg/kg-day)$^{-1}$ and reference doses (mg/kg-day), rather than inhalation unit risks (ug/m^3)$^{-1}$ and reference concentrations (mg/m^3), to be consistent with the RI HHRA inhalation toxicity values.

(b) The toxicity comparison focused strictly on U.S. EPA values. Cal/EPA toxicity values are provided in the text for additional information, but were not included in the comparison.

Table 2. Summary of Revised Cancer Risks and Noncancer Hazards for the Future Office Worker for Exposure Unit 2

Medium	2008 RI[(a)]		2014 Recalculation[(b)]	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index[(c)]
Soil	9.0E-06	0.44	8.0E-06	0.46
Groundwater	2.0E-05	0.66	1.9E-05	1.8
Total (soil+groundwater)	2.9E-05	1.1	2.7E-05	2.3
Soil Gas	1.0E-06	0.002	3.0E-07	0.014

(a) Based on U.S. EPA toxicity values evaluated in the RI (2008).
(b) Based on November 2013 U.S. EPA RSL toxicity values.
(c) The hazard index for the 2014 recalculation is higher than the 2008 RI value due primarily to the change in the noncancer inhalation toxicity for TCE. Refer to Table A-2 in Attachment A for details.

Notes:
Scientific notation such as 1.E-03 is equivalent to 1×10^{-3}.
U.S. EPA guidance states that risk results are to be provided as one significant figure, but additional values provided in this table so that the reader can see the small differences between numbers. Detailed calculations are provided in Attachment 1.

Table 3. Summary of Revised Cancer Risks and Noncancer Hazards for the Future Office Worker for Exposure Unit 3

Medium	2008 RI[(a)]		2014 Recalculation[(b)]	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Soil	3.3E-04	19.8[(c)]	2.1E-05	23.1[(d)]
Groundwater	5.0E-05	0.21	3.3E-06	0.69
Total (soil+groundwater)	3.8E-04	20	2.5E-05	23.8

(a) Based on U.S. EPA toxicity values evaluated in the RI (2008).
(b) Based on November 2013 U.S. EPA RSL toxicity values.
(c) Excess hazard index across soil is primarily associated with ingestion and dermal contact with organic lead in soil (HQ=6 and HQ=4, respectively) and inhalation of 1,2,4-trimethylbenzene in soil that volatilizes indoors (HQ=7).
(d) The hazard index for the 2014 recalculation is higher than the 2008 RI value due primarily to the change in the noncancer inhalation toxicity for TCE. Refer to Table A-4 in Attachment A for details.

Notes:
Scientific notation such as 1.E-03 is equivalent to 1×10^{-3}.
U.S. EPA guidance states that risk results are to be provided as one significant figure, but additional values provided in this table so that the reader can see the small differences between numbers. Detailed calculations are provided in Attachment 1.

Attachment A

Detailed Calculations

Table A-1. Summary of Revised Cancer Risks for EU-2

Exposure Unit 2	Medium	EPC for benzene											Intake	Intake - EPC
					Exposure Paramters									
Office Worker	soil	ing	2.40E-03	100	0.000001	250	25	70	25550				8E-10	3E-07
Adult		derm	2.40E-03		0.000001	3300	0.2	0.1	250	25	70	25550	6E-10	2E-07
Risk		inh ind	3.82E-06	0.83	8	250	25	70	25550				9.E-08	2E-02
		inh out	8.78E-07	0.83	8	250	25	70	25550				2.E-08	2E-02
		inh sg	9.30E-07	0.83	8	250	25	70	25550				2.E-08	2E-02
	gw	inh ind	2.94E-05	0.83	8	250	25	70	25550				7.E-07	2E-02
		inh out	6.55E-06	0.83	8	250	25	70	25550				2.E-07	2E-02

			EPC			CANCER INTAKE					2013 Tox Values		Cancer Risk						These risk values obtained from the 2008 RI, Appendix M				
Exposure Medium	CAS Number	Chemical	Direct Contact	Indoor Vapor	Outdoor Vapor	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation soil gas	CSFo (mg/kg-day)$^{-1}$	CSFi (mg/kg-day)$^{-1}$	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation of Soil Gas	Revised Exposure Route Total	Exposure Route Total from RI (a)	RI Total Across Medium	Site Wide: All media, all COPCs	Revised Pathway (b)	Revised Site Wide (c)
Soil	56-23-5	Carbon Tetrachloride	ND	ND	ND	3E-07	2E-07	2E-02	2E-02	2E-02	7.0E-02	2.10E-02	ND	ND	ND	ND	NA	0.00E+00	0.00E+00		2.90E-05		2.65E-05
	67-66-3	Chloroform	ND	ND	ND	3E-07	2E-07	2E-02	2E-02	2E-02	3.1E-02	8.05E-02	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	75-34-3	Dichloroethane, 1,1-	3.09E-03	9.87E-06	1.28E-06	3E-07	2E-07	2E-02	2E-02	2E-02	5.7E-03	5.60E-03	6.15E-12	4.06E-12	1.28E-09	1.66E-10	NA	1.46E-09	0.00E+00				
	107-06-2	Dichloroethane, 1,2-	ND	ND	ND	3E-07	2E-07	2E-02	2E-02	2E-02	9.1E-02	9.10E-02	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	123-91-1	Dioxane, 1,4-	3.10E-02	7.25E-07	7.87E-07	3E-07	2E-07	2E-02	2E-02	2E-02	1.0E-01	1.75E-02	1.08E-09	7.15E-10	2.94E-10	3.20E-10	NA	2.41E-09	6.00E-10				
	100-41-4	Ethylbenzene	9.69E-03	3.34E-05	1.80E-06	3E-07	2E-07	2E-02	2E-02	2E-02	1.1E-02	8.75E-03	3.72E-11	2.46E-11	6.78E-09	3.65E-10	NA	7.21E-09	0.00E+00				
	591-78-6	Hexanone, 2-	1.01E-02	5.89E-05	7.28E-06	3E-07	2E-07	2E-02	2E-02	2E-02	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	75-09-2	Methylene Chloride	2.63E-02	9.55E-05	1.05E-05	3E-07	2E-07	2E-02	2E-02	2E-02	2.0E-03	3.50E-05	1.84E-11	1.21E-11	7.76E-11	8.53E-12	NA	1.17E-10	0.00E+00				
	91-20-3	Naphthalene	8.60E-03	3.94E-07	1.99E-07	3E-07	2E-07	2E-02	2E-02	2E-02	na	1.19E-01	ND	ND	1.09E-09	5.49E-10	NA	1.64E-09	0.00E+00				
	103-65-1	Propyl benzene	2.74E-03	1.56E-05	2.42E-07	3E-07	2E-07	2E-02	2E-02	2E-02	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	127-18-4	Tetrachloroethylene	4.59E-03	2.07E-04	1.80E-06	3E-07	2E-07	2E-02	2E-02	2E-02	2.1E-03	9.10E-04	3.37E-12	2.22E-12	4.37E-09	3.80E-11	NA	4.41E-09	1.00E-07				
	79-01-6	Trichloroethylene	4.69E-03	1.42E-04	1.44E-06	3E-07	2E-07	2E-02	2E-02	2E-02	4.6E-02	1.44E-02	7.54E-11	4.98E-11	4.73E-08	4.79E-10	NA	4.79E-08	1.00E-06				
																	Total	6.51E-08	1.10E-06	9.00E-06		7.96E-06	
groundwater	56-23-5	Carbon Tetrachloride	NA	2.30E-03	1.20E-04	NA	NA	2E-02	2E-02	NA	7.0E-02	2.10E-02	ND	ND	1.12E-06	5.85E-08	NA	1.18E-06	3.00E-06				
	67-66-3	Chloroform	NA	3.03E-06	1.21E-06	NA	NA	2E-02	2E-02	NA	3.1E-02	8.05E-02	ND	ND	5.66E-09	2.26E-09	NA	7.92E-09	8.00E-09				
	75-34-3	Dichloroethane, 1,1-	NA	3.85E-02	1.62E-03	NA	NA	2E-02	2E-02	NA	5.7E-03	5.60E-03	ND	ND	5.00E-06	2.11E-07	NA	5.21E-06	0.00E+00				
	107-06-2	Dichloroethane, 1,2-	NA	1.66E-04	1.46E-05	NA	NA	2E-02	2E-02	NA	9.1E-02	9.10E-02	ND	ND	3.51E-07	3.08E-08	NA	3.81E-07	4.00E-07				
	123-91-1	Dioxane, 1,4-	NA	1.93E-06	3.14E-07	NA	NA	2E-02	2E-02	NA	1.0E-01	1.75E-02	ND	ND	7.84E-10	1.28E-10	NA	9.11E-10	6.00E-10				
	100-41-4	Ethylbenzene	NA	5.66E-06	2.05E-06	NA	NA	2E-02	2E-02	NA	1.1E-02	8.75E-03	ND	ND	1.15E-09	4.16E-10	NA	1.57E-09	0.00E+00				
	591-78-6	Hexanone, 2-	NA	1.49E-01	2.77E-02	NA	NA	2E-02	2E-02	NA	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	75-09-2	Methylene Chloride	NA	6.13E-06	2.38E-06	NA	NA	2E-02	2E-02	NA	2.0E-03	3.50E-05	ND	ND	4.98E-12	1.93E-12	NA	6.91E-12	3.00E-10				
	91-20-3	Naphthalene	NA	1.50E-06	2.57E-07	NA	NA	2E-02	2E-02	NA	na	1.19E-01	ND	ND	4.14E-09	7.10E-10	NA	4.85E-09	0.00E+00				
	103-65-1	Propyl benzene	NA	5.11E-05	1.56E-07	NA	NA	2E-02	2E-02	NA	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	127-18-4	Tetrachloroethylene	NA	2.41E-05	5.25E-09	NA	NA	2E-02	2E-02	NA	2.1E-03	9.10E-04	ND	ND	5.09E-10	1.11E-13	NA	5.09E-10	1.00E-08				
	79-01-6	Trichloroethylene	NA	5.11E-04	7.97E-05	NA	NA	2E-02	2E-02	NA	4.6E-02	1.44E-02	ND	ND	1.70E-07	2.65E-08	NA	1.97E-07	5.00E-06				
																	Total	6.99E-06	8.42E-06	2.00E-05		1.86E-05	
Soil Gas	56-23-5	Carbon Tetrachloride	NA	ND	NA	NA	NA	2E-02	NA	NA	7.0E-02	2.10E-02	NA	NA	NA	NA	ND	ND	0.00E+00				
	67-66-3	Chloroform	NA	3.65E-06	NA	NA	NA	2E-02	NA	NA	3.1E-02	8.05E-02	NA	NA	NA	NA	6.82E-09	7.E-09	7.00E-09				
	75-34-3	Dichloroethane, 1,1-	NA	1.97E-03	NA	NA	NA	2E-02	NA	NA	5.7E-03	5.60E-03	NA	NA	NA	NA	2.56E-07	3.E-07	3.00E-07				
	107-06-2	Dichloroethane, 1,2-	NA	ND	NA	NA	NA	2E-02	NA	NA	9.1E-02	9.10E-02	NA	NA	NA	NA	ND	ND	0.00E+00				
	123-91-1	Dioxane, 1,4-	NA	5.73E-07	NA	NA	NA	2E-02	NA	NA	1.0E-01	1.75E-02	NA	NA	NA	NA	2.33E-10	2.E-10	1.00E-10				
	100-41-4	Ethylbenzene	NA	1.03E-06	NA	NA	NA	2E-02	NA	NA	1.1E-02	8.75E-03	NA	NA	NA	NA	2.09E-10	2.E-10	2.00E-10				
	591-78-6	Hexanone, 2-	NA	1.56E-06	NA	NA	NA	2E-02	NA	NA	na	na	NA	NA	NA	NA	ND	ND	0.00E+00				
	75-09-2	Methylene Chloride	NA	ND	NA	NA	NA	2E-02	NA	NA	2.0E-03	3.50E-05	NA	NA	NA	NA	ND	ND	0.00E+00				
	91-20-3	Naphthalene	NA	4.40E-07	NA	NA	NA	2E-02	NA	NA	na	1.19E-01	NA	NA	NA	NA	1.21E-09	1.E-09	1.00E-09				
	103-65-1	Propyl benzene	NA	1.34E-07	NA	NA	NA	2E-02	NA	NA	na	na	NA	NA	NA	NA	ND	ND	0.00E+00				
	127-18-4	Tetrachloroethylene	NA	1.57E-05	NA	NA	NA	2E-02	NA	NA	2.1E-03	9.10E-04	NA	NA	NA	NA	3.32E-10	3.E-10	8.00E-09				
	79-01-6	Trichloroethylene	NA	1.25E-04	NA	NA	NA	2E-02	NA	NA	4.6E-02	1.44E-02	NA	NA	NA	NA	4.16E-08	4.E-08	1.00E-06				
																	Total	3.E-07	1.32E-06	1.00E-06			

na- not available
ND - not determined
NA - not applicable

(a) A "0.00E+00" was provided in the RI report when risk/hazards were not calculated for a COPC.
(b) Revised pathway value is calculated as (RI Total Across Medium - Exposure Route) + Revised Exposure Route.
(c) Revised site wide = sum of the soil and groundwater revised pathway values.

Table A-2. Summary of Revised Noncancer Health Hazards for EU-2

Exposure Parameters

Exposure Unit 2	Medium		EPC for benzene										Intake	Intake - EPC
Office Worker	soil	ing	2.40E-03	100	0.000001	250	25	70	9125				2E-09	1E-06
Adult		derm	2.40E-03		0.000001	3300	0.2	0.1	250	25	70	9125	2E-09	6E-07
Noncancer Health Hazard		inh ind	3.82E-06	0.83	8	250	25	70	9125				2.E-07	6E-02
		inh out	8.78E-07	0.83	8	250	25	70	9125				6.E-08	6E-02
		inh sg	9.30E-07	0.83	8	250	25	70	9125				6.E-08	6E-02
	gw	inh ind	2.94E-05	0.83	8	250	25	70	9125				2.E-06	6E-02
		inh out	6.55E-06	0.83	8	250	25	70	9125				4.E-07	6E-02

			EPC			NONCANCER INTAKE					2013 Toxicity Values		NonCancer Hazard						These risk values obtained from the 2008 RI, Appendix M				
Exposure Medium	Cas Number	Chemical	Direct Contact[a]	Indoor Vapor[b]	Outdoor Vapor	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation of Soil Gas	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation of Soil Gas	Exposure Route Total	Exposure Route Total from RI[(a)]	RI Total Across Medium	Site Wide: All media, all COPCs	Revised Pathway[(b)]	Revised Site Wide[(c)]
Soil	56-23-5	Carbon Tetrachloride	NA	ND	ND	1E-06	6E-07	6E-02	6E-02	6E-02	4.0E-03	2.9E-02	ND	ND	ND	ND	NA	ND	0.00E+00		1.10E+00		2.30E+00
	67-66-3	Chloroform	NA	ND	ND	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-02	2.8E-02	ND	ND	ND	ND	NA	ND	0.00E+00				
	75-34-3	Dichloroethane, 1,1-	3.09E-03	9.87E-06	1.28E-06	1E-06	6E-07	6E-02	6E-02	6E-02	2.0E-01	NA	1.51E-08	9.98E-09	ND	ND	NA	2.51E-08	6.00E-06				
	107-06-2	Dichloroethane, 1,2-	NA	ND	ND	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	2.0E-03	ND	ND	ND	ND	NA	ND	0.00E+00				
	123-91-1	Dioxane, 1,4-	3.10E-02	7.25E-07	7.87E-07	1E-06	6E-07	6E-02	6E-02	6E-02	3.0E-02	8.6E-03	1.01E-06	6.67E-07	5.50E-06	5.97E-06	NA	1.31E-05	0.00E+00				
	100-41-4	Ethylbenzene	9.69E-03	3.34E-05	1.80E-06	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-01	2.9E-01	9.48E-08	6.26E-08	7.60E-06	4.09E-07	NA	8.16E-06	9.00E-06				
	591-78-6	Hexanone, 2-	1.01E-02	5.89E-05	7.28E-06	1E-06	6E-07	6E-02	6E-02	6E-02	5.0E-03	8.6E-03	1.98E-06	1.30E-06	4.46E-04	5.52E-05	NA	5.05E-04	8.00E-05				
	75-09-2	Methylene Chloride	2.63E-02	9.55E-05	1.05E-05	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	1.7E-01	4.29E-06	2.83E-06	3.62E-05	3.98E-06	NA	4.73E-05	9.00E-06				
	91-20-3	Naphthalene	8.60E-03	3.94E-07	1.99E-07	1E-06	6E-07	6E-02	6E-02	6E-02	2.0E-02	8.6E-04	4.21E-07	2.78E-07	2.99E-05	1.51E-05	NA	4.56E-05	5.00E-05				
	103-65-1	Propyl benzene	2.74E-03	1.56E-05	2.42E-07	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-01	2.9E-01	2.68E-08	1.77E-08	3.55E-06	5.50E-08	NA	3.65E-06	3.00E-05				
	127-18-4	Tetrachloroethylene	4.59E-03	2.07E-04	1.80E-06	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	1.1E-02	7.49E-07	4.94E-07	1.18E-03	1.02E-05	NA	1.19E-03	1.00E-03				
	79-01-6	Trichloroethylene	4.69E-03	1.42E-04	1.44E-06	1E-06	6E-07	6E-02	6E-02	6E-02	5.0E-04	5.7E-04	9.18E-06	6.06E-06	1.61E-02	1.64E-04	NA	1.63E-02	9.00E-04				
																	Total	1.81E-02	2.08E-03	4.40E-01		4.56E-01	
Groundwater	56-23-5	Carbon Tetrachloride	NA	2.30E-03	1.20E-04	NA	NA	6E-02	6E-02	NA	4.0E-03	2.9E-02	ND	ND	5.23E-03	2.73E-04	NA	5.50E-03	2.00E-01				
	67-66-3	Chloroform	NA	3.03E-06	1.21E-06	NA	NA	6E-02	6E-02	NA	1.0E-02	2.8E-02	ND	ND	7.03E-06	2.81E-06	NA	9.84E-06	2.00E-05				
	75-34-3	Dichloroethane, 1,1-	NA	3.85E-02	1.62E-03	NA	NA	6E-02	6E-02	NA	2.0E-01	NA	ND	ND	ND	ND	NA	ND	2.00E-02				
	107-06-2	Dichloroethane, 1,2-	NA	1.66E-04	1.46E-05	NA	NA	6E-02	6E-02	NA	6.0E-03	2.0E-03	ND	ND	5.39E-03	4.74E-04	NA	5.87E-03	9.00E-03				
	123-91-1	Dioxane, 1,4-	NA	1.93E-06	3.14E-07	NA	NA	6E-02	6E-02	NA	3.0E-02	8.6E-03	ND	ND	1.46E-05	2.38E-06	NA	1.70E-05	0.00E+00				
	100-41-4	Ethylbenzene	NA	5.66E-06	2.05E-06	NA	NA	6E-02	6E-02	NA	1.0E-01	2.9E-01	ND	ND	1.29E-06	4.66E-07	NA	1.75E-06	1.00E-06				
	591-78-6	Hexanone, 2-	NA	1.49E-01	2.77E-02	NA	NA	6E-02	6E-02	NA	5.0E-03	8.6E-03	ND	ND	1.13E+00	2.10E-01	NA	1.34E+00	2.00E-01				
	75-09-2	Methylene Chloride	NA	6.13E-06	2.38E-06	NA	NA	6E-02	6E-02	NA	6.0E-03	1.7E-01	ND	ND	2.32E-06	9.02E-07	NA	3.23E-06	7.00E-07				
	91-20-3	Naphthalene	NA	1.50E-06	2.57E-07	NA	NA	6E-02	6E-02	NA	2.0E-02	8.6E-04	ND	ND	1.14E-04	1.95E-05	NA	1.33E-04	1.00E-04				
	103-65-1	Propyl benzene	NA	5.11E-05	1.56E-07	NA	NA	6E-02	6E-02	NA	1.0E-01	2.9E-01	ND	ND	1.16E-05	3.55E-08	NA	1.17E-05	8.00E-05				
	127-18-4	Tetrachloroethylene	NA	2.41E-05	5.25E-09	NA	NA	6E-02	6E-02	NA	6.0E-03	1.1E-02	ND	ND	1.37E-04	2.98E-08	NA	1.37E-04	2.00E-04				
	79-01-6	Trichloroethylene	NA	5.11E-04	7.97E-05	NA	NA	6E-02	6E-02	NA	5.0E-04	5.7E-04	ND	ND	5.81E-02	9.06E-03	NA	6.72E-02	4.00E-03				
																	Total	1.42E+00	2.33E-01	6.60E-01		1.84E+00	
Soil Gas	56-23-5	Carbon Tetrachloride	NA	ND	NA	NA	NA	6E-02	NA	NA	4.0E-03	2.9E-02	NA	NA	NA	NA	ND	ND					
	67-66-3	Chloroform	NA	3.65E-06	NA	NA	NA	6E-02	NA	NA	1.0E-02	2.8E-02	NA	NA	NA	NA	8.47E-06	8.47E-06	2.00E-05				
	75-34-3	Dichloroethane, 1,1-	NA	1.97E-03	NA	NA	NA	6E-02	NA	NA	2.0E-01	NA	NA	NA	NA	NA	ND	ND	9.00E-04				
	107-06-2	Dichloroethane, 1,2-	NA	ND	NA	NA	NA	6E-02	NA	NA	6.0E-03	2.0E-03	NA	NA	NA	NA	ND	ND	0.00E+00				
	123-91-1	Dioxane, 1,4-	NA	5.73E-07	NA	NA	NA	6E-02	NA	NA	3.0E-02	8.6E-03	NA	NA	NA	NA	4.34E-06	4.34E-06	0.00E+00				
	100-41-4	Ethylbenzene	NA	1.03E-06	NA	NA	NA	6E-02	NA	NA	1.0E-01	2.9E-01	NA	NA	NA	NA	2.34E-07	2.34E-07	2.00E-07				
	591-78-6	Hexanone, 2-	NA	1.56E-06	NA	NA	NA	6E-02	NA	NA	5.0E-03	8.6E-03	NA	NA	NA	NA	1.18E-05	1.18E-05	2.00E-06				
	75-09-2	Methylene Chloride	NA	ND	NA	NA	NA	6E-02	NA	NA	6.0E-03	1.7E-01	NA	NA	NA	NA	ND	ND	0.00E+00				
	91-20-3	Naphthalene	NA	4.40E-07	NA	NA	NA	6E-02	NA	NA	2.0E-02	8.6E-04	NA	NA	NA	NA	3.34E-05	3.34E-05	3.00E-05				
	103-65-1	Propyl benzene	NA	1.34E-07	NA	NA	NA	6E-02	NA	NA	1.0E-01	2.9E-01	NA	NA	NA	NA	3.05E-08	3.05E-08	2.00E-07				
	127-18-4	Tetrachloroethylene	NA	1.57E-05	NA	NA	NA	6E-02	NA	NA	6.0E-03	1.1E-02	NA	NA	NA	NA	8.93E-05	8.93E-05	1.00E-04				
	79-01-6	Trichloroethylene	NA	1.25E-04	NA	NA	NA	6E-02	NA	NA	5.0E-04	5.7E-04	NA	NA	NA	NA	1.42E-02	1.42E-02	8.00E-04				
																	Total	1.44E-02	1.83E-03				

na - not available
ND - not determined
NA - not applicable

(a) A "0.00E+00" was provided in the RI report when risk/hazard were not calculated for a COPC.
(b) Revised pathway value is calculated as (RI Total Across Medium - Exposure Route)+Revised Exposure Route.
(c) Revised site wide = sum of the soil and groundwater revised pathway values.

Table A-3. Summary of Revised Cancer Risks for EU-3

Exposure Unit 3	Medium		EPC for benzene					Exposure Parameters					Intake	Intake - EPC
Office Worker	soil	ing	2.40E-03	100	0.000001	250	25	70	25550				8E-10	3E-07
Adult		derm	2.40E-03		0.000001	3300	0.2	0.1	250	25	70	25550	6E-10	2E-07
Risk		inh ind	3.82E-06	0.83	8	250	25	70	25550				9.E-08	2E-02
		inh out	8.78E-07	0.83	8	250	25	70	25550				2.E-08	2E-02
		inh sg	9.30E-07	0.83	8	250	25	70	25550				2.E-08	2E-02
	gw	inh ind	2.94E-05	0.83	8	250	25	70	25550				7.E-07	2E-02
		inh out	6.55E-06	0.83	8	250	25	70	25550				2.E-07	2E-02

			EPC			CANCER INTAKE					2013 Tox Values		Cancer Risk						These risk values obtained from the 2008 RI, Appendix M				
Exposure Medium	CAS Number	Chemical	Direct Contact	Indoor Vapor	Outdoor Vapor	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation soil gas	CSFo (mg/kg-day)$^{-1}$	CSFi (mg/kg-day)$^{-1}$	Ingestion	Dermal Contact	Inhalation of Indoor Air	Inhalation of Outdoor Air	Inhalation of Soil Gas	Revised Exposure Route Total	Exposure Route Total from RI (a)	RI Total Across Medium	Site Wide: All media, all COPCs	Revised Pathway (b)	Revised Site Wide (c)
Soil	56-23-5	Carbon Tetrachloride	ND	ND	ND	3E-07	2E-07	2E-02	2E-02	2E-02	7.0E-02	2.10E-02	ND	ND	ND	ND	NA	0.00E+00	0.00E+00		3.80E-04		2.47E-05
	67-66-3	Chloroform	2.00E-03	3.18E-06	7.52E-07	3E-07	2E-07	2E-02	2E-02	2E-02	3.1E-02	8.05E-02	2.17E-11	1.43E-11	5.94E-09	1.40E-09	NA	7.38E-09	7.00E-09				
	75-34-3	Dichloroethane, 1,1-	2.34E-01	2.87E-03	9.66E-05	3E-07	2E-07	2E-02	2E-02	2E-02	5.7E-03	5.60E-03	4.66E-10	3.08E-10	3.73E-07	1.26E-08	NA	3.86E-07	0.00E+00				
	107-06-2	Dichloroethane, 1,2-	9.60E-03	1.53E-05	2.45E-06	3E-07	2E-07	2E-02	2E-02	2E-02	9.1E-02	9.10E-02	3.05E-10	2.01E-10	3.23E-08	5.17E-09	NA	3.80E-08	4.00E-08				
	123-91-1	Dioxane, 1,4-	ND	ND	ND	3E-07	2E-07	2E-02	2E-02	2E-02	1.0E-01	1.75E-02	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	100-41-4	Ethylbenzene	1.91E+00	4.30E-02	3.54E-04	3E-07	2E-07	2E-02	2E-02	2E-02	1.1E-02	8.75E-03	7.34E-09	4.85E-09	8.73E-06	7.19E-08	NA	8.81E-06	0.00E+00				
	591-78-6	Hexanone, 2-	2.60E-01	4.14E-04	1.88E-04	3E-07	2E-07	2E-02	2E-02	2E-02	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	75-09-2	Methylene Chloride	2.87E-01	2.71E-03	1.15E-04	3E-07	2E-07	2E-02	2E-02	2E-02	2.0E-03	3.50E-05	2.01E-10	1.32E-10	2.20E-09	9.34E-11	NA	2.63E-09	1.00E-07				
	91-20-3	Naphthalene	2.60E-01	1.61E-04	6.01E-06	3E-07	2E-07	2E-02	2E-02	2E-02	na	1.19E-01	ND	ND	4.45E-07	1.66E-08	NA	4.61E-07	0.00E+00				
	103-65-1	Propyl benzene	4.80E+00	1.23E-01	4.23E-04	3E-07	2E-07	2E-02	2E-02	2E-02	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	127-18-4	Tetrachloroethylene	1.56E+00	5.25E-02	6.10E-04	3E-07	2E-07	2E-02	2E-02	2E-02	2.1E-03	9.10E-04	1.14E-09	7.56E-10	1.11E-06	1.29E-08	NA	1.12E-06	3.00E-05				
	79-01-6	Trichloroethylene	9.19E-01	3.18E-02	2.82E-04	3E-07	2E-07	2E-02	2E-02	2E-02	4.6E-02	1.44E-02	1.48E-08	9.75E-09	1.06E-05	9.39E-08	NA	1.07E-05	3.00E-04				
																	Total	2.15E-05	3.30E-04	3.30E-04		2.14E-05	
groundwater	56-23-5	Carbon Tetrachloride	NA	1.43E-03	3.35E-05	NA	NA	2E-02	2E-02	NA	7.0E-02	2.10E-02	ND	ND	6.97E-07	1.63E-08	NA	7.13E-07	2.00E-06				
	67-66-3	Chloroform	NA	1.29E-04	3.31E-06	NA	NA	2E-02	2E-02	NA	3.1E-02	8.05E-02	ND	ND	2.41E-07	6.18E-09	NA	2.47E-07	2.00E-07				
	75-34-3	Dichloroethane, 1,1-	NA	4.66E-03	1.18E-04	NA	NA	2E-02	2E-02	NA	5.7E-03	5.60E-03	ND	ND	6.06E-07	1.53E-08	NA	6.21E-07	0.00E+00				
	107-06-2	Dichloroethane, 1,2-	NA	1.98E-05	3.11E-06	NA	NA	2E-02	2E-02	NA	9.1E-02	9.10E-02	ND	ND	4.18E-08	6.57E-09	NA	4.84E-08	5.00E-08				
	123-91-1	Dioxane, 1,4-	NA	7.77E-07	1.51E-07	NA	NA	2E-02	2E-02	NA	1.0E-01	1.75E-02	ND	ND	3.16E-10	6.13E-11	NA	3.77E-10	2.00E-10				
	100-41-4	Ethylbenzene	NA	2.57E-04	6.99E-06	NA	NA	2E-02	2E-02	NA	1.1E-02	8.75E-03	ND	ND	5.22E-08	1.42E-09	NA	5.36E-08	0.00E+00				
	591-78-6	Hexanone, 2-	NA	ND	ND	NA	NA	2E-02	2E-02	NA	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	75-09-2	Methylene Chloride	NA	2.29E-05	1.30E-06	NA	NA	2E-02	2E-02	NA	2.0E-03	3.50E-05	ND	ND	1.86E-11	1.06E-12	NA	1.97E-11	1.00E-09				
	91-20-3	Naphthalene	NA	5.17E-05	1.04E-06	NA	NA	2E-02	2E-02	NA	na	1.19E-01	ND	ND	1.43E-07	2.87E-09	NA	1.46E-07	0.00E+00				
	103-65-1	Propyl benzene	NA	1.41E-04	6.30E-06	NA	NA	2E-02	2E-02	NA	na	na	ND	ND	ND	ND	NA	0.00E+00	0.00E+00				
	127-18-4	Tetrachloroethylene	NA	3.73E-04	4.84E-05	NA	NA	2E-02	2E-02	NA	2.1E-03	9.10E-04	ND	ND	7.88E-09	1.02E-09	NA	8.90E-09	2.00E-07				
	79-01-6	Trichloroethylene	NA	4.38E-03	8.79E-05	NA	NA	2E-02	2E-02	NA	4.6E-02	1.44E-02	ND	ND	1.46E-06	2.93E-08	NA	1.49E-06	4.00E-05				
																	Total	3.33E-06	5.00E-05	5.00E-05		3.33E-06	

na- not available
ND - not determined
NA - not applicable

(a) A "0.00E+00" was provided in the RI report when risk/hazards were not calculated for a COPC.
(b) Revised pathway value is calculated as (RI Total Across Medium - Exposure Route) + Revised Exposure Route.
(c) Revised site wide = sum of the soil and groundwater revised pathway values.

Table A-4. Summary of Revised Noncancer Health Hazards for EU-3

							Exposure Parameters								
Exposure Unit 3	**Medium**		**EPC for benzene**											Intake	Intake - EPC
Office Worker	soil	ing	2.40E-03	100	0.000001	250	25	70	9125					2E-09	1E-06
Adult		derm	2.40E-03		0.000001	3300	0.2	0.1	250	25	70	9125		2E-09	6E-07
Noncancer Health Hazard		inh ind	3.82E-06	0.83	8	250	25	70	9125					2.E-07	6E-02
		inh out	8.78E-07	0.83	8	250	25	70	9125					6.E-08	6E-02
		inh sg	9.30E-07	0.83	8	250	25	70	9125					6.E-08	6E-02
	gw	inh ind	2.94E-05	0.83	8	250	25	70	9125					2.E-06	6E-02
		inh out	6.55E-06	0.83	8	250	25	70	9125					4.E-07	6E-02

			EPC			NONCANCER INTAKE					2013 Toxicity Values		NonCancer Hazard						These risk values obtained from the 2008 RI, Appendix M				
Exposure Medium	**Cas Number**	**Chemical**	**Direct Contact[a]**	**Indoor Vapor[b]**	**Outdoor Vapor**	**Ingestion**	**Dermal Contact**	**Inhalation of Indoor Air**	**Inhalation of Outdoor Air**	**Inhalation of Soil Gas**	**RfDo (mg/kg-day)**	**RfDi (mg/kg-day)**	**Ingestion**	**Dermal Contact**	**Inhalation of Indoor Air**	**Inhalation of Outdoor Air**	**Inhalation of Soil Gas**	**Exposure Route Total**	**Exposure Route Total from RI[(a)]**	**RI Total Across Medium**	**Site Wide: All media, all COPCs**	**Revised Pathway[(b)]**	**Revised Site Wide[(c)]**
Soil	56-23-5	Carbon Tetrachloride	ND	ND	ND	1E-06	6E-07	6E-02	6E-02	6E-02	4.0E-03	2.9E-02	ND	ND	ND	ND	NA	ND	0.00E+00		2.00E+01		2.38E+01
	67-66-3	Chloroform	2.00E-03	3.18E-06	7.52E-07	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-02	2.8E-02	1.96E-07	1.29E-07	7.38E-06	1.74E-06	NA	9.45E-06	1.00E-05				
	75-34-3	Dichloroethane, 1,1-	2.34E-01	2.87E-03	9.66E-05	1E-06	6E-07	6E-02	6E-02	6E-02	2.0E-01	NA	1.14E-06	7.56E-07	ND	ND	NA	1.90E-06	1.00E-03				
	107-06-2	Dichloroethane, 1,2-	9.60E-03	1.53E-05	2.45E-06	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	2.0E-03	1.57E-06	1.03E-06	4.97E-04	7.96E-05	NA	5.79E-04	8.00E-04				
	123-91-1	Dioxane, 1,4-	ND	ND	ND	1E-06	6E-07	6E-02	6E-02	6E-02	3.0E-02	8.6E-03	ND	ND	ND	ND	NA	ND	0.00E+00				
	100-41-4	Ethylbenzene	1.91E+00	4.30E-02	3.54E-04	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-01	2.9E-01	1.87E-05	1.23E-05	9.78E-03	8.05E-05	NA	9.89E-03	1.00E-02				
	591-78-6	Hexanone, 2-	2.60E-01	4.14E-04	1.88E-04	1E-06	6E-07	6E-02	6E-02	6E-02	5.0E-03	8.6E-03	5.09E-05	3.36E-05	3.14E-03	1.43E-03	NA	4.65E-03	7.00E-04				
	75-09-2	Methylene Chloride	2.87E-01	2.71E-03	1.15E-04	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	1.7E-01	4.68E-05	3.09E-05	1.03E-03	4.36E-05	NA	1.15E-03	2.00E-04				
	91-20-3	Naphthalene	2.60E-01	1.61E-04	6.01E-06	1E-06	6E-07	6E-02	6E-02	6E-02	2.0E-02	8.6E-04	1.27E-05	8.40E-06	1.22E-02	4.56E-04	NA	1.27E-02	1.00E-02				
	103-65-1	Propyl benzene	4.80E+00	1.23E-01	4.23E-04	1E-06	6E-07	6E-02	6E-02	6E-02	1.0E-01	2.9E-01	4.70E-05	3.10E-05	2.80E-02	9.62E-05	NA	2.81E-02	2.00E-01				
	127-18-4	Tetrachloroethylene	1.56E+00	5.25E-02	6.10E-04	1E-06	6E-07	6E-02	6E-02	6E-02	6.0E-03	1.1E-02	2.54E-04	1.68E-04	2.98E-01	3.47E-03	NA	3.02E-01	3.00E-01				
	79-01-6	Trichloroethylene	9.19E-01	3.18E-02	2.82E-04	1E-06	6E-07	6E-02	6E-02	6E-02	5.0E-04	5.7E-04	1.80E-03	1.19E-03	3.62E+00	3.21E-02	NA	3.65E+00	2.00E-01				
																	Total	4.01E+00	7.23E-01	1.98E+01		2.31E+01	
Groundwater	56-23-5	Carbon Tetrachloride	NA	1.43E-03	3.35E-05	NA	NA	6E-02	6E-02	NA	4.0E-03	2.9E-02	ND	ND	3.25E-03	7.62E-05	NA	3.33E-03	1.00E-01				
	67-66-3	Chloroform	NA	1.29E-04	3.31E-06	NA	NA	6E-02	6E-02	NA	1.0E-02	2.8E-02	ND	ND	2.99E-04	7.68E-06	NA	3.07E-04	6.00E-04				
	75-34-3	Dichloroethane, 1,1-	NA	4.66E-03	1.18E-04	NA	NA	6E-02	6E-02	NA	2.0E-01	NA	ND	ND	ND	ND	NA	ND	2.00E-03				
	107-06-2	Dichloroethane, 1,2-	NA	1.98E-05	3.11E-06	NA	NA	6E-02	6E-02	NA	6.0E-03	2.0E-03	ND	ND	6.43E-04	1.01E-04	NA	7.44E-04	1.00E-03				
	123-91-1	Dioxane, 1,4-	NA	7.77E-07	1.51E-07	NA	NA	6E-02	6E-02	NA	3.0E-02	8.6E-03	ND	ND	5.89E-06	1.14E-06	NA	7.03E-06	0.00E+00				
	100-41-4	Ethylbenzene	NA	2.57E-04	6.99E-06	NA	NA	6E-02	6E-02	NA	1.0E-01	2.9E-01	ND	ND	5.84E-05	1.59E-06	NA	6.00E-05	6.00E-05				
	591-78-6	Hexanone, 2-	NA	ND	ND	NA	NA	6E-02	6E-02	NA	5.0E-03	8.6E-03	ND	ND	ND	ND	NA	ND	0.00E+00				
	75-09-2	Methylene Chloride	NA	2.29E-05	1.30E-06	NA	NA	6E-02	6E-02	NA	6.0E-03	1.7E-01	ND	ND	8.68E-06	4.93E-07	NA	9.17E-06	2.00E-06				
	91-20-3	Naphthalene	NA	5.17E-05	1.04E-06	NA	NA	6E-02	6E-02	NA	2.0E-02	8.6E-04	ND	ND	3.92E-03	7.88E-05	NA	4.00E-03	4.00E-03				
	103-65-1	Propyl benzene	NA	1.41E-04	6.30E-06	NA	NA	6E-02	6E-02	NA	1.0E-01	2.9E-01	ND	ND	3.21E-05	1.43E-06	NA	3.35E-05	2.00E-04				
	127-18-4	Tetrachloroethylene	NA	3.73E-04	4.84E-05	NA	NA	6E-02	6E-02	NA	6.0E-03	1.1E-02	ND	ND	2.12E-03	2.75E-04	NA	2.40E-03	2.00E-03				
	79-01-6	Trichloroethylene	NA	4.38E-03	8.79E-05	NA	NA	6E-02	6E-02	NA	5.0E-04	5.7E-04	ND	ND	4.98E-01	9.99E-03	NA	5.08E-01	3.00E-02				
																	Total	5.19E-01	3.93E-02	2.09E-01		6.89E-01	

na - not available
ND - not determined
NA - not applicable

(a) A "0.00E+00" was provided in the RI report when risk/hazard were not calculated for a COPC.
(b) Revised pathway value is calculated as (RI Total Across Medium - Exposure Route)+Revised Exposure Route
(c) Revised site wide = sum of the soil and groundwater revised pathway values.

Table M2-6
Toxicity Values[a]

CAS Number	Chemical	Soil	GW	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
Volatile Organic Compounds																
83-32-9	acenaphthene	x	x	NA	—		—		—		—		6.00E-02	I	6.00E-02	R
208-96-8	acenaphthylene	x	x	D	—		—		—		—		6.00E-02	S	6.00E-02	S
67-64-1	acetone	x	x	NP	—		—		—		—		9.00E-01	I	9.00E-01	R
120-12-7	anthracene	x	x	D	—		—		—		—		3.00E-01	I	3.00E-01	R
71-43-2	benzene	x	x	A	5.50E-02	I	2.73E-02	I	1.00E-01	C	1.00E-01	C	4.00E-03	I	8.57E-03	I
191-24-2	benzo(g,h,i)perylene	x		D	—		—		—		—		3.00E-02	S	3.00E-02	S
111-44-4	bis(2-chloroethyl)ether	x	x	B2	1.10E+00	I	1.10E+00	I	2.50E+00	C	2.50E+00	C	4.00E-02	S	4.00E-02	S
108-60-1	bis(2-chloroisopropyl)ether		x	NA	7.00E-02	X	3.50E-02	X	7.00E-02	X	3.50E-02	X	4.00E-02	I	4.00E-02	R
74-97-5	bromochloromethane	x		D	—		—		—		—		1.40E-03	S	1.40E-03	S
75-27-4	bromodichloromethane		x	B2	6.20E-02	I	6.20E-02	R	1.30E-01	C	1.30E-01	C	2.00E-02	I	2.00E-02	R
74-83-9	bromomethane	x		D	—		—		—		—		1.40E-03	I	1.40E-03	I
78-93-3	2-butanone	x	x	NP	—		—		—		—		6.00E-01	I	1.43E+00	I
104-51-8	n-butylbenzene	x	x	Not in IRIS	—		—		—		—		4.00E-02	N	4.00E-02	R
135-98-8	sec-butylbenzene	x	x	Not in IRIS	—		—		—		—		4.00E-02	N	4.00E-02	R
98-06-6	tert-butylbenzene	x	x	Not in IRIS	—		—		—		—		4.00E-02	N	4.00E-02	R
75-15-0	carbon disulfide	x	x	NA	—		—		—		—		1.00E-01	I	2.00E-01	I
56-23-5	carbon tetrachloroethene		x	B2	1.30E-01	I	5.25E-02	I	1.50E-01	C	1.50E-01	C	7.00E-04	I	7.00E-04	R
108-90-7	chlorobenzene	x	x	D	—		—		—		—		2.00E-02	I	1.70E-02	N
75-00-3	chloroethane	x	x	NA	2.90E-03	N	2.90E-03	R	2.90E-03	N	2.90E-03	R	4.00E-01	N	2.86E+00	I
67-66-3	chloroform	x	x	B2	—		8.05E-02	I	3.10E-02	C	1.90E-02	C	1.00E-02	I	1.40E-02	N
74-87-3	chloromethane	x	x	D	—		—		—		—		2.57E-02		2.57E-02	I
95-57-8	2-chlorophenol	x		NA	—		—		—		—		5.00E-03	I	5.00E-03	R
110-82-7	cyclohexane			NP	—		—		—		—		1.70E+00	R	1.70E+00	I
132-64-9	dibenzofuran	x		D	—		—		—		—		2.00E-03	N	2.00E-03	R
95-50-1	1,2-dichlorobenzene	x	x	D	—		—		—		—		9.00E-02	I	5.70E-02	H
541-73-1	1,3-dichlorobenzene	x	x	D	—		—		—		—		3.00E-02	N	3.00E-02	R
106-46-7	1,4-dichlorobenzene	x	x	NA	2.40E-02	H	2.20E-02	N	5.40E-03	C	4.00E-02	C	3.00E-02	N	2.29E-01	I
75-71-8	dichlorodifluoromethane			NA	—		—		—		—		2.00E-01	I	5.70E-02	H
75-34-3	1,1-dichloroethane	x	x	C	—		—		5.70E-03	C	5.70E-03	C	1.00E-01	H	1.40E-01	H
107-06-2	1,2-dichloroethane	x	x	B2	9.10E-02	I	9.10E-02	I	4.70E-02	C	7.20E-02	C	2.00E-02	N	1.40E-03	N
75-35-4	1,1-dichloroethene	x	x	C	—		—		—		—		5.00E-02	I	5.71E-02	I
540-59-0	1,2-dichloroethene	x		Not in IRIS	—		—		—		—		1.00E-02	S	1.00E-02	S
156-59-2	cis-1,2-dichloroethene	x	x	D	—		—		—		—		1.00E-02	P	1.00E-02	R
156-60-5	trans-1,2-dichloroethene	x	x	NA	—		—		—		—		2.00E-02	I	2.00E-02	R

Table M2-6
Toxicity Values[a]

CAS Number	Chemical	Soil	GW	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
78-87-5	1,2-dichloropropane	x	x	NA	6.80E-02	H	6.80E-02	R	3.60E-02	C	3.60E-02	C	1.14E-03	R	1.14E-03	R
123-91-1	1,4-dioxane	x	x	B2	1.10E-02	I	1.10E-02	R	2.70E-02	C	2.70E-02	C	—		—	
64-17-5	ethanol			Not in IRIS	—		—		—		—		5.00E-01	S	5.00E-01	S
100-41-4	ethylbenzene	x	x	D	—		—		1.10E-02	C	8.70E-03	C	1.00E-01	I	2.86E-01	I
622-96-8	p-ethyltoluene			Not in IRIS	—		—		—		—		8.00E-02	S	1.43E+00	S
86-73-7	fluorene	x	x	D	—		—		—		—		4.00E-02	I	4.00E-02	R
142-82-5	n-heptane			D	—		—		—		—		1.10E+01	S	2.00E-01	S
110-54-3	n-hexane			NP	—		—		—		—		1.10E+01	P	2.00E-01	I
591-78-6	2-hexanone	x	x	Not in IRIS	—		—		—		—		1.10E+01	S	5.71E-02	S
98-82-8	isopropylbenzene	x	x	D	—		—		—		—		1.00E-01	I	1.14E-01	I
99-87-6	p-isopropyltoluene	x	x	D	—		—		—		—		1.00E-01	S	1.14E-01	S
1634-04-4	methyl tert-butyl ether	x	x	NA	1.80E-03	C	9.10E-04	C	1.80E-03	C	9.10E-04	C	8.57E-01	R	8.57E-01	I
75-09-2	methylene chloride	x	x	B2	7.50E-03	I	1.65E-03	I	1.40E-02	C	3.50E-03	C	6.00E-02	I	8.60E-01	H
91-57-6	2-methylnaphthalene	x	x	NP	—		—		—		—		4.00E-03	I	8.57E-04	S
108-10-1	4-methyl-2-pentanone	x	x	NP	—		—		—		—		8.00E-02	H	8.60E-01	I
91-20-3	naphthalene	x	x	C	—		—		1.20E-01	C	1.20E-01	C	2.00E-02	I	8.57E-04	I
85-01-8	phenanthrene	x	x	D	—		—		—		—		3.00E-01	S	3.00E-01	S
103-65-1	n-propylbenzene	x	x	Not in IRIS	—		—		—		—		4.00E-02	N	4.00E-02	R
129-00-0	pyrene	x	x	D	—		—		—		—		3.00E-02	I	3.00E-02	R
127-18-4	tetrachloroethene	x	x	NA	5.40E-01	C	2.10E-02	C	5.40E-01	C	2.10E-02	C	1.00E-02	I	1.00E-02	C
108-88-3	toluene	x	x	D	—		—		—		—		8.00E-02	I	1.43E+00	I
87-61-6	1,2,3-trichlorobenzene	x	x	Not in IRIS	—		—		—		—		1.00E-02	S	1.00E-03	S
120-82-1	1,2,4-trichlorobenzene	x		D	—		—		—		—		1.00E-02	I	1.00E-03	P
71-55-6	1,1,1-trichloroethane	x	x	D	—		—		—		—		2.80E-01	N	6.30E-01	N
79-00-5	1,1,2-trichloroethane		x	C	5.70E-02	I	5.60E-02	I	7.20E-02	C	5.70E-02	C	4.00E-03	I	4.00E-03	R
79-01-6	trichloroethene	x	x	NA	4.00E-01	N	4.00E-01	N	1.30E-02	C	7.00E-03	C	3.00E-04	N	1.00E-02	N
76-13-1	1,1,2-trichloro-1,2,2-trifluoroethane			NA	—		—		—		—		3.00E+01	I	8.60E+00	H
95-63-6	1,2,4-trimethylbenzene	x	x	Not in IRIS	—		—		—		—		5.00E-02	P	1.70E-03	P
108-67-8	1,3,5-trimethylbenzene	x	x	Not in IRIS	—		—		—		—		5.00E-02	P	1.70E-03	P
540-84-1	2,2,4-trimethylpentane	x		NP	—		—		—		—		1.10E+01	S	2.00E-01	S
75-01-4a	vinyl chloride	x	x	A	7.20E-01	I	1.60E-02	I	2.70E-01	C	2.70E-01	C	3.00E-03	I	2.90E-02	I
75-01-4c	vinyl chloride	x	x	A	1.50E+00	I	3.10E-02	I	2.70E-01	C	2.70E-01	C	3.00E-03	I	2.90E-02	I
7816-60-0	m,p-xylene	x	x	Not in IRIS	—		—		—		—		2.00E-01	S	2.86E-02	S
95-47-6	o-xylene	x	x	Not in IRIS	—		—		—		—		2.00E-01	S	2.86E-02	S
1330-20-7	xylenes, total	x	x	NP	—		—		—		—		2.00E-01	I	2.86E-02	I

Table M2-6
Toxicity Values[a]

CAS Number	Chemical	Soil	GW	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
Semivolatile Organic Compounds																
56-55-3	benz(a)anthracene	x	x	B2	7.30E-01	N	7.30E-01	R	1.20E+00	C	3.90E-01	C	3.00E-01	S	3.00E-01	S
205-99-2	benzo(b)fluoranthene	x	x	B2	7.30E-01	N	7.30E-01	R	1.20E+00	C	3.90E-01	C	4.00E-02	S	4.00E-02	S
207-08-9	benzo(k)fluoranthene	x	x	B2	7.30E-02	N	7.30E-02	R	1.20E+00	C	3.90E-01	C	4.00E-02	S	4.00E-02	S
50-32-8	benzo(a)pyrene	x	x	B2	7.30E+00	I	7.30E+00	R	1.20E+01	C	3.90E+00	C	3.00E-02	S	3.00E-02	S
65-85-0	benzoic acid	x		D	—		—		—		—		4.00E+00	I	4.00E+00	R
117-81-7	bis(2-ethylhexyl)phthalate	x		B2	1.40E-02	I	1.40E-02	R	3.00E-03	C	8.40E-03	C	2.00E-02	I	2.00E-02	R
85-68-7	butyl benzyl phthalate	x		C	—		—		—		—		2.00E-01	I	2.00E-01	R
86-74-8	carbazole	x		Not in IRIS	2.00E-02	H	2.00E-02	R	2.00E-02	H	2.00E-02	R	2.50E-02	S	2.50E-02	S
59-50-7	4-chloro-3-methylphenol	x		Not in IRIS	—		—		—		—		5.00E-02	S	5.00E-02	S
218-01-9	chrysene	x	x	B2	7.30E-03	N	7.30E-03	R	1.20E-01	C	3.90E-02	C	3.00E-01	S	3.00E-01	S
53-70-3	dibenz(a,h)anthracene	x		B2	7.30E+00	N	7.30E+00	R	4.10E+00	C	4.10E+00	C	3.00E-01	S	3.00E-01	S
84-74-2	di-n-butyl phthalate	x		D	—		—		—		—		1.00E-01	I	1.00E-01	R
84-66-2	diethyl phthalate	x		D	—		—		—		—		8.00E-01	I	8.00E-01	R
131-11-3	dimethyl phthalate	x		D	—		—		—		—		1.00E+01	H	1.00E+01	R
117-84-0	di-n-octyl phthalate	x		D	—		—		—		—		4.00E-02	P	4.00E-02	R
206-44-0	fluoranthene	x	x	D	—		—		—		—		4.00E-02	I	4.00E-02	R
87-68-3	hexachlorobutadiene	x		C	7.80E-02	I	7.70E-02	I	7.80E-02	I	7.70E-02	I	3.00E-04	N	3.00E-04	R
193-39-5	indeno(1,2,3-cd)pyrene	x		B2	7.30E-01	N	7.30E-01	R	1.20E+00	C	3.90E-01	C	4.00E-02	S	4.00E-02	S
100-02-7	4-nitrophenol	x		NA	—		—		—		—		2.00E-03	S	2.00E-02	s
621-64-7	N-nitroso-di-n-propylamine	x		B2	7.00E+00	I	7.00E+00	R	7.00E+00	C	7.00E+00	C	2.50E-02	S	2.50E-02	S
87-86-5	pentachlorophenol	x		B2	1.20E-01	I	1.20E-01	R	8.10E-02	C	1.80E-02	C	3.00E-02	I	3.00E-02	R
108-95-2	phenol	x		D	—		—		—		—		3.00E-01	I	3.00E-01	R
Pesticides/Polychlorinated Biphenyls																
309-00-2	aldrin	x		B2	1.70E+01	I	1.70E+01	I	1.70E+01	C	1.70E+01	C	3.00E-05	I	3.00E-05	R
11096-82-5	Aroclor-1260	x		B2	2.00E+00	I	2.00E+00	I	5.00E+00	C	2.00E+00	C	2.00E-05	I	2.00E-05	R
319-85-7	beta-BHC	x		C	1.80E+00	I	1.80E+00	I	1.50E+00	C	1.50E+00	C	2.00E-04	N	2.00E-04	R
319-86-8	delta-BHC	x		D	1.30E+00	S	1.30E+00	S	1.10E+00	S	1.10E+00	S	3.00E-04	S	3.00E-04	S
5103-71-9	alpha-chlordane	x		Not in IRIS	3.50E-01	S	3.50E-01	S	1.30E+00	S	1.20E+00	S	5.00E-04	S	2.00E-04	S
5566-34-7	gamma-chlordane	x	x	Not in IRIS	3.50E-01	S	3.50E-01	S	1.30E+00	S	1.20E+00	S	5.00E-04	S	2.00E-04	S
50-29-3	4,4'-DDT	x		B2	3.40E-01	I	3.40E-01	I	3.40E-01	C	3.40E-01	C	5.00E-04	I	5.00E-04	R
7421-93-4	endrin aldehyde	x		Not in IRIS	—		—		—		—		3.00E-04	S	3.00E-04	S
76-44-8	heptachlor	x		B2	4.50E+00	I	4.60E+00	I	4.10E+00	C	4.10E+00	C	5.00E-04	I	5.00E-04	R

Table M2-6
Toxicity Values[a]

CAS Number	Chemical	Soil	GW	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$		U.S. EPA CSFi (mg/kg-day)$^{-1}$		Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
Metals																
7429-90-5	aluminum	x	x	Not in IRIS	—		—		—		—		1.00E+00	P	1.40E-03	P
7440-36-0	antimony	x	x	NA	—		—		—		—		4.00E-04	I	—	
7440-38-2	arsenic	x	x	A	1.50E+00	I	1.51E+01	I	9.45E+00	C	1.20E+01	C	3.00E-04	I	—	
7440-39-3	barium	x	x	D	—		—		—		—		2.00E-01	I	1.40E-04	H
7440-41-7	beryllium	x	x	B1	—		8.40E+00	I	—		8.40E+00	C	2.00E-03	I	5.71E-06	I
7440-43-9	cadmium	x	x	B1	—		6.30E+00	I	3.80E-01	C	1.50E+01	C	5.00E-04	I	—	
7440-47-3	chromium	x	x	A	—		4.20E+01	I	—		7.40E+01	C	3.00E-03	S	2.29E-06	S
18540-29-9	chromium, hexavalent	x	x	A	—		2.90E+02	I	—		5.10E+02	C	3.00E-03	I	2.29E-06	I
7440-48-4	cobalt	x	x	Not in IRIS	—		9.80E+00	P	—		9.80E+00	P	2.00E-02	P	5.70E-06	P
7440-50-8	copper	x	x	D	—		—		—		—		4.00E-02	H	—	
7439-89-6	iron	x	x	Not in IRIS	—		—		—		—		3.00E-01	N	—	
7439-92-1	lead	x	x	B2	—		—		—		—		—		—	
10-02-0	lead, organic	x		NA	—		—		—		—		1.00E-07	I	—	
7439-96-5	manganese	x	x	D	—		—		—		—		2.40E-02	I	1.43E-05	I
7439-97-6	mercury	x	x	C	—		—		—		—		3.00E-04	I	—	
7439-98-7	molybdenum	x	x	NA	—		—		—		—		5.00E-03	I	—	
7440-02-0	nickel	x	x	A	—		8.40E-01	I	—		9.10E-01	C	2.00E-02	I	—	
7782-49-2	selenium	x	x	D	—		—		—		—		5.00E-03	I	—	
7440-22-4	silver	x	x	D	—		—		—		—		5.00E-03	I	—	
7440-28-0	thallium	x	x	D	—		—		—		—		6.60E-05	S	—	
7440-62-2	vanadium	x	x	Not in IRIS	—		—		—		—		1.00E-03	N	—	
7440-66-6	zinc	x	x	D	—		—		—		—		3.00E-01	I	—	
General Chemistry																
57-12-5	cyanide	x		D	—		—		—		—		2.00E-02	I	—	

Table M2-6
Toxicity Values[a]

CAS Number	Chemical	Soil	GW	Cancer Class	U.S. EPA CSFo (mg/kg-day)$^{-1}$	U.S. EPA CSFi (mg/kg-day)$^{-1}$	Cal/EPA CSFo (mg/kg-day)$^{-1}$	Cal/EPA CSFi (mg/kg-day)$^{-1}$	U.S. EPA RfDo (mg/kg-day)	U.S. EPA RfDi (mg/kg-day)

Note:

[a] a dash indicates that a toxicity value is not available

[b] the Cal/EPA inhalation slope factor for total chromium was calculated per U.S. EPA guidance

[c] IRIS values modified per U.S. EPA guidance

Acronyms/Abbreviations:

BHC – hexachlorocyclohexane
Cal/EPA – California Environmental Protection Agen
CAS – chemical abstract services number
CSFi – inhalation cancer slope factor
CSFo – oral cancer slope factor
DDT – dichlorodiphenyltrichloroethane
HEAST – Health Effects Assessment Summary Tabl
IRIS – Integrated Risk Information System
(mg/kg-day)$^{-1}$ – kilogram-day per milligrams
mg/kg-day – milligrams per kilogram-day
NCEA – National Center for Environmental Assessment
PPRTV – Provisional Peer Reviewed Toxicity Values
RfDi – inhalation reference dose
RfDo – oral reference dose
U.S. EPA – United States Environmental Protection Agency

Reference:

C – California website source, http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H – HEAST as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
I – IRIS, http://www.epa.gov/iris/subst/index.html
N – NCEA as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
P – PPRTV as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
R – route-to-route extrapolation as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
S – values based on a surrogate chemical (see Table I5-2)
X – withdrawn as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.

Cancer class:

A – human carcinogen
B1 – probable human carcinogen with limited human data
B2 – probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans
C – possible human carcinogen
D – not classifiable as to human carcinogenicity
NA – not assessed
NP – not applicable (not assessed using the 1986 U.S. EPA cancer guidelines)

Source: Bechtel, 2008. Final Remedial Investigation Report For Operable Unit 2C, Alameda Point, Alameda, California.

Table M5-11
Summary of Risk Drivers for Cancer Risk - Reasonable Maximum Exposure
U.S. EPA (Office Worker)

Scenario Time Frame: Future
Exposure Point: OU-2C Exposure Unit 3
Receptor Population: Office Worker
Receptor Age: Adult

		EPC		CANCER RISK							
Exposure Medium	**Chemical**	**Direct Contact[a]**	**Indoor Vapor[b]**	**Ingestion**	**Dermal Contact**	**Inhalation of Dust**	**Inhalation of Indoor Air**	**Inhalation of Outdoor Air**	**Ingestion of Homegrown Produce**	**Exposure Route Total**	**Percent of Total**
0–8 feet bgs Soil	**Volatile Organic Compounds**										
	tetrachloroethene	1.56E+00	5.25E-02	3E-07	2E-07		3E-05	3E-07		3E-05	8%
	trichloroethene	9.19E-01	3.18E-02	1E-07	8E-08		3E-04	3E-06		3E-04	76%
	Metals										
	arsenic	2.13E+00	—	1E-06	2E-07	6E-10				1E-06	0.3%
	Risk Drivers Across Soil			**1E-06**	**5E-07**	**6E-10**	**3E-04**	**3E-06**	**0E+00**	**3E-04**	
Groundwater	**Volatile Organic Compounds**										
	carbon tetrachloride	—	1.43E-03				2E-06	4E-08		2E-06	0.5%
	trichloroethene	—	4.38E-03				4E-05	8E-07		4E-05	10%
	vinyl chloride	—	7.12E-03				5E-06	7E-08		5E-06	1%
	Risk Drivers Across Groundwater			**0E+00**	**0E+00**	**0E+00**	**5E-05**	**9E-07**	**0E+00**	**5E-05**	
	Total Sitewide Risk Across All Media and All Exposure Routes			**2E-06**	**6E-07**	**2E-07**	**4E-04**	**4E-06**	**0E+00**	**4E-04**	

Notes:
[a] Units for soil concentrations are milligrams per kilogram (mg/kg) and units for groundwater concentrations are milligrams per liter (mg/L)
[b] Units for vapor phase are milligrams per cubic meter (mg/m³)

Acronyms/Abbreviations:
bgs – below ground surface
EPC – exposure point concentration
U.S. EPA – United States Environmental Protection Agency

Source: Bechtel, 2008. Final Remedial Investigation Report For Operable Unit 2C, Alameda Point, Alameda, California.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
8	screening-level ecological risk assessment	Section 2.5.2	Final Remedial Investigation Report for Operable Unit 2C. Section 6.2, Figures 6-6 and 6-7, Tables 6-8 through 6-37. Bechtel Environmental Inc. 2008.

For construction workers, the cancer risks are within the risk management range and the HI is less than 1.

6.1.6.3 EXPOSURE UNIT 3

For residents, the cancer risks are above the risk management range and the HI is above 1 for Exposure Unit 3 (areas with more impact). The local area residential risk drivers include primarily VOCs in groundwater and soil, and metals in soil. The risk results were not adjusted because local areas or COPCs that warranted exclusion were not identified.

For office workers, the U.S. EPA cancer risks are above the risk management range and the Cal/EPA cancer risks are at 1×10^{-4}. The noncancer HI is above 1.

For construction workers, the cancer risks are within the risk management range and the HI is above 1.

6.2 ECOLOGICAL RISK ASSESSMENT

A screening-level ERA was conducted by the Navy in association with the RI to estimate the potential impacts of chemicals reported at concentrations above detection limits in soil and groundwater at OU-2C. Soil gas data are not used in the ERA because exposure pathways that include inhalation of vapors are not considered a significant source of exposure for ecological receptors (Figure 6-1). A screening-level ERA is Tier 1 (Steps 1 and 2) of the Navy policy for conducting ERAs (DON 1999, 2001a). The ERA process of the Navy policy is substantially identical to the U.S. EPA's ERA Guidance for Superfund and functionally equivalent to the ERA guidance documents for the state of California.

This risk assessment also includes an evaluation of refined exposure estimates described by U.S. EPA guidance (U.S. EPA 1997) and Step 3a of Navy policy (DON 1999, 2001a). The supplemental refined evaluation is presented in addition to the screening-level ERA (rather than as part of the screening-level ERA) and as an aid to the risk managers.

A summary of the ERA is presented in this subsection and complete details of the ERA are presented in Appendix N.

6.2.1 Screening-Level Ecological Risk Assessment

The screening-level ERA employs existing data and conservative assumptions regarding contaminant exposure to evaluate whether additional assessment is warranted. Step 1 develops the screening-level conceptual model through problem formulation and toxicity evaluation. Step 2 prepares the exposure estimates and risk calculations.

6.2.1.1 PROBLEM FORMULATION

The problem formulation evaluates potential exposure pathways between COPECs and ecological receptors based on considerations of site characteristics, COPECs, and representative organisms.

Facility Location and Description

Alameda Point is located on the western end of Alameda Island, which is located along the eastern margin of the San Francisco Bay near the city of Oakland in Alameda County, California (Figure 1-1).

The land that comprises Alameda Point was created by filling natural bay tidelands and offshore areas with dredge spoils from the Oakland Estuary (now the Oakland Inner Harbor), Seaplane Lagoon, and the San Francisco Bay. Oakland Inner Harbor and Seaplane Lagoon are large bodies of water contiguous with San Francisco Bay (Figure 1-2). Because these water bodies are contiguous with the San Francisco Bay, references to "the bay" in this ERA refer also to Oakland Inner Harbor and Seaplane Lagoon. Oakland Inner Harbor represents the northern boundary of Alameda Point. Seaplane Lagoon is located in the southeastern portion of Alameda Point.

OU-2C, located in the central portion of Alameda Point, occupies approximately 53 acres and consists of IR Sites 5, 10, and 12. Approximately 93 percent of OU-2C is covered by pavement and buildings and the remaining area is bare soil or landscaped areas (Figure 6-5). The ground surface at OU-2C is flat, with an approximate elevation of 12 feet above MSL.

IR Site 5 consists of approximately 47 acres and is located in the central portion of OU-2C. The most prominent site feature is Building 5, the former aircraft rework facility, which covers approximately 40 percent of the site. Most of IR Site 5 is barren habitat covered primarily by buildings and pavement with small areas of bare soil and landscaped areas.

IR Site 10 consists of approximately 4 acres and is located in the southern portion of OU-2C. The primary site feature is Building 400, which covers about 85 percent of the site. All of IR Site 10 is barren habitat covered by buildings and pavement.

IR Site 12 consists of approximately 2 acres and is located in the southeastern portion of OU-2C. Most of IR Site 12 is barren habitat covered primarily by buildings and pavement with small areas of bare soil.

For risk assessment purposes and because of its large size, OU-2C was divided into three exposure units (Section 6.1.1.2, Figure 6-2), based on similarities in the nature and extent of impacts of chemicals (see Section 4) and historical use. The ERA uses the three exposure units to evaluate risk to terrestrial receptors from COPECs in soil. The descriptions of the exposure units are as follows.

- Exposure Unit 1 is an approximate 30.3-acre area around the perimeter of OU-2C where fewer impacts were noted, which is consistent with historical use. Approximately 90 percent of Exposure Unit 1 is covered by pavement or buildings and 10 percent by landscaping.
- Exposure Unit 2 is Building 5, which occupies approximately 15.2 acres. All of Exposure Unit 2 is covered by Building 5.
- Exposure Unit 3 is an approximate 7.2-acre strip of land along the eastern boundary of Exposure Unit 2 that extends north and south to the boundaries of

OU-2C and includes areas of higher impacts. Approximately 95 percent of Exposure Unit 3 is covered by pavement or buildings and 5 percent by landscaping.

Ecological Habitats at OU-2C and Adjacent Areas

Six ecological habitats occur within 1 mile of OU-2C: barren habitat, urban habitat, nonnative grassland habitat, coastal scrub habitat, wetland habitat, and estuarine habitat. Only barren and urban habitats are present at OU-2C.

Barren habitat occurs at OU-2C as bare soil, paved areas, and buildings. Barren habitat also occurs on adjacent land at Alameda Point and in the cities of Oakland and Alameda as paved areas, runways, and buildings. Barren habitat generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but it is not a significant place of shelter.

Urban habitat occurs as ornamental shrubs, trees, and landscaped areas at OU-2C and on adjacent land at Alameda Point and in the cities of Oakland and Alameda. Urban habitat generally supports few wildlife species, due to human disturbances and limited vegetation.

Nonnative grassland habitat occurs at the western portion of Alameda Point. Nonnative grassland habitat offers shelter, forage, and nesting opportunities for a variety of birds and small mammals.

Coastal scrub habitat occurs along the margins of the West Beach Wetland and the Runway Wetland at Alameda Point and in an area between these wetlands and along the south shore of Transfer Parcel Federal Agency Disposal 1A. The coastal scrub habitat on Alameda Point occurs as a disturbed habitat with mixed scrub vegetation and vegetation from the non-native grassland. Wildlife characteristics of the scrub habitat are essentially the same as for the grasslands.

Wetland habitat occurs in the western portion of Alameda Point as salt marsh at the West Beach Wetland and the Runway Wetland, and as seasonal wetlands at low grassy areas. Seasonal wetlands are characterized by hydrophytic vegetation, i.e., plants which have adapted to growing in the low-oxygen (anaerobic) conditions associated with prolonged saturation or flooding. The seasonal wetlands also provide rest, shelter, and forage for Canada geese (*Branta canadensis*) and other migratory water fowl.

Estuarine habitat occurs as intertidal and subtidal zones of San Francisco Bay such as at the Oakland Inner Harbor, Seaplane Lagoon, and the main San Francisco Bay. The estuarine habitat supports submerged aquatic vegetation such as eelgrass, numerous invertebrates such as worms and small crustaceans, fish, birds, and marine mammals.

Threatened, Endangered, and of-Concern Species

Special-status species considered for OU-2C are those plant and animal species that are classified as threatened, endangered, or species-of-concern by state or federal agencies, and that are known to occur or have the potential to occur in the terrestrial or aquatic habitats in the vicinity of OU-2C. Local environmental impact reports were used to

determine the likelihood of these species occurring at or in the vicinity of Alameda Point (LSA 2001, WRT 2002, EDAW 2005). Due to the lack of suitable habitat, none of the listed species are expected to be present at OU-2C.

Identification of Chemicals of Potential Ecological Concern

The results of investigations at OU-2C indicate the presence of various organic and inorganic chemical compounds in soil and groundwater. The list of COPECs includes VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Additionally, gross alpha and gross beta reported in groundwater were evaluated. Many of the SVOCs reported in soil and groundwater samples are PAHs.

Compounds not reported above their detection limits were eliminated as COPECs. The concentrations of inorganic COPECs were compared to background concentrations for Alameda Point (the maximum concentrations were compared to the 95th percentile of background data).

Soil Chemicals of Potential Ecological Concern. COPECs in soil were identified using analytical data from samples collected at depths up to 8 feet bgs. Most of the soil samples were collected between 0 and 6 feet bgs, as recommended for ERAs (Cal/EPA 1998). Average soil sampling depths at Exposure Units 1, 2, and 3 are 3.0, 2.8, and 3.0 feet bgs, respectively. The data from samples collected below 6 feet bgs are not expected to affect the exposure estimates because of the large number of total soil samples collected. In addition, any redevelopment activities are likely to include disturbance of soil below 6 feet bgs (e.g., removal of building foundations).

The initial COPEC list for soil includes all chemical compounds that were reported at least once at a concentration above the detection limit. An initial COPEC list was prepared for each of the three exposure units (Tables 6-8, 6-9, and 6-10).

Groundwater Chemicals of Potential Ecological Concern. COPECs in groundwater were identified using analytical data collected from groundwater monitoring wells and other groundwater sampling locations. The initial COPEC list for groundwater includes all chemical compounds that were reported at least once at a concentration greater than the detection limit (Table 6-11). The initial COPEC list was developed from the combined data for three groundwater units: the shallower FWBZ, the deeper FWBZ, and the SWBZ.

Exposure Pathway Analysis

Exposure pathway analysis evaluates the potential for contact between the chemicals reported in soil and groundwater and the ecological receptors that are representative of the ecosystem at (or potentially at) the site.

Exposure of terrestrial organisms to soil at OU-2C is considered unlikely under current conditions. However, if suitable habitats were present in the future, terrestrial organisms might be exposed to soil COPECs. Potential exposure of terrestrial organisms to chemical compounds might occur by direct contact, inhalation, incidental soil ingestion, and ingestion of food items that had absorbed site contaminants. Exposure by direct (e.g., dermal) contact and inhalation is not readily estimated or evaluated for ecological

receptors; exposure by ingestion is assumed to be a more significant contributor to total risk than exposure by direct contact or inhalation. Therefore, direct contact and inhalation exposures for terrestrial receptors are not evaluated in this risk assessment.

Exposure of aquatic organisms to OU-2C groundwater is considered a potential occurrence because groundwater may migrate toward and discharge to Seaplane Lagoon or the Oakland Inner Harbor. Aquatic organism exposures may include direct contact, ingestion, and ingestion of food items that have absorbed contaminants from groundwater.

Conceptual Site Model

The CSM can be described as a representation of the known, expected, and/or predicted relationships between site COPECs and ecological receptors (Figures 6-1, 6-6, and 6-7). The CSM is based on current knowledge about OU-2C.

OU-2C investigations have reported the presence of VOCs, SVOCs (including PAHs), pesticides, PCBs, metals, and cyanide in soil; and VOCs, SVOCs, PAHs, metals, cyanide, and gross alpha and beta in groundwater. These are potential chemicals that could affect the ecological habitats and associated organisms occurring at or in the vicinity of OU-2C.

Soil Model. Fate-and-transport mechanisms exist that provide models for potential exposure of terrestrial organisms to COPECs. Soil COPECs generally maintain persistent forms and stable concentrations by bonding with soil particles and materials. These soil COPECs may migrate with soil erosion patterns and may bioaccumulate in local biota. Transfer of soil COPECs to the biota of lower trophic levels (e.g., vegetation, invertebrates, and small mammals) is estimated using bioaccumulation factors (BAFs). A BAF is a ratio of the concentration of a chemical compound in biota (e.g., plants) to the concentration in soil. Transfer to biota of higher trophic orders (e.g., predators) is estimated using receptor-specific exposure factors.

Representative terrestrial receptors were selected based on a review of current site conditions, reuse plans, and potential habitat. The site is currently covered primarily by paved surfaces and buildings. The NAS Alameda Community Reuse Plan identifies an area that includes OU-2C as the "Civic Core," which would include business parks, civic uses, offices, retail, housing, parks, and public open space (LSA 2001). However, the final Preliminary Development Concept for Alameda Point (ARRA 2006) indicates the planned land use of the OU-2C portion of the Civic Core to be commercial/mixed use, other commercial use, and community/institutional/civic use. The small portion of OU-2C identified for commercial/mixed use, which could include some type of housing, includes the far northeastern portion of IR Site 5 surrounding Building 2 and IR Site 10 (Figure 2-15).

This screening-level risk assessment evaluates plants, soil invertebrates, and birds and mammals of the major terrestrial feeding guilds as potential ecological receptors. The terrestrial assessment end points are the survival, growth, and reproduction of populations of plants, invertebrates, omnivorous and herbivorous mammals; birds that feed on plant material and invertebrates; and carnivorous birds. Measurement end points are HQs based on exposure estimates and toxicity reference values (TRVs). The deer mouse is a

representative species for omnivorous mammals. The California ground squirrel is a representative species for herbivorous mammals. The Alameda song sparrow is a representative species for avian receptors that feed on a combination of invertebrates and plant material. The American robin is a representative species for avian receptors that feed primarily on terrestrial invertebrates. The red-tailed hawk is a representative species for avian predators (raptors) that feed on small mammals. However, these receptors are not likely to have an important presence under the current or planned future use of the site.

Groundwater Model. Existing fate-and-transport mechanisms indicate the potential exposure of aquatic organisms to groundwater COPECs. These groundwater COPECs may discharge to surface water according to groundwater flow patterns and may bioaccumulate in local aquatic biota. Transfer of COPECs to the biota of lower trophic levels, such as invertebrates and small fish, is estimated using BAF values. Transfer to biota of higher trophic orders, such as predators, is estimated using receptor-specific exposure factors. Benthic organisms, dwelling in or on the mud of the bay bottom, are potentially exposed to COPECs by direct contact, as groundwater discharges through the mud to the bay. Pelagic organisms, dwelling in the open water column of the bay, are exposed by direct contact to much smaller concentrations of COPECs than benthic organisms, due to the tidal mixing and dilution that occurs in the water column.

This screening-level risk assessment evaluates aquatic life as well as aquatic-dependent birds and mammals as potential ecological receptors. Aquatic life is a group name applied to the general classification that includes fish and invertebrates in the bay. The aquatic assessment end points are the survival, growth, and reproduction of aquatic life populations; populations of piscivorous marine mammals and birds; and populations of birds that feed on aquatic invertebrates. Measurement end points are HQs based on exposure estimates and TRVs. The harbor seal is a representative species for piscivorous (fish-eating) marine mammals. The California least tern and California brown pelican are representative species for piscivorous birds. The western snowy plover is a representative species for birds that feed on aquatic invertebrates.

Risk Estimation

The risk for potential ecological receptors is estimated by the HQ, obtained by dividing the exposure dose estimate by the TRV.

$$HQ = \frac{Dose}{TRV}$$

where

HQ	=	hazard quotient
Dose	=	daily exposure dose for a COPEC, mg/kg-day
TRV	=	toxicity reference value, mg/kg-day

HI values were calculated to assess the potential for cumulative effect from multiple COPECs having similar modes of action. The HI was calculated as the sum of all of the individual HQ values for a group of COPECs (e.g., metals, PAHs).

6.2.1.2 ECOTOXICITY OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

COPECs were evaluated with ecotoxicity estimates. These values are preferentially based on a no-effect level for chronic exposures.

Soil screening benchmarks were compared to the site soil concentrations for terrestrial plants and invertebrates. Soil screening benchmarks were selected from Efroymson et al. (1997a,b). Screening benchmarks have been developed for only a few COPECs.

Toxicity Reference Values for Mammals and Birds

COPECs identified in soil and groundwater are known or suspected to cause various adverse responses in terrestrial wildlife. Guideline TRVs originally prepared by the Navy and the U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) (EFA-West 1998) are included in ERA guidance documents by Cal/EPA (Cal/EPA 2000, 2002b). Wildlife TRVs are presented as an upper estimate and a lower estimate of effect thresholds. The low-TRV, based on no-observed-adverse-effect-level (NOAEL) data, represents a threshold below which no adverse effect is expected. The high-TRV, based on an approximate midpoint of the range of effect levels, represents a threshold above which an adverse effect is likely to occur. TRVs used in this screening-level ERA are low-TRVs.

For chemicals without a Navy-BTAG TRV, a TRV was selected from the scientific literature. If literature-based values were not chronic NOAEL values, a factor of 0.1 was used to convert to a chronic value, and a factor of 0.1 was used to convert to a NOAEL value, as necessary. If an avian TRV was unavailable for a COPEC, the mammalian TRV was used with an adjustment factor of 0.1. An allometric adjustment was applied to a TRV if the difference in body weight was more than two orders of magnitude (Cal/EPA 1999) between test species (usually standard laboratory animals) and selected ecological receptors for the site.

Toxicity Reference Values for Aquatic Life

For this screening-level ERA, the preferred aquatic threshold value was a chemical-specific chronic ambient water quality criterion for saltwater aquatic life as presented in the California Toxics Rule (CTR) (U.S. EPA 2000a).

If a value for a chemical was not listed in the CTR, a value was selected from available resources, as described in Appendix N.

6.2.1.3 EXPOSURE ESTIMATES

Exposure estimates represent the quantity of COPECs to which the representative ecological receptors are exposed. Soil exposure estimates are evaluated as a daily dose for ingestion.

Terrestrial Exposure Model

The wildlife exposure estimate was based on an ingestion-exposure pathway. Maximum concentrations reported for each soil COPEC were assumed to represent the concentration throughout the exposure unit.

Tissue residue concentrations of the COPECs in prey species were estimated using soil-to-plant, soil-to-invertebrate, and soil-to-small-mammal BAFs.

Concentrations of Bay Water Chemicals of Potential Ecological Concern

Bay water concentrations of COPECs were estimated using maximum concentrations of COPECs reported from groundwater monitoring wells and other groundwater sampling locations.

Tissue residue concentrations of the groundwater COPECs in prey species were estimated with water-to-invertebrate and water-to-fish BAFs. The aquatic BAFs were estimated as the bioconcentration factor (BCF) multiplied by the food chain multiplier (FCM). The BCF only accounts for direct contact transfer of COPECs; the FCM accounts for the COPEC transfer to prey species via ingestion of food items.

Exposure Factors

Exposure factors for the ingestion pathway for terrestrial and aquatic wildlife include ingestion rate, body weight, and site-use factors. These exposure factors are specific for each ecological receptor evaluated. Fractional intake, the dietary component, is specific for each receptor and ingested medium (food type). Gastrointestinal assimilation efficiency and bioavailability are specific to each receptor, ingested medium, and chemical compound. For this screening-level risk assessment, conservative assumptions are used for assimilation efficiency and site-use factors (values set to 1). The receptors are assumed to experience no reduction in bioavailability and are also assumed to feed only at the site.

Exposure factors were selected from available scientific literature, such as the U.S. EPA Wildlife Exposure Handbook (U.S. EPA 1993) and the California Wildlife Biology, Exposure Factor, and Toxicity database (Cal/EPA 2002a). Minimum values were used for body weight. Maximum values were used for ingestion rates.

6.2.1.4 RISK ESTIMATE FOR EXPOSURE UNIT 1 SOIL

Table 6-12 lists the HQ for each Exposure Unit 1 soil COPEC and potential terrestrial plant and invertebrate receptors. Most of the HQ values for organic chemicals are not available since few benchmarks are available for organic compounds. None of the available plant or invertebrate organic compound HQ values exceeds 1. Several inorganic HQ values for plants exceed 1, ranging from 2 for nickel and zinc to 600 for aluminum. Five inorganic HQ values for invertebrates exceed 1, ranging from 2 for barium and copper to 200 for chromium. Phenol, acenaphthene, antimony, arsenic, beryllium, cadmium, and lead have HQ values less than 1 for both plants and invertebrates; therefore, these chemicals were eliminated from further evaluation for the plant and invertebrate receptors.

Table 6-13 lists the HQ for each Exposure Unit 1 soil COPEC and potential terrestrial wildlife receptor (mammals and birds). Most of the HQ values for organic chemicals are less than or equal to 1, indicating that those COPECs are unlikely to represent an ecological risk for terrestrial wildlife. Five VOCs, three SVOCs, and most metals are presented with HQ values above 1, indicating potentially unacceptable ecological risk. The COPECs with the highest HQ values from the five representative wildlife receptors are aluminum (HQ 500), antimony (HQ 200), lead (HQ 700), and nickel (HQ 200). Potential risk to terrestrial wildlife receptors from these COPECs could be further evaluated with refined EPCs and refined exposure factors for the representative receptors. COPECs with maximum HQ and HI values less than 1 were eliminated from further evaluation for terrestrial wildlife receptors. PCBs were eliminated from further evaluation for terrestrial wildlife receptors due to HQ and HI values below 1 for Aroclor 1260, the only PCB reported in Exposure Unit 1 soil.

6.2.1.5 RISK ESTIMATE FOR EXPOSURE UNIT 2 SOIL

Table 6-14 lists the HQ for each Exposure Unit 2 soil COPEC and potential terrestrial plant and invertebrate receptors. Most of the HQ values for organic chemicals are not available since few benchmarks are available for organic compounds. None of the available plant or invertebrate organic compound HQ values exceeds 1. Several inorganic HQ values for plants exceed 1, ranging from 2 for barium to 600 for aluminum. Several inorganic HQ values for invertebrates exceed 1, ranging from 2 for barium to 700 for chromium. Pentachlorophenol, phenol, acenaphthene, beryllium, and cadmium have HQ values not exceeding 1 for both plants and invertebrates; therefore, these chemicals were eliminated from further evaluation for the plant and invertebrate receptors.

Table 6-15 lists the HQ for each Exposure Unit 2 soil COPEC and potential terrestrial wildlife receptor (mammals and birds). Most of the HQ values for organic chemicals are less than or equal to 1, indicating that those COPECs are unlikely to represent an ecological risk for terrestrial wildlife. Four VOCs, one SVOC, and most metals are presented with HQ values above 1, indicating potentially unacceptable ecological risk. The COPECs with the highest HQ values from the five representative wildlife receptors are lead (HQ 2,000) and selenium (HQ 2,000). Potential risk to terrestrial wildlife receptors from these COPECs could be further evaluated with refined EPCs and refined exposure factors for the representative receptors. The PAH and PCB analytical groups were eliminated from further evaluation for terrestrial wildlife receptors due to HQ and HI values less than 1.

6.2.1.6 RISK ESTIMATE FOR EXPOSURE UNIT 3 SOIL

Table 6-16 lists the HQ for each Exposure Unit 3 soil COPEC and potential terrestrial plant and invertebrate receptors. Most of the HQ values for organic chemicals are not available, since few benchmarks are available for organic compounds. None of the available plant or invertebrate organic compound HQ values exceeds 1. Several inorganic HQ values for plants exceed 1, ranging from 2 for nickel to 900 for chromium. Several inorganic HQ values for invertebrates exceed 1, ranging from 2 for copper, manganese, and mercury to 2,000 for chromium. Pentachlorophenol, acenaphthene,

antimony, arsenic, barium, beryllium, cadmium, and lead have HQ values at or below 1 for both plants and invertebrates; therefore, these chemicals were eliminated from further evaluation for the plant and invertebrate receptors.

Table 6-17 lists the HQ for each Exposure Unit 3 soil COPEC and potential terrestrial wildlife receptor (mammals and birds). Several organic compounds and most metals are presented with HQ values above 1, indicating potentially unacceptable ecological risk. The COPECs with the highest HQ values from the five representative wildlife receptors are n-butylbenzene (HQ 20,000), sec-butylbenzene (HQ 20,000), and 1,2,4-trimethylbenzene (HQ 20,000). Potential risk to terrestrial wildlife receptors from these COPECs could be further evaluated with refined EPCs and refined exposure factors for the representative receptors.

6.2.1.7 RISK ESTIMATE FOR GROUNDWATER

Table 6-18 lists the HQ for each groundwater COPEC and potential aquatic wildlife receptor (mammals and birds). Many of the organic and inorganic COPECs are presented with HQ values above 1, indicating potentially unacceptable ecological risk for aquatic wildlife receptors. VOCs, SVOCs, PAHs, pesticides, and metals have HQ values above 1,000. Potential risk to aquatic wildlife receptors could be further evaluated for the COPECs with HQ values greater than 1 using refined EPCs and refined exposure factors for the representative receptors. Cyanide was eliminated from further evaluation for aquatic wildlife receptors due to an HQ value not exceeding 1.

Table 6-19 lists the HQ for each groundwater COPEC for potential pelagic (in the water column) and benthic (near the bottom) aquatic life receptors (fish and invertebrates). Some of the HQ values for the COPECs are less than or equal to 1, indicating that those COPECs are unlikely to represent an ecological risk to aquatic life. Many organic and inorganic COPECs are presented with HQ values above 1, indicating potentially unacceptable ecological risk to aquatic life. The COPECs with the highest HQ values are TCE (HQ 4,000), aluminum (HQ 3,000), iron (HQ 600), and cyanide (HQ 1,000). Potential risk to the aquatic life receptors could be further evaluated with refined EPCs.

6.2.1.8 SCREENING-LEVEL RISK ASSESSMENT SUMMARY

Based on the soil concentrations, there is potential ecological risk for terrestrial ecological receptors for certain organic and inorganic COPECs at Exposure Units 1, 2, and 3 if the existing pavement were to be removed. Based on the groundwater concentrations, there is potential ecological risk for aquatic wildlife (vertebrates) and aquatic life (fish and invertebrates) for certain organic and inorganic COPECs if groundwater discharges to the bay. Most of the soil and groundwater COPECs likely represent a negligible potential ecological risk due to HQs less than 1. Since the screening-level ERA indicates potentially unacceptable ecological risk, further evaluation with a Tier 2 baseline ERA is warranted for those COPECs and COPEC groups that have HQ values greater than 1. Section 6.2.2 presents the first step of the baseline ERA, Step 3a, which uses refined exposure estimates to refine the COPEC list.

6.2.1.9 SCREENING-LEVEL RISK ASSESSMENT UNCERTAINTY

In general, the risk characterization is more likely to overestimate than underestimate the actual hazard of adverse ecological effects because of the conservative nature of the assumptions used. In particular, uncertainties resulting from the extrapolation of literature-based TRVs to the representative ecological receptors for the site are due to differences in exposure scenarios, differential bioavailability, and interspecies sensitivity differences. The risk assessment implemented adjustment factors when these conditions were encountered to minimize the likelihood of underestimating the effects. Therefore, use of the selected TRVs causes an overestimation of the ecological risk.

Selecting the maximum soil COPEC concentrations potentially overestimates the EPCs. For COPECs with estimated exposures lower than the toxicity benchmark values, the probability of significant ecological hazard is very low. Potential risk from chemical exposures that exceed the toxicity benchmark values cannot be eliminated from consideration; however, marginal exceedances of the benchmark values would suggest that significant levels of risk at the population or community level are not likely.

6.2.2 Refined Exposure Estimate (Step 3a) Ecological Risk Assessment

This risk assessment includes a step for refined exposure estimates described by Step 3a of Navy policy (DON 1999, 2001a) and U.S. EPA guidance (U.S. EPA 1997). The refined exposure estimate uses exposure factors that are more realistic for the site than the most-conservative values used for Steps 1 and 2. Only COPECs with HQ or HI values above 1 in Step 2 were retained for further risk estimation using refined exposure estimates under Step 3a.

During the refined risk estimation, inorganic COPECs with concentrations below the Alameda Point background threshold concentrations were eliminated from further evaluation.

6.2.2.1 REFINED EXPOSURE FACTORS

The refined EPCs for soil COPECs for each exposure unit are the 95 percent UCLs representative of average exposures. Maximum concentrations for each exposure unit were compared to the background threshold values (95th percentile background concentrations) for Alameda Point. The only metals with maximum concentrations below background threshold concentrations were antimony and molybdenum in Exposure Unit 1 (Table 6-8); and antimony, beryllium, mercury, and molybdenum in Exposure Unit 3 (Table 6-10). All maximum concentrations for metals were greater than the background threshold values in Exposure Unit 2 (Table 6-9). Additional evaluation of metals concentrations in soil based on statistical analysis and the distributions of concentrations (see Section 4, and Appendices L and P) indicated that all metals in soil in Exposure Unit 1 are ambient. In Exposure Unit 2, all metals in soil are considered ambient except arsenic, cadmium, chromium, lead and thallium in limited areas. In Exposure Unit 3, all metals in soil are considered ambient except cadmium and chromium in limited areas.

The refinement of the groundwater data set included looking at concentrations in downgradient samples and dissolved metals concentrations (rather than both total and dissolved). Dissolved metals concentrations are considered more representative of metals that are mobile in groundwater. Based on lithology and groundwater flow directions, three groundwater data sets were evaluated: shallower FWBZ, deeper FWBZ, and SWBZ. The shallower and deeper portions of the FWBZ were evaluated independently because of clay layers that locally divide the FWBZ and different flow directions in the shallower and deeper portions (Figures 2-11 and 2-12) suggest some hydraulic separation. Hydraulic communication between the FWBZ and SWBZ is considered limited across most or all of OU-2C, where these hydraulic zones are separated by the Young Bay Mud.

As shown on Figure 2-11, groundwater in the shallower FWBZ flows toward a groundwater low west of Building 5 at well M05-06. Data for the shallower FWBZ includes concentrations for locations within 200 feet of well M05-06, and includes three sampling locations (one well and two discrete sample locations, Table 6-20).

Groundwater in the deeper FWBZ flows toward the west side of Building 5 and then flows south. Data for the deeper FWBZ include concentrations for sampling locations south and west of the 5-foot contour line shown on Figure 2-12, and includes 17 sampling locations (one well and 16 discrete groundwater sampling locations, Table 6-20).

The 1997 tidal influence study indicated that groundwater in the SWBZ between IR Sites 10 and 5 flowed inland from Seaplane Lagoon, regardless of tides (PRC and MW 1997c). Groundwater flow in the SWBZ was not evaluated as part of the 2007 RI supplemental sampling mean groundwater elevation study. The BGMP groundwater elevation maps and the groundwater elevations measured during the 2007 RI supplemental activities show that SWBZ groundwater flows toward the center of OU-2C from the east and from the west. Since there are few SWBZ elevation data for the center portion of OU-2C, the ERA conservatively assumed that SWBZ groundwater in the southern portion of OU-2C may flow toward Seaplane Lagoon. Data for the SWBZ includes eight sampling locations (four wells and four discrete groundwater sampling locations, Table 6-20).

The data include organic results from discrete samples along with recent samples collected from monitoring wells (well data collected since 2005 and one sample collected in 2001 from well D10A-01 because more recent data are not available). Data used to represent dissolved metals concentrations include samples known to be field filtered (e.g., samples collected during supplemental RI activities), and samples collected from monitoring wells because low-flow sampling techniques have typically been employed by the Navy at Alameda Point when sampling monitoring wells. The maximum concentrations were used for each chemical in each data set (Tables 6-21, 6-22, and 6-23).

Background threshold values for Alameda Point were compared to the maximum reported concentration. If the maximum reported concentration was less than the background threshold value, the COPEC concentrations were considered to be within the range of background concentrations. The inorganic groundwater COPECs that were not greater than background concentrations were:

- aluminum, antimony, barium, chromium, copper, lead, selenium, vanadium, and zinc in the shallower FWBZ (Table 6-21);
- aluminum, antimony, barium, copper, iron, manganese, vanadium, and zinc in the deeper FWBZ (Table 6-22); and
- aluminum, antimony, barium, beryllium, chromium, copper, iron, thallium, and vanadium in the SWBZ (Table 6-23).

Additional evaluation of metals concentrations, based on statistical analysis and distributions of concentrations (see Section 4 and Appendix P), indicated that all metals in the shallower FWBZ groundwater are ambient except cadmium, hexavalent chromium, and nickel in limited areas. In the deeper FWBZ, all metals in groundwater are considered ambient except nickel in limited areas. In the SWBZ, all metals in groundwater are considered ambient.

Exposure factors for terrestrial wildlife and aquatic wildlife were refined to represent average site-specific conditions. Mean values were used for body weight and ingestion rate, and site-use factors were evaluated.

6.2.2.2 REFINED RISK ESTIMATE FOR EXPOSURE UNIT 1 SOIL

Table 6-24 lists the refined HQ for each soil COPEC and potential terrestrial plant and invertebrate receptors. None of the available refined organic COPEC HQ values for plants or invertebrates exceeds 1. Five inorganic COPEC refined HQ values for plants exceed 1, ranging from 2 for silver to 200 for aluminum. Two inorganic COPEC refined HQ values for invertebrates exceed 1: chromium (HQ 70) and mercury (HQ 20). Most of the Exposure Unit 1 refined HQ values for plants and invertebrates are lower than the refined HQ values calculated for the background threshold concentrations. Mercury and silver refined HQ values for plants and the mercury refined HQ value for invertebrates slightly exceed the background refined HQ values.

Table 6-25 lists the refined HQ for each soil COPEC and potential terrestrial wildlife receptor (mammals and birds). Except for PCE (HQ 2), total xylenes (HQ 6), and di-n-butyl phthalate (HQ 2), the refined HQ values for organic COPECs are less than 1, indicating that the COPECs are unlikely to represent an ecological risk for terrestrial wildlife. Eleven inorganic COPECs had refined HQ values above 1, ranging from 2 for beryllium, chromium, cobalt, selenium, and vanadium, to 60 for antimony.

Antimony and molybdenum maximum concentrations were not greater than the background threshold concentrations (Table 6-8) and were eliminated from further evaluation for terrestrial wildlife receptors.

The refined wildlife HQ values for PCE and total xylenes are low and these VOCs are not likely to persist in soils to represent a significant ecological risk. Di-n-butyl phthalate is unlikely to represent a significant ecological risk due to the low HQ values. Most of the Exposure Unit 1 refined HQ values for terrestrial wildlife are less than the refined HQ values calculated for the background threshold concentrations, except for cadmium and mercury. The cadmium and mercury refined HQ values for wildlife exceed the background refined HQ values.

The Exposure Unit 1 refined wildlife HQ for cadmium (HQ 30) exceeds the refined HQ calculated for the background threshold concentration (HQ 20). The Exposure Unit 1 refined cadmium EPC (2.02 mg/kg) slightly exceeds the background threshold value (1.72 mg/kg); however, cadmium concentrations in Exposure Unit 1 are considered ambient.

The Exposure Unit 1 refined wildlife HQ for mercury (HQ 10) exceeds the refined HQ calculated for the background threshold concentrations (HQ 4). The Exposure Unit 1 refined mercury EPC (1.87 mg/kg) exceeds the background threshold value (0.52 mg/kg); however, mercury concentrations in Exposure Unit 1 are considered ambient.

6.2.2.3 REFINED RISK ESTIMATE FOR EXPOSURE UNIT 2 SOIL

Table 6-26 lists the refined HQ for each soil COPEC and potential terrestrial plant and invertebrate receptors. None of the available organic COPEC refined HQ values for plants or invertebrates exceeds 1. Seven inorganic COPEC refined HQ values for plants exceed 1, ranging from 2 for lead and mercury to 100 for aluminum. Two inorganic COPEC refined HQ values for invertebrates exceed 1: chromium (HQ 100) and mercury (HQ 6). Most of the Exposure Unit 2 refined HQ values for plants and invertebrates are less than the refined HQ values calculated for the background concentrations. The lead, selenium, and thallium refined HQ values for plants and the mercury refined HQ value for invertebrates slightly exceed the background refined HQ values.

Table 6-27 lists the refined HQ for each soil COPEC and potential terrestrial wildlife receptor (mammals and birds). Except for 1,4-dioxane (HQ 6), the refined HQ values for organic COPECs are less than 1, indicating that the COPECs are unlikely to represent an ecological risk for terrestrial wildlife. The HI for VOCs was 4, principally due to n-butylbenzene (HQ 0.6), sec-butylbenzene (HQ 0.7), tert-butylbenzene (HQ 0.8), and 1,2,4-trimethylbenzene (HQ 0.4). The HI for the remaining VOCs does not exceed 1. Thirteen inorganic COPECs had refined HQ values above 1, ranging from 2 for beryllium, cobalt, vanadium, and zinc, to 1,000 for lead.

The refined wildlife HQ value for 1,4-dioxane is low and this organic compound is not likely to persist in soils and therefore unlikely to represent a significant ecological risk. Additionally, 1,4-dioxane was reported in only one of 76 soil samples collected at Exposure Unit 2 and it was reported at a low concentration. The two deeper soil samples collected at this location did not have reported concentrations of 1,4-dioxane. Of the 13 inorganic COPECs with HQ values above 1, only lead, mercury, selenium, and thallium refined HQ values for wildlife exceeded the background refined HQ values.

The Exposure Unit 2 refined wildlife HQ for lead (HQ 1,000) exceeds the refined HQ calculated for the background threshold concentrations (HQ 200). The Exposure Unit 2 refined lead EPC (279 mg/kg) exceeds the background threshold value (37.7 mg/kg).

The Exposure Unit 2 refined wildlife HQ for mercury (HQ 5) exceeds the refined HQ calculated for the background threshold concentrations (HQ 4). The Exposure Unit 2 refined mercury EPC (0.617 mg/kg) slightly exceeds the background threshold value (0.52 mg/kg); however, mercury concentrations in Exposure Unit 2 are considered ambient.

The Exposure Unit 2 refined wildlife HQ for selenium (HQ 30) exceeds the refined HQ calculated for the background threshold concentrations (HQ 5). The Exposure Unit 2 refined selenium EPC (9.27 mg/kg) exceeds the background threshold value (1.78 mg/kg); however, selenium concentrations in Exposure Unit 2 are considered ambient.

The Exposure Unit 2 refined wildlife HQ for thallium (HQ 5) exceeds the refined HQ calculated for the background threshold concentrations (HQ 0.3). The Exposure Unit 2 refined thallium EPC (10.1 mg/kg) exceeds the background threshold value (0.5 mg/kg). Thallium in one sample at Exposure Unit 2 is not considered ambient. All other thallium concentrations are believed to be ambient.

6.2.2.4 REFINED RISK ESTIMATE FOR EXPOSURE UNIT 3 SOIL

Table 6-28 lists the refined HQ for each soil COPEC and potential terrestrial plant and invertebrate receptors. None of the available organic COPEC refined HQ values for plants or invertebrates exceeds 1. Three inorganic COPEC refined HQ values for plants exceed 1, ranging from 9 for chromium to 100 for aluminum. Two inorganic COPEC refined HQ values for invertebrates exceed 1: chromium (HQ 200) and mercury (HQ 2). Most of the Exposure Unit 3 refined HQ values for plants and invertebrates are less than the refined HQ values calculated for the background threshold concentrations. The chromium refined HQ values for plants and for invertebrates slightly exceed the background refined HQ values.

Table 6-29 lists the refined HQ for each soil COPEC and potential terrestrial wildlife receptor (mammals and birds). The refined HQ values for several VOCs and two SVOCs exceed 1, indicating that the COPECs potentially represent an ecological risk for terrestrial wildlife. Twelve inorganic COPECs had refined HQ values above 1, ranging from 2 for beryllium, cobalt, and zinc, to 100 for antimony and lead.

Antimony, beryllium, mercury, and molybdenum maximum concentrations were not higher than the background threshold concentrations (Table 6-10) and were eliminated from further evaluation for terrestrial wildlife receptors.

The refined wildlife HQ values for the VOCs, which range up to 1,000 for sec-butylbenzene and 1,2,4-trimethylbenzene, may represent a potential ecological risk to terrestrial wildlife. The two SVOC compounds, bis(2-ethylhexyl)phthalate (HQ 5) and di-n-butyl phthalate (HQ 2), are unlikely to represent a significant ecological risk due to the low HQ values.

Most of the Exposure Unit 3 refined HQ values for terrestrial wildlife are less than the refined HQ values calculated for the background concentrations, except for cadmium, chromium, and cyanide. The cadmium and chromium refined HQ values for wildlife exceed the background refined HQ values.

The Exposure Unit 3 refined wildlife HQ for cadmium (HQ 40) exceeds the refined HQ calculated for the background concentrations (HQ 20). The Exposure Unit 3 refined cadmium EPC (3.27 mg/kg) slightly exceeds the background threshold value (1.72 mg/kg).

The Exposure Unit 3 refined wildlife HQ for chromium (HQ 6) exceeds the refined HQ calculated for the background concentrations (HQ 3). The Exposure Unit 3 refined chromium EPC (93.1 mg/kg) exceeds the background threshold value (54.8 mg/kg).

6.2.2.5 HQ VALUES FOR THE AMERICAN ROBIN AND THE RED-TAILED HAWK

The home ranges of the American robin and red-tailed hawk are larger than the exposure areas for Exposure Unit 1, Exposure Unit 2, and Exposure Unit 3. The refined calculations described above assume that exposures for these two representative receptors can be represented by a single exposure unit and by the background concentrations. However, these receptors may accumulate exposure at more than one exposure unit as well as at areas represented by background concentrations.

In order to assess the effect of exposure from multiple exposure units, the HQ values for Exposure Unit 1, Exposure Unit 2, and Exposure Unit 3 are presented together on Tables 6-30 and 6-31 for the American robin and the red-tailed hawk, respectively. Based on the HQ values presented in these tables, it is unlikely that there is significant accumulated risk exposure to multiple exposure units, which has not already been identified by the assessment of the individual exposure units.

6.2.2.6 REFINED RISK ESTIMATE FOR SHALLOWER FWBZ GROUNDWATER

Table 6-32 lists the refined HQ for each groundwater COPEC of the shallower FWBZ and the potential aquatic wildlife receptors (mammals and birds). The refined HQ values for all organic COPECs are less than 1, indicating that the COPECs are unlikely to represent an ecological risk for aquatic wildlife.

One inorganic COPEC, lead (HQ 10), had refined HQ values above 1, indicating potentially unacceptable ecological risk to one or more of the four representative wildlife receptors. The refined lead concentrations of the shallower FWBZ were not higher than the background concentration and lead was eliminated from further evaluation for aquatic wildlife receptors.

Table 6-33 lists the refined HQ for each groundwater COPEC of the shallower FWBZ and potential aquatic life receptor (fish and invertebrates). The refined HQ values for all organic COPECs are less than 1, indicating that the organic COPECs are unlikely to represent an ecological risk for aquatic wildlife.

Three inorganic COPECs, copper (HQ 5), iron (HQ 9), and silver (HQ 5), had refined HQ values above 1, indicating potentially unacceptable ecological risk to aquatic life receptors. Copper maximum concentrations were not higher than the background threshold concentration and copper was eliminated from further evaluation for aquatic life receptors.

The refined HQ for iron exceeds the refined HQ calculated for the background concentrations (HQ 7). The refined iron EPC (8,970 µg/L) exceeds the background threshold value (6,586 µg/L); however, iron concentrations in groundwater are considered ambient.

There is no background value available for silver; however, statistical analysis and evaluation of the lateral distribution of silver indicates that silver concentrations are ambient.

6.2.2.7 REFINED RISK ESTIMATE FOR DEEPER FWBZ GROUNDWATER

Table 6-34 lists the refined HQ for each groundwater COPEC of the deeper FWBZ and the potential aquatic wildlife receptors (mammals and birds). The refined HQ values for all organic COPECs are less than 1, indicating that the organic COPECs are unlikely to represent an ecological risk for aquatic wildlife.

One inorganic COPEC, thallium (HQ 3), had refined HQ values above 1, indicating potentially unacceptable ecological risk to one or more of the four representative wildlife receptors. The refined HQ for thallium exceeds the refined HQ calculated for the background concentration (HQ 2). The refined thallium EPC (22.3 μg/L) slightly exceeds the background threshold value (16.15 μg/L); however, thallium concentrations are considered ambient.

Table 6-35 lists the refined HQ for each groundwater COPEC of the deeper FWBZ and the potential aquatic life receptors (fish and invertebrates). The refined HQ values for all organic COPECs are less than 1, indicating that the organic COPECs are unlikely to represent an ecological risk for aquatic wildlife.

Four inorganic COPECs, copper (HQ 5), iron (HQ 5), nickel (HQ 3), and silver (HQ 10), had refined HQ values above 1, indicating potentially unacceptable ecological risk to aquatic life receptors. Copper and iron maximum concentrations were not higher than the background threshold concentrations and were eliminated from further evaluation for aquatic life receptors. There were no background values available for comparison for nickel and silver; however, statistical analysis and evaluation of the lateral distribution of these metals indicates that concentrations of nickel and silver in the refined ERA data set are ambient.

6.2.2.8 REFINED RISK ESTIMATE FOR SWBZ GROUNDWATER

Table 6-36 lists the refined HQ for each groundwater COPEC of the SWBZ and the potential aquatic wildlife receptors (mammals and birds). The refined HQ values for all organic and inorganic COPECs are less than 1, indicating that these COPECs are unlikely to represent an ecological risk for aquatic wildlife.

Table 6-37 lists the refined HQ for each groundwater COPEC of the SWBZ and the potential aquatic life receptors (fish and invertebrates). The refined HQ values for all organic COPECs are less than 1, indicating that the organic COPECs are unlikely to represent an ecological risk for aquatic wildlife.

Five inorganic COPECs, copper (HQ 2), iron (HQ 5), manganese (HQ 6), nickel (HQ 3), and silver (HQ 40), had refined HQ values above 1, indicating potentially unacceptable ecological risk to aquatic life receptors. Copper and iron maximum concentrations were not higher than the background threshold concentrations and were eliminated from further evaluation for aquatic life receptors. There were no background values available

for comparison for nickel and silver; however, metals concentrations in the SWBZ are considered ambient.

The refined HQ for manganese exceeds the refined HQ calculated for the background threshold concentrations (HQ 0.7). The refined manganese EPC (15,000 µg/L) exceeds the background threshold value (1,741 µg/L); however, metals concentrations in the SWBZ are considered ambient.

6.2.3 Refined Risk Characterization

After Steps 1 and 2 of Tier 1, this screening-level ERA indicated several organic and inorganic soil and groundwater chemicals as representing potentially unacceptable ecological risk to terrestrial wildlife, aquatic wildlife, and aquatic life organisms. Exposure estimates were further analyzed according to the procedures of Step 3a to refine the COPEC list. The refined risk estimates so derived indicated potentially unacceptable ecological risk to terrestrial receptors from COPECs including some VOCs, SVOCs, metals, and cyanide in soil. The refined risk estimates also indicated potentially unacceptable risk to aquatic receptors from metals in groundwater; however, the metals concentrations in groundwater in the refined data set are considered ambient in the shallower FWBZ, the deeper FWBZ, and the SWBZ.

6.2.3.1 EXPOSURE UNIT 1 SOIL

Potential ecological risk to terrestrial receptors at Exposure Unit 1 was indicated for PCE, total xylenes, di-n-butyl phthalate, cadmium, mercury, and silver; however, cadmium, mercury, and silver concentrations in Exposure Unit 1 soil are considered ambient. The risk assessment conservatively assumed that ecological receptors were present at the site and could be exposed to the soil COPECs. It is unlikely under existing conditions that ecological receptors are present at the site or would be exposed to the soil COPECs because most of Exposure Unit 1 is covered by pavement or buildings (90 percent). The remaining area is bare soil or landscaped areas, which offer little habitat value.

It is unlikely that PCE or total xylenes represent a significant source of ecological risk to terrestrial receptors because the HQ values are low and these compounds are not likely to persist in soil. It is also unlikely that di-n-butyl phthalate (HQ 2), represents a significant ecological risk due to the low HQ values.

6.2.3.2 EXPOSURE UNIT 2 SOIL

Potential ecological risk to terrestrial receptors at Exposure Unit 2 was indicated for 1,4-dioxane, VOCs (principally n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and 1,2,4-trimethylbenzene), lead, mercury, selenium, and thallium; however, mercury and selenium concentrations in Exposure Unit 1 soil are considered ambient. The risk assessment conservatively assumed that ecological receptors were present at the site and could be exposed to the soil COPECs. It is unlikely under existing conditions that ecological receptors are present at the site or would be exposed to the soil COPECs because Exposure Unit 2 is covered entirely by Building 5.

If future conditions allow for the return of natural habitat at Exposure Unit 2, then potential ecological risk may be present for the noted COPECs. To support such a future condition, potential risk to terrestrial wildlife from exposures to lead in the northern portion of Building 5 and thallium at one location in Exposure Unit 2 could be evaluated further. It is unlikely that 1,4-dioxane represents a significant source of ecological risk to terrestrial receptors because the HQ values are low, this compound is unlikely to persist in soil, and it was only reported in 1 of 76 soil samples collected at Exposure Unit 2, indicating that it is not widespread. The VOCs other than n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and 1,2,4-trimethylbenzene are not likely to represent actual ecological risk because the HQs did not exceed 1, the HI was low (HI 4), and many VOCs were rarely reported at concentrations above detection limits (less than 5 percent frequency of detection).

6.2.3.3 EXPOSURE UNIT 3 SOIL

Potential ecological risk to terrestrial receptors at Exposure Unit 3 was indicated for several VOCs, two phthalate compounds, cadmium, chromium, and cyanide. The risk assessment conservatively assumed that ecological receptors were present at the site and could be exposed to the soil COPECs. It is unlikely under existing conditions that ecological receptors are present at the site or would be exposed to the soil COPECs because most of Exposure Unit 3 is covered by pavement or buildings (95 percent). The remaining area is landscaped, which offers little habitat value.

If future conditions allow for the return of natural habitat at Exposure Unit 3, then potential ecological risk may be present for the noted COPECs. To support such a future condition, potential risk to terrestrial wildlife from exposures to VOCs, cadmium, chromium, and cyanide could be evaluated further. It is unlikely that the phthalate compounds represent a significant source of ecological risk to terrestrial receptors because the HQ values are low.

6.2.3.4 SHALLOWER FWBZ GROUNDWATER

Potential ecological risk to aquatic life receptors for the shallower FWBZ was indicated for iron and silver. The risk assessment conservatively assumed that aquatic life receptors were exposed to the groundwater COPECs at concentrations represented by the maximum value in the refined data set. It is unlikely under existing conditions that these concentrations are present in the bay since attenuation during groundwater transport and mixing of groundwater and bay water would likely reduce the concentrations.

It is unlikely that iron represents a significant source of ecological risk to aquatic receptors because the HQ value is low (near the background level) and there are uncertainties associated with the TRV based on using a freshwater benchmark as a surrogate for a saltwater benchmark. Only one of the four reported iron concentrations in the refined data set exceeded the TRV. Additionally, iron concentrations are considered ambient.

Silver may not represent a significant source of ecological risk to aquatic receptors because the HQ value is low and because of the uncertainties associated with the TRV

based on using the acute criterion (the criteria maximum concentration [CMC]) with an uncertainty factor as a surrogate for a chronic TRV. Silver concentrations did not exceed the acute criterion. Additionally, silver concentrations are considered ambient.

6.2.3.5 DEEPER FWBZ GROUNDWATER

Potential ecological risk to aquatic life receptors for the deeper FWBZ was indicated for nickel, silver, and thallium. The risk assessment conservatively assumed that aquatic life receptors were exposed to the groundwater COPECs at concentrations represented by the maximum value in the refined data set. It is unlikely under existing conditions that these concentrations are present in the bay since attenuation during groundwater transport and mixing of groundwater and bay water would likely reduce the concentrations.

It is unlikely that nickel represents a significant source of ecological risk to aquatic receptors because the HQ value is low, and all but one value were below the detection limit and the TRV. Additionally, nickel concentrations in the refined data set are considered ambient.

Silver may not represent a significant source of ecological risk to aquatic receptors since the HQ value is low and because of the uncertainties associated with the TRV based on using the acute criterion (the CMC) with an uncertainty factor as a surrogate for a chronic TRV. All but one result value were lower than the acute criterion; most were lower than the detection limit. Additionally, silver concentrations are considered ambient.

It is unlikely that thallium represents a significant source of ecological risk to aquatic receptors because the HQ value is low (near the background level) and there are uncertainties associated with the TRV based on using a LD50 value with an uncertainty factor as a surrogate for a chronic TRV. All but one result value were lower than the background threshold value; most were lower than the detection limit. Additionally, thallium concentrations are considered ambient.

6.2.3.6 SWBZ GROUNDWATER

Potential ecological risk to aquatic life receptors for the SWBZ was indicated for manganese, nickel, and silver. The risk assessment conservatively assumed that aquatic life receptors were exposed to the groundwater COPECs at concentrations represented by the maximum value in the refined data set. It is unlikely under existing conditions that these concentrations are present in the bay since attenuation during groundwater transport and mixing of groundwater and bay water would likely reduce the concentrations.

It is unlikely that manganese represents a significant source of ecological risk to aquatic receptors because the HQ value is low and there are uncertainties associated with the TRV based on using a no effect concentration with an uncertainty factor as a surrogate for a chronic TRV. However, all of the reported concentrations exceed the TRV. Additionally, manganese concentrations are considered ambient.

It is unlikely that nickel represents a significant source of ecological risk to aquatic receptors because the HQ value is low. All of the reported concentrations exceed the TRV; however, nickel concentrations are considered ambient.

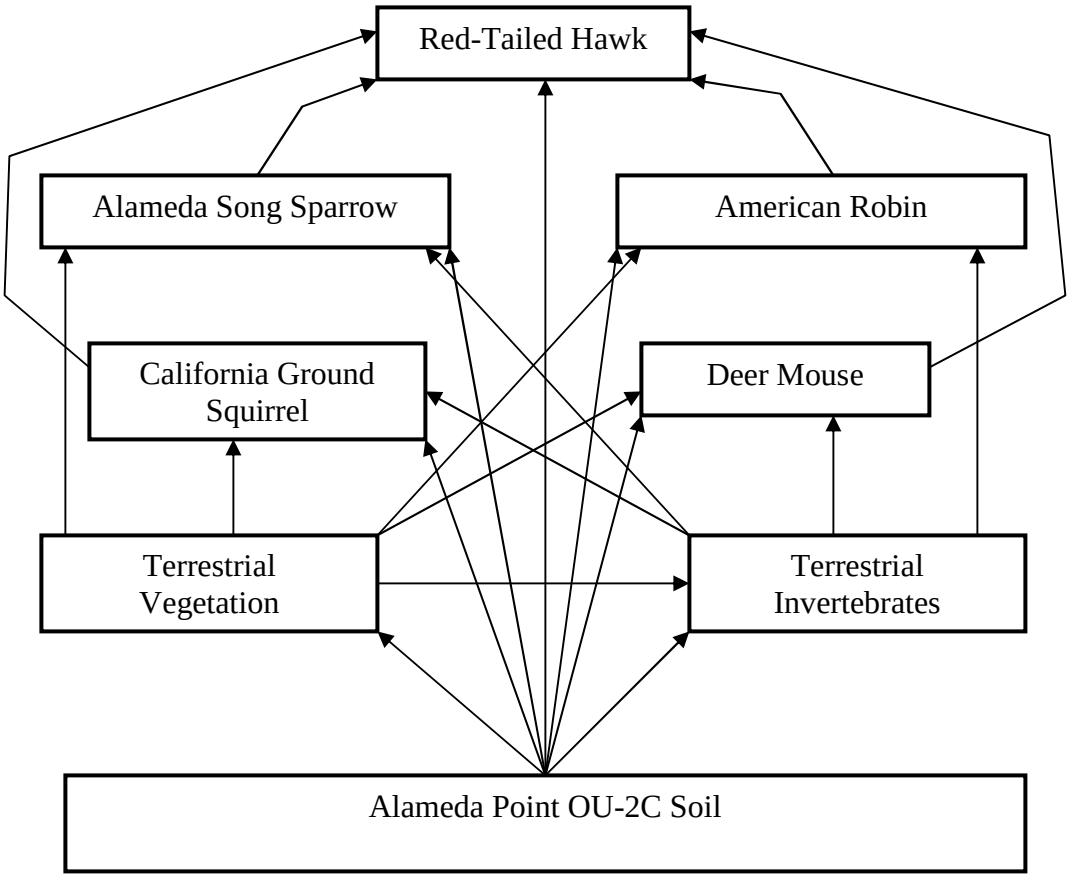
Silver may not represent a significant source of ecological risk to aquatic receptors because of the uncertainties associated with the TRV based on using the acute criterion (the CMC) with an uncertainty factor as a surrogate for a chronic TRV. Three of the five concentrations reported above the detection limit were also greater than the acute criterion; however, silver concentrations are considered ambient.

6.2.4 Ecological Risk Assessment Conclusions and Recommendations

Most exposure and toxicity assumptions and estimates used in this screening-level ERA are intentionally conservative; therefore, the risk assessment likely overestimates rather than underestimates the potential hazard for ecological receptors. For the exposure estimate of Step 3a, the COPEC concentrations and wildlife exposure factors were refined to represent more realistic, site-specific conditions. The refined risk estimate is also expected to overestimate the risk yet include some site-specific estimates.

Potential ecological risk to terrestrial receptors at the exposure units of OU-2C (Exposure Unit 1, Exposure Unit 2, and Exposure Unit 3) was indicated for several soil COPECs. Under existing conditions, it is unlikely that ecological receptors are present at the site or would be exposed to the COPECs in soil since most of the exposure units are covered by pavement or buildings and most of the remaining area is landscaped, which offers little habitat value. If future conditions allow for the return of natural habitat at OU-2C, which is unlikely, then potential ecological risk might be present for the noted COPECs. If such future conditions were to be present at the site, the potential risk to terrestrial wildlife from exposures to soil COPECs could be further evaluated.

Potential ecological risk to aquatic receptors for OU-2C groundwater was indicated for iron, manganese, nickel, silver, and thallium. The risk assessment conservatively assumed that aquatic receptors were exposed to the groundwater COPECs at concentrations represented by the maximum value in the refined data set. However, it is unlikely under existing conditions that these concentrations are present in the bay since attenuation during groundwater transport and mixing of groundwater and bay water would likely reduce the concentrations. COPEC concentrations in the shallower FWBZ and deeper FWBZ are unlikely to represent significant ecological risk due to low HQ values, similarity to background values, uncertainties associated with TRVs, and few reported concentrations above both the detection limits and the TRVs. COPEC concentrations (manganese, nickel, and silver) in the SWBZ exceeded the detection limits and the TRVs, but these COPECs may not represent existing ecological risk due to uncertainties of the TRVs and uncertainties in groundwater flow direction in the SWBZ. Additionally, all of the metal concentrations in the refined groundwater data set are considered ambient. No further evaluation of groundwater is recommended for ecological risk, due to the distance to the shoreline (approximately 1,000 feet), the uncertainties of the risk estimates, and because metals concentrations are considered ambient.



Remedial Investigation Report for OU-2C

Figure 6-6

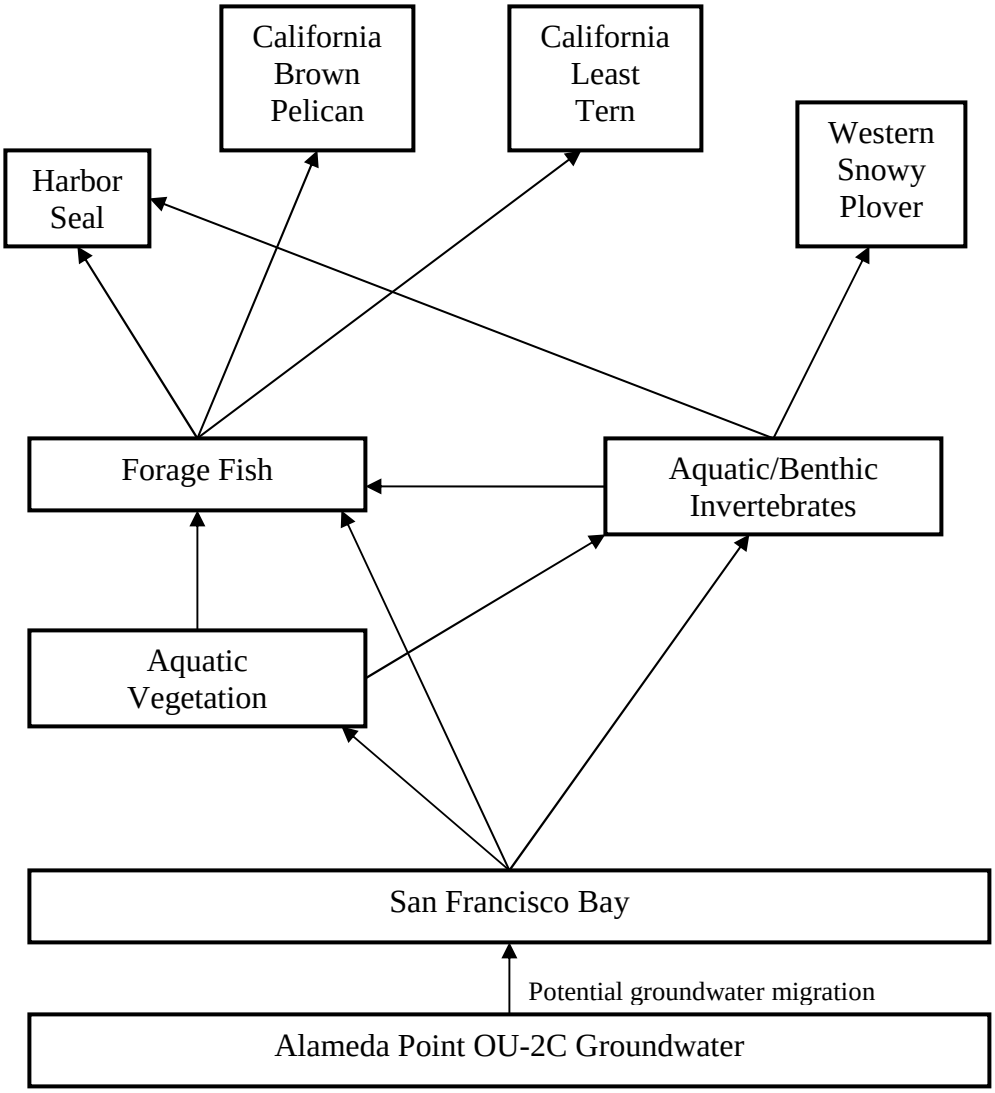
Conceptual Site Model and Representative Ecological Receptors for Soil-Based Evaluation

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 4/14/08
File No. RI_FIG6-6.doc
Job No. 23818-093
Rev. No. B



Remedial Investigation Report for OU-2C

Figure 6-7

Conceptual Site Model and Representative Ecological Receptors for Groundwater-Based Evaluation

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 4/14/08
File No. RI_FIG6-7.doc
Job No. 23818-093
Rev. No. B

Table 6-8
Soil Chemicals of Potential Ecological Concern
Exposure Unit 1

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Volatile Organic Compounds[a]									
acetone	60/210	3.40E-03	8.00E-02	2.46E-02	2.11E-02	3.09E-02	3.09E-02	NA	NA
benzene	17/274	6.50E-04	6.00E+00	6.74E-02	5.93E-01	2.91E-01	2.91E-01	NA	NA
2-butanone	32/223	9.70E-04	8.40E-03	2.40E-02	2.28E-02	3.35E-02	8.40E-03	NA	NA
carbon disulfide	22/210	1.10E-03	1.30E-02	2.61E-02	2.37E-02	3.63E-02	1.30E-02	NA	NA
chlorobenzene	26/210	5.50E-04	5.00E-03	3.40E-03	1.55E-03	3.58E-03	3.58E-03	NA	NA
chloroform	1/210	1.00E-03	1.00E-03	3.50E-03	1.41E-03	3.67E-03	1.00E-03	NA	NA
chloromethane	2/210	2.60E-03	4.90E-03	5.04E-03	9.10E-04	5.14E-03	4.90E-03	NA	NA
1,1-dichloroethene	1/223	3.00E-03	3.00E-03	3.60E-03	1.40E-03	3.76E-03	3.00E-03	NA	NA
cis-1,2-dichloroethene	9/151	5.20E-04	3.50E-02	3.47E-03	3.65E-03	3.96E-03	3.96E-03	NA	NA
trans-1,2-dichloroethene	4/169	3.90E-04	1.70E-03	2.88E-03	8.20E-04	2.98E-03	1.70E-03	NA	NA
ethylbenzene	7/274	1.30E-03	6.90E-01	4.19E-02	2.98E-01	1.55E-01	1.55E-01	NA	NA
2-hexanone	16/210	5.60E-04	2.00E-03	8.80E-03	5.35E-03	1.04E-02	2.00E-03	NA	NA
4-methyl-2-pentanone	69/210	9.90E-04	1.00E-02	7.09E-03	5.79E-03	8.84E-03	8.84E-03	NA	NA
methylene chloride	19/223	5.00E-04	4.30E-02	1.64E-02	1.18E-02	2.14E-02	2.14E-02	NA	NA
tetrachloroethene	29/223	5.90E-04	2.00E+00	1.30E-02	1.34E-01	5.20E-02	5.20E-02	NA	NA
toluene	54/273	6.70E-04	6.00E+00	6.92E-02	5.95E-01	2.94E-01	2.94E-01	NA	NA
trichloroethene	13/223	2.30E-03	1.30E+00	1.03E-02	8.70E-02	3.57E-02	3.57E-02	NA	NA
1,2,4-trimethylbenzene	1/131	1.50E-03	1.50E-03	9.68E-03	2.90E-03	1.01E-02	1.50E-03	NA	NA
m-, p-xylene (mixed)	6/136	5.00E-04	2.20E-02	3.60E-03	2.86E-03	4.67E-03	4.67E-03	NA	NA
xylenes, total	8/141	1.60E-02	3.10E+00	9.44E-02	4.85E-01	3.50E-01	3.50E-01	NA	NA

Table 6-8 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Semivolatile Organic Compounds[a]									
bis(2-ethylhexyl)phthalate	15/180	2.00E-02	7.80E-01	1.54E-01	1.24E-01	1.95E-01	1.95E-01	NA	NA
butylbenzyl phthalate	2/180	1.80E-02	2.00E-02	1.56E-01	1.09E-01	1.91E-01	2.00E-02	NA	NA
carbazole	3/144	4.50E-02	3.40E-01	2.77E-01	1.34E-01	3.26E-01	3.26E-01	NA	NA
4-chloro-3-methylphenol	1/180	3.00E-02	3.00E-02	1.64E-01	1.31E-01	2.06E-01	3.00E-02	NA	NA
dibenzofuran	1/180	1.20E-01	1.20E-01	1.61E-01	1.17E-01	1.99E-01	1.20E-01	NA	NA
di-n-butyl phthalate	20/180	2.30E-02	1.10E-01	1.39E-01	1.06E-01	1.73E-01	1.10E-01	NA	NA
diethyl phthalate	4/180	2.00E-02	2.50E-02	1.49E-01	1.03E-01	1.83E-01	2.50E-02	NA	NA
dimethyl phthalate	1/180	4.40E-02	4.40E-02	1.52E-01	1.02E-01	1.85E-01	4.40E-02	NA	NA
hexachlorobutadiene	2/222	8.40E-04	3.70E-03	8.43E-02	1.28E-01	1.38E-01	3.70E-03	NA	NA
N-nitroso-di-n-propylamine	1/180	2.30E-02	2.30E-02	1.56E-01	1.09E-01	1.91E-01	2.30E-02	NA	NA
phenol	2/180	2.70E+00	2.80E+00	1.93E-01	3.01E-01	2.91E-01	2.91E-01	NA	NA
Polycyclic Aromatic Hydrocarbons[a]									
acenaphthene	69/436	2.00E-04	1.80E-01	4.07E-03	1.01E-02	6.18E-03	6.18E-03	NA	NA
acenaphthylene	113/436	2.00E-04	2.80E-01	4.55E-03	1.50E-02	7.68E-03	7.68E-03	NA	NA
anthracene	150/436	2.00E-04	7.20E-01	6.06E-03	3.60E-02	1.68E-02	1.68E-02	NA	NA
benzo(a)anthracene	248/436	2.00E-04	1.20E+00	1.58E-02	7.35E-02	3.77E-02	3.77E-02	NA	NA
benzo(b)fluoranthene	325/436	2.00E-04	1.00E+00	1.89E-02	7.80E-02	4.22E-02	4.22E-02	NA	NA
benzo(k)fluoranthene	247/436	2.00E-04	9.70E-01	1.43E-02	6.36E-02	3.33E-02	3.33E-02	NA	NA
benzo(g,h,i)perylene	308/436	1.00E-04	1.20E+00	2.27E-02	8.79E-02	4.90E-02	4.90E-02	NA	NA
benzo(a)pyrene	306/436	2.00E-04	1.50E+00	2.30E-02	1.04E-01	5.40E-02	5.40E-02	NA	NA
chrysene	302/436	2.00E-04	1.50E+00	2.08E-02	9.21E-02	4.83E-02	4.83E-02	NA	NA
dibenz(a,h)anthracene	174/436	2.00E-04	1.80E-01	5.11E-03	1.30E-02	9.00E-03	9.00E-03	NA	NA
fluoranthene	292/436	2.00E-04	3.80E+00	3.42E-02	2.15E-01	9.86E-02	9.86E-02	NA	NA
fluorene	88/436	2.00E-04	2.50E-01	4.47E-03	1.39E-02	7.36E-03	7.36E-03	NA	NA
indeno(1,2,3-cd)pyrene	259/436	2.00E-04	1.20E+00	2.10E-02	9.00E-02	4.79E-02	4.79E-02	NA	NA
2-methylnaphthalene	149/436	2.00E-04	4.20E-01	5.26E-03	2.88E-02	1.39E-02	1.39E-02	NA	NA
naphthalene	223/448	2.00E-04	5.40E-01	5.87E-03	3.49E-02	1.62E-02	1.62E-02	NA	NA
phenanthrene	288/436	2.00E-04	4.10E+00	2.32E-02	2.13E-01	8.68E-02	8.68E-02	NA	NA
pyrene	325/436	1.00E-04	4.30E+00	4.28E-02	2.48E-01	1.17E-01	1.17E-01	NA	NA

Table 6-8 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Pesticides									
aldrin	2/32	6.10E-03	8.30E-03	1.75E-03	1.51E-03	2.91E-03	2.91E-03	NA	NA
beta-BHC	1/32	1.50E-03	1.50E-03	1.42E-03	3.97E-04	1.54E-03	1.50E-03	NA	NA
delta-BHC	1/32	2.80E-03	2.80E-03	1.46E-03	4.66E-04	1.60E-03	1.60E-03	NA	NA
alpha-chlordane	1/32	1.80E-03	1.80E-03	1.43E-03	4.02E-04	1.55E-03	1.55E-03	NA	NA
gamma-chlordane	1/32	2.30E-03	2.30E-03	1.45E-03	4.26E-04	1.57E-03	1.57E-03	NA	NA
4,4'-DDT	2/32	2.60E-03	3.90E-03	2.88E-03	8.22E-04	3.12E-03	3.12E-03	NA	NA
endrin aldehyde	1/14	3.60E-03	3.60E-03	1.97E-03	4.75E-04	2.20E-03	2.20E-03	NA	NA
heptachlor	1/32	1.70E-03	1.70E-03	1.43E-03	3.99E-04	1.55E-03	1.55E-03	NA	NA
Polychlorinated Biphenyls									
Aroclor 1260	2/128	1.50E-02	5.10E-02	4.45E-02	1.76E-02	5.13E-02	5.10E-02	NA	NA
Metals									
aluminum	178/179	2.99E+03	2.99E+04	6.30E+03	4.66E+03	7.82E+03	7.82E+03	1.40E+04	> Bkgd[b]
antimony	37/184	2.60E-01	7.40E+00	1.42E+00	2.88E+00	2.75E+00	2.75E+00	9.50E+00	< Bkgd
arsenic	144/194	7.04E-01	1.12E+01	2.12E+00	1.94E+00	2.72E+00	2.72E+00	9.14E+00	> Bkgd[b]
barium	181/182	1.81E+01	6.24E+02	4.92E+01	5.30E+01	6.63E+01	6.63E+01	9.37E+01	> Bkgd[b]
beryllium	131/192	6.10E-02	2.29E+00	8.86E-01	2.74E+00	2.12E+00	2.12E+00	1.27E+00	> Bkgd[b]
cadmium	71/204	3.10E-02	3.00E+00	8.54E-01	2.67E+00	2.02E+00	2.02E+00	1.72E+00	> Bkgd[b]
chromium	196/204	4.20E+00	7.55E+01	2.73E+01	1.00E+01	2.85E+01	2.85E+01	5.48E+01	> Bkgd[b]
cobalt	178/182	3.10E+00	1.80E+02	8.93E+00	1.60E+01	1.41E+01	1.41E+01	1.43E+01	> Bkgd[b]
copper	193/204	3.00E+00	1.05E+02	1.27E+01	1.65E+01	1.77E+01	1.77E+01	3.91E+01	> Bkgd[b]
iron	191/191	1.70E+00	5.02E+04	1.23E+04	7.25E+03	1.46E+04	1.46E+04	2.23E+04	> Bkgd[b]
lead	193/212	1.00E+00	1.16E+02	6.49E+00	1.14E+01	9.89E+00	9.89E+00	3.77E+01	> Bkgd[b]
manganese	178/179	6.30E+01	1.42E+03	1.76E+02	1.84E+02	2.35E+02	2.35E+02	3.83E+02	> Bkgd[b]
mercury	51/204	1.80E-02	1.90E+00	6.92E-01	2.69E+00	1.87E+00	1.87E+00	5.20E-01	> Bkgd[b]
molybdenum	2/39	8.20E-01	1.10E+00	7.73E-01	4.79E-01	1.11E+00	1.10E+00	5.20E+00	< Bkgd
nickel	203/204	2.70E+00	9.30E+01	2.60E+01	1.12E+01	2.94E+01	2.94E+01	5.57E+01	> Bkgd[b]
selenium	54/182	2.80E-01	2.50E+00	4.65E-01	4.45E-01	6.09E-01	6.09E-01	1.78E+00	> Bkgd[b]

Table 6-8 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Metals (continued)									
silver	80/204	7.00E-02	2.36E+01	2.04E+00	3.74E+00	3.68E+00	3.68E+00	2.22E+00	> Bkgd[b]
thallium	29/182	2.30E-01	5.50E+00	9.01E-01	8.45E-01	1.29E+00	1.29E+00	5.00E-01	> Bkgd[b]
vanadium	181/182	1.37E+01	1.12E+02	2.57E+01	1.57E+01	2.76E+01	2.76E+01	4.73E+01	> Bkgd[b]
zinc	200/204	1.18E+01	1.04E+02	2.54E+01	1.55E+01	3.02E+01	3.02E+01	6.75E+01	> Bkgd[b]

Notes:
[a] organic compounds are grouped into categories according to toxicity assessment protocols used in the ecological risk assessment
[b] concentrations considered ambient, based on further evaluation (statistical analysis, detection frequency, and lateral distribution)

Acronyms/Abbreviations:
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data
< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern (for soil 0 to 6 feet below ground surface)
DDT – dichlorodiphenytrichloroethane
EPC – exposure point concentration
mg/kg – milligrams per kilogram
NA – not available
UCL – upper confidence level

Table 6-9
Soil Chemicals of Potential Ecological Concern
Exposure Unit 2
(milligrams per kilogram)

COPEC	Frequency of Detection	Minimum Detection	Maximum Detection	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Volatile Organic Compounds[a]									
acetone	85/217	4.10E-03	2.40E-01	3.83E-02	2.91E-02	4.69E-02	4.69E-02	NA	NA
benzene	29/216	6.90E-04	2.40E-03	2.81E-03	1.24E-03	2.95E-03	2.40E-03	NA	NA
bromochloromethane	5/185	1.20E-03	3.40E-03	2.63E-03	2.91E-04	2.66E-03	2.66E-03	NA	NA
bromomethane	14/216	1.90E-03	4.00E-02	5.76E-03	4.47E-03	6.26E-03	6.26E-03	NA	NA
2-butanone	95/216	7.70E-04	1.80E-02	2.30E-02	2.30E-02	3.27E-02	1.80E-02	NA	NA
n-butylbenzene	2/185	8.50E-04	4.10E-03	1.02E-02	1.36E-03	1.03E-02	4.10E-03	NA	NA
sec-butylbenzene	1/185	3.40E-03	3.40E-03	1.02E-02	1.19E-03	1.04E-02	3.40E-03	NA	NA
tert-butylbenzene	1/185	8.40E-03	8.40E-03	1.02E-02	1.09E-03	1.04E-02	8.40E-03	NA	NA
carbon disulfide	35/216	1.10E-03	1.10E-02	3.59E-02	2.14E-02	4.50E-02	1.10E-02	NA	NA
chlorobenzene	12/216	5.80E-04	3.00E-03	2.96E-03	1.10E-03	3.09E-03	3.00E-03	NA	NA
chloromethane	10/216	2.00E-03	4.80E-02	5.39E-03	3.22E-03	5.76E-03	5.76E-03	NA	NA
1,2-dichlorobenzene	2/228	6.90E-04	1.40E-03	3.54E-02	6.89E-02	6.39E-02	1.40E-03	NA	NA
1,3-dichlorobenzene	1/228	8.10E-04	8.10E-04	3.54E-02	6.89E-02	6.39E-02	8.10E-04	NA	NA
1,4-dichlorobenzene	1/228	2.60E-03	2.60E-03	3.54E-02	6.89E-02	6.40E-02	2.60E-03	NA	NA
1,1-dichloroethane	13/216	6.00E-04	6.20E-03	2.96E-03	1.10E-03	3.09E-03	3.09E-03	NA	NA
1,1-dichloroethene	3/216	2.50E-03	2.80E-03	3.03E-03	1.01E-03	3.15E-03	2.80E-03	NA	NA
cis-1,2-dichloroethene	4/185	3.50E-04	1.50E-03	2.60E-03	3.55E-04	2.64E-03	1.50E-03	NA	NA
trans-1,2-dichloroethene	1/185	4.00E-04	4.00E-04	2.63E-03	2.85E-04	2.67E-03	4.00E-04	NA	NA
1,2-dichloropropane	1/216	3.90E-03	3.90E-03	3.04E-03	1.02E-03	3.16E-03	3.16E-03	NA	NA
ethylbenzene	4/216	9.70E-04	2.10E-02	9.43E-03	2.28E-03	9.69E-03	9.69E-03	NA	NA
2-hexanone	16/216	4.60E-04	3.70E-02	9.08E-03	3.32E-03	1.01E-02	1.01E-02	NA	NA
isopropylbenzene	1/185	8.90E-03	8.90E-03	1.02E-02	1.08E-03	1.04E-02	8.90E-03	NA	NA
p-isopropyltoluene	3/185	6.00E-04	5.60E-03	2.63E-03	3.80E-04	2.68E-03	2.68E-03	NA	NA
methyl tert-butyl ether	1/185	1.20E-03	1.20E-03	2.10E-02	2.60E-03	2.13E-02	1.20E-03	NA	NA
4-methyl-2-pentanone	20/216	1.00E-03	3.50E-02	8.95E-03	3.49E-03	9.99E-03	9.99E-03	NA	NA
methylene chloride	5/217	7.20E-03	6.00E-02	2.38E-02	8.49E-03	2.63E-02	2.63E-02	NA	NA
n-propylbenzene	2/185	1.60E-03	9.80E-03	2.67E-03	5.80E-04	2.74E-03	2.74E-03	NA	NA

Table 6-9 (continued)

COPEC	Frequency of Detection	Minimum Detection	Maximum Detection	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Volatile Organic Compounds[a] (continued)									
tetrachloroethene	5/216	6.00E-04	1.30E-01	3.62E-03	8.71E-03	4.59E-03	4.59E-03	NA	NA
toluene	33/216	7.20E-04	2.70E-02	3.07E-03	2.33E-03	3.33E-03	3.33E-03	NA	NA
1,2,3-trichlorobenzene	2/185	2.40E-03	4.50E-03	1.02E-02	1.34E-03	1.04E-02	4.50E-03	NA	NA
1,2,4-trichlorobenzene	3/228	1.10E-03	3.50E-03	4.16E-02	6.60E-02	6.89E-02	3.50E-03	NA	NA
1,1,1-trichloroethane	14/216	4.60E-04	5.50E-02	3.38E-03	3.98E-03	3.83E-03	3.83E-03	NA	NA
trichloroethene	31/216	1.10E-03	8.90E-02	3.82E-03	7.77E-03	4.69E-03	4.69E-03	NA	NA
1,2,4-trimethylbenzene	4/185	1.80E-03	6.70E-02	1.05E-02	4.40E-03	1.10E-02	1.10E-02	NA	NA
1,3,5-trimethylbenzene	3/185	1.60E-03	2.10E-02	1.02E-02	1.56E-03	1.04E-02	1.04E-02	NA	NA
m-, p-xylene (mixed)	12/185	4.60E-04	9.80E-02	3.12E-03	7.04E-03	3.97E-03	3.97E-03	NA	NA
o-xylene	7/185	9.30E-04	4.80E-02	2.85E-03	3.35E-03	3.26E-03	3.26E-03	NA	NA
Semivolatile Organic Compounds[a]									
bis(2-ethylhexyl)phthalate	8/119	1.90E-02	1.30E-01	1.57E-01	3.71E-02	1.63E-01	1.30E-01	NA	NA
butylbenzyl phthalate	11/119	1.90E-02	3.50E-02	1.51E-01	4.57E-02	1.69E-01	3.50E-02	NA	NA
4-chloro-3-methylphenol	3/119	2.10E-02	4.00E-02	1.61E-01	2.96E-02	1.66E-01	4.00E-02	NA	NA
2-chlorophenol	1/119	2.90E-02	2.90E-02	1.64E-01	2.43E-02	1.68E-01	2.90E-02	NA	NA
diethyl phthalate	2/119	1.80E-02	1.90E-02	1.62E-01	2.92E-02	1.67E-01	1.90E-02	NA	NA
1,4-dioxane	1/76	3.10E-02	3.10E-02	5.46E+00	7.58E-01	5.84E+00	3.10E-02	NA	NA
N-nitroso-di-n-propylamine	1/119	2.30E-02	2.30E-02	1.64E-01	2.53E-02	1.68E-01	2.30E-02	NA	NA
pentachlorophenol	1/118	3.70E-02	3.70E-02	8.20E-01	3.19E-01	9.48E-01	3.70E-02	NA	NA
phenol	2/119	3.20E-02	3.50E-02	1.63E-01	2.69E-02	1.67E-01	3.50E-02	NA	NA
Polycyclic Aromatic Hydrocarbons[a]									
acenaphthene	1/59	2.90E-03	2.90E-03	4.93E-03	1.72E-02	1.47E-02	2.90E-03	NA	NA
acenaphthylene	2/59	3.80E-03	8.00E-03	5.03E-03	1.72E-02	1.48E-02	8.00E-03	NA	NA
anthracene	3/59	1.20E-03	1.00E-02	5.04E-03	1.72E-02	1.48E-02	1.00E-02	NA	NA
benzo(a)anthracene	15/59	2.40E-03	7.40E-02	6.72E-03	1.95E-02	1.78E-02	1.78E-02	NA	NA
benzo(b)fluoranthene	26/59	1.70E-03	8.70E-02	8.14E-03	2.04E-02	1.97E-02	1.97E-02	NA	NA
benzo(k)fluoranthene	20/59	1.90E-03	2.10E-02	6.02E-03	1.73E-02	1.59E-02	1.59E-02	NA	NA
benzo(g,h,i)perylene	27/59	1.70E-03	2.50E-01	9.54E-03	3.33E-02	2.84E-02	2.84E-02	NA	NA
benzo(a)pyrene	24/59	2.10E-03	9.50E-02	7.69E-03	2.10E-02	1.96E-02	1.96E-02	NA	NA
chrysene	19/59	1.70E-03	7.90E-02	7.10E-03	1.99E-02	1.84E-02	1.84E-02	NA	NA
dibenz(a,h)anthracene	2/59	4.20E-03	1.10E-02	5.09E-03	1.72E-02	1.49E-02	1.10E-02	NA	NA

Table 6-9 (continued)

COPEC	Frequency of Detection	Minimum Detection	Maximum Detection	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Polycyclic Aromatic Hydrocarbons[a] (continued)									
fluoranthene	21/59	2.40E-03	1.70E-01	1.02E-02	2.87E-02	2.65E-02	2.65E-02	NA	NA
fluorene	1/59	1.90E-03	1.90E-03	4.91E-03	1.72E-02	1.47E-02	1.90E-03	NA	NA
indeno(1,2,3-cd)pyrene	13/59	2.10E-03	5.60E-02	6.38E-03	1.85E-02	1.69E-02	1.69E-02	NA	NA
2-methylnaphthalene	4/59	1.20E-03	2.90E-03	4.87E-03	1.72E-02	1.47E-02	2.90E-03	NA	NA
naphthalene	2/59	2.50E-03	8.60E-03	5.02E-03	1.72E-02	1.48E-02	8.60E-03	NA	NA
phenanthrene	9/59	2.60E-03	4.80E-02	6.56E-03	1.85E-02	1.71E-02	1.71E-02	NA	NA
pyrene	29/59	1.60E-03	1.50E-01	1.03E-02	2.65E-02	2.53E-02	2.53E-02	NA	NA
Polychlorinated Biphenyls									
Aroclor 1260	1/59	7.20E-02	7.20E-02	4.19E-01	2.79E+00	2.00E+00	7.20E-02	NA	NA
Metals									
aluminum	200/200	2.08E+03	2.90E+04	6.00E+03	3.67E+03	6.43E+03	6.43E+03	1.40E+04	> Bkgd[b]
antimony	28/190	2.40E-01	2.07E+01	5.92E-01	1.72E+00	1.14E+00	1.14E+00	9.50E+00	> Bkgd[b]
arsenic	135/200	7.40E-01	3.29E+02	3.71E+00	2.32E+01	1.40E+01	1.40E+01	9.14E+00	> Bkgd
barium	200/200	6.60E+00	7.58E+02	3.84E+01	5.39E+01	5.50E+01	5.50E+01	9.37E+01	> Bkgd[b]
beryllium	153/200	5.60E-02	1.50E+00	2.94E-01	2.87E-01	3.83E-01	3.83E-01	1.27E+00	> Bkgd[b]
cadmium	63/223	2.90E-02	1.02E+01	4.62E-01	1.26E+00	9.90E-01	9.90E-01	1.72E+00	> Bkgd
chromium	209/209	5.70E-01	2.95E+02	2.94E+01	2.88E+01	3.80E+01	3.80E+01	5.48E+01	> Bkgd
chromium, hexavalent	12/54	5.90E-02	7.80E-01	1.39E-01	1.37E-01	1.70E-01	1.70E-01	NA	NA
cobalt	200/200	2.10E+00	8.87E+01	9.09E+00	1.23E+01	1.29E+01	1.29E+01	1.43E+01	> Bkgd[b]
copper	197/200	7.70E-01	1.38E+02	1.24E+01	1.78E+01	1.79E+01	1.79E+01	3.91E+01	> Bkgd[b]
iron	200/200	5.29E+03	5.28E+04	1.41E+04	9.34E+03	1.70E+04	1.70E+04	2.23E+04	> Bkgd[b]
lead	207/209	1.50E-01	4.31E+03	9.88E+01	4.17E+02	2.79E+02	2.79E+02	3.77E+01	> Bkgd
manganese	200/200	5.23E+01	1.19E+03	1.83E+02	1.62E+02	2.33E+02	2.33E+02	3.83E+02	> Bkgd[b]
mercury	56/200	1.80E-02	1.89E+01	1.89E-01	1.39E+00	6.17E-01	6.17E-01	5.20E-01	> Bkgd[b]
molybdenum	3/42	2.60E+00	1.13E+01	1.53E+00	1.64E+00	1.95E+00	1.95E+00	5.20E+00	> Bkgd[b]
nickel	200/200	1.00E+00	9.86E+01	2.37E+01	1.29E+01	2.77E+01	2.77E+01	5.57E+01	> Bkgd[b]
selenium	99/200	2.70E-01	3.20E+02	2.30E+00	2.26E+01	9.27E+00	9.27E+00	1.78E+00	> Bkgd[b]
silver	66/200	4.20E-02	1.56E+01	1.42E+00	2.92E+00	2.71E+00	2.71E+00	2.22E+00	> Bkgd[b]
thallium	27/200	3.10E-01	3.35E+02	2.85E+00	2.36E+01	1.01E+01	1.01E+01	5.00E-01	> Bkgd
vanadium	200/200	1.07E+01	1.59E+02	2.78E+01	2.14E+01	3.44E+01	3.44E+01	4.73E+01	> Bkgd[b]
zinc	200/200	7.80E+00	6.99E+02	3.15E+01	6.83E+01	5.25E+01	5.25E+01	6.75E+01	> Bkgd[b]

Table 6-9 (continued)

Notes:

[a] organic compounds are grouped into categories according to toxicity assessment protocols used in the ecological risk assessment

[b] concentrations considered ambient, based on further evaluation (statistical analysis, detection frequency, and lateral distribution)

Acronyms/Abbreviations:

> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data

< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data

COPEC – chemical of potential ecological concern (for soil 0 to 6 feet below ground surface)

EPC – exposure point concentration

mg/kg – milligrams per kilogram

NA – not available

UCL – upper confidence level

Table 6-10
Soil Chemicals of Potential Ecological Concern
Exposure Unit 3
(milligrams per kilogram)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Volatile Organic Compounds[a]									
acetone	64/146	3.30E-03	1.60E-01	1.87E-01	7.51E-01	5.75E-01	1.60E-01	NA	NA
benzene	18/178	6.90E-04	6.10E-02	1.49E-01	7.08E-01	4.80E-01	6.10E-02	NA	NA
2-butanone	31/149	1.10E-03	1.20E+00	1.91E-01	7.54E-01	5.77E-01	5.77E-01	NA	NA
n-butylbenzene	4/111	7.00E-04	7.70E+01	1.09E+00	7.82E+00	5.73E+00	5.73E+00	NA	NA
sec-butylbenzene	8/111	3.80E-03	5.90E+01	8.75E-01	6.03E+00	4.45E+00	4.45E+00	NA	NA
tert-butylbenzene	2/100	8.90E-01	1.00E+01	1.20E-01	1.00E+00	5.56E-01	5.56E-01	NA	NA
carbon disulfide	25/146	1.20E-03	1.90E-02	1.79E-01	7.49E-01	5.66E-01	1.90E-02	NA	NA
chlorobenzene	20/159	5.20E-04	1.20E-02	1.49E-01	7.24E-01	5.07E-01	1.20E-02	NA	NA
chloroform	1/157	2.00E-03	2.00E-03	1.44E-01	7.28E-01	5.07E-01	2.00E-03	NA	NA
1,2-dichlorobenzene	7/155	6.70E-04	1.00E+00	8.37E-02	3.47E-01	2.58E-01	2.58E-01	NA	NA
1,4-dichlorobenzene	1/155	4.10E-03	4.10E-03	7.28E-02	3.38E-01	2.42E-01	4.10E-03	NA	NA
1,1-dichloroethane	10/157	8.10E-04	2.00E+01	2.35E-01	1.68E+00	1.07E+00	1.07E+00	NA	NA
1,2-dichloroethane	4/160	3.90E-04	9.60E-03	1.43E-01	7.21E-01	4.99E-01	9.60E-03	NA	NA
1,1-dichloroethene	3/160	3.10E-03	2.60E-01	1.39E-01	7.20E-01	4.94E-01	2.60E-01	NA	NA
1,2-dichloroethylene	5/35	2.00E-03	7.70E+01	3.05E+00	1.32E+01	2.53E+01	2.53E+01	NA	NA
cis-1,2-dichloroethene	11/120	3.00E-04	3.50E-02	4.10E-03	6.40E-03	6.65E-03	6.65E-03	NA	NA
trans-1,2-dichloroethene	1/128	1.60E-03	1.60E-03	6.10E-03	2.97E-02	1.75E-02	1.60E-03	NA	NA
ethylbenzene	12/181	2.40E-03	2.70E+01	5.89E-01	3.29E+00	2.12E+00	2.12E+00	NA	NA
2-hexanone	10/146	4.80E-04	2.60E-01	1.69E-01	7.54E-01	5.58E-01	2.60E-01	NA	NA
isopropylbenzene	6/111	7.10E-03	3.90E+01	4.82E-01	3.80E+00	2.73E+00	2.73E+00	NA	NA
p-isopropyltoluene	11/111	5.80E-04	8.10E+01	1.08E+00	7.88E+00	5.75E+00	5.75E+00	NA	NA
4-methyl-2-pentanone	63/146	1.10E-03	1.00E-02	1.65E-01	7.55E-01	5.55E-01	1.00E-02	NA	NA
methylene chloride	13/160	1.00E-03	1.70E+00	1.64E-01	7.28E-01	5.23E-01	5.23E-01	NA	NA
n-propylbenzene	7/111	1.30E-03	7.70E+01	9.51E-01	7.55E+00	5.43E+00	5.43E+00	NA	NA
tetrachloroethene	38/160	6.60E-04	1.10E+02	1.25E+00	1.02E+01	6.29E+00	6.29E+00	NA	NA
toluene	52/181	7.00E-04	8.40E+01	7.53E-01	6.48E+00	5.54E+00	5.54E+00	NA	NA

Table 6-10 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Volatile Organic Compounds[a] (continued)									
1,2,3-trichlorobenzene	1/111	5.90E-03	5.90E-03	1.03E-02	5.15E-03	1.11E-02	5.90E-03	NA	NA
1,1,1-trichloroethane	16/160	9.30E-04	3.00E+01	3.70E-01	2.53E+00	1.62E+00	1.62E+00	NA	NA
trichloroethene	35/160	1.20E-03	2.60E+02	1.92E+00	2.07E+01	1.21E+01	1.21E+01	NA	NA
1,2,4-trimethylbenzene	9/111	2.30E-03	5.50E+02	6.62E+00	5.34E+01	3.83E+01	3.83E+01	NA	NA
1,3,5-trimethylbenzene	7/111	1.60E-03	1.80E+02	2.16E+00	1.75E+01	1.25E+01	1.25E+01	NA	NA
2,2,4-trimethylpentane	3/100	1.60E-02	2.50E+00	8.97E-02	2.83E-01	2.13E-01	2.13E-01	NA	NA
m-, p-xylene (mixed)	13/105	4.80E-04	1.40E+02	1.60E+00	1.38E+01	9.99E+00	9.99E+00	NA	NA
o-xylene	10/109	6.40E-04	5.00E+01	6.23E-01	4.92E+00	3.56E+00	3.56E+00	NA	NA
xylenes, total	16/78	4.00E-03	2.40E+02	7.17E+00	3.61E+01	4.79E+01	4.79E+01	NA	NA
Semivolatile Organic Compounds[a]									
benzoic acid	1/55	2.90E-01	2.90E-01	1.07E+00	1.49E+00	1.95E+00	2.90E-01	NA	NA
bis(2-ethylhexyl)phthalate	9/82	2.00E-02	4.40E+01	8.82E-01	4.99E+00	4.32E+00	4.32E+00	NA	NA
butylbenzyl phthalate	1/82	2.30E-02	2.30E-02	2.18E-01	4.52E-01	4.36E-01	2.30E-02	NA	NA
carbazole	1/54	1.30E+00	1.30E+00	3.71E-01	5.29E-01	6.85E-01	6.85E-01	NA	NA
4-chloro-3-methylphenol	1/82	1.90E-02	1.90E-02	2.46E-01	4.75E-01	4.75E-01	1.90E-02	NA	NA
dibenzofuran	2/82	2.50E-01	4.40E+00	2.77E-01	6.51E-01	5.91E-01	5.91E-01	NA	NA
di-n-butyl phthalate	3/82	2.50E-02	1.90E-01	2.09E-01	4.44E-01	4.23E-01	1.90E-01	NA	NA
diethyl phthalate	3/82	2.00E-02	1.10E-01	2.06E-01	4.45E-01	4.20E-01	1.10E-01	NA	NA
di-n-octyl phthalate	1/82	1.80E-02	1.80E-02	2.33E-01	4.71E-01	4.60E-01	1.80E-02	NA	NA
4-nitrophenol	2/82	7.70E-02	1.10E-01	1.03E+00	2.15E+00	2.07E+00	1.10E-01	NA	NA
pentachlorophenol	1/82	1.90E-01	1.90E-01	1.04E+00	2.15E+00	2.08E+00	1.90E-01	NA	NA
Polycyclic Aromatic Hydrocarbons[a]									
acenaphthene	19/128	3.00E-04	1.10E-01	5.37E-03	1.24E-02	1.01E-02	1.01E-02	NA	NA
acenaphthylene	24/128	2.00E-04	4.50E-03	3.44E-03	6.23E-03	5.84E-03	4.50E-03	NA	NA
anthracene	43/128	2.00E-04	1.10E-01	4.47E-03	1.15E-02	1.08E-02	1.08E-02	NA	NA
benzo(a)anthracene	98/128	2.00E-04	1.10E-01	4.89E-03	1.22E-02	1.16E-02	1.16E-02	NA	NA
benzo(b)fluoranthene	105/128	3.00E-04	5.60E-02	5.00E-03	9.33E-03	1.02E-02	1.02E-02	NA	NA
benzo(k)fluoranthene	96/128	2.00E-04	5.50E-02	4.24E-03	8.37E-03	8.86E-03	8.86E-03	NA	NA
benzo(g,h,i)perylene	100/128	4.00E-04	4.20E-02	5.88E-03	9.04E-03	1.09E-02	1.09E-02	NA	NA

Table 6-10 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Polycyclic Aromatic Hydrocarbons[a] (continued)									
benzo(a)pyrene	101/128	2.00E-04	6.50E-02	5.27E-03	9.79E-03	1.07E-02	1.07E-02	NA	NA
chrysene	103/128	2.00E-04	9.30E-02	5.86E-03	1.16E-02	1.23E-02	1.23E-02	NA	NA
dibenz(a,h)anthracene	47/128	2.00E-04	8.50E-03	3.32E-03	6.32E-03	5.76E-03	5.76E-03	NA	NA
fluoranthene	102/128	3.00E-04	3.30E-01	8.58E-03	3.02E-02	2.53E-02	2.53E-02	NA	NA
fluorene	21/128	2.00E-04	1.80E-01	7.86E-03	2.20E-02	2.00E-02	2.00E-02	NA	NA
indeno(1,2,3-cd)pyrene	93/128	3.00E-04	3.60E-02	4.76E-03	8.00E-03	7.84E-03	7.84E-03	NA	NA
2-methylnaphthalene	45/128	2.00E-04	1.40E+00	2.44E-02	1.34E-01	9.85E-02	9.85E-02	NA	NA
naphthalene	68/139	2.00E-04	3.50E+00	4.13E-02	3.09E-01	2.05E-01	2.05E-01	NA	NA
phenanthrene	95/128	2.00E-04	4.20E-01	1.30E-02	4.71E-02	3.90E-02	3.90E-02	NA	NA
pyrene	108/128	2.00E-04	2.90E-01	1.00E-02	2.77E-02	1.11E-02	1.11E-02	NA	NA
Polychlorinated Biphenyls									
Aroclor 1260	2/55	1.60E-02	1.40E-01	5.61E-02	1.56E-02	5.96E-02	5.96E-02	NA	NA
Metals									
aluminum	91/91	2.81E+03	2.41E+04	5.62E+03	2.85E+03	6.12E+03	6.12E+03	1.40E+04	> Bkgd[b]
antimony	13/105	4.40E-01	5.20E+00	1.56E+00	2.28E+00	2.95E+00	2.95E+00	9.50E+00	< Bkgd
arsenic	70/102	1.03E+00	1.26E+01	1.51E+00	1.43E+00	2.13E+00	2.13E+00	9.14E+00	> Bkgd[b]
barium	102/102	1.11E+01	1.97E+02	4.33E+01	2.73E+01	4.78E+01	4.78E+01	9.37E+01	> Bkgd[b]
beryllium	72/105	1.10E-01	1.20E+00	6.46E-01	2.05E+00	1.52E+00	1.20E+00	1.27E+00	< Bkgd
cadmium	59/103	1.30E-02	1.52E+01	1.33E+00	3.16E+00	3.27E+00	3.27E+00	1.72E+00	> Bkgd
chromium	102/105	3.50E+00	8.76E+02	5.05E+01	1.00E+02	9.31E+01	9.31E+01	5.48E+01	> Bkgd
chromium, hexavalent	7/33	4.80E-02	5.64E-01	1.54E-01	1.23E-01	2.48E-01	2.48E-01	NA	NA
cobalt	96/102	3.50E+00	4.78E+01	6.62E+00	6.12E+00	9.26E+00	9.26E+00	1.43E+01	> Bkgd[b]
copper	102/105	3.78E+00	8.48E+01	1.14E+01	1.21E+01	1.65E+01	1.65E+01	3.91E+01	> Bkgd[b]
iron	91/91	5.95E+03	5.53E+04	1.12E+04	6.38E+03	1.23E+04	1.23E+04	2.23E+04	> Bkgd[b]
lead	104/109	1.40E+00	1.70E+02	1.39E+01	2.56E+01	2.46E+01	2.46E+01	3.77E+01	> Bkgd[b]
manganese	91/91	6.13E+01	9.33E+02	1.51E+02	1.23E+02	2.07E+02	2.07E+02	3.83E+02	> Bkgd[b]
mercury	20/105	1.40E-02	1.69E-01	4.16E-01	2.08E+00	1.69E+00	1.69E-01	5.20E-01	< Bkgd
molybdenum	3/37	2.00E-01	1.60E+00	6.29E-01	5.08E-01	1.46E+00	1.46E+00	5.20E+00	< Bkgd
nickel	105/105	1.00E+00	7.00E+01	2.83E+01	1.10E+01	3.00E+01	3.00E+01	5.57E+01	> Bkgd[b]

Table 6-10 (continued)

COPEC	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean	Standard Deviation	95% UCL of Mean	Refined EPC	Background Threshold Value	Background Comparison
Metals (continued)									
selenium	21/102	5.00E-01	5.60E+00	5.90E-01	8.27E-01	9.47E-01	9.47E-01	1.78E+00	> Bkgd[b]
silver	21/105	4.80E-01	5.60E+00	1.15E+00	2.39E+00	2.61E+00	2.61E+00	2.22E+00	> Bkgd[b]
thallium	16/102	1.20E-01	5.10E+00	8.86E-01	9.25E-01	1.46E+00	1.46E+00	5.00E-01	> Bkgd[b]
vanadium	102/102	1.11E+01	6.87E+01	2.32E+01	8.72E+00	2.46E+01	2.46E+01	4.73E+01	> Bkgd[b]
zinc	104/105	1.20E+01	2.60E+02	3.08E+01	2.97E+01	3.56E+01	3.56E+01	6.75E+01	> Bkgd[b]
Cyanide									
cyanide	5/56	3.60E-01	6.30E+00	3.88E-01	8.45E-01	8.80E-01	8.80E-01	NA	NA

Notes:
[a] organic compounds are grouped into categories according to toxicity assessment protocols used in the ecological risk assessment
[b] concentrations considered ambient, based on further evaluation (statistical analysis, detection frequency, and lateral distribution)

Acronyms/Abbreviations:
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data
< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of "pink" background data
COPEC – chemical of potential ecological concern (for soil 0 to 6 feet below ground surface)
EPC – exposure point concentration
mg/kg – milligrams per kilogram
NA – not available
UCL – upper confidence level

Table 6-11
Groundwater Chemicals of Potential Ecological Concern
(micrograms per liter)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Volatile Organic Compounds*							
acetone	71	594	12	0.5	440	NA	NA
benzene	246	964	26	0.08	22	NA	NA
bromochloromethane	1	427	0.23	0.9	0.9	NA	NA
bromodichloromethane	2	680	0.29	0.3	1	NA	NA
bromoform	2	680	0.29	0.1	0.2	NA	NA
2-butanone	29	591	4.9	0.2	49	NA	NA
tert-butyl alcohol	1	181	0.55	1	1	NA	NA
n-butylbenzene	7	363	1.9	0.18	6	NA	NA
sec-butylbenzene	17	363	4.7	0.08	41	NA	NA
tert-butylbenzene	7	363	1.9	0.14	30	NA	NA
carbon disulfide	134	666	20	0.1	40	NA	NA
carbon tetrachloride	13	731	1.8	0.68	4,600	NA	NA
chlorobenzene	45	741	6.1	0.1	410	NA	NA
chloroethane	142	897	16	0.3	37,000	NA	NA
chloroform	84	680	12	0.1	85	NA	NA
chloromethane	5	733	0.68	0.3	4	NA	NA
1,2-dichlorobenzene	76	684	11	0.1	220	NA	NA
1,3-dichlorobenzene	22	684	3.2	0.1	9	NA	NA
1,4-dichlorobenzene	39	684	5.7	0.1	68	NA	NA
1,1-dichloroethane	423	1,096	39	0.1	110,000	NA	NA
1,2-dichloroethane	76	1,094	6.9	0.1	570	NA	NA
1,1-dichloroethene	210	1,095	19	0.2	65,000	NA	NA
1,2-dichloroethene	95	248	38	0.1	1,100	NA	NA
cis-1,2-dichloroethene	275	846	33	0.09	85,000	NA	NA
trans-1,2-dichloroethene	171	846	20	0.07	2,600	NA	NA
1,2-dichloropropane	25	680	3.7	0.2	2	NA	NA
diisopropyl ether	17	181	9.4	0.1	1.2	NA	NA
ethane	14	112	13	1.1	180	NA	NA

Table 6-11 (continued)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Volatile Organic Compounds* (continued)							
ethene	3	112	2.7	4	210	NA	NA
ethylbenzene	58	964	6	0.2	126.8	NA	NA
2-hexanone	11	654	1.7	0.4	180	NA	NA
isopropylbenzene	15	363	4.1	0.19	41	NA	NA
p-isopropyltoluene	11	363	3	0.14	62	NA	NA
methane	92	115	80	1.5	16,000	NA	NA
methyl tert-butyl ether	21	500	4.2	0.1	160	NA	NA
4-methyl-2-pentanone	11	663	1.7	0.2	1,300	NA	NA
methylene chloride	25	734	3.4	0.1	58	NA	NA
n-propylbenzene	11	363	3	0.21	47	NA	NA
styrene	6	680	0.88	0.5	5.4	NA	NA
tetrachloroethene	134	1,094	12	0.1	230	NA	NA
toluene	193	964	20	0.1	370	NA	NA
1,2,3-trichlorobenzene	1	363	0.28	0.58	0.58	NA	NA
1,2,4-trichlorobenzene	4	602	0.66	2	2	NA	NA
1,1,1-trichloroethane	119	1094	11	0.2	100,000	NA	NA
1,1,2-trichloroethane	1	924	0.11	4.7	4.7	NA	NA
trichloroethene	304	1,095	28	0.1	580,000	NA	NA
trichlorofluoromethane	1	365	0.27	1.5	1.5	NA	NA
1,2,3-trichloropropane	1	363	0.28	0.97	0.97	NA	NA
1,2,4-trimethylbenzene	21	366	5.7	0.2	482	NA	NA
1,3,5-trimethylbenzene	14	366	3.8	0.12	130	NA	NA
vinyl chloride	294	1,094	27	0.1	7,000	NA	NA
xylenes, total	116	964	12	0.2	1,400	NA	NA
Semivolatile Organic Compounds*							
bis(2-chloroethyl)ether	30	274	11	0.4	86	NA	NA
bis(2-chloroisopropyl)ether	1	82	1.2	3.9	3.9	NA	NA
bis(2-chloro-1-methylethyl)ether	22	192	11	1	31	NA	NA
bis(2-ethylhexyl)phthalate	5	274	1.8	11	5,900	NA	NA
butylbenzyl phthalate	1	273	0.37	10	10	NA	NA

Table 6-11 (continued)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Semivolatile Organic Compounds* (continued)							
carbazole	2	246	0.81	6	18	NA	NA
dibenzofuran	3	274	1.1	0.3	20	NA	NA
2,4-dimethylphenol	4	275	1.5	4	23	NA	NA
2,4-dinitrophenol	1	275	0.36	25	25	NA	NA
1,4-dioxane	65	149	44	0.44	770	NA	NA
isophorone	4	273	1.5	1	6	NA	NA
2-methylphenol	1	275	0.36	2	2	NA	NA
4-methylphenol	3	275	1.1	2	15	NA	NA
N-nitrosodiphenylamine	3	274	1.1	1	4	NA	NA
phenol	5	275	1.8	0.5	150	NA	NA
Polycyclic Aromatic Hydrocarbons*							
acenaphthene	23	236	9.7	0.083	5	NA	NA
acenaphthylene	8	236	3.4	0.083	3	NA	NA
anthracene	10	236	4.2	0.13	17	NA	NA
benzo(a)anthracene	4	236	1.7	0.13	14	NA	NA
benzo(b)fluoranthene	3	236	1.3	0.15	18	NA	NA
benzo(k)fluoranthene	1	236	0.42	0.15	0.15	NA	NA
benzo(a)pyrene	4	236	1.7	0.085	8	NA	NA
chrysene	4	236	1.7	0.087	14	NA	NA
fluoranthene	27	236	11	0.07	53	NA	NA
fluorene	16	236	6.8	0.082	23	NA	NA
2-methylnaphthalene	16	236	6.8	0.085	240	NA	NA
naphthalene	38	506	7.5	0.09	1,000	NA	NA
phenanthrene	29	236	12	0.082	75	NA	NA
pyrene	72	236	31	0.04	43	NA	NA
Pesticides							
aldrin	2	33	6.1	0.009	0.09	NA	NA
beta-BHC	3	33	9.1	0.1	0.3	NA	NA
delta-BHC	2	33	6.1	0.03	0.04	NA	NA
gamma-BHC (lindane)	1	33	3	0.02	0.02	NA	NA

Table 6-11 (continued)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Pesticides (continued)							
gamma-chlordane	5	33	15	0.002	0.01	NA	NA
4,4'-DDT	1	33	3	0.01	0.01	NA	NA
dieldrin	2	33	6.1	0.02	0.02	NA	NA
endosulfan I	1	33	3	0.006	0.006	NA	NA
heptachlor epoxide	2	33	6.1	0.009	0.02	NA	NA
Metals							
aluminum	124	510	24	1.1	247,000	1.07E+03	> Bkgd
antimony	118	589	20	0.07	206	3.75E+01	> Bkgd
arsenic	360	596	60	0.55	87.3	2.07E+01	> Bkgd
barium	533	539	99	0.68	5,600	5.70E+02	> Bkgd
beryllium	27	581	4.6	0.22	7.7	2.50E+00	> Bkgd
cadmium	84	593	14	0.061	51.5	NA	NA
chromium	214	593	36	0.21	1,130	1.25E+01	> Bkgd
chromium, hexavalent	11	227	4.8	10	9,350	NA	NA
cobalt	204	539	38	0.038	375	NA	NA
copper	184	581	32	0.32	668	2.40E+01	> Bkgd
iron	392	527	74	8	556,000	6.59E+03	> Bkgd
lead	123	603	20	0.028	4,420	1.15E+01	> Bkgd
manganese	514	525	98	1.6	31,500	1.74E+03	> Bkgd
mercury	65	581	11	0.00037	6.8	NA	NA
molybdenum	175	389	45	0.4	70.7	NA	NA
nickel	381	596	64	0.69	1,220	NA	NA
selenium	122	570	21	0.29	108	8.58E+00	> Bkgd
silver	74	571	13	0.042	70.4	NA	NA
thallium	44	522	8.4	0.016	65.2	1.62E+01	> Bkgd
vanadium	310	554	56	0.28	1,330	2.63E+01	> Bkgd
zinc	216	596	36	0.68	11,500	3.64E+01	> Bkgd
Cyanide							
cyanide	40	163	25	5.3	1,090	NA	NA

Table 6-11 (continued)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Radionuclides (pCi/L)							
total gross alpha	1	2	50	11	11	NA	NA
total gross beta	3	3	100	9	35	NA	NA

Note:
* organic compounds are grouped into categories according to toxicity assessment protocols used in the ecological risk assessment

Acronyms/Abbreviations:
BHC – benzene hexachloride
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of background data
COPEC – chemical of potential ecological concern for soil (0 to 6 feet below ground surface)
DDT – dichlorodiphenyltrichloroethane
µg/L – micrograms per liter
pCi/L – picocuries per liter

Table 6-12
Terrestrial Plant and Invertebrate Hazard Quotients
Exposure Unit 1

COPEC	EU1 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	8.00E-02	NA	NA	NA	NA
benzene	6.00E+00	NA	NA	NA	NA
2-butanone	8.40E-03	NA	NA	NA	NA
carbon disulfide	1.30E-02	NA	NA	NA	NA
chlorobenzene	5.00E-03	NA	NA	40	1E-04
chloroform	1.00E-03	NA	NA	NA	NA
chloromethane	4.90E-03	NA	NA	NA	NA
1,1-dichloroethene	3.00E-03	NA	NA	NA	NA
cis-1,2-dichloroethene	3.50E-02	NA	NA	NA	NA
trans-1,2-dichloroethene	1.70E-03	NA	NA	NA	NA
ethylbenzene	6.90E-01	NA	NA	NA	NA
2-hexanone	2.00E-03	NA	NA	NA	NA
4-methyl-2-pentanone	1.00E-02	NA	NA	NA	NA
methylene chloride	4.30E-02	NA	NA	NA	NA
tetrachloroethene	2.00E+00	NA	NA	NA	NA
toluene	6.00E+00	200	3E-02	NA	NA
trichloroethene	1.30E+00	NA	NA	NA	NA
1,2,4-trimethylbenzene	1.50E-03	NA	NA	NA	NA
m-, p-xylene	2.20E-02	NA	NA	NA	NA
xylenes, total	3.10E+00	NA	NA	NA	NA
Semivolatile Organic Compounds					
bis(2-ethylhexyl)phthalate	7.80E-01	NA	NA	NA	NA
butylbenzyl phthalate	2.00E-02	NA	NA	NA	NA
carbazole	3.40E-01	NA	NA	NA	NA
4-chloro-3-methylphenol	3.00E-02	NA	NA	NA	NA
dibenzofuran	1.20E-01	NA	NA	NA	NA
di-n-butyl phthalate	1.10E-01	200	6E-04	NA	NA
diethyl phthalate	2.50E-02	100	3E-04	NA	NA
dimethyl phthalate	4.40E-02	NA	NA	200	2E-04
hexachlorobutadiene	3.70E-03	NA	NA	NA	NA
N-nitroso-di-n-propylamine	2.30E-02	NA	NA	NA	NA
phenol	2.80E+00	70	4E-02	30	9E-02
Polycyclic Aromatic Hydrocarbons					
acenaphthene	1.80E-01	20	9E-03	29	6E-03
acenaphthylene	2.80E-01	NA	NA	29	1E-02
anthracene	7.20E-01	NA	NA	29	2E-02
benzo(a)anthracene	1.20E+00	NA	NA	18	7E-02
benzo(b)fluoranthene	1.00E+00	NA	NA	18	6E-02
benzo(k)fluoranthene	9.70E-01	NA	NA	18	5E-02
benzo(g,h,i)perylene	1.20E+00	NA	NA	18	7E-02
benzo(a)pyrene	1.50E+00	NA	NA	18	8E-02
chrysene	1.50E+00	NA	NA	18	8E-02

Table 6-12 (continued)

COPEC	EU1 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds (continued)					
dibenz(a,h)anthracene	1.80E-01	NA	NA	18	1E-02
fluoranthene	3.80E+00	NA	NA	18	2E-01
fluorene	2.50E-01	NA	NA	29	9E-03
indeno(1,2,3-cd)pyrene	1.20E+00	NA	NA	18	7E-02
2-methylnaphthalene	4.20E-01	NA	NA	29	1E-02
naphthalene	5.40E-01	NA	NA	29	2E-02
phenanthrene	4.10E+00	NA	NA	29	1E-01
pyrene	4.30E+00	NA	NA	NA	NA
Pesticides					
aldrin	8.30E-03	NA	NA	NA	NA
beta-BHC	1.50E-03	NA	NA	NA	NA
delta-BHC	2.80E-03	NA	NA	NA	NA
alpha-chlordane	1.80E-03	NA	NA	NA	NA
gamma-chlordane	2.30E-03	NA	NA	NA	NA
4,4'-DDT	3.90E-03	NA	NA	NA	NA
endrin aldehyde	3.60E-03	NA	NA	NA	NA
heptachlor	1.70E-03	NA	NA	NA	NA
Polychlorinated Biphenyls					
Aroclor 1260	5.10E-02	40	1E-03	NA	NA
Metals					
aluminum	2.99E+04	50	**6E+02***	NA	NA
antimony	7.40E+00	5	1E+00	78	9E-02
arsenic	1.12E+01	18	6E-01	60	2E-01
barium	6.24E+02	500	1E+00	330	**2E+00***
beryllium	2.29E+00	10	2E-01	40	6E-02
cadmium	3.00E+00	32	9E-02	140	2E-02
chromium	7.55E+01	1	**8E+01***	0.4	**2E+02***
cobalt	1.80E+02	13	**1E+01***	NA	NA
copper	1.05E+02	100	1E+00	50	**2E+00***
iron	5.02E+04	NA	NA	NA	NA
lead	1.16E+02	120	1E+00	1700	7E-02
manganese	1.42E+03	220	**6E+00***	450	**3E+00***
mercury	1.90E+00	0.3	**6E+00***	0.1	**2E+01***
molybdenum	1.10E+00	2	6E-01	NA	NA
nickel	9.30E+01	38	**2E+00***	280	3E-01
selenium	2.50E+00	1	**3E+00***	70	4E-02
silver	2.36E+01	2	**1E+01***	NA	NA
thallium	5.50E+00	1	**6E+00***	NA	NA
vanadium	1.12E+02	2	**6E+01***	NA	NA
zinc	1.04E+02	50	**2E+00***	200	5E-01

Table 6-12 (continued)

Note:
* bold type indicates an HQ>1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenytrichloroethane
EU – exposure unit
HQ – hazard quotient
mg/kg – milligrams per kilogram
NA – not available

Table 6-13
Terrestrial Wildlife Receptor-Specific Hazard Quotients
Exposure Unit 1

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	1E-02	8E-03	2E-02	4E-03	2E-04	2E-02
benzene	6E-01	2E-01	**4E+00***	**3E+00***	3E-01	**4E+00***
2-butanone	1E-04	8E-05	1E-03	3E-04	2E-05	1E-03
carbon disulfide	2E-03	1E-03	2E-02	1E-02	1E-03	2E-02
chlorobenzene	7E-04	2E-04	8E-03	8E-03	3E-04	8E-03
chloroform	1E-03	9E-04	1E-02	7E-03	9E-04	1E-02
chloromethane	2E-02	1E-02	1E-01	4E-02	4E-03	1E-01
1,1-dichloroethene	2E-04	1E-04	2E-03	1E-03	1E-04	2E-03
cis-1,2-dichloroethene	5E-02	3E-02	4E-01	2E-01	2E-02	4E-01
trans-1,2-dichloroethene	3E-03	1E-03	2E-02	9E-03	1E-03	2E-02
ethylbenzene	4E-02	8E-03	3E-01	4E-01	8E-03	4E-01
2-hexanone	2E-04	1E-04	5E-03	2E-03	2E-04	5E-03
4-methyl-2-pentanone	1E-03	8E-04	1E-02	3E-03	4E-04	1E-02
methylene chloride	3E-02	2E-02	2E-01	6E-02	8E-03	2E-01
tetrachloroethene	**1E+01***	**2E+00***	**1E+02***	**1E+02***	**2E+00***	**1E+02***
toluene	8E-01	2E-01	**6E+00***	**6E+00***	3E-01	**6E+00***
trichloroethene	**5E+00***	**2E+00***	**4E+01***	**3E+01***	**2E+00***	**4E+01***
1,2,4-trimethylbenzene	1E-02	2E-03	7E-02	1E-01	8E-04	1E-01
m-, p-xylene	6E-02	1E-02	4E-01	6E-01	1E-02	6E-01
xylenes, total	**9E+00***	**2E+00***	**6E+01***	**8E+01***	**2E+00***	**8E+01***
Semivolatile Organic Compounds						
bis(2-ethylhexyl)phthalate	1E-01	1E-02	1E+00	**2E+00***	8E-02	**2E+00***
butylbenzyl phthalate	3E-04	5E-05	3E-01	4E-01	2E-02	4E-01
carbazole	2E-02	4E-03	6E-01	8E-01	4E-02	8E-01
4-chloro-3-methylphenol	4E-01	9E-02	2E-02	2E-02	8E-04	4E-01
dibenzofuran	6E-03	1E-03	2E-01	3E-01	1E-02	3E-01
di-n-butyl phthalate	5E-04	9E-05	**2E+00***	**2E+00***	1E-01	**2E+00***
diethyl phthalate	2E-05	6E-06	6E-02	6E-02	3E-03	6E-02
dimethyl phthalate	5E-05	2E-05	2E-01	1E-01	5E-03	2E-01
hexachlorobutadiene	4E-02	8E-03	2E-03	3E-03	1E-04	4E-02
N-nitroso-di-n-propylamine	3E-02	1E-02	2E-01	1E-01	5E-03	2E-01
phenol	2E-01	1E-01	**1E+01***	**7E+00***	3E-01	**1E+01***
Polycyclic Aromatic Hydrocarbons						
acenaphthene	3E-04	7E-05	1E-02	2E-02	2E-02	2E-02
acenaphthylene	5E-04	2E-04	2E-02	2E-02	3E-02	3E-02
anthracene	2E-03	7E-04	8E-02	6E-02	7E-02	8E-02
benzo(a)anthracene	8E-02	2E-02	9E-02	1E-01	1E-01	1E-01
benzo(b)fluoranthene	9E-02	4E-02	1E-01	8E-02	1E-01	1E-01
benzo(k)fluoranthene	6E-02	2E-02	7E-02	7E-02	1E-01	1E-01
benzo(g,h,i)perylene	1E-01	6E-02	1E-01	9E-02	1E-01	1E-01
benzo(a)pyrene	1E-01	5E-02	2E-01	1E-01	2E-01	2E-01
chrysene	1E-01	3E-02	2E-01	2E-01	2E-01	2E-01

Table 6-13 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Polycyclic Aromatic Hydrocarbons (continued)						
dibenz(a,h)anthracene	2E-02	5E-03	2E-02	2E-02	2E-02	2E-02
fluoranthene	6E-01	2E-01	6E-01	4E-01	4E-01	6E-01
fluorene	3E-04	7E-05	1E-02	2E-02	3E-02	3E-02
indeno(1,2,3-cd)pyrene	1E-01	3E-02	1E-01	1E-01	1E-01	1E-01
2-methylnaphthalene	8E-04	3E-04	3E-02	3E-02	5E-02	5E-02
naphthalene	3E-02	2E-02	1E+00	3E-01	6E-02	1E+00
phenanthrene	4E-02	2E-02	1E+00	6E-01	4E-01	1E+00
pyrene	8E-01	3E-01	8E-01	5E-01	5E-01	8E-01
Pesticides						
aldrin	1E-01	2E-02	1E-01	1E-01	1E-02	1E-01
beta-BHC	6E-03	2E-03	3E-03	4E-03	3E-04	6E-03
delta-BHC	1E-02	3E-03	6E-03	7E-03	6E-04	1E-02
alpha-chlordane	5E-04	9E-05	9E-04	1E-03	9E-05	1E-03
gamma-chlordane	7E-04	1E-04	1E-03	1E-03	1E-04	1E-03
4,4'-DDT	7E-03	1E-03	1E+00	6E-01	5E-02	1E+00
endrin aldehyde	6E-02	1E-02	4E-01	5E-01	4E-02	5E-01
heptachlor	2E-02	3E-03	8E-04	1E-03	9E-05	2E-02
Polychlorinated Biphenyls						
Aroclor 1260	2E-01	3E-02	6E-01	8E-01	6E-02	8E-01
Metals						
antimony	**2E+01***	**3E+00***	**1E+02***	**2E+02***	**6E+01***	**2E+02***
arsenic	**3E+00***	6E-01	1E-01	1E-01	1E-03	**3E+00***
barium	**8E+00***	**3E+00***	**2E+00***	1E+00	2E-01	**8E+00***
beryllium	1E-01	3E-02	1E+00	1E+00	**4E+00***	**4E+00***
cadmium	**8E+01***	**2E+01***	**5E+01***	**6E+01***	1E+00	**8E+01***
chromium	**2E+00***	5E-01	**6E+00***	**7E+00***	7E-01	**7E+00***
cobalt	**7E+00***	**2E+00***	**4E+01***	**4E+01***	**2E+00***	**4E+01***
copper	**6E+00***	1E+00	**6E+00***	**6E+00***	9E-01	**6E+00***
iron	NA	NA	NA	NA	NA	NA
lead	**9E+00***	**2E+00***	**6E+02***	**7E+02***	**9E+01***	**7E+02***
manganese	**5E+00***	**2E+00***	9E-01	7E-01	5E-02	**5E+00***
mercury	**4E+00***	1E+00	**2E+01***	**2E+01***	3E-01	**2E+01***
molybdenum	1E+00	3E-01	6E-02	7E-02	3E-02	1E+00
nickel	**2E+02***	**3E+01***	**1E+01***	**2E+01***	**2E+00***	**2E+02***
selenium	**2E+01***	**6E+00***	**3E+00***	**3E+00***	2E-01	**2E+01***
silver	5E-01	7E-02	4E-02	6E-02	1E-04	5E-01
thallium	**3E+00***	5E-01	**3E+00***	**4E+00***	2E-01	**4E+00***
vanadium	**2E+01***	**5E+00***	3E-01	3E-01	2E-02	**2E+01***
zinc	**8E+00***	**2E+00***	**3E+00***	**4E+00***	5E-01	**8E+00***
Hazard Indices						
HI VOC	**3E+01***	**6E+00***	**2E+02***	**2E+02***	**7E+00***	**2E+02***
HI SVOC	8E-01	2E-01	**1E+01***	**1E+01***	6E-01	**1E+01***
HI PAH	**2E+00***	8E-01	**4E+00***	**3E+00***	**2E+00***	**4E+00***

Table 6-13 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Hazard Indices (continued)						
HI pesticides	2E-01	4E-02	**2E+00***	1E+00	1E-01	**2E+00***
HI PCB	2E-01	3E-02	6E-01	8E-01	6E-02	8E-01
HI metals	**9E+02***	**2E+02***	**9E+02***	**1E+03***	**2E+02***	**1E+03***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
NA – not available
HI – hazard index
HQ – hazard quotient
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyls
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-14
Terrestrial Plant and Invertebrate Hazard Quotients
Exposure Unit 2

COPEC	EU2 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	2.40E-01	NA	NA	NA	NA
benzene	2.40E-03	NA	NA	NA	NA
bromochloromethane	3.40E-03	NA	NA	NA	NA
bromomethane	4.00E-02	NA	NA	NA	NA
2-butanone	1.80E-02	NA	NA	NA	NA
n-butylbenzene	4.10E-03	NA	NA	NA	NA
sec-butylbenzene	3.40E-03	NA	NA	NA	NA
tert-butylbenzene	8.40E-03	NA	NA	NA	NA
carbon disulfide	1.10E-02	NA	NA	NA	NA
chlorobenzene	3.00E-03	NA	NA	40	8E-05
chloromethane	4.80E-02	NA	NA	NA	NA
1,2-dichlorobenzene	1.40E-03	NA	NA	NA	NA
1,3-dichlorobenzene	8.10E-04	NA	NA	NA	NA
1,4-dichlorobenzene	2.60E-03	NA	NA	20	1E-04
1,1-dichloroethane	6.20E-03	NA	NA	NA	NA
1,1-dichloroethene	2.80E-03	NA	NA	NA	NA
cis-1,2-dichloroethene	1.50E-03	NA	NA	NA	NA
trans-1,2-dichloroethene	4.00E-04	NA	NA	NA	NA
1,2-dichloropropane	3.90E-03	NA	NA	700	6E-06
ethylbenzene	2.10E-02	NA	NA	NA	NA
2-hexanone	3.70E-02	NA	NA	NA	NA
isopropylbenzene	8.90E-03	NA	NA	NA	NA
p-isopropyltoluene	5.60E-03	NA	NA	NA	NA
methyl tert-butyl ether	1.20E-03	NA	NA	NA	NA
4-methyl-2-pentanone	3.50E-02	NA	NA	NA	NA
methylene chloride	6.00E-02	NA	NA	NA	NA
n-propylbenzene	9.80E-03	NA	NA	NA	NA
tetrachloroethene	1.30E-01	NA	NA	NA	NA
toluene	2.70E-02	200	1E-04	NA	NA
1,2,3-trichlorobenzene	4.50E-03	NA	NA	20	2E-04
1,2,4-trichlorobenzene	3.50E-03	NA	NA	20	2E-04
1,1,1-trichloroethane	5.50E-02	NA	NA	NA	NA
trichloroethene	8.90E-02	NA	NA	NA	NA
1,2,4-trimethylbenzene	6.70E-02	NA	NA	NA	NA
1,3,5-trimethylbenzene	2.10E-02	NA	NA	NA	NA
m-, p-xylene	9.80E-02	NA	NA	NA	NA
o-xylene	4.80E-02	NA	NA	NA	NA

Table 6-14 (continued)

COPEC	EU2 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Semivolatile Organic Compounds					
bis(2-ethylhexyl)phthalate	1.30E-01	NA	NA	NA	NA
butylbenzyl phthalate	3.50E-02	NA	NA	NA	NA
4-chloro-3-methylphenol	4.00E-02	NA	NA	NA	NA
2-chlorophenol	2.90E-02	NA	NA	NA	NA
diethyl phthalate	1.90E-02	100	2E-04	NA	NA
1,4-dioxane	3.10E-02	NA	NA	NA	NA
N-nitroso-di-n-propylamine	2.30E-02	NA	NA	NA	NA
pentachlorophenol	3.70E-02	5	7E-03	31	1E-03
phenol	3.50E-02	70	5E-04	30	1E-03
Polycyclic Aromatic Hydrocarbons					
acenaphthene	2.90E-03	20	1E-04	29	1E-04
acenaphthylene	8.00E-03	NA	NA	29	3E-04
anthracene	1.00E-02	NA	NA	29	3E-04
benzo(a)anthracene	7.40E-02	NA	NA	18	4E-03
benzo(b)fluoranthene	8.70E-02	NA	NA	18	5E-03
benzo(k)fluoranthene	2.10E-02	NA	NA	18	1E-03
benzo(g,h,i)perylene	2.50E-01	NA	NA	18	1E-02
benzo(a)pyrene	9.50E-02	NA	NA	18	5E-03
chrysene	7.90E-02	NA	NA	18	4E-03
dibenz(a,h)anthracene	1.10E-02	NA	NA	18	6E-04
fluoranthene	1.70E-01	NA	NA	18	9E-03
fluorene	1.90E-03	NA	NA	29	7E-05
indeno(1,2,3-cd)pyrene	5.60E-02	NA	NA	18	3E-03
2-methylnaphthalene	2.90E-03	NA	NA	29	1E-04
naphthalene	8.60E-03	NA	NA	29	3E-04
phenanthrene	4.80E-02	NA	NA	29	2E-03
pyrene	1.50E-01	NA	NA	18	8E-03
Polychlorinated Biphenyls					
Aroclor 1260	7.20E-02	40	2E-03	NA	NA
Metals					
aluminum	2.90E+04	50	**6E+02***	NA	NA
antimony	2.07E+01	5	**4E+00***	78	3E-01
arsenic	3.29E+02	18	**2E+01***	60	**5E+00***
barium	7.58E+02	500	**2E+00***	330	**2E+00***
beryllium	1.50E+00	10	1E-01	40	4E-02
cadmium	1.02E+01	32	3E-01	140	7E-02
chromium	2.95E+02	1	**3E+02***	0.4	**7E+02***
chromium, hexavalent	7.80E-01	NA	NA	NA	NA
cobalt	8.87E+01	13	**7E+00***	NA	NA
copper	1.38E+02	100	1E+00	50	**3E+00***
iron	5.28E+04	NA	NA	NA	NA

Table 6-14 (continued)

COPEC	EU2 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Metals (continued)					
lead	4.31E+03	120	**4E+01***	1700	**3E+00***
manganese	1.19E+03	220	**5E+00***	450	**3E+00***
mercury	1.89E+01	0.3	**6E+01***	0.1	**2E+02***
molybdenum	1.13E+01	2	**6E+00***	NA	NA
nickel	9.86E+01	38	**3E+00***	280	4E-01
selenium	3.20E+02	1	**3E+02***	70	**5E+00***
silver	1.56E+01	2	**8E+00***	NA	NA
thallium	3.35E+02	1	**3E+02***	NA	NA
vanadium	1.59E+02	2	**8E+01***	NA	NA
zinc	6.99E+02	50	**1E+01***	200	**3E+00***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
EU – exposure unit
HQ – hazard quotient
mg/kg – milligrams per kilogram
NA – not available

Table 6-15
Terrestrial Wildlife Receptor-Specific Hazard Quotients
Exposure Unit 2

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	4E-02	2E-02	5E-02	1E-02	5E-04	5E-02
benzene	2E-04	1E-04	2E-03	1E-03	1E-04	2E-03
bromochloromethane	3E-04	2E-04	2E-03	6E-04	9E-05	2E-03
bromomethane	1E-01	7E-02	9E-01	2E-01	3E-02	9E-01
2-butanone	3E-04	2E-04	2E-03	6E-04	4E-05	2E-03
n-butylbenzene	1E-01	2E-02	8E-01	1E+00	2E-03	1E+00
sec-butylbenzene	1E-01	2E-02	9E-01	1E+00	2E-03	1E+00
tert-butylbenzene	1E-01	2E-02	1E+00	1E+00	4E-03	1E+00
carbon disulfide	2E-03	1E-03	2E-02	9E-03	1E-03	2E-02
chlorobenzene	4E-04	1E-04	5E-03	5E-03	2E-04	5E-03
chloromethane	2E-01	1E-01	1E+00	3E-01	4E-02	1E+00
1,2-dichlorobenzene	2E-04	3E-05	6E-04	8E-04	1E-05	8E-04
1,3-dichlorobenzene	1E-04	2E-05	4E-04	6E-04	6E-06	6E-04
1,4-dichlorobenzene	3E-04	5E-05	1E-03	2E-03	2E-05	2E-03
1,1-dichloroethane	3E-04	2E-04	7E-04	3E-04	4E-05	7E-04
1,1-dichloroethene	2E-04	1E-04	2E-03	1E-03	1E-04	2E-03
cis-1,2-dichloroethene	2E-03	1E-03	2E-02	8E-03	1E-03	2E-02
trans-1,2-dichloroethene	6E-04	3E-04	5E-03	2E-03	3E-04	5E-03
1,2-dichloropropane	1E-03	5E-04	8E-03	4E-03	5E-04	8E-03
ethylbenzene	1E-03	3E-04	1E-02	1E-02	2E-04	1E-02
2-hexanone	3E-03	2E-03	1E-01	3E-02	4E-03	1E-01
isopropylbenzene	6E-02	1E-02	1E-01	1E-01	1E-03	1E-01
p-isopropyltoluene	9E-02	1E-02	4E-02	6E-02	2E-04	9E-02
methyl tert-butyl ether	6E-04	4E-04	5E-03	1E-03	1E-04	5E-03
4-methyl-2-pentanone	5E-03	3E-03	4E-02	1E-02	2E-03	4E-02
methylene chloride	4E-02	2E-02	3E-01	9E-02	1E-02	3E-01
n-propylbenzene	7E-02	1E-02	5E-01	7E-01	5E-03	7E-01
tetrachloroethene	9E-01	1E-01	**6E+00***	**8E+00***	1E-01	**8E+00***
toluene	4E-03	1E-03	3E-02	3E-02	1E-03	3E-02
1,2,3-trichlorobenzene	9E-03	1E-03	7E-02	9E-02	3E-04	9E-02
1,2,4-trichlorobenzene	7E-03	1E-03	5E-02	7E-02	3E-04	7E-02
1,1,1-trichloroethane	2E-04	5E-05	1E-03	1E-03	6E-05	1E-03
trichloroethene	3E-01	1E-01	**3E+00***	**2E+00***	1E-01	**3E+00***
1,2,4-trimethylbenzene	4E-01	7E-02	**3E+00***	**4E+00***	4E-02	**4E+00***
1,3,5-trimethylbenzene	1E-01	2E-02	7E-01	9E-01	1E-02	9E-01
m-, p-xylene	3E-01	5E-02	**2E+00***	**2E+00***	5E-02	**2E+00***
o-xylene	1E-01	3E-02	1E+00	1E+00	3E-02	1E+00
Semivolatile Organic Compounds						
bis(2-ethylhexyl)phthalate	2E-02	2E-03	2E-01	3E-01	1E-02	3E-01
butylbenzyl phthalate	5E-04	9E-05	6E-01	7E-01	4E-02	7E-01

Table 6-15 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Semivolatile Organic Compounds (continued)						
4-chloro-3-methylphenol	5E-01	1E-01	2E-02	2E-02	1E-03	5E-01
2-chlorophenol	2E-01	7E-02	7E-02	6E-02	3E-03	2E-01
diethyl phthalate	1E-05	4E-06	5E-02	5E-02	2E-03	5E-02
1,4-dioxane	1E+00	6E-01	**8E+00***	**3E+00***	7E-02	**8E+00***
N-nitroso-di-n-propylamine	3E-02	1E-02	2E-01	1E-01	5E-03	2E-01
pentachlorophenol	4E-01	6E-02	2E-02	2E-02	1E-03	4E-01
phenol	3E-03	1E-03	1E-01	9E-02	3E-03	1E-01
Polycyclic Aromatic Hydrocarbons						
acenaphthene	1E-05	5E-06	4E-04	3E-04	3E-04	4E-04
acenaphthylene	1E-05	2E-06	5E-04	5E-04	9E-04	9E-04
anthracene	2E-05	4E-06	7E-04	8E-04	1E-03	1E-03
benzo(a)anthracene	4E-03	1E-03	5E-03	6E-03	8E-03	8E-03
benzo(b)fluoranthene	8E-03	3E-03	9E-03	7E-03	1E-02	1E-02
benzo(k)fluoranthene	1E-03	2E-04	1E-03	1E-03	2E-03	2E-03
benzo(g,h,i)perylene	1E-02	4E-03	2E-02	1E-02	3E-02	3E-02
benzo(a)pyrene	7E-03	1E-03	7E-03	9E-03	1E-02	1E-02
chrysene	7E-03	1E-03	7E-03	9E-03	9E-03	9E-03
dibenz(a,h)anthracene	1E-03	3E-04	1E-03	1E-03	1E-03	1E-03
fluoranthene	3E-02	1E-02	3E-02	2E-02	2E-02	3E-02
fluorene	8E-06	4E-06	3E-04	2E-04	2E-04	3E-04
indeno(1,2,3-cd)pyrene	5E-03	1E-03	6E-03	6E-03	6E-03	6E-03
2-methylnaphthalene	4E-06	8E-07	2E-04	2E-04	3E-04	3E-04
naphthalene	4E-04	2E-04	2E-02	4E-03	9E-04	2E-02
phenanthrene	1E-04	3E-05	4E-03	4E-03	5E-03	5E-03
pyrene	3E-02	1E-02	3E-02	2E-02	2E-02	3E-02
Polychlorinated Biphenyls						
Aroclor 1260	3E-01	4E-02	8E-01	1E+00	9E-02	1E+00
Metals						
aluminum	**4E+02***	**1E+02***	**9E+00***	**9E+00***	8E-01	**4E+02***
antimony	**5E+01***	**8E+00***	**4E+02***	**5E+02***	**2E+02***	**5E+02***
arsenic	**7E+01***	**2E+01***	**4E+00***	**4E+00***	4E-02	**7E+01***
barium	**1E+01***	**4E+00***	**2E+00***	**2E+00***	2E-01	**1E+01***
beryllium	7E-02	2E-02	8E-01	8E-01	**2E+00***	**2E+00***
cadmium	**3E+02***	**5E+01***	**2E+02***	**2E+02***	**5E+00***	**3E+02***
chromium	**8E+00***	**2E+00***	**2E+01***	**3E+01***	**3E+00***	**3E+01***
chromium, hexavalent	2E-02	5E-03	6E-02	7E-02	7E-03	7E-02
cobalt	**3E+00***	9E-01	**2E+01***	**2E+01***	9E-01	**2E+01***
copper	**8E+00***	**2E+00***	**7E+00***	**8E+00***	1E+00	**8E+00***
iron	NA	NA	NA	NA	NA	0E+00
lead	**4E+02***	**9E+01***	**2E+04***	**2E+04***	**3E+03***	**2E+04***
manganese	**4E+00***	**2E+00***	7E-01	6E-01	4E-02	**4E+00***
mercury	**4E+01***	**1E+01***	**2E+02***	**2E+02***	**3E+00***	**2E+02***
molybdenum	**1E+01***	**3E+00***	7E-01	7E-01	3E-01	**1E+01***

Table 6-15 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Metals (continued)						
nickel	**2E+02***	**3E+01***	**1E+01***	**2E+01***	**2E+00***	**2E+02***
selenium	**2E+03***	**7E+02***	**4E+02***	**3E+02***	**2E+01***	**2E+03***
silver	3E-01	5E-02	3E-02	4E-02	7E-05	3E-01
thallium	**2E+02***	**3E+01***	**2E+02***	**3E+02***	**1E+01***	**3E+02***
vanadium	**2E+01***	**7E+00***	5E-01	5E-01	2E-02	**2E+01***
zinc	**5E+01***	**1E+01***	**2E+01***	**3E+01***	**3E+00***	**5E+01***
Hazard Indices						
HI VOC	**3E+00***	7E-01	**2E+01***	**2E+01***	4E-01	**2E+01***
HI SVOC	**2E+00***	8E-01	**9E+00***	**4E+00***	1E-01	**9E+00***
HI PAH	1E-01	3E-02	1E-01	1E-01	1E-01	1E-01
HI PCB	3E-01	4E-02	8E-01	1E+00	9E-02	1E+00
HI metals	**4E+03***	**1E+03***	**2E+04***	**2E+04***	**3E+03***	**2E+04***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
mg/kg – milligrams per kilogram
NA – not available
HI – hazard index
HQ – hazard quotient
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-16
Terrestrial Plant and Invertebrate Hazard Quotients
Exposure Unit 3

COPEC	EU3 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	1.60E-01	NA	NA	NA	NA
benzene	6.10E-02	NA	NA	NA	NA
2-butanone	1.20E+00	NA	NA	NA	NA
n-butylbenzene	7.70E+01	NA	NA	NA	NA
sec-butylbenzene	5.90E+01	NA	NA	NA	NA
tert-butylbenzene	1.00E+01	NA	NA	NA	NA
carbon disulfide	1.90E-02	NA	NA	NA	NA
chlorobenzene	1.20E-02	NA	NA	40	3E-04
chloroform	2.00E-03	NA	NA	NA	NA
1,2-dichlorobenzene	1.00E+00	NA	NA	NA	NA
1,4-dichlorobenzene	4.10E-03	NA	NA	20	2E-04
1,1-dichloroethane	2.00E+01	NA	NA	NA	NA
1,2-dichloroethane	9.60E-03	NA	NA	NA	NA
1,1-dichloroethene	2.60E-01	NA	NA	NA	NA
1,2-dichloroethylene	7.70E+01	NA	NA	NA	NA
cis-1,2-dichloroethene	3.50E-02	NA	NA	NA	NA
trans-1,2-dichloroethene	1.60E-03	NA	NA	NA	NA
ethylbenzene	2.70E+01	NA	NA	NA	NA
2-hexanone	2.60E-01	NA	NA	NA	NA
isopropylbenzene	3.90E+01	NA	NA	NA	NA
p-isopropyltoluene	8.10E+01	NA	NA	NA	NA
4-methyl-2-pentanone	1.00E-02	NA	NA	NA	NA
methylene chloride	1.70E+00	NA	NA	NA	NA
n-propylbenzene	7.70E+01	NA	NA	NA	NA
tetrachloroethene	1.10E+02	NA	NA	NA	NA
toluene	8.40E+01	200	4E-01	NA	NA
1,2,3-trichlorobenzene	5.90E-03	NA	NA	20	3E-04
1,1,1-trichloroethane	3.00E+01	NA	NA	NA	NA
trichloroethene	2.60E+02	NA	NA	NA	NA
1,2,4-trimethylbenzene	5.50E+02	NA	NA	NA	NA
1,3,5-trimethylbenzene	1.80E+02	NA	NA	NA	NA
2,2,4-trimethylpentane	2.50E+00	NA	NA	NA	NA
m-, p-xylene	1.40E+02	NA	NA	NA	NA
o-xylene	5.00E+01	NA	NA	NA	NA
xylenes, total	2.40E+02	NA	NA	NA	NA
Semivolatile Organic Compounds					
benzoic acid	2.90E-01	NA	NA	NA	NA
bis(2-ethylhexyl)phthalate	4.40E+01	NA	NA	NA	NA
butylbenzyl phthalate	2.30E-02	NA	NA	NA	NA
carbazole	1.30E+00	NA	NA	NA	NA

Table 6-16 (continued)

COPEC	EU3 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Semivolatile Organic Compounds (continued)					
4-chloro-3-methylphenol	1.90E-02	NA	NA	NA	NA
dibenzofuran	4.40E+00	NA	NA	NA	NA
di-n-butyl phthalate	1.90E-01	200	1E-03	NA	NA
diethyl phthalate	1.10E-01	100	1E-03	NA	NA
di-n-octyl phthalate	1.80E-02	NA	NA	NA	NA
4-nitrophenol	1.10E-01	NA	NA	7	2E-02
pentachlorophenol	1.90E-01	5	4E-02	31	6E-03
Polycyclic Aromatic Hydrocarbons					
acenaphthene	1.10E-01	20	6E-03	29	4E-03
acenaphthylene	4.50E-03	NA	NA	29	2E-04
anthracene	1.10E-01	NA	NA	29	4E-03
benzo(a)anthracene	1.10E-01	NA	NA	18	6E-03
benzo(b)fluoranthene	5.60E-02	NA	NA	18	3E-03
benzo(k)fluoranthene	5.50E-02	NA	NA	18	3E-03
benzo(g,h,i)perylene	4.20E-02	NA	NA	18	2E-03
benzo(a)pyrene	6.50E-02	NA	NA	18	4E-03
chrysene	9.30E-02	NA	NA	18	5E-03
dibenz(a,h)anthracene	8.50E-03	NA	NA	18	5E-04
fluoranthene	3.30E-01	NA	NA	18	2E-02
fluorene	1.80E-01	NA	NA	29	6E-03
indeno(1,2,3-cd)pyrene	3.60E-02	NA	NA	18	2E-03
2-methylnaphthalene	1.40E+00	NA	NA	29	5E-02
naphthalene	3.50E+00	NA	NA	29	1E-01
phenanthrene	4.20E-01	NA	NA	29	1E-02
pyrene	2.90E-01	NA	NA	18	2E-02
Polychlorinated Biphenyls					
Aroclor 1260	1.40E-01	40	4E-03	NA	NA
Metals					
aluminum	2.41E+04	50	**5E+02***	NA	NA
antimony	5.20E+00	5	1E+00	78	7E-02
arsenic	1.26E+01	18	7E-01	60	2E-01
barium	1.97E+02	500	4E-01	330	6E-01
beryllium	1.20E+00	10	1E-01	40	3E-02
cadmium	1.52E+01	32	5E-01	140	1E-01
chromium	8.76E+02	1	**9E+02***	0.4	**2E+03***
chromium, hexavalent	5.64E-01	NA	NA	NA	NA
cobalt	4.78E+01	13	**4E+00***	NA	NA
copper	8.48E+01	100	8E-01	50	**2E+00***
iron	5.53E+04	NA	NA	NA	NA
lead	1.70E+02	120	1E+00	1700	1E-01
manganese	9.33E+02	220	**4E+00***	450	**2E+00***

Table 6-16 (continued)

COPEC	EU3 Soil Maximum Detection (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Metals (continued)					
mercury	1.69E-01	0.3	6E-01	0.1	**2E+00***
molybdenum	1.60E+00	2	8E-01	NA	NA
nickel	7.00E+01	38	**2E+00***	280	3E-01
selenium	5.60E+00	1	**6E+00***	70	8E-02
silver	5.60E+00	2	**3E+00***	NA	NA
thallium	5.10E+00	1	**5E+00***	NA	NA
vanadium	6.87E+01	2	**3E+01***	NA	NA
zinc	2.60E+02	50	**5E+00***	200	1E+00
Cyanide					
cyanide	6.30E+00	NA	NA	NA	NA

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
EU – exposure unit
HQ – hazard quotient
mg/kg – milligrams per kilogram
NA – not available

Table 6-17
Terrestrial Wildlife Receptor-Specific Hazard Quotients
Exposure Unit 3

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	3E-02	2E-02	3E-02	8E-03	3E-04	3E-02
benzene	6E-03	3E-03	4E-02	3E-02	3E-03	4E-02
2-butanone	2E-02	1E-02	2E-01	4E-02	3E-03	2E-01
n-butylbenzene	**2E+03***	**3E+02***	**1E+04***	**2E+04***	**4E+01***	**2E+04***
sec-butylbenzene	**2E+03***	**3E+02***	**2E+04***	**2E+04***	**3E+01***	**2E+04***
tert-butylbenzene	**2E+02***	**2E+01***	**1E+03***	**2E+03***	**5E+00***	**2E+03***
carbon disulfide	3E-03	2E-03	3E-02	2E-02	2E-03	3E-02
chlorobenzene	2E-03	6E-04	2E-02	2E-02	7E-04	2E-02
chloroform	3E-03	2E-03	3E-02	1E-02	2E-03	3E-02
1,2-dichlorobenzene	1E-01	2E-02	4E-01	6E-01	7E-03	6E-01
1,4-dichlorobenzene	5E-04	8E-05	2E-03	2E-03	3E-05	2E-03
1,1-dichloroethane	1E+00	6E-01	**2E+00***	1E+00	1E-01	**2E+00***
1,2-dichloroethane	6E-04	3E-04	1E-03	4E-04	6E-05	1E-03
1,1-dichloroethene	2E-02	9E-03	2E-01	1E-01	1E-02	2E-01
1,2-dichloroethylene	**4E+00***	**2E+00***	**3E+01***	**1E+01***	**2E+00***	**3E+01***
cis-1,2-dichloroethene	5E-02	3E-02	4E-01	2E-01	2E-02	4E-01
trans-1,2-dichloroethene	2E-03	1E-03	2E-02	8E-03	1E-03	2E-02
ethylbenzene	**2E+00***	3E-01	**1E+01***	**2E+01***	3E-01	**2E+01***
2-hexanone	2E-02	1E-02	7E-01	2E-01	3E-02	7E-01
isopropylbenzene	**3E+02***	**4E+01***	**4E+02***	**6E+02***	**4E+00***	**6E+02***
p-isopropyltoluene	**1E+03***	**2E+02***	**6E+02***	**8E+02***	**3E+00***	**1E+03***
4-methyl-2-pentanone	1E-03	8E-04	1E-02	3E-03	4E-04	1E-02
methylene chloride	1E+00	6E-01	**8E+00***	**2E+00***	3E-01	**8E+00***
n-propylbenzene	**6E+02***	**9E+01***	**4E+03***	**6E+03***	**4E+01***	**6E+03***
tetrachloroethene	**7E+02***	**1E+02***	**5E+03***	**7E+03***	**9E+01***	**7E+03***
toluene	**1E+01***	**3E+00***	**8E+01***	**9E+01***	**4E+00***	**9E+01***
1,2,3-trichlorobenzene	1E-02	2E-03	9E-02	1E-01	4E-04	1E-01
1,1,1-trichloroethane	8E-02	3E-02	6E-01	5E-01	3E-02	6E-01
trichloroethene	**1E+03***	**4E+02***	**7E+03***	**6E+03***	**4E+02***	**7E+03***
1,2,4-trimethylbenzene	**4E+03***	**6E+02***	**3E+04***	**4E+04***	**3E+02***	**4E+04***
1,3,5-trimethylbenzene	**8E+02***	**1E+02***	**6E+03***	**8E+03***	**9E+01***	**8E+03***
2,2,4-trimethylpentane	NA	NA	NA	NA	NA	0E+00
m-, p-xylene	**4E+02***	**8E+01***	**3E+03***	**4E+03***	**7E+01***	**4E+03***
o-xylene	**1E+02***	**3E+01***	**1E+03***	**1E+03***	**3E+01***	**1E+03***
xylenes, total	**7E+02***	**1E+02***	**5E+03***	**6E+03***	**1E+02***	**6E+03***
Semivolatile Organic Compounds						
benzoic acid	3E-01	1E-01	9E-01	8E-01	3E-02	9E-01
bis(2-ethylhexyl)phthalate	**5E+00***	8E-01	**7E+01***	**9E+01***	**4E+00***	**9E+01***
butylbenzyl phthalate	3E-04	6E-05	4E-01	5E-01	2E-02	5E-01
carbazole	7E-02	1E-02	**2E+00***	**3E+00***	1E-01	**3E+00***

Table 6-17 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Semivolatile Organic Compounds (continued)						
4-chloro-3-methylphenol	2E-01	6E-02	1E-02	1E-02	5E-04	2E-01
dibenzofuran	2E-01	4E-02	**8E+00***	**1E+01***	5E-01	**1E+01***
di-n-butyl phthalate	8E-04	2E-04	**3E+00***	**4E+00***	2E-01	**4E+00***
diethyl phthalate	8E-05	3E-05	3E-01	3E-01	1E-02	3E-01
di-n-octyl phthalate	1E-02	2E-03	8E-02	1E-01	5E-03	1E-01
4-nitrophenol	3E-01	1E-01	6E-02	5E-02	2E-03	3E-01
pentachlorophenol	**2E+00***	3E-01	8E-02	1E-01	5E-03	**2E+00***
Polycyclic Aromatic Hydrocarbons						
acenaphthene	2E-04	4E-05	8E-03	9E-03	1E-02	1E-02
acenaphthylene	6E-06	1E-06	3E-04	3E-04	5E-04	5E-04
anthracene	2E-04	5E-05	8E-03	9E-03	1E-02	1E-02
benzo(a)anthracene	7E-03	1E-03	8E-03	9E-03	1E-02	1E-02
benzo(b)fluoranthene	5E-03	2E-03	6E-03	4E-03	6E-03	6E-03
benzo(k)fluoranthene	3E-03	6E-04	3E-03	4E-03	6E-03	6E-03
benzo(g,h,i)perylene	2E-03	4E-04	2E-03	2E-03	5E-03	5E-03
benzo(a)pyrene	4E-03	9E-04	5E-03	6E-03	7E-03	7E-03
chrysene	8E-03	2E-03	9E-03	1E-02	1E-02	1E-02
dibenz(a,h)anthracene	9E-04	2E-04	1E-03	1E-03	9E-04	1E-03
fluoranthene	5E-02	2E-02	5E-02	4E-02	4E-02	5E-02
fluorene	2E-04	5E-05	1E-02	1E-02	2E-02	2E-02
indeno(1,2,3-cd)pyrene	3E-03	9E-04	4E-03	4E-03	4E-03	4E-03
2-methylnaphthalene	4E-03	2E-03	2E-01	1E-01	2E-01	2E-01
naphthalene	2E-01	1E-01	**6E+00***	**2E+00***	4E-01	**6E+00***
phenanthrene	1E-03	6E-04	5E-02	4E-02	4E-02	5E-02
pyrene	5E-02	2E-02	5E-02	4E-02	3E-02	5E-02
Polychlorinated Biphenyls						
Aroclor 1260	5E-01	8E-02	**2E+00***	**2E+00***	2E-01	**2E+00***
Metals						
aluminum	**4E+02***	**1E+02***	**8E+00***	**7E+00***	7E-01	**4E+02***
antimony	**1E+01***	**2E+00***	**9E+01***	**1E+02***	**4E+01***	**1E+02***
arsenic	**3E+00***	7E-01	2E-01	2E-01	1E-03	**3E+00***
barium	**3E+00***	1E+00	6E-01	5E-01	6E-02	**3E+00***
beryllium	6E-02	2E-02	6E-01	6E-01	**2E+00***	**2E+00***
cadmium	**4E+02***	**8E+01***	**2E+02***	**3E+02***	**7E+00***	**4E+02***
chromium	**2E+01***	**6E+00***	**7E+01***	**8E+01***	**8E+00***	**8E+01***
chromium, hexavalent	2E-02	4E-03	4E-02	5E-02	5E-03	5E-02
cobalt	**2E+00***	5E-01	**9E+00***	**1E+01***	5E-01	**1E+01***
copper	**5E+00***	1E+00	**4E+00***	**5E+00***	8E-01	**5E+00***
iron	NA	NA	NA	NA	NA	NA
lead	**1E+01***	**3E+00***	**9E+02***	**1E+03***	**1E+02***	**1E+03***
manganese	**3E+00***	1E+00	6E-01	4E-01	3E-02	**3E+00***
mercury	3E-01	9E-02	**2E+00***	**2E+00***	3E-02	**2E+00***

Table 6-17 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Metals (continued)						
molybdenum	**2E+00***	4E-01	9E-02	1E-01	5E-02	**2E+00***
nickel	**1E+02***	**2E+01***	**9E+00***	**1E+01***	1E+00	**1E+02***
selenium	**4E+01***	**1E+01***	**7E+00***	**6E+00***	4E-01	**4E+01***
silver	1E-01	2E-02	1E-02	1E-02	2E-05	1E-01
thallium	**3E+00***	5E-01	**3E+00***	**4E+00***	2E-01	**4E+00***
vanadium	**1E+01***	**3E+00***	2E-01	2E-01	1E-02	**1E+01***
zinc	**2E+01***	**4E+00***	**8E+00***	**1E+01***	1E+00	**2E+01***
Cyanide						
cyanide	4E-02	1E-02	**5E+01***	**4E+01***	**2E+01***	**5E+01***
Hazard Indices						
HI VOC	**1E+04***	**2E+03***	**9E+04***	**1E+05***	**1E+03***	**1E+05***
HI SVOC	**8E+00***	1E+00	**8E+01***	**1E+02***	**5E+00***	**1E+02***
HI PAH	3E-01	2E-01	**6E+00***	**2E+00***	8E-01	**6E+00***
HI PCB	5E-01	8E-02	**2E+00***	**2E+00***	2E-01	**2E+00***
HI metals	**1E+03***	**2E+02***	**1E+03***	**2E+03***	**2E+02***	**2E+03***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
NA – not available
HI – hazard index
HQ – hazard quotient
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-18
Aquatic Wildlife Receptor-Specific Hazard Quotients

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Volatile Organic Compounds					
acetone	5E-03	8E-03	4E-02	4E-02	4E-02
benzene	3E-03	2E-02	1E-01	1E-01	1E-01
bromochloromethane	2E-05	2E-04	7E-04	7E-04	7E-04
bromodichloromethane	1E-03	1E-02	5E-02	5E-02	5E-02
bromoform	5E-05	5E-04	2E-03	2E-03	2E-03
2-butanone	8E-05	9E-04	4E-03	4E-03	4E-03
tert-butyl alcohol	3E-05	3E-04	1E-03	1E-03	1E-03
n-butylbenzene	8E-01	**7E+00***	**3E+01***	**3E+01***	**3E+01***
sec-butylbenzene	**9E+00***	**8E+01***	**3E+02***	**3E+02***	**3E+02***
tert-butylbenzene	**2E+00***	**2E+01***	**8E+01***	**7E+01***	**8E+01***
carbon disulfide	6E-03	7E-02	3E-01	3E-01	3E-01
carbon tetrachloride	**3E+00***	**3E+01***	**1E+02***	**1E+02***	**1E+02***
chlorobenzene	2E-01	**2E+00***	**9E+00***	**9E+00***	**9E+00***
chloroethane	**2E+01***	**2E+00***	**7E+00***	**7E+00***	**2E+01***
chloroform	9E-02	1E+00	**6E+00***	**2E+00***	**6E+00***
chloromethane	3E-03	3E-02	1E-01	1E-01	1E-01
1,2-dichlorobenzene	9E-02	4E-01	**2E+00***	**2E+00***	**2E+00***
1,3-dichlorobenzene	4E-03	2E-02	9E-02	8E-02	9E-02
1,4-dichlorobenzene	3E-02	1E-01	6E-01	5E-01	6E-01
1,1-dichloroethane	**4E+00***	**9E+00***	**4E+01***	**4E+01***	**4E+01***
1,2-dichloroethane	1E-02	3E-02	1E-01	1E-01	1E-01
1,1-dichloroethene	**6E+00***	**6E+01***	**3E+02***	**3E+02***	**3E+02***
1,2-dichloroethene	7E-02	6E-01	**3E+00***	**3E+00***	**3E+00***
cis-1,2-dichloroethene	**2E+02***	**1E+03***	**6E+03***	**5E+03***	**6E+03***
trans-1,2-dichloroethene	**5E+00***	**4E+01***	**2E+02***	**2E+02***	**2E+02***
1,2-dichloropropane	6E-04	5E-03	2E-02	2E-02	2E-02
diisopropyl ether	1E-05	1E-04	6E-04	6E-04	6E-04
ethane	NA	NA	NA	NA	NA
ethene	NA	NA	NA	NA	NA
ethylbenzene	2E-02	2E-01	1E+00	1E+00	1E+00
2-hexanone	3E-03	1E-01	6E-01	6E-01	6E-01
isopropylbenzene	1E+00	**2E+00***	**8E+00***	**8E+00***	**8E+00***
p-isopropyltoluene	**4E+00***	**2E+00***	**1E+01***	**1E+01***	**1E+01***
methane	NA	NA	NA	NA	NA
methyl tert-butyl ether	8E-03	7E-02	3E-01	3E-01	3E-01
4-methyl-2-pentanone	3E-02	3E-01	1E+00	1E+00	1E+00
methylene chloride	6E-03	6E-02	2E-01	2E-01	2E-01
n-propylbenzene	1E+00	**1E+01***	**5E+01***	**5E+01***	**5E+01***
styrene	3E-03	2E-02	1E-01	1E-01	1E-01
tetrachloroethene	**5E+00***	**4E+01***	**2E+02***	**2E+02***	**2E+02***
toluene	1E-01	1E+00	**5E+00***	**5E+00***	**5E+00***

Table 6-18 (continued)

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Volatile Organic Compounds (continued)					
1,2,3-trichlorobenzene	4E-03	4E-02	2E-01	2E-01	2E-01
1,2,4-trichlorobenzene	1E-02	1E-01	6E-01	6E-01	6E-01
1,1,1-trichloroethane	6E-01	**2E+01***	**9E+01***	**9E+01***	**9E+01***
1,1,2-trichloroethane	2E-03	2E-02	9E-02	9E-02	9E-02
trichloroethene	**5E+03***	**4E+04***	**2E+05***	**2E+05***	**2E+05***
trichlorofluoromethane	5E-04	5E-03	2E-02	2E-02	2E-02
1,2,3-trichloropropane	1E-03	9E-03	4E-02	4E-02	4E-02
1,2,4-trimethylbenzene	**1E+01***	**1E+02***	**4E+02***	**4E+02***	**4E+02***
1,3,5-trimethylbenzene	**2E+00***	**2E+01***	**8E+01***	**8E+01***	**8E+01***
vinyl chloride	**4E+01***	**4E+02***	**2E+03***	**3E+02***	**2E+03***
xylenes, total	**1E+01***	**1E+02***	**5E+02***	**5E+02***	**5E+02***
Semivolatile Organic Compounds					
bis(2-chloroethyl)ether	7E-02	7E-01	**3E+00***	**3E+00***	**3E+00***
bis(2-chloroisopropyl)ether	7E-03	6E-02	2E-01	2E-01	2E-01
bis(2-chloro-1-methylethyl)ether	5E-03	4E-02	2E-01	2E-01	2E-01
bis(2-ethylhexyl)phthalate	**6E+02***	**8E+03***	**4E+04***	**4E+04***	**4E+04***
butylbenzyl phthalate	4E-02	**5E+01***	**2E+02***	**2E+02***	**2E+02***
carbazole	2E-02	9E-01	**4E+00***	**4E+00***	**4E+00***
dibenzofuran	5E-02	**2E+00***	**1E+01***	**1E+01***	**1E+01***
2,4-dimethylphenol	2E-02	9E-02	4E-01	4E-01	4E-01
2,4-dinitrophenol	1E-01	1E+00	**4E+00***	**4E+00***	**4E+00***
1,4-dioxane	**2E+00***	**1E+01***	**7E+01***	**7E+01***	**7E+01***
isophorone	3E-05	2E-04	1E-03	1E-03	1E-03
2-methylphenol	4E-03	4E-03	2E-02	2E-02	2E-02
4-methylphenol	1E-02	3E-02	1E-01	1E-01	1E-01
n-nitrosodiphenylamine	1E-03	1E-02	6E-02	6E-02	6E-02
phenol	2E-03	1E-01	5E-01	5E-01	5E-01
Polycyclic Aromatic Hydrocarbons					
acenaphthene	8E-03	4E-01	**2E+00***	**2E+00***	**2E+00***
acenaphthylene	5E-03	2E-01	1E+00	1E+00	1E+00
anthracene	1E-01	**4E+00***	**2E+01***	**2E+01***	**2E+01***
benzo(a)anthracene	**3E+02***	**3E+02***	**1E+03***	**3E+03***	**3E+03***
benzo(b)fluoranthene	**4E+02***	**4E+02***	**2E+03***	**2E+03***	**2E+03***
benzo(k)fluoranthene	**8E+00***	**8E+00***	**4E+01***	**4E+01***	**4E+01***
benzo(a)pyrene	**4E+02***	**5E+02***	**2E+03***	**9E+02***	**2E+03***
chrysene	**2E+02***	**3E+02***	**1E+03***	**2E+02***	**1E+03***
fluoranthene	**1E+02***	**1E+02***	**6E+02***	**6E+02***	**6E+02***
fluorene	7E-02	**3E+00***	**1E+01***	**1E+01***	**1E+01***
2-methylnaphthalene	4E-01	**2E+01***	**7E+01***	**7E+01***	**7E+01***
naphthalene	5E-01	**2E+01***	**1E+02***	**1E+02***	**1E+02***
phenanthrene	5E-01	**2E+01***	**9E+01***	**8E+01***	**9E+01***
pyrene	**4E+01***	**4E+01***	**2E+02***	**2E+02***	**2E+02***

Table 6-18 (continued)

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Pesticides					
aldrin	**2E+02***	**2E+02***	**8E+02***	**8E+02***	**8E+02***
beta-BHC	8E-02	6E-02	3E-01	2E-01	3E-01
delta-BHC	1E-02	8E-03	3E-02	3E-02	3E-02
gamma-BHC (lindane)	5E-02	1E-03	5E-03	5E-03	5E-02
gamma-chlordane	1E+00	**2E+00***	**1E+01***	**1E+01***	**1E+01***
4,4'-DDT	**5E+00***	**4E+02***	**4E+03***	**4E+03***	**4E+03***
dieldrin	**4E+00***	9E-01	**4E+00***	**4E+00***	**4E+00***
endosulfan I	3E-03	4E-05	2E-04	2E-04	3E-03
heptachlor epoxide	2E-01	1E-02	6E-02	5E-02	2E-01
Metals					
aluminum	**1E+02***	**2E+00***	**8E+00***	**8E+00***	**1E+02***
antimony	**2E+01***	**2E+02***	**9E+02***	**2E+02***	**9E+02***
arsenic	**9E+00***	6E-01	**2E+00***	**2E+00***	**9E+00***
barium	**1E+01***	8E-02	4E-01	**7E+01***	**7E+01***
beryllium	2E-01	**2E+00***	**1E+01***	**7E+00***	**1E+01***
cadmium	**5E+02***	**2E+02***	**8E+02***	**3E+03***	**3E+03***
chromium	**7E+01***	**7E+00***	**3E+01***	**5E+03***	**5E+03***
chromium, hexavalent	**6E+02***	**5E+01***	**2E+02***	**4E+04***	**4E+04***
cobalt	**2E+00***	6E-01	**3E+00***	**2E+02***	**2E+02***
copper	**1E+02***	**6E+01***	**3E+02***	**1E+03***	**1E+03***
iron	NA	NA	NA	NA	NA
lead	**1E+03***	**9E+00***	**4E+01***	**2E+06***	**2E+06***
manganese	**4E+01***	**5E+00***	**2E+01***	**2E+01***	**4E+01***
mercury	**6E+01***	**2E+02***	**8E+02***	**5E+03***	**5E+03***
molybdenum	1E-01	6E-03	3E-02	3E-02	1E-01
nickel	**2E+02***	**2E+01***	**9E+01***	**3E+01***	**2E+02***
selenium	**3E+02***	**2E+01***	**8E+01***	**8E+02***	**8E+02***
silver	1E-01	1E-02	5E-02	2E-01	2E-01
thallium	**5E+02***	**6E+02***	**3E+03***	**4E+03***	**4E+03***
vanadium	**2E+00***	3E-02	1E-01	1E-01	**2E+00***
zinc	**1E+03***	**4E+02***	**2E+03***	**4E+03***	**4E+03***
Cyanide					
cyanide	3E-02	3E-01	1E+00	1E+00	1E+00
Radionuclides					
total gross alpha	NA	NA	NA	NA	NA
total gross beta	NA	NA	NA	NA	NA
Hazard Indices					
HI VOC	**5E+03***	**4E+04***	**2E+05***	**2E+05***	**2E+05***
HI SVOC	**6E+02***	**8E+03***	**4E+04***	**4E+04***	**4E+04***
HI PAH	**1E+03***	**2E+03***	**7E+03***	**7E+03***	**7E+03***
HI pesticides	**9E+00***	**4E+02***	**4E+03***	**4E+03***	**4E+03***
HI metals	**4E+03***	**2E+03***	**8E+03***	**2E+06***	**2E+06***

Table 6-18 (continued)

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
HQ – hazard quotient
NA – not available
PAH – polycyclic aromatic hydrocarbon
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-19
Aquatic Life Hazard Quotients

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Volatile Organic Compounds			
acetone	440	21,000	2E-02
benzene	22	109	2E-01
bromochloromethane	0.9	640	1E-03
bromodichloromethane	1	640	2E-03
bromoform	0.2	640	3E-04
2-butanone	49	40,000	1E-03
tert-butyl alcohol	1	46,070	2E-05
n-butylbenzene	6	4	1E+00
sec-butylbenzene	41	4	**1E+01***
tert-butylbenzene	30	4	**7E+00***
carbon disulfide	40	450	9E-02
carbon tetrachloride	4,600	1,500	**3E+00***
chlorobenzene	410	105	**4E+00***
chloroethane	37000	1,130	**3E+01***
chloroform	85	815	1E-01
chloromethane	4	2,700	1E-03
1,2-dichlorobenzene	220	20	**1E+01***
1,3-dichlorobenzene	9	29	3E-01
1,4-dichlorobenzene	68	20	**3E+00***
1,1-dichloroethane	110,000	1,130	**1E+02***
1,2-dichloroethane	570	1,130	5E-01
1,1-dichloroethene	65,000	2,240	**3E+01***
1,2-dichloroethene	1,100	2,240	5E-01
cis-1,2-dichloroethene	85,000	2,240	**4E+01***
trans-1,2-dichloroethene	2,600	2,240	1E+00
1,2-dichloropropane	2	2,400	8E-04
diisopropyl ether	1.2	66,000	2E-05
ethane	180	1,130	2E-01
ethene	210	2,240	9E-02
ethylbenzene	126.8	4	**3E+01***
2-hexanone	180	99	**2E+00***
isopropylbenzene	41	4	**1E+01***
p-isopropyltoluene	62	4	**1E+01***
methane	16,000	2,700	**6E+00***
methyl tert-butyl ether	160	18,000	9E-03
4-methyl-2-pentanone	1,300	170	**8E+00***
methylene chloride	58	2,560	2E-02
n-propylbenzene	47	4	**1E+01***
styrene	5.4	32	2E-01
tetrachloroethene	230	45	**5E+00***
toluene	370	37	**1E+01***

Table 6-19 (continued)

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Volatile Organic Compounds (continued)			
1,2,3-trichlorobenzene	0.58	259	2E-03
1,2,4-trichlorobenzene	2	5	4E-01
1,1,1-trichloroethane	100,000	312	**3E+02***
1,1,2-trichloroethane	4.7	500	9E-03
trichloroethene	580,000	140	**4E+03***
trichlorofluoromethane	1.5	640	2E-03
1,2,3-trichloropropane	0.97	259	4E-03
1,2,4-trimethylbenzene	482	4	**1E+02***
1,3,5-trimethylbenzene	130	4	**3E+01***
vinyl chloride	7,000	2,240	**3E+00***
xylenes, total	1,400	500	**3E+00***
Semivolatile Organic Compounds			
bis(2-chloroethyl)ether	86	19,000	5E-03
bis(2-chloroisopropyl)ether	3.9	400	1E-02
bis(2-chloro-1-methylethyl)ether	31	NA	NA
bis(2-ethylhexyl)phthalate	5,900	55,000	1E-01
butylbenzyl phthalate	10	29	3E-01
carbazole	18	NA	**NA**
dibenzofuran	20	4	**5E+00***
2,4-dimethylphenol	23	100	2E-01
2,4-dinitrophenol	25	19	1E+00
1,4-dioxane	770	22,000	4E-02
isophorone	6	129	5E-02
2-methylphenol	2	67	3E-02
4-methylphenol	15	25	6E-01
N-nitrosodiphenylamine	4	33,000	1E-04
phenol	150	180	8E-01
Polycyclic Aromatic Hydrocarbons			
acenaphthene	5	10	5E-01
acenaphthylene	3	3	1E+00
anthracene	17	3	**6E+00***
benzo(a)anthracene	14	3	**5E+00***
benzo(b)fluoranthene	18	3	**6E+00***
benzo(k)fluoranthene	0.15	3	5E-02
benzo(a)pyrene	8	3	**3E+00***
chrysene	14	3	**5E+00***
fluoranthene	53	2	**3E+01***
fluorene	23	3	**8E+00***
2-methylnaphthalene	240	3	**8E+01***
naphthalene	1,000	24	**4E+01***
phenanthrene	75	5	**2E+01***
pyrene	43	95	5E-01

Table 6-19 (continued)

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Pesticides			
aldrin	0.09	0	7E-01
beta-BHC	0.3	0	**2E+01***
delta-BHC	0.04	0	**3E+00***
gamma-BHC (lindane)	0.02	0	1E+00
gamma-chlordane	0.01	0	**3E+00***
4,4'-DDT	0.01	0	**1E+01***
dieldrin	0.02	0	**1E+01***
endosulfan I	0.006	0	7E-01
heptachlor epoxide	0.02	0	**6E+00***
Metals			
aluminum	247,000	87	**3E+03***
antimony	206	500	4E-01
arsenic	87.3	36	**2E+00***
barium	5,600	5,000	1E+00
beryllium	7.7	50	2E-01
cadmium	51.5	9	**6E+00***
chromium	1,130	50	**2E+01***
chromium, hexavalent	9,350	50	**2E+02***
cobalt	375	227	**2E+00***
copper	668	3	**2E+02***
iron	556,000	1,000	**6E+02***
lead	4,420	8	**5E+02***
manganese	31,500	2,500	**1E+01***
mercury	6.8	1	**7E+00***
molybdenum	70.7	1,230	6E-02
nickel	1,220	8	**1E+02***
selenium	108	71	**2E+00***
silver	70.4	0	**4E+02***
thallium	65.2	21	**3E+00***
vanadium	1,330	205	**6E+00***
zinc	11,500	81	**1E+02***
Cyanide			
cyanide	1,090	1	**1E+03***
Radionuclides (pCi/L)			
total gross alpha	11	NA	NA
total gross beta	35	NA	NA

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
µg/L – micrograms per liter
NA – not applicable
HQ – hazard quotient
pCi/L – picocuries per liter

Table 6-20
Refined Groundwater Sampling Locations

Shallower FWBZ	Deeper FWBZ	SWBZ
M05-06	EA3SB12	D05-03
SND27SB01	EA3SB44	D05-08
SND27SB03	EA3SB45	D10A-01
	EA3SB46	D12-01
	HP-S10A-01	DHP-S05-08
	HP-S10A-02	DHP-S05-09
	HP-S10A-03	HP-S05-04
	HP-S10A-04	HP-S05-05
	L05-02	
	L05-03	
	S10-DGS-DP02	
	S10-DGS-DP03	
	SND17SB01	
	SND17SB03	
	SND27SB01	
	SND27SB03	
	SND27SB05	

Acronyms/Abbreviations:
FWBZ – first water-bearing zone
SWBZ – second water-bearing zone

Table 6-21
Refined Groundwater Chemicals of Potential Ecological Concern, Shallower FWBZ

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Volatile Organic Compounds							
benzene	1	5	20	0.31	0.31	NA	NA
2-butanone	1	5	20	0.74	0.74	NA	NA
carbon disulfide	1	5	20	10	10	NA	NA
1,1-dichloroethane	1	5	20	0.22	0.22	NA	NA
cis-1,2-dichloroethene	2	5	40	0.17	2.1	NA	NA
trans-1,2-dichloroethene	1	5	20	0.55	0.55	NA	NA
toluene	1	5	20	0.25	0.25	NA	NA
trichloroethene	2	5	40	0.29	0.52	NA	NA
Metals							
aluminum	2	4	50	9	38.5	1,070	< Bkgd
antimony	3	6	50	0.18	7.2	37.5	< Bkgd
arsenic	5	6	83	9.2	23	20.72	> Bkgd*
barium	4	4	100	49.2	545	569.5	< Bkgd
cadmium	1	6	17	1.6	1.6	NA	NA
chromium	2	6	33	1.1	1.9	12.45	< Bkgd
cobalt	1	4	25	0.29	0.29	NA	NA
copper	5	6	83	1	15.6	24.03	< Bkgd
iron	4	4	100	45.8	8,970	6,586	> Bkgd*
lead	1	6	17	10.6	10.6	11.45	< Bkgd
manganese	4	4	100	284	1,880	1741	> Bkgd*
mercury	2	6	33	0.00276	0.006	NA	NA
molybdenum	1	1	100	6.8	6.8	NA	NA
nickel	1	6	17	1.8	1.8	NA	NA
selenium	2	6	33	0.29	1.8	8.58	< Bkgd
silver	1	6	17	0.91	0.91	NA	NA
vanadium	3	4	75	1.4	11	26.27	< Bkgd
zinc	2	6	33	13	15	36.39	< Bkgd

Table 6-21 (continued)

Note:

* concentrations in refined data set considered ambient, based on further evaluation (lateral distribution of concentrations, detection frequency, and [for wells] time series data)

Acronyms/Abbreviations:

< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of background data
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of background data
COPEC – chemical of potential ecological concern (for soil 0 to 6 feet below ground surface)
FWBZ – first water-bearing zone
µg/L – micrograms per liter
NA – not available

Table 6-22
Refined Groundwater Chemicals of Potential Ecological Concern, Deeper FWBZ

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Volatile Organic Compounds							
acetone	3	13	23	2	45	NA	NA
benzene	3	15	20	0.1	0.31	NA	NA
2-butanone	4	13	31	0.92	3.6	NA	NA
carbon disulfide	9	13	69	0.32	37	NA	NA
chloroform	3	13	23	0.21	2.4	NA	NA
cis-1,2-dichloroethene	5	11	45	0.35	16	NA	NA
ethane	1	2	50	7.2	7.2	NA	NA
methane	2	2	100	160	350	NA	NA
methylene chloride	1	15	6.7	0.93	0.93	NA	NA
toluene	5	15	33	0.17	2.7	NA	NA
vinyl chloride	3	15	20	5.7	460	NA	NA
xylenes, total	3	15	20	0.71	2.2	NA	NA
Polycyclic Aromatic Hydrocarbons							
pyrene	1	3	33	0.24	0.24	NA	NA
Metals							
aluminum	9	11	82	28.4	130	1,070	< Bkgd
antimony	5	11	45	2.1	3.7	37.5	< Bkgd
arsenic	7	11	64	7.6	23.5	20.72	> Bkgd*
barium	11	11	100	110	194	569.5	< Bkgd
chromium	5	11	45	2.9	41.2	12.45	> Bkgd*
cobalt	1	11	9.1	12.9	12.9	NA	NA
copper	2	11	18	13.3	15.9	24.03	< Bkgd
iron	5	11	45	73.2	4,840	6,586	< Bkgd
manganese	11	11	100	1.9	497	1741	< Bkgd
mercury	2	11	18	0.00113	0.00158	NA	NA

Table 6-22 (continued)

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Metals (continued)							
nickel	1	11	9.1	27.6	27.6	NA	NA
selenium	2	11	18	14.7	61	8.58	> Bkgd*
silver	4	11	36	0.88	1.9	NA	NA
thallium	3	11	27	7	22.3	16.15	> Bkgd*
vanadium	9	11	82	2.1	21.3	26.27	< Bkgd
zinc	1	11	9.1	2.8	2.8	36.39	< Bkgd

Note:
* concentrations in refined data set considered ambient, based on further evaluation (lateral distribution of concentrations, detection frequency, and [for wells] time series data)

Acronyms/Abbreviations:
< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of background data
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of background data
COPEC – chemical of potential ecological concern (for soil 0-6 feet below ground surface)
FWBZ – first water-bearing zone
µg/L – micrograms per liter
NA – not available

Table 6-23
Refined Groundwater Chemicals of Potential Ecological Concern, SWBZ

COPEC	Number of Positive Detections	Number of Samples	Frequency of Detection	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Background Threshold Value	Background Comparison
Volatile Organic Compounds							
acetone	2	15	13	7.6	9	NA	NA
benzene	1	17	5.9	0.2	0.2	NA	NA
2-butanone	2	15	13	2.2	3	NA	NA
carbon disulfide	3	17	18	0.28	4	NA	NA
methane	2	5	40	3	3	NA	NA
4-methyl-2-pentanone	1	17	5.9	0.2	0.2	NA	NA
Semivolatile Organic Compounds							
isophorone	2	5	40	2	6	NA	NA
Metals							
aluminum	2	4	50	1.1	1.2	1,070	< Bkgd
antimony	3	11	27	0.3	0.9	37.5	< Bkgd
arsenic	8	11	73	0.55	25	20.72	> Bkgd*
barium	4	4	100	120	546	569.5	< Bkgd
beryllium	2	11	18	0.66	0.66	2.5	< Bkgd
cadmium	3	11	27	0.34	0.39	NA	NA
chromium	5	11	45	1	2.5	12.45	< Bkgd
cobalt	4	4	100	6.8	17	NA	NA
copper	9	11	82	0.38	6.9	24.03	< Bkgd
iron	4	4	100	563	5,000	6,586	< Bkgd
manganese	4	4	100	4,200	15,000	1,741	> Bkgd*
molybdenum	2	3	67	0.84	0.91	NA	NA
nickel	8	11	73	12.6	27	NA	NA
selenium	6	11	55	0.29	58	8.58	> Bkgd*
silver	5	11	45	0.042	7.5	NA	NA
thallium	1	11	9.1	0.44	0.44	16.15	< Bkgd
vanadium	4	4	100	0.81	2.9	26.27	< Bkgd
zinc	6	11	55	8.7	98	36.39	> Bkgd*

Table 6-23 (continued)

Note:
* SWBZ concentrations considered ambient, based on further evaluation

Acronyms/Abbreviations:
< Bkgd – site data were not greater than the background data; maximum site concentration compared to 95th percentile of background data
> Bkgd – site data were greater than the background data; maximum site concentration compared to 95th percentile of background data
COPEC – chemical of potential ecological concern (for soil 0 to 6 feet below ground surface)
µg/L – micrograms per liter
NA – not available
SWBZ – second water-bearing zone

Table 6-24
Terrestrial Plant and Invertebrate Refined Hazard Quotients
Exposure Unit 1

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	3.09E-02	NA	NA	NA	NA
benzene	2.91E-01	NA	NA	NA	NA
2-butanone	8.40E-03	NA	NA	NA	NA
carbon disulfide	1.30E-02	NA	NA	NA	NA
chlorobenzene	3.58E-03	NA	NA	40	9E-05
chloroform	1.00E-03	NA	NA	NA	NA
chloromethane	4.90E-03	NA	NA	NA	NA
1,1-dichloroethene	3.00E-03	NA	NA	NA	NA
cis-1,2-dichloroethene	3.96E-03	NA	NA	NA	NA
trans-1,2-dichloroethene	1.70E-03	NA	NA	NA	NA
ethylbenzene	1.55E-01	NA	NA	NA	NA
2-hexanone	2.00E-03	NA	NA	NA	NA
4-methyl-2-pentanone	8.84E-03	NA	NA	NA	NA
methylene chloride	2.14E-02	NA	NA	NA	NA
tetrachloroethene	5.20E-02	NA	NA	NA	NA
toluene	2.94E-01	200	1E-03	NA	NA
trichloroethene	3.57E-02	NA	NA	NA	NA
1,2,4-trimethylbenzene	1.50E-03	NA	NA	NA	NA
m-, p-xylene	4.67E-03	NA	NA	NA	NA
xylenes, total	3.50E-01	NA	NA	NA	NA
Semivolatile Organic Compounds					
bis(2-ethylhexyl)phthalate	1.95E-01	NA	NA	NA	NA
butylbenzyl phthalate	2.00E-02	NA	NA	NA	NA
carbazole	3.26E-01	NA	NA	NA	NA
4-chloro-3-methylphenol	3.00E-02	NA	NA	NA	NA
dibenzofuran	1.20E-01	NA	NA	NA	NA
di-n-butyl phthalate	1.10E-01	200	6E-04	NA	NA
diethyl phthalate	2.50E-02	100	3E-04	NA	NA
dimethyl phthalate	4.40E-02	NA	NA	200	2E-04
hexachlorobutadiene	3.70E-03	NA	NA	NA	NA
N-nitroso-di-n-propylamine	2.30E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons					
acenaphthene	6.18E-03	20	3E-04	29	2E-04
acenaphthylene	7.68E-03	NA	NA	29	3E-04
anthracene	1.68E-02	NA	NA	29	6E-04
benzo(a)anthracene	3.77E-02	NA	NA	18	2E-03
benzo(b)fluoranthene	4.22E-02	NA	NA	18	2E-03

Table 6-24 (continued)

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Polycyclic Aromatic Hydrocarbons (continued)					
benzo(k)fluoranthene	3.33E-02	NA	NA	18	2E-03
benzo(g,h,i)perylene	4.90E-02	NA	NA	18	3E-03
benzo(a)pyrene	5.40E-02	NA	NA	18	3E-03
chrysene	4.83E-02	NA	NA	18	3E-03
dibenz(a,h)anthracene	9.00E-03	NA	NA	18	5E-04
fluoranthene	9.86E-02	NA	NA	18	5E-03
fluorene	7.36E-03	NA	NA	29	3E-04
indeno(1,2,3-cd)pyrene	4.79E-02	NA	NA	18	3E-03
2-methylnaphthalene	1.39E-02	NA	NA	29	5E-04
naphthalene	1.62E-02	NA	NA	29	6E-04
phenanthrene	8.68E-02	NA	NA	29	3E-03
pyrene	1.17E-01	NA	NA	18	7E-03
Pesticides					
aldrin	2.91E-03	NA	NA	NA	NA
beta-BHC	1.50E-03	NA	NA	NA	NA
delta-BHC	1.60E-03	NA	NA	NA	NA
alpha-chlordane	1.55E-03	NA	NA	NA	NA
gamma-chlordane	1.57E-03	NA	NA	NA	NA
4,4'-DDT	3.12E-03	NA	NA	NA	NA
endrin aldehyde	2.20E-03	NA	NA	NA	NA
heptachlor	1.55E-03	NA	NA	NA	NA
Polychlorinated Biphenyls					
Aroclor 1260	5.10E-02	40	1E-03	NA	NA
Metals					
aluminum	7.82E+03	50	**2E+02***	NA	NA
barium	6.63E+01	500	1E-01	330	2E-01
chromium	2.85E+01	1	**3E+01***	0.4	**7E+01***
cobalt	1.41E+01	13	1E+00	NA	NA
copper	1.77E+01	100	2E-01	50	4E-01
iron	1.46E+04	NA	NA	NA	NA
manganese	2.35E+02	220	1E+00	450	5E-01
mercury	1.87E+00	0.3	**6E+00***	0.1	**2E+01***
molybdenum	1.10E+00	2	6E-01	NA	NA
nickel	2.94E+01	30	1E+00	280	1E-01
selenium	6.09E-01	1	6E-01	70	9E-03
silver	3.68E+00	2	**2E+00***	NA	NA
thallium	1.29E+00	1	1E+00	NA	NA
vanadium	2.76E+01	2	**1E+01***	NA	NA
zinc	3.02E+01	50	6E-01	200	2E-01

Table 6-24 (continued)

Note:
* bold type indicates an HQ >1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
EPC – exposure point concentration
HQ – hazard quotient
mg/kg – milligrams per kilogram
NA – not applicable

Table 6-25
Terrestrial Wildlife Receptor-Specific Refined Hazard Quotients
Exposure Unit 1

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	2E-03	1E-03	5E-03	1E-03	1E-06	5E-03
benzene	1E-02	5E-03	2E-01	8E-02	3E-04	2E-01
2-butanone	6E-05	3E-05	9E-04	2E-04	4E-07	9E-04
carbon disulfide	1E-03	6E-04	2E-02	7E-03	3E-05	2E-02
chlorobenzene	2E-04	7E-05	4E-03	4E-03	4E-06	4E-03
chloroform	6E-04	4E-04	1E-02	5E-03	2E-05	1E-02
chloromethane	8E-03	4E-03	1E-01	2E-02	8E-05	1E-01
1,1-dichloroethene	1E-04	4E-05	1E-03	7E-04	2E-06	1E-03
cis-1,2-dichloroethene	3E-03	1E-03	4E-02	1E-02	5E-05	4E-02
trans-1,2-dichloroethene	1E-03	5E-04	2E-02	6E-03	2E-05	2E-02
ethylbenzene	4E-03	7E-04	6E-02	6E-02	4E-05	6E-02
2-hexanone	7E-05	4E-05	4E-03	1E-03	5E-06	4E-03
4-methyl-2-pentanone	6E-04	3E-04	8E-03	2E-03	8E-06	8E-03
methylene chloride	6E-03	3E-03	8E-02	2E-02	9E-05	8E-02
tetrachloroethene	1E-01	2E-02	**2E+00***	**2E+00***	9E-04	**2E+00***
toluene	2E-02	4E-03	2E-01	2E-01	3E-04	2E-01
trichloroethene	6E-02	2E-02	8E-01	6E-01	1E-03	8E-01
1,2,4-trimethylbenzene	4E-03	6E-04	6E-02	6E-02	2E-05	6E-02
m-, p-xylene	5E-03	1E-03	7E-02	8E-02	5E-05	8E-02
xylenes, total	4E-01	7E-02	**6E+00***	**6E+00***	4E-03	**6E+00***
Semivolatile Organic Compounds						
bis(2-ethylhexyl)phthalate	1E-02	1E-03	2E-01	3E-01	4E-04	3E-01
butylbenzyl phthalate	1E-04	2E-05	3E-01	3E-01	4E-04	3E-01
carbazole	7E-03	1E-03	5E-01	5E-01	8E-04	5E-01
4-chloro-3-methylphenol	2E-01	3E-02	1E-02	1E-02	2E-05	2E-01
dibenzofuran	3E-03	4E-04	2E-01	2E-01	3E-04	2E-01
di-n-butyl phthalate	2E-04	3E-05	1E+00	**2E+00***	2E-03	**2E+00***
diethyl phthalate	8E-06	2E-06	5E-02	4E-02	6E-05	5E-02
dimethyl phthalate	2E-05	7E-06	1E-01	8E-02	1E-04	1E-01
hexachlorobutadiene	2E-02	3E-03	2E-03	2E-03	3E-06	2E-02
N-nitroso-di-n-propylamine	1E-02	4E-03	2E-01	9E-02	1E-04	2E-01
phenol	1E-02	4E-03	8E-01	5E-01	6E-04	8E-01
Polycyclic Aromatic Hydrocarbons						
acenaphthene	7E-06	2E-06	6E-04	4E-04	1E-05	6E-04
acenaphthylene	4E-06	9E-07	4E-04	3E-04	2E-05	4E-04
anthracene	1E-05	2E-06	9E-04	9E-04	4E-05	9E-04
benzo(a)anthracene	9E-04	2E-04	2E-03	2E-03	9E-05	2E-03
benzo(b)fluoranthene	2E-03	6E-04	3E-03	2E-03	1E-04	3E-03
benzo(k)fluoranthene	7E-04	1E-04	2E-03	1E-03	8E-05	2E-03

Table 6-25 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Polycyclic Aromatic Hydrocarbons (continued)						
benzo(g,h,i)perylene	8E-04	2E-04	2E-03	2E-03	1E-04	2E-03
benzo(a)pyrene	2E-03	3E-04	3E-03	3E-03	1E-04	3E-03
chrysene	2E-03	3E-04	4E-03	4E-03	1E-04	4E-03
dibenz(a,h)anthracene	4E-04	1E-04	8E-04	8E-04	2E-05	8E-04
fluoranthene	6E-03	2E-03	1E-02	8E-03	2E-04	1E-02
fluorene	7E-06	2E-06	5E-04	4E-04	2E-05	5E-04
indeno(1,2,3-cd)pyrene	2E-03	5E-04	4E-03	3E-03	1E-04	4E-03
2-methylnaphthalene	7E-06	2E-06	6E-04	6E-04	3E-05	6E-04
naphthalene	3E-04	2E-04	2E-02	5E-03	4E-05	2E-02
phenanthrene	8E-05	2E-05	6E-03	4E-03	2E-04	6E-03
pyrene	9E-03	4E-03	2E-02	1E-02	3E-04	2E-02
Pesticides						
aldrin	2E-02	2E-03	3E-02	3E-02	9E-05	3E-02
beta-BHC	3E-03	6E-04	3E-03	3E-03	6E-06	3E-03
delta-BHC	3E-03	6E-04	3E-03	3E-03	7E-06	3E-03
alpha-chlordane	2E-04	3E-05	6E-04	7E-04	2E-06	7E-04
gamma-chlordane	2E-04	3E-05	6E-04	7E-04	2E-06	7E-04
4,4'-DDT	2E-03	3E-04	7E-01	3E-01	8E-04	7E-01
endrin aldehyde	2E-02	3E-03	2E-01	2E-01	5E-04	2E-01
heptachlor	7E-03	1E-03	6E-04	7E-04	2E-06	7E-03
Metals						
aluminum	**5E+01***	**1E+01***	**2E+00***	**2E+00***	3E-01	**5E+01***
antimony	**3E+00***	4E-01	**4E+01***	**4E+01***	**6E+01***	**6E+01***
arsenic	3E-01	6E-02	3E-02	2E-02	8E-04	3E-01
barium	4E-01	1E-01	2E-01	1E-01	2E-02	4E-01
beryllium	4E-02	1E-02	9E-01	7E-01	**2E+00***	**2E+00***
cadmium	**2E+01***	**4E+00***	**3E+01***	**3E+01***	6E-01	**3E+01***
chromium	3E-01	7E-02	**2E+00***	**2E+00***	4E-01	**2E+00***
cobalt	2E-01	5E-02	**2E+00***	**2E+00***	1E-01	**2E+00***
copper	4E-01	9E-02	7E-01	7E-01	3E-01	7E-01
iron	NA	NA	NA	NA	NA	0E+00
lead	3E-01	8E-02	**4E+01***	**4E+01***	**2E+01***	**4E+01***
manganese	3E-01	1E-01	1E-01	8E-02	9E-03	3E-01
mercury	**2E+00***	4E-01	**1E+01***	**1E+01***	7E-02	**1E+01***
molybdenum	5E-01	1E-01	5E-02	5E-02	1E-01	5E-01
nickel	**2E+01***	**3E+00***	**3E+00***	**3E+00***	8E-01	**2E+01***
selenium	**2E+00***	5E-01	6E-01	4E-01	1E-01	**2E+00***
silver	3E-02	4E-03	5E-03	6E-03	8E-06	3E-02
thallium	3E-01	5E-02	6E-01	7E-01	1E-02	7E-01
vanadium	**2E+00***	5E-01	7E-02	5E-02	5E-03	**2E+00***
zinc	1E+00	2E-01	8E-01	8E-01	2E-01	1E+00

Table 6-25 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Hazard Indices						
HI VOC	6E-01	1E-01	**1E+01***	**9E+00***	7E-03	**1E+01***
HI SVOC	3E-01	4E-02	**3E+00***	**4E+00***	5E-03	**4E+00***
HI PAH	3E-02	9E-03	8E-02	5E-02	2E-03	8E-02
HI pesticides	6E-02	8E-03	9E-01	5E-01	1E-03	9E-01
HI metals	**1E+02***	**2E+01***	**1E+02***	**1E+02***	**9E+01***	**1E+02***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
HQ – hazard quotient
HI – hazard index
NA – not available
PAH – polycyclic aromatic hydrocarbon
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-26
Terrestrial Plant and Invertebrate Refined Hazard Quotients
Exposure Unit 2

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	4.69E-02	NA	NA	NA	NA
benzene	2.40E-03	NA	NA	NA	NA
bromochloromethane	2.66E-03	NA	NA	NA	NA
bromomethane	6.26E-03	NA	NA	NA	NA
2-butanone	1.80E-02	NA	NA	NA	NA
n-butylbenzene	4.10E-03	NA	NA	NA	NA
sec-butylbenzene	3.40E-03	NA	NA	NA	NA
tert-butylbenzene	8.40E-03	NA	NA	NA	NA
carbon disulfide	1.10E-02	NA	NA	NA	NA
chlorobenzene	3.00E-03	NA	NA	40	8E-05
chloromethane	5.76E-03	NA	NA	NA	NA
1,2-dichlorobenzene	1.40E-03	NA	NA	NA	NA
1,3-dichlorobenzene	8.10E-04	NA	NA	NA	NA
1,4-dichlorobenzene	2.60E-03	NA	NA	20	1E-04
1,1-dichloroethane	3.09E-03	NA	NA	NA	NA
1,1-dichloroethene	2.80E-03	NA	NA	NA	NA
cis-1,2-dichloroethene	1.50E-03	NA	NA	NA	NA
trans-1,2-dichloroethene	4.00E-04	NA	NA	NA	NA
1,2-dichloropropane	3.16E-03	NA	NA	700	5E-06
ethylbenzene	9.69E-03	NA	NA	NA	NA
2-hexanone	1.01E-02	NA	NA	NA	NA
isopropylbenzene	8.90E-03	NA	NA	NA	NA
p-isopropyltoluene	2.68E-03	NA	NA	NA	NA
methyl tert-butyl ether	1.20E-03	NA	NA	NA	NA
4-methyl-2-pentanone	9.99E-03	NA	NA	NA	NA
methylene chloride	2.63E-02	NA	NA	NA	NA
n-propylbenzene	2.74E-03	NA	NA	NA	NA
tetrachloroethene	4.59E-03	NA	NA	NA	NA
toluene	3.33E-03	200	2E-05	NA	NA
1,2,3-trichlorobenzene	4.50E-03	NA	NA	20	2E-04
1,2,4-trichlorobenzene	3.50E-03	NA	NA	20	2E-04
1,1,1-trichloroethane	3.83E-03	NA	NA	NA	NA
trichloroethene	4.69E-03	NA	NA	NA	NA
1,2,4-trimethylbenzene	1.10E-02	NA	NA	NA	NA
1,3,5-trimethylbenzene	1.04E-02	NA	NA	NA	NA
m-, p-xylene	3.97E-03	NA	NA	NA	NA
o-xylene	3.26E-03	NA	NA	NA	NA

Table 6-26 (continued)

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Semivolatile Organic Compounds					
bis(2-ethylhexyl)phthalate	1.30E-01	NA	NA	NA	NA
butylbenzyl phthalate	3.50E-02	NA	NA	NA	NA
4-chloro-3-methylphenol	4.00E-02	NA	NA	NA	NA
2-chlorophenol	2.90E-02	NA	NA	NA	NA
diethyl phthalate	1.90E-02	100	2E-04	NA	NA
1,4-dioxane	3.10E-02	NA	NA	NA	NA
N-nitroso-di-n-propylamine	2.30E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons					
acenaphthene	2.90E-03	20	1E-04	29	1E-04
acenaphthylene	8.00E-03	NA	NA	29	3E-04
anthracene	1.00E-02	NA	NA	29	3E-04
benzo(a)anthracene	1.78E-02	NA	NA	18	1E-03
benzo(b)fluoranthene	1.97E-02	NA	NA	18	1E-03
benzo(k)fluoranthene	1.59E-02	NA	NA	18	9E-04
benzo(g,h,i)perylene	2.84E-02	NA	NA	18	2E-03
benzo(a)pyrene	1.96E-02	NA	NA	18	1E-03
chrysene	1.84E-02	NA	NA	18	1E-03
dibenz(a,h)anthracene	1.10E-02	NA	NA	18	6E-04
fluoranthene	2.65E-02	NA	NA	18	1E-03
fluorene	1.90E-03	NA	NA	29	7E-05
indeno(1,2,3-c,d)pyrene	1.69E-02	NA	NA	18	9E-04
2-methylnaphthalene	2.90E-03	NA	NA	29	1E-04
naphthalene	8.60E-03	NA	NA	29	3E-04
phenanthrene	1.71E-02	NA	NA	29	6E-04
pyrene	2.53E-02	NA	NA	18	1E-03
Polychlorinated Biphenyls					
Aroclor 1260	7.20E-02	40	2E-03	NA	NA
Metals					
aluminum	6.43E+03	50	**1E+02***	NA	NA
antimony	1.14E+00	5	2E-01	78	1E-02
arsenic	1.40E+01	18	8E-01	60	2E-01
barium	5.50E+01	500	1E-01	330	2E-01
chromium	3.80E+01	1	**4E+01***	0.4	**1E+02***
chromium, hexavalent	1.70E-01	NA	NA	NA	NA
cobalt	1.29E+01	13	1E+00	NA	NA
copper	1.79E+01	100	2E-01	50	4E-01
iron	1.70E+04	NA	NA	NA	NA
lead	2.79E+02	120	**2E+00***	1700	2E-01
manganese	2.33E+02	220	1E+00	450	5E-01

Table 6-26 (continued)

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Metals (continued)					
mercury	6.17E-01	0.3	**2E+00***	0.1	**6E+00***
molybdenum	1.95E+00	2	1E+00	NA	NA
nickel	2.77E+01	38	7E-01	280	1E-01
selenium	9.27E+00	1	**9E+00***	70	1E-01
silver	2.71E+00	2	1E+00	NA	NA
thallium	1.01E+01	1	**1E+01***	NA	NA
vanadium	3.44E+01	2	**2E+01***	NA	NA
zinc	5.25E+01	50	1E+00	200	3E-01

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
EPC – exposure point concentration
HQ – hazard quotient
mg/kg – milligrams per kilogram
NA – not applicable

Table 6-27
Terrestrial Wildlife Receptor-Specific Refined Hazard Quotients
Exposure Unit 2

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	3E-03	2E-03	8E-03	9E-04	1E-06	8E-03
benzene	9E-05	4E-05	1E-03	4E-04	1E-06	1E-03
bromochloromethane	9E-05	5E-05	1E-03	2E-04	7E-07	1E-03
bromomethane	8E-03	4E-03	1E-01	1E-02	5E-05	1E-01
2-butanone	1E-04	6E-05	2E-03	2E-04	4E-07	2E-03
n-butylbenzene	5E-02	6E-03	6E-01	4E-01	2E-05	6E-01
sec-butylbenzene	5E-02	7E-03	7E-01	5E-01	2E-05	7E-01
tert-butylbenzene	6E-02	8E-03	8E-01	5E-01	5E-05	8E-01
carbon disulfide	1E-03	5E-04	1E-02	3E-03	1E-05	1E-02
chlorobenzene	2E-04	6E-05	4E-03	2E-03	2E-06	4E-03
chloromethane	9E-03	5E-03	1E-01	2E-02	5E-05	1E-01
1,2-dichlorobenzene	7E-05	1E-05	5E-04	3E-04	1E-07	5E-04
1,3-dichlorobenzene	5E-05	7E-06	3E-04	2E-04	6E-08	3E-04
1,4-dichlorobenzene	1E-04	2E-05	9E-04	6E-04	2E-07	9E-04
1,1-dichloroethane	7E-05	3E-05	3E-04	6E-05	2E-07	3E-04
1,1-dichloroethene	1E-04	4E-05	1E-03	4E-04	1E-06	1E-03
cis-1,2-dichloroethene	1E-03	4E-04	1E-02	3E-03	1E-05	1E-02
trans-1,2-dichloroethene	3E-04	1E-04	4E-03	8E-04	3E-06	4E-03
1,2-dichloropropane	4E-04	2E-04	5E-03	1E-03	4E-06	5E-03
ethylbenzene	3E-04	5E-05	4E-03	2E-03	1E-06	4E-03
2-hexanone	4E-04	2E-04	2E-02	3E-03	1E-05	2E-02
isopropylbenzene	3E-02	4E-03	8E-02	5E-02	1E-05	8E-02
p-isopropyltoluene	2E-02	2E-03	2E-02	1E-02	1E-06	2E-02
methyl tert-butyl ether	3E-04	1E-04	4E-03	4E-04	1E-06	4E-03
4-methyl-2-pentanone	6E-04	3E-04	9E-03	1E-03	5E-06	9E-03
methylene chloride	7E-03	4E-03	1E-01	1E-02	5E-05	1E-01
n-propylbenzene	9E-03	1E-03	1E-01	7E-02	2E-05	1E-01
tetrachloroethene	1E-02	2E-03	2E-01	1E-01	4E-05	2E-01
toluene	2E-04	5E-05	3E-03	1E-03	2E-06	3E-03
1,2,3-trichlorobenzene	4E-03	5E-04	5E-02	3E-02	4E-06	5E-02
1,2,4-trichlorobenzene	3E-03	4E-04	4E-02	2E-02	3E-06	4E-02
1,1,1-trichloroethane	4E-06	1E-06	6E-05	3E-05	5E-08	6E-05
trichloroethene	8E-03	2E-03	1E-01	4E-02	8E-05	1E-01
1,2,4-trimethylbenzene	3E-02	4E-03	4E-01	3E-01	6E-05	4E-01
1,3,5-trimethylbenzene	2E-02	3E-03	3E-01	2E-01	6E-05	3E-01
m-, p-xylene	5E-03	8E-04	6E-02	4E-02	2E-05	6E-02
o-xylene	4E-03	7E-04	5E-02	3E-02	2E-05	5E-02

Table 6-27 (continued)

COPEC	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Semivolatile Organic Compounds						
bis(2-ethylhexyl)phthalate	7E-03	9E-04	2E-01	1E-01	1E-04	2E-01
butylbenzyl phthalate	2E-04	4E-05	4E-01	3E-01	4E-04	4E-01
4-chloro-3-methylphenol	2E-01	5E-02	2E-02	9E-03	1E-05	2E-01
2-chlorophenol	9E-02	3E-02	6E-02	2E-02	3E-05	9E-02
diethyl phthalate	6E-06	2E-06	4E-02	2E-02	2E-05	4E-02
1,4-dioxane	5E-01	2E-01	**6E+00***	1E+00	7E-04	**6E+00***
N-nitroso-di-n-propylamine	1E-02	4E-03	2E-01	5E-02	6E-05	2E-01
pentachlorophenol	2E-01	2E-02	1E-02	8E-03	1E-05	2E-01
phenol	1E-03	5E-04	1E-01	3E-02	4E-05	1E-01
Metals						
aluminum	**4E+01***	**1E+01***	**2E+00***	**2E+00***	3E-01	**4E+01***
antimony	1E+00	2E-01	**2E+01***	**7E+01***	**6E+01***	**7E+01***
arsenic	1E+00	3E-01	1E-01	1E-01	8E-04	1E+00
barium	3E-01	1E-01	1E-01	1E-01	2E-02	3E-01
beryllium	8E-03	2E-03	2E-01	3E-01	**2E+00***	**2E+00***
cadmium	**1E+01***	**2E+00***	**1E+01***	**2E+01***	6E-01	**2E+01***
chromium	4E-01	9E-02	**2E+00***	**3E+00***	4E-01	**3E+00***
chromium, hexavalent	2E-03	4E-04	1E-02	6E-03	2E-05	1E-02
cobalt	2E-01	5E-02	**2E+00***	**2E+00***	1E-01	**2E+00***
copper	4E-01	9E-02	7E-01	1E+00	3E-01	1E+00
iron	NA	NA	NA	NA	NA	0E+00
lead	**1E+01***	**2E+00***	**1E+03***	**7E+02***	**3E+01***	**1E+03***
manganese	3E-01	1E-01	1E-01	1E-01	9E-03	3E-01
mercury	5E-01	1E-01	**5E+00***	**4E+00***	6E-02	**5E+00***
molybdenum	8E-01	2E-01	9E-02	1E-01	1E-01	8E-01
nickel	**2E+01***	**3E+00***	**3E+00***	**5E+00***	8E-01	**2E+01***
selenium	**3E+01***	**8E+00***	**9E+00***	**4E+00***	1E-01	**3E+01***
silver	2E-02	3E-03	4E-03	4E-03	7E-06	2E-02
thallium	**3E+00***	4E-01	**5E+00***	**3E+00***	2E-02	**5E+00***
vanadium	**2E+00***	6E-01	8E-02	8E-02	5E-03	**2E+00***
zinc	**2E+00***	3E-01	1E+00	**2E+00***	2E-01	**2E+00***
Hazard Indices						
HI VOC	3E-01	6E-02	**4E+00***	**2E+00***	6E-04	**4E+00***
HI SVOC	1E+00	3E-01	**7E+00***	**2E+00***	1E-03	**7E+00***
HI metals	**1E+02***	**3E+01***	**1E+03***	**8E+02***	**1E+02***	**1E+03***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
HI – hazard index
HQ – hazard quotient
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-28
Terrestrial Plant and Invertebrate Refined Hazard Quotients
Exposure Unit 3

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Volatile Organic Compounds					
acetone	1.60E-01	NA	NA	NA	NA
benzene	6.10E-02	NA	NA	NA	NA
2-butanone	5.77E-01	NA	NA	NA	NA
n-butylbenzene	5.73E+00	NA	NA	NA	NA
sec-butylbenzene	4.45E+00	NA	NA	NA	NA
tert-butylbenzene	5.56E-01	NA	NA	NA	NA
carbon disulfide	1.90E-02	NA	NA	NA	NA
chlorobenzene	1.20E-02	NA	NA	40	3E-04
chloroform	2.00E-03	NA	NA	NA	NA
1,2-dichlorobenzene	2.58E-01	NA	NA	NA	NA
1,4-dichlorobenzene	4.10E-03	NA	NA	20	2E-04
1,1-dichloroethane	1.07E+00	NA	NA	NA	NA
1,2-dichloroethane	9.60E-03	NA	NA	NA	NA
1,1-dichloroethene	2.60E-01	NA	NA	NA	NA
1,2-dichloroethylene	2.53E+01	NA	NA	NA	NA
cis-1,2-dichloroethene	6.65E-03	NA	NA	NA	NA
trans-1,2-dichloroethene	1.60E-03	NA	NA	NA	NA
ethylbenzene	2.12E+00	NA	NA	NA	NA
2-hexanone	2.60E-01	NA	NA	NA	NA
isopropylbenzene	2.73E+00	NA	NA	NA	NA
p-isopropyltoluene	5.75E+00	NA	NA	NA	NA
4-methyl-2-pentanone	1.00E-02	NA	NA	NA	NA
methylene chloride	5.23E-01	NA	NA	NA	NA
n-propylbenzene	5.43E+00	NA	NA	NA	NA
tetrachloroethene	6.29E+00	NA	NA	NA	NA
toluene	5.54E+00	200	3E-02	NA	NA
1,2,3-trichlorobenzene	5.90E-03	NA	NA	20	3E-04
1,1,1-trichloroethane	1.62E+00	NA	NA	NA	NA
trichloroethene	1.21E+01	NA	NA	NA	NA
1,2,4-trimethylbenzene	3.83E+01	NA	NA	NA	NA
1,3,5-trimethylbenzene	1.25E+01	NA	NA	NA	NA
2,2,4-trimethylpentane	2.13E-01	NA	NA	NA	NA
m-, p-xylene	9.99E+00	NA	NA	NA	NA
o-xylene	3.56E+00	NA	NA	NA	NA
xylenes, total	4.79E+01	NA	NA	NA	NA

Table 6-28 (continued)

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Semivolatile Organic Compounds					
benzoic acid	2.90E-01	NA	NA	NA	NA
bis(2-ethylhexyl)phthalate	4.32E+00	NA	NA	NA	NA
butylbenzyl phthalate	2.30E-02	NA	NA	NA	NA
carbazole	6.85E-01	NA	NA	NA	NA
4-chloro-3-methylphenol	1.90E-02	NA	NA	NA	NA
dibenzofuran	5.91E-01	NA	NA	NA	NA
di-n-butyl phthalate	1.90E-01	200	1E-03	NA	NA
diethyl phthalate	1.10E-01	100	1E-03	NA	NA
di-n-octyl phthalate	1.80E-02	NA	NA	NA	NA
4-nitrophenol	1.10E-01	NA	NA	7	2E-02
Polycyclic Aromatic Hydrocarbons					
acenaphthene	1.01E-02	20	5E-04	29	3E-04
acenaphthylene	4.50E-03	NA	NA	29	2E-04
anthracene	1.08E-02	NA	NA	29	4E-04
benzo(a)anthracene	1.16E-02	NA	NA	18	6E-04
benzo(b)fluoranthene	1.02E-02	NA	NA	18	6E-04
benzo(k)fluoranthene	8.86E-03	NA	NA	18	5E-04
benzo(g,h,i)perylene	1.09E-02	NA	NA	18	6E-04
benzo(a)pyrene	1.07E-02	NA	NA	18	6E-04
chrysene	1.23E-02	NA	NA	18	7E-04
dibenz(a,h)anthracene	5.76E-03	NA	NA	18	3E-04
fluoranthene	2.53E-02	NA	NA	18	1E-03
fluorene	2.00E-02	NA	NA	29	7E-04
indeno(1,2,3-cd)pyrene	7.84E-03	NA	NA	18	4E-04
2-methylnaphthalene	9.85E-02	NA	NA	29	3E-03
naphthalene	2.05E-01	NA	NA	29	7E-03
phenanthrene	3.90E-02	NA	NA	29	1E-03
pyrene	1.11E-02	NA	NA	18	6E-04
Polychlorinated Biphenyls					
Aroclor 1260	5.96E-02	40	1E-03	NA	NA
Metals					
aluminum	6.12E+03	50	**1E+02***	NA	NA
chromium	9.31E+01	1	**9E+01***	0.4	**2E+02***
chromium, hexavalent	2.48E-01	NA	NA	NA	NA
cobalt	9.26E+00	13	7E-01	NA	NA
copper	1.65E+01	100	2E-01	50	3E-01
iron	1.23E+04	NA	NA	NA	NA
manganese	2.07E+02	220	9E-01	450	5E-01
mercury	1.69E-01	0.3	6E-01	0.1	**2E+00***

Table 6-28 (continued)

COPEC	Soil Refined EPC (mg/kg)	Plant Benchmark Value (mg/kg)	Plant HQ	Invertebrate Benchmark Value (mg/kg)	Invertebrate HQ
Metals (continued)					
molybdenum	1.46E+00	2	7E-01	NA	NA
nickel	3.00E+01	38	8E-01	280	1E-01
selenium	9.47E-01	1	9E-01	70	1E-02
silver	2.61E+00	2	1E+00	NA	NA
thallium	1.46E+00	1	1E+00	NA	NA
vanadium	2.46E+01	2	**1E+01***	NA	NA
zinc	3.56E+01	50	7E-01	200	2E-01
Cyanide					
cyanide	8.80E-01	NA	NA	NA	NA

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
EPC – exposure point concentration
HQ - hazard quotient
mg/kg – milligrams per kilogram
NA – not applicable

Table 6-29
Terrestrial Wildlife Receptor-Specific Refined Hazard Quotients
Exposure Unit 3

COPEC	Deer Mouse	Califonia Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Volatile Organic Compounds						
acetone	1E-02	6E-03	3E-02	1E-03	2E-06	3E-02
benzene	2E-03	1E-03	3E-02	5E-03	1E-05	3E-02
2-butanone	4E-03	2E-03	6E-02	3E-03	6E-06	6E-02
n-butylbenzene	**6E+01***	**9E+00***	**9E+02***	**3E+02***	2E-02	**9E+02***
sec-butylbenzene	**7E+01***	**1E+01***	**1E+03***	**3E+02***	1E-02	**1E+03***
tert-butylbenzene	**4E+00***	5E-01	**5E+01***	**2E+01***	1E-03	**5E+01***
carbon disulfide	2E-03	8E-04	3E-02	3E-03	1E-05	3E-02
chlorobenzene	7E-04	2E-04	1E-02	4E-03	4E-06	1E-02
chloroform	1E-03	7E-04	2E-02	3E-03	9E-06	2E-02
1,2-dichlorobenzene	1E-02	2E-03	9E-02	3E-02	9E-06	9E-02
1,4-dichlorobenzene	2E-04	3E-05	1E-03	4E-04	1E-07	1E-03
1,1-dichloroethane	2E-02	1E-02	1E-01	9E-03	3E-05	1E-01
1,2-dichloroethane	3E-04	1E-04	1E-03	8E-05	3E-07	1E-03
1,1-dichloroethene	9E-03	4E-03	1E-01	2E-02	5E-05	1E-01
1,2-dichloroethylene	6E-01	3E-01	**9E+00***	9E-01	3E-03	**9E+00***
cis-1,2-dichloroethene	4E-03	2E-03	6E-02	6E-03	2E-05	6E-02
trans-1,2-dichloroethene	1E-03	5E-04	1E-02	1E-03	5E-06	1E-02
ethylbenzene	6E-02	1E-02	8E-01	2E-01	1E-04	8E-01
2-hexanone	1E-02	5E-03	5E-01	4E-02	1E-04	5E-01
isopropylbenzene	**8E+00***	1E+00	**2E+01***	**7E+00***	2E-03	**2E+01***
p-isopropyltoluene	**4E+01***	**5E+00***	**3E+01***	**1E+01***	1E-03	**4E+01***
4-methyl-2-pentanone	6E-04	3E-04	9E-03	6E-04	2E-06	9E-03
methylene chloride	1E-01	8E-02	**2E+00***	1E-01	5E-04	**2E+00***
n-propylbenzene	**2E+01***	**2E+00***	**2E+02***	**7E+01***	1E-02	**2E+02***
tetrachloroethene	**2E+01***	**3E+00***	**2E+02***	**7E+01***	3E-02	**2E+02***
toluene	3E-01	8E-02	**4E+00***	1E+00	1E-03	**4E+00***
1,2,3-trichlorobenzene	5E-03	7E-04	7E-02	2E-02	2E-06	7E-02
1,1,1-trichloroethane	2E-03	6E-04	3E-02	5E-03	9E-06	3E-02
trichloroethene	**2E+01***	**6E+00***	**3E+02***	**5E+01***	1E-01	**3E+02***
1,2,4-trimethylbenzene	**1E+02***	**2E+01***	**1E+03***	**4E+02***	1E-01	**1E+03***
1,3,5-trimethylbenzene	**2E+01***	**4E+00***	**3E+02***	**1E+02***	3E-02	**3E+02***
2,2,4-trimethylpentane	NA	NA	NA	NA	NA	0E+00
m-, p-xylene	**1E+01***	**2E+00***	**2E+02***	**4E+01***	3E-02	**2E+02***
o-xylene	**4E+00***	7E-01	**6E+01***	**2E+01***	9E-03	**6E+01***
xylenes, total	**6E+01***	**1E+01***	**8E+02***	**2E+02***	1E-01	**8E+02***

Table 6-29 (continued)

COPEC	Deer Mouse	Califonia Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Semivolatile Organic Compounds						
benzoic acid	1E-01	4E-02	7E-01	1E-01	2E-04	7E-01
bis(2-ethylhexyl)phthalate	2E-01	3E-02	**5E+00***	**2E+00***	2E-03	**5E+00***
butylbenzyl phthalate	1E-04	2E-05	3E-01	8E-02	1E-04	3E-01
carbazole	2E-02	3E-03	1E+00	3E-01	4E-04	1E+00
4-chloro-3-methylphenol	1E-01	2E-02	8E-03	2E-03	3E-06	1E-01
dibenzofuran	1E-02	2E-03	8E-01	2E-01	3E-04	8E-01
di-n-butyl phthalate	4E-04	6E-05	**2E+00***	7E-01	1E-03	**2E+00***
diethyl phthalate	4E-05	1E-05	2E-01	5E-02	6E-05	2E-01
di-n-octyl phthalate	5E-03	6E-04	6E-02	2E-02	3E-05	6E-02
4-nitrophenol	8E-03	3E-03	5E-02	9E-03	1E-05	5E-02
pentachlorophenol	8E-01	1E-01	6E-02	2E-02	3E-05	8E-01
Polycyclic Aromatic Hydrocarbons						
acenaphthene	1E-05	3E-06	8E-04	2E-04	6E-06	8E-04
acenaphthylene	2E-06	5E-07	2E-04	5E-05	2E-06	2E-04
anthracene	8E-06	1E-06	6E-04	2E-04	5E-06	6E-04
benzo(a)anthracene	3E-04	5E-05	6E-04	2E-04	6E-06	6E-04
benzo(b)fluoranthene	4E-04	1E-04	8E-04	1E-04	6E-06	8E-04
benzo(k)fluoranthene	2E-04	4E-05	4E-04	1E-04	5E-06	4E-04
benzo(g,h,i)perylene	2E-04	4E-05	4E-04	1E-04	6E-06	4E-04
benzo(a)pyrene	3E-04	5E-05	6E-04	2E-04	6E-06	6E-04
chrysene	4E-04	7E-05	9E-04	2E-04	7E-06	9E-04
dibenz(a,h)anthracene	3E-04	6E-05	5E-04	1E-04	3E-06	5E-04
fluoranthene	2E-03	6E-04	3E-03	5E-04	1E-05	3E-03
fluorene	1E-05	4E-06	1E-03	2E-04	1E-05	1E-03
indeno(1,2,3-cd)pyrene	3E-04	7E-05	6E-04	2E-04	4E-06	6E-04
2-methylnaphthalene	6E-05	1E-05	5E-03	1E-03	5E-05	5E-03
naphthalene	4E-03	2E-03	3E-01	2E-02	1E-04	3E-01
phenanthrene	3E-05	9E-06	2E-03	5E-04	2E-05	2E-03
pyrene	9E-04	3E-04	2E-03	2E-04	6E-06	2E-03
Polychlorinated Biphenyls						
Aroclor 1260	1E-01	1E-02	5E-01	2E-01	4E-04	5E-01
Metals						
aluminum	**4E+01***	**1E+01***	1E+00	**2E+00***	3E-01	**4E+01***
antimony	**3E+00***	4E-01	**4E+01***	**1E+02***	**6E+01***	**1E+02***
arsenic	2E-01	5E-02	2E-02	6E-02	8E-04	2E-01
barium	3E-01	1E-01	1E-01	1E-01	2E-02	3E-01
beryllium	2E-02	7E-03	5E-01	4E-01	**2E+00***	**2E+00***

Table 6-29 (continued)

COPEC	Deer Mouse	Califonia Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk	Maximum
Metals (continued)						
cadmium	**4E+01***	**6E+00***	**4E+01***	**3E+01***	6E-01	**4E+01***
chromium	1E+00	2E-01	**6E+00***	**4E+00***	4E-01	**6E+00***
chromium, hexavalent	3E-03	6E-04	2E-02	4E-03	1E-05	2E-02
cobalt	1E-01	3E-02	1E+00	**2E+00***	1E-01	**2E+00***
copper	4E-01	9E-02	7E-01	1E+00	3E-01	1E+00
iron	NA	NA	NA	NA	NA	NA
lead	9E-01	2E-01	**1E+02***	**1E+02***	**2E+01***	**1E+02***
manganese	3E-01	1E-01	1E-01	1E-01	9E-03	3E-01
mercury	1E-01	3E-02	1E+00	**3E+00***	6E-02	**3E+00***
molybdenum	6E-01	1E-01	7E-02	2E-01	1E-01	6E-01
nickel	**2E+01***	**4E+00***	**3E+00***	**6E+00***	8E-01	**2E+01***
selenium	**3E+00***	8E-01	9E-01	1E+00	1E-01	**3E+00***
silver	2E-02	3E-03	4E-03	4E-03	7E-06	2E-02
thallium	4E-01	5E-02	7E-01	4E-01	1E-02	7E-01
vanadium	1E+00	4E-01	6E-02	8E-02	5E-03	1E+00
zinc	1E+00	2E-01	9E-01	**2E+00***	2E-01	**2E+00***
Cyanide						
cyanide	2E-03	8E-04	**6E+00***	1E+00	1E-02	**6E+00***
Hazard Indices						
HI VOC	**4E+02***	**7E+01***	**5E+03***	**2E+03***	4E-01	**5E+03***
HI SVOC	1E+00	2E-01	**1E+01***	**3E+00***	4E-03	**1E+01***
HI PAH	9E-03	3E-03	3E-01	2E-02	3E-04	3E-01
HI PCB	1E-01	1E-02	5E-01	2E-01	4E-04	5E-01
HI metals	**1E+02***	**2E+01***	**2E+02***	**3E+02***	**9E+01***	**3E+02***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
HI – hazard index
HQ – hazard quotient
NA – not available
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-30
Refined Hazard Quotients for the American Robin

COPEC	EU 1	EU 2	EU 3
Volatile Organic Compounds			
acetone	1E-03	9E-04	1E-03
benzene	8E-02	4E-04	5E-03
bromochloromethane	NA	2E-04	NA
bromomethane	NA	1E-02	NA
2-butanone	2E-04	2E-04	3E-03
n-butylbenzene	NA	4E-01	**3E+02***
sec-butylbenzene	NA	5E-01	**3E+02***
tert-butylbenzene	NA	5E-01	**2E+01***
carbon disulfide	7E-03	3E-03	3E-03
chlorobenzene	4E-03	2E-03	4E-03
chloroform	5E-03	NA	3E-03
chloromethane	2E-02	2E-02	NA
1,2-dichlorobenzene	NA	3E-04	3E-02
1,3-dichlorobenzene	NA	2E-04	NA
1,4-dichlorobenzene	NA	6E-04	4E-04
1,1-dichloroethane	NA	6E-05	9E-03
1,2-dichloroethane	NA	NA	8E-05
1,1-dichloroethene	7E-04	4E-04	2E-02
1,2-dichloroethylene	NA	NA	9E-01
cis-1,2-dichloroethene	1E-02	3E-03	6E-03
trans-1,2-dichloroethene	6E-03	8E-04	1E-03
1,2-dichloropropane	NA	1E-03	NA
ethylbenzene	6E-02	2E-03	2E-01
2-hexanone	1E-03	3E-03	4E-02
isopropylbenzene	NA	5E-02	**7E+00***
p-isopropyltoluene	NA	1E-02	**1E+01***
methyl tert-butyl ether	NA	4E-04	NA
4-methyl-2-pentanone	2E-03	1E-03	6E-04
methylene chloride	2E-02	1E-02	1E-01
n-propylbenzene	NA	7E-02	**7E+01***
tetrachloroethene	**2E+00***	1E-01	**7E+01***
toluene	2E-01	1E-03	1E+00
1,2,3-trichlorobenzene	NA	3E-02	2E-02
1,2,4-trichlorobenzene	NA	2E-02	NA
1,1,1-trichloroethane	NA	3E-05	5E-03
trichloroethene	6E-01	4E-02	**5E+01***
1,2,4-trimethylbenzene	6E-02	3E-01	**4E+02***
1,3,5-trimethylbenzene	NA	2E-01	**1E+02***
2,2,4-trimethylpentane	NA	NA	NA
m-, p-xylene	8E-02	4E-02	**4E+01***
o-xylene	NA	3E-02	**2E+01***
xylenes, total	**6E+00***	NA	**2E+02***

Table 6-30 (continued)

COPEC	EU 1	EU 2	EU 3
Semivolatile Organic Compounds			
benzoic acid	NA	NA	1E-01
bis(2-ethylhexyl)phthalate	3E-01	1E-01	**2E+00***
butylbenzyl phthalate	3E-01	3E-01	8E-02
carbazole	5E-01	NA	3E-01
4-chloro-3-methylphenol	1E-02	9E-03	2E-03
2-chlorophenol	NA	2E-02	NA
dibenzofuran	2E-01	NA	2E-01
di-n-butyl phthalate	**2E+00***	NA	7E-01
diethyl phthalate	4E-02	2E-02	5E-02
dimethyl phthalate	8E-02	NA	NA
di-n-octyl phthalate	NA	NA	2E-02
1,4-dioxane	NA	1E+00	NA
hexachlorobutadiene	2E-03	NA	NA
4-nitrophenol	NA	NA	9E-03
N-nitroso-di-n-propylamine	9E-02	5E-02	NA
pentachlorophenol	NA	8E-03	2E-02
phenol	5E-01	3E-02	NA
Polycyclic Aromatic Hydrocarbons			
acenaphthene	4E-04	1E-04	2E-04
acenaphthylene	3E-04	2E-04	5E-05
anthracene	9E-04	3E-04	2E-04
benzo(a)anthracene	2E-03	5E-04	2E-04
benzo(b)fluoranthene	2E-03	6E-04	1E-04
benzo(k)fluoranthene	1E-03	4E-04	1E-04
benzo(g,h,i)perylene	2E-03	6E-04	1E-04
benzo(a)pyrene	3E-03	7E-04	2E-04
chrysene	4E-03	8E-04	2E-04
dibenz(a,h)anthracene	8E-04	5E-04	1E-04
fluoranthene	8E-03	1E-03	5E-04
fluorene	4E-04	7E-05	2E-04
indeno(1,2,3-cd)pyrene	3E-03	7E-04	2E-04
2-methylnaphthalene	6E-04	7E-05	1E-03
naphthalene	5E-03	2E-03	2E-02
phenanthrene	4E-03	5E-04	5E-04
pyrene	1E-02	1E-03	2E-04
Pesticides			
aldrin	3E-02	NA	NA
beta-BHC	3E-03	NA	NA
delta-BHC	3E-03	NA	NA
alpha-chlordane	7E-04	NA	NA
gamma-chlordane	7E-04	NA	NA
4,4'-DDT	3E-01	NA	NA
endrin aldehyde	2E-01	NA	NA
heptachlor	7E-04	NA	NA

Table 6-30 (continued)

COPEC	EU 1	EU 2	EU 3
Polychlorinated Biphenyls			
Aroclor 1260	5E-01	4E-01	2E-01
Metals			
aluminum	**2E+00***	**2E+00***	**2E+00***
antimony	**4E+01***	**7E+01***	**1E+02***
arsenic	2E-02	1E-01	6E-02
barium	1E-01	1E-01	1E-01
beryllium	7E-01	3E-01	4E-01
cadmium	**3E+01***	**2E+01***	**3E+01***
chromium	**2E+0***	**3E+00***	**4E+00***
chromium, hexavalent	NA	6E-03	4E-03
cobalt	**2E+00***	**2E+00***	**2E+00***
copper	7E-01	1E+00	1E+00
iron	NA	NA	NA
lead	**4E+01***	**7E+02**	**1E+02***
manganese	8E-02	1E-01	1E-01
mercury	**1E+01***	**4E+00***	**3E+00***
molybdenum	5E-02	1E-01	2E-01
nickel	**3E+00***	**5E+00***	**6E+00***
selenium	4E-01	**4E+00***	1E+00
silver	6E-03	4E-03	4E-03
thallium	7E-01	**3E+00***	4E-01
vanadium	5E-02	8E-02	8E-02
zinc	8E-01	**2E+00***	**2E+00***
Cyanide			
cyanide	NA	NA	1E+00
Hazard Indices			
HI VOC	**9E+00***	**2E+00***	**2E+03***
HI SVOC	**4E+00***	**2E+00***	**3E+00***
HI PAH	5E-02	1E-02	2E-02
HI pesticides	5E-01	NA	NA
HI PCB	5E-01	4E-01	2E-01
HI metals	**1E+02***	**8E+02***	**3E+02***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
EU – exposure unit
HI – hazard index
HQ – hazard quotient
NA – not available
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-31
Refined Hazard Quotients for the Red-Tailed Hawk

COPEC	EU 1	EU 2	EU 3
Volatile Organic Compounds			
acetone	1E-06	1E-06	2E-06
benzene	3E-04	1E-06	1E-05
bromochloromethane	NA	7E-07	NA
bromomethane	NA	5E-05	NA
2-butanone	4E-07	4E-07	6E-06
n-butylbenzene	NA	2E-05	2E-02
sec-butylbenzene	NA	2E-05	1E-02
tert-butylbenzene	NA	5E-05	1E-03
carbon disulfide	3E-05	1E-05	1E-05
chlorobenzene	4E-06	2E-06	4E-06
chloroform	2E-05	NA	9E-06
chloromethane	8E-05	5E-05	NA
1,2-dichlorobenzene	NA	1E-07	9E-06
1,3-dichlorobenzene	NA	6E-08	NA
1,4-dichlorobenzene	NA	2E-07	1E-07
1,1-dichloroethane	NA	2E-07	3E-05
1,2-dichloroethane	NA	NA	3E-07
1,1-dichloroethene	2E-06	1E-06	5E-05
1,2-dichloroethylene	NA	NA	3E-03
cis-1,2-dichloroethene	5E-05	1E-05	2E-05
trans-1,2-dichloroethene	2E-05	3E-06	5E-06
1,2-dichloropropane	NA	4E-06	NA
ethylbenzene	4E-05	1E-06	1E-04
2-hexanone	5E-06	1E-05	1E-04
isopropylbenzene	NA	1E-05	2E-03
p-isopropyltoluene	NA	1E-06	1E-03
methyl tert-butyl ether	NA	1E-06	NA
4-methyl-2-pentanone	8E-06	5E-06	2E-06
methylene chloride	9E-05	5E-05	5E-04
n-propylbenzene	NA	2E-05	1E-02
tetrachloroethene	9E-04	4E-05	3E-02
toluene	3E-04	2E-06	1E-03
1,2,3-trichlorobenzene	NA	4E-06	2E-06
1,2,4-trichlorobenzene	NA	3E-06	NA
1,1,1-trichloroethane	NA	5E-08	9E-06
trichloroethene	1E-03	8E-05	1E-01
1,2,4-trimethylbenzene	2E-05	6E-05	1E-01
1,3,5-trimethylbenzene	NA	6E-05	3E-02
2,2,4-trimethylpentane	NA	NA	NA
m-, p-xylene	5E-05	2E-05	3E-02
o-xylene	NA	2E-05	9E-03
xylenes, total	4E-03	NA	1E-01

Table 6-31 (continued)

COPEC	EU 1	EU 2	EU 3
Semivolatile Organic Compounds			
benzoic acid	NA	NA	2E-04
bis(2-ethylhexyl)phthalate	4E-04	1E-04	2E-03
butylbenzyl phthalate	4E-04	4E-04	1E-04
carbazole	8E-04	NA	4E-04
4-chloro-3-methylphenol	2E-05	1E-05	3E-06
2-chlorophenol	NA	3E-05	NA
dibenzofuran	3E-04	NA	3E-04
di-n-butyl phthalate	2E-03	NA	1E-03
diethyl phthalate	6E-05	2E-05	6E-05
dimethyl phthalate	1E-04	NA	NA
di-n-octyl phthalate	NA	NA	3E-05
1,4-dioxane	NA	7E-04	NA
hexachlorobutadiene	3E-06	NA	NA
4-nitrophenol	NA	NA	1E-05
N-nitroso-di-n-propylamine	1E-04	6E-05	NA
pentachlorophenol	NA	1E-05	3E-05
phenol	6E-04	4E-05	NA
Polycyclic Aromatic Hydrocarbons			
acenaphthene	1E-05	3E-06	6E-06
acenaphthylene	2E-05	9E-06	2E-06
anthracene	4E-05	1E-05	5E-06
benzo(a)anthracene	9E-05	2E-05	6E-06
benzo(b)fluoranthene	1E-04	2E-05	6E-06
benzo(k)fluoranthene	8E-05	2E-05	5E-06
benzo(g,h,i)perylene	1E-04	3E-05	6E-06
benzo(a)pyrene	1E-04	2E-05	6E-06
chrysene	1E-04	2E-05	7E-06
dibenz(a,h)anthracene	2E-05	1E-05	3E-06
fluoranthene	2E-04	3E-05	1E-05
fluorene	2E-05	2E-06	1E-05
indeno(1,2,3-cd)pyrene	1E-04	2E-05	4E-06
2-methylnaphthalene	3E-05	3E-06	5E-05
naphthalene	4E-05	1E-05	1E-04
phenanthrene	2E-04	2E-05	2E-05
pyrene	3E-04	3E-05	6E-06
Pesticides			
aldrin	9E-05	NA	NA
beta-BHC	6E-06	NA	NA
delta-BHC	7E-06	NA	NA
alpha-chlordane	2E-06	NA	NA
gamma-chlordane	2E-06	NA	NA
4,4'-DDT	8E-04	NA	NA
endrin aldehyde	5E-04	NA	NA
heptachlor	2E-06	NA	NA

Table 6-31 (continued)

COPEC	EU 1	EU 2	EU 3
Polychlorinated Biphenyls			
Aroclor 1260	1E-03	1E-03	4E-04
Metals			
aluminum	3E-01	3E-01	3E-01
antimony	**6E+01***	**6E+01**	**6E+01***
arsenic	8E-04	8E-04	8E-04
barium	2E-02	2E-02	2E-02
beryllium	**2E+00***	**2E+00***	**2E+00***
cadmium	6E-01	6E-01	6E-01
chromium	4E-01	4E-01	4E-01
chromium, hexavalent	NA	2E-05	1E-05
cobalt	1E-01	1E-01	1E-01
copper	3E-01	3E-01	3E-01
iron	NA	NA	NA
lead	**2E+01***	**3E+01***	**2E+01***
manganese	9E-03	9E-03	9E-03
mercury	7E-02	6E-02	6E-02
molybdenum	1E-01	1E-01	1E-01
nickel	8E-01	8E-01	8E-01
selenium	1E-01	1E-01	1E-01
silver	8E-06	7E-06	7E-06
thallium	1E-02	2E-02	1E-02
vanadium	5E-03	5E-03	5E-03
zinc	2E-01	2E-01	2E-01
Cyanide			
cyanide	NA	NA	1E-02
Hazard Indices			
HI VOC	7E-03	6E-04	4E-01
HI SVOC	5E-03	1E-03	4E-03
HI PAH	2E-03	3E-04	3E-04
HI pesticides	1E-03	NA	NA
HI PCB	1E-03	1E-03	4E-04
HI metals	**9E+01***	**1E+02***	**9E+01***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
BHC – benzene hexachloride
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
EU – exposure unit
HI – hazard index
HQ – hazard quotient
NA – not available
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
VOC – volatile organic compound

Table 6-32
Aquatic Wildlife Receptor-Specific Refined Hazard Quotients – Shallower FWBZ

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Volatile Organic Compounds					
benzene	4E-09	5E-09	2E-07	3E-06	3E-06
2-butanone	1E-10	2E-10	1E-08	1E-07	1E-07
carbon disulfide	1E-07	3E-07	1E-05	1E-04	1E-04
1,1-dichloroethane	8E-10	3E-10	1E-08	2E-07	2E-07
cis-1,2-dichloroethene	4E-07	5E-07	2E-05	3E-04	3E-04
trans-1,2-dichloroethene	1E-07	1E-07	6E-06	7E-05	7E-05
toluene	1E-08	1E-08	6E-07	6E-06	6E-06
trichloroethene	4E-07	6E-07	3E-05	3E-04	3E-04
Metals					
aluminum	2E-06	5E-09	2E-07	2E-06	2E-06
antimony	8E-05	1E-04	5E-03	1E-02	1E-02
arsenic	3E-04	3E-06	1E-04	8E-04	8E-04
barium	1E-04	1E-07	6E-06	1E-02	1E-02
cadmium	1E-03	1E-04	4E-03	2E-01	2E-01
chromium	1E-05	2E-07	8E-06	1E-02	1E-02
cobalt	1E-07	8E-09	3E-07	2E-04	2E-04
copper	3E-04	3E-05	1E-03	7E-02	7E-02
iron	NA	NA	NA	NA	NA
lead	4E-04	4E-07	2E-05	**1E+01***	**1E+01***
manganese	2E-04	6E-06	2E-04	2E-03	2E-03
mercury	6E-06	3E-06	1E-04	8E-03	8E-03
molybdenum	1E-06	1E-08	5E-07	5E-06	5E-06
nickel	3E-05	5E-07	2E-05	1E-04	1E-04
selenium	5E-04	5E-06	2E-04	3E-02	3E-02
silver	2E-07	2E-09	1E-07	4E-06	4E-06
vanadium	1E-06	4E-09	2E-07	2E-06	2E-06
zinc	2E-04	1E-05	4E-04	1E-02	1E-02
Hazard Indices					
HI VOC	1E-06	2E-06	7E-05	8E-04	8E-04
HI metals	3E-03	3E-04	1E-02	**1E+01***	**1E+01***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
FWBZ – first water-bearing zone
HI – hazard index
HQ – hazard quotient
NA – not available
VOC – volatile organic compound

Table 6-33
Aquatic Life Refined Hazard Quotients – Shallower FWBZ

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Volatile Organic Compounds			
benzene	0.31	109	3E-03
2-butanone	0.74	40,000	2E-05
carbon disulfide	10	450	2E-02
1,1-dichloroethane	0.22	1,130	2E-04
cis-1,2-dichloroethene	2.1	2,240	9E-04
trans-1,2-dichloroethene	0.55	2,240	2E-04
toluene	0.25	37	7E-03
trichloroethene	0.52	140	4E-03
Metals			
aluminum	38.5	87	4E-01
antimony	7.2	500	1E-02
arsenic	23	36	6E-01
barium	545	5,000	1E-01
cadmium	1.6	8.8	2E-01
chromium	1.9	50	4E-02
cobalt	0.29	227	1E-03
copper	15.6	3.1	**5E+00***
iron	8,970	1,000	**9E+00***
lead	10.6	8.1	1E+00
manganese	1,880	2,500	8E-01
mercury	0.006	0.94	6E-03
molybdenum	6.8	1,230	6E-03
nickel	1.8	8.2	2E-01
selenium	1.8	71	3E-02
silver	0.91	0.19	**5E+00***
vanadium	11	205	5E-02
zinc	15	81	2E-01

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
FWBZ – first water-bearing zone
HQ – hazard quotient
µg/L – micrograms per liter
TRV – toxicity reference value
VOC – volatile organic compound

Table 6-34
Aquatic Wildlife Receptor-Specific Refined Hazard Quotients – Deeper FWBZ

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Volatile Organic Compounds					
acetone	5E-08	1E-08	6E-07	7E-06	7E-06
benzene	4E-09	5E-09	2E-07	3E-06	3E-06
2-butanone	7E-10	1E-09	5E-08	6E-07	6E-07
carbon disulfide	5E-07	1E-06	5E-05	5E-04	5E-04
chloroform	3E-07	6E-07	3E-05	1E-04	1E-04
cis-1,2-dichloroethene	3E-06	4E-06	2E-04	2E-03	2E-03
ethane	NA	NA	NA	NA	NA
methane	NA	NA	NA	NA	NA
methylene chloride	1E-08	2E-08	7E-07	8E-06	8E-06
toluene	1E-07	1E-07	6E-06	7E-05	7E-05
vinyl chloride	3E-04	5E-04	2E-02	4E-02	4E-02
xylenes, total	2E-06	3E-06	1E-04	1E-03	1E-03
Polycyclic Aromatic Hydrocarbons					
pyrene	2E-05	4E-06	2E-04	2E-03	2E-03
Metals					
aluminum	7E-06	2E-08	7E-07	8E-06	8E-06
antimony	4E-05	6E-05	3E-03	5E-03	5E-03
arsenic	3E-04	3E-06	1E-04	8E-04	8E-04
barium	5E-05	5E-08	2E-06	5E-03	5E-03
chromium	3E-04	4E-06	2E-04	3E-01	3E-01
cobalt	6E-06	3E-07	1E-05	1E-02	1E-02
copper	3E-04	3E-05	1E-03	7E-02	7E-02
iron	NA	NA	NA	NA	NA
manganese	6E-05	1E-06	7E-05	6E-04	6E-04
mercury	2E-06	8E-07	3E-05	2E-03	2E-03
nickel	5E-04	8E-06	4E-04	1E-03	1E-03
selenium	2E-02	2E-04	8E-03	9E-01	9E-01
silver	4E-07	5E-09	2E-07	8E-06	8E-06
thallium	2E-02	3E-03	1E-01	**3E+00***	**3E+00***
vanadium	3E-06	8E-09	3E-07	4E-06	4E-06
zinc	3E-05	2E-06	8E-05	2E-03	2E-03
Hazard Indices					
HI VOCs	3E-04	5E-04	2E-02	4E-02	4E-02
HI PAHs	2E-05	4E-06	2E-04	2E-03	2E-03
HI metals	4E-02	3E-03	1E-01	**4E+00***	**4E+00***

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
FWBZ – first water-bearing zone
NA – not available
HI – hazard index
HQ – hazard quotient
PAH – polycyclic aromatic hydrocarbons
VOC – volatile organic compound

Table 6-35
Aquatic Life Refined Hazard Quotients – Deeper FWBZ

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Volatile Organic Compounds			
acetone	45	21,000	2E-03
benzene	0.31	109	3E-03
2-butanone	3.6	40,000	9E-05
carbon disulfide	37	450	8E-02
chloroform	2.4	815	3E-03
cis-1,2-dichloroethene	16	2,240	7E-03
ethane	7.2	1,130	6E-03
methane	350	2,700	1E-01
methylene chloride	0.93	2,560	4E-04
toluene	2.7	37	7E-02
vinyl chloride	460	2,240	2E-01
xylenes, total	2.2	500	4E-03
Polycyclic Aromatic Hydrocarbons			
pyrene	0.24	95	3E-03
Metals			
aluminum	130	87	1E+00
antimony	3.7	500	7E-03
arsenic	23.5	36	7E-01
barium	194	5,000	4E-02
chromium	41.2	50	8E-01
cobalt	12.9	227	6E-02
copper	15.9	3.1	**5E+00***
iron	4,840	1,000	**5E+00***
manganese	497	2,500	2E-01
mercury	0.00158	0.94	2E-03
nickel	27.6	8.2	**3E+00***
selenium	61	71	9E-01
silver	1.9	0.19	**1E+01**
thallium	22.3	21.3	1E+00
vanadium	21.3	205	1E-01
zinc	2.8	81	3E-02

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
FWBZ – first water-bearing zone
HQ – hazard quotient
µg/L – micrograms per liter
TRV – toxicity reference value

Table 6-36
Aquatic Wildlife Receptor-Specific Refined Hazard Quotients – SWBZ

COPEC	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover	Maximum
Volatile Organic Compounds					
acetone	1E-08	3E-09	1E-07	1E-06	1E-06
benzene	3E-09	4E-09	2E-07	2E-06	2E-06
2-butanone	5E-10	1E-09	4E-08	5E-07	5E-07
carbon disulfide	6E-08	1E-07	5E-06	6E-05	6E-05
methane	NA	NA	NA	NA	NA
4-methyl-2-pentanone	6E-10	9E-10	4E-08	4E-07	4E-07
Semivolatile Organic Compounds					
isophorone	3E-09	4E-09	2E-07	2E-06	2E-06
Metals					
aluminum	7E-08	2E-10	7E-09	8E-08	8E-08
antimony	1E-05	2E-05	7E-04	1E-03	1E-03
arsenic	3E-04	3E-06	1E-04	9E-04	9E-04
barium	1E-04	1E-07	6E-06	1E-02	1E-02
beryllium	2E-06	3E-06	1E-04	1E-03	1E-03
cadmium	4E-04	2E-05	1E-03	5E-02	5E-02
chromium	2E-05	3E-07	1E-05	2E-02	2E-02
cobalt	8E-06	4E-07	2E-05	1E-02	1E-02
copper	1E-04	1E-05	5E-04	3E-02	3E-02
iron	NA	NA	NA	NA	NA
manganese	2E-03	5E-05	2E-03	2E-02	2E-02
molybdenum	1E-07	1E-09	6E-08	7E-07	7E-07
nickel	5E-04	8E-06	4E-04	1E-03	1E-03
selenium	1E-02	2E-04	8E-03	8E-01	8E-01
silver	1E-06	2E-08	9E-07	3E-05	3E-05
thallium	4E-04	7E-05	3E-03	5E-02	5E-02
vanadium	4E-07	1E-09	5E-08	5E-07	5E-07
zinc	1E-03	6E-05	3E-03	7E-02	7E-02
Hazard Indices					
HI VOCs	7E-08	1E-07	5E-06	6E-05	6E-05
HI SVOCs	3E-09	4E-09	2E-07	2E-06	2E-06
HI metals	1E-02	4E-04	2E-02	1E+00	1E+00

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
HI – hazard index
NA – not available
SVOC – semivolatile organic compound
SWBZ – second water-bearing zone
VOC – volatile organic compound

Table 6-37
Aquatic Life Refined Hazard Quotients – SWBZ

COPEC	Groundwater Maximum Detection (µg/L)	Aquatic TRV (µg/L)	Hazard Quotient
Volatile Organic Compounds			
acetone	9	21,000	4E-04
benzene	0.2	109	2E-03
2-butanone	3	40,000	7E-05
carbon disulfide	4	450	9E-03
methane	3	2,700	1E-03
4-methyl-2-pentanone	0.2	170	1E-03
Semivolatile Organic Compounds			
isophorone	6	129	5E-02
Metals			
aluminum	1.2	87	1E-02
antimony	0.9	500	2E-03
arsenic	25	36	7E-01
barium	546	5,000	1E-01
beryllium	0.66	50	1E-02
cadmium	0.39	8.8	4E-02
chromium	2.5	50	5E-02
cobalt	17	227	7E-02
copper	6.9	3.1	**2E+00***
iron	5,000	1,000	**5E+00***
manganese	15,000	2,500	**6E+00***
molybdenum	0.91	1,230	7E-04
nickel	27	8.2	**3E+00***
selenium	58	71	8E-01
silver	7.5	0.19	**4E+01***
thallium	0.44	21.3	2E-02
vanadium	2.9	205	1E-02
zinc	98	81	1E+00

Note:
* bold type indicates an HQ > 1

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
µg/L – micrograms per liter
SWBZ – second water-bearing zone
TRV – toxicity reference value

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
9	general response actions (GRAs) and remedial approaches	Section 2.8	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Sections 4.1 and 4.2, Pages 4-1 and 4-2. Battelle 2011.

Section 4
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

4.1 TECHNOLOGY IDENTIFICATION AND SCREENING APPROACH

The primary objective of the technology identification and screening phase of the FS is to develop an appropriate range of possible technologies and process options suitable to address COCs in each of the environmental media of interest at OU-2C, namely soil and groundwater. In this section, various technologies and process options are identified, described, and subjected to an initial screening analysis, which focuses on remediation of the particular COCs for each media, as discussed in Section 3.

GRAs are medium-specific actions that would satisfy project RAOs (U.S. EPA, 1988a). The following potential GRAs were developed to satisfy the RAOs developed for OU-2C:

- No action
- ICs
- Monitoring
- Monitored natural attenuation (MNA)
- Engineering controls (general controls and containment)
- Removal
- Ex situ treatment
- In situ treatment
- Disposal

The technologies and process options presented in this section are grouped in accordance with these GRAs as well as separately, as appropriate, by soil and groundwater. Appropriate technologies and process options are identified and retained to be used in the development of remedial alternatives for OU-2C (see Section 5). The vendors and products, including the equipment, system components, and other materials identified in this report, are primarily for information purposes only. Although Battelle may have used some of these vendors and products in the past, mention in this report does not constitute Battelle's recommendation for using these vendors or products.

The screening analysis of technologies and process options is based on a subset of the NCP evaluation criteria. Specifically, the NCP criteria used for this initial screening analysis include effectiveness, implementability, and cost. These criteria are summarized below:

Effectiveness

The effectiveness of each technology or process option is evaluated based on the ability of the technology/option to meet the RAOs, potential effects to human health and the environment during the construction and implementation phase, and reliability with respect to the chemical constituents and conditions at the site.

Implementability

Implementability encompasses both the technical and administrative feasibility of implementing a technology or process option. This includes the availability of necessary equipment and labor to implement the process option as well as the ability to obtain necessary permits and approvals. It should be noted that CERCLA actions conducted on-site are exempt from permits, although CERCLA actions are still undertaken in a manner consistent with the conditions of permits that would otherwise apply.

Cost

Cost plays a limited role in the screening of technologies and process options. The relative cost for each option is estimated as to whether it is low, moderate, or high. Costs are based on engineering judgment and available information associated with the respective option.

The screening analysis of technologies and process options is discussed in Sections 4.2 through 4.4. Tables 4-1 and 4-2 summarize the screening results for each medium of interest, and identify technologies and process options retained for further consideration in the development of the OU-2C remedial alternatives. Those technologies and process options that are retained are carried forward to Section 5.

4.2 NO ACTION

Evaluation of the "No Action" option is required by the NCP as the baseline case to which all other response actions are compared. Under the no action response, no remedial activities would be conducted and there would not be any short- or long-term monitoring.

Effectiveness

No action may be appropriate if a site does not currently pose a potential threat to human health or the environment or if previous remedial actions have eliminated the need for further action. The no action response for OU-2C represents the existing site conditions for soil and groundwater as described in the final RI Report (BEI, 2008) and in Section 2. This response would not reduce potential exposure to soil and groundwater containing COCs for OU-2C. Therefore, this option would not be effective in reducing the potential risk to human receptors.

Implementability

Because no action would be taken, this response would be easily implementable for both soil and groundwater.

Cost

Because no action would be taken, no costs would apply to this option for either soil or groundwater.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
10	preliminary remedial alternatives	Section 2.8	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.0, Pages 6-1 through 6-71. Battelle 2011.

Section 6
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents a detailed evaluation of the soil and groundwater remedial alternatives determined to be most suitable for OU-2C and retained through the screening conducted in Section 5. The detailed evaluation of alternatives is intended to allow decision makers to select an appropriate and suitable remedy for the site.

The soil and groundwater remedial alternatives considered in the detailed analysis are evaluated against the nine NCP feasibility criteria: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; community acceptance; and state acceptance.

The first two feasibility criteria, overall protection of human health and the environment and compliance with ARARs, are threshold criteria. CERCLA and the NCP require that a remedial action protect human health and the environment and comply with ARARs unless justification to waive a particular ARAR is documented in the ROD. An alternative that does not meet these threshold criteria is not considered a viable remedy. The next five criteria, long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost; are considered balancing criteria. Balancing criteria are the primary means by which alternatives that meet the threshold criteria are differentiated and compared. The final two criteria, community acceptance and state acceptance, are considered modifying criteria, which are essentially the final test in determining that the community and regulators find a remedial alternative acceptable.

The evaluation criteria are described in more detail below.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a threshold criterion, in that a remedial alternative must achieve this criterion to be considered viable. Evaluation of the overall protection of human health and the environment determines whether the alternative achieves adequate protection and describes how site risks are eliminated, reduced, and/or managed through treatment, engineering, or controls.

Compliance with ARARs

Compliance with ARARs also is a threshold criterion. The evaluation includes a determination of whether each alternative meets all federal, state, and local chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness of each alternative is evaluated based on the risk likely to be present at the site after response actions have been employed. This evaluation includes an assessment of

the extent and effectiveness of controls that may be required to manage residual risk posed by treated residuals and/or untreated COCs. The evaluation of long-term effectiveness evaluates both the magnitude of residual risk and the adequacy and reliability of controls.

Reduction in Toxicity, Mobility, or Volume through Treatment

This criterion addresses the regulatory preference for remedial actions that permanently and significantly reduce the toxicity, mobility, or volume of contamination through treatment. The evaluation includes an assessment of the anticipated efficiency of the remedial alternative at reducing the risk associated with COCs at the site.

Short-Term Effectiveness

Short-term effectiveness is an assessment of the effects of the alternative during the construction and implementation phase. This criterion includes an evaluation of potential impacts to the community, site workers, and the environment during remedy execution to achieve short-term protection and the time required to achieve preliminary RGs.

A detailed green and sustainable remediation (GSR) evaluation was completed to assess the environmental impacts associated with implementation of each alternative evaluated in detail for OU-2C, including atmospheric emissions, worker hazards, and other sustainability metrics. Details of the sustainability analysis are provided in Appendix E.

Implementability

Implementability is evaluated in a manner that encompasses both the technical and administrative feasibility of implementing a remedial alternative. It incorporates an evaluation of the technical difficulties associated with construction and operation of the remediation system, the reliability of the chosen technologies, and the ease of implementing additional remedial action if anticipated or necessary. This criterion also includes an assessment of the ability to resolve administrative issues; procure treatment, storage, and disposal services; and the availability of equipment and labor to implement all facets of the remedial alternative.

Cost

Total and net present value (NPV) costs are calculated for each alternative using a variety of cost-estimating data, including, but not limited to, vendor information, cost-estimating guides (e.g., RS Means cost guides), engineering judgment, and available historic information. Present worth costs are calculated by applying a 2.8% discount rate, in accordance with U.S. EPA (2000b) guidance for developing cost estimates during an FS.

Cost estimate details are provided in Appendix F of this FS Report for each remedial alternative evaluated in detail. This appendix identifies quantities and unit costs for each alternative, including monitoring assumptions. The monitoring assumptions used for the cost estimates are considered reasonable and provide sufficient detail to compare remedial alternative costs in this FS. However, monitoring assumptions (e.g., quantities and frequencies of various types of

samples) are not intended to be prescriptive for the various remedies. Specific monitoring plans will be developed in the detailed design for the selected remedy.

Community Acceptance

This criterion evaluates the issues and concerns the general public may have regarding each remedial alternative. In accordance with U.S. EPA guidance (1998a), this will be addressed in the ROD, once community comments on the FS and PP are received and addressed.

State Acceptance

This criterion evaluates the technical and administrative issues and concerns that federal, state, or other agencies may have regarding each remedial alternative. In accordance with U.S. EPA guidance (1998a), this will be addressed in the ROD once agency comments on the FS and PP are received and addressed.

6.1 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

All five of the soil remedial alternatives in Section 5 were retained and are evaluated in detail in Section 6.2. Five of the six remedial alternatives screened in Section 5 for the shallow FWBZ were retained and are evaluated in detail in Section 6.3, and all five of the groundwater remedial alternatives screened in Section 5 for the deep FWBZ and SWBZ were retained and are evaluated in detail in Section 6.4. The No Action alternative is included in the detailed analysis for soil, groundwater in the shallow FWBZ, and groundwater in deep FWBZ and SWBZ in accordance with NCP requirements.

In providing a detailed description and analysis of the screened alternatives, the alternatives are described and evaluated specifically in the context of addressing potentially unacceptable risk associated with the future use of the site. Specifically, the future site use is for commercial land use throughout OU-2C. In addition, addressing residential risk in Local Area 2 in western Exposure Unit 1 is included in the soil remedial alternatives because the DON has determined this to be an insignificant increase in effort and cost. In addition, one remedial alternative each for soil and shallow groundwater are further expanded in this section to include an evaluation of applying the alternative to mitigate potentially unacceptable risk to a hypothetical future residential receptor (i.e., assuming hypothetical future residential land use with non-potable groundwater use at OU-2C).

For each of the commercial land use alternatives presented in this section, Appendix G presents a description of the incremental level of effort and cost that would be needed to mitigate potentially unacceptable risk to a hypothetical future residential receptor throughout OU-2C. This description of incremental effort and cost to achieve residential land use is not required per an RAO for OU-2C because the RAOs are specifically associated only with the future site use as documented above. The description of incremental effort and cost to achieve residential land use throughout OU-2C also does not apply to the groundwater remedial alternatives developed for the deep FWBZ and SWBZ, as there is currently no potentially unacceptable human health risk associated with groundwater in these aquifer intervals and cleanup is instead predicated on mitigating the potential for downgradient impacts (see Section 3.5 and Appendix B).

The soil remedial alternatives evaluated in detail in this section are:

S1. No Action
S2. Engineering Controls, ICs, and Monitoring
S3. Partial Excavation, Engineering Controls, Off-site Disposal, ICs, and Monitoring
S4. Excavation, Off-site Disposal, ICs, and Monitoring
S5. Excavation, SVE, Off-site Disposal, ICs, and Monitoring
S6. Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-Site Disposal, Institutional Controls, and Monitoring
S4R. Excavation, Off-site Disposal, ICs, and Monitoring - Residential

The shallow FWBZ groundwater remedial alternatives evaluated in detail in this section are:

GS1. No Action
GS2. ISCO, Enhanced Bioremediation, ICs, and Monitoring
GS3. ISCR, Enhanced Bioremediation, ICs, and Monitoring
GS4. AS-SVE, Enhanced Bioremediation, ICs, and Monitoring
GS5. ERH, ISCO/ISCR/AS-SVE, Enhanced Bioremediation, ICs, and Monitoring
GS2R. ISCO, Enhanced Bioremediation, ICs, and Monitoring - Residential

The deep FWBZ and SWBZ groundwater remedial alternatives evaluated in detail in this section are:

GD1. No Action
GD2. ICs and Monitoring
GD3. ISCO, ICs, and Monitoring
GD4. ISCR, ICs, and Monitoring
GD5. ERH, ICs, and Monitoring

6.2 DETAILED ANALYSIS OF SOIL REMEDIAL ALTERNATIVES

6.2.1 Detailed Description of Soil Alternative S1 – No Action. In accordance with the requirements of the NCP and CERCLA, the No Action alternative is presented and carried through the entire FS to serve as the baseline condition to which to compare other remedial alternatives. This alternative would entail no active remediation of impacted soil at OU-2C. ICs and monitoring would not be components of this alternative. No periodic reviews would be conducted to evaluate the protectiveness of this alternative. There would be no costs associated with this alternative.

6.2.1.1 Detailed Analysis of Soil Alternative S1 – No Action. This subsection provides a discussion of the detailed analysis for Soil Alternative S1 with respect to the NCP evaluation criteria. As described below, this alternative would not meet the threshold criterion of overall protection of human health and the environment and does not trigger an ARARs determination. Therefore, an analysis of the balancing criteria is not required.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C. However, current conditions result in potentially unacceptable risk to future commercial/ industrial receptors from chemicals in soil (BEI, 2008). In addition, there are potentially remaining radiological impacts beneath Building 5 associated with the abandoned piping and/or surrounding soil. Under Soil Alternative S1, no remedial action would be completed to reduce chemical or radionuclide concentrations in soil, and no ICs would be implemented to restrict future land use. In addition, Local Area 2 would not be addressed. Therefore, Soil Alternative S1 would not be protective of human health and the environment at OU-2C.

Compliance with ARARs

There is no need to identify ARARs for Soil Alternative S1 because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA sec. 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the No Action alternative for soil. Therefore, a discussion of compliance with ARARs is not appropriate for Soil Alternative S1.

6.2.2 Detailed Description of Soil Alternative S2 – Engineering Controls, Institutional Controls, and Monitoring

Engineering Controls

Concentrations of arsenic, lead, and thallium that exceed the preliminary RGs developed to be protective of future commercial land use are contained within the footprint of Building 5 (see Figure 6-1). In addition, there is known or potential radiological impact associated with the presence of the drain lines/piping and surrounding soil beneath Buildings 5 and 400. Because the building slabs currently isolate human receptors from the metal COCs and the pertinent exposure pathways (i.e., direct contact and incidental ingestion) and provide an effective barrier between human receptors and radiological constituents, Soil Alternative S2 would include maintaining these slabs in their current location to function as an engineering control.

Concentrations of VOCs and chromium in soil south and east of Building 5 that exceed the preliminary RGs developed to be protective of future commercial land use are currently covered by concrete or asphalt pavement. In addition, concentrations of PCE in soil in Local Area 2 that are responsible for potentially unacceptable risk to a future residential receptor are currently covered by pavement. The pavement in these areas serves as an engineering control and provides adequate protection against the exposure pathways of concern. In addition, general engineering controls such as fencing could be an appropriate method for limiting or restricting future access to areas with residual risks.

Under Soil Alternative S2, the slabs of Buildings 5 and 400 and other paved areas currently existing over soil footprint areas would be maintained in good condition to prevent future human exposure to the underlying soil.

To further enhance the engineering control of known or potentially radiologically-impacted drain lines/piping, these pipelines would be sealed in-place with appropriate grout material.

Institutional Controls

Soil Alternative S2 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 and Local Area 2 in Western Exposure Unit 1 (i.e., Western Exposure Unit 1 outside of Local Area 2 is not characterized by potentially unacceptable soil risks to a hypothetical future residential receptor);
- Require that the Buildings 5 and 400 slabs and the areas of pavement that currently cover soil footprint areas be maintained as engineering controls over the footprint areas;
- Require that another suitable engineering control (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) be installed in any footprint area where the existing control is demolished; and
- Require that impacted soil that would remain in footprint areas be excavated and disposed off-site (i.e., through a SMP or other documentation) if the existing engineering controls (i.e., the Building 5 and 400 slabs and areas of pavement that currently cover soil footprint areas) are demolished and other suitable engineering controls (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) are not constructed in their place.

Site use restrictions would be implemented through a detailed land use control (LUC) plan. Residential land use restrictions would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use, and the requirements/restrictions surrounding the presence and maintenance of the engineering controls would be required indefinitely unless the soil footprints in these areas were directly addressed through removal or treatment.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design, including in areas within the northern portion of Building 5. For purposes of this FS, it is assumed that 20 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

This FS assumes, based on soil gas samples collected under the southern part of Building 5, that high levels of radon are not present under Building 5A. Prior to finalization of the ROD, the Navy will conduct soil gas sampling for radon to confirm this assumption.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.2.1 Detailed Analysis of Soil Alternative S2 – Engineering Controls, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Soil Alternative S2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S2 would achieve the identified project RAOs and would therefore be considered protective of human health. ICs would prohibit future residential site use in Exposure Units 2 and 3 and Local Area 2 and would ensure the long-term presence and protectiveness of Building 5 and surrounding paved areas as engineering controls. If any of the cap areas were to be removed in the future, ICs would require the replacement of a suitable cap or the removal of soil footprint areas where chemical concentrations exceed the preliminary RGs. Monitoring of the ICs would ensure that unacceptable risks due to restricted site use would not occur and that appropriate measures would be taken to ensure the protectiveness of a cap or implementation of other risk mitigation measures in the cap area.

Grouting in-place the known or potentially radiologically-impacted drain lines/piping would mitigate the potential for future migration of radionuclides and provide additional shielding against radiological exposures.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6}, and the residual non-cancer hazard would be greater than 1 (i.e., HQ = 8) at only one location for future commercial receptors, as discussed in Appendix C.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. Portions of the California Civil Code, California Health and Safety Code, and CCR are considered potential state ARARs for the transfer or property, and these are therefore potential state ARARs for ICs. Soil Alternative S2 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S2 would provide an effective remedy for soil containing COCs at the site. Occupational risk associated with identified COCs would remain at the site, but the building slabs and surrounding paved areas would function as engineering controls and ICs would restrict specific site uses and/or require certain mitigation measures to ensure continued protectiveness.

ICs would be required to prohibit future residential site use in Exposure Units 2 and 3 and Local Areas 2. In addition, ICs would ensure the proper management of soil that would be exposed if Building 5, Building 400 or surrounding paved areas were removed (or require the replacement of engineering controls over such areas). Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing the risk associated with future commercial land use throughout OU-2C (and residential risk in Local Area 2).

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S2 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include use of Buildings 5 and 400 slabs and existing paved areas as an engineering control, and appropriate ICs to prohibit future residential land use and ensure long-term maintenance of the controls.

Short-Term Effectiveness

No active remediation is included in Soil Alternative S2, therefore no short-term risks or environmental sustainability impacts would result from implementation of this alternative. Soil Alternative S2 is not directly evaluated in the GSR analysis.

Implementability

Existing site conditions (Buildings 5 and 400 and surrounding paved areas) together with grouting of drain lines/piping would serve as the engineering controls. Since no active remediation would occur under this alternative, the technical implementability of this alternative would be high. However, the Final PDC (ARRA, 2006) does not include reuse of Building 5, suggesting this building would be demolished. Demolition of either Building 5 or 400 would reduce the implementability of Soil Alternative S2. Also related to the Final PDC, the administrative implementability of this alternative would be low.

Cost

The present-value cost for Soil Alternative S2 is approximately $575,000 (see Table 6-1). Primary cost components for this alternative include pipe grouting and IC implementation and monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.3 Detailed Description of Soil Alternative S3 – Partial Excavation, Engineering Controls, Off-site Disposal, Institutional Controls, and Monitoring

Excavation

Soil Alternative S3 would include excavation of soil in areas outside the footprint of Building 5 that contain concentrations of COCs above the preliminary RGs for soil which were developed to

be protective of future commercial land use. In addition, soil within Local Area 2 characterized by risks to a hypothetical future residential receptor would be excavated (see Figure 6-2). COCs requiring excavation in these areas include PCE, TCE, ethylbenzene, 1,2,4-TMB, and chromium. For purposes of this FS, it is assumed that standard, track-mounted and/or rubber-tired earthmoving equipment would be suitable to perform excavation in these areas.

The total area identified for excavation outside of Building 5 would be approximately 17,000 sf, and the targeted excavation depth would extend to between 3 and 8 ft depending on the specific soil removal area. Excavation of this vertical interval would address the potentially unacceptable risk levels associated with inhalation of vapors from VOCs in soil and direct contact and/or incidental ingestion of soil containing metals in the identified footprints. The total volume of excavated soil would be approximately 2,300 cubic yards (cy).

Material would be excavated to limits defined by a land survey of the excavation areas. Provisions for minimizing water infiltration or removing and treating water from the excavation areas may be required depending on the depth of excavation and groundwater table at the time of excavation. A detailed plan for excavation water management would be developed during the remedial design phase of work for implementation of the OU-2C remedy. Upon excavation, material would be stockpiled in accordance with a waste management plan pending characterization and off-site disposal. Certified clean backfill material would be used to backfill the open excavations.

Engineering Controls

Concentrations of arsenic, lead, and thallium that exceed the preliminary RGs developed to be protective of future commercial land use are contained within the footprint of Building 5 (see Figure 6-2). In addition, there is known or potential radiological impact associated with the presence of drain lines/piping and surrounding soil beneath Buildings 5 and 400. Because the building slabs currently isolate human receptors from the COCs and the pertinent exposure pathways (i.e., direct contact and incidental ingestion) and provides an effective barrier between human receptors and radiological constituents, Soil Alternative S3 would include maintaining the slabs of Buildings 5 and 400 in their current location to function as engineering controls. As part of the maintenance of this engineering control, the concrete slabs in identified footprint areas within the buildings would be maintained in good condition. In addition, general engineering controls such as fencing could be an appropriate method for limiting or restricting future access to areas with residual risks.

To further enhance the engineering control of known or potentially radiologically-impacted drain lines/piping beneath Buildings 5 and 400, these pipelines would be sealed in-place with appropriate grout material.

Off-Site Disposal

After excavation, removed soil would be stockpiled and sampled for waste characterization purposes. Depending on the results of the waste characterization sampling, the material would be disposed at an appropriate off-site disposal facility (i.e., landfill). Once adequate waste

characterization sampling was completed, the soil material would be loaded into trucks and hauled to the selected disposal facility.

Based on currently available data contained in the RI, chromium concentrations in excavated soil would exceed 20 times the toxicity characteristic leaching procedure (TCLP) limit for RCRA hazardous waste. Therefore, for purposes of this FS, it is assumed that chromium containing soil would be disposed as RCRA hazardous waste, and the remainder of the excavated soil would be suitable for disposal at a Class II California landfill facility.

Institutional Controls

Soil Alternative S3 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., once Local Area 2 is addressed, there would be no potentially unacceptable risk from soil to a hypothetical future residential receptor in Exposure Unit 1); and
- Require that the Buildings 5 and 400 slabs be maintained as engineering controls over the soil footprint areas beneath the buildings;
- Require that another suitable engineering control (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) be installed in any footprint area where the existing control is demolished; and
- Require that impacted soil that would remain in footprint areas be excavated and disposed off-site (i.e., through a SMP or other documentation) if the existing engineering controls (i.e., the Building 5 and 400 slabs) are demolished and other suitable engineering controls (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) are not constructed in their place.

Site use restrictions would be implemented through a detailed LUC plan. Residential land use restrictions would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use, and the requirements/restrictions surrounding the presence and maintenance of the slabs of Buildings 5 and 400 would be required indefinitely unless the soil footprints beneath the building were addressed.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs outside the Building 5 footprint and within the northern portion of Building 5. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. For purposes of this FS, it is assumed that 20 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

This FS assumes, based on soil gas samples collected under the southern part of Building 5, that high levels of radon are not present under Building 5A. Prior to finalization of the ROD, the Navy will conduct soil gas sampling for radon to confirm this assumption.

Performance monitoring would be conducted to verify adequate soil removal during the excavation process. Performance monitoring would consist of surveying and direct observation. Post-excavation sampling would also be conducted to confirm that preliminary RGs have been achieved. A long-term monitoring program would not be necessary because post-excavation sampling would immediately verify the removal of soil containing COCs. For purposes of this FS, it is assumed that post-excavation sampling would be conducted at a frequency of one excavation bottom sample per 1,000 sf of excavation area and one excavation sidewall sample per 30 linear ft of excavation sidewall (with a minimum of one sample per sidewall); however, a detailed monitoring program would be developed during the remedial design phase of work.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.3.1 Detailed Analysis of Soil Alternative S3 – Partial Excavation, Engineering Controls, Off-site Disposal, Institutional Controls, and Monitoring.

This subsection provides a discussion of the detailed analysis for Soil Alternative S3 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S3 would achieve the identified project RAOs and would therefore be considered protective of human health. Excavation of soil within Local Area 2 would mitigate potentially unacceptable risk to a hypothetical future residential receptor in western Exposure Unit 1. Excavation of soil in other areas outside the footprint of Building 5 would remove concentrations of metals and VOCs exceeding the occupational risk-based preliminary RGs, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from, direct contact with, and/or incidental ingestion of chemicals in soil outside of Building 5. ICs would restrict future residential site use outside of the western portion of Exposure Unit 1 and would ensure the long-term presence and protectiveness of the slabs of Buildings 5 and 400 as engineering controls, the replacement of a suitable cap if slabs were removed, or the removal of soil footprint areas beneath the buildings following the removal of the buildings and the absence of a suitable replacement cap. Monitoring of the ICs would ensure that unacceptable risks due to restricted site use would not occur and that appropriate measures would be taken to ensure the protectiveness of the engineering controls or implementation of other risk mitigation measures in the building areas.

Grouting in-place the known or potentially radiologically-impacted drain lines/piping would mitigate the potential for future migration of radionuclides and provide additional shielding against radiological exposures.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6}, and the residual non-cancer hazard would be greater than 1 (i.e., HQ = 8) at only one location for future commercial receptors, as discussed in Appendix C.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during soil excavation should be classified and managed as hazardous waste.

Soil Alternative S3 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S3 would provide an effective remedy for soil containing COCs at the site. Chemical concentrations in soil within the remedial footprints outside of the buildings, including the residential footprint area at Local Area 2, would be removed from the site and disposed at a permitted off-site facility. Occupational risk would remain under Building 5, as would known or potential radiological impacts associated with the drain lines/piping and surrounding soil beneath Buildings 5 and 400, but the building slabs would function as engineering controls and ICs would restrict specific site uses and/or require certain mitigation measures to ensure continued protectiveness. Grouting in-place the known or potentially radiologically-impacted drain lines/piping would mitigate the potential for future migration of radionuclides and provide additional shielding against radiological exposures. Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be 4×10^{-6} and the maximum non-cancer hazard would exceed 1 at only one location. The maximum non-cancer hazard (i.e., HQ = 8) is based on the 1,2,4-TMB concentration at one location, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial/ industrial site use.

ICs would be required to restrict future residential site use outside of the western portion of Exposure Unit 1 and to ensure the proper management of soil that would be exposed if the building slabs were removed (or require the replacement of an engineering controls over such areas). Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing the risk associated with future commercial land use throughout OU-2C.

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S3 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include excavation and off-site disposal or on-site management of COCs through engineering controls and ICs. Implementation of this alternative would result in transferring much of the OU-2C soil containing COCs to a permitted off-site disposal facility and the continued presence of certain

soil COCs under the engineering controls. This alternative would reduce the volume and mobility of chemicals at OU-2C, albeit not through treatment. In the event that the disposal process for excavated soil would require a treatment component on the basis of measured levels of chemicals, then this alternative could effectively meet this criterion.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as remedial action would be designed to limit any potential for such impact (i.e., through a storm water management plan, waste management plan, and related plans). Handling of waste materials could present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and monitoring.

Soil Alternative S3 would have a low degree of environmental impact, as determined through the GSR evaluation (see Appendix E). Those impacts related to greenhouse gas (GHG) emissions and energy usage would be driven primarily by consumables (i.e., asphalt and grout). Air emissions would be driven primarily by equipment use, and collateral risk would be driven primarily by consumables and transportation.

Implementability

Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. In addition, dewatering, treatment of the collected water, and discharge to surface water (if necessary during excavation) would be implementable as long as the appropriate administrative requirements could be met and the water treated to the required levels. Dewatering, treatment and surface water discharge has been successfully completed at other sites addressing similar COCs at Alameda.

Soil sampling has been conducted throughout OU-2C, including within Building 5, using various techniques. Based on this information, Soil Alternative S3 is considered to be highly implementable. However, the Final PDC (ARRA, 2006) does not include reuse of Building 5, suggesting this building would be demolished. Demolition of either Building 5 or 400 would reduce the implementability of Soil Alternative S3. Also related to the Final PDC, the administrative implementability of this alternative would be low.

Cost

The present-value cost for Soil Alternative S3 is approximately $1,762,000 (see Table 6-1). Primary cost components for this alternative include excavation, off-site disposal, pipe grouting and monitoring. For cost-estimating purposes, it is assumed that any water which accumulates within the excavation areas would be removed, treated using filtration and GAC processes, and

then discharged to surface water. It is also assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.4 Detailed Description of Soil Alternative S4 – Excavation, Off-Site Disposal, Institutional Controls, and Monitoring

Excavation

Soil Alternative S4 would include excavation of soil in areas outside and within the footprint of Building 5 that contain concentrations of COCs above the preliminary RGs for soil developed to be protective of future commercial land use. In addition, soil within Local Area 2 characterized by unacceptable risks to a future hypothetical residential receptor would be excavated (see Figure 6-3). COCs requiring excavation in these areas include PCE, TCE, ethylbenzene, 1,2,4-TMB, arsenic, chromium, lead, and thallium. In addition, there is known or potential radiological impact associated with the presence of the drain lines/piping and surrounding soil beneath Buildings 5 and 400, and the piping and surrounding soil would be excavated. For purposes of this FS, it is assumed that standard, track-mounted and/or rubber-tired earthmoving equipment would be suitable to perform excavation in these areas. In locations within the footprints of Buildings 5 and 400, it is assumed that the building slabs could be saw-cut and demolished to allow access to the soil containing COCs by standard earthmoving equipment. In areas where the proposed excavation is adjacent to load bearing walls, columns, or foundation footings, measures to maintain the building's structural integrity will be implemented during excavation. The design of these temporary structural measures will be site specific, depending on depth of excavation and proximity to structural element. Provisions for minimizing water infiltration or removing and treating water from the excavation areas may be required depending on the depth of excavation and groundwater table at the time of excavation. A detailed plan for excavation water management would be developed during the remedial design phase of work for implementation of the OU-2C remedy.

The total area identified for excavation at OU-2C would be approximately 144,300 sf, assuming there is little deviation in pipe location or discovery of other lateral piping networks, and the targeted excavation depth would extend from between 3 and 8 ft depending on the specific soil removal area. Excavation of this vertical interval would address the unacceptable risk levels associated with inhalation of vapors from VOCs in soil and direct contact and/or incidental ingestion of soil containing metals, and would remove known or potential radiological impact associated with the drain lines/piping and surrounding soil. The total volume of excavated soil would be approximately 28,000 cy.

Material other than that associated with the drain lines/piping would be excavated to limits defined by a land survey. For the drain lines/piping, excavation would be conducted in accordance with a radiological surveying approach consistent with that followed for the storm drain line TCRA at OU-2C (TtECI, 2008). The approach would include radiological surveying of piping segments and surrounding soil followed by excavation to limits defined by the surveying and confirmatory soil sampling. Upon excavation, material would be stockpiled in accordance with a waste management plan pending characterization and off-site disposal.

Certified clean backfill material would be used to backfill the open excavations. Cut floor areas inside of Buildings 5 and 400 would be restored to their pre-existing condition.

Off-Site Disposal

After excavation, removed soil would be stockpiled and sampled for waste characterization purposes. Depending on the results of the waste characterization sampling, the material would be disposed at an appropriate off-site disposal facility (i.e., landfill). Once adequate waste characterization sampling was completed, the soil material would be loaded into trucks and hauled to the selected disposal facility.

For purposes of this FS, it is assumed that 35% of the soil excavated around the known and potentially radiologically-impacted drain lines/piping would be required to be disposed as low-level radiological waste disposed through the DoD low-level radiological waste disposal program, or approximately 9,400 loose cy. The remaining 65% of soil excavated around the known and potentially radiologically-impacted drain lines/piping is assumed to be non-hazardous waste. Based on currently available data contained in the RI, lead, arsenic, and chromium concentrations in excavated soil would exceed 20 times the TCLP limit for RCRA hazardous waste. Therefore, for purposes of this FS, it is assumed that soil containing metals would be disposed as RCRA hazardous waste, and excavated soil containing VOCs would be suitable for disposal at a Class II California landfill facility.

Institutional Controls

Soil Alternative S4 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., once Local Area 2 is addressed, there would be no potentially unacceptable risk from soil to a hypothetical future residential receptor in Exposure Unit 1).

Site use restrictions would be implemented through a detailed LUC plan, and would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design, including within the northern portion of Building 5. For purposes of this FS, it is assumed that 25 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify adequate soil removal during the excavation process. Performance monitoring would consist of physical and radiological surveying and direct observation. Post-excavation sampling would also be conducted to confirm that preliminary RGs have been achieved and all radiologically impacted soil has been removed. A long-term monitoring program would not be necessary because post-excavation sampling would immediately verify the removal of soil containing COCs. For purposes of this FS, it is assumed that post-excavation sampling would be conducted at a frequency of one excavation bottom sample per 1,000 sf of excavation area and one excavation sidewall sample per 30 linear ft of excavation sidewall (with a minimum of one sample per sidewall); however, a detailed monitoring program would be developed during the remedial design phase of work. In addition, it is assumed that 1,300 samples for Ra-226 would be required to provide adequate post-excavation final status survey of the drain lines/piping. Moreover, a one-time groundwater sampling event would be implemented in the vicinity of the removed piping to demonstrate a lack of radiological impact to groundwater.

Waste characterization sampling would be required to determine the specific nature of the excavated soil, to develop appropriate waste manifests, and to support off-site disposal at an appropriate off-site disposal facility (i.e., landfill). For purposes of this FS, it is assumed that waste characterization sampling would be performed at a frequency of one sample per 500 cy of excavated material. The specific sampling approach and frequency would be determined during the remedial design phase of work in direct consultation with potential disposal facilities.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.4.1 Detailed Analysis of Soil Alternative S4 – Excavation, Off-site Disposal, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Soil Alternative S4 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S4 would achieve the identified project RAOs and would therefore be considered protective of human health. Excavation of soil within Local Area 2 would mitigate potentially unacceptable risk to hypothetical future residential receptors in western Exposure Unit 1. Excavation of other soil containing COCs throughout OU-2C would remove concentrations of metals and VOCs exceeding the occupational risk-based preliminary RGs, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from, direct contact with, and/or incidental ingestion of chemicals in soil. The drain lines/piping and surrounding soils potentially containing Ra-226 would also be removed.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6} and the residual non-cancer hazard would exceed 1 (i.e., HQ = 8) at only one location for future commercial receptors, as discussed in Appendix C.

ICs would restrict future residential site use outside the western portion of Exposure Unit 1. Monitoring of the ICs would ensure that unacceptable risks due to prohibited site use would not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during soil excavation should be classified and managed as hazardous waste.

Soil Alternative S4 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S4 would provide an effective long-term remedy for soil containing COCs at the site. Chemical concentrations in soil within the remedial footprints throughout OU-2C would be removed from the site and disposed at a permitted off-site facility. The known or potentially radiologically impacted drain lines/piping and surrounding soils beneath Buildings 5 and 400 would also be removed. Residual cancer risk remaining at OU-2C after completion of this remedy would be 4×10^{-6} and the maximum non-cancer hazard would exceed 1 (i.e., HQ = 8) at only one location. The non-cancer HQ of 8 is based on the 1,2,4-TMB concentration at one location, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use.

ICs would be required to restrict future residential site use outside the western portion of Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing risk associated with future commercial land use throughout OU-2C.

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S4 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include excavation and off-site disposal and ICs. Implementation of this alternative would result in transferring the OU-2C soil COCs to permitted off-site disposal facilities. This alternative would reduce the volume and mobility of chemicals at OU-2C, albeit not through treatment. In the event that the disposal process for excavated soil would require a treatment component on the basis of measured levels of chemicals, then this alternative could effectively meet this criterion.

Short-Term Effectiveness

Implementation of Soil Alternative S4 would increase traffic and could subsequently cause other short-term risks to the community as a result of the increased truck activity. A total of over

5,000 truck loads of soil would be needed to transport excavated soil off-site for disposal and bring clean fill on-site for backfill. Soil Alternative S4 would have relatively significant environmental footprint impacts, as demonstrated by the GSR evaluation in Appendix E. Those impacts related to GHG emissions and energy usage would be driven primarily by consumables (i.e., asphalt and grout) and soil transportation. Air emissions would be driven primarily by equipment use and soil transportation, and collateral risk would be driven primarily by personnel and soil transportation.

Under Soil Alternative S4, the remedial action would be designed to limit the potential for other short-term impacts (i.e., through a storm water management plan, waste management plan, and related plans). Handling of waste materials could present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and monitoring.

Implementability

Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. In addition, dewatering, treatment of the collected water, and discharge to surface water (if necessary during excavation) would be implementable as long as the appropriate administrative requirements could be met and the water treated to the required levels. Dewatering, treatment and surface water discharge has been successfully completed at other sites addressing similar COCs at Alameda. Soil sampling has been conducted throughout OU-2C, including within Building 5, using various techniques. Based on this information, Soil Alternative S4 is considered to be highly implementable.

However, at the present time, there is no information on the specific structural composition of Building 5. While it is assumed that concrete slabs could be saw-cut and demolished to allow access to excavation areas, the presence and nature of structural walls and/or footers is not known. Although the specific design parameters of Building 5 are not known, assumptions can be made relative to the development of temporary structural measures for excavation in close proximity of structural elements. The design of these temporary structural measures will be site specific, depending on depth of proposed excavation and proximity to the structural component.

It may not be feasible to excavate and remove piping found beneath the building's structural components. As an alternative to excavation, piping found in these areas could be filled with structural grout, capped, and abandoned in place.

The structural design of Building 5 and the technical difficulty associated with effectively excavating soil around structural building elements could reduce the implementability of this alternative. In addition, the inability to access excavation areas with the most suitable earthmoving equipment could limit the implementability.

Moreover, the level of effort associated with the excavation, handling, and disposal of radiologically impacted drain/lines piping and soils is greater than that associated with more

standard soil excavation, including the use of specialized equipment, labor, and handling requirements. Removal of the radiologically impacted drain lines/piping and surrounding soil would therefore pose an implementability challenge. Given the storm drain line TCRA at OU-2C, this implementability challenge can be overcome with proper design and remedial action planning.

Cost

The present-value cost for Soil Alternative S4 is approximately $45,418,000 (see Table 6-1). Of this total cost, approximately $27,000,000 is associated with removal of the potentially radiologically-impacted lines beneath Building 5. This cost includes structural support of the building during excavation, as well as removal and replacement of the foundation over the excavation areas. If Building 5 and its foundation were demolished prior to implementation of the remedial action, the cost associated with removal of the potentially radiologically-impacted lines beneath this area would be approximately $22,000,000.

Primary cost components for this alternative include excavation, off-site disposal, and monitoring, along with handling and disposal of radiologically impacted material. For cost-estimating purposes, it is assumed that any water which accumulates within the excavation areas would be removed, treated using filtration and GAC processes, and then discharged to surface water. It is also assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.5 Detailed Description of Soil Alternative S5 – Excavation, Soil Vapor Extraction, Off-Site Disposal, Institutional Controls, and Monitoring

Excavation

Soil Alternative S5 would include excavation of soil in areas outside and within the footprint of Building 5 that contain concentrations of metals above the preliminary RGs developed for soil to be protective of future commercial land use. In addition, soil within Local Area 2 characterized by unacceptable risks to a future hypothetical residential receptor would be excavated (see Figure 6-4). COCs requiring excavation in these areas include the VOC PCE and the metals arsenic, chromium, lead, and thallium. In addition, the radiologically impacted drain lines/piping under Buildings 5 and 400 and surrounding soils would be excavated. For purposes of this FS, it is assumed that standard, track-mounted and/or rubber-tired earthmoving equipment would be suitable to perform excavation in these areas. In locations within the footprints of Buildings 5 and 400, it is assumed that the slabs could be saw-cut and demolished to allow access to the soil containing COCs by standard earthmoving equipment. In areas where the proposed excavation is adjacent to load bearing walls, columns, or foundation footings, measures to maintain the building's structural integrity will be implemented during excavation. The design of these temporary structural measures will be site specific, depending on depth of excavation and proximity to structural element. Provisions for minimizing water infiltration or removing and treating water from the excavation areas may be required depending on the depth of excavation and groundwater table at the time of excavation. A detailed plan for excavation water

management would be developed during the remedial design phase of work for implementation of the OU-2C remedy.

The total area identified for excavation at OU-2C would be approximately 136,600 sf, assuming there is little deviation in pipe location or discovery of other lateral piping networks, and the targeted excavation depth would extend from between 3 and 8 ft depending on the specific soil removal area. Excavation of this vertical interval would address the unacceptable risk levels associated with inhalation of vapors from VOCs in soil in Local Area 2, direct contact and/or incidental ingestion of soil containing metals, and the presence of potential radiologically impacted soil. The total volume of excavated soil would be approximately 26,400 cy.

Material other than that associated with the drain lines/pipelines and surrounding soil would be excavated to limits defined by a land survey. For the drain lines/piping, excavation would be conducted in accordance with a radiological surveying approach consistent with that followed for the storm drain line TCRA at OU-2C (TtECI, 2008). The approach would include radiological surveying of drain lines/piping segments and surrounding soil followed by excavation to limits defined by the surveying and confirmatory soil sampling. Upon excavation, material would be stockpiled in accordance with a waste management plan pending characterization and off-site disposal. Certified clean backfill material would be used to backfill the open excavations. Cut floor areas inside of the buildings would be restored to their pre-existing condition.

Soil Vapor Extraction

Soil Alternative S5 would include the implementation of SVE to address soil in areas that contain concentrations of VOCs above the preliminary RGs developed for soil to be protective of future commercial land use, other than Local Area 2 (see Figure 6-4). COCs requiring remediation in these areas include PCE, 1,2,4-TMB, and ethylbenzene.

The total area identified for SVE treatment would be approximately 7,700 sf, and the targeted treatment interval would be from 0 to 8 ft bgs (i.e., within the unsaturated zone). Treatment of this vertical interval would address the unacceptable occupational risk levels associated with inhalation of vapors from VOCs in soil. Based on geologic conditions, a 20-ft SVE radius of influence is estimated to be appropriate for this site. This would result in a total of approximately 8 SVE locations across the site.

SVE would be conducted by installing a network of vapor capture wells with target capture zones above the saturated zone. The vapors resulting from volatilization of volatile chemicals would be extracted under vacuum and conveyed to an on-site treatment system for treatment prior to atmospheric discharge. The specific construction of the vapor extraction points and the off-gas treatment system for SVE would be developed in the remedial design.

Off-Site Disposal

After excavation, removed soil would be stockpiled and sampled for waste characterization. Depending on the results of the waste characterization sampling, the material would be disposed at an appropriate off-site disposal facility (i.e., landfill). Once adequate waste characterization

sampling was completed, the soil material would be loaded into trucks and hauled to the selected disposal facility.

For purposes of this FS, it is assumed that 35% of the soil excavated around the known and potentially radiologically-impacted drain lines/piping would be required to be disposed as low-level radiological waste disposed through the DoD low-level radiological waste disposal program, or approximately 9,400 loose cy. The remaining 65% of soil excavated around the known and potentially radiologically-impacted drain lines/piping is assumed to be non-hazardous waste. Based on currently available data contained in the RI, lead, arsenic, and chromium concentrations in excavated soil would exceed 20 times the TCLP limit for RCRA hazardous waste. Therefore, for purposes of this FS, it is assumed that soil containing metals would be disposed as RCRA hazardous waste, and excavated soil containing VOCs would be suitable for disposal at a Class II California landfill facility.

Institutional Controls

Soil Alternative S5 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., once Local Area 2 is addressed, there would be no potentially unacceptable risk from soil to a hypothetical future residential receptor in Exposure Unit 1).

Site use restrictions would be implemented through a detailed LUC plan, and would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design, including in the northern portion of Building 5. For purposes of this FS, it is assumed that 25 additional soil sampling locations would be required to adequately verify the precise extent of required excavation and SVE. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify adequate soil removal during the excavation process and the effective operation of the SVE system. Performance monitoring for excavation would consist of physical and radiological surveying and direct observation, and performance monitoring for SVE would consist of system sampling prior to and after the treatment system. Post-excavation and post-SVE sampling would also be conducted to confirm that preliminary RGs have been achieved and all radiologically impacted soil has been removed. A long-term monitoring program would not be necessary because post-excavation monitoring would immediately verify the removal or treatment of soil containing COCs. For purposes of

this FS, it is assumed that post-excavation sampling would be conducted at a frequency of one excavation bottom sample per 1,000 sf of excavation area and one excavation sidewall sample per 30 linear ft of excavation sidewall (with a minimum of one sample per sidewall) and two soil samples per SVE treatment area; however, a detailed monitoring program would be developed during the remedial design phase of work. In addition, it is assumed that 1,300 samples for Ra-226 would be required to provide adequate post-excavation final status survey of the drain lines/piping. Moreover, a one-time groundwater sampling program would be implemented in the vicinity of the removed piping to demonstrate a lack of radiological impact to groundwater.

Waste characterization sampling would be required to determine the specific nature of the excavated soil, to develop appropriate waste manifests, and to support off-site disposal at an appropriate off-site disposal facility (i.e., landfill). For purposes of this FS, it is assumed that waste characterization sampling would be performed at a frequency of one sample per 500 cy of excavated material. The specific sampling approach and frequency would be determined during the remedial design phase of work in direct consultation with potential disposal facilities.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.5.1 Detailed Analysis of Soil Alternative S5 – Excavation, Soil Vapor Extraction, Off-Site Disposal, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Soil Alternative S5 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S5 would achieve the identified project RAOs and would therefore be considered protective of human health. Excavation of soil within Local Area 2 would address unacceptable risks to hypothetical future residential receptors in western Exposure Unit 1. Excavation or SVE treatment of other soil containing COCs throughout OU-2C would remove concentrations of metals and VOCs exceeding the occupational risk-based preliminary RGs, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from, direct contact with, and/or incidental ingestion of chemicals in soil. The radiologically impacted drain lines/piping and surrounding soil would also be removed.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6} and the maximum residual non-cancer hazard would exceed 1 (i.e., HQ = 8) at only one sampling location for future commercial receptors, as discussed in Appendix C.

ICs would restrict future residential site use outside of the western portion of Exposure Unit 1. Monitoring of the ICs would ensure that unacceptable risks due to restricted site use would not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during soil excavation should be classified and managed as hazardous waste.

Soil Alternative S5 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S5 would provide an effective long-term remedy for soil containing COCs at the site. Chemical concentrations in soil within the remedial footprints throughout OU-2C would be removed from the site and disposed at a permitted off-site facility or treated prior to atmospheric release. Residual cancer risk remaining at OU-2C after completion of this remedy would be 4×10^{-6} and the maximum non-cancer hazard would exceed 1 (i.e., HQ = 8) at only one location, The non-cancer HQ of 8 is based on 1,2,4-TMB concentration at one location, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use.

ICs would be required to restrict future residential site use outside the western portion of Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing risk associated with future commercial land use throughout OU-2C.

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S5 would partially address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include SVE, which would capture and treat volatile chemicals. This alternative would also include excavation and off-site disposal and ICs. Implementation of excavation and disposal would result in transferring some of the OU-2C soil COCs to permitted off-site disposal facilities. Excavation and disposal would reduce the volume and mobility of chemicals at OU-2C, albeit not through treatment. In the event that the disposal process for excavated soil would require a treatment component on the basis of measured levels of chemicals, then this alternative could effectively meet this criterion.

Short-Term Effectiveness

Implementation of this alternative would increase traffic and could subsequently cause other risks to the community as a result of the increased truck activity. A total of more than 4,800 truck loads of soil would be needed to transport excavated soil off-site for disposal and bring clean fill on-site for backfill. This alternative would not result in any adverse environmental impacts, as remedial action would be designed to limit any potential for such impact (i.e.,

through a storm water management plan, waste management plan, and related plans). Handling of waste materials could present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and monitoring.

Soil Alternative S5 would have relatively high environmental footprint impacts in terms of GHG emissions, energy usage, air emissions, and collateral risk (see Appendix E). Those impacts related to GHG emissions and energy usage would be driven primarily by consumables (i.e., asphalt and grout) and soil transportation. Air emissions would be driven primarily by equipment use and soil transportation, and collateral risk would be driven primarily by personnel and soil transportation.

Implementability

Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. In addition, dewatering, treatment of the collected water, and discharge to surface water (if necessary during excavation) would be implementable as long as the appropriate administrative requirements could be met and the water treated to the required levels. Dewatering, treatment and surface water discharge has been successfully completed at other sites addressing similar COCs at Alameda. Monitoring wells have been installed throughout the site using various drilling techniques, and both soil and groundwater samples have been routinely collected throughout the site, including within the footprint of Building 5, using various techniques. Therefore, installation of an SVE system is considered to be highly implementable.

Implementation of the SVE system would require ongoing O&M for the remedial system. However, these activities are routine and would not pose any implementability concerns for this alternative. In addition, an SVE system for soil treatment would be compatible with the use of AS-SVE for groundwater treatment. Based on this information, Soil Alternative S5 is considered to be highly implementable.

However, at the present time, there is no information on the specific structural composition of Building 5. While it is assumed that the concrete slab could be saw-cut and demolished to allow access to excavation areas, the presence and nature of structural walls and/or footers is unknown. Although the specific design parameters of Building 5 are not known, assumptions can be made relative to the development of temporary structural measures for excavation in close proximity of structural elements. The design of these temporary structural measures will be site specific, depending on depth of proposed excavation and proximity to the structural component.

It may not be feasible to excavate and remove piping found beneath the building's structural components. As an alternative to excavation, piping found in these areas could be filled with structural grout, capped, and abandoned in place.

The structural design of Building 5 and the inability to effectively excavate soil around structural building elements could reduce the implementability of this alternative. In addition, the inability

to access excavation areas with suitable earthmoving equipment could limit the implementability.

Moreover, the level of effort associated with the excavation, handling, and disposal of radiologically impacted drain lines/piping and soils is greater than that associated with more standard soil excavation, including the use of specialized equipment, labor, and handling requirements. Removal of the radiologically impacted drain lines/piping and surrounding soil would therefore pose an implementability challenge. Given the storm drain line TCRA at OU-2C, this implementability challenge could be overcome with proper design and remedial action planning.

Cost

The present-value cost for Soil Alternative S5 is approximately $45,384,000 (see Table 6-1). Of this total cost, approximately $27,000,000 is associated with removal of the potentially radiologically-impacted lines beneath Building 5. This cost includes structural support of the building during excavation, as well as removal and replacement of the foundation over the excavation areas. If Building 5 and its foundation were demolished prior to implementation of the remedial action, the cost associated with removal of the potentially radiologically-impacted lines beneath this area would be approximately $22,000,000.

Primary cost components for this alternative include excavation, SVE extraction point installation, SVE O&M, off-site disposal, and monitoring. For cost-estimating purposes, it is assumed that any water which accumulates within the excavation areas would be removed, treated using filtration and GAC processes, and then discharged to surface water. It is also assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.6 Detailed Description of Soil Alternative S6 – Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-site Disposal, Institutional Controls, and Monitoring

Excavation

Soil Alternative S6 includes excavation of the radiologically-impacted drain lines/piping and surrounding soil beneath Buildings 5 and 400, but not excavation of the areas of elevated metals beneath Building 5. In addition, the soil footprints outside the buildings would be excavated in Alternative S6. In Alternative S6, soil in areas outside the footprint of Building 5 that contain concentrations of COCs above the preliminary RGs for soil, which were developed to be protective of future commercial land use, would be excavated. In addition, soil within Local Area 2 characterized by risks to a hypothetical future residential receptor would be excavated (see Figure 6-5). COCs requiring excavation in these areas include PCE, TCE, ethylbenzene, 1,2,4-TMB, and chromium.

For purposes of this FS, it is assumed that standard, track-mounted and/or rubber-tired earthmoving equipment would be suitable to perform excavation in these areas. In locations within the footprints of Buildings 5 and 400, it is assumed that the building slabs could be saw-cut and demolished to allow access to the known or potentially radiologically-impacted drain lines/piping and surrounding soil by standard earthmoving equipment. In areas where the proposed excavation is adjacent to load-bearing walls, columns, or foundation footings, measures to maintain the building's structural integrity will be implemented during excavation. The design of these temporary structural measures will be site specific, depending on depth of excavation and proximity to structural element. Provisions for minimizing water infiltration or removing and treating water from the excavation areas may be required depending on the depth of excavation and groundwater table at the time of excavation. A detailed plan for excavation water management would be developed during the remedial design phase of work for implementation of the OU-2C remedy.

The total area identified for excavation outside of Building 5 would be approximately 17,000 sf, and the targeted excavation depth would extend to between 3 and 8 ft depending on the specific soil removal area. Excavation of this vertical interval would address the potentially unacceptable risk levels associated with inhalation of vapors from VOCs in soil and direct contact and/or incidental ingestion of soil containing metals in the identified footprints. The excavation area of known and potentially radiologically-impacted drain lines/piping and surrounding soil beneath Buildings 5 and 400 is approximately 69,700 sf, assuming there is little deviation in pipe location or discovery of other lateral piping networks, and the targeted excavation depth would extend down to 8 ft (i.e., a depth known to be below the drain line/piping invert elevation). The total volume of excavated soil would be approximately 2,300 in-place cy from outside of the building, and approximately 20,700 in-place cy associated with the known or potentially radiologically-impacted drain lines/piping and surrounding soil.

Material other than that associated with the drain lines/piping would be excavated to limits defined by a land survey of the excavation areas. For drain lines/piping, excavation would be conducted in accordance with a radiological surveying approach consistent with that followed for the storm drain line TCRA at OU-2C (TtECI, 2008). The approach would include radiological surveying of piping segments and surrounding soil followed by excavation to limits defined by the surveying and confimatory soil sampling. Upon excavation, material would be stockpiled in accordance with a waste management plan pending characterization and off-site disposal. Certified clean backfill material would be used to backfill the open excavations. Cut floor areas inside of Buildings 5 and 400 would be restored to their pre-existing condition.

Engineering Controls

Concentrations of arsenic, lead, and thallium that exceed the preliminary RGs developed to be protective of future commercial land use are contained within the footprint of Building 5 (see Figure 6-5). Because the building slabs currently isolate human receptors from the COCs and the pertinent exposure pathways (i.e., direct contact and incidental ingestion), Soil Alternative S6 would include maintaining the slab of Building 5 in its current location to function as an engineering control. As part of the maintenance of this engineering control, the concrete slabs in identified footprint areas within the building would be maintained in good condition. In

addition, general engineering controls such as fencing could be an appropriate method for limiting or restricting future access to areas with residual risks.

Off-Site Disposal

After excavation, removed soil would be stockpiled and sampled for waste characterization purposes. Depending on the results of the waste characterization sampling, the material would be disposed at an appropriate off-site disposal facility (i.e., landfill). Once adequate waste characterization sampling was completed, the soil material would be loaded into trucks and hauled to the selected disposal facility.

For purposes of this FS, it is assumed that 35% of the soil excavated around the known and potentially radiologically-impacted drain lines/piping would be required to be disposed as low-level radiological waste disposed through the DoD low-level radiological waste disposal program, or approximately 9,400 loose cy. The remaining 65% of soil excavated around the known and potentially radiologically-impacted drain lines/piping is assumed to be non-hazardous waste. Based on currently available data contained in the RI, chromium concentrations in excavated soil would exceed 20 times the TCLP limit for RCRA hazardous waste. Therefore, for purposes of this FS, it is assumed that chromium containing soil would be disposed as RCRA hazardous waste, and excavated soil containing VOCs would be suitable for disposal at a Class II California landfill facility.

Institutional Controls

Soil Alternative S6 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., once Local Area 2 is addressed, there would be no potentially unacceptable risk from soil to a hypothetical future residential receptor in Exposure Unit 1); and
- Require that the Building 5 slab be maintained as an engineering control over the soil footprint areas beneath the buildings; and
- Require that another suitable engineering control (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) be installed in any footprint area where the existing control is demolished; and
- Require that impacted soil that would remain in footprint areas be excavated and disposed offsite (i.e., through a SMP or other documentation) if the existing engineering control (i.e., the Building 5 slab) is demolished and other suitable engineering controls (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) are not constructed in their place.

Site use restrictions would be implemented through a detailed LUC plan. Residential land use restrictions would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use, and the requirements/restrictions surrounding the presence and maintenance of the slab of Building 5 would be required indefinitely unless the soil footprints beneath the building were addressed.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs outside the Building 5 footprint and within the northern portion of Building 5. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. For purposes of this FS, it is assumed that 25 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify adequate soil removal during the excavation process. Performance monitoring would consist of surveying and direct observation. Post-excavation sampling would also be conducted to confirm that preliminary RGs have been achieved and all radiologically-impacted soil has been removed. A long-term monitoring program would not be necessary because post-excavation sampling would immediately verify the removal of soil containing COCs. For purposes of this FS, it is assumed that post-excavation sampling would be conducted at a frequency of one excavation bottom sample per 1,000 sf of excavation area and one excavation sidewall sample per 30 linear ft of excavation sidewall (with a minimum of one sample per sidewall); however, a detailed monitoring program would be developed during the remedial design phase of work. In addition, it is assumed that 1,300 samples for Ra-226 would be required to provide an adequate post-excavation final status survey of the drain lines/piping. Moreover, a one-time groundwater sampling event would be implementated in the vicinity of the removed piping to demonstrate a lack of radiological impact to groundwater.

Waste characterization sampling would be required to determine the specific nature of the excavated soil, to develop appropriate waste manifests, and to support off-site disposal at an appropriate offsite disposal facility (i.e., landfill). For purposes of this FS, it is assumed that waste characterization sampling would be performed at a frequency of one sample per 500 cy of excavated material. The specific sampling approach and frequency would be determined during the remedial design phase of work in direct consultation with potential disposal facilities.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.6.1 Detailed Analysis of Soil Alternative S6 – Partial Excavation Beneath Building 5, Complete Excavation Beneath Building 400 and Outside Building Footprints, Engineering Controls, Off-site Disposal, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Soil Alternative S6 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S6 would achieve the identified project RAOs and would therefore be considered protective of human health. Excavation of soil within Local Area 2 would mitigate potentially unacceptable risk to a hypothetical future residential receptor in western Exposure Unit 1. Excavation of soil in other areas outside the footprint of Building 5 would remove concentrations of metals and VOCs exceeding the occupational risk-based preliminary RGs, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from, direct contact with, and/or incidental ingestion of chemicals in soil outside of Building 5. The drain lines/piping and surrounding soils potentially containing Ra-226 beneath Buildings 5 and 400 would also be removed under this alternative.

ICs would restrict future residential site use outside of the western portion of Exposure Unit 1 and would ensure the long-term presence and protectiveness of the Building 5 slab as engineering controls to protect against exposure to metals contamination in soil that would remain beneath the Building 5 foundation. Additional ICs would require the replacement of a suitable cap if the slab was removed, or the removal of soil footprint areas beneath the building following the removal of the building and the absence of a suitable replacement cap. Monitoring of the ICs would ensure that unacceptable risks due to restricted site use would not occur and that appropriate measures would be taken to ensure the protectiveness of the engineering controls or implementation of other risk mitigation measures in the building areas.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6}, and the residual non-cancer hazard would be greater than 1 (i.e., HQ = 8) at only one location for future commercial receptors, as discussed in Appendix C.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during soil excavation should be classified and managed as hazardous waste.

Soil Alternative S6 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S6 would provide an effective remedy for soil containing COCs at the site. Chemical concentrations in soil within the remedial footprints outside of the buildings, including the residential footprint area at Local Area 2, would be removed from the site and disposed at a permitted off-site facility. The drain lines/piping and surrounding soils potentially containing Ra-226 beneath Buildings 5 and 400 would also be removed under this alternative. Occupational risk associated with metals contamination in soil would remain under Building 5, but the building slab would function as an engineering control and ICs would restrict specific site uses

and/or require certain mitigation measures to ensure continued protectiveness. Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be 4×10^{-6} and the maximum non-cancer hazard would exceed 1 at only one location. The maximum non-cancer hazard (i.e., HQ = 8) is based on the 1,2,4-TMB concentration at one location, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial/ industrial site use.

ICs would be required to restrict future residential site use outside of the western portion of Exposure Unit 1 and to ensure the proper management of soil containing metals contamination that would be exposed if the Building 5 slab was removed (or require the replacement of engineering controls over such areas). Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing the risk associated with future commercial land use throughout OU-2C.

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S6 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include excavation and off-site disposal or on-site management of COCs through engineering controls and ICs. Implementation of this alternative would result in transferring much of the OU-2C soil containing COCs to a permitted off-site disposal facility and the continued presence of certain soil COCs under the engineering controls. This alternative would reduce the volume and mobility of chemicals at OU-2C, albeit not through treatment. In the event that the disposal process for excavated soil would require a treatment component on the basis of measured levels of chemicals, then this alternative could effectively meet this criterion.

Short-Term Effectiveness

Implementation of this alternative would increase traffic and could subsequently cause other short-term risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as remedial action would be designed to limit any potential for such impact (i.e., through a storm water management plan, waste management plan, and related plans). Handling of waste materials could present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and monitoring.

Soil Alternative S6 would have a relatively low degree of environmental impact, as determined through the GSR evaluation (see Appendix E). Those impacts related to GHG emissions and energy usage would be driven primarily by consumables (i.e., asphalt and concrete) and handling of the excavated soil. Air emissions would be driven primarily by equipment use (i.e., heavy machinery operation for soil excavation and handling), and collateral risk would be driven primarily by handling of the excavated soil and transportation.

Implementability

Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. In addition, dewatering, treatment of the collected water, and discharge to surface water (if necessary during excavation) would be implementable as long as the appropriate administrative requirements could be met and the water treated to the required levels. Dewatering, treatment and surface water discharge has been successfully completed at other sites addressing similar COCs at Alameda.

Soil sampling has been conducted throughout OU-2C, including within Building 5, using various techniques. Based on this information, Soil Alternative S6 is considered to be implementable. However, the Final PDC (ARRA, 2006) does not include reuse of Building 5, suggesting this building would be demolished. Demolition of Building 5 would reduce the implementability of Soil Alternative S6 given the need to maintain engineering controls to ensure protectiveness in areas with metals contamination remaining beneath the building. Also related to the Final PDC, the administrative implementability of this alternative would be low.

At the present time, there is no information on the specific structural composition of Building 5. While it is assumed that the concrete slab could be saw-cut and demolished to allow access to excavation areas, the presence and nature of structural walls and/or footers is unknown. Although the specific design parameters of Building 5 are not known, assumptions can be made relative to the development of temporary structural measures for excavation in close proximity of structural elements. The design of these temporary structural measures will be site specific, depending on depth of proposed excavation and proximity to the structural component.

It may not be feasible to excavate and remove piping found beneath the building's structural components. As an alternative to excavation, piping found in these areas could be filled with structural grout, capped, and abandoned in place.

The structural design of Building 5 and the inability to effectively excavate soil around structural building elements could reduce the implementability of this alternative. In addition, the inability to access excavation areas with suitable earthmoving equipment could limit the implementability.

Moreover, the level of effort associated with the excavation, handling, and disposal of radiologically impacted drain lines/piping and soils is greater than that associated with more standard soil excavation, including the use of specialized equipment, labor, and handling requirements. Removal of the radiologically impacted drain lines/piping and surrounding soil would therefore pose an implementability challenge. Given the storm drain line TCRA at OU-2C, this implementability challenge could be overcome with proper design and remedial action planning.

Cost

The present-value cost for Soil Alternative S6 is approximately $42,110,000 (see Table 6-1). Of this total cost, approximately $27,000,000 is associated with removal of the potentially radiologically-impacted lines beneath Building 5. This cost includes structural support of the building during excavation, as well as removal and replacement of the foundation over the excavation areas. If Building 5 and its foundation were demolished prior to implementation of the remedial action, the cost associated with removal of the potentially radiologically-impacted lines beneath this area would be approximately $22,000,000.

Primary cost components for this alternative include excavation and off-site disposal. For cost-estimating purposes, it is assumed that any water that accumulates within the excavation areas would be removed, treated using filtration and GAC processes, and then discharged to surface water. It is also assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.7 Detailed Description of Soil Alternative S4R – Excavation, Off-Site Disposal, and Monitoring – Residential

Excavation

Soil Alternative S4R would include excavation of soil in areas outside and within the footprint of Building 5 that contain concentrations of COCs above the residential RBCs for soil developed to be protective of hypothetical future residential receptors. COCs requiring excavation in these areas include 1,1-DCA, benzene, ethylbenzene, isopropylbenzene, n-propylbenzene, naphthalene, xylenes, PCE, TCE, 1,2,4-TMB, 1,3,5-TMB, arsenic, chromium, lead, thallium, and cadmium. In addition, there is potential radiological impact associated with the presence of the drain lines/piping and surrounding soil beneath Buildings 5 and 400, and the piping and surrounding soil would be excavated (Figure 6-6). For purposes of this FS, it is assumed that standard, track-mounted and/or rubber-tired earthmoving equipment would be suitable to perform excavation in these areas. In locations within the footprints of Buildings 5 and 400, it is assumed that the building slabs could be saw-cut and demolished to allow access to the soil containing COCs by standard earthmoving equipment. In areas where the proposed excavation is adjacent to load bearing walls, columns, or foundation footings, measures to maintain the building's structural integrity will be implemented during excavation. The design of these temporary structural measures will be site specific, depending on depth of excavation and proximity to structural element. Provisions for minimizing water infiltration or removing and treating water from the excavation areas may be required depending on the depth of excavation and groundwater table at the time of excavation. A detailed plan for excavation water management would be developed during the remedial design phase of work for implementation of the OU-2C remedy.

The total area identified for excavation at OU-2C would be approximately 310,000 sf, assuming there is little deviation in pipe location or discovery of other lateral piping networks, and the targeted excavation depth would extend from between 3 and 8 ft depending on the specific soil removal area. Excavation of this vertical interval would address the unacceptable risk levels

associated with inhalation of vapors from VOCs in soil and direct contact and/or incidental ingestion of soil containing metals, and would remove potential radiological impact associated with the drain lines/piping and surrounding soil. The total volume of excavated soil would be approximately 49,000 cy.

Material other than that associated with the drain lines/piping would be excavated to limits defined by a land survey. For the drain lines/piping, excavation would be conducted in accordance with a radiological surveying approach consistent with that followed for the storm drain line TCRA at OU-2C (TtECI, 2008). The approach would include radiological surveying of drain lines/piping segments and surrounding soil followed by excavation to limits defined by the surveying and confirmatory soil sampling. Upon excavation, material would be stockpiled in accordance with a waste management plan pending characterization and off-site disposal. Certified clean backfill material would be used to backfill the open excavations. Cut floor areas inside of Buildings 5 and 400 would be restored to their pre-existing condition.

Off-Site Disposal

After excavation, removed soil would be stockpiled and sampled for waste characterization purposes. Depending on the results of the waste characterization sampling, the material would be disposed at an appropriate off-site disposal facility (i.e., landfill). Once adequate waste characterization sampling was completed, the soil material would be loaded into trucks and hauled to the selected disposal facility.

For purposes of this FS, it is assumed that 35% of the soil excavated around the known and potentially radiologically-impacted drain lines/piping would be required to be disposed as low-level radiological waste disposed through the DoD low-level radiological waste disposal program, or approximately 9,400 cy. The remaining 65% of soil excavated around the known and potentially radiologically-impacted drain lines/piping is assumed to be non-hazardous waste. Based on currently available data contained in the RI, lead, arsenic, and chromium concentrations in excavated soil would exceed 20 times the TCLP limit for RCRA hazardous waste. Therefore, for purposes of this FS, it is assumed that soil containing metals would be disposed as RCRA hazardous waste, and excavated soil containing VOCs would be suitable for disposal at a Class II California landfill facility.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design, including within the northern portion of Building 5. For purposes of this FS, it is assumed that 25 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify adequate soil removal during the excavation process. Performance monitoring would consist of physical and radiological surveying and direct observation. Post-excavation sampling would also be conducted to confirm that preliminary RGs have been achieved and all radiologically impacted soil has been removed. A long-term monitoring program would not be necessary because post-excavation sampling would immediately verify the removal of soil containing COCs. For purposes of this FS, it is assumed that post-excavation sampling would be conducted at a frequency of one excavation bottom sample per 1,000 sf of excavation area and one excavation sidewall sample per 30 linear ft of excavation sidewall (with a minimum of one sample per sidewall); however, a detailed monitoring program would be developed during the remedial design phase of work. In addition, it is assumed that 1,300 samples for Ra-226 would be required to provide adequate post-excavation final status survey of the drain lines/piping. Moreover, a one-time groundwater sampling event would be implemented in the vicinity of the removed drain lines/piping to demonstrate a lack of radiological impact to groundwater.

Waste characterization sampling would be required to determine the specific nature of the excavated soil, to develop appropriate waste manifests, and to support off-site disposal at an appropriate off-site disposal facility (i.e., landfill). For purposes of this FS, it is assumed that waste characterization sampling would be performed at a frequency of one sample per 500 cy of excavated material. The specific sampling approach and frequency would be determined during the remedial design phase of work in direct consultation with potential disposal facilities.

6.2.7.1 Detailed Analysis of Soil Alternative S4R – Excavation, Off-Site Disposal, and Monitoring - Residential. This subsection provides a discussion of the detailed analysis for Soil Alternative S4R with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S4R would mitigate unacceptable risks to hypothetical future residential receptors through excavation and off-site disposal of soil with concentrations exceeding the residential RBCs, thereby addressing the identified risks associated with inhalation of vapors from, direct contact with, and/or incidental ingestion of chemicals in soil. The drain lines/piping and surrounding soils potentially containing Ra-226 would also be removed.

Maximum residual cancer risk for a hypothetical future residential receptor at OU-2C after completion of this remedy would be at 5×10^{-6} and the residual non-cancer hazard would be less than 1, as discussed in Appendix C.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during soil excavation should be classified and managed as hazardous waste.

Soil Alternative S4R would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S4R would provide an effective long-term remedy for soil containing COCs at the site. Chemical concentrations in soil within the remedial footprints throughout OU-2C would be removed from the site and disposed at a permitted off-site facility. The radiologically impacted drain lines/piping and surrounding soils beneath Buildings 5 and 400 would also be removed. Residual cancer risk remaining at OU-2C after completion of this remedy would be 5×10^{-6} and the maximum non-cancer hazard would be less than 1, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. No ICs would be required following completion of this remedial alternative.

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S4R would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include excavation and off-site disposal. Implementation of this alternative would result in transferring the OU-2C soil COCs to permitted off-site disposal facilities. This alternative would reduce the volume and mobility of chemicals at OU-2C, albeit not through treatment. In the event that the disposal process for excavated soil would require a treatment component on the basis of measured levels of chemicals, then this alternative could effectively meet this criterion.

Short-Term Effectiveness

Implementation of Soil Alternative S4R would increase traffic and could subsequently cause other short-term risks to the community as a result of the increased truck activity. A total of over 9,000 truck loads of soil would be needed to transport excavated soil off-site for disposal and bring clean fill on-site for backfill. Soil Alternative S4R would have significant environmental footprint impacts, as demonstrated by the GSR evaluation in Appendix E. Those impacts related to GHG emissions and energy usage would be driven primarily by consumables (i.e., asphalt and grout) and soil transportation. Air emissions would be driven primarily by equipment use and soil transportation, and collateral risk would be driven primarily by personnel and soil transportation.

Under Soil Alternative S4R, the remedial action would be designed to limit the potential for other short-term impacts (i.e., through a storm water management plan, waste management plan, and related plans). Handling of waste materials could present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and monitoring.

Implementability

Equipment and materials for implementation of excavation, sampling, and off-site disposal would be readily available through various vendors, and the technologies have also been documented to successfully address the soil COCs that are present at OU-2C. In addition, dewatering, treatment of the collected water, and discharge to surface water (if necessary during excavation) would be implementable as long as the appropriate administrative requirements could be met and the water treated to the required levels. Dewatering, treatment and surface water discharge has been successfully completed at other sites addressing similar COCs at Alameda. Soil sampling has been conducted throughout OU-2C, including within Building 5, using various techniques. Based on this information, Soil Alternative S4R is considered to be highly implementable.

However, at the present time, there is no information on the specific structural composition of Building 5. While it is assumed that concrete slabs could be saw-cut and demolished to allow access to excavation areas, the presence and nature of structural walls and/or footers is not known. Although the specific design parameters of Building 5 are not known, assumptions can be made relative to the development of temporary structural measures for excavation in close proximity of structural elements. The design of these temporary structural measures will be site specific, depending on depth of proposed excavation and proximity to the structural component.

It may not be feasible to excavate and remove piping found beneath the building's structural components. As an alternative to excavation, piping found in these areas could be filled with structural grout, capped, and abandoned in place.

The structural design of Buildings 5 and 400, and the technical difficulty associated with effectively excavating soil around structural building elements could reduce the implementability of this alternative.

Moreover, the level of effort associated with the excavation, handling, and disposal of radiologically impacted drain lines/piping and soils is greater than that associated with more standard soil excavation, including the use of specialized equipment, labor, and handling requirements. Removal of the radiologically impacted drain lines/piping and surrounding soil would therefore pose an implementability challenge. Given the storm drain line TCRA at OU-2C, this implementability challenge can be overcome with proper design and remedial action planning.

Cost

The present-value cost for Soil Alternative S4R is approximately $54,137,000 (see Table 6-1). Of this total cost, approximately $27,000,000 is associated with removal of the potentially radiologically-impacted lines beneath Building 5. This cost includes structural support of the building during excavation, as well as removal and replacement of the foundation over the excavation areas. If Building 5 and its foundation were demolished prior to implementation of the remedial action, the cost associated with removal of the potentially radiologically-impacted lines beneath this area would be approximately $22,000,000.

Primary cost components for this alternative include excavation, off-site disposal, and monitoring, along with handling and disposal of radiologically impacted material. For cost-estimating purposes, it is assumed that any water which accumulates within the excavation areas would be removed, treated using filtration and GAC processes, and then discharged to surface water. A detailed cost estimate for this alternative is provided in Appendix F.

6.3 DETAILED ANALYSIS OF GROUNDWATER REMEDIAL ALTERNATIVES FOR THE SHALLOW FWBZ

6.3.1 Detailed Description of Groundwater Alternative GS1 – No Action. In accordance with the requirements of the NCP, the No Action alternative is presented and carried through the entire FS to serve as the baseline condition to which to compare other remedial alternatives. This alternative would entail no active remediation of VOC-impacted groundwater in the shallow FWBZ. ICs and monitoring would not be components of this alternative. No periodic reviews would be conducted to evaluate the protectiveness of this alternative. There would be no costs associated with this alternative.

6.3.1.1 Detailed Analysis of Groundwater Alternative GS1 – No Action. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS1 with respect to the NCP evaluation criteria. As described below, this alternative does not meet the threshold criterion of overall protection of human health and the environment and does not trigger an ARARs determination. Therefore, an analysis of the balancing criteria is not required.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). However, current conditions result in potentially unacceptable risk to future commercial receptors from chemicals in groundwater at the site. Under this alternative, no remedial action would be completed to reduce chemical concentrations in groundwater in the shallow FWBZ, and no ICs would be implemented to restrict future land and/or groundwater use. Therefore, Groundwater Alternative GS1 would not be protective of human health and the environment at OU-2C.

Compliance with ARARs

There is no need to identify ARARs for the No Action alternative because ARARs apply to “any removal or remedial action conducted entirely on-site” and “no action” is not a removal or remedial action (CERCLA Section 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the No Action alternative. Therefore, a discussion of compliance with ARARs is not appropriate for Groundwater Alternative GS1.

6.3.2 Detailed Description of Groundwater Alternative GS2 – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring

ISCO and Enhanced Bioremediation

Groundwater Alternative GS2 would include treatment of VOC-impacted groundwater footprint areas throughout OU-2C. ISCO would be implemented to treat higher concentration areas located east of Building 5, as well as in the middle of Building 5 in the areas located immediately north and east of what was historically identified as Plume 5-3 (see Figure 6-7). COCs requiring treatment in these areas include 1,1-DCA and VC. For purposes of this FS, it is assumed that the ISCO technology best suited to treat these COCs is alkaline activated persulfate.

The total area identified for ISCO treatment would be approximately 35,800 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval would address the potentially unacceptable future office worker risk levels associated with inhalation of vapors from VOCs in groundwater. Based on information from sites with similar geology at Alameda Point and where ISCO has been conducted, it is assumed that a 15-ft radius of influence would provide adequate reagent distribution in the subsurface. This would result in a total of approximately 51 injection locations across the site. Based on the volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 40 pounds of persulfate and 20 pounds of sodium hydroxide would be injected at each location. For purposes of this FS, it is assumed that three full rounds of ISCO injection will be required to reduce chemical concentrations in groundwater below the preliminary RGs.

The more dilute plume located to the south of and beneath the remainder of Building 5 would be treated using enhanced bioremediation. Aerobic bioremediation is best suited for treatment of both 1,1-DCA and vinyl chloride. For purposes of cost estimating in this FS, the Oxygen Release Compound (ORC®) substrate is assumed to be representative of technologies for accomplishing enhanced aerobic bioremediation. The total area requiring treatment with enhanced aerobic bioremediation is estimated to be 29,850 sf. Based on site specific information and the vendor's recommendation, injection points would be spaced 10 ft apart with 10 ft spacing between rows. Approximately 60 pounds of reagent would be injected into each of approximately 300 injection points throughout the site. For purposes of cost estimating in this FS, it is assumed that approximately one-third of the bioremediation treatment area would require a second round of injection to reduce chemical concentrations in groundwater below the preliminary RGs.

Given the relatively high solubility of 1,1-DCA that is present at the site, the ISCO injection would be conducted using either a push-pull or recirculation technique. For purposes of this FS, it is assumed that a push-pull technique would be implemented by extracting groundwater from an injection point, mixing the groundwater with oxidant, and then reinjecting the mixture. It is assumed that three rounds of injection would be completed to achieve the preliminary RGs. All injection points would be installed with screened intervals located at target injection depths. The specific construction of the injection points would be developed in the remedial design.

Cleanup goals for both ISCO and enhanced bioremediation would be based on the risk-based preliminary RGs that were developed to be protective of the documented commercial land use. In addition, this alternative would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1. Chemical concentrations throughout western Exposure Unit 1 are currently acceptable for unrestricted land use, and groundwater concentrations in monitoring well M05-02 (located immediately west of Building 5) have been decreasing over time. Therefore, treatment of the upgradient shallow FWBZ plume areas east of and beneath Building 5 would be conservatively protective of western Exposure Unit 1.

Institutional Controls

This alternative would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., shallow FWBZ groundwater in Exposure Unit 1 is not characterized by potentially unacceptable risk to a hypothetical future residential receptor); and
- Prohibit the use of groundwater from the shallow FWBZ.

Site use restrictions would be required until such time that groundwater concentrations reach a level acceptable for residential land use, and ICs prohibiting the use of groundwater would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach using ISCO, ISCR, or AS-SVE would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that pre-design sampling would be completed using a total of 30 sampling points. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and oxidant distribution in the subsurface during the ISCO injection process. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. It is assumed that five new monitoring wells would be installed within the treatment areas to enable this monitoring. For purposes of this FS, it is

assumed that the five new monitoring wells would be sampled along with 5 existing OU-2C monitoring wells quarterly for 5 years until the preliminary RGs have been met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.2.1 Detailed Analysis of Groundwater Alternative GS2 – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS2 would achieve the identified project RAOs and would therefore be considered protective of human health. In situ treatment, including ISCO and enhanced bioremediation, would reduce chemical concentrations in groundwater, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from chemicals in groundwater. Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 3×10^{-6} and there would be no residual non-cancer hazards exceeding 1 remaining for future commercial receptors, as discussed in Appendix C.

As discussed above, Groundwater Alternative GS2 would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1, where chemical concentrations are currently at an acceptable level for future residential land use and have also been decreasing over time.

ICs would restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1, and would prohibit the use of groundwater. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater and site use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative were summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCO and enhanced bioremediation. Groundwater Alternative GS2 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods including ISCO and enhanced bioremediation. ISCO treatments can be challenged by chemical rebound effects, but repeated treatments can address this issue.

Maximum residual cancer risk remaining after completion of this remedy would be at 3×10^{-6} and there would be no non-cancer hazards exceeding 1 remaining, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. This alternative would also be protective of unrestricted land use within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of groundwater throughout OU-2C and restrict future site use to commercial throughout OU-2C with the exception of Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in addressing risk associated with commercial land use outside the western portion of Exposure Unit 1, and would also provide conservative protection of shallow FWBZ groundwater in the western area of Exposure Unit 1.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS2 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative includes ISCO treatment in the highest concentration areas to reduce chemical concentrations to levels consistent with the preliminary RGs. It also includes implementation of enhanced bioremediation treatment of lower COC concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of this alternative would result in reducing the toxicity and volume of chemicals in groundwater, resulting in final chemical concentrations consistent with the preliminary RGs identified for future commercial land use throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse groundwater impacts, as the treatment reagents are designed to react with the chemicals in groundwater, leaving behind non-toxic byproducts. Handling of injectable materials for ISCO treatment would present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GS2 would be characterized by a relatively low level of environmental impact from a sustainability perspective. The greatest

environmental impacts would be associated with consumption of injectables and equipment use, and personnel transportation for collateral risk.

Implementability

Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using various techniques.

In order to ensure adequate mixing and contact time with the ISCO reagents, treatment would likely be implemented using either a push-pull approach or recirculation system. This approach does add complexity to implementation of this alternative over traditional injection methods; however, recirculation for ISCO injection has been implemented elsewhere at Alameda Point for groundwater treatment.

Materials for implementation of ISCO and enhanced bioremediation would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. Based on this information, Groundwater Alternative GS2 is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GS2 is approximately $2,187,000 (see Table 6-2). Primary cost components for this alternative include treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.3.3 Detailed Description of Groundwater Alternative GS3 – In Situ Chemical Reduction, Enhanced Bioremediation, Institutional Controls, and Monitoring

ISCR and Enhanced Bioremediation

Groundwater Alternative GS3 would include treatment of VOC-impacted groundwater footprint areas throughout OU-2C. ISCR would be implemented to treat higher concentration areas located east of Building 5, as well as in the middle of Building 5 in the areas located immediately north and east of what was historically identified as Plume 5-3 (see Figure 6-7). COCs requiring treatment in these areas include 1,1-DCA and vinyl chloride. For purposes of this FS, it is assumed that the ISCR technology best suited to treat these COCs is ZVI.

The total area identified for ISCR treatment would be approximately 35,800 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval would address the potentially unacceptable future occupational risk levels associated with inhalation of vapors from VOCs in groundwater. Based on vendor information, it is assumed that injection points would be installed with 15 ft spacing to ensure adequate distribution of the treatment media. This would result in a total of approximately 215 injection locations across the site. Based on the

volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 1,040 pounds of ZVI would be injected at each location.

The more dilute plume located to the south of and beneath the remainder of Building 5 would be treated using enhanced bioremediation. Aerobic bioremediation is best suited for treatment of both 1,1-DCA and vinyl chloride. For purposes of cost estimating in this FS, the ORC® substrate is assumed to be representative of technologies for accomplishing enhanced aerobic bioremediation. The total area requiring treatment with enhanced aerobic bioremediation is estimated to be 29,850 sf. Based on the vendor's recommendation, an injection point spacing of 10 ft is assumed to be appropriate for this site. Approximately 60 pounds of reagent would be injected into each of approximately 300 injection points throughout the site. For purposes of cost estimating in this FS, it is assumed that approximately one-third of the treatment area would require a second round of injection to reduce chemical concentrations in groundwater below the preliminary RGs.

Reagents would be injected under pressure using a system of mixers, pumps, valves, and hoses. The injection points would have screened intervals located at target injection depths. ZVI is typically a coarser material that is more commonly injected using pneumatic injection techniques. For purposes of this FS, it is assumed that ZVI would be injected using pneumatic injection. The specific construction of the injection points for both enhanced bioremediation reagent and ZVI would be developed in the remedial design.

Cleanup goals for both ISCR and enhanced bioremediation would be based on the risk-based preliminary RGs which were developed to be protective of the likely future commercial land use outside the western portion of Exposure Unit 1. In addition, this alternative would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1. Chemical concentrations throughout western Exposure Unit 1 are currently acceptable for unrestricted land use, and groundwater concentrations in monitoring well M05-02 (located immediately west of Building 5) have been decreasing over time. Therefore, treatment of the upgradient plume areas east of and beneath Building 5 would be conservatively protective of western Exposure Unit 1.

Institutional Controls

This alternative would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., shallow FWBZ groundwater in Exposure Unit 1 is not characterized by potentially unacceptable risk to a hypothetical future residential receptor); and
- Prohibit the use of groundwater from the shallow FWBZ.

Site use restrictions would be required until such time that groundwater concentrations reach a level acceptable for residential land use, and ICs prohibiting the use of groundwater would be required until such time that groundwater concentrations reach levels acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or in conjunction with completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach using ISCO, ISCR, or AS-SVE would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that pre-design sampling would be completed using a total of 30 sampling points. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and ZVI distribution in the subsurface during the injection process. For purposes of this FS, it is assumed that five new monitoring wells would be installed within the treatment areas to enable this monitoring. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. For purposes of this FS, it is assumed that five new monitoring wells and 5 existing monitoring wells would be sampled quarterly for 5 years until the preliminary RGs are met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.3.1 Detailed Analysis of Groundwater Alternative GS3 – In Situ Chemical Reduction, Enhanced Bioremediation, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS3 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS3 would achieve the identified RAOs and would therefore be considered protective of human health. In situ treatment, including ISCR and enhanced bioremediation, would reduce chemical concentrations in groundwater, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from chemicals in groundwater. Maximum residual cancer risk remaining at OU-2C after

completion of this remedy would be at 3×10^{-6} and there would be no residual non-cancer hazards above 1 remaining for future commercial receptors, as discussed in Appendix C.

As discussed above, this alternative would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1, where chemical concentrations have been decreasing over time and are currently at an acceptable level for future residential land use.

ICs would restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1, and would restrict the use of groundwater throughout OU-2C. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater and site use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether aqueous waste generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCR and enhanced bioremediation. Groundwater Alternative GS3 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at OU-2C. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods including ISCR and enhanced bioremediation. Maximum residual cancer risk remaining after completion of this remedy would be 3×10^{-6} and there would be no non-cancer hazards above 1 remaining, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. This alternative would also be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of shallow FWBZ groundwater throughout OU-2C and restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would address risk associated with future commercial land use outside the western portion of Exposure Unit 1 and would also provide conservative protection of shallow FWBZ groundwater in the western area of Exposure Unit 1.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS3 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This alternative includes ISCR treatment in the highest concentration areas to reduce chemical concentrations to

levels consistent with the preliminary RGs. It also includes implementation of enhanced bioremediation treatment in areas of lower concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of this alternative would result in reducing the toxicity and volume of chemicals in groundwater, resulting in final chemical concentrations consistent with the preliminary RGs identified for future commercial land use throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse groundwater impacts, as the treatment reagents are designed to react with the chemicals in the groundwater, leaving behind non-toxic byproducts. While increased dissolved iron concentrations are documented at some sites, these impacts are short-lived and naturally attenuated as groundwater flows through the treatment area. Health and safety concerns for workers during remedial activities would be minimal. Any worker safety concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring. ISCR treatments typically require a relatively long treatment duration, and this increased duration would tend to increase short-term risks.

As described in Appendix E, Groundwater Alternative GS3 would be characterized by a relatively high level of environmental impact from a sustainability perspective. The greatest environmental impacts would be associated with consumption of ZVI and equipment use, and personnel transportation for collateral risk.

Implementability

Both soil and groundwater samples have been routinely collected throughout the site, including within the footprint of Building 5, using various techniques. However, appropriate system monitoring would be required during the pneumatic injection beneath Building 5 to ensure that the building slab/foundation is not affected and uncertainty surrounding the construction of Building 5 yields uncertainty in the potential reduction in implementability.

Materials for implementation of ISCR and enhanced bioremediation are readily available through multiple vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. Based on this information, this alternative is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GS3 is approximately $6,878,000 (see Table 6-2). Primary cost components for this alternative include treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.3.4 Detailed Description of Groundwater Alternative GS4 – Air Sparge-Soil Vapor Extraction, Enhanced Bioremediation, Institutional Controls, and Monitoring

AS-SVE and Enhanced Bioremediation

Groundwater Alternative GS4 would include treatment of VOC-impacted groundwater footprint areas throughout OU-2C. AS-SVE would be implemented to treat higher concentration areas located east of Building 5, as well as in the middle of Building 5 in the areas located immediately north and east of what was historically identified as Plume 5-3 (see Figure 6-7). COCs requiring treatment in these areas include 1,1-DCA and vinyl chloride. Groundwater treatment areas east of Building 5 also approximately coincide with the presence of elevated VOC concentrations in soil. Therefore, implementation of this alternative would be compatible with the use of SVE to address VOCs in certain soil footprint areas as well.

The total area identified for AS-SVE treatment would be approximately 35,800 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval would address the unacceptable occupational risk levels associated with inhalation of vapors from VOCs in groundwater. Based on geologic conditions, a 15-ft AS radius of influence and 20-ft SVE radius of influence is estimated to be appropriate for this site. This would result in a total of approximately 66 AS locations and 37 SVE locations across the site.

The more dilute plume located to the south of and beneath the remainder of Building 5 would be treated using enhanced bioremediation. Aerobic bioremediation is best suited for treatment of both 1,1-DCA and vinyl chloride. For purposes of cost estimating in this FS, ORC® substrate is assumed to be representative of technologies for accomplishing enhanced aerobic bioremediation. The total area requiring treatment with enhanced aerobic bioremediation is estimated to be 29,850 sf. Based on the vendor's recommendation, a 10-ft radius of influence is assumed to be appropriate for this site. Approximately 60 pounds of reagent would be injected into each of approximately 300 injection points throughout the site. For purposes of cost estimating in this FS, it is assumed that approximately one-third of the treatment area would require a second round of injection to reduce chemical concentrations in groundwater below the preliminary RGs.

Reagents would be injected under pressure using a system of mixers, pumps, valves, and hoses. The injection points would have screened intervals located at target injection depths. AS-SVE would be conducted by installing a network of air injection points with screened intervals at the target treatment depth, and injecting air under pressure to these points. The resulting vapors from the volatilized chemicals would be extracted under vacuum at SVE wells and conveyed to an on-site treatment system for treatment. The specific construction of the injection points for bioremediation and air injection/vapor extraction points for AS-SVE would be developed in the remedial design.

Cleanup goals for both AS-SVE and enhanced bioremediation would be based on the risk-based preliminary RGs which were developed to be protective of the likely future commercial land use at OU-2C. In addition, this alternative would be conservatively protective of shallow FWBZ

groundwater within the western area of Exposure Unit 1. Chemical concentrations throughout western Exposure Unit 1 are currently acceptable for unrestricted land use, and groundwater concentrations in monitoring well M05-02 (located immediately west of Building 5) have been decreasing over time. Therefore, treatment of the upgradient plume areas east of and beneath Building 5 would be conservatively protective of western Exposure Unit 1.

Institutional Controls

This alternative would also include implementation of institutional controls to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., shallow FWBZ groundwater in Exposure Unit 1 is not characterized by potentially unacceptable risk to a hypothetical future residential receptor); and
- Prohibit the use of groundwater from the shallow FWBZ.

Site use restrictions would be required until such time that groundwater concentrations reach a level acceptable for residential land use, and ICs prohibiting the use of groundwater would be required until such time that groundwater concentrations reach levels acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach using ISCO, ISCR, or AS-SVE would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that 30 sampling points would be installed to accomplish pre-design sampling. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify air injection rates, vacuum rates, and mass removal rates during the AS-SVE process. For purposes of this FS, it is assumed that five new monitoring wells would be installed within the treatment areas to enable this monitoring. Post-treatment monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. Monitoring would be implemented to ensure adequate treatment of vapor phase chemicals in the SVE system. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. For purposes of this FS, it is assumed that five new monitoring wells and five existing OU-2C monitoring wells

would be sampled quarterly for 5 years until the preliminary RGs have been met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.4.1 Detailed Analysis of Groundwater Alternative GS4 – Air Sparge-Soil Vapor Extraction, Enhanced Bioremediation, Institutional Controls, and Monitoring

This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS4 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS4 would achieve the identified RAOs and would therefore be considered protective of human health. In situ treatment of groundwater and treatment of vapor phase chemicals from the SVE system and enhanced bioremediation would reduce chemical concentrations in groundwater, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from chemicals in groundwater. Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 3×10^{-6} and there would be no residual non-cancer hazards above 1 remaining for future commercial receptors, as discussed in Appendix C.

As discussed above, this alternative would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1, where chemical concentrations have been decreasing over time and are currently at an acceptable level for future residential land use.

ICs would restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1, and would also restrict the use of groundwater from the shallow FWBZ. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater and site use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for enhanced bioremediation. Groundwater Alternative GS4 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through treatment methods including AS-SVE and enhanced bioremediation. The effectiveness of AS-SVE can be decreased with significant subsurface heterogeneity, but this is not expected to be a significant issue at OU-2C.

Maximum residual risk remaining after completion of this remedy would be 3×10^{-6} and there would be no residual non-cancer hazards above 1 remaining, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. This alternative would also be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of shallow FWBZ groundwater throughout OU-2C and restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would address risk associated with future commercial land use outside the western portion of Exposure Unit 1 and would also conservatively protect shallow FWBZ groundwater in the western portion of the Exposure Unit 1.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS4 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This alternative would include AS-SVE treatment in the highest concentration areas to reduce chemical concentrations to levels consistent with the preliminary RGs. It would also include implementation of enhanced bioremediation treatment of lower concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of this alternative would result in reducing the toxicity and volume of chemicals in groundwater, resulting in final chemical concentrations consistent with the preliminary RGs identified for future commercial land use throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts. Health and safety concerns for workers during remedial activities would be minimal. Any worker safety concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GS4 would be characterized by a relatively low level of environmental impact from a sustainability perspective. The greatest

environmental impacts would be associated with operation of the AS-SVE system for GHG emissions, energy usage and air emissions, and equipment use and personnel transportation for collateral risk.

Implementability

Monitoring wells have been installed throughout the site using rotary drilling techniques, and both soil and groundwater samples have been routinely collected throughout the site, including within the footprint of Building 5, using various techniques. Therefore installation of AS and SVE systems is considered to be highly implementable, as is injection of bioremediation reagent. Implementation of the AS-SVE system would require on-going O&M for the remedial system. However, these activities are routine and would not pose any implementability concerns for this alternative.

Cost

The present-value cost for Groundwater Alternative GS4 is approximately $3,548,00 (see Table 6-2). Primary cost components for this alternative include installation of the AS-SVE system, O&M, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.3.5 Detailed Description of Groundwater Alternative GS5 – ERH, ISCO/ISCR/AS-SVE, Enhanced Bioremediation, ICs, and Monitoring

ERH, ISCO/ISCR/AS-SVE, and Enhanced Bioremediation

Groundwater Alternative GS5 would include treatment of VOC-impacted shallow FWBZ groundwater footprint areas throughout OU-2C. ERH would be used to treat source areas where potential DNAPL may be present, specifically in the area with total chlorinated VOC concentrations greater than 10,000 µg/L (see Figure 6-7). COCs requiring treatment in this area include 1,1-DCA and VC.

The total area identified for ERH treatment would be approximately 4,600 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval using ERH is expected to reduce total chlorinated VOC concentrations to 1,000 µg/L or less, as was accomplished during previous removal actions in Plumes 5-1 and 5-3. Electrode spacing would be approximately 19 ft, requiring 21 electrodes to complete the ERH in this area. Vapor extraction wells would be collocated with the electrodes to enable extraction of steam and volatilized chemicals produced during the ERH treatment. All extracted vapors would be treated using granular activated carbon prior to atmospheric discharge.

Following completion of the ERH treatment, the remaining high concentrations areas would be treated with either ISCO, ISCR, or AS-SVE, and the more dilute plume areas would be treated using enhanced bioremediation, as discussed in groundwater alternatives GS2 through GS4 (see Sections 6.3.2, 6.3.3., and 6.3.4).

Cleanup goals would be based on the risk-based preliminary RGs that were developed to be protective of the likely future commercial land use. In addition, treatment of the upgradient shallow FWBZ plume areas assumed in this alternative (east of and beneath Building 5) would be conservatively protective of groundwater in downgradient areas, including within the western area of Exposure Unit 1.

Institutional Controls

This alternative would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., shallow FWBZ groundwater in Exposure Unit 1 is not characterized by potentially unacceptable risk to a hypothetical future residential receptor); and

- Prohibit groundwater use from the shallow FWBZ.

Site use restrictions would be required until such time that groundwater concentrations reach a level acceptable for residential land use, and ICs prohibiting groundwater use would be required until such time that groundwater concentrations are acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach using ISCO, ISCR, or AS-SVE would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that a total of 30 sampling points would be installed. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify effectiveness of the ERH, as well as the other remedial technologies. Performance monitoring would be conducted to verify electrode operation and mass removal rates during the ERH process. For purposes of this FS, it is assumed that five new monitoring wells would be installed within the treatment areas to enable this monitoring. Post-treatment monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. Monitoring would be implemented to ensure adequate treatment of vapor phase chemicals in the activated carbon system. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. For purposes of this FS, it is assumed that five new monitoring wells and five existing OU-2C monitoring wells would be sampled quarterly for 5 years until the preliminary RGs have been

met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.5.1 Detailed Analysis of Groundwater Alternative GS5 – ERH, ISCO/ISCR/ AS-SVE, Enhanced Bioremediation, ICs and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS5 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS5 would achieve the identified project RAOs and would therefore be considered protective of human health. In situ treatment would reduce chemical concentrations in groundwater, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from chemicals in groundwater. Maximum residual cancer risk remaining after completion of this remedy would be at 3×10^{-6} and no residual non-cancer hazards above 1 would remain for future commercial receptors at OU-2C (see Appendix C).

Groundwater Alternative GS5 would be conservatively protective of downgradient shallow FWBZ groundwater, where chemical concentrations are currently at an acceptable level for future residential land use and have also been decreasing over time.

ICs would restrict future site use to commercial throughout OU-2C except for western Exposure Unit 1, and would prohibit groundwater use throughout the site. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater and site use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative were summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of any chemicals into groundwater. Groundwater Alternative GS5 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Groundwater Alternative GS5 would provide an effective long-term remedy for groundwater containing COCs at the site. One remaining area with concentrations of total VOCs indicative of

potential DNAPL (i.e., greater than 10,000 µg/L) was identified in the shallow FWBZ. Two prior removal actions have demonstrated that ERH can successfully treat areas with potential DNAPL in the shallow FWBZ at OU-2C. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods.

Maximum residual cancer risk remaining after completion of this remedy would be at 3×10^{-6} and no residual non-cancer hazards above 1 would remain, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. This alternative would also be conservatively protective of downgradient groundwater, including within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of groundwater throughout OU-2C and restrict future site use to commercial throughout OU-2C except for western Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in addressing risk associated with commercial land use, and would also provide conservative protection of downgradient groundwater.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS5 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative includes ERH, with ISCO, ISCR, or AS-SVE and also enhanced bioremediation to permanently reduce the toxicity and volume of chemicals in the groundwater, and to reduce chemical concentrations to levels consistent with the preliminary RGs identified for future commercial land use throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as the vapors generated during ERH would be collected and treated prior to being discharged to the atmosphere. Potential safety concerns for workers during the remedial actions would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, addition of ERH to the shallow FWBZ groundwater alternatives would result in increased environmental impacts primarily due to equipment operation and activated carbon usage. Increases in air emissions (i.e., SOx) and energy usage would occur due to the energy required for the heating system. A very low collateral risk exists for ERH. It should also be noted that 55% of Alameda Municipal Power's energy is obtained from eligible renewable sources, and this was accounted for by using modified emissions factors in the model which were obtained from Alameda Municipal Power.

Implementability

Monitoring wells have been installed at OU-2C using conventional drilling techniques. Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using various techniques. Therefore, installation of an ERH system and system monitoring are considered implementable, as is injection of treatment reagents.

ERH removal actions at OU-2C have been successfully implemented, and equipment necessary to complete this treatment is currently present at the site. Materials for implementation of ISCO, ISCR, AS-SVE and enhanced bioremediation would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. Based on this information, Groundwater Alternative GS5 is considered to be implementable.

Cost

For purposes of cost estimating, Groundwater Alternative GS5 is assumed to consist of ERH, ISCO, enhanced bioremediation, and ICs. The present-value cost for this alternative is approximately $4,300,000 (see Table 6-2). Primary cost components for this alternative include the ERH system installation and operation, treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

The cost for ERH treatment of the shallow groundwater with total chlorinated VOC concentrations greater than 10,000 µg/L is approximately $1,353,000. The cost for ERH treatment of a larger area where total chlorinated VOC concentrations exceed 1,000 µg/L would be approximately $4,800,000.

6.3.6 Detailed Description of Groundwater Alternative GS2R – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring – Residential

ISCO and Enhanced Bioremediation

The remedial footprints for Groundwater Alternative GS2 could be expanded to accomplish groundwater treatment resulting in a maximum residual cancer risk of 1×10^{-6} for a hypothetical future residential receptor at OU-2C. Chemicals in shallow FWBZ groundwater requiring treatment to achieve risk-based residential preliminary RGs include 1,1,1-TCA, 1,1-DCA, 1,2-DCA, PCE, TCE, 1,1-DCE, vinyl chloride, chloroform, benzene, ethylbenzene, naphthalene, 1,2,4-TMB, and 1,4-DCB. The overall approach for treatment in GS2R would be the same as that described for the Groundwater Alternative GS2 occupational remediation scenario, including ISCO by alkaline activated persulfate for higher concentrations and areas with parent products, and enhanced aerobic bioremediation for areas with more dilute concentrations and daughter products (see Figure 6-8).

The total area identified for ISCO treatment for residential remediation would be approximately 112,000 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. It is assumed that a 15-ft radius of influence would be achieved for this site, which would result in a total of approximately 158 ISCO injection locations across the site. Based on the volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 40 pounds of persulfate and 20 pounds of sodium hydroxide would be injected at each location.

The total area requiring treatment with enhanced aerobic bioremediation to achieve preliminary RGs based on future residential land use is estimated to be 6.7 acres. Due to the large area identified for enhanced bioremediation treatment as part of this scenario, injection of bioremediation reagent over a uniform grid is not considered cost-effective. Rather, a series of several bioremediation barriers intersecting the treatment areas is assumed for this alternative (see Figure G-5). An injection point spacing of 10 ft within each barrier is assumed to be appropriate for injection of reagent at this site. Approximately 60 pounds of reagent would be injected into each of approximately 940 injection points throughout the site. For purposes of the FS, it is assumed that approximately one-third of the treatment area would require a second round of injection to reduce chemical concentrations in groundwater below the residential preliminary RGs.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that pre-design sampling would be completed using a total of 30 sampling points. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and oxidant distribution in the subsurface during the ISCO injection process. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. It is assumed that 15 new monitoring wells would be installed within the treatment areas to enable this monitoring. For purposes of this FS, it is assumed that the 15 new monitoring wells would be sampled along with 5 existing OU-2C monitoring wells quarterly for 10 years until the preliminary RGs have been met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste

characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

This alternative would also include implementation of ICs to prohibit the use of groundwater from the shallow FWBZ until such time that groundwater concentrations reach levels acceptable for unrestricted groundwater use. Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.6.1 Detailed Analysis of Groundwater Alternative GS2R – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS2R with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS2R would address unacceptable risks to hypothetical future residential receptors due to inhalation of vapors from chemicals in groundwater and would therefore be considered protective of human health. Maximum residual cancer risk to a hypothetical future residential receptor remaining at OU-2C after completion of this remedy would be at 5×10^{-6} and there would be no residual non-cancer hazards exceeding 1 remaining, as discussed in Appendix C.

Groundwater Alternative GS2R would also be protective of shallow FWBZ groundwater within the western area of Exposure Unit 1, where chemical concentrations are currently at an acceptable level for residential land use and have also been decreasing over time.

ICs would prohibit future groundwater use throughout OU-2C. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative were summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCO and enhanced bioremediation. Groundwater Alternative GS2R would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods including ISCO and enhanced

bioremediation. ISCO treatments can be challenged by chemical rebound effects, but repeated treatments can address this issue.

Maximum residual cancer risk to a hypothetical future residential receptor remaining after completion of this remedy would be at 5×10^{-6} and there would be no non-cancer hazards exceeding 1 remaining, as discussed in Appendix C. This represents the low end of the acceptable risk management range. This alternative would also be protective of unrestricted land use within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of groundwater throughout OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS2R would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative includes ISCO treatment in the highest concentration areas to reduce chemical concentrations to levels consistent with the residential RBCs. It also includes implementation of enhanced bioremediation treatment of lower COC concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of this alternative would result in reducing the toxicity and volume of chemicals in groundwater, resulting in final chemical concentrations consistent with the residential RBCs throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as the treatment reagents are designed to react with the chemicals in groundwater, leaving behind non-toxic byproducts. Handling of injectable materials for ISCO treatment would present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GS2R would be characterized by a high level of environmental impact from a sustainability perspective. The greatest environmental impacts would be associated with consumption of injectables and equipment use, and personnel transportation for collateral risk.

Implementability

Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using various techniques.

In order to ensure adequate mixing and contact time with the ISCO reagents, treatment would likely be implemented using either a push-pull approach or recirculation system. This approach

does add complexity to implementation of this alternative over traditional injection methods; however, recirculation for ISCO injection has been implemented elsewhere at Alameda Point for groundwater treatment.

Materials for implementation of ISCO and enhanced bioremediation would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. Based on this information, Groundwater Alternative GS2R is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GS2R is approximately $4,981,000 (see Table 6-2). Primary cost components for this alternative include treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.4 DETAILED ANALYSIS OF GROUNDWATER REMEDIAL ALTERNATIVES FOR THE DEEP FWBZ AND SWBZ

6.4.1 Detailed Description of Groundwater Alternative GD1 – No Action. In accordance with the requirements of the NCP and CERCLA, the No Action alternative is presented and carried through the entire FS to serve as the baseline condition to which to compare other remedial alternatives. This alternative would entail no active remediation of VOC-impacted groundwater in the deep FWBZ or SWBZ. Institutional controls and monitoring would not be components of this alternative. There are no costs associated with this alternative.

6.4.1.1 Detailed Analysis of Groundwater Alternative GD1 – No Action. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD1 with respect to the NCP evaluation criteria. As described below, this alternative does meet the threshold criteria of overall protection of human health and the environment. Therefore, an analysis of the balancing criteria is not required.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (Bechtel, 2008). As discussed in Section 2.3.7, FWBZ groundwater at OU-2C is not considered a likely future drinking water source and SWBZ groundwater is characteristically unsuitable for drinking water. Deep FWBZ and SWBZ groundwater do not present a risk based on vapor inhalation because no complete exposure pathway was identified for the deep FWBZ and SWBZ. However, total chlorinated VOC concentrations in some areas of the deep FWBZ and SWBZ are elevated, and some indicate that DNAPL may be present. These source areas present a potential risk for degradation of downgradient groundwater, which could ultimately present a risk to receptors in the western portion of Exposure Unit 1 or off-site receptors. Therefore, it is concluded that Groundwater Alternative GD1 would not be protective of human health.

Compliance with ARARs

There is no need to identify ARARs for the No Action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Sec. 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the No Action alternative (U.S. EPA, 1991b). Therefore, a discussion of compliance with ARARs is not appropriate for Groundwater Alternative GD1.

6.4.2 Detailed Description of Groundwater Alternative GD2 – Institutional Controls and Monitoring

Institutional Controls

As discussed in Section 2.3.7, FWBZ groundwater at OU-2C is unlikely to be used as a potential drinking water source, and does not need to be considered as such for purposes of CERCLA cleanup decisions. SWBZ groundwater is characteristically unsuitable for drinking water. The risk assessment presented in the RI (BEI, 2008) concluded that there is no current human health or ecological risk associated with chemical is the deep FWBZ and SWBZ groundwater. Therefore no active remediation is included in Groundwater Alternative GD2.

However, ICs would be required under Groundwater Alternative GD2 to accomplish the following:

- Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C.

ICs would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to be in place for 30 years.

6.4.2.1 Detailed Analysis of Groundwater Alternative GD2 – Institutional Controls and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). As discussed in Section 2.3.7, groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. Because no current human health or ecological risks are present, implementation of ICs to restrict use of groundwater from the deep FWBZ and SWBZ would be protective of human health and the environment.

Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater use would not occur. Implementation and monitoring of ICs would not actively protect against the potential for downgradient groundwater impacts from chemical migration.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. Portions of the California Civil Code, California Health and Safety Code, and CCR are considered potential state ARARs for the transfer or property, and these are therefore potential state ARARs for ICs. Groundwater alternative GD2 would meet all identified chemical-specific, location-specific, and action-specific ARARs

Long-Term Effectiveness and Permanence

ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative at OU-2C. However, implementation and monitoring of ICs would not be effective in preventing the potential for downgradient impacts to groundwater from chemical migration.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GD2 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include only ICs to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C.

Short-Term Effectiveness

No active remediation is included in Groundwater Alternative GD2, therefore no short-term risks or environmental impacts would be result from implementation of this alternative. Groundwater Alternative GD2 is not evaluated in the GSR evaluation.

Implementability

Since no active remediation would occur under Groundwater Alternative GD2, the technical implementability of this alternative would be high. In addition, since deep FWBZ and SWBZ groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, respectively, the administrative implementability associated with ICs for this alternative would also be high.

Cost

The present-value cost for Groundwater Alternative GD2 is approximately $511,000 (see Table 6-3). Primary cost components for this alternative include the implementation and monitoring of ICs. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.4.3 Detailed Description of Groundwater Alternative GD3 – In Situ Chemical Oxidation, Institutional Controls, and Monitoring

ISCO

Groundwater Alternative GD3 would include treatment of groundwater with total chlorinated VOC concentrations greater than the 1,000 µg/L preliminary RG in the deep FWBZ and SWBZ at OU-2C (see Figures 6-9 and 6-10). The ISCO technology that appears to be best suited to treat chlorinated VOCs present is alkaline activated persulfate. ISCO can effectively treat the COCs present and achieve the preliminary RG of less than 1,000 µg/L total VOCs as well as the preliminary RGs for individual VOCs. The preliminary RGs for total and individual VOCs were developed based on protectiveness of downgradient areas (i.e., western Exposure Unit 1) and modeling results that simulate migration of chemicals in the deep FWBZ and SWBZ (see Section 3.5 and Appendix B).

The total area identified for ISCO treatment would be approximately 10,800 sf in the deep FWBZ (approximately 20 to 40 ft bgs) and 1,500 sf in the SWBZ (approximately 40 to 70 ft bgs). Based on information from sites with similar geology at Alameda Point and where ISCO has been conducted, it is assumed that a 15-ft radius of influence would provide adequate reagent distribution in the subsurface. This would result in a total of approximately 18 injection locations in the deep FWBZ and 3 injection locations in the SWBZ. Based on the volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 1,860 pounds of persulfate and 970 pounds of sodium hydroxide would be injected at each location in the deep FWBZ, and 630 pounds of persulfate and 330 pounds of sodium hydroxide would be injected at each location in the SWBZ.

Institutional Controls

ICs would be required under Groundwater Alternative GD3 to accomplish the following:

- Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C.

ICs would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in groundwater exceeding the preliminary RGs. For purposes of this FS, it is assumed that 10 sampling points would be installed to conduct pre-design groundwater sampling. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and oxidant distribution in the subsurface during the injection process. For purposes of this FS, it is

assumed that seven new monitoring wells would be installed within the ISCO injection areas to enable this monitoring. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound. For purposes of this FS, it is assumed that post-injection monitoring would be conducted at the seven new monitoring wells, and would include four post-injection monitoring events. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to be in place for 30 years.

6.4.3.1 Detailed Analysis of Groundwater Alternative GD3 – In Situ Chemical Oxidation, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD3 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). As discussed in Section 2.3.7, groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. However, total chlorinated VOC concentrations in some areas of the deep FWBZ and SWBZ are very high, and some indicate that DNAPL may be present. These source areas present the potential for degradation of downgradient groundwater, which could ultimately present a risk to human health in western Exposure Unit 1 or off-site.

Implementation of this alternative would reduce chemical concentrations to levels below the preliminary RG of 1,000 µg/L total VOCs as well as preliminary RGs for individual VOCs, thereby limiting the degradation of downgradient groundwater and eliminating potentially unacceptable downgradient risks.

ICs would restrict the use of groundwater from the deep FWBZ and SWBZ. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater would not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCO. Groundwater Alternative GD3 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Groundwater Alternative GD3 would provide an effective long-term remedy for groundwater containing COCs in the deep FWBZ and SWBZ at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through ISCO injection. Modeling results indicate that achieving the preliminary RGs within the remedial footprints would result in downgradient concentrations within western Exposure Unit 1 that are below risk-based residential criteria (see Section 3.5 and Appendix B).

ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GD3 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This alternative would include ISCO treatment in deep FWBZ and SWBZ plume areas to reduce chemical concentrations to levels consistent with the preliminary RGs.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as the treatment reagents are designed to react with the chemicals in the groundwater, leaving behind non-toxic byproducts. Handling of the chemical oxidants does present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GD3 would be characterized by a relatively low level of environmental impact from a sustainability perspective. The greatest environmental impacts would be associated with consumption of ISCO injectables and equipment use, and personnel transportation for collateral risk.

Implementability

Implementation of this alternative would rely on installation of ISCO injection wells. Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using various techniques. In order to ensure adequate oxidant contact time and mixing, implementation of the injection process would likely be completed using either a push-pull approach or recirculation system. This approach is more complex than a traditional injection approach; however, recirculation has been implemented for ISCO treatment at Alameda Point. Materials for implementation of ISCO are readily available through various vendors, and the technologies have also been documented to successfully treat the COCs which are present at

OU-2C. Based on this information, Groundwater Alternative GD3 is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GD3 is approximately $1,851,000 (see Table 6-3). Primary cost components for this alternative include the chemical oxidant, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.4.4 Detailed Description of Groundwater Alternative GD4 – In Situ Chemical Reduction, Institutional Controls, and Monitoring

ISCR

Groundwater Alternative GD4 would include treatment of groundwater with total chlorinated VOC concentrations greater than the 1,000 µg/L preliminary RG in the deep FWBZ and SWBZ at OU-2C using ISCR (see Figures 6-9 and 6-10). The ISCR technology that appears to be best suited to treat chlorinated VOCs present is ZVI. Therefore, the injection of ZVI is assumed for this alternative. ZVI can effectively treat the COCs present and can achieve the preliminary RG of less than 1,000 µg/L total VOCs as well as the preliminary RGs for individual VOCs. The preliminary RGs for total and individual VOCs were developed based on protectiveness of downgradient areas (i.e., western Exposure Unit 1) and modeling results that simulate migration of chemicals in these zones (see Section 3.5 and Appendix B).

The total area identified for ZVI treatment would be approximately 10,800 sf in the deep FWBZ (approximately 20 to 40 ft bgs) and 1,500 sf in the SWBZ (approximately 40 to 70 ft bgs). Based on vendor information, an injection spacing of 15 ft is estimated to be appropriate for this site. This would result in a total of approximately 24 injection locations in the deep FWBZ and 3 injection locations in the SWBZ. Based on the volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 4,550 pounds of ZVI would be injected at each location in the deep FWBZ and approximately 7,770 pounds of ZVI would be injected at each location in the SWBZ.

Institutional Controls

ICs would be required under Groundwater Alternative GD4 to accomplish the following:

- Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C.

ICs would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in groundwater exceeding the preliminary RGs. For purposes of this FS, it is assumed that 10 sampling points would be installed to accomplish pre-design sampling. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and ZVI distribution in the subsurface during the injection process. For purposes of this FS, it is assumed that seven new monitoring wells would be installed within the ISCR injection areas to enable this monitoring. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound. For purposes of this FS, it is assumed that post-injection monitoring would be conducted at the seven new monitoring wells, and would include two post-injection monitoring events. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to be in place for 30 years.

6.4.4.1 Detailed Analysis of Groundwater Alternative GD4 – In Situ Chemical Reduction, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD4 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (Bechtel, 2008). As discussed in Section 2.3.7, groundwater at OU-2C is not considered a likely future drinking water source or is characteristically not suitable for drinking water, and deep FWBZ and SWBZ groundwater do not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. However, total chlorinated VOC concentrations in some areas of the deep FWBZ and SWBZ are very high, and some indicate that DNAPL may be present. These source areas present the potential for degradation of downgradient groundwater, which could ultimately present a risk to human receptors in western Exposure Unit 1 or off-site.

Implementation of this alternative would reduce chemical concentrations to levels below the preliminary RG of 1,000 µg/L total VOCs as well as the preliminary RGs for individual VOCs, thereby eliminating potentially unacceptable downgradient risks.

ICs would restrict the use of groundwater from the deep FWBZ and SWBZ. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater use would not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCR. Groundwater Alternative GD4 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at OU-2C. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through ISCR injection. Modeling results indicate that achieving the preliminary RGs within the remedial footprints would result in downgradient concentrations within western Exposure Unit 1 that are below risk-based residential criteria (see Section 3.5 and Appendix B).

ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative G8 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This alternative would include ISCR treatment within the remedial footprints to reduce the toxicity and volume of the COCs and to reduce the chemical concentrations to levels consistent with the preliminary RGs.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as the treatment reagents are designed to react with the chemicals in the groundwater, leaving behind non-toxic byproducts. Health and safety concerns for workers during remedial activities would be minimal. Any worker safety concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GD4 would be characterized by a relatively high level of environmental impact from a sustainability perspective. The greatest environmental impacts would be associated with consumption and transportation of ZVI along with equipment use, and personnel transportation for collateral risk.

Implementability

Injection of ZVI would likely be completed using pneumatic injection. Appropriate system monitoring would be required during the pneumatic injection beneath and around Building 5 to ensure that the building slab/foundation is not affected. To the extent there is uncertainty surrounding the structural makeup of Building 5, there is uncertainty in the reduction in implementability posed by conducting ISCR beneath Building 5.

Materials for implementation of ISCR are readily available through multiple vendors, and the technology has also been documented to successfully treat the COCs which are present at OU-2C. Based on this information, Groundwater Alternative GD4 is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GD4 is approximately $2,259,000 (see Table 6-3). Primary cost components for this alternative include treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.4.5 Detailed Description of Groundwater Alternative GD5 – Electrical Resistive Heating, Institutional Controls, and Monitoring

ERH

Groundwater Alternative GD5 would include treatment of groundwater with total chlorinated VOC concentrations greater than the 1,000 µg/L preliminary RG in the deep FWBZ and SWBZ at OU-2C (see Figures 6-9 and 6-10). ERH has been demonstrated to effectively treat the COCs present and achieve the preliminary RG of less than 1,000 µg/L total VOCs within the shallow FWBZ at OU-2C. The preliminary RGs for total and individual VOCs were developed based on protectiveness of downgradient areas and modeling results that simulate migration of chemicals in the deep FWBZ and SWBZ (see Section 3.5 and Appendix B).

The total area identified for ERH treatment would be approximately 10,800 sf in the deep FWBZ (approximately 20 to 40 ft bgs) and 1,500 sf in the SWBZ (approximately 40 to 70 ft bgs). It is assumed that electrodes would be spaced approximately 20 ft apart, requiring a total of 32 electrodes. Vapor extraction wells would be collocated with the electrodes to enable extraction of steam and volatilized chemicals produced during the ERH treatment. All extracted vapors would be treated using granular activated carbon prior to atmospheric discharge. In order to extract vapors as steam during treatment, the entire saturated zone would be heated, from approximately 6 ft bgs to 40 ft bgs in the deep FWBZ and 70 ft bgs in the SWBZ.

Institutional Controls

ICs would be required under Groundwater Alternative GD5 to accomplish the following:

- Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C.

ICs would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in groundwater exceeding the preliminary RGs. For purposes of this FS, it is assumed that pre-design groundwater sampling would be conducted at 10 sampling points. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify heat distribution and vapor extraction rates during the treatment process. For purposes of this FS, it is assumed that seven new monitoring wells would be installed within the treatment zones to enable this monitoring. Post-treatment monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound. For purposes of this FS, it is assumed that post-treatment monitoring would be conducted at the seven new monitoring wells, and would include two post-treatment monitoring events. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility.

6.4.5.1 Detailed Analysis of Groundwater Alternative GD5 – Electrical Resistive Heating, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD5 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). As discussed in Section 2.3.7, groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. However, total chlorinated VOC concentrations in some areas of the deep FWBZ and SWBZ are very high, and some indicate that DNAPL may be present. These source areas present the potential for degradation of downgradient groundwater, which could ultimately present a risk to human health in downgradient areas.

Implementation of this alternative would reduce chemical concentrations to levels below the preliminary RG of 1,000 µg/L total VOCs as well as preliminary RGs for individual VOCs, thereby limiting the degradation of downgradient groundwater and eliminating potentially unacceptable downgradient risks.

ICs would restrict the use of groundwater from the deep FWBZ and SWBZ at OU-2C. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater use would not occur.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, ARARs associated with implementation of SVE would apply, including requirements of the Clean Air Act (see Appendix D).

Groundwater Alternative GD5 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Groundwater Alternative GD5 would provide an effective long-term remedy for groundwater containing COCs in the deep FWBZ and SWBZ at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through ERH. Previous removal actions in the shallow FWBZ at OU-2C have demonstrated that total VOC concentrations can be reduced to 1,000 µg/L or less using ERH. Modeling results indicate that achieving the preliminary RGs within the remedial footprints would result in downgradient concentrations that are below risk-based residential RBCs (see Section 3.5 and Appendix B). ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Groundwater Alternative GD5 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This alternative would include ERH treatment in deep FWBZ and SWBZ plume areas to reduce chemical concentrations to the preliminary RGs.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse environmental impacts, as the vapors generated during ERH would be collected and

treated prior to being discharged to the atmosphere. Any safety concerns for workers present during the remedial action would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GD5 would be characterized by a relatively high level of environmental impact from a sustainability perspective, primarily driven by the energy usage for the heating system, and personnel transportation for collateral risk. It should also be noted that 55% of Alameda Municipal Power's energy is obtained from eligible renewable sources, and this was accounted for by using modified emissions factors in the model which were obtained from Alameda Municipal Power.

Implementability

Implementation of this alternative would rely on installation of electrodes into boreholes likely installed via hollow stem auger drilling techniques. Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using this technique. Much of the equipment necessary for implementation of ERH is currently available at the site from completion of previous ERH removal actions. Based on this information, Groundwater Alternative GD5 is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GD5 is approximately $2,893,000 (see Table 6-3). Primary cost components for this alternative include the ERH system installation and operation and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

For comparison purposes, the cost to use ERH for treatment of those areas in the deep FWBZ and SWBZ with total chlorinated VOC concentrations greater than 10,000 µg/L was also estimated. This cost would be approximately $900,000.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
11	**nine evaluation criteria**	**Section 2.8.2**	Proposed Plan for Operable Unit 2C, IR Sites 5, 10, and 12, Alameda Point. Table 8.

Table 8. NCP Evaluation Criteria

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.
2. **Compliance with ARARs** addresses whether or not a remedy will meet all applicable or relevant and appropriate federal and state environmental laws and regulations or provide grounds for a waiver.
3. **Long-term effectiveness and permanence** refers to the ability of a remedy to provide reliable protection of human health and the environment over time.
4. **Reduction of toxicity, mobility, or volume through treatment** refers to preference for a remedy that reduces health hazards, the movement of contaminants, or the quantity of contaminants at the site through treatment.
5. **Short-term effectiveness** addresses period of time needed to complete remedy and any adverse effects to human health and the environment that may be caused during construction and implementation of the remedy.
6. **Implementability** refers to the technical and administrative feasibility of the remedy, including availability of materials and services needed to carry out the remedy and coordination of federal, state, and local governments to work together to clean up the site.
7. **Cost** evaluates estimated capital and operation and maintenance costs of each alternative in comparison to other equally protective measures.
8. **State agency acceptance** indicates whether the state agrees with, opposes, or has no comment on the alternative.
9. **Community acceptance** includes determining which components of the alternatives are supported by, have reservations about, or opposed by (not complete until public comments on proposed plan are received) interested persons in the community.

NCP evaluation criteria are divided into three categories:

- **Threshold**. These criteria (1 and 2) must be satisfied for an alternative to be eligible.
- **Primary balancing**. These criteria (3, 4, 5, 6, and 7) are used to weigh major trade-offs among alternatives.
- **Modifying**. Once all comments are evaluated, state and community acceptance (8 and 9) may prompt modifications of the final remedy and are thus designated modifying criteria.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
12	Alternative S2	Section 2.8.3	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.2.2, Pages 6-5 through 6-8. Battelle 2011.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C. However, current conditions result in potentially unacceptable risk to future commercial/ industrial receptors from chemicals in soil (BEI, 2008). In addition, there are potentially remaining radiological impacts beneath Building 5 associated with the abandoned piping and/or surrounding soil. Under Soil Alternative S1, no remedial action would be completed to reduce chemical or radionuclide concentrations in soil, and no ICs would be implemented to restrict future land use. In addition, Local Area 2 would not be addressed. Therefore, Soil Alternative S1 would not be protective of human health and the environment at OU-2C.

Compliance with ARARs

There is no need to identify ARARs for Soil Alternative S1 because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA sec. 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the No Action alternative for soil. Therefore, a discussion of compliance with ARARs is not appropriate for Soil Alternative S1.

6.2.2 Detailed Description of Soil Alternative S2 – Engineering Controls, Institutional Controls, and Monitoring

Engineering Controls

Concentrations of arsenic, lead, and thallium that exceed the preliminary RGs developed to be protective of future commercial land use are contained within the footprint of Building 5 (see Figure 6-1). In addition, there is known or potential radiological impact associated with the presence of the drain lines/piping and surrounding soil beneath Buildings 5 and 400. Because the building slabs currently isolate human receptors from the metal COCs and the pertinent exposure pathways (i.e., direct contact and incidental ingestion) and provide an effective barrier between human receptors and radiological constituents, Soil Alternative S2 would include maintaining these slabs in their current location to function as an engineering control.

Concentrations of VOCs and chromium in soil south and east of Building 5 that exceed the preliminary RGs developed to be protective of future commercial land use are currently covered by concrete or asphalt pavement. In addition, concentrations of PCE in soil in Local Area 2 that are responsible for potentially unacceptable risk to a future residential receptor are currently covered by pavement. The pavement in these areas serves as an engineering control and provides adequate protection against the exposure pathways of concern. In addition, general engineering controls such as fencing could be an appropriate method for limiting or restricting future access to areas with residual risks.

Under Soil Alternative S2, the slabs of Buildings 5 and 400 and other paved areas currently existing over soil footprint areas would be maintained in good condition to prevent future human exposure to the underlying soil.

To further enhance the engineering control of known or potentially radiologically-impacted drain lines/piping, these pipelines would be sealed in-place with appropriate grout material.

Institutional Controls

Soil Alternative S2 would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 and Local Area 2 in Western Exposure Unit 1 (i.e., Western Exposure Unit 1 outside of Local Area 2 is not characterized by potentially unacceptable soil risks to a hypothetical future residential receptor);
- Require that the Buildings 5 and 400 slabs and the areas of pavement that currently cover soil footprint areas be maintained as engineering controls over the footprint areas;
- Require that another suitable engineering control (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) be installed in any footprint area where the existing control is demolished; and
- Require that impacted soil that would remain in footprint areas be excavated and disposed off-site (i.e., through a SMP or other documentation) if the existing engineering controls (i.e., the Building 5 and 400 slabs and areas of pavement that currently cover soil footprint areas) are demolished and other suitable engineering controls (e.g., asphalt or concrete pavement, a soil cover, or an engineered cap) are not constructed in their place.

Site use restrictions would be implemented through a detailed land use control (LUC) plan. Residential land use restrictions would be required indefinitely unless soil concentrations reach a level acceptable for unrestricted land use, and the requirements/restrictions surrounding the presence and maintenance of the engineering controls would be required indefinitely unless the soil footprints in these areas were directly addressed through removal or treatment.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the extent of chemical concentrations in soil exceeding the preliminary RGs. At least some of the overall remedial footprint for this alternative is based on interpolation between soil data points that are relatively distant from one another. Therefore, the precise location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design, including in areas within the northern portion of Building 5. For purposes of this FS, it is assumed that 20 additional soil sampling locations would be required to adequately verify the precise extent of soil footprint areas. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

This FS assumes, based on soil gas samples collected under the southern part of Building 5, that high levels of radon are not present under Building 5A. Prior to finalization of the ROD, the Navy will conduct soil gas sampling for radon to confirm this assumption.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.2.2.1 Detailed Analysis of Soil Alte rnative S2 – Engineering Contr ols, Institutional Controls, and M onitoring. This subsection provides a discussion of the detailed analysis for Soil Alternative S2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Soil Alternative S2 would achieve the identified project RAOs and would therefore be considered protective of human health. ICs would prohibit future residential site use in Exposure Units 2 and 3 and Local Area 2 and would ensure the long-term presence and protectiveness of Building 5 and surrounding paved areas as engineering controls. If any of the cap areas were to be removed in the future, ICs would require the replacement of a suitable cap or the removal of soil footprint areas where chemical concentrations exceed the preliminary RGs. Monitoring of the ICs would ensure that unacceptable risks due to restricted site use would not occur and that appropriate measures would be taken to ensure the protectiveness of a cap or implementation of other risk mitigation measures in the cap area.

Grouting in-place the known or potentially radiologically-impacted drain lines/piping would mitigate the potential for future migration of radionuclides and provide additional shielding against radiological exposures.

Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 4×10^{-6}, and the residual non-cancer hazard would be greater than 1 (i.e., HQ = 8) at only one location for future commercial receptors, as discussed in Appendix C.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and are discussed in detail in Appendix D. Portions of the California Civil Code, California Health and Safety Code, and CCR are considered potential state ARARs for the transfer or property, and these are therefore potential state ARARs for ICs. Soil Alternative S2 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Soil Alternative S2 would provide an effective remedy for soil containing COCs at the site. Occupational risk associated with identified COCs would remain at the site, but the building slabs and surrounding paved areas would function as engineering controls and ICs would restrict specific site uses and/or require certain mitigation measures to ensure continued protectiveness.

ICs would be required to prohibit future residential site use in Exposure Units 2 and 3 and Local Areas 2. In addition, ICs would ensure the proper management of soil that would be exposed if Building 5, Building 400 or surrounding paved areas were removed (or require the replacement of engineering controls over such areas). Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in adequately addressing the risk associated with future commercial land use throughout OU-2C (and residential risk in Local Area 2).

Reduction of Toxicity, Mobility, or Volume through Treatment

Soil Alternative S2 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include use of Buildings 5 and 400 slabs and existing paved areas as an engineering control, and appropriate ICs to prohibit future residential land use and ensure long-term maintenance of the controls.

Short-Term Effectiveness

No active remediation is included in Soil Alternative S2, therefore no short-term risks or environmental sustainability impacts would result from implementation of this alternative. Soil Alternative S2 is not directly evaluated in the GSR analysis.

Implementability

Existing site conditions (Buildings 5 and 400 and surrounding paved areas) together with grouting of drain lines/piping would serve as the engineering controls. Since no active remediation would occur under this alternative, the technical implementability of this alternative would be high. However, the Final PDC (ARRA, 2006) does not include reuse of Building 5, suggesting this building would be demolished. Demolition of either Building 5 or 400 would reduce the implementability of Soil Alternative S2. Also related to the Final PDC, the administrative implementability of this alternative would be low.

Cost

The present-value cost for Soil Alternative S2 is approximately $575,000 (see Table 6-1). Primary cost components for this alternative include pipe grouting and IC implementation and monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.2.3 Detailed Description of Soil Alternative S3 – Partial Excavation, Engineering Controls, Off-site Disposal, Institutional Controls, and Monitoring

Excavation

Soil Alternative S3 would include excavation of soil in areas outside the footprint of Building 5 that contain concentrations of COCs above the preliminary RGs for soil which were developed to

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
13	Alternative GS2	Section 2.8.9	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.3.2, Pages 6-38 through 6-42; Pages 2-32 through 2-34. Battelle 2011.

6.3.2 Detailed Description of Groundwater Alternative GS2 – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring

ISCO and Enhanced Bioremediation

Groundwater Alternative GS2 would include treatment of VOC-impacted groundwater footprint areas throughout OU-2C. ISCO would be implemented to treat higher concentration areas located east of Building 5, as well as in the middle of Building 5 in the areas located immediately north and east of what was historically identified as Plume 5-3 (see Figure 6-7). COCs requiring treatment in these areas include 1,1-DCA and VC. For purposes of this FS, it is assumed that the ISCO technology best suited to treat these COCs is alkaline activated persulfate.

The total area identified for ISCO treatment would be approximately 35,800 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval would address the potentially unacceptable future office worker risk levels associated with inhalation of vapors from VOCs in groundwater. Based on information from sites with similar geology at Alameda Point and where ISCO has been conducted, it is assumed that a 15-ft radius of influence would provide adequate reagent distribution in the subsurface. This would result in a total of approximately 51 injection locations across the site. Based on the volume of groundwater to be treated and the chemical concentrations present, it is estimated that approximately 40 pounds of persulfate and 20 pounds of sodium hydroxide would be injected at each location. For purposes of this FS, it is assumed that three full rounds of ISCO injection will be required to reduce chemical concentrations in groundwater below the preliminary RGs.

The more dilute plume located to the south of and beneath the remainder of Building 5 would be treated using enhanced bioremediation. Aerobic bioremediation is best suited for treatment of both 1,1-DCA and vinyl chloride. For purposes of cost estimating in this FS, the Oxygen Release Compound (ORC®) substrate is assumed to be representative of technologies for accomplishing enhanced aerobic bioremediation. The total area requiring treatment with enhanced aerobic bioremediation is estimated to be 29,850 sf. Based on site specific information and the vendor's recommendation, injection points would be spaced 10 ft apart with 10 ft spacing between rows. Approximately 60 pounds of reagent would be injected into each of approximately 300 injection points throughout the site. For purposes of cost estimating in this FS, it is assumed that approximately one-third of the bioremediation treatment area would require a second round of injection to reduce chemical concentrations in groundwater below the preliminary RGs.

Given the relatively high solubility of 1,1-DCA that is present at the site, the ISCO injection would be conducted using either a push-pull or recirculation technique. For purposes of this FS, it is assumed that a push-pull technique would be implemented by extracting groundwater from an injection point, mixing the groundwater with oxidant, and then reinjecting the mixture. It is assumed that three rounds of injection would be completed to achieve the preliminary RGs. All injection points would be installed with screened intervals located at target injection depths. The specific construction of the injection points would be developed in the remedial design.

Cleanup goals for both ISCO and enhanced bioremediation would be based on the risk-based preliminary RGs that were developed to be protective of the documented commercial land use. In addition, this alternative would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1. Chemical concentrations throughout western Exposure Unit 1 are currently acceptable for unrestricted land use, and groundwater concentrations in monitoring well M05-02 (located immediately west of Building 5) have been decreasing over time. Therefore, treatment of the upgradient shallow FWBZ plume areas east of and beneath Building 5 would be conservatively protective of western Exposure Unit 1.

Institutional Controls

This alternative would also include implementation of ICs to accomplish the following:

- Restrict future site use to commercial throughout Exposure Units 2 and 3 (i.e., shallow FWBZ groundwater in Exposure Unit 1 is not characterized by potentially unacceptable risk to a hypothetical future residential receptor); and
- Prohibit the use of groundwater from the shallow FWBZ.

Site use restrictions would be required until such time that groundwater concentrations reach a level acceptable for residential land use, and ICs prohibiting the use of groundwater would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Pre-design sampling would be completed as part of this alternative to confirm the current concentrations and extent of chemical concentrations in groundwater exceeding the preliminary RGs. Much of the remedial footprint for this alternative is based on hydropunch sampling data collected more than 10 years ago. Therefore, the location and extent of the remedial footprints would be confirmed prior to or as part of completing the remedial design. In addition, the pre-design sampling would serve to identify the most appropriate treatment technology for each area. Enhanced bioremediation would be selected for areas where this remedy could meet the preliminary RGs within a reasonable time frame, while a more active approach using ISCO, ISCR, or AS-SVE would be selected for other areas with higher concentrations. For purposes of this FS, it is assumed that pre-design sampling would be completed using a total of 30 sampling points. The exact number and location of the pre-design sampling locations would be selected during the remedial design and remedial action work plan phase of work for the ultimately selected remedy for OU-2C.

Performance monitoring would be conducted to verify injection rates, radius of influence, and oxidant distribution in the subsurface during the ISCO injection process. Post-injection monitoring would also be conducted to confirm that preliminary RGs have been achieved and demonstrate that chemical concentrations do not rebound over time. In addition, a monitoring program would be established to demonstrate attainment of the preliminary RGs in areas where enhanced bioremediation is implemented. It is assumed that five new monitoring wells would be installed within the treatment areas to enable this monitoring. For purposes of this FS, it is

assumed that the five new monitoring wells would be sampled along with 5 existing OU-2C monitoring wells quarterly for 5 years until the preliminary RGs have been met; however, an actual monitoring program would be developed during the remedial design phase of work. Purge water associated with groundwater monitoring activities will be drummed, sampled for waste characterization, and taken to an appropriate disposal facility. In addition, post-remedy vapor monitoring will be conducted, as appropriate, to evaluate vapor intrusion.

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to occur for 30 years.

6.3.2.1 Detailed Analysis of Groundwater Alternative GS2 – In Situ Chemical Oxidation, Enhanced Bioremediation, Institutional Controls, and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GS2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). Groundwater Alternative GS2 would achieve the identified project RAOs and would therefore be considered protective of human health. In situ treatment, including ISCO and enhanced bioremediation, would reduce chemical concentrations in groundwater, thereby addressing the previously identified risks to future commercial receptors associated with inhalation of vapors from chemicals in groundwater. Maximum residual cancer risk remaining at OU-2C after completion of this remedy would be at 3×10^{-6} and there would be no residual non-cancer hazards exceeding 1 remaining for future commercial receptors, as discussed in Appendix C.

As discussed above, Groundwater Alternative GS2 would be conservatively protective of shallow FWBZ groundwater within the western area of Exposure Unit 1, where chemical concentrations are currently at an acceptable level for future residential land use and have also been decreasing over time.

ICs would restrict future site use to commercial throughout OU-2C with the exception of western Exposure Unit 1, and would prohibit the use of groundwater. Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater and site use do not occur.

Compliance with ARARs

Potential ARARs identified for this alternative were summarized in Section 3.6 and are discussed in detail in Appendix D. ARARs for this alternative include the substantive provisions of potential RCRA ARARs to determine whether wastes generated during groundwater sampling should be classified and managed as hazardous waste. In addition, the substantive provisions of the Underground Injection Control Program are potential ARARs associated with the injection of chemicals into groundwater for ISCO and enhanced bioremediation. Groundwater Alternative GS2 would meet all identified chemical-specific, location-specific, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative would provide an effective long-term remedy for groundwater containing COCs at the site. Chemical concentrations in groundwater within the remedial footprints identified would be permanently reduced through in situ treatment methods including ISCO and enhanced bioremediation. ISCO treatments can be challenged by chemical rebound effects, but repeated treatments can address this issue.

Maximum residual cancer risk remaining after completion of this remedy would be at 3×10^{-6} and there would be no non-cancer hazards exceeding 1 remaining, as discussed in Appendix C. This represents the low end of the acceptable risk management range for future commercial site use. This alternative would also be protective of unrestricted land use within the western area of Exposure Unit 1 at OU-2C.

ICs would be required to prohibit the use of groundwater throughout OU-2C and restrict future site use to commercial throughout OU-2C with the exception of Exposure Unit 1. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative. Implementation of this alternative would result in addressing risk associated with commercial land use outside the western portion of Exposure Unit 1, and would also provide conservative protection of shallow FWBZ groundwater in the western area of Exposure Unit 1.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GS2 would address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative includes ISCO treatment in the highest concentration areas to reduce chemical concentrations to levels consistent with the preliminary RGs. It also includes implementation of enhanced bioremediation treatment of lower COC concentrations to permanently reduce the toxicity and volume of chemicals in the groundwater at OU-2C. Implementation of this alternative would result in reducing the toxicity and volume of chemicals in groundwater, resulting in final chemical concentrations consistent with the preliminary RGs identified for future commercial land use throughout the treatment areas.

Short-Term Effectiveness

Implementation of this alternative would not significantly increase traffic or cause other risks to the community as a result of the remedial action activity. This alternative would not result in any adverse groundwater impacts, as the treatment reagents are designed to react with the chemicals in groundwater, leaving behind non-toxic byproducts. Handling of injectable materials for ISCO treatment would present some health and safety concerns. However, these concerns would be addressed through implementing proper health and safety measures, including the use of appropriate personal protective equipment and system monitoring.

As described in Appendix E, Groundwater Alternative GS2 would be characterized by a relatively low level of environmental impact from a sustainability perspective. The greatest

environmental impacts would be associated with consumption of injectables and equipment use, and personnel transportation for collateral risk.

Implementability

Both soil and groundwater samples have been collected throughout the site, including within the footprint of Building 5, using various techniques.

In order to ensure adequate mixing and contact time with the ISCO reagents, treatment would likely be implemented using either a push-pull approach or recirculation system. This approach does add complexity to implementation of this alternative over traditional injection methods; however, recirculation for ISCO injection has been implemented elsewhere at Alameda Point for groundwater treatment.

Materials for implementation of ISCO and enhanced bioremediation would be readily available through various vendors, and the technologies have also been documented to successfully treat the COCs that are present at OU-2C. Based on this information, Groundwater Alternative GS2 is considered to be implementable.

Cost

The present-value cost for Groundwater Alternative GS2 is approximately $2,187,000 (see Table 6-2). Primary cost components for this alternative include treatment reagents, injection activities, and groundwater monitoring. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

6.3.3 Detailed Description of Groundwater Alternative GS3 – In Situ Chemical Reduction, Enhanced Bioremediation, Institutional Controls, and Monitoring

ISCR and Enhanced Bioremediation

Groundwater Alternative GS3 would include treatment of VOC-impacted groundwater footprint areas throughout OU-2C. ISCR would be implemented to treat higher concentration areas located east of Building 5, as well as in the middle of Building 5 in the areas located immediately north and east of what was historically identified as Plume 5-3 (see Figure 6-7). COCs requiring treatment in these areas include 1,1-DCA and vinyl chloride. For purposes of this FS, it is assumed that the ISCR technology best suited to treat these COCs is ZVI.

The total area identified for ISCR treatment would be approximately 35,800 sf, and the targeted treatment interval would be from 5 to 20 ft bgs. Treatment of this vertical interval would address the potentially unacceptable future occupational risk levels associated with inhalation of vapors from VOCs in groundwater. Based on vendor information, it is assumed that injection points would be installed with 15 ft spacing to ensure adequate distribution of the treatment media. This would result in a total of approximately 215 injection locations across the site. Based on the

Carbon tetrachloride has not been reported at concentrations above detection limits in groundwater samples collected since 1997 and is therefore not present or is not likely to be present at significant concentrations.

Ten of the 14 chlorinated VOCs were reported at concentrations above comparison criteria in groundwater samples collected in 2006 and 2007. These ten chlorinated VOCs consisted of three chlorinated solvents typically used in degreasing operations (1,2-DCA, 1,1,1-TCA, and TCE) and their biodegradation breakdown products (1,1-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride), and two chlorinated aromatic compounds (chlorobenzene and 1,4-DCB).

Chlorinated VOCs remaining in groundwater at concentrations greater than 10,000 µg/L are confined to locations near and within the historically defined DNAPL plume areas (see Section 2.4.1).

Fuel-related Volatile Organic Compounds in Groundwater

Benzene, methyl tertiary butyl ether (MTBE), and toluene were reported at concentrations above comparison criteria in the shallow FWBZ at IR Site 5. None of these VOCs were reported at concentrations above comparison criteria in the deep FWBZ or the SWBZ. Only two of these VOCs were reported at concentrations above comparison criteria in groundwater samples collected in 2006 and 2007. Toluene was only reported at concentrations above comparison criteria in samples collected in 1995 and 1997 and does not appear to be currently present at concentrations above comparison criteria in groundwater.

Benzene and MTBE are typically associated with gasoline. The highest concentrations and concentrations above comparison criteria for benzene were present almost exclusively in areas associated with Building 5. MTBE was reported at concentrations above comparison criteria only in samples from locations in the vicinity of the former fueling station at Building 282 and concentrations were above the California MCL but below ESLs.

2.4.3 Chemical Fate and Transport. Chemical fate is the tendency of a chemical to undergo transformation or degradation. Mobility is the tendency of a chemical to move along a pathway in response to a driving force. A chemical that is immobile and persistent in the environment tends to remain in place. The tendency toward immobility and persistence is a function of site-specific characteristics and of the physical and chemical properties of the chemical. These properties include solubility, volatility, tendency to transform, tendency of organic compounds to degrade (usually described as a half-life or an environmental half-life in a given medium), and affinity for solids or organic matter (usually described by a partition coefficient).

The chemicals responsible for potentially unacceptable risk in soil and groundwater at OU-2C are VOCs and metals in localized areas within IR Site 5. A summary of the possible fate and transport mechanisms considered applicable for these chemicals follows:

- Horizontal migration of chemicals in the FWBZ at OU-2C to off-site areas and Seaplane Lagoon due to groundwater flow is considered a potentially significant transport pathway. Based on total chlorinated VOC concentrations exceeding 10,000 µg/L, a chlorinated VOC DNAPL may exist beneath and near Building 5, and could provide a continuing source of dissolved VOC concentrations. Groundwater in the shallow FWBZ flows generally towards the shoreline and groundwater in the deep FWBZ flows generally westerly beneath OU-2C and then southwesterly toward Seaplane Lagoon (see Section 2.3.5.2 and Figures 2-14 and 2-15). Horizontal migration of chemicals in the SWBZ to surface water is considered a possible but not significant transport pathway, since groundwater flows inland (away from Seaplane Lagoon) where VOCs have been identified in SWBZ groundwater (see Section 2.3.5.2 and Figure 2-16).

- Vertical migration of chemicals in groundwater from the FWBZ to the SWBZ has occurred, but appears to have been limited. The presence of the BSU clay layer acts as a confining unit between the FWBZ and the SWBZ, and appears to be limiting further hydraulic communication between these two water-bearing zones (BEI, 2008).

- Migration of DNAPL is a possible pathway; however, removal actions and a treatability study to address concentrations above 10,000 µg/L in the shallow FWBZ have been completed (1999, 2004, and 2009) at Plumes 5-1 and 5-3, respectively (see Section 2.4.1.2). Concentrations of VOCs in the shallow FWBZ at Plume 5-1 have been reduced to levels below 10,000 µg/L. Results from the Plume 5-3 phased removal action indicate that concentrations of VOCs in that plume area have been significantly reduced. A final report documenting the Plume 5-3 removal action was completed in January 2010 (Shaw Environmental, Inc., 2010). Based on RI and basewide groundwater monitoring data, concentrations above 10,000 µg/L in the deep FWBZ and SWBZ are limited in extent and are adequately defined for purposes of this FS. Additional pre-design sampling will be completed to further verify plume areas prior to completion of the remedial design. The additional pre-design sampling is included as part of the groundwater remedial alternatives in this FS. Because primary sources of solvents have been removed from the site and any active releases have been stopped, DNAPL, if present, is not currently expected to be mobile under ambient conditions from the standpoint of non-aqueous phase migration.

- The transport of chemicals in groundwater along preferential pathways is considered a potentially significant pathway. Groundwater in the shallow FWBZ flows toward a groundwater low located west of Building 5 and near monitoring well M05-06 (see Section 2.3.5.2 and Figure 2-14). This groundwater flow may be affected locally by a preferential flow pathway in the vicinity of the well; storm drain lines near this well discharge to Seaplane Lagoon (see Figure 2-17). However, groundwater sampling results from the RI indicate that VOCs (which were infrequently detected) were below relevant comparison criteria at this monitoring well.

- Volatilization of VOCs to outdoor air is possible, but is not considered a significant transport pathway (because of mixing and dilution that occurs in the atmosphere) when compared to volatilization to indoor air.

- Volatilization of VOCs to indoor air is considered a potentially significant transport pathway at OU-2C. Soil and groundwater impacted with VOCs are encountered at shallow depths at IR Site 5. Potential chlorinated VOC DNAPL plume areas also exist in the FWBZ beneath and near Building 5. VOCs could potentially migrate through the vadose zone soil and building floors to impact indoor air.

- The transport of chemicals in soil to groundwater by infiltration of precipitation is possible but not considered a significant transport pathway. Net infiltration from precipitation is minimal because more than 90 percent of the ground surface at OU-2C is covered with buildings, concrete, or asphalt.

- The transport of chemicals in soil to groundwater by fluctuating groundwater levels due to tidal influences and seasonal variations is possible but not considered a significant transport pathway. Based on tidal studies performed at and in the vicinity of OU-2C, tidal influence is generally greatest for groundwater in the FWBZ and SWBZ closer to the shoreline and significantly decreases inland (see Section 2.3.6). Seasonal fluctuations of groundwater elevations have also been observed to be minimal.

- Dispersion of particulates from unpaved surfaces is possible but not considered a significant transport pathway. At OU-2C, more than 90 percent of the ground surface is covered with buildings, concrete, or asphalt. Only small isolated areas are unpaved and these areas are mostly landscaped and covered with grass. The presence of buildings, pavement, and landscaped areas reduces the potential for the release of chemicals as particulates.

2.5 SUMMARY OF HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

2.5.1 Human Health Risk Assessment. Data considered usable from previous investigations and the RI were included in the OU-2C HHRA as follows (note that data from samples collected prior to removal actions at locations that have been the subject of a removal action were not included in the HHRA; see Section 2.4.1):

- The identification of COPCs in soil was based on the results from analyses of samples collected from 0 to 8 feet bgs because, on average, the groundwater table is located at approximately 8 feet bgs. All chemicals reported in at least one soil sample collected from the upper 8 feet of OU-2C were included as HHRA COPCs, except calcium, magnesium, potassium, and sodium, which are known to be required human nutrients. All metals were included in the list of COPCs regardless of whether the concentrations were above or below Alameda Point background levels.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
14	Alternative GD2	Section 2.8.15	Final Feasibility Study Report for Operable Unit 2C, IR Sites 5 and 10, Alameda Point. Section 6.4.2, Pages 6-60 and 6-61. Battelle 2011.

Compliance with ARARs

There is no need to identify ARARs for the No Action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Sec. 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the No Action alternative (U.S. EPA, 1991b). Therefore, a discussion of compliance with ARARs is not appropriate for Groundwater Alternative GD1.

6.4.2 Detailed Description of Groundwater Alternative GD2 – Institutional Controls and Monitoring

Institutional Controls

As discussed in Section 2.3.7, FWBZ groundwater at OU-2C is unlikely to be used as a potential drinking water source, and does not need to be considered as such for purposes of CERCLA cleanup decisions. SWBZ groundwater is characteristically unsuitable for drinking water. The risk assessment presented in the RI (BEI, 2008) concluded that there is no current human health or ecological risk associated with chemical is the deep FWBZ and SWBZ groundwater. Therefore no active remediation is included in Groundwater Alternative GD2.

However, ICs would be required under Groundwater Alternative GD2 to accomplish the following:

- Restrict groundwater use in the deep FWBZ and SWBZ at OU-2C.

ICs would be required until such time that groundwater concentrations reach a level acceptable for unrestricted groundwater use.

Monitoring

Five-year reviews would be conducted to evaluate the continued protectiveness of the ICs. For purposes of cost-estimating, monitoring of ICs would be assumed to be in place for 30 years.

6.4.2.1 Detailed Analysis of Groundwater Alternati ve GD2 – Institutional Controls and Monitoring. This subsection provides a discussion of the detailed analysis for Groundwater Alternative GD2 with respect to the NCP evaluation criteria.

Overall Protection of Human Health and the Environment

The RI concluded that there are no unacceptable ecological risks associated with OU-2C (BEI, 2008). As discussed in Section 2.3.7, groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, and deep FWBZ and SWBZ groundwater does not present a risk based on vapor inhalation. Therefore, no complete exposure pathway was identified for the deep FWBZ and SWBZ. Because no current human health or ecological risks are present, implementation of ICs to restrict use of groundwater from the deep FWBZ and SWBZ would be protective of human health and the environment.

Monitoring of the ICs would ensure that unacceptable risks due to restricted groundwater use would not occur. Implementation and monitoring of ICs would not actively protect against the potential for downgradient groundwater impacts from chemical migration.

Compliance with ARARs

Potential ARARs identified for this alternative are summarized in Section 3.6 and discussed in detail in Appendix D. Portions of the California Civil Code, California Health and Safety Code, and CCR are considered potential state ARARs for the transfer or property, and these are therefore potential state ARARs for ICs. Groundwater alternative GD2 would meet all identified chemical-specific, location-specific, and action-specific ARARs

Long-Term Effectiveness and Permanence

ICs would be required to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C. Monitoring and maintaining these ICs would ensure the long-term effectiveness of this alternative at OU-2C. However, implementation and monitoring of ICs would not be effective in preventing the potential for downgradient impacts to groundwater from chemical migration.

Reduction of Toxicity, Mobility, or Volume through Treatment

Groundwater Alternative GD2 would not address the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This alternative would include only ICs to restrict the use of groundwater within the deep FWBZ and SWBZ at OU-2C.

Short-Term Effectiveness

No active remediation is included in Groundwater Alternative GD2, therefore no short-term risks or environmental impacts would be result from implementation of this alternative. Groundwater Alternative GD2 is not evaluated in the GSR evaluation.

Implementability

Since no active remediation would occur under Groundwater Alternative GD2, the technical implementability of this alternative would be high. In addition, since deep FWBZ and SWBZ groundwater at OU-2C is not considered a likely future drinking water source or is characteristically unsuitable for drinking water, respectively, the administrative implementability associated with ICs for this alternative would also be high.

Cost

The present-value cost for Groundwater Alternative GD2 is approximately $511,000 (see Table 6-3). Primary cost components for this alternative include the implementation and monitoring of ICs. For cost-estimating purposes, it is assumed that the duration of IC monitoring would be 30 years. A detailed cost estimate for this alternative is provided in Appendix F.

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
15	Administrative Record	Section 2.9.1	Alameda Point NAS Draft Administrative Record File Index. Pages 1-148.

ALAMEDA POINT

DRAFT ENVIRONMENTAL RESTORATION RECORD PUBLIC / IR INDEX - UPDATE (SORTED BY RECORD DATE/RECORD NUMBER)

ADMINISTRATIVE RECORD INDEX FOR SITES 5, 10, 12 AND OU 2C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000198 REPORT 176	04-01-1983	ECOLOGY AND ENVIRONMENT, INC.	INITIAL ASSESSMENT STUDY (SEE RECORD # 191 - ALAMEDA POINT TRANSMITTAL LETTER)	YES	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 00017

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000274 REPORT 123	**12-01-1988**	CANONIE ENVIRONMENTAL SERVICES CORP.	FINAL HEALTH AND SAFETY PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME II OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

ALAMEDA POINT

DRAFT ENVIRONMENTAL RESTORATION RECORD PUBLIC / IR INDEX - UPDATE (SORTED BY RECORD DATE/RECORD NUMBER)

ADMINISTRATIVE RECORD INDEX FOR SITES 5, 10, 12 AND OU 2C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00013
					SITE 00014
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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000275 REPORT 34	**12-01-1988**	CANONIE ENVIRONMENTAL SERVICES CORP.	FINAL AIR SAMPLING PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME IB OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

ALAMEDA POINT

DRAFT ENVIRONMENTAL RESTORATION RECORD PUBLIC / IR INDEX - UPDATE (SORTED BY RECORD DATE/RECORD NUMBER)

ADMINISTRATIVE RECORD INDEX FOR SITES 5, 10, 12 AND OU 2C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00013
					SITE 00014
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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000291 REPORT 212	**01-01-1989**	CANONIE ENVIRONMENTAL SERVICES CORP.	SAMPLING PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY,[VOLUME I OF VIII (REVISED VERSION)	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000322 REPORT 45	**02-01-1989**	CANONIE ENVIRONMENTAL SERVICES CORP.	FINAL PROJECT MANAGEMENT PLAN/SCHEDULE, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME V OF VIII {***SEE COMMENTS}	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000351 REPORT 154	**05-01-1989**	CANONIE ENVIRONMENTAL SERVICES CORP.	REVISED FINAL HEALTH AND SAFETY PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME II OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000361 REPORT 86	**05-01-1989**	CANONIE ENVIRONMENTAL SERVICES CORP.	DATA MANAGEMENT PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME VI OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000371 REPORT 364	**06-01-1989**	CLEMENT ASSOCIATES, INC.	FINAL PRELIMINARY PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION PLAN, REMEDIAL INVESTIGATION FEASIBILITY STUDY, VOLUME VII OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000780 REPORT 178	**11-01-1989**	CANONIE ENVIRONMENTAL SERVICES CORP.	REVISED FINAL HEALTH AND SAFETY PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME II OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000783 REPORT 93	**01-01-1990**	CANONIE ENVIRONMENTAL SERVICES CORP.	FINAL FEASIBILITY STUDY PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME VIII OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000785 REPORT 283	**02-01-1990**	CANONIE ENVIRONMENTAL SERVICES CORP.	FINAL SAMPLING PLAN, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, VOLUME I OF VIII	YES	AREA 00097 AREA C-2 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020
AR_N00236_000535 CORRESPONDENCE 2	**11-01-1990**	CALIFORNIA DEPARTMENT OF HEALTH SERVICES - BERKELEY, CA	REQUEST FOR SOIL SAMPLING OUTSIDE BUILDING 5	YES	SITE 00005
AR_N00236_000797 REPORT 24	**12-01-1990**	CANONIE ENVIRONMENTAL SERVICES CORP.	PHASE 2A ANALYTICAL RESULTS FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (ENCLOSURE 7)	YES	BLDG 0000530 SITE 00010
AR_N00236_000603 CORRESPONDENCE 9	**03-13-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE PROPOSED ADDITIONAL FIELD WORK FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (W/ ENCLOSURE)	YES	BLDG 0000005 BLDG 0000360 SITE 00004 SITE 00005
AR_N00236_001095 CORRESPONDENCE 2	**04-14-1992**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE PROPOSED ADDITIONAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY FIELD WORK	YES	SITE 00004 SITE 00005
AR_N00236_000615 CORRESPONDENCE 3	**05-05-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE RESPONSE TO DTSC COMMENTS ON PROPOSED ADDITIONAL FIELD WORK FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001098 CORRESPONDENCE 1	**05-07-1992**	DTSC - BERKELEY, CA	APPROVAL OF REQUESTED CHANGES FOR ADDITIONAL FIELD WORK FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY	YES	SITE 00004 SITE 00005
AR_N00236_000710 CORRESPONDENCE 3	**08-06-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE DRAFT FINAL DATA SUMMARY REPORT FOR BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK (ENCLOSURE IS RECORDS # 720 AND # 721)	YES	SITE 00004 SITE 00005
AR_N00236_000907 CORRESPONDENCE 3	**08-27-1992**	RESTORATION ADVISORY BOARD MEMBER	REVIEW AND COMMENTS ON THE DRAFT FINAL DATA SUMMARY REPORT FOR BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK	YES	SITE 00004 SITE 00005
AR_N00236_000749 CORRESPONDENCE 3	**09-16-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE CLARIFICATION ON ADDITIONAL SAMPLING FOR THE REMEDIAL INVESTIGATION/INVESTIGATION/FEASIBILITY STUDY [W/ ENCLOSURE]	YES	BLDG 0000005 SITE 00005
AR_N00236_000909 CORRESPONDENCE 5	**09-16-1992**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT FINAL DATA SUMMARY REPORT FOR BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000843 REPORT 422	**10-27-1992**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL DATA SUMMARY REPORT REMEDIAL INVESTIGATION/FEASIBILITY STUDY PHASES 2B AND 3, VOLUME I OF II [SEE RECORD # 844 - VOLUME II OF II]	YES	BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000459 SITE 00004 SITE 00005 SITE 00006 SITE 00007A SITE 00007B SITE 00008 SITE 00010A SITE 00011 SITE 00012 SITE 00014 SITE 00015

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000844 REPORT 364	**10-27-1992**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL DATA SUMMARY REPORT REMEDIAL INVESTIGATION/FEASIBILITY STUDY PHASES 2B AND 3, VOLUME II OF II [SEE RECORD # 843 - VOLUME I OF II]	YES	BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000459 SITE 00004 SITE 00005 SITE 00006 SITE 00007A SITE 00007B SITE 00008 SITE 00010A SITE 00011 SITE 00012 SITE 00014 SITE 00015
AR_N00236_000917 CORRESPONDENCE 3	**11-05-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF DRAFT FINAL ADDENDUM SECOND ROUND BACKGROUND GROUNDWATER SAMPLE RESULTS AND RESAMPLE RESULTS	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000918 MINUTES 5	**11-16-1992**	NAS ALAMEDA - ALAMEDA, CA	INVITATION FOR TECHNICAL REVIEW COMMITTEE (TRC) MEETING FOR 2 DECEMBER 1992 (INCLUDES AGENDA AND 27 AUGUST 1992 MEETING MINUTES)	YES	SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00010 SITE 00011 SITE 00012 SITE 00014 SITE 00015
AR_N00236_000919 CORRESPONDENCE 7	**11-18-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE RESPONSE TO COMMENTS ON THE DRAFT FINAL DATA SUMMARY REPORT BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005
AR_N00236_000921 CORRESPONDENCE 6	**11-20-1992**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE RESPONSE TO COMMENTS ON THE DRAFT FINAL DATA SUMMARY REPORT: BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005
AR_N00236_000932 CORRESPONDENCE 1	**01-22-1993**	DTSC - BERKELEY, CA	REVIEW AND APPROVAL OF THE DRAFT FINAL DATA SUMMARY REPORT: BACKGROUND AND TIDAL INFLUENCE STUDIES GROUNDWATER SAMPLE RESULTS AND RESAMPLE RESULTS	YES	SITE 00004 SITE 00005
AR_N00236_000939 CORRESPONDENCE 1	**02-16-1993**	DTSC - BERKELEY, CA	REVIEW AND APPROVAL OF ADDENDUM, SECOND ROUND BACKGROUND GROUNDWATER SAMPLE RESULTS AND RESAMPLE RESULTS	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001005 CORRESPONDENCE 3	**03-02-1993**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF RESPONSES TO NAVY COMMENTS ON SAMPLING RESULTS [ENCLOSURE 2) IS RECORD # 721]	YES	SITE 00004 SITE 00005
AR_N00236_000976 MINUTES 7	**09-02-1993**	NAS ALAMEDA - ALAMEDA, CA	TRANSMITTAL OF ANNOUNCEMENT OF TECHNICAL REVIEW COMMITTEE (TRC) MEETING FOR 6 OCTOBER 1993 (INCLUDES 2 JUNE 1993 MEETING MINUTES AND AGENDA)	YES	BLDG 0000005 BLDG 0000397 SITE 00005 SITE 00007A SITE 00015 WELL MW-IMF-01
AR_N00236_001088 CORRESPONDENCE 34	**09-08-1994**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE DRAFT FINAL LETTER REPORT FOR THE ADDITIONAL SITE INVESTIGATION, PLATING SHOP (W/ ENCLOSURE)	YES	SITE 00005
AR_N00236_001106 CORRESPONDENCE 3	**10-07-1994**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT FINAL LETTER REPORT FOR THE ADDITIONAL SITE INVESTIGATION, PLATING SHOP	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001129 CORRESPONDENCE 3	**10-24-1994**	NAVFAC - EFA WEST	IDENTIFICATION OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	YES	OU 0000001 OU 0000002 OU 0000003 OU 0000004 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007A SITE 00007B SITE 00007C SITE 00008 SITE 00009 SITE 00010A SITE 00010B SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000663 MINUTES 5	**01-18-1995**	TETRA TECH EM, INC.	18 JANUARY 1995 PROGRESS REVIEW MEETING MINUTES	YES	SITE 00005 SITE 00007A SITE 00007C SITE 00013 SITE 00015 SITE 00016
AR_N00236_003430 FACT SHEET 6	**03-01-1995**	NAVFAC - EFA WEST	ENVIRONMENTAL FACT SHEET (DOCUMENT PERTAINS TO MULTIPLE BASES) [CD COPY ENCLOSED]	NO	AOC 000001 AOC 000002 AOC 000003 AOC 000008 BLDG 0000003 BLDG 0000025 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SWMU 00001 SWMU 00003 SWMU 00004

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000666 MINUTES 6	**03-14-1995**	TETRA TECH EM, INC.	14 MARCH 1995 PROGRESS REVIEW MEETING MINUTES	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00007A SITE 00007C SITE 00010A SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00018
AR_N00236_001182 CORRESPONDENCE 5	**05-01-1995**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DOCUMENT SUMMARY FOR DRAFT DATA TRANSMITTAL MEMORANDUM (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00010A SITE 00012 SITE 00014
AR_N00236_001188 CORRESPONDENCE 3	**05-18-1995**	NAVFAC - WESTERN DIVISION	TRANSMITTAL OF THE FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY DRAFT DATA TRANSMITTAL MEMORANDUM, VOLUMES I AND II OF II [ENCLOSURE IS RECORDS # 1189 AND # 1190]	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00010A SITE 00012 SITE 00014

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001213 CORRESPONDENCE 5	**07-11-1995**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DOCUMENT SUMMARY FOR DRAFT DATA TRANSMITTAL MEMORANDUM FOR INSTALLATION RESTORATION SITES (W/ ENCLOSURE)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00006 SITE 00007 SITE 00010 SITE 00011 SITE 00013 SITE 00015 SITE 00016 SITE 00019
AR_N00236_001218 CORRESPONDENCE 7	**07-26-1995**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY DATA TRANSMITTAL MEMORANDUM (INCLUDES CRWQCB COMMENTS DATED 05 JULY 1995 ON THE DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY DATA TRANSMITTAL MEMORANDUM)	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00009 SITE 00010 SITE 00012 SITE 00014
AR_N00236_001296 REPORT 119	**10-16-1995**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL DATA SUMMARY REPORT BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK, VOLUME I OF II (SEE RECORD # 1297 - VOLUME II OF II)	YES	SITE 00004 SITE 00005
AR_N00236_001297 REPORT 506	**10-16-1995**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL DATA SUMMARY REPORT BACKGROUND AND TIDAL INFLUENCE STUDIES AND ADDITIONAL WORK, VOLUME II OF II (SEE RECORD # 1296 - VOLUME I OF II)	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000670 MINUTES 8	**02-20-1996**	TETRA TECH EM, INC.	20 FEBRUARY 1996 MONTHLY TRACKING MEETING AGENDA FOR ENVIRONMENTAL ACTIONS (INCLUDES ATTENDANCE LIST AND NOTES)	YES	OU 0000004 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00007A SITE 00007C SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00018
AR_N00236_001189 REPORT 176	**04-01-1996**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY DATA TRANSMITTAL MEMORANDUM, VOLUME I OF II (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT DATED 18 MAY 1995 TO FINAL)	YES	SITE 00004 SITE 00008 SITE 00010A SITE 00012 SITE 00014
AR_N00236_001190 REPORT 306	**04-01-1996**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DATA TRANSMITTAL MEMORANDUM, VOLUME II OF II (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT DATED 18 MAY 1995 TO FINAL)	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00010A SITE 00012 SITE 00014

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001279 CORRESPONDENCE 9	**04-01-1996**	NAVFAC - EFA WEST	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY DATA TRANSMITTAL MEMORANDUM (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00010A SITE 00012 SITE 00014
AR_N00236_001280 CORRESPONDENCE 3	**04-01-1996**	NAVFAC - EFA WEST	TRANSMITTAL OF THE REPLACEMENT PAGES CONVERTING THE DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DATA TRANSMITTAL MEMORANDUM DATED 18 MAY 1995 TO FINAL(ENCLOSURE IS RECORDS # 1189 AND # 1190)	YES	SITE 00004 SITE 00005 SITE 00008 SITE 00010 SITE 00012 SITE 00014
AR_N00236_001214 REPORT 398	**05-01-1996**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DATA TRANSMITTAL MEMORANDUM, VOLUME I OF II (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT DATED 11 JULY 1995 TO FINAL)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00006 SITE 00007 SITE 00010 SITE 00011 SITE 00013 SITE 00015 SITE 00016 SITE 00019

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001215 REPORT 849	**05-01-1996**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DATA TRANSMITTAL MEMORANDUM, VOLUME II OF II (INCLUDES REPLACEMENT PAGES CONVERTING DRAFT DATED 11 JULY 1995 TO FINAL)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00006 SITE 00007 SITE 00010 SITE 00011 SITE 00013 SITE 00015 SITE 00016 SITE 00019
AR_N00236_001313 CORRESPONDENCE 29	**08-12-1996**	NAVFAC - EFA WEST	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON THE DRAFT COMMUNITY RELATIONS PLAN (W/ ENCLOSURE)	YES	BLDG 0000001 BLDG 0000005 BLDG 0000041 SITE 00002 SITE 00005 SITE 00006

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000674 MINUTES 11	**08-20-1996**	TETRA TECH EM, INC.	20 AUGUST 1996 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (AGENDA AND ATTENDANCE LIST)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00007 SITE 00007A SITE 00007C SITE 00010 SITE 00010A SITE 00014 SITE 00015 SITE 00016 SITE 00018 SITE 00022

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001357 CORRESPONDENCE 2	**09-12-1996**	NAVFAC - EFA WEST	REQUEST FOR IDENTIFICATION OF STATE "APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS" FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR OPERABLE UNITS	YES	OU 0000001 OU 0000002 OU 0000003 OU 0000004 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007B SITE 00007C SITE 00008 SITE 00009 SITE 00010A SITE 00010B SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000679 MINUTES 10	**09-17-1996**	TETRA TECH EM, INC.	17 SEPTEMBER 1996 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA AND ATTENDANCE LIST)	YES	SITE 00002 SITE 00003 SITE 00005 SITE 00007 SITE 00010 SITE 00013 SITE 00014 SITE 00016 SITE 00017 SITE 00018 SITE 00022
AR_N00236_000680 MINUTES 7	**10-15-1996**	TETRA TECH EM, INC.	15 OCTOBER 1996 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA AND ATTENDANCE LIST)	YES	SITE 00001 SITE 00002 SITE 00005
AR_N00236_001359 REPORT 52	**10-16-1996**	NAVFAC - EFA WEST	TRANSMITTAL OF THE PETROLEUM SITES HUMAN HEALTH RISK-BASED SCREENING EVALUATIONS (W/ ENCLOSURE)	YES	SITE 00003 SITE 00007A SITE 00007C SITE 00012 SITE 00014 SITE 00016

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001344 REPORT 181	**12-01-1996**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL COMMUNITY RELATIONS PLAN (CRP) [SEE RECORD #1378 - REPLACEMENT PAGES AND RECORD # 1343 - NAVFAC EFAW TRANSMITTAL LETTER]	YES	AREA 00097 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000365 BLDG 0000400 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007A SITE 00007B SITE 00007C SITE 00008 SITE 00009 SITE 00010A SITE 00011 SITE 00012 SITE 00013

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020 SITE 00023
AR_N00236_000681 MINUTES 16	**12-17-1996**	TETRA TECH EM, INC.	17 DECEMBER 1996 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA, ATTENDANCE LIST, AND PROJECT STATUS AND UPDATE SHEETS)	YES	OU 0000004 SITE 00001 SITE 00003 SITE 00005 SITE 00007 SITE 00012 SITE 00014 SITE 00016 SITE 00022
AR_N00236_000682 MINUTES 11	**02-18-1997**	TETRA TECH EM, INC.	18 FEBRUARY 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA AND ATTENDANCE LIST)	YES	SITE 00002 SITE 00003 SITE 00005 SITE 00007 SITE 00014 SITE 00017 SITE 00022

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000683 MINUTES 7	**02-26-1997**	TETRA TECH EM, INC.	26 FEBRUARY 1997 BACKGROUND ASSESSMENT MEETING MINUTES	YES	OU 0000001 OU 0000002 OU 0000003 SITE 00003 SITE 00004 SITE 00005 SITE 00007 SITE 00011 SITE 00012 SITE 00018 SITE 00022
AR_N00236_000684 MINUTES 21	**03-25-1997**	TETRA TECH EM, INC.	25 MARCH 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA, ATTENDANCE LIST, AND PROJECT STATUS SHEETS)	YES	SITE 00004 SITE 00005
AR_N00236_001396 CORRESPONDENCE 2	**04-01-1997**	NAVFAC - EFA WEST	REVIEW AND COMMENTS ON THE PROPOSED UNDERGROUND STORAGE TANK REMOVAL	YES	SITE 00005
AR_N00236_001397 CORRESPONDENCE 3	**04-03-1997**	PRC ENVIRONMENTAL MANAGEMENT, INC.	REVISED SCHEDULE FOR PROPOSED REMOVAL OF ONE 10,000 GALLON CAPACITY UNDERGROUND SOLVENT STORAGE TANK	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001378 CORRESPONDENCE 17	**04-07-1997**	NAVFAC - EFA WEST	TRANSMITTAL OF THE REPLACEMENT PAGES FOR THE FINAL COMMUNITY RELATIONS PLAN (W/ ENCLOSURES) [SEE RECORD # 1344 - FINAL COMMUNITY RELATIONS PLAN]	YES	AREA 00097 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000301 BLDG 0000365 BLDG 0000400 BLDG 0000459 BLDG 0000530 BLDG 0000547 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007A SITE 00007B SITE 00007C SITE 00008 SITE 00009 SITE 00010A SITE 00011 SITE 00012 SITE 00013

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020 SITE 00023
AR_N00236_000685 MINUTES 12	**04-29-1997**	TETRA TECH EM, INC.	29 APRIL 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES ATTENDANCE LIST) {SEE RECORD # 684 - ATTACHMENT D - 25 MARCH 1997 MONTHLY TRACKING MEETING MINUTES}	YES	OU 0000001 SITE 00003 SITE 00004 SITE 00005 SITE 00007 SITE 00010 SITE 00012 SITE 00022
AR_N00236_001383 REPORT 22	**05-27-1997**	PRC ENVIRONMENTAL MANAGEMENT, INC.	FINAL UNDERGROUND STORAGE TANK REMOVAL WORK PLAN	YES	BLDG 0000005 SITE 00005
AR_N00236_001382 CORRESPONDENCE 2	**05-28-1997**	NAVFAC - EFA WEST	TRANSMITTAL OF THE FINAL UNDERGROUND STORAGE TANK REMOVAL WORK PLAN (ENCLOSURE IS RECORD # 1383)	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000686 MINUTES 11	**06-23-1997**	TETRA TECH EM, INC.	23 JUNE 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA AND ATTENDANCE LIST)	YES	SITE 00003 SITE 00004 SITE 00005 SITE 00007 SITE 00011 SITE 00012 SITE 00022
AR_N00236_001428 CORRESPONDENCE 1	**06-24-1997**	NAVFAC - EFA WEST	REQUEST TO 1) EXTEND THE REVIEW OF DRAFT RISK BASED CORRECTIVE ACTION REPORT, AND 2) RE-SCHEDULE THE PROJECT TRACKING MEETING TO 26 AUGUST 1997	YES	SITE 00003 SITE 00007 SITE 00011 SITE 00012 SITE 00022
AR_N00236_000687 MINUTES 10	**07-29-1997**	TETRA TECH EM, INC.	29 JULY 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA)	YES	OU 0000002 OU 0000003 SITE 00001 SITE 00002 SITE 00004 SITE 00005 SITE 00014 SITE 00015 SITE 00016 SITE 00024
AR_N00236_001431 REPORT 360	**08-07-1997**	NAVY PUBLIC WORKS CENTER - SAN DIEGO, CA	FINAL SUMMARY REPORT, PRELIMINARY SITE CHARACTERIZATION USING THE SITE CHARACTERIZATION AND ANALYSIS PENETROMETER SYSTEM FUEL FARM AND MISCELLANEOUS FUEL PIPELINE SITES (INCLUDES PWC TRANSMITTAL LETTER)	YES	SITE 00003 SITE 00005 SITE 00013 SITE 00021

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000689 MINUTES 13	**09-16-1997**	TETRA TECH EM, INC.	16 SEPTEMBER 1997 MONTHLY TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA)	YES	OU 0000002 SITE 00001 SITE 00003 SITE 00004 SITE 00005 SITE 00007 SITE 00011 SITE 00012 SITE 00014 SITE 00015 SITE 00022
AR_N00236_001437 CORRESPONDENCE 3	**09-24-1997**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DRAFT SITE 5 UNDERGROUND STORAGE TANK REMOVAL CLOSURE REPORT (ENCLOSURE IS RECORD # 1438)	YES	SITE 00005
AR_N00236_001458 CORRESPONDENCE 5	**10-02-1997**	NAVFAC - EFA WEST	REQUEST FOR IDENTIFICATION OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR REMOVAL ACTIONS	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000690 MINUTES 12	**10-28-1997**	TETRA TECH EM, INC.	28 OCTOBER 1997 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA AND ATTENDANCE LIST)	YES	OU 0000001 SITE 00003 SITE 00004 SITE 00005 SITE 00007 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00022
AR_N00236_001452 CORRESPONDENCE 3	**11-05-1997**	NAVFAC - EFA WEST	TRANSMITTAL OF 1) RADIOLOGICAL REMOVAL ACTION, DRAFT TECHNICAL WORK DOCUMENT/PRELIMINARY DRAFT REMOVAL ACTION PLAN AND 2) RADIOLOGICAL REMOVAL ACTION, DRAFT REMOVAL SITE EVALUATION (ENCLOSURE 1 IS RECORD #1453 AND 2) IS RECORD # 1531)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_000691 MINUTES 13	**12-09-1997**	TETRA TECH EM, INC.	09 DECEMBER 1997 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA)	YES	SITE 00001 SITE 00002 SITE 00004 SITE 00005 SITE 00010 SITE 00014
AR_N00236_001489 REPORT 137	**12-12-1997**	TETRA TECH EM, INC.	FINAL FIELD SAMPLING PLAN, CHLORINATED SOLVENT PLUME DEFINITION AND SUMP INVESTIGATION	YES	SITE 00004 SITE 00005 SITE 00014

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001476 CORRESPONDENCE 5	**01-13-1998**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE WORK PLAN FOR LANDFILL 1 AND 2 RADIOLOGICAL SURVEYS, SAMPLING AND REMEDIATION; AND WORK PLAN FOR BUILDING 5 AND 400 CONTAMINATED DRAIN PIPING REMOVAL	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001477 CORRESPONDENCE 14	**01-15-1998**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE RADIOLOGICAL REMOVAL ACTION, DRAFT TECHNICAL WORK DOCUMENT/PRELIMINARY DRAFT REMOVAL ACTION PLAN (INCLUDES APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR REMEDIATION OF RADIUM-226 CONTAMINATION)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_000693 MINUTES 11	**01-20-1998**	TETRA TECH EM, INC.	20 JANUARY 1998 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS	YES	SITE 00001 SITE 00002 SITE 00004 SITE 00005 SITE 00010 SITE 00014
AR_N00236_001478 CORRESPONDENCE 9	**01-30-1998**	DTSC - BERKELEY, CA	CORRECTIONS TO THE APPLICABLE OR RELEVANT AND APPROPRIATE FOR REMEDIATION OF RADIUM - 226 CONTAMINATION	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001483 REPORT 40	**02-01-1998**	TETRA TECH, INC.	FINAL TREATABILITY STUDY PROPOSAL	NO	SITE 00004 SITE 00005 SITE 00013
AR_N00236_001479 CORRESPONDENCE 2	**02-13-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DRAFT WORK PLAN, TREATABILITY STUDY FOR NATURAL ATTENUATION OF CHLORINATED ALIPHATIC HYDROCARBONS	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000694 MINUTES 12	**02-17-1998**	TETRA TECH EM, INC.	17 FEBRUARY 1998 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS	YES	OU 0000001 OU 0000002 SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001482 CORRESPONDENCE 2	**03-02-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE FINAL TREATABILITY STUDY PROPOSAL	YES	SITE 00004 SITE 00005 SITE 00013
AR_N00236_000695 MINUTES 12	**03-17-1998**	TETRA TECH EM, INC.	17 MARCH 1998 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS	YES	PARCEL 0182 SITE 00004 SITE 00005 SITE 00014
AR_N00236_001495 CORRESPONDENCE 4	**03-25-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE 1) RADIOLOGICAL REMOVAL ACTION DRAFT IMPLEMENTATION WORK PLAN, TECHNICAL SPECIFICATIONS AND 2) RADIOLOGICAL REMOVAL ACTION DRAFT IMPLEMENTATION WORK PLAN, DRAWINGS (ENCLOSURE 1) IS RECORD # 1496 AND 2) IS RECORD # 1497)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001498 CORRESPONDENCE 7	**03-31-1998**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON VARIOUS DOCUMENTS FOR INSTALLATION RESTORATION SITES (INCLUDES TABLE OF DOCUMENTS REVIEWED BY AGENCIES)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001500 CORRESPONDENCE 7	**04-07-1998**	NAVFAC - EFA WEST	RESPONSES TO COMMENTS ON THE WORK PLAN RADIOLOGICAL SURVEYS, SAMPLING AND REMEDIATION; AND WORK PLAN FOR CONTAMINATED DRAIN PIPING REMOVAL	YES	BLDG 0000005 BLDG 0000400 SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001499 CORRESPONDENCE 3	**04-08-1998**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE RADIOLOGICAL REMOVAL ACTION FOR INSTALLATION RESTORATION SITES, TECHNICAL WORK DOCUMENT/DRAFT REMEDIAL ACTION PLAN	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001501 CORRESPONDENCE 3	**04-22-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF 1) DRAFT FINAL WORK PLAN FOR LANDFILLS 1 AND 2 RADIOLOGICAL SURVEYS AND ANOMALY REMOVAL AND 2) DRAFT FINAL WORK PLAN FOR CONTAMINATED DRAIN/PIPING/WALL/FLOOR REMOVAL (ENCLOSURE 1) IS RECORD # 1503 AND 2) IS RECORD # 1537)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001531 REPORT 8	**05-01-1998**	TETRA TECH EM, INC.	FINAL REMOVAL SITE EVALUATION FOR REMOVAL ACTION [SEE RECORD # 1452 - EFA WEST TRANSMITTAL LETTER]	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001510 CORRESPONDENCE 2	**05-12-1998**	DTSC - BERKELEY, CA	REQUIREMENTS FOR DISCHARGE OF GROUNDWATER TO SAN FRANCISCO BAY	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001511 CORRESPONDENCE 4	**05-15-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE 1) DRAFT SITE WORK PLAN, 2) DRAFT SITE QUALITY ASSURANCE PLAN, AND 3) DRAFT SITE HEALTH AND SAFETY PLAN FOR THE STORM WATER DRAIN EXCAVATION, CLEANING, REMOVAL AND REPLACEMENT	YES	SITE 00005 SITE 00010
AR_N00236_001525 CORRESPONDENCE 5	**05-15-1998**	NAVFAC - EFA WEST	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR DISCHARGE OF GROUNDWATER INTO SAN FRANCISCO BAY FOR REMOVAL ACTIONS	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_000697 MINUTES 10	**05-19-1998**	TETRA TECH EM, INC.	19 MAY 1998 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS	YES	SITE 00004 SITE 00005
AR_N00236_001537 REPORT 98	**06-03-1998**	SSPORTS ENVIRONMENTAL DETACHMENT - VALLEJO, CA	FINAL WORK PLAN FOR RADIOACTIVELY CONTAMINATED DRAIN PIPING/WALL/FLOOR REMOVAL, REVISION 2 [SEE RECORD # 1536 - EFA WEST TRANSMITTAL LETTER]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_001529 CORRESPONDENCE 10	**06-22-1998**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE RADIOLOGICAL REMOVAL ACTION SITE QUALITY ASSURANCE PLAN, SITE WORK PLAN, AND SITE HEALTH AND SAFETY PLAN (INCLUDES COMMENTS BY HERD DATED 06/17/98)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001534 REPORT 66	**06-26-1998**	TETRA TECH EM, INC.	DATA TRANSMITTAL MEMORANDUM FOR CHLORINATED SOLVENT PLUME DEFINITION AND SUMP INVESTIGATION (SEE RECORD # 1535 - DATA TRANSMITTAL MEMORANDUM, APPENDICES A THROUGH F]	YES	SITE 00004 SITE 00005 SITE 00014

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001535 REPORT 390	**06-26-1998**	TETRA TECH EM, INC.	DATA TRANSMITTAL MEMORANDUM FOR CHLORINATED SOLVENT PLUME DEFINITION AND SUMP INVESTIGATION, APPENDICES A THROUGH F (SEE RECORD # 1534 - DATA TRANSMITTAL MEMORANDUM, TEXT)	YES	SITE 00004 SITE 00005 SITE 00014
AR_N00236_001536 CORRESPONDENCE 3	**07-01-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF 1) FINAL WORK PLAN RADIOACTIVELY CONTAMINATED DRAIN PIPING/WALL/FLOOR REMOVAL, REVISION 2 AND 2) FINAL WORK PLAN FOR LANDFILL 1 AND 2, RADIOLOGICAL SURVEYS AND ANOMALY REMOVAL [ENCLOSURE 1) IS RECORD # 1537 AND 2) IS RECORD # 1538]	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001567 REPORT 113	**08-01-1998**	TETRA TECH EM, INC.	FINAL RADIOLOGICAL REMOVAL ACTION AND STORM DRAIN LINE F, IMPLEMENTATION WORK PLAN TECHNICAL SPECIFICATIONS (SEE RECORD # 1566 - NAVFAC EFAW TRANSMITTAL LETTER)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010 SITE 00017
AR_N00236_001568 REPORT 9	**08-01-1998**	TETRA TECH EM, INC.	FINAL RADIOLOGICAL REMOVAL ACTION AND STORM DRAIN LINE F, IMPLEMENTATION WORK PLAN DRAWINGS (SEE RECORD # 1566 - NAVFAC EFAW TRANSMITTAL LETTER)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010 SITE 00017
AR_N00236_000701 MINUTES 53	**08-18-1998**	TETRA TECH EM, INC.	18 AUGUST 1998 TRACKING MEETING MINUTES FOR ENVIRONMENTAL ACTIONS (INCLUDES AGENDA, ATTENDANCE SHEETS, AND VARIOUS HANDOUTS)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010 SITE 00016

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001566 CORRESPONDENCE 3	**08-27-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE 1) RADIOLOGICAL REMOVAL ACTION FINAL IMPLEMENTATION WORK PLAN, TECHNICAL SPECIFICATIONS AND 2) RADIOLOGICAL REMOVAL ACTION FINAL IMPLEMENTATION WORK PLAN, DRAWINGS (ENCLOSURE 1) IS RECORD # 1567 AND 2) IS RECORD # 1568)	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001570 REPORT 74	**11-01-1998**	TETRA TECH EM, INC.	TECHNICAL MEMORANDUM RADIOLOGICAL ASSESSMENT FOR RESIDUAL ACTIVITY GUIDELINES (SEE RECORD # 1569 - NAVFAC EFAW TRANSMITTAL LETTER)	YES	SITE 00005 SITE 00010
AR_N00236_001569 CORRESPONDENCE 3	**11-11-1998**	NAVFAC - EFA WEST	TRANSMITTAL OF THE TECHNICAL MEMORANDUM RADIOLOGICAL ASSESSMENT FOR RESIDUAL ACTIVITY GUIDELINES, INSTALLATION RESTORATION (ENCLOSURE IS RECORD # 1570)	YES	SITE 00005 SITE 00010
AR_N00236_001573 REPORT 838	**12-07-1998**	TETRA TECH EM, INC.	DATA SUMMARY REPORT FOR QUARTERLY GROUNDWATER MONITORING, NOVEMBER 1997 - AUGUST 1998 [SEE RECORD #1533 - EFAW TRANSMITTAL LETTER]	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00009 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00016 SITE 00022 SITE 00023

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001662 MINUTES 32	**01-05-1999**	NAVFAC - EFA WEST	05 JANUARY 1999 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, ATTENDANCE LIST, AND VARIOUS HANDOUTS)	YES	OU 0000001 SITE 00001 SITE 00002 SITE 00005 SITE 00007
AR_N00236_001582 CORRESPONDENCE 4	**01-08-1999**	TETRA TECH EM, INC.	TRANSMITTAL OF SUPPLEMENTAL RADIOLOGICAL SURVEY DATA, RADIOLOGICAL REMOVAL ACTION INTERIM DATA	YES	SITE 00005 SITE 00010
AR_N00236_001588 CORRESPONDENCE 13	**01-14-1999**	DTSC - BERKELEY, CA	COMMENTS ON THE 1) FINAL STATUS RADIATION SURVEY AND FIELD SAMPLING WORK PLAN, 2) TECHNICAL MEMORANDUM RADIOLOGICAL ASSESSMENT FOR RESIDUAL ACTIVITY GUIDELINES, AND	YES	SITE 00001 SITE 00002 SITE 00005 SITE 00010
AR_N00236_001583 CORRESPONDENCE 3	**01-26-1999**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DRAFT WORK IMPLEMENTATION PLAN FOR SURFACTANT ENHANCED DENSE NONAQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY (ENCLOSURE IS RECORD # 1584)	YES	SITE 00005
AR_N00236_001598 CORRESPONDENCE 4	**02-03-1999**	NAVFAC - EFA WEST	REVIEW AND COMMENTS ON THE DRAFT TREATABILITY STUDY WORK PLAN, STEAM ENHANCED EXTRACTION	YES	SITE 00005
AR_N00236_001590 CORRESPONDENCE 8	**02-19-1999**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE RADIATION SURVEYS AND SAMPLE DATA ASSOCIATED WITH THE STORM DRAIN AND INDUSTRIAL WASTE LINE REMOVALS	YES	SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001615 MINUTES 3	**03-31-1999**	DTSC - BERKELEY, CA	10 MARCH 1999 RADIOLOGICAL REMOVAL ACTION TECHNICAL MEETING SUMMARY	YES	SITE 00005 SITE 00010
AR_N00236_001614 CORRESPONDENCE 41	**04-16-1999**	TETRA TECH EM, INC.	RESPONSES TO COMMENTS ON THE SURVEY AND SAMPLING PLAN FOR REMOVAL OF CONTAMINATED STORM DRAIN BETWEEN MANWAYS 5F AND 6F	YES	SITE 00005 SITE 00010
AR_N00236_001616 REPORT 275	**05-18-1999**	SURBEC ENVIRONMENTAL	FINAL WORK IMPLEMENTATION PLAN FOR SURFACTANT ENHANCED DENSE NON-AQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY (SEE RECORD # 1622 - NAVFAC EFAW TRANSMITTAL LETTER)	YES	SITE 00005
AR_N00236_001637 CORRESPONDENCE 56	**06-07-1999**	TETRA TECH EM, INC.	RESPONSES TO COMMENTS ON THE INTERIM DATA LETTER REPORT, FINAL C-LINE AND D-LINE	YES	SITE 00005 SITE 00010
AR_N00236_001638 CORRESPONDENCE 3	**06-22-1999**	NAVFAC - EFA WEST	TRANSMITTAL OF THE RESPONSE TO COMMENT ON THE REVIEW OF RADIATION SURVEYS AND SAMPLE DATA ASSOCIATED WITH THE STORM DRAIN AND INDUSTRIAL WASTE LINE REMOVALS AT SIT	YES	SITE 00005 SITE 00010
AR_N00236_001643 REPORT 186	**06-23-1999**	SURBEC ENVIRONMENTAL	TECHNICAL MEMORANDUM FOR SURFACTANT ENHANCED DENSE NON-AQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY (SEE RECORD # 1642 - NAVFAC EFAW TRANSMITTAL LETTER)	YES	SITE 00005
AR_N00236_001642 CORRESPONDENCE 3	**06-28-1999**	NAVFAC - EFA WEST	TRANSMITTAL OF THE TECHNICAL MEMORANDUM FOR SURFACTANT ENHANCED DENSE NON-AQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY (ENCLOSURE IS RECORD # 1643)	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001679 MINUTES 29	**08-03-1999**	NAVFAC - EFA WEST	03 AUGUST 1999 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, HANDOUTS AND SIGN-IN SHEETS)	YES	BLDG 0000005 BLDG 0000014 BLDG 0000162 BLDG 0000360 BLDG 0000400 BLDG 0000410 OU 0000001 OU 0000002 OU 0000003 OU 0000004 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00017 SITE 00019 SITE 00020 SITE 00021 SITE 00022 SITE 00023 SITE 00024

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00025
AR_N00236_001689 REPORT 15	**08-30-1999**	TETRA TECH EM, INC.	FINAL - F LINE FIELD SAMPLING WORK PLAN (INCLUDES EFA WEST TRANSMITTAL LETTER, SER 612.4/L9206)	YES	BLDG 0000005 SITE 00005 SITE 00010
AR_N00236_001678 MINUTES 85	**09-07-1999**	NAVFAC - WESTERN DIVISION	07 SEPTEMBER 1999 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, SIGN-IN SHEETS AND VARIOUS HANDOUT MATERIALS)	YES	BLDG 0000005 BLDG 0000014 BLDG 0000400 BLDG 0000410 BLDG 0000530 OU 0000002 SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00019 SITE 00021 SITE 00022 SITE 00023 SITE 00025

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001659 CORRESPONDENCE 3	**09-21-1999**	NAVFAC - EFA WEST	TRANSMITTAL OF THE DRAFT ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY OVERSIGHT REPORT (ENCLOSURE IS RECORD # 1660)	YES	SITE 00005
AR_N00236_001673 CORRESPONDENCE 6	**10-26-1999**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON DRAFT ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY OVERSIGHT REPORT (INCLUDES OFFICE OF POLLUTION PREVENTION AND TECHNOLOGY DEVELOPMENT COMMENTS DATED 22 OCTOBER 1999)	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001676 MINUTES 43	**11-11-1999**	NAVFAC - SOUTHWEST DIVISION	11 NOVEMBER 1999 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS AND SIGN-IN SHEETS)	YES	BLDG 0000005 BLDG 0000400 OU 0000001 OU 0000002 OU 0000003 OU 0000004 SITE 00001 SITE 00002 SITE 00004 SITE 00006 SITE 00007 SITE 00008 SITE 00010 SITE 00012 SITE 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00020 SITE 00024 SITE 00025

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000511 MINUTES 26	**01-04-2000**	TETRA TECH EM, INC.	04 JANUARY 2000 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, SIGN-IN SHEETS AND VARIOUS HANDOUTS)	YES	BLDG 0000400 OU 0000001 OU 0000002 OU 0000003 OU 0000004 SITE 00001 SITE 00002 SITE 00005 SITE 00010 SITE 00014 SITE 00025
AR_N00236_001692 REPORT 125	**03-31-2000**	TETRA TECH EM, INC.	FINAL FEASIBILITY STUDY FOR THE MARSH CRUST AND THE FORMER SUBTIDAL AREA	YES	OU 0000001 OU 0000002 OU 0000003 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007
AR_N00236_001695 CORRESPONDENCE 10	**04-03-2000**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON DRAFT SURFACTANT ENHANCED SUBSURFACE REMEDIATION DENSE NON-AQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY RESULTS REPORT	YES	SITE 00005
AR_N00236_002425 CORRESPONDENCE 8	**05-08-2000**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS OF DRAFT SURFACTANT ENHANCED SUBSURFACE REMEDIATION DENSE NON-AQUEOUS PHASE LIQUID REMOVAL TREATABILITY STUDY RESULTS REPORT	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000568 MINUTES 12	**07-11-2000**	TETRA TECH EM, INC.	11 JULY 2000 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY	YES	OU 0000002 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004 OU 0000005 SITE 00015 SITE 00023 SITE 00025
AR_N00236_000589 MINUTES 8	**09-05-2000**	TETRA TECH EM, INC.	05 SEPTEMBER 2000 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY	YES	OU 0000003 SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00010 SITE 00011 SITE 00012 SITE 00014 SITE 00017 SITE 00024 SITE 00027

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000590 MINUTES 19	**10-03-2000**	TETRA TECH EM, INC.	03 OCTOBER 2000 RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES	YES	OU 0000001 OU 0000002 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004 OU 0000005 OU 0000007 SITE 00001 SITE 00002 SITE 00005 SITE 00007 SITE 00013 SITE 00025
AR_N00236_000058 CORRESPONDENCE 3	**12-27-2000**	NAVFAC - SOUTHWEST DIVISION	IDENTIFICATION OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR REMOVAL ACTIONS	YES	SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00011 SITE 00016 SITE 00019 SITE 00021

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000594 MINUTES 12	**02-06-2001**	NAVFAC - EFA WEST	06 FEBRUARY 2001 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00019 SITE 00021 SITE 00022 SITE 00023

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002539 CORRESPONDENCE 3	**02-08-2001**	DTSC - BERKELEY, CA	RESPONSES TO REQUEST FOR IDENTIFICATION OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR REMOVAL ACTIONS	YES	SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00011 SITE 00016 SITE 00019 SITE 00021
AR_N00236_000085 CORRESPONDENCE 4	**03-05-2001**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT ENGINEERING EVALUATION AND COST ANALYSIS FOR CADMIUM REMOVAL ACTION	YES	SITE 00005
AR_N00236_000087 CORRESPONDENCE 6	**03-05-2001**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE ENGINEERING EVALUATION AND COST ANALYSIS FOR THE DIOXIN AND CADMIUM REMOVAL ACTIONS	YES	SITE 00005 SITE 00014
AR_N00236_000595 MINUTES 8	**03-06-2001**	TETRA TECH EM, INC.	06 MARCH 2004 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY	YES	PARCEL 0125 PARCEL 0178 SITE 00005 SITE 00025
AR_N00236_000094 CORRESPONDENCE 5	**03-12-2001**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION, ENGINEERING EVALUATION/COST ANALYSIS	YES	SITE 00004 SITE 00005
AR_N00236_002159 CORRESPONDENCE 6	**03-13-2001**	IT CORPORATION	REVIEW AND COMMENTS ON THE DRAFT DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION, ENGINEERING EVALUATION AND COST ANALYSIS	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000095 CORRESPONDENCE 4	**03-15-2001**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION, ENGINEERING EVALUATION/COST ANALYSIS	YES	SITE 00004 SITE 00005
AR_N00236_000096 CORRESPONDENCE 4	**03-16-2001**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT DENSE NON AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION, ENGINEERING EVALUATION/COST ANALYSIS	YES	SITE 00004 SITE 00005
AR_N00236_000097 CORRESPONDENCE 15	**05-04-2001**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON THE DRAFT DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION, ENGINEERING EVALUATION/COST ANALYSIS (W/ ENCLOSURE0	YES	SITE 00004 SITE 00005
AR_N00236_000099 CORRESPONDENCE 15	**05-04-2001**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON THE DRAFT CADMIUM REMOVAL ACTION, ENGINEERING EVALUATION/COST ANALYSIS (W/ ENCLOSURE)	YES	SITE 00005
AR_N00236_002404 CORRESPONDENCE 2	**05-14-2001**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE RESPONSES TO COMMENTS ON THE DRAFT DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION ENGINEERING EVALUATION AND COST ANALYSIS	YES	SITE 00004 SITE 00005
AR_N00236_002160 CORRESPONDENCE 3	**05-17-2001**	IT CORPORATION	OPTIMAL REMEDIATION TECHNIQUE FOR DENSE NON-AQUEOUS LIQUID PHASE SOURCE REMOVALS	YES	SITE 00004 SITE 00005
AR_N00236_003069 CORRESPONDENCE 20	**06-05-2001**	IT CORPORATION	RESPONSES TO COMMENTS ON THE DRAFT REMOVAL ACTION WORK PLAN DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000206 CORRESPONDENCE 16	**07-19-2001**	TETRA TECH EM, INC.	REVISED RESPONSES TO COMMENTS ON THE DRAFT DENSE NONAQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION ENGINEERING EVALUATION/COST ANALYSIS	YES	SITE 00004 SITE 00005
AR_N00236_000240 REPORT 47	**08-30-2001**	TETRA TECH EM, INC.	STORM SEWER STUDY - TECHNICAL MEMORANDUM ADDENDUM AND RESPONSE TO AGENCY COMMENTS {SEE RECORD # 7 - DRAFT FINAL STORM SEWER STUDY REPORT ADDENDUM AND # 42 - DRAFT FINAL STORM SEWER STUDY REPORT}	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000005 SITE 00018
AR_N00236_000250 CORRESPONDENCE 7	**09-19-2001**	U.S. EPA - SAN FRANCISCO, CA	TRANSMITTAL OF THE REVIEW AND COMMENTS ON THE DENSE NONAQUEOUS PHASE LIQUID AND DISSOLVED SOURCE DRAFT REMOVAL ACTION WORK PLAN (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005
AR_N00236_000253 CORRESPONDENCE 10	**09-28-2001**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON DRAFT ACTION MEMORANDUM, CADMIUM NON-TIME CRITICAL REMOVAL ACTION; DRAFT ACTION MEMORANDUM, DIOXIN NON-TIME CRITICAL REMOVAL ACTION; DRAFT ACTION MEMO, DENSE NONAQUEOUS PHASE LIQUID AND	YES	SITE 00004 SITE 00005 SITE 00014
AR_N00236_000265 CORRESPONDENCE 5	**10-12-2001**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON DRAFT PROJECT PLANS, SOIL REMOVAL ACTIONS	YES	SITE 00005 SITE 00014 SITE 00015

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002430 CORRESPONDENCE 4	**10-26-2001**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON DRAFT FIELD SAMPLING PLAN/ QUALITY ASSURANCE PROJECT PLAN FOR REMOVAL ACTION CONFIRMATION SAMPLING	YES	SITE 00005 SITE 00014 SITE 00015
AR_N00236_000284 CORRESPONDENCE 13	**11-05-2001**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON, DRAFT ACTION MEMORANDUM, 1) DENSE NON-AQUEOUS PHASE LIQUID, 2) CADMIUM REMOVAL ACTION, AND 3) DIOXIN REMOVAL ACTION (W/ENCLOSURE 1, 2) IS RECORD # 293, AND 3) IS RECORD # 283)	YES	BLDG 0000005 SITE 00004 SITE 00005
AR_N00236_000293 CORRESPONDENCE 15	**11-05-2001**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON, DRAFT ACTION MEMORANDUM, 1) DENSE NON-AQUEOUS PHASE LIQUID, 2) CADMIUM REMOVAL ACTION, AND 3) DIOXIN REMOVAL ACTION (ENCLOSURE 1) IS RECORD # 284, W/ ENCLOSURE 2), AND 3) IS RECORD # 283)	YES	BLDG 0000005 OU 0000002 SITE 00005
AR_N00236_000610 MINUTES 50	**11-06-2001**	TETRA TECH EM, INC.	06 NOVEMBER 2001 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA, SIGN-IN SHEETS, AND VARIOUS HANDOUTS)	YES	SITE 00004 SITE 00005 SITE 00009 SITE 00011 SITE 00016
AR_N00236_000295 CORRESPONDENCE 11	**11-15-2001**	IT CORPORATION	RESPONSES TO COMMENTS ON THE DRAFT PROJECT PLANS, SOIL REMOVAL ACTIONS (SEE RECORD #265 - COMMENTS)	YES	SITE 00005 SITE 00014 SITE 00015
AR_N00236_000281 CORRESPONDENCE 29	**11-21-2001**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE RESPONSES TO COMMENTS ON THE DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE DRAFT REMOVAL ACTION WORK PLAN (W/ ENCLOSURE)	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000303 REPORT 240	**11-30-2001**	IT CORPORATION	FINAL PROJECT PLANS - WORK PLAN, QUALITY CONTROL PLAN, SAMPLING AND ANALYSIS PLAN, SITE HEALTH AND SAFETY PLAN, SOIL REMOVAL ACTIONS (INCLUDES NAVFAC SWDIV TRANSMITTAL LETTER)	YES	SITE 00005 SITE 00014 SITE 00015
AR_N00236_000611 MINUTES 11	**12-04-2001**	TETRA TECH EM, INC.	04 DECEMBER 2001 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA AND SIGN-IN SHEETS)	YES	SITE 00005 SITE 00025
AR_N00236_000306 REPORT 302	**12-07-2001**	TETRA TECH EM, INC.	FINAL CADMIUM NON-TIME CRITICAL REMOVAL ACTION, ACTION MEMORANDUM	YES	SITE 00005
AR_N00236_000307 REPORT 238	**12-07-2001**	TETRA TECH EM, INC.	FINAL INSTALLATION RESTORATION DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE NON-TIME CRITICAL REMOVAL ACTION - ACTION MEMORANDUM	YES	SITE 00004 SITE 00005
AR_N00236_000612 MINUTES 47	**01-08-2002**	TETRA TECH EM, INC.	08 JANUARY 2002 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA, SIGN-IN SHEETS, AND VARIOUS HANDOUTS)	YES	BLDG 0000195 SITE 00005 SITE 00014 SITE 00015 SITE 00025

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000354 CORRESPONDENCE 9	**01-28-2002**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT WORK PLAN FOR BASEWIDE GROUNDWATER MONITORING PROGRAM	YES	BLDG 0000410 OU 0000001 SITE 00004 SITE 00005 SITE 00008 SITE 00009 SITE 00016 SITE 00025 SITE 00026 SITE 00027 UST 0000608-1
AR_N00236_000344 REPORT 527	**02-08-2002**	IT CORPORATION	FINAL REMOVAL ACTION PROJECT PLANS (INCLUDES WORK PLAN, SITE HEALTH AND SAFETY PLAN, QUALITY CONTROL PLAN, SAMPLING AND ANALYSIS PLAN, WASTE MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN) - *	YES	SITE 00004 SITE 00005
AR_N00236_000617 MINUTES 47	**03-05-2002**	TETRA TECH EM, INC.	05 MARCH 2002 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA, SIGN-IN SHEETS, AND VARIOUS HANDOUTS)	YES	OU 0000001 OU 0000003 SITE 00004 SITE 00005 SITE 00014 SITE 00015 SITE 00018 SITE 00028

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000368 CORRESPONDENCE 11	**05-15-2002**	IT CORPORATION	AMENDMENT TO THE FINAL REMOVAL ACTION PROJECT PLAN - DENSE NON-AQUEOUS PHASE LIQUID AND DISSOLVED SOURCE REMOVAL ACTION (SEE RECORD # 344 - FINAL REMOVAL ACTION PROJECT PLAN)	YES	BLDG 0000005 OU 0000002B OU 0000002C SITE 00004 SITE 00005
AR_N00236_000621 MINUTES 58	**06-04-2002**	TETRA TECH EM, INC.	04 JUNE 2002 DRAFT RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES MEETING AGENDA, SIGN-IN SHEETS, AND VARIOUS HANDOUTS)	YES	SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000367 CORRESPONDENCE 35	**06-14-2002**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF DRAFT SITE MANAGEMENT PLAN AMENDMENT (W/ ENCLOSURE)	YES	AREA 00001 AREA 00002 AREA 00003 OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006 SITE 00001 SITE 00002 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00017 SITE 00019 SITE 00020 SITE 00022 SITE 00023

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00024 SITE 00025 SITE 00026 SITE 00027 SITE 00028 SITE 00029
AR_N00236_000405 CORRESPONDENCE 20	**07-18-2002**	TETRA TECH EM, INC.	RESPONSES TO COMMENTS ON THE DRAFT ACTION MEMORANDUM NON-TIME CRITICAL REMOVAL ACTION LEAD IN SOIL AND LEAD BASED PAINT (INCLUDES NAVFAC SWDIV TRANSMITTAL LETTER)	YES	BLDG 0000023 BLDG 0000024 BLDG 0000073B OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006 PARCEL 0079 PARCEL 0098 PARCEL 0105 PARCEL 0106 PARCEL 0107 SITE 00008

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000406 REPORT 2083	**07-25-2002**	TETRA TECH EM, INC.	DATA SUMMARY REPORT - SUPPLEMENTAL REMEDIAL INVESTIGATION DATA GAP SAMPLING	YES	BLDG 0000005 BLDG 0000014 BLDG 0000041 BLDG 0000162 BLDG 0000397 BLDG 0000398 BLDG 0000400 BLDG 0000410 BLDG 0000497 BLDG 0000528 BLDG 0000608 OU 0000001 OU 0000002 OU 0000002A OU 0000002B OU 0000002C SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00009 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00019 SITE 00021 SITE 00022

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00023
AR_N00236_000423 REPORT 187	**08-01-2002**	TETRA TECH EM, INC.	FINAL QUALITY CONTROL SUMMARY REPORT FOR REMOVAL ACTION CONFIRMATION SAMPLING	YES	SITE 00005 SITE 00014
AR_N00236_000410 CORRESPONDENCE 36	**08-21-2002**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE FINAL SITE MANAGEMENT PLAN AMENDMENT (W/ OUT ENCLOSURE)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000456 CORRESPONDENCE 7	**12-16-2002**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT TECHNICAL MEMORANDUM: EVALUATION OF ISSUES RELATED TO THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY PERMIT EPA ID CA 217002323G TIERED PERMITS AND THE NON-PERMITTED AREAS	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00019 SITE 00020 SITE 00022 SITE 00023 SITE 00027 SITE 00028

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000454 REPORT 390	**12-31-2002**	IT CORPORATION	FINAL REMOVAL ACTION SITE CLOSEOUT REPORT, REMOVAL ACTION FOR SOIL REMOVAL AT THE AIRCRAFT REWORK FACILITY AND THE FORMER FIRE TRAINING AREA (INCLUDES NAVFAC SWDIV TRANSMITTAL LETTER)	YES	BLDG 0000005 OU 0000001 OU 0000002C SITE 00005 SITE 00014
AR_N00236_000470 CORRESPONDENCE 31	**01-16-2003**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE SITE MANAGEMENT PLAN UPDATE (W/ ENCLOSURE)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006 SITE 00017 SITE 00020 SITE 00024 SITE 00025 SITE 00029
AR_N00236_001921 CORRESPONDENCE 4	**04-04-2003**	CRWQCB - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT FOR THE WESTERN HANGAR ZONE	YES	BLDG 0000023 BLDG 0000024 SITE 00005 SITE 00026

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000503 REPORT 96	**05-23-2003**	SHAW ENVIRONMENTAL, INC.	DENSE NON-AQUEOUS LIQUID PHASE REMOVAL PILOT TEST REPORT (INCLUDES CD COPY AND NAVFAC SWDIV TRANSMITTAL LETTER)	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000772 PUBLIC NOTICE 16	**07-01-2003**	NAVFAC - SOUTHWEST DIVISION	JULY 2003 ALAMEDA POINT FOCUS ENVIRONMENTAL NEWSLETTER	YES	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 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019 SITE 00020 SITE 00021 SITE 00022 SITE 00023 SITE 00024 SITE 00025 SITE 00026 SITE 00027 SITE 00028

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00029 SITE 00030 SITE 00031 SITE 00032

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001988 CORRESPONDENCE 6	**07-15-2003**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT WORK PLAN FOR THE ASSESSMENT OF POLYCYCLIC AROMATIC HYDROCARBON CONTAMINATION AT SELECTED CERCLA SITES AND ENVIRONMENTAL BASELINE STUDY PARCELS (INCLUDES COMMENTS BY HERD DATED 08 JULY 2003)	YES	PARCEL 0028 PARCEL 0051 PARCEL 0205 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 00015 SITE 00016 SITE 00019 SITE 00021 SITE 00022 SITE 00023 SITE 00030 SITE 00031 SITE 00032
AR_N00236_000777 REPORT 234	**07-31-2003**	SHAW ENVIRONMENTAL, INC.	GROUNDWATER MONITORING REPORT FOR, SUMMER 2002 TO SPRING 2003 (INCLUDES REPLACEMENT PAGES, NAVFAC SWDIV TRANSMITTAL LETTERS AND CD COPY)	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001803 MINUTES 34	**08-05-2003**	SULTECH	05 AUGUST 2003 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA AND VARIOUS HANDOUTS)	YES	BLDG 0000195 SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00011 SITE 00014 SITE 00016 SITE 00021 SITE 00025 SITE 00026 SITE 00027

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001757 REPORT 33	**11-05-2003**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF SITE MANAGEMENT PLAN UPDATE (W/ ENCLOSURE)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00011 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00018 SITE 00019 SITE 00020

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00021 SITE 00022 SITE 00023 SITE 00024 SITE 00025 SITE 00026 SITE 00027
AR_N00236_001880 CORRESPONDENCE 15	**11-24-2003**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF THE GROUNDWATER MONITORING REPORTS, SUMMER 2002 TO SPRING 2003 (ENCLOSURES ARE RECORDS # 774 THROUGH # 778, # 823, # 824, # 839, # 840, # 861, # 873, AND # 880)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00025 SITE 00027

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001787 REPORT 621	**02-06-2004**	SHAW ENVIRONMENTAL, INC.	FINAL WORK PLAN FOR BASEWIDE GROUNDWATER MONITORING PROGRAM (INCLUDES CD COPY, RESPONSES TO COMMENTS ON THE REVISED DRAFT GROUNDWATER MONITORING WORK PLAN AND NAVFAC SWDIV TRANSMITTAL LETTER)	YES	AREA 00097 BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000162 BLDG 0000360 BLDG 0000372 BLDG 0000398 BLDG 0000400 BLDG 0000594 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 00014 SITE 00016 SITE 00025 SITE 00026 SITE 00027 SITE 00032

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					WELL M001-A
					WELL M001-B
					WELL M001-E
					WELL M001-P
					WELL M002-A
					WELL M002-E
					WELL M003-B
					WELL M003-C
					WELL M003-E
					WELL M004-A
					WELL M005-A
					WELL M006-A
					WELL M007-A
					WELL M007-C
					WELL M008-A
					WELL M025-A
					WELL M025-C
					WELL M025-E
					WELL M026-A
					WELL M026-E
					WELL M027-A
					WELL M027-B
					WELL M027-C
					WELL M027-E
					WELL M028-A
					WELL M028-C
					WELL M028-E
					WELL M029-A

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					WELL M029-E WELL M030-A WELL M030-C WELL M030-E WELL M031-A WELL M031-C WELL M031-E WELL M032-A WELL M033-A WELL M034-A WELL M035-A
AR_N00236_001841 FACT SHEET 4	**03-01-2004**	NAS ALAMEDA - ALAMEDA, CA	NEWSLETTER REGARDING CLEANUP OPTIONS BEING EVALUATED	YES	SITE 00005 SITE 00009 SITE 00014 SITE 00015 SITE 00016 SITE 00025 SITE 00026

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001830 CORRESPONDENCE 7	**05-07-2004**	NAVFAC - SOUTHWEST DIVISION	TRANSMITTAL OF WINTER AND FALL 2003 QUARTERLY GROUNDWATER MONITORING DATA REPORTS (COMPACT DISC FORMAT ONLY) [ENCLOSURES ARE RECORDS # 1813 THROUGH 1823 AND RECORD # 1827]	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00025
AR_N00236_001876 REPORT 43	**09-14-2004**	NAVFAC - SOUTHWEST DIVISION	FINAL SITE MANAGEMENT PLAN FOR FISCAL YEAR 2005 [INCLUDES NAVFAC SWDIV TRANSMITTAL, SER 06CA.GL/0942]	YES	OU 0000001 OU 0000002A OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000005 OU 0000006

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001902 CORRESPONDENCE 21	**11-10-2004**	BRAC PMO WEST	TRANSMITTAL OF GROUNDWATER MONITORING REPORTS FOR SUMMER 2003 TO SPRING 2004 [INCLUDES SUMMARY OF SIGNIFICANT CHANGES TO ANNUAL 2003 TO 2004 ALAMEDA BASEWIDE GROUNDWATER MONITORING PROGRAM] (ENCLOSURES ARE RECORDS # 1813 THROUGH # 1823 AND # 1827)	YES	OU 0000002C SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00027 SITE 00032
AR_N00236_001901 CORRESPONDENCE 88	**11-22-2004**	BRAC PMO WEST	TRANSMITTAL OF 1) RESPONSE TO REGULATOR COMMENTS FOR THE SPRING 2003 ALAMEDA POINT QUARTERLY GROUNDWATER REPORTS, AND 2) REPLACEMENT PAGES (W/ ENCLOSURES)	YES	"PERCHLORATE " SEARCH - ROUND 1 SITE 00001 SITE 00002 SITE 00005 SITE 00007 SITE 00008 SITE 00025
AR_N00236_001814 REPORT 247	**12-17-2004**	SHAW ENVIRONMENTAL, INC.	GROUNDWATER MONITORING REPORT FOR SUMMER 2003 TO SPRING 2004 [INCLUDES REPLACEMENT PAGES THAT REFLECT SUMMER 2003 TO SPRING 2004, CD COPY AND NAVFAC SWDIV TRANSMITTAL LETTER)	YES	SITE 00005
AR_N00236_001912 CORRESPONDENCE 3	**12-21-2004**	BRAC PMO WEST	REQUEST FOR A SIXTY DAY EXTENSION ON DRAFT REMEDIAL INVESTIGATION REPORT	YES	OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_001417 CORRESPONDENCE 11	**12-23-2004**	DTSC - BERKELEY, CA	EXPOSURE PARAMETERS TO BE USED IN THE REMEDIAL INVESTIGATION AND THE HUMAN HEALTH RISK ASSESSMENT (INCLUDES HERD MEMORANDUM DATED 01 DECEMBER 2004)	YES	SITE 00002 SITE 00004 SITE 00005 SITE 00006
AR_N00236_003004 REPORT 513	**03-01-2005**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	FINAL FALL/WINTER 2004 QUARTERLY GROUNDWATER MONITORING DATA REPORT (INCLUDES ANALYTICAL DATA) [SEE RECORD # 2034 - BRAC PMO WEST TRANSMITTAL LETTER]	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00025 SITE 00027 SITE 00028 SITE 00032
AR_N00236_002435 CORRESPONDENCE 3	**07-26-2005**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON DRAFT SITE MANAGEMENT PLAN SCHEDULE ADDENDUM FOR 2006	YES	OU 0000002A OU 0000002B OU 0000002C SITE 00002 SITE 00026 SITE 00031 SITE 00032

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002120 CORRESPONDENCE 1	**08-25-2005**	U.S. EPA - SAN FRANCISCO, CA	REQUEST FOR AN EXTENSION OF REVIEW ON THE DRAFT OPERABLE UNIT REMEDIAL INVESTIGATION REPORT	YES	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_002123 CORRESPONDENCE 2	**08-29-2005**	CALIFORNIA DEPARTMENT OF HEALTH SERVICES - SACRAMENTO, CA	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT	YES	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_002147 CORRESPONDENCE 26	**10-03-2005**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT (INCLUDES COMMENTS BY S. SERDA DATED 20 SEPTEMBER 2005)	YES	"PERCHLORATE " SEARCH - ROUND 1 OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_002148 CORRESPONDENCE 39	**10-06-2005**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT (INCLUDES COMMENTS BY GSU DATED 09/30/05 AND HERD DATED 08/25/05)	YES	"PERCHLORATE " SEARCH - ROUND 1 OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_002146 CORRESPONDENCE 3	**10-14-2005**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT	YES	OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002196 REPORT 449	**12-23-2005**	SULTECH	COMPILATION OF SOLID WASTE MANAGEMENT UNIT EVALUATION REPORTS PREVIOUSLY SUBMITTED WITH COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT DOCUMENTS, HAZARDOUS WASTE PERMIT EPA ID NUMBER CA 2170023236	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C PARCEL EDC-3 PARCEL EDC-5 PARCEL PBC-1A SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00016 SITE 00019 SITE 00021 SITE 00022 SITE 00023
AR_N00236_002157 REPORT 1302	**01-25-2006**	SHAW ENVIRONMENTAL, INC.	FINAL FIELD ACTIVITIES REPORT, DENSE NON-AQUEOUS PHASE LIQUID SOURCE REMOVAL ACTION, REVISION 1 (INCLUDES REPLACEMENT PAGES CONVERTING DRAFT DATED 09 NOVEMBER 2005 TO FINAL) [CD COPY OF APPENDICES A THROUGH F ENCLOSED]	YES	SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002963 REPORT 17502	**03-01-2006**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	SUMMER 2005 QUARTERLY GROUNDWATER MONITORING DATA REPORT (INCLUDES ANALYTICAL DATA - PAPER ONLY)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00025 SITE 00027 SITE 00028 SITE 00032
AR_N00236_003134 REPORT 45	**08-15-2006**	SHAW ENVIRONMENTAL, INC.	FINAL SAMPLING AND ANALYSIS PLAN ADDENDUM # 2, DENSE NON-AQUEOUS-PHASE LIQUIDS REMOVAL ACTION (SEE RECORD # 344 FINAL REMOVAL ACTION PROJECT PLANS)	YES	SITE 00004 SITE 00005
AR_N00236_002607 CORRESPONDENCE 4	**09-11-2006**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING (ENCLOSURE IS RECORD # 2608)	YES	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003126 REPORT 206	**10-10-2006**	SHAW ENVIRONMENTAL, INC.	SELF-MONITORING REPORT - 3RD QUARTER 2006 WASTEWATER DISCHARGE PERMIT NO. 50249812 (INCLUDES ANALYTICAL DATA)	YES	BLDG 0000397 BLDG 0000410 BLDG 0000530 CAA 000004C CAA 000007 CAA 000011 PARCEL 0037 SITE 00004 SITE 00005
AR_N00236_002648 CORRESPONDENCE 3	**11-21-2006**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING	YES	OU 0000002C
AR_N00236_002649 CORRESPONDENCE 11	**12-06-2006**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING	YES	OU 0000002C
AR_N00236_002652 CORRESPONDENCE 26	**12-11-2006**	DTSC - SACRAMENTO, CA	REVIEW AND COMMENTS ON DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING [INCLUDES GSU AND HERD COMMENTS]	YES	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002979 CORRESPONDENCE 4	**12-27-2006**	DTSC - SACRAMENTO, CA	REVIEW AND COMMENTS ON THE DRAFT SPRING 2006, ALAMEDA BASEWIDE, ANNUAL GROUNDWATER MONITORING REPORT (SEE RECORD # 2965 - DRAFT MONITORING REPORT)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00027 SITE 00028 SITE 00032
AR_N00236_002742 MINUTES 64	**02-01-2007**	SULTECH	01 FEBRUARY 2007 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, HANDOUT MATERIALS, AND VARIOUS ATTACHMENTS)	YES	OU 0000001 OU 0000002A OU 0000002B PARCEL EDC-17 SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002965 REPORT 1493	**02-01-2007**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	FINAL SPRING 2006 BASEWIDE ANNUAL GROUNDWATER MONITORING REPORT, VOLUMES I AND II OF II (INCLUDES ANALYTICAL DATA, CD COPY, AND RESPONSE TO COMMENTS ON THE DRAFT)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00027 SITE 00028 SITE 00032
AR_N00236_002987 CORRESPONDENCE 5	**02-27-2007**	DTSC - SACRAMENTO, CA	REVIEW AND COMMENTS ON THE DRAFT SPRING 2006, ANNUAL GROUNDWATER MONITORING REPORT (SEE RECORD # 2965 - FINAL SPRING 2006, ANNUAL GROUNDWATER MONITORING REPORT)	YES	SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00027 SITE 00028 SITE 00032

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003135 REPORT 286	**04-20-2007**	SHAW ENVIRONMENTAL, INC.	SELF-MONITORING REPORT - 1ST QUARTER 2007 WASTEWATER DISCHARGE PERMIT NO. 50249812 (INCLUDES ANALYTICAL DATA)	YES	BLDG 0000005 BLDG 0000012 BLDG 0000360 BLDG 0000397 SITE 00005
AR_N00236_002752 REPORT 884	**05-01-2007**	BECHTEL ENVIRONMENTAL, INC.	FINAL WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING (CD COPY IS ENCLOSED) [SEE RECORD #2751 - BRAC PMO WEST TRANSMITTAL LETTER]	YES	"PERCHLORATE " SEARCH - ROUND 1 OU 0000002C
AR_N00236_002751 CORRESPONDENCE 4	**05-04-2007**	BRAC PMO WEST	TRANSMITTAL OF THE FINAL WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING (ENCLOSURE IS RECORD # 2752)	YES	OU 0000002C
AR_N00236_002773 CORRESPONDENCE 5	**05-29-2007**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT PROJECT WORK PLAN, TIME-CRITICAL REMOVAL ACTION, STORM DRAIN AND SEWER LINE (ENCLOSURE IS RECORD # 2774)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002776 CORRESPONDENCE 4	**05-29-2007**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT ACTION MEMORANDUM, TIME-CRITICAL REMOVAL ACTION AT INSTALLATION RESTORATION SITES, STORM DRAIN AND SEWER LINE (ENCLOSURE IS RECORD # 2777)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002925 CORRESPONDENCE 2	**07-10-2007**	CALIFORNIA DEPARTMENT OF PUBLIC HEALTH - SACRAMENTO, CA	REVIEW AND NO COMMENTS ON THE DRAFT ACTION MEMORANDUM, COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT TIME-CRITICAL REMOVAL ACTION, STORM DRAIN AND SEWER LINE [SEE RECORD # 2777 - DRAFT ACTION MEMORANDUM]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002926 CORRESPONDENCE 2	**07-10-2007**	CALIFORNIA DEPARTMENT OF PUBLIC HEALTH - SACRAMENTO, CA	REVIEW AND NO COMMENTS ON THE DRAFT TIME-CRITICAL REMOVAL ACTION WORK PLAN, STORM DRAIN AND SEWER LINE [SEE RECORD # 2774 - DRAFT WORK PLAN]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002931 CORRESPONDENCE 16	**07-12-2007**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT ACTION MEMORANDUM AND WORK PLAN FOR COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT TIME-CRITICAL REMOVAL ACTION	YES	SITE 00005 SITE 00010
AR_N00236_002927 CORRESPONDENCE 4	**07-16-2007**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT PROJECT WORK PLAN FOR THE STORM DRAIN AND SEWER LINE TIME-CRITICAL REMOVAL ACTION [SEE RECORD # 2774 - DRAFT PROJECT WORK PLAN]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002937 CORRESPONDENCE 2	**07-16-2007**	CRWQCB - OAKLAND, CA	REVIEW AND COMMENTS ON THE DRAFT ACTION MEMORANDUM FOR THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT TIME-CRITICAL REMOVAL ACTION, STORM DRAIN AND SEWER LINE [SEE RECORD # 2777 - DRAFT ACTION MEMORANDUM]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002923 CORRESPONDENCE 3	**07-31-2007**	DTSC - SACRAMENTO, CA	REVIEW AND NO COMMENTS ON THE DRAFT ACTION MEMORANDUM, COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT TIME-CRITICAL REMOVAL ACTION STORM DRAIN AND SEWER LINE	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002924 CORRESPONDENCE 6	**07-31-2007**	DTSC - SACRAMENTO, CA	REVIEW AND COMMENTS ON THE DRAFT PROJECT WORK PLAN, STORM DRAIN AND SEWER LINE TIME CRITICAL REMOVAL ACTION [SEE RECORD # 2774 - DRAFT PROJECT WORK PLAN]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002840 REPORT 23	**08-08-2007**	SULTECH	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS TEMPLATE (CD COPY IS ENCLOSED)	YES	OU 0000001 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

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_002957 MINUTES 51	**09-06-2007**	SULTECH	06 SEPTEMBER 2007 FINAL RESTORATION ADVISORY BOARD MEETING SUMMARY (INCLUDES CD COPY, LIST OF ATTENDEES, AGENDA, AND VARIOUS HANDOUT MATERIALS)	YES	SITE 00005 SITE 00009 SITE 00010 SITE 00012 SITE 00013 SITE 00014 SITE 00015 SITE 00016 SITE 00019 SITE 00022 SITE 00023 SITE 00025 SITE 00030 SITE 00031 SITE 00032
AR_N00236_002932 CORRESPONDENCE 1	**09-17-2007**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND NO FURTHER COMMENTS ON THE TIME CRITICAL REMOVAL ACTION MEMORANDUM, STORM DRAIN AND SEWER LINE REMOVAL [SEE RECORD # 2777 - DRAFT ACTION MEMORANDUM]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_002973 MINUTES 47	**11-01-2007**	SULTECH	01 NOVEMBER 2007 FINAL RESTORATION ADVISORY BOARD MEETING SUMMARY (INCLUDES CD COPY, AGENDA AND VARIOUS HANDOUTS)	YES	SITE 00001 SITE 00003 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003054 MINUTES 40	**03-14-2008**	SULTECH	06 DECEMBER 2007 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	AOC 000023G BLDG 0000071 CAA 000003A CAA 000003B CAA 000003C CAA 000004C CAA-A OU 0000001 OU 0000002A OU 0000004 OU 0000005 PARCEL 0012 SITE 00001 SITE 00002 SITE 00004 SITE 00005 SITE 00010 SITE 00014 SITE 00017 SITE 00020 SITE 00026 SITE 00027 SITE 00028 SITE 00031 SITE 00032 SITE 00033 SITE 00035

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003055 MINUTES 43	**03-14-2008**	SULTECH	10 JANUARY 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	BLDG 0000005 BLDG 0000400 SITE 00002 SITE 00005 SITE 00010 SITE 00013 SITE 00017 SITE 00024 SITE 00034
AR_N00236_003056 MINUTES 51	**03-14-2008**	SULTECH	07 FEBRUARY 2008 RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA AND VARIOUS HANDOUT MATERIALS) [CD COPY ENCLOSED]	YES	OU 0000001 SITE 00005 SITE 00014 SITE 00025 SITE 00026 SITE 00034 SITE 00035
AR_N00236_003044 CORRESPONDENCE 3	**03-25-2008**	BRAC PMO WEST	TRANSMITTAL OF THE GEOTECHNICAL EXPLORATION WORK PLAN, STORM DRAIN AND SEWER LINE, TIME-CRITICAL REMOVAL ACTION (ENCLOSURE IS RECORD # 3045)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003045 REPORT 11	**03-28-2008**	TETRA TECH EC, INC.	GEOTECHNICAL EXPLORATION WORK PLAN, STORM DRAIN AND SEWER LINE, TIME-CRITICAL REMOVAL ACTION (CD COPY ENCLOSED) [SEE RECORD # 3044 - BRAC PMO WEST TRANSMITTAL LETTER]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003028 REPORT 1130	**04-01-2008**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	FINAL SPRING 2007, ANNUAL GROUNDWATER MONITORING REPORT, VOLUMES I AND II OF II (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT FINAL DATED 01 MARCH 2008 TO FINAL, ANALYTICAL DATA, RESPONSE TO COMMENTS ON THE DRAFT, AND CD COPY)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000005 OU 0000006 SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00025 SITE 00026 SITE 00027 SITE 00028 SITE 00032 WELL M002-A WELL M002-E WELL M003-10 WELL M003-15 WELL M003-16

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					WELL M015-A
					WELL M016-A
					WELL M016-E
					WELL M018-A
					WELL M019-A
					WELL M019-E
					WELL M022-A
					WELL M022-E
					WELL M023-A
					WELL M023-E
					WELL M024-E
					WELL M025-E
					WELL M026-A
					WELL M026-E
					WELL M029-A
					WELL M030-E
					WELL MW-013-04
					WELL MW-360-01
					WELL MW-360-02
					WELL MW-360-04
					WELL MW-410-03

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003186 REPORT 796	**04-01-2008**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	FALL 2007, ALAMEDA BASEWIDE, SEMI-ANNUAL GROUNDWATER MONITORING REPORT (CD COPY ENCLOSED)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000006 SITE 00001 SITE 00002 SITE 00003 SITE 00005 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00014 SITE 00016 SITE 00026 SITE 00027 SITE 00028 SITE 00032 WELL 00013-MW-03 WELL M006-01 WELL M006-02 WELL M006-03 WELL M006-04 WELL M006-05 WELL M006-06

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					WELL M006-07
AR_N00236_000826 CORRESPONDENCE 4	**04-22-2008**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT REMEDIAL INVESTIGATION REPORT, REVISION 1, VOLUMES I THROUGH III OF III (ENCLOSURE IS RECORD # 897)	YES	OU 0000002C
AR_N00236_003236 MINUTES 48	**06-05-2008**	SULTECH	05 JUNE 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	BLDG 0000002 BLDG 0000005 OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00010 SITE 00012 SITE 00025 SITE 00035
AR_N00236_003178 CORRESPONDENCE 59	**06-13-2008**	BRAC PMO WEST	TRANSMITTAL OF THE 1) FINAL PROJECT WORK PLAN, STORM DRAIN AND SEWER LINE, TIME-CRITICAL REMOVAL ACTION; 2) RESPONSE TO COMMENTS ON DRAFT PROJECT WORK PLAN; 3) RESPONSE TO ADDITIONAL COMMENTS ON DRAFT PROJECT WORK PLAN; AND	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003183 CORRESPONDENCE 5	**06-13-2008**	BRAC PMO WEST	TRANSMITTAL OF THE 1) FINAL ACTION MEMORANDUM, CERCLA TIME-CRITICAL REMOVAL ACTION AT INSTALLATION RESTORATION SITES, STORM DRAIN AND SEWER LINE REMOVAL, AND 2) RESPONSE TO COMMENTS ON DRAFT ACTION MEMORANDUM	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003184 REPORT 175	**06-13-2008**	TETRA TECH EC, INC.	FINAL ACTION MEMORANDUM, CERCLA TIME-CRITICAL REMOVAL ACTION AT INSTALLATION RESTORATION SITES, STORM DRAIN AND SEWER LINE REMOVAL (CD COPY ENCLOSED) [SEE RECORD # 3183 - BRAC PMO WEST TRANSMITTAL LETTER]	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003185 CORRESPONDENCE 34	**06-13-2008**	TETRA TECH EC, INC.	RESPONSES TO COMMENTS ON THE DRAFT TECHNICAL MEMORANDUM, CERCLA TIME-CRITICAL REMOVAL ACTION AT INSTALLATION RESTORATION SITES, STORM DRAIN AND SEWER LINE REMOVAL (SEE RECORD # 2777 - DRAFT TECHNICAL MEMORANDUM)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_000781 PUBLIC NOTICE 3	**06-20-2008**	BAY AREA NEWS GROUP - SAN RAMON, CA	PUBLIC NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD FOR ACTION MEMORANDUM CERCLA TIME-CRITICAL REMOVAL ACTION (INCLUDES PROOF OF PUBLICATION FOR ALAMEDA JOURNAL)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_000820 PUBLIC NOTICE 2	**06-21-2008**	ALAMEDA TIMES-STAR - ALAMEDA, CA	PROOF OF PUBLICATION OF PUBLIC NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD FOR ACTION MEMORANDUM CERCLA TIME-CRITICAL REMOVAL ACTION	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003237 MINUTES 78	**08-14-2008**	SULTECH	14 AUGUST 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004B OU 0000004C OU 0000005 SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00006 SITE 00007 SITE 00008 SITE 00009 SITE 00011 SITE 00013 SITE 00014 SITE 00016 SITE 00017 SITE 00019 SITE 00020 SITE 00021 SITE 00022 SITE 00023 SITE 00026 SITE 00027

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00028 SITE 00030 SITE 00031 SITE 00032 SITE 00034 SITE 00035
AR_N00236_003230 CORRESPONDENCE 4	**09-04-2008**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT ((ENCLOSURE IS RECORD # 3232)	YES	OU 0000002C
AR_N00236_003231 CORRESPONDENCE 4	**09-18-2008**	BRAC PMO WEST	TRANSMITTAL OF REPLACEMENT PAGES CONVERTING THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT DATED 01 SEPTEMBER 2008, TO FINAL (ENCLOSURE IS RECORD # 3232)	YES	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003232 REPORT 16739	**09-18-2008**	BECHTEL ENVIRONMENTAL, INC.	FINAL REMEDIAL INVESTIGATION REPORT, VOLUME I THROUGH III OF III (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT FINAL DATED 04 SEPTEMBER 2008 TO FINAL, ANALYTICAL DATA - PAPER ONLY, AND CD COPY)	YES	"PERCHLORATE " SEARCH - ROUND 1 AOC 000005 AST 0000005C AST 0000005G AST M-01 AST M-02 AST M-05 AST M-08 AST M-09 BLDG 0000002 BLDG 0000005 BLDG 0000005A BLDG 0000043 BLDG 0000062 BLDG 0000282 BLDG 0000348 BLDG 0000400 CAA 000005A CAA 000005B CAA 000005C CAA 000010 CAA-B OU 0000002C PARCEL 0054 PARCEL 0068 PARCEL 0069 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00010
					SITE 00012
					SITE 00026
					SWMU 00006A
					SWMU 00006B
					SWMU 00010
					UST 0000005-3
					UST 0000012
					UST 0000261-1
					UST 0000261-2
					WELL D12-01
					WELL M005-01
					WELL M005-02
					WELL M005-03
					WELL M005-04
					WELL M005-05
					WELL M005-06
					WELL M005-07
					WELL M005-08
					WELL M005-09
					WELL M005-10
					WELL M010-02
					WELL M010-03
					WELL M012-01
					WELL M012-02
					WELL M012-03
					WELL M012-04

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003276 MINUTES 91	**10-02-2008**	CHADUX - TT, JOINT VENTURE	02 OCTOBER 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	CAA-C OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00014 SITE 00015 SITE 00017 SITE 00024 SITE 00026 SITE 00033
AR_N00236_003244 CORRESPONDENCE 3	**10-16-2008**	BRAC PMO WEST	REQUEST FOR IDENTIFICATION OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY	YES	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_003277 MINUTES 34	**11-06-2008**	CHADUX - TT, JOINT VENTURE	06 NOVEMBER 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	YES	OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00005 SITE 00026 SITE 00030

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003365 MINUTES 40	**12-04-2008**	CHADUX - TT, JOINT VENTURE	04 DECEMBER 2008 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY [INCLUDES AGENDA, VARIOUS HANDOUTS AND CD COPY]	NO	AOC 000003 AOC 000010 AOC 000012 BLDG 0000410 CAA 000003 CAA 000005B CAA-C OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00014 SITE 00017 SITE 00024 SITE 00026 SITE 00027 SITE 00028 SITE 00030 SITE 00032 SITE 00034 SITE 00035

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003260 CORRESPONDENCE 22	**12-05-2008**	BRAC PMO WEST	TRANSMITTAL OF THE FINAL 2009 AMENDMENT TO THE SITE MANAGEMENT PLAN (ENCLOSURE IS RECORD # 1710)	YES	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000005 OU 0000006 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

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00022
					SITE 00023
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					SITE 00027
					SITE 00028
					SITE 00030
					SITE 00031
					SITE 00032
					SITE 00034
					SITE 00035

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003366 MINUTES 50	**01-08-2009**	CHADUX - TT, JOINT VENTURE	08 JANUARY 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY [INCLUDES AGENDA AND VARIOUS HANDOUTS] {CD COPY ENCLOSED}	NO	AST 0000360E BLDG 0000014 BLDG 0000112 BLDG 0000113 BLDG 0000118 BLDG 0000162 BLDG 0000163 BLDG 0000265 BLDG 0000360 BLDG 0000372 BLDG 0000398 OU 0000002A OU 0000002B OU 0000002C OU 0000005 OWS 000014A OWS 000014B OWS 000014C OWS 000014D OWS 000014E OWS 000163 OWS 000360 OWS 000372A SITE 00001 SITE 00002 SITE 00002A SITE 00002B SITE 00003

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00003B SITE 00004 SITE 00009 SITE 00011 SITE 00013 SITE 00014 SITE 00019 SITE 00021 SITE 00022 SITE 00026 SITE 00032 SWMU 00372
AR_N00236_003367 MINUTES 50	**02-05-2009**	CHADUX - TT, JOINT VENTURE	05 FEBRUARY 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY [INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY]	NO	OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00014 SITE 00026 SITE 00027
AR_N00236_003328 CORRESPONDENCE 2	**03-24-2009**	BRAC PMO WEST	FEDERAL FACILITY AGREEMENT EXTENSION REQUEST FOR THE DRAFT FEASIBILITY STUDY REPORT	NO	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003374 MINUTES 33	**04-02-2009**	CHADUX - TT, JOINT VENTURE	02 APRIL 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING SUMMARY (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00002 SITE 00024 SITE 00025 SITE 00026 SITE 00028
AR_N00236_003411 MINUTES 51	**05-07-2009**	CHADUX - TT, JOINT VENTURE	07 MAY 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002A OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00017 SITE 00025 SITE 00026 SITE 00032 SITE 00034 SITE 00035
AR_N00236_003343 CORRESPONDENCE 2	**05-08-2009**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT FEASIBILITY STUDY REPORT (ENCLOSURE IS RECORD # 3344)	NO	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003410 MINUTES 59	**06-04-2009**	CHADUX - TT, JOINT VENTURE	04 JUNE 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000001 OU 0000002C SITE 00001 SITE 00002 SITE 00005 SITE 00010 SITE 00012 SITE 00024 SITE 00034 SITE 00035
AR_N00236_003462 CORRESPONDENCE 5	**06-17-2009**	BRAC PMO WEST	2009 CHANGES RELATED TO TEMPORARY DISCHARGE OF TREATED GROUNDWATER FROM STRUCTURAL DEWATERING ACTIVITIES TO SEAPLANE LAGOON FOR TIME-CRITICAL REMOVAL ACTION	NO	SITE 00005 SITE 00010
AR_N00236_003378 CORRESPONDENCE 55	**06-18-2009**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 6 SUMMARY REPORT FOR WATER TREATMENT SYSTEM, STORM DRAIN TIME-CRITICAL REMOVAL ACTION DATED 10 JUNE 2009 (W/ ENCLOSURE)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003179 REPORT 915	**06-24-2009**	TETRA TECH EC, INC.	FINAL PROJECT WORK PLAN REVISION 2, STORM DRAIN AND SEWER LINE, TIME-CRITICAL REMOVAL ACTION (INCLUDES REPLACEMENT PAGES CONVERTING THE FINAL PROJECT WORK PLAN REVISION 1, DATED 13 JUNE 2008, TO REVISION 2 AND CD COPY)	YES	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003397 CORRESPONDENCE 2	**06-26-2009**	BRAC PMO WEST	ADMINISTRATIVE RECORD DOCUMENTATION OF MINOR CHANGE FOR TIME-CRITICAL REMOVAL ACTION (SEE RECORD # 3184 - FINAL ACTION MEMORANDUM, TIME-CRITICAL REMOVAL ACTION AT INSTALLATION RESTORATION SITES, STORM DRAIN AND SEWER LINE REMOVAL)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003622 REPORT 525	**07-01-2009**	INNOVATIVE TECHNICAL SOLUTIONS, INC.	FINAL BASEWIDE 2008 SEMIANNUAL GROUNDWATER MONITORING REPORT (CD COPY ENCLOSED) [SEE RECORD # 3621 - BRAC PMO WEST TRANSMITTAL LETTER]	NO	AOC 000023 OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000006 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 00019 SITE 00021 SITE 00022 SITE 00023 SITE 00025

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00026 SITE 00027 SITE 00028 SITE 00032 SITE 00035
AR_N00236_003389 CORRESPONDENCE 2	**07-20-2009**	BRAC PMO WEST	FEDERAL FACILITY AGREEMENT EXTENSION LETTER FOR THE DRAFT COMPLETION REPORT FOR DENSE NONAQUEOUS PHASE LIQUID SOURCE REMOVAL ACTION	NO	SITE 00005
AR_N00236_003499 CORRESPONDENCE 3	**08-06-2009**	BRAC PMO WEST	TRANSMITTAL OF REPLACEMENT PAGES CONVERTING THE FINAL PROJECT WORK PLAN, STORM DRAIN AND SEWER LINE, TIME-CRITICAL REMOVAL ACTION REVISION 1. DATED 13 JUNE 2008, TO REVISION 2 (ENCLOSURE IS RECORD # 3179)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003543 CORRESPONDENCE 72	**08-06-2009**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 7 SUMMARY REPORT FOR WATER TREATMENT SYSTEM DATED 14 JULY 2009 (W/ ENCLOSURE)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003432 CORRESPONDENCE 30	**08-30-2009**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT 2010 AMENDMENT TO THE SITE MANAGEMENT PLAN (W/ ENCLOSURE) [DOCUMENT PERTAINS TO MULTIPLE BASES]	NO	BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000163 BLDG 0000301 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000005 OU 0000006 PIER 00001 PIER 00002 SITE 00001 SITE 00002

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00003
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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003472 MINUTES 24	**09-03-2009**	CHADUX - TT, JOINT VENTURE	FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002A OU 0000002B SITE 00001 SITE 00005 SITE 00024 SITE 00027 SITE 00030 SITE 00034 SITE 00035

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003431 CORRESPONDENCE 30	**09-14-2009**	BRAC PMO WEST	TRANSMITTAL OF THE 2010 AMENDMENT TO THE SITE MANAGEMENT PLAN (W/ ENCLOSURE)	NO	BLDG 0000005 BLDG 0000010 BLDG 0000014 BLDG 0000041 BLDG 0000114 BLDG 0000162 BLDG 0000163 BLDG 0000360 BLDG 0000389 BLDG 0000400 BLDG 0000410 BLDG 0000459 BLDG 0000530 BLDG 0000547 OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000005 OU 0000006 PIER 00001 PIER 00002 SITE 00002 SITE 00003 SITE 00004

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
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UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003434 CORRESPONDENCE 25	**09-30-2009**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 9 SUMMARY REPORT FOR WATER TREATMENT SYSTEM (W /ENCLOSURE)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003474 MINUTES 94	**10-01-2009**	CHADUX - TT, JOINT VENTURE	01 OCTOBER 2009 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002C OU 0000003 SITE 00001 SITE 00002 SITE 00005 SITE 00014 SITE 00028 SITE 00034
AR_N00236_003433 CORRESPONDENCE 10	**10-07-2009**	BRAC PMO WEST	TRANSMITTAL OF THE ALAMEDA COUNTY CLOSURE PLAN AND PERMIT APPLICATION (FORMS A AND B) [W/ ENCLOSURE]	NO	BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003454 CORRESPONDENCE 2	**10-16-2009**	BRAC PMO WEST	FEDERAL FACILITY AGREEMENT EXTENSION REQUEST FOR THE DRAFT FEASIBILITY STUDY REPORT	NO	OU 0000002C
AR_N00236_003501 REPORT 200	**12-01-2009**	TETRA TECH EC, INC.	FINAL ADDENDUM 1 TO THE FINAL SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN) REVISION 2, STORM DRAIN AND SEWER LINE TIME-CRITICAL REMOVAL ACTION (CD COPY ENCLOSED)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003500 CORRESPONDENCE 2	**12-04-2009**	BRAC PMO WEST	TRANSMITTAL OF THE FINAL ADDENDUM 1 TO THE FINAL SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN) REVISION 2, STORM DRAIN AND SEWER LINE TIME-CRITICAL REMOVAL ACTION (ENCLOSURE IS RECORD # 3501)	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003478 CORRESPONDENCE 3	**12-07-2009**	BRAC PMO WEST	LETTER OF NOTIFICATION THAT STORM-SEWER LINE FF SHOULD BE INVESTIGATED AS A RESULT OF DOCUMENTED ELEVATED RADIATION LEVELS (INCLUDES LOCATION MAP)	NO	BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003492 CORRESPONDENCE 2	**12-14-2009**	BRAC PMO WEST	FEDERAL FACILITY AGREEMENT EXTENSION REQUEST FOR THE DRAFT FEASIBILITY STUDY REPORT	NO	OU 0000002C
AR_N00236_001972 CORRESPONDENCE 7	**12-28-2009**	ALAMEDA REUSE AND REDEVELOPMENT AUTHORITY - ALAMEDA, CA	REVIEW AND COMMENTS ON THE DRAFT FEASIBILITY STUDY REPORT (SEE RECORD # 3344 - DRAFT FEASIBILITY STUDY REPORT)	NO	BLDG 0000005 OU 0000002C SITE 00010
AR_N00236_003572 CORRESPONDENCE 4	**01-29-2010**	BRAC PMO WEST	TRANSMITTAL OF THE FINAL REMOVAL ACTION COMPLETION REPORT, DENSE NON-AQUEOUS PHASE LIQUID REMOVAL ACTION (ENCLOSURE IS RECORD # 3573)	YES	SITE 00005
AR_N00236_003573 REPORT 7697	**01-29-2010**	SHAW ENVIRONMENTAL, INC.	FINAL REMOVAL ACTION COMPLETION REPORT, DENSE NON-AQUEOUS PHASE LIQUID REMOVAL ACTION (CD COPY ENCLOSED) [SEE RECORD # 3572 - BRAC PMO WEST TRANSMITTAL LETTER]	YES	BLDG 0000005A SITE 00004 SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003542 REPORT 143	**03-01-2010**	CHADUX - TT, JOINT VENTURE	FINAL COMMUNITY INVOLVEMENT PLAN UPDATE (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT FINAL, DATED 28 JANUARY 2010, TO FINAL AND CD COPY) [INCLUDES REPLACEMENT PAGES, DATED 01 MARCH 2010]	NO	OU 0000001 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A OU 0000004B OU 0000004C OU 0000006 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 00015 SITE 00016 SITE 00017 SITE 00018 SITE 00019

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
					SITE 00020 SITE 00021 SITE 00022 SITE 00023 SITE 00024 SITE 00025 SITE 00026 SITE 00027 SITE 00028 SITE 00029 SITE 00030 SITE 00031 SITE 00032 SITE 00033 SITE 00034 SITE 00035
AR_N00236_001967 MINUTES 40	**03-04-2010**	CHADUX - TT, JOINT VENTURE	04 MARCH 2010 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000005 SITE 00001 SITE 00002 SITE 00005 SITE 00024 SITE 00025 SITE 00027 SITE 00032 SITE 00033

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003595 MINUTES 39	**04-01-2010**	CHADUX - TT, JOINT VENTURE	01 APRIL 2010 FINAL RESTORATION ADVISORY BOARD MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, FINAL REMEDIAL INVESTIGATION REPORT DATED 18 NOVEMBER 2004, AND CD COPY)	NO	BLDG 0000005 BLDG 0000360 OU 0000002B SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00006 SITE 00007 SITE 00010 SITE 00011 SITE 00016 SITE 00021 SITE 00025 SITE 00026 SITE 00032
AR_N00236_001826 CORRESPONDENCE 2	**04-19-2010**	BRAC PMO WEST	REQUEST FOR EXTENSION FOR THE 1) REVISED DRAFT FEASIBILITY STUDY REPORT AND 2) DRAFT TIME-CRITICAL REMOVAL ACTION STORM DRAIN COMPLETION REPORT	NO	OU 0000002C SITE 00005 SITE 00010
AR_N00236_003577 CORRESPONDENCE 60	**04-27-2010**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 14 SUMMARY REPORT FOR WATER TREATMENT SYSTEM, STORM DRAIN TIME-CRITICAL REMOVAL ACTION (W/ENCLOSURE) [INCLUDES LABORATORY DATA REPORTS]	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003013 CORRESPONDENCE 55	**05-17-2010**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 15 SUMMARY REPORT FOR WATER TREATMENT SYSTEM (W/ ENCLOSURE) [INCLUDES LABORATORY DATA REPORTS]	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010
AR_N00236_003651 MINUTES 48	**06-03-2010**	CHADUX - TT, JOINT VENTURE	03 JUNE 2010 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000001 OU 0000001 OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00005 SITE 00007 SITE 00010 SITE 00016 SITE 00032
AR_N00236_003838 CORRESPONDENCE 70	**07-08-2010**	BRAC PMO WEST	TRANSMITTAL OF THE BATCH 16 SUMMARY REPORT FOR WATER TREATMENT SYSTEM, STORM DRAIN TIME-CRITICAL REMOVAL ACTION (W/ ENCLOSURE) [CD COPY ENCLOSED]	NO	BLDG 0000005 BLDG 0000400 SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003726 REPORT 2117	**08-01-2010**	AMEC EARTH AND ENVIRONMENTAL, INC.	FINAL SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING AND QUALITY ASSURANCE PROJECT PLAN) BASEWIDE GROUNDWATER MONITORING PROGRAM [CD COPY ENCLOSED] {SEE RECORD # 3725 - BRAC PMO WEST TRANSMITTAL LETTER}	NO	AOC 000023 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00019 SITE 00021 SITE 00022 SITE 00023 SITE 00032 SITE 00035
AR_N00236_003648 MINUTES 43	**08-05-2010**	CHADUX - TT, JOINT VENTURE	05 AUGUST 2010 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000163 OU 0000002A OU 0000002B OU 0000002C SITE 00035

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003700 REPORT 86	**11-01-2010**	AMEC EARTH AND ENVIRONMENTAL, INC.	FINAL FALL 2009/2010 DATA SUBMISSION, BASEWIDE GROUNDWATER MONITORING PROGRAM (CD COPY ENCLOSED) [SEE RECORD # 3699 - BRAC PMO WEST TRANSMITTAL LETTER]	NO	AOC 000023 OU 0000002A OU 0000002B OU 0000002C OU 0000003 OU 0000004A SITE 00001 SITE 00002 SITE 00003 SITE 00004 SITE 00005 SITE 00009 SITE 00010 SITE 00011 SITE 00012 SITE 00013 SITE 00019 SITE 00021 SITE 00022 SITE 00023 SITE 00032 SITE 00035 WELL 00001-MW-6S WELL 00002-MW-08S WELL 00005-3-MW-01S

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					WELL 00005-3-MW-06S
					WELL 00005-3-MW-07S
					WELL 00372-MW-01
					WELL 00398-MW-01
					WELL 00398-MW-04
					WELL 00442-MW-01
					WELL D03-01
					WELL D03-02
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					WELL D11-01
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					WELL L05-04
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					WELL M001-A

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					WELL M001-B
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					WELL M005-13
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					WELL M007-A
					WELL M007-B-01
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					WELL M039-A

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					WELL M039-B
					WELL MLS-006
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					WELL MW-004-02-04
					WELL MW-004-02-06
					WELL MW-004-02-12
					WELL MW-097-03
					WELL MW-360-01
					WELL MW-360-02
					WELL MW-360-03
					WELL MW-360-04
					WELL MW-410-01
					WELL MW-410-02
					WELL MW-410-03
					WELL MW-410-04
					WELL MW-D13-01
					WELL MW-D13-03

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					WELL MW-D13-04
					WELL MW-OR-04
					WELL MW-OR-05
					WELL OU2B-MW-01
					WELL OU2B-MW-02
					WELL OU2B-MW-03
					WELL OU2B-MW-04
					WELL OU2B-MW-05
					WELL P-005-01-MW-13
					WELL S-004-TT-MW-02A
					WELL S-004-TT-MW-02B
					WELL S-004-TT-MW-02C
					WELL S-004-TT-MW-03A
					WELL S-004-TT-MW-03B
					WELL S-011-TT-MW-04A
					WELL S-011-TT-MW-06B

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					WELL S-011-TT-MW-06C WELL S-011-TT-MW-06D WELL S-021-TT-MW-02A WELL S-021-TT-MW-05B WELL S-021-TT-MW-05C WELL S-021-TT-MW-05D
AR_N00236_003672 CORRESPONDENCE 2	**11-05-2010**	BRAC PMO WEST	TRANSMITTAL OF THE REVISED DRAFT FEASIBILITY STUDY REPORT (ENCLOSURE IS RECORD # 3673)	NO	OU 0000002C
AR_N00236_003751 CORRESPONDENCE 5	**12-20-2010**	BRAC PMO WEST	RESPONSE TO CITY OF ALAMEDA'S INFORMAL REQUEST TO MAINTAIN STORM DRAIN LINES UNDER INVESTIGATION (W/ENCLOSURE)	NO	OU 0000002C SITE 00005 SITE 00010
AR_N00236_003801 MINUTES 28	**01-06-2011**	TREVET, INC.	06 JANUARY 2011 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES [INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY]	NO	OU 0000002C SITE 00005

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003819 MINUTES 38	**02-03-2011**	TREVET, INC.	03 FEBRUARY 2011 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000005 BLDG 0000005A BLDG 0000400 OU 0000002C SITE 00005 SITE 00010 SITE 00025 SITE 00035
AR_N00236_003790 CORRESPONDENCE 2	**03-23-2011**	BRAC PMO WEST	EXTENSION LETTER FOR THE DRAFT FEASIBILITY STUDY ADDENDUM	NO	OU 0000002C
AR_N00236_003824 MINUTES 32	**04-07-2011**	TREVET, INC.	07 APRIL 2011 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000005 BLDG 0000005A BLDG 0000041 BLDG 0000400 OU 0000002A OU 0000002C SITE 00001 SITE 00002 SITE 00006 SITE 00017 SITE 00025
AR_N00236_003786 CORRESPONDENCE 2	**04-08-2011**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT FINAL FEASIBILITY STUDY REPORT (ENCLOSURE IS RECORD # 3787)	NO	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003787 REPORT 1002	**05-20-2011**	BATTELLE	FINAL FEASIBILITY STUDY REPORT, VOLUME I AND II OF II (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT FINAL DATED 8 APRIL 2011 TO FINAL, AND CD COPY) [SEE RECORDS # 3786 AND # 3878 - BRAC PMO WEST TRANSMITTAL LETTERS]	NO	BLDG 0000005 BLDG 0000400 OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_003878 CORRESPONDENCE 2	**05-20-2011**	BRAC PMO WEST	TRANSMITTAL OF THE REPLACEMENT PAGES CONVERTING THE DRAFT FINAL FEASIBILITY STUDY REPORT DATED 8 APRIL 2011 TO FINAL (ENCLOSURE IS RECORD # 3787)	NO	OU 0000002C
AR_N00236_003861 MINUTES 27	**08-04-2011**	TREVET, INC.	FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	AREA B BLDG 0000001 OU 0000002A OU 0000002B OU 0000002C SITE 00001 SITE 00002 SITE 00017 SITE 00024 WELL MW-028 WELL MW-028B
AR_N00236_003879 CORRESPONDENCE 2	**08-08-2011**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT ADDENDUM 1 TO THE FEASIBILITY STUDY REPORT (ENCLOSURE IS RECORD # 3880)	NO	OU 0000002C SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003910 MINUTES 22	**09-01-2011**	TREVET, INC.	01 SEPTEMBER 2011 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002A OU 0000002C SITE 00009 SITE 00013 SITE 00019 SITE 00022 SITE 00023 SITE 00024
AR_N00236_003962 MINUTES 26	**12-01-2011**	TREVET, INC.	01 DECEMBER 2011 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002A OU 0000002B OU 0000002C SITE 00001 SITE 00017 SITE 00024 SITE 00028
AR_N00236_003914 CORRESPONDENCE 2	**12-06-2011**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT FINAL ADDENDUM 1 TO THE FEASIBILITY STUDY REPORT (ENCLOSURE IS RECORD # 3915)	NO	OU 0000002C SITE 00005 SITE 00010
AR_N00236_003915 REPORT 3935	**01-13-2012**	TETRA TECH EC, INC.	FINAL ADDENDUM 1 TO THE FEASIBILITY STUDY REPORT (INCLUDES REPLACEMENT PAGES CONVERTING THE DRAFT FINAL ADDENDUM 1 TO THE FEASIBILITY STUDY REPORT, DATED 06 DECEMBER 2011 TO FINAL, AND CD COPY)	NO	OU 0000002C SITE 00005 SITE 00010
AR_N00236_003934 CORRESPONDENCE 2	**01-13-2012**	BRAC PMO WEST	TRANSMITTAL OF THE REPLACEMENT PAGES CONVERTING THE DRAFT FINAL ADDENDUM 1 TO THE FEASIBILITY STUDY REPORT, DATED 06 DECEMBER 2011 TO FINAL (ENCLOSURE IS RECORD # 3915)	NO	OU 0000002C SITE 00005 SITE 00010

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_003986 MINUTES 57	**03-08-2012**	TREVET, INC.	08 MARCH 2012 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA; VARIOUS HANDOUTS; AND CD COPY)	NO	OU 0000002A OU 0000002B OU 0000002C SITE 00004 SITE 00017 SITE 00024
AR_N00236_003979 CORRESPONDENCE 3	**04-03-2012**	BRAC PMO WEST	NOTIFICATION OF FEDERAL FACILITY AGREEMENT EXTENSION	NO	OU 0000002C
AR_N00236_003965 CORRESPONDENCE 2	**04-27-2012**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT PROPOSED PLAN TO ANNOUNCE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER AND PROPOSAL OF NO ACTION (ENCLOSURE IS RECORD # 3966)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004014 CORRESPONDENCE 4	**06-28-2012**	U.S. EPA - SAN FRANCISCO, CA	REVIEW AND COMMENTS ON THE DRAFT PROPOSED PLAN TO ANNOUNCE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER AND PROPOSAL OF NO ACTION (SEE RECORD # 3966 - DRAFT PROPOSED PLAN)	NO	AREA 00001 AREA 00002 OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004012 CORRESPONDENCE 8	**07-02-2012**	DTSC - BERKELEY, CA	REVIEW AND COMMENTS ON THE DRAFT PROPOSED PLAN TO ANNOUNCE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER AND PROPOSAL OF NO ACTION (SEE RECORD # 3966 - DRAFT PROPOSED PLAN)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_004013 CORRESPONDENCE 3	**07-02-2012**	RUSSELL RESOURCES	REVIEW AND COMMENTS ON THE DRAFT PROPOSED PLAN TO ANNOUNCE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER AND PROPOSAL OF NO ACTION (SEE RECORD # 3966 - DRAFT PROPOSED PLAN)	NO	BLDG 0000005 BLDG 0000400 OU 0000002B OU 0000002C SITE 00005 SITE 00010
AR_N00236_004026 MINUTES 33	**07-12-2012**	TREVET, INC.	12 JULY 2012 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA; VARIOUS HANDOUTS; AND CD COPY)	NO	BLDG 0000066 OU 0000002B OU 0000002C SITE 00002 SITE 00028 SITE 00034
AR_N00236_004010 CORRESPONDENCE 2	**08-31-2012**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT FINAL PROPOSED PLAN TO ANNOUNCE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER AND PROPOSAL OF NO ACTION (ENCLOSURE IS RECORD # 4011)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004016 REPORT 25	**09-01-2012**	BATTELLE	PROPOSED PLAN ANNOUNCING THE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER (CD COPY ENCLOSED) [SEE RECORD # 4015 - BRAC PMO WEST TRANSMITTAL LETTER]	NO	BLDG 0000400 OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_004095 MINUTES 30	**09-13-2012**	TREVET, INC.	13 SEPTEMBER 2012 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	OU 0000002B OU 0000002C SITE 00001 SITE 00002 SITE 00017 SITE 00025 SITE 00026 SITE 00035
AR_N00236_004015 CORRESPONDENCE 2	**09-25-2012**	BRAC PMO WEST	TRANSMITTAL OF THE PROPOSED PLAN ANNOUNCING THE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER (ENCLOSURE IS RECORD # 4016)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004059 PUBLIC NOTICE 2	**10-03-2012**	EAST BAY EXPRESS - OAKLAND, CA	PUBLIC NOTICE ANNOUNCING THE PUBLIC COMMENT ON THE PROPOSED PLAN	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004058 PUBLIC NOTICE 2	**10-04-2012**	ALAMEDA SUN - ALAMEDA, CA	PUBLIC NOTICE ANNOUNCING THE PUBLIC COMMENT ON THE PROPOSED PLAN	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004057 PUBLIC NOTICE 4	**10-05-2012**	BAY AREA NEWS GROUP - SAN JOSE, CA	PUBLIC NOTICE ANNOUNCING THE PUBLIC COMMENT ON THE PROPOSED PLAN	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_000821 MEETING MINUTES 9	**10-11-2012**	JAN BROWN AND ASSOCIATES	11 OCTOBER 2012 PUBLIC MEETING MINUTES, POSTER SESSION REGARDING THE PROPOSED PLAN FOR SITE 5, 10, 12, AND OPERABLE UNIT (OU) 2C (CD COPY ENCLSOED)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004042 CORRESPONDENCE 2	**10-29-2012**	PUBLIC CITIZEN	LETTER OF CONCERN REGARDING SPECIFICS OF REMOVAL OF RADIOLOGICAL CONTAMINATION, AND REQUEST FOR A MORE EXTENSIVE CLEANUP	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004107 CORRESPONDENCE 2	**10-29-2012**	PUBLIC CITIZEN	LETTER OF CONCERN REGARDING CLEANUP	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004044 CORRESPONDENCE 4	**11-02-2012**	RESTORATION ADVISORY BOARD MEMBER	REVIEW AND COMMENTS ON THE PROPOSED PLAN ANNOUNCING THE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER (SEE RECORD # 4016 - PROPOSED PLAN)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004043 CORRESPONDENCE 4	**11-03-2012**	RESTORATION ADVISORY BOARD	REVIEW AND COMMENTS ON THE PROPOSED PLAN ANNOUNCING THE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER (SEE RECORD # 4016 - PROPOSED PLAN)	NO	BLDG 0000005 BLDG 0000005A BLDG 0000400 OU 0000002C SITE 00005 SITE 00010 SITE 00012

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_004139 MINUTES 35	**11-08-2012**	TREVET, INC.	08 NOVEMBER 2012 FINAL RESTORATION ADVISORY BOARD (RAB) MEETING MINUTES (INCLUDES AGENDA, VARIOUS HANDOUTS, AND CD COPY)	NO	BLDG 0000007 BLDG 0000025 BLDG 0000066 BLDG 0000113 BLDG 0000114 BLDG 0000360 BLDG 0000410 BLDG 0000530 CAA 000005B CAA 000013 OU 0000002B OU 0000002C OU 0000005 SITE 00001 SITE 00002 SITE 00017 SITE 00032
AR_N00236_004060 CORRESPONDENCE 5	**11-13-2012**	CITY OF ALAMEDA - ALAMEDA, CA	REVIEW AND COMMENTS ON THE PROPOSED PLAN ANNOUNCING THE PREFERRED ALTERNATIVES TO ADDRESS AREAS WITH CONTAMINATED SOIL AND GROUNDWATER (SEE RECORD # 4016 - PROPOSED PLAN)	NO	BLDG 0000005 BLDG 0000400 OU 0000002C SITE 00005 SITE 00010 SITE 00012
AR_N00236_004165 REPORT 1326	**07-01-2013**	TETRA TECH EC, INC.	FINAL FIELD SUMMARY REPORT FOR DRAIN LINES (CD COPY ENCLOSED) [SEE RECORD # 4164 - BRAC PMO WEST TRANSMITTAL LETTER]	NO	OU 0000002C

UIC No. _ Rec. No. Record Type Approx. # Pages	Record Date	Author Affiliation	Title	Imaged?	Sites
AR_N00236_004164 CORRESPONDENCE 3	**07-16-2013**	BRAC PMO WEST	TRANSMITTAL OF THE FINAL FIELD SUMMARY REPORT FOR DRAIN LINES (ENCLOSURE IS RECORD # 4165)	NO	OU 0000002C
AR_N00236_001490 CORRESPONDENCE 2	**11-14-2013**	BRAC PMO WEST	TRANSMITTAL OF THE DRAFT RECORD OF DECISION (ENCLOSURE IS RECORD # 1491)	NO	OU 0000002C SITE 00005 SITE 00010 SITE 00012

Total Estimated Record Page Count: 76,782

Total Records: 336

(([SSIC NUMBER]="5090.3.A.")) AND [UIC NUMBER]='N00236'
No Keywords
Sites=OU 0000002C;SITE 00005;SITE 00010;SITE 00012
No Distribution
No FRC Box number
No Litigation Case Number

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
16	**DON BRAC Program Management Office website**	**Section 2.9.1**	http://www.bracpmo.navy.mil/

Item	Reference Phrase In ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
17	meeting transcript	Section 3	Public Meeting Transcript, October 11, 2012, Public Comment Period for Proposed Plan for Operable Unit 2C, former NAS Alameda, Alameda, California.

PROPOSED PLAN FOR OPERABLE UNIT 2C,

INSTALLATION RESTORATION SITES 5, 10, AND 12,

ALAMEDA POINT

PUBLIC MEETING

POSTER SESSION

ALAMEDA POINT, CALIFORNIA

Thursday, October 11, 2012

Alameda Point Main Office Building 1

950 West Mall Square, Room 201

Alameda Point

Alameda, California

Reported by:

VALERIE E. JENSEN, CSR No. 4401

JAN BROWN & ASSOCIATES

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(415) 981-3498 or (800) 522-7096

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

2

3 AGENCY, NAVY STAFF AND CONSULTANT REPRESENTATIVES:

4 DEREK ROBINSON, U.S. Navy

5 MARY PARKER, U.S. Navy

6 JAMES FYFE, California Department of Toxic Substances Control

7 XUAN-MAI TRAN, U.S. Environmental Protection Agency

8 ANDREW BULLARD, Battelle Memorial Institute

9 JOHN WEST, San Francisco Bay Regional Water Quality Control Board

10 TOMMIE JEAN VALMASSY, Tetra Tech EM Inc.

11

COMMUNITY MEMBERS AND INTERESTED PARTIES:

12

DOUG deHAAN, Alameda City Council
13 PETER RUSSELL, City of Alameda
JAMES D. LEACH, Restoration Advisory Board
14 CAROL GOTTSTEIN, Restoration Advisory Board
DANIEL HOY, Restoration Advisory Board
15 BETH MORGAN, Restoration Advisory Board
BRUCE MARVIN, Geosyntec
16 WILLIAM SMITH, Sierra Club
JANE SULLWOLD
17 GRETCHEN LIPOW
FRED GARDNER
18 ROBERT TODD
S. GALLEYNOR

19

20

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OCTOBER 11, 2012 6:31 P.M.

MR. ROBINSON: At this point, we are going to start the Proposed Plan Public Meeting for Operable Unit 2C.

It is a poster board session. Andy, myself and Mary will be up in front of the poster boards. We have lots of different information. We can answer your questions on any of these topics.

We also have in attendance Mr. John West from the Water Board, Mr. Jim Fyfe from DTSC and Ms. Xuan-Mai Tran from EPA, who can also answer your questions.

We are officially starting the Proposed Plan Meeting on Operable Unit 2C.

If you do have any comments, please go to the stenographer. She can take your verbal comments.

We also have a written comment form, if you would rather do that, that you can fill out. The sheets are right up at the desk.

(Off the record at 6:32 p.m.)

///

VERBAL COMMENTS

(On the record at 7:27 p.m.)

MR. SMITH: I would just like to give a broad overview of my reaction to the suitability of the

1 remedial plan here, the proposed plan for Operable Unit
2 2C, Installation Restoration Sites 5, 10 and 12 of the
3 former NAS Alameda.
4 The plan is a good synthesis of the RI,
5 the RA and the FS, but it still is incomplete for --
6 especially for evaluating the community acceptance
7 criteria and, in particular, it doesn't provide the
8 information we need to identify increased subsequent
9 costs for reusing the land and replacing old structures.
10 And, for example, Building 5, the
11 preferred alternative would leave metals in place
12 under the concrete slab. So, if we ever tear that
13 building down and tear up the concrete slab, then the
14 construction costs will increase, and we'll have to pay
15 for the disposal of the metal soil.
16 Another cost that we have -- another
17 concern -- even bigger concern -- is the cost of
18 removing RAD from around the piping, especially
19 under the street. That's a cost that will come up very
20 shortly along West Tower Avenue. The RAD is proposed
21 to be left in place there. And as soon as the street
22 movers come in and the -- street construction and
23 utility layers come in to put in the infrastructure
24 needed for the street, they're going to have to deal
25 with that RAD, potentially.

1 So, in short, we need additional financial
2 information to judge whether or not a alternative is
3 acceptable. And I think it's important, because from
4 my talking with a knowledgeable fellow in the community
5 about this, he thinks that the metal-contaminated
6 soil under Building 5 is probably a small cost -- a few
7 hundred thousand dollars -- to dispose of, but the RAD
8 along the long pipelines is a much more -- could cost
9 millions to get rid of. So that would suggest that,
10 if it's a higher cost, we should look harder at the
11 higher-cost alternatives which leave the site in a
12 better condition for the longer term, and we can't
13 do that because we don't have that information in this
14 report.
15 Another thing that we need to assess the
16 alternatives is to get a sense of what they actually
17 physically accomplish in terms of contaminant reduction.
18 The report presents the remedial goals for it which
19 presents final concentration of contaminants have
20 to be less than; it does not present the initial
21 concentration of the contaminants.
22 We need the initial concentration of the
23 contaminants presented. That information is available
24 in the Remedial Investigation, but I don't have the
25 time to go back and dig up that huge, long document.

The other thing which would be very useful is if we can compare -- the community could compare the residential goals with -- the remedial goals for occupational use versus the remedial goals for residential use. Again, that would be useful for determining community acceptance, which is a criteria. So that would give us a sense of how much additional work would be required to meet the residential goals instead of just the occupational goals.

So, to reiterate, the alternatives that leave the RAD in place are unacceptable. It's a questionable alternative to leave the metals in place.

The petroleum hydrocarbons are less of a concern. And I see they're not addressed, anyway, in this remedial plan; they're in another program. That's fine.

So, all in all, the plan was helpful, fairly easy to read; it just lacks a little information to really formulate the community acceptance.

Thank you.

(Off the record at 7:33 p.m.)

///

(On the record at 7:34 p.m.)

MR. LEACH: I have three major comments. The first one is I believe that the industrial waste

1 lines should be removed rather than just plugged with
2 concrete.
3 The second thing is they should -- if
4 Building 5 is not contaminated itself, then it should
5 be removed, because it's an eyesore and the metal is
6 valuable enough that it might be economical to get.
7 The third thing is institutional controls,
8 as a remedy, have not worked in the past, and I object
9 to any remediation that relies on institutional
10 controls.
11 (Off the record at 7:35 p.m.)
12 ///
13 (On the record at 7:43 p.m.)
14 MS. GOTTSTEIN: On Page 3 in the Removal
15 Action, the bottom paragraph, beginning "approximately
16 700 feet," the text states that a great deal of
17 radiologically-impacted drain line was removed by 2000,
18 and then it jumps to the Time Critical Removal Action
19 that was completed between 2008 and 2010, but there
20 really isn't a good explanation as to why -- it's
21 something that was always there -- it became time
22 critical in 2008. Because it's been there.
23 I was just talking to the Navy
24 representative, Derek. He said, yes, they could put a
25 line in there about how the detection methods improved

1 dramatically between the year 2000 and the year 2008
2 as well as the threshold for radiological contamination
3 that affects human health.
4 I think there should be some kind of
5 explanation why over that eight-year period -- what
6 happened to suddenly mandate the media addressing of
7 the problem in 2008 that they should have found earlier.
8 I don't know if that came out clearly or not.
9 (Discussion off the record)
10 (Record read)
11 (Record closed at 8 p.m.)
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STATE OF CALIFORNIA) SS.

I do hereby certify that the poster session 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 25th day of October, 2012.

VALERIE E. JENSEN

Certified Shorthand Reporter