BASELINE

HUMAN HEALTH RISK ASSESSMENT

SEPTEMBER 1998

SEABREEZE YACHT CENTER
Oakland, California

For:

Port of Oakland
Oakland, California

S9171-C1

5900 Hollis Street, Suite D • Emeryville, California 94608 • (510) 420-8686

PORT OF OAKLAND

September 15, 1998

Mr. Derek Lee
S.F. Bay RWQCB
1515 Clay Street, Suite 1400
Oakland, CA 94612

Mr. Barney Chan
Alameda County Health Agency
Department of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, CA 94502

Subject: **Transmittal of Human Health Risk Assessment**
Former Seabreeze Yacht Center, 280 Sixth Avenue, Oakland

Dear Mr. Lee and Mr. Chan:

Enclosed please find a copy of Baseline Environmental Consulting's "Human Health Risk Assessment" for the former Seabreeze Yacht Center. The risk assessment evaluated human health risks to proposed current site users (beach cleanup workers and commercial workers) and potential future site users (occasional utility workers). Beach cleanup workers (adults and children) were assumed to participate in shoreline cleanups once a month for ten years. Commercial workers (adults only) were assumed to be present at the site 5 days/week for 25 years. Future occasional utility workers (adults only) were assumed to be present at the site for 20 days/year for 25 years.

Based on the results of the human health risk assessment, risks to proposed current users (beach cleanup workers and commercial workers) and future occasional utility workers is below threshold values. Consequently, remedial actions or institutional controls are not necessary for these uses. If land uses change, the risk assessment will be amended, as necessary.

SEP 16 '98 PM 2:55

530 Water Street ■ Jack London Square ■ P.O. Box 2064 ■ Oakland, California 94604-2064
Telephone (510) 272-1100 ■ Fax (510) 272-1172 ■ TDD (510) 763-5703 ■ Cable address, PORTOFOAK, Oakland

If you have any questions, please contact me at 272-1467.

Sincerely,

Diane Heinze, P.E.
Associate Environmental Scientist

encl: Baseline Environmental "Human Health Risk Assessment"

cc: w/encl:
Michele Heffes, legal
Bob Jones, CRE
Jonathan Redding, Fitzgerald, Abbott & Beardsley

cc: w/out encl:
Chris Perry, CCC
Julie Pettijohn, Baseline Environmental Consulting

SEP 16 '98 PM 2:55

C:\mydocs\seabreeze\hhra.trans

BASELINE

ENVIRONMENTAL CONSULTING

10 September 1998
S9171-C1

Diane Heinze
Port of Oakland
Environmental Department
530 Water Street
Oakland, California 94607

Subject: Human Health Risk Assessment, Seabreeze Yacht Center, Oakland, California

Dear Ms. Heinze:

This letter transmits the *Human Health Risk Assessment for the Seabreeze Yacht Center,* 280 Sixth Avenue, Oakland, California. This risk assessment evaluates health risks for current and potential future site users consisting of beach cleanup workers, commercial workers, and occasional utility workers. Should you have any questions regarding this report, or need further information, please do not hesitate to contact us at your convenience. We will look forward to receiving your comments.

Sincerely,

Julie Pettijohn, M.P.H.
Environmental Health Scientist

Yane Nordhav
Principal

JP:YN:cr
Enclosures

s9171-c1.hra.wpd - 9/10/98

5900 Hollis Street, Suite D • Emeryville, CA 94608 • (510) 420-8686 • FAX: (510) 420-1707
Emeryville Petaluma San Francisco

HUMAN HEALTH RISK ASSESSMENT

SEPTEMBER 1998

SEABREEZE YACHT CENTER
Oakland, California

For:

Port of Oakland
Oakland, California

S9171-C1

BASELINE Environmental Consulting
5900 Hollis Street, Suite D • Emeryville, California 94608
(510) 420-8686

TABLE OF CONTENTS

HUMAN HEALTH RISK ASSESSMENT

Seabreeze Yacht Center
280 Sixth Avenue
Oakland, California

INTRODUCTION

The Seabreeze Yacht Center project site (site) is located at the terminus of Sixth Avenue in Oakland, California (Figure 1). The site is shown in Figure 2 and includes: Clinton Basin Canal (part of the Oakland Inner Harbor); unpaved, vacant land located at the southern terminus of Sixth Avenue along Clinton Basin; an abandoned dry dock; paved areas where Port of Oakland (Port) buildings and a café are located; a paved parking lot adjacent to the Embarcadero at the north end of Clinton Basin; and unpaved areas in the western portion of the site that are currently used for storing shipping containers by the Orient Reefer Container Services Facility. The site is located on a portion of the City of Oakland Assessor's Parcel Numbers (APN) 0-460-3 and 0-460-4 (BASELINE, 1994d).

This document evaluates human health risks to current and future site users from potential exposure to site contaminants in soil and groundwater underlying the site, as identified during environmental investigations at the site from 1990 to 1998. The site history, findings of previous environmental investigations, and the human health risk assessment process are described below.

SITE HISTORY

A site history investigation of the site was completed by BASELINE in 1994 by reviewing Port records, information available at the City of Oakland Public Library, Sanborn Fire Insurance maps, regulatory records, and historic aerial photographs (BASELINE, 1994d). The site land use history was dominated by two activities: marine services facilities and operation of an electric power generating station. The marine services activities were primarily centered on the northwestern portion of Clinton Basin. These activities included operation of wharves and storage and maintenance of boats at docks and on land. The land areas were predominately unpaved. An electric power plant on the western portion of the property was operated from 1909 until the late 1950s. The plant was apparently abandoned in 1959 and demolished sometime between 1977 and 1979. The operation of the plant included storage of petroleum fuel in a large aboveground steel tank located on the southern portion of the site. Other historical site uses included a lumber operation at the northern end of Clinton Basin. Details of the electrical power plant operations and marine services activities are described below.

Electric Power Plant

The electric power plant was identified in several fire insurance maps from 1911 to 1952 as containing large boilers, fueled with petroleum hydrocarbons, which produced steam for three 3,500-kilowatt power turbines at the plant. Two water supply wells were located southwest of the plant and provided groundwater for steam production. The water supply was stored in an elevated

250,000-gallon water tank. Salt water was pumped from an intake on the Oakland Inner Harbor through a tunnel to provide cooling water for the steam condensers. This cooling water was discharged to Clinton Basin via a separate tunnel. Operation of the boilers likely required periodic "blow down" to remove accumulated soils. Typical "blow down" discharges from boilers contain detectable concentration of metals. Lead fittings were common in plumbing systems constructed during this time and could also have contributed lead to water within the system. No data indicating the type of management of "blow down" discharges were found in records reviewed (BASELINE, 1994d).

A 135,000-gallon, steel-walled aboveground fuel storage tank was located south of the plant and contained heavy petroleum fuel (bunker C) for powering the plant boilers. The tank was placed in a concrete containment structure. An aboveground supply pipeline extended northeast of the tank and then northwest toward the plant. The concrete containment structure was apparently filled with soil following decommission of the tank.

Aerial photos from 1959 and 1969 show that significant filling activities occurred at the southwestern end of the site at this time. Details of the filling operations were not available, however, the photos indicate that approximately one acre was filled. Later photographs indicate that only minor amounts of fill were placed after 1969. Following demolition of the plant, most of the area of the former plant was used for storage of shipping containers by 1985.

Marine Services

Photographs from 1911 indicate two wharves along the northwestern margin of Clinton Basin. In a 1930 aerial photo, the wharf had been extended. Drydocked boats and building associated with the lumber operations were observed in the 1930 photo of the site.

By 1950, portions of the wharf had been removed and the area behind the wharf dredged. The area was leased at the time of the photo for boat repair and storage activities. By 1950, lumber operation at the northern end of Clinton Basin had been removed and the area began to be used for boat storage and automobile parking. The storage area for boats had expanded by 1977. This area was included in a lease to Seabreeze Yacht Center, Inc. for boat repair/storage. By 1985, the wharf had been removed and was replaced by additional boat berths.

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

In September 1990, BASELINE conducted a preliminary soil investigation at the site for the Port of Oakland in response to Notices of Violation issued in 1988 and 1989 by Alameda County (BASELINE, 1990). In response to the Notices of Violation, BASELINE collected 43 soil samples at 0 to 5.5 feet below ground surface (bgs) from fifteen locations in September 1990 (SB-1 through SB-15) (see figure in Appendix B, Figure B-1 for sample locations). The samples were analyzed for metals, and selectively analyzed for oil and grease and volatile organic compounds (VOCs). Sample activities, including analytical results, were documented in a report by BASELINE (1990). Analytical results indicated levels of lead and copper exceeding hazardous waste levels, as defined

SB-1 thru SB15

by Title 22 of the California Code of Regulations (CCR), at four shallow soil sampling locations (SB-6, SB-9, SB-12, and SB-14).

From November 1990 through December 1991, BASELINE conducted a Phase II Remedial Investigation at the site. A total of 59 soil samples were collected and selectively analyzed for lead and copper near the four locations identified above as exceeding hazardous waste thresholds, (SB-6A through SB-6H; SB-9A through SB-9H; SB-12A through SB-12G; and SB-14A through SB-14G) up to 1.5 feet bgs (Appendix B, Figure B-1). Sixteen of the samples contained soluble concentrations of lead above the Soluble Threshold Limit Concentration (STLC) of 5 mg/L for hazardous wastes. One soil sample contained soluble copper at a level greater than the STLC for copper of 25 mg/L. None of the soil samples contained total concentrations above the total threshold limit concentration (TTLC) for lead or copper. These results were documented in a report by BASELINE (1992).

Two groundwater monitoring wells, MW-SB1 and MW-SB2, were also installed and sampled in April 1991 (BASELINE, 1992) (Appendix B, Figure B-3). The groundwater samples did not contain lead, oil and grease, or volatile organic compounds (VOCs) above the laboratory reporting limits. Copper was identified in the groundwater samples from both wells above the laboratory reporting limits. A second groundwater sampling event in July 1991 did not identify lead or copper above the laboratory reporting limits; the samples were not analyzed for oil and grease or VOCs (BASELINE, 1992).

In June 1991, soils within the concrete containment structure, formerly containing the aboveground fuel oil tank, were excavated and treated on-site by the Port's contractor. Stockpile soil samples were collected and analyzed for total extractable hydrocarbons, metals, VOCs, and semi-volatiles. The treated soils (approximately 700 cubic yards) were later transported off site in April 1994 for disposal (BASELINE, 1992).

In January, April, May and August 1994, a Phase III Remedial Investigation was implemented at the site following approval of a workplan by Alameda County. The investigation included collection of additional soil samples (51 samples from 27 locations[1]), from 0.5 to 2.0 feet below ground surface, associated with the four sampling locations previously identified as having lead and/or copper concentrations in excess of TTLCs and/or STLCs. The soil samples were collected at five-foot increments radially outward from the four former sampling locations and selectively analyzed for total lead, total copper, soluble lead and soluble copper (SB-6H through SB-6L; SB-9 through SB-9O; SB-12A through SB-12L; SB-14C, SB-14H, and SB-14I) (Appendix B, Figure B-1) (BASELINE, 1994a). Based on the findings of this investigation, the approximate extent of soils containing hazardous concentrations of lead and copper was identified around locations SB-6, SB-9, SB-12 and SB-14. Soluble concentrations of these metals appeared to be generally restricted to the shallow soil column within 2.0 to 3.0 feet bgs (BASELINE, 1994a).

[1]Only 36 of the samples were analyzed.

In January 1994, a water sample of standing water, two concrete core samples from the base of the containment structure (SB-CC4C and SB-CC5C at 0.5 foot bgs), and two samples from beneath the concrete base (SB-CC4S and SB-CC5S at approximately 3 feet bgs) were collected and analyzed for total extractable hydrocarbons (THE), oil and grease, and total copper and lead (Appendix B, Figure B-1). These results indicated that releases from the concrete containment structure, which previously held the aboveground tank, had occurred (BASELINE, 1994a).

Also during the Phase III Remedial Investigation, quarterly groundwater samples began to be collected for one year beginning in April 1994 from the two wells (MW-SB1 and MW-SB2) and analyzed for total lead and total copper, VOCs, and total oil and grease (Appendix B, Figure B-3). Lead and copper were reported above laboratory reporting limits for groundwater samples collected in 1994. Oil and grease were reported below laboratory reporting limits. Common laboratory contaminants (i.e., acetone and 2-butanone) were also reported in groundwater samples (BASELINE, 1994a).

Soils were later removed immediately around the concrete containment structure and seven verification samples (SB-CC1 through SB-CC7) were collected in April at 2.0 to 3.5 feet bgs and analyzed for lead, TEH as diesel, kerosene, and motor oil (Appendix B, Figure B-1). During excavation, a black viscous liquid emanated from under the containment foundation. The source is unknown, but may have been related to an aboveground tank providing bunker C fuel for the former power generating plant. The product was removed and added to the stockpiled soils. A sample of the product was subjected to fingerprint analysis in an attempt to determine the type of petroleum hydrocarbon, as well as an analysis of polynuclear aromatic hydrocarbons (PNAs). An additional product sample collected was analyzed for VOCs and Title 26 metals. The results indicated that the product may be aged bunker C. Riprap rock was placed around the perimeter of the concrete structure and on top of the Bay Mud to prevent erosion (BASELINE, 1994a).

Additional soil samples from nineteen areas north and west of the concrete containment structure were also collected in August 1994 and analyzed for total petroleum hydrocarbons as bunker C (BC-1 to BC-19) from 0.5 to 4.0 feet bgs (Appendix B, Figure B-2). The highest concentrations of bunker C were generally identified near the former location of an aboveground product line extending from the former aboveground tank in the concrete containment toward the former power generating plant (BASELINE, 1994a).

In November and December 1994, an additional 20 soil samples were collected from 0 to 6.5 feet bgs (BD-1 through BD-5; MW-SB3 through MW-SB5) and three additional monitoring wells were installed at the site (MW-SB3, MW-SB4, and MW-SB5) (Appendix B, Figure B-3). The three wells, as well as the two previous wells installed (MW-SB1 and MW-SB2), were also sampled. Soil samples were selectively analyzed for petroleum hydrocarbons as diesel, kerosene, and bunker C, metals, VOCs, and creosote. Groundwater samples were selectively analyzed for petroleum hydrocarbons as gasoline, diesel, and bunker C, metals, VOCs, and benzene, toluene, ethylbenzene, and xylenes (BASELINE, 1994c). Petroleum hydrocarbons as bunker C and diesel were identified in all soil samples collected. The soil quality data indicated contamination of the soils in the unsaturated soil column in and around the footprint of a former power plant and along and near a

former fuel pipeline. Groundwater was also identified as containing petroleum hydrocarbons as bunker C and diesel, and for one sample, total lead and total copper.

In March 1995, soil samples were collected from six shoreline locations[2] (for a total of 15 samples, Shore-1-Surface to Shore-6-2.0 (Appendix B, Figure B-4), eight soil boring locations (for a total of 27 samples, T-1 through T-4 and TP-1A through TP-4) (Appendix B, Figure B-5), and groundwater samples were collected for nine groundwater monitoring well locations (MW-1 through MW-5, plus four additional wells installed by another Port consultant, PW-1 through PW-4[3]) (Appendix B, Figure B-9). Soil and groundwater samples were selectively analyzed for total petroleum hydrocarbons (TPH), metals, PCBs (soil samples only) and semi-volatile organic compounds. A tidal study was also completed to determine the extent of tidal influence in groundwater monitoring wells at the site. The results indicated limited tidally-influenced water level fluctuations at the site, and groundwater beneath the site flows toward and discharges to Clinton Basin. Detectable levels of all analytes were reported for soil and groundwater samples collected during this investigation (BASELINE, 1995a).

In August 1995, eleven additional borings for a total of 26 samples were completed in areas associated with the former plant, at depths from 1.0 to 6.0 feet bgs (S1 through S-11) (Appendix B, Figure B-6). The samples were selectively analyzed for PCBs, TPH as diesel, motor oil, and bunker C, total lead and total copper. All analytes were reported above laboratory reporting limits in at least one sample analyzed. The site investigation also included a geophysical investigation for the purpose of identifying possible underground structures associated with the former plant. Six trenches were excavated during the investigation to locate possible subsurface structures: these included a possible underground pipeline, a discharge tunnel, and an intake tunnel located parallel to 5th Avenue. Soil samples were collected of excavated materials for appropriate offsite disposal (BASELINE, 1995c).

In October 1995, ten soil samples were collected from five locations (S-13 through S-16B at depths of 4.0 to 9.0 feet bgs) around the former tank location (Appendix B, Figure B-7). TPH as diesel, motor oil or bunker C were reported above laboratory reporting limits for all of the samples analyzed. The sample chromatogram for diesel and motor oil did not resemble the hydrocarbon standard (BASELINE, 1995d).

In November and December 1996, the concrete containment structure and soils beneath and surrounding the structure to a depth of 2.0 to 3.0 feet bgs were removed. Water generated by dewatering activities were treated and discharged, under permit, to the East Bay Municipal Utility District (EBMUD) sanitary sewer system. Verification soil samples were collected following excavation of the soils from beneath the concrete containment structure to determine the levels of petroleum hydrocarbons remaining at the limits of excavation (C-1 through C-7; collected at 0.5 to 1.0 foot bgs); verification samples were also collected within a trench located beyond the

C1-C7

---

[2] Soil samples along Clinton Basin were collected above the mean tide mark.

[3] Soil samples were also collected during the installation of PW-1 through PW-4 and selectively analyzed for TPH as diesel, metals, semi-volatiles, and soil parameters (10 foot bgs samples only).

containment area completed to remove free product identified during excavation activities (CS-1 through CS-3; collected at 5.0 to 5.5 feet bgs) (Appendix B, Figure B-8) (BASELINE, 1997a).

Total lead and copper levels in the containment area verification samples were below the TTLC for lead and copper and less than ten times the STLC. One of the seven samples contained detectable levels of TPH as diesel (at 33 mg/kg); the remaining soil samples did not contain TPH as diesel, motor oil, or bunker C above laboratory reporting limits. Trench sidewall verification samples contained up to 22 mg/kg TPH as diesel[4,5] and 44 mg/kg TPH as motor oil. Bunker C was not identified in any of the soil samples from the trench sidewalls. Excavated soils and debris were transported off-site for disposal following classification of the waste by stockpile sampling. Following removal of contaminated soils, the excavation was backfilled with soil and capped with filter fabric, fine grained and then coarse grained fill, another filter fabric, and a layer of riprap (BASELINE, 1997a).

Quarterly groundwater sampling of monitoring wells PW-2, MW-SB2, MW-SB3, MW-SB4, and MW-SB5 continued in June-July 1996, September 1996, December 1996, March 1997, and June 1997 (BASELINE, 1996 a, 1996b, 1997b, 1997c, and 1997d) (Appendix B, Figure B-9). Annual groundwater sampling of MW-SB2, MW-SB3, MW-SB4, and MW-SB5 was also completed in January 1998 (BASELINE, 1998). During these sampling events, the maximum concentration of total lead was 0.014 mg/L; total copper, 0.065 mg/L; TEH as diesel, 0.29 mg/L; TEH as bunker C, <0.5 mg/L; and TEH as motor oil, 0.28 mg/L. The sample chromatograms for diesel and motor oil did not resemble the hydrocarbon standard. No additional soil or groundwater samples were collected as part of this health risk assessment.

CONCEPTUAL SITE MODEL

Evaluation of potential health risks to human receptors for chemical contamination at the site was based on a conceptual site model (CSM). The CSM summarizes contaminant sources, relevant fate and transport mechanisms, exposure pathways, routes of exposure, and potential receptors. Specific elements in the CSM include historical and current contaminant sources, land and groundwater use, chemicals of potential concern, potential for contaminant migration, and potential exposure pathways, routes, and receptors. The conceptual site model is shown in Figure 3 and is summarized below.

Physical Setting and Sources of Contamination

Sources of contamination identified in soil and groundwater underlying the site are likely related to the major historic and current operations throughout the site, including marine service operations, operation of an electrical power plant, and filling activities. Marine service and electrical power

---

[4]The diesel did not resemble the laboratory standard.

[5]The method blank for the TPH analysis of the trench samples contained 5.1 mg/kg of diesel. The laboratory indicated that the diesel contamination resulted from the silica gel cleanup column and likely affected the diesel results from all three samples from the trench.

plant operations may have resulted in surface spills to soil or surface water, releases from the use and storage of hazardous materials or equipment operated at the site, releases attributed to facility operations (e.g, "blow down" events), and leaks from underground and aboveground storage tanks and pipelines. These sources are suspected to have caused the observed levels of contamination in soil and groundwater underlying the site. Soil contamination at the site appears to be generally restricted to the shallow soil column within the first few feet below the existing ground surface, which coincides with these former and current site operations.

Land Use

The northwestern margins of Clinton Basin are currently used for storage and maintenance of boats; the eastern margins of the Basin consist of riprapped slopes. A café and buildings owned by the Port are located to the western side of Clinton Basin. Berthing facilities for small boats are also located in Clinton Basin. The southwestern, unpaved portion of the site is used for storage of shipping containers. The remainder of the site is vacant. With the exception of the area around Clinton Basin, the site is unpaved and fenced to prevent trespassers from entering the site. Adjacent areas are used for commercial/industrial and residential purposes.

Lithology and Groundwater Use

The site is underlain by artificial fill materials, including sand, gravel, and debris to a depth of about 4.0 to 5.0 feet bgs. The fill is underlain by clay materials (Bay Muds). The Bay Mud is underlain by the San Antonio formation, inclusive of the Merritt Sands. Shallow groundwater at the site generally occurs at the interface between the fill and Bay Muds at depths of less than 2.0 feet bgs to greater than 15.0 feet bgs, with an average groundwater depth of approximately 4.5 feet bgs.

Groundwater at the site is not currently used as a drinking water source. Electrical conductivity values measured during the last four groundwater monitoring events (December 1996, March and June 1997, and January 1998) generally exceed 5,000 μmho/cm, and is therefore not considered by the State Water Resources Control Board (SWRCB) as a potential drinking water source (SWRCB, Resolution No. 88-63). The electrical conductivity values for groundwater in monitoring wells PW-2 ranged from 29,000 to 32,000 μmho/cm; MW-SB2, 13,000-21,000; MW-SB3, 19,000-27,000; MW-SB4, 1,000-22,000; and MW-SB5, 29,000-30,000 (BASELINE, 1997b-d, 1998). All drinking water at the site is supplied by EBMUD.

Environmental Setting and Climate

The environmental setting is characterized by a moderate climate, ruderal vegetation, and the presence of the Clinton Basin. The average minimum air temperature approximates 50.2° F; maximum air temperature, 65° F, and average total precipitation, 18.11 inches (Western Regional Climate Center, 1998). Winds are predominately westerly to northwesterly reaching speeds of approximately 16 ft/sec for the Oakland Area (USDC, 1989).

DATA SUMMARY AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC)

COPC were selected from the analytical results for soil and groundwater samples collected at the site as identified in seventeen reports/memoranda prepared by BASELINE for the Port of Oakland (BASELINE 1990, 1991, 1992, 1994a-c, 1995a-d, 1996a,b, 1997a-d, 1998). No additional soil or groundwater samples were collected during the preparation of this health risk assessment. All chemicals in soil and groundwater reported above the laboratory reporting limits in at least one soil or groundwater sample were considered in the screening of COPC, with the exception of soil samples collected as part of stockpile samples or soil samples collected in areas that were later excavated and subsequently removed. Chemicals not reported above laboratory reporting limits in soil or groundwater samples collected at the site were excluded from further consideration as COPC. Standard laboratory quality assurance (quality control) procedures were followed during the analysis of soil and groundwater samples collected from the site. The analytical results and quality assurance documentation can be found in the referenced reports, previously submitted to the Port.

During the screening process, chemicals were selected as COPC if they met one or more of the following criteria:

- Chemical is known to be associated with historical or current site uses (e.g., bunker C fuel).
- Exceeded the U.S. Environmental Protection Agency Preliminary Remediation Goals (PRGs) for soil, developed for residential site users, (Smucker 1998)[7] for soil data. PRG's
- Exceeded drinking water Maximum Contaminant Limits (MCL) (Title 22, California Code of Regulations Sections 64431 and 64444), or California Environmental Protection Agency, Public Health Goals for Chemicals in Drinking Water (Cal/EPA, 1997), or U.S. EPA, Region IX, tap water preliminary remediation goals (PRGs) (Smucker, 1998) (where MCLs and public health goals were not available) for groundwater data. MCL's
- Reported at greater than ten times the laboratory reporting limit for common laboratory contaminants (i.e., acetone, 2-butanone). ✓

Based on this screening process, chemicals included as COPC in soil and groundwater are summarized in Tables 1 and 2. Petroleum hydrocarbons, including total petroleum hydrocarbons as diesel, motor oil, and bunker C fuel; oil and grease; and total recoverable petroleum hydrocarbons, were evaluated as COPC using an indicator chemical approach in accordance with ASTM guidelines (1995). Indicator chemicals including the polycyclic aromatic hydrocarbons (PAHs) -- acenaphthylene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(g,h,i)perylene,

---

[7] Preliminary remediation goals (PRGs) for residential land uses were developed by U.S. EPA by combining toxicity values with standard exposure factors for residential site users to estimate contaminant concentrations in environmental media that are considered protective of humans over a lifetime of exposure. Chemical concentrations above residential PRG levels would warrant further evaluation of potential risks to site users.

dibenz(a,h)anthracene, and phenanthrene -- were selected as indicator COPC for petroleum hydrocarbons, according to the procedure above.

POTENTIAL HUMAN RECEPTORS AND EXPOSURE PATHWAYS

An exposure pathway generally consists of four elements: 1) a source and mechanism of chemical release, 2) a retention or transport medium, 3) a point of potential contact with the contaminated medium, and 4) an exposure route by the receptor at the contact point. An exposure pathway is incomplete is any of the above-mentioned elements is missing.

Current On-Site Land Uses and Receptors

The only potential human receptors identified under current land uses include individuals performing beach cleanup activities along Clinton Basin/Oakland Inner Harbor and workers at the container facility located on the southwestern portion of the property. The site is not used for residential purposes, and trespassers are prevented from entry to the site by fences along the northern and western site boundaries. Beach cleanup workers (adults and children) and commercial site workers (adults only) were evaluated as exposure scenarios under current land use conditions, where the site is mainly unpaved (Figure 3).

Potential Future On-Site Land Uses and Receptors

Potential future land use of the site is unknown; however, the Port has expressed interest in developing the site. Possible future site uses could include development of the site for commercial uses where the site is assumed to be paved. It is also possible that this future land use may include the need for utility work to be conducted on the site for a limited number of days per year as part of this future exposure scenario, where excavation of specific areas of the site for utility work would take place. Occasional utility workers (adults) were evaluated as a potential future exposure scenario in this human health risk assessment. The site was assumed to be paved, where specific areas of the paving would be compromised during this work (Figure 3). Future commercial site users were not evaluated in the human health risk assessment as the site was assumed to be paved under this scenario, resulting in no complete exposure pathways to commercial site users if the paving were maintained.

If other future uses of the site are being considered by the Port (e.g., open space, recreational), the results of this risk assessment should be evaluated by a qualified environmental professional, and modified or amended, as necessary.

Exposure Pathways

Transport mechanisms of COPC from soil and groundwater may include volatilization and wind erosion of surface soils; volatilization from surface soils, subsurface soils, and groundwater; leaching to groundwater from soils; groundwater transport of dissolved chemicals; mobile free liquid migration and leaching to groundwater; and storm water and surface water transport (Figure 3).

Based on site conditions, it was assumed that the only complete exposure pathways for **current beach cleanup workers and commercial workers,** where the site is unpaved, would include contact with COPC in air, soil, and groundwater. Exposure routes for COPC were assumed to include dermal contact and ingestion of surface soils, and inhalation of vapors and particulates in outdoor air from surface and subsurface soil and groundwater. Contact with COPC in surface water (ingestion, dermal contact, and inhalation), contact with COPC in indoor air, and ingestion of COPC in groundwater were not considered complete exposure pathways. Drinking water was assumed to be supplied by EBMUD.

What about commercial out-of question?

For future exposure scenarios, **occasional utility workers** were also assumed to have contact with COPC in air, soil, and groundwater. Exposure routes for COPC were assumed be the same as described above: dermal contact and ingestion of soils and inhalation of vapors (only) in air from soil and groundwater. Utility workers were also assumed to have dermal contact with groundwater in a utility trench. Exposure to occasional utility workers were evaluated for work in a utility trench, and did not include exposures that may occur during excavation of soils for trench preparation.[7]

RISK EVALUATION

Approach

To evaluate potential human health risks, exposure algorithms based on those developed by the U.S. Environmental Protection Agency (U.S. EPA, 1989), including fate and transport modeling for indirect pathways (air) (ASTM, 1995: GSI, 1995-97), were used to calculate potential excess lifetime cancer risks and hazards to current and future human receptors from potential exposure to site contaminants.

95% - 720
max - < 20

The 95th upper confidence limit (UCL) on the arithmetic mean concentration of the total concentrations[8] of COPC was used in calculating risks from exposure to COPC in surface soil (≤3.5 feet bgs), subsurface soil (>3.5 feet bgs), and groundwater underlying the site, as suggested by the California Department of Toxic Substances Control (DTSC, 1994a) and U.S. EPA (1989).[9] The 95th UCL was calculated only for those COPC with equal to or greater than 20 analyses. Where COPC concentrations were reported below a laboratory reporting limit, one-half of the laboratory reporting limit was used in calculating the 95th UCL. For duplicate samples, the highest concentration was included in the calculation of 95th UCL. If fewer than 20 analyses were performed (for example, for PAHs where only four soil samples were collected and analyzed), the maximum concentration of COPC was used in the risk calculations. See Table 1 and 2 for 95th UCL for COPC used in the risk assessment. Calculation of the 95th UCL for COPC are presented in Appendix A, Tables A-1 through

---

[7]The trench where utility work was performed was assumed to be 100 feet long by 10 feet wide by four feet deep.

[8] Soluble concentrations of COPC are not appropriate for inclusion in hazard evaluations, and are used only for waste characterization.

[9]The 95th UCL is calculated as: $\bar{x} + t.95s_{\bar{x}}$ with t.95 obtained from the cumulative t distribution with the appropriate degrees of freedom (n-1, where n equals the number of samples analyzed).

A-4. The risk assessment calculations therefore assume no remediation of contaminated soils or groundwater under current or future land use exposure scenarios.

All COPC, identified above, were evaluated for potential human health risks to current and future site users, with one exception. Benzo(g,h,i)perylene was excluded from the original list of COPC previously developed, as a detailed literature search did not reveal available toxicity information. Exclusion of this chemical does not adversely affect the results of this assessment, as the risk associated with potential exposure to other metals and polycyclic aromatic hydrocarbons (PAHs) was accounted for. As described above, petroleum hydrocarbons were evaluated as COPC using an indicator chemical approach

Exposure Assumptions and Modeling

Basic exposure parameters for current and future exposure scenarios are identified in Table 3. The main differences between the exposure scenarios are the averaging time for non-carcinogens (years), exposure duration (years), exposure frequency (days/year), and soil ingestion rate (mg/day). For example, beach cleanup workers were assumed to participate in cleanup activities at the site once a month (12 days per year) (exposure frequency) for ten years (exposure duration). Commercial workers were assumed to be present at the site for 250 days per year (5 days/week x 50 weeks) for 25 years. Future occasional utility workers were assumed to be present at the site for 20 days per year (5 days/week x 4 weeks) for 25 years.

For beach cleanup workers, adult and children human receptors were considered in the calculation of risks and hazards. Only adult receptors were considered for current commercial workers and future occasional utility workers. Age-adjusted exposure factors for soil ingestion, skin surface area, and inhalation were used for estimating health risks for the beach cleanup worker scenario. Use of age-adjusted factors takes into account different adult and child soil ingestion and inhalation rates, body weights, soil to skin adherence factors, and exposure durations. Use of age-adjusted factors is considered protective of children in estimating risks/hazards.

The complete spreadsheets indicating all exposure parameters, air modeling assumptions, algorithms, and risk and hazard index calculations for all exposure scenarios evaluated are included in Appendix C.

Toxicity Information

The primary source of toxicity information included in the risk assessment was the U.S. EPA Integrated Risk Information System (IRIS) (IRIS, 1998), and Cal/EPA's Criteria for Carcinogens (Cal/EPA, 1994). Where cancer potency values were presented in both IRIS and in Cal/EPA's Criteria for Carcinogens, the most conservative cancer potency value was selected. Where toxicity information was not presented in either source, U.S. EPA's Health Effects Assessment Summary Tables (HEAST) were also reviewed (U.S. EPA, 1997). For PAHs, potency factors for carcinogens were developed by applying the potency equivalence factor (PEF) of carcinogenic PAHs relative to the potency for benzo(a)pyrene, in accordance with the guidance provided by Cal/EPA (Cal/EPA, 1994b), for both oral and inhalation exposure pathways. In addition, unadjusted oral toxicity values

were used in calculating human health risks where inhalation and dermal toxicity values were lacking; unadjusted inhalation toxicity values were also used in calculating health risks where ingestion toxicity values were lacking. See Appendix C for toxicity values used in the health risk assessment.

Dermal Exposure to PAHs

It is recognized that oral cancer potency factors, discussed in the toxicity section above, should be used to evaluate the risks associated with dermal exposure to carcinogens (such as benzene) that cause cancer through systemic action, and not for carcinogens that cause skin cancer through direct action at the point of contact. Benzo(a)pyrene and other PAHs are considered to be direct action carcinogens that cause cancer through direct action at the point of application (U.S. EPA, 1989, and DTSC, 1992a). At present, regulatory risk assessment does not provide potency values for skin carcinogenesis or a paradigm to compute risk (DTSC, 1992a). In the absence of a paradigm for quantitatively evaluating risk for dermal exposure to PAHs, the unadjusted oral slope factor was used to assess the potential risk from dermal exposure to PAH carcinogens in soil and groundwater, and health risks were calculated as described above. Risks calculated for dermal exposure to PAHs should therefore be considered informational and qualitative, and provide only an indication of potential risk.

Evaluation of Lead

Recent toxicological and epidemiological studies indicate that a low-level lead exposure does not appear to have a threshold, below which no adverse health effects occur. Toxicity values have therefore not been developed for lead exposure. Instead, a blood threshold level of 10 ug/dl for children has been established (DTSC, 1992b). The Cal/EPA's Department of Toxic Substances Control Lead Risk Spreadsheet, Version 6.0 (DTSC, 1992b) was used to separately address potential health risks associated with exposure to lead in soil. The corresponding blood level for the 99th percentile exposed receptor was calculated based on the 95th UCL concentration of lead reported in shallow site soils less than or equal to 3.5 feet bgs (129.7 mg/kg). The point of departure for risk management by DTSC is a 0.01 risk of exceeding the blood lead threshold value of 10 μg/dl for children and adults (DTSC 1992b). Receptor scenarios evaluated included: current beach cleanup workers, current commercial site workers, and future occasional utility workers. For current beach cleanup workers, blood lead levels for adults, children, and pica children[10] were estimated. For current commercial workers, and future occasional utility workers, only blood lead levels for adults were estimated.

To calculate blood lead levels from lead exposure, exposure algorithms defined in the spreadsheet model, including inhalation of dust, incidental ingestion of soil and dust, ingestion of lead in drinking water and the diet, and dermal contact with soil were used to calculate a blood lead level corresponding with the 99th percentile of the exposed population. Although ingestion of plant

---

[10] Pica behavior is the indiscriminate eating of non-nutritious or harmful substances. It is common in early childhood, but may also be found in mentally handicapped and psychotic patients (Bantam Medical Dictionary, Revised Edition, 1990).

material grown on-site is identified as a potential exposure algorithm in the spreadsheet, this pathway was assumed to be incomplete for all exposure scenarios evaluated and was excluded from calculation of blood lead levels. Parameters for all scenarios are presented in Table 4. The default parameters in the spreadsheet were modified, where possible, to represent the current and future receptor scenarios evaluated. For example, an exposure frequency of one day per week was used in estimating blood lead concentrations for beach cleanup workers. It should be noted, however, that this assumption likely overestimates the time participating in these activities, which is approximately once a month (12 days/year), and therefore the estimated blood lead concentration associated with this exposure. The complete lead risk spreadsheets, including blood lead concentration calculations, for all exposure scenarios evaluated are presented in Appendix D.

RESULTS

Risk Characterization

Risk characterization combines quantitative exposure estimates and toxicity factors, described above, to calculate numerical estimates of health risk. The results described below are estimates of cancer risk and noncancer health hazards based on long-term exposure to chemicals detected in soil and groundwater samples at the site. Quantifying total excess lifetime cancer risk and hazard requires calculating risks/hazards associated with exposure to individual COPC and aggregating risks/hazards associated with simultaneous exposure to several carcinogenic and non-carcinogenic substances to estimate cumulative risks/hazards.

An excess lifetime cancer risk of 1×10^{-6} represents the mathematical probability that one person in one million persons exposed to a carcinogen over a lifetime of seventy years will develop cancer; this is often considered to be a negligible excess lifetime cancer risk for residential exposures by U.S. EPA and DTSC. A negligible cancer risk for commercial workers is often considered to be 1×10^{-5} (one in one hundred thousand excess lifetime cancer risk); this is the same value that is considered in regulating substances under Proposition 65, the Safe Drinking Water and Toxic Enforcement Act (California Health and Safety Code, Sec. 25249.5, et seq.). The excess lifetime cancer risk is often misconstrued as an expectation that one of one million (1×10^{-6}) people exposed, under the exposure scenario evaluated, will be stricken with cancer. In actuality, the excess lifetime cancer risk is not an actual risk, but a mathematical risk based on conservative scientific assumptions in the risk assessment process.

A hazard quotient for non-carcinogens of 1.0 is equivalent to the ratio of exposure to the toxicity value for COPC that elicit a noncarcinogenic effect. Health effects would not be expected for values equal to, or less than one (i.e., the exposure to COPC is equal to or less than the toxicity values). As described above, hazard quotients are summed for each exposure pathway and are then summed for the receptor under the exposure pathways evaluated; the summed hazard quotients is called the cumulative hazard index.

Current Land Uses

Table 5 summarizes the results of the cumulative human health risk assessment for beach cleanup workers and commercial site workers. The cumulative excess lifetime cancer risk and hazard index

to beach cleanup workers were estimated as 9.0×10^{-7} and 0.03, respectively, resulting from combined exposure to COPC under the exposure scenario evaluated. The cumulative excess lifetime cancer risk and hazard index to commercial workers were estimated as 3.9×10^{-6} and 0.03, respectively.

The exposure pathway resulting in the highest combined risk and hazard was incidental ingestion and dermal contact with soil for both beach cleanup workers and commercial site worker scenarios. Within this exposure pathway, the COPC responsible for the largest excess lifetime cancer risk were PCBs and benzo(a)pyrene. The greatest hazard indices were attributed to PCBs for both exposure scenarios.

The blood lead concentration for the 99th percentile for adult, child, and pica children for beach cleanup workers was estimated as 3.9, 7.1, and 9.2 μg/dl, respectively (Table 6). All beach cleanup workers (adults, children, pica children) were below the 10 μg lead/dl blood threshold for this exposure scenario. The blood lead concentration for the 99th percentile for adult commercial workers was estimated as 4.1 μg/dl, which is below the threshold of 10 μg/dl.

Future Land Uses

Table 5 summarizes the results of the cumulative human health risk assessment for potential occasional utility workers. The cumulative excess lifetime cancer risk and hazard index to occasional utility workers were estimated as 1.1×10^{-6} and 0.008, respectively. As above, the exposure pathway resulting in the highest combined risk and hazard was ingestion and dermal contact with soil for occasional utility workers. Within this exposure pathway, the COPC responsible for the largest excess lifetime cancer risk were PCBs and benzo(a)pyrene. The greatest hazard indices were attributed to PCBs. The blood lead concentration for the 99th percentile occasional adult utility worker was estimated as 6.1 μg/dl, which is below the 10 μg/dl threshold.

Interpretation of Results

Although the determination of an acceptable risk is ultimately a risk management decision, the results of this risk assessment for current beach cleanup workers may be compared to the negligible excess lifetime cancer risk for residential site users of 1×10^{-6} (one-in-one million) and a hazard index of 1.0. The cumulative estimated excess lifetime cancer risk for this scenario (9.0×10^{-7}) is below this threshold value; the cumulative hazard index of 1.0 was also not exceeded for the beach cleanup worker scenario.

The results for current commercial site workers and future occasional utility workers may be compared to the excess lifetime cancer risk often considered to be negligible for commercial workers of 1×10^{-5} (one-in-one hundred thousand) and a hazard index of 1.0. The cumulative estimated excess lifetime cancer risk for current commercial site workers of 3.9×10^{-6} is below this threshold value. The cumulative cancer risk for future occasional utility worker of 1.1×10^{-6} is also below this threshold. The cumulative hazard index for both exposure scenarios was below the threshold of 1.0.

The results for the hazard evaluation for lead may be compared with DTSC's point of departure for risk management of a 0.01 risk of exceeding the whole blood lead threshold value of 10 μg/dl (DTSC, 1994b). Presumably, risk management would not be required by DTSC for soil lead concentrations contributing to less than a whole blood lead concentration of 10 μg lead/dl blood for the 99th percentile exposed population for adults and children. None of the exposure scenarios evaluated (beach cleanup worker, commercial site worker, or future occasional utility worker) exceeded the blood lead threshold concentration of 10 μg/dl at the 99th percentile.

The results of this risk assessment should be interpreted in terms of the likelihood of exposure to COPC, conservative exposure assumptions, and the uncertainties associated with the risk assessment process (the uncertainty analysis is described below). The likelihood that the results described above, particularly excess lifetime cancer risks, are underestimated is very low because of the conservative assumptions used. Actual risks may be significantly less than predicted values.

Based on a comparison of estimated health risks/hazards for the exposure scenarios evaluated in this risk assessment with threshold risk values for residential and worker exposures, it does not appear that implementation of cleanup activities or other institutional controls are warranted. However, if other future land uses are being considered by the Port for the site, and/or if the assumptions upon which the exposure scenarios evaluated in this health risk assessment are found to be invalid, the results of this risk assessment should be evaluated by a qualified environmental professional and modified or amended, as necessary.

UNCERTAINTY ANALYSIS

Uncertainties are associated with each step of the risk assessment process and may influence the results. Many uncertainties are generic, while others are site-specific. The major sources of uncertainty are identified below.

Uncertainties Associated with Identification of Chemicals of Potential Concern

- Environmental sampling and analysis techniques, heterogeneity of the media, and number and location of samples collected.

  For example, matrix interference due to the presence of high concentrations often raises the laboratory detection limits of other chemicals in the analytical procedure and introduces uncertainty in the method of data analysis. Also, some of the sampling locations were specifically designed to identify areas that were suspected to have elevated chemical concentrations. This sampling bias may have resulted in a data base that focused on some of the work-cases areas of the site; therefore COPC concentrations included in the risk calculations may be conservative in nature.

- Potential risks associated with chemicals intentionally or unintentionally excluded from the risk assessment.

- Potential risks associated with chemicals included in the risk assessment, but not known to be related to historical or current site activities (e.g., bis-2 ethylhexyl phthalate).

Uncertainties Associated with Exposure Assessment

The greatest number of uncertainties are associated with the exposure assessment. The most significant uncertainties with this step that may influence the results include:

- Conservative assumptions used to estimate exposure point concentrations and intake variables, including environmental modeling (e.g., human receptors are assumed to be directly over contaminated soil and groundwater, the entire thickness of soils is contaminated, no loss mechanisms to attenuate COPC in soil, and the modeling assumes homogenous soil conditions for physical and chemical properties).

  For example, beach cleanup workers do not remove refuse from the northern part of Clinton Basin where the highest concentrations of PAHs were reported. Inclusion of the maximum concentration of PAHs in the risk assessment would therefore tend to overestimate risks/hazards associated with exposure to these COPCs. In addition, the assumption of an exposure frequency of one day per week in estimating blood lead concentrations for beach cleanup workers likely overestimates the actual time participating in these activities (approximately once a month), which would also tend to overestimate blood lead concentrations.

- Difficulties in accurately characterizing exposure and exposure pathways, particularly under future land use considerations.

- Risks associated with potential exposure pathways excluded from the risk assessment process.

Uncertainties Associated with Toxicity Assessment

- The use of animals studies to predict potential human health effects of COPC and the quality of these studies. There may be important, but unidentified differences in uptake, metabolism, distribution and elimination of chemicals between a test species and a human.

- Use of oral toxicity values for which there are no inhalation or dermal toxicity values, inhalation values for which there are no oral toxicity values, and the use of oral toxicity values to evaluate risks for PAHs from dermal contact.

- Lack of toxicity values for some COPC (e.g., benzo(g,h,i)perylene), and the validity of potency equivalency factor approach for PAHs, for which there are no chemical-specific toxicity factors.

- Applicability of studies conducted in experimental animals dosed at high levels to human exposure at lower concentrations and the underlying dose-response model for carcinogens (i.e., there is no dose of a carcinogen that is not associated with a risk of cancer).

- Potential for synergistic or antagonistic interactions of chemicals to which the same receptor may be exposed are not considered.

Uncertainties Associated with Risk Characterization

- The validity of summing risks or hazard quotients for multiple chemicals and across exposure pathways.

REFERENCES

American Society for Testing and Materials (ASTM), 1995, *Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, ASTM E-1739*, Philadelphia, PA.

Bantam Medical Dictionary, 1990, Revised Edition, Market House Books, Ltd., Eds., New York: Bantam Books.

BASELINE, 1990, *Preliminary Remedial Investigation, Seabreeze Yacht Center, Inc., 280 Sixth Avenue, Oakland, California*, prepared for the Port of Oakland, November.

_____, 1991, *Draft Progress Report on Remedial Investigation, Seabreeze Yacht Center, Inc., 280 Sixth Avenue, Oakland, California*, prepared for the Port of Oakland, July.

_____, 1992, *Phase II Remedial Investigation, Seabreeze Yacht Center, Inc., Oakland, California*, prepared for the Port of Oakland, March.

_____, 1994a, *Phase III Remedial Investigation, Seabreeze Yacht Center, Inc., Oakland, California*, prepared for the Port of Oakland, September.

_____, 1994b, *Draft Removal Action Workplan, Seabreeze Yacht Center, Inc., Oakland, California*, prepared for the Port of Oakland, September.

_____, 1994c, *Subsurface Investigation Interim Data Report, Seabreeze Yacht Center, Oakland, California*, prepared for the Port of Oakland, December.

_____, 1994d, *Site History Investigation, Seabreeze Yacht Center, Inc., Oakland, California*, prepared for the Port of Oakland, July.

_____, 1995a, *Subsurface Investigation Second Interim Data Report, Seabreeze Yacht Center, Oakland, California*, prepared for the Port of Oakland, April.

_____, 1995b, *Seabreeze Analytical Results*, prepared for the Port of Oakland, July.

_____, 1995c, *Third Interim Data Report, Additional Subsurface Investigation, Seabreeze Yacht Center, Oakland*, prepared for the Port of Oakland, October.

_____, 1995d, *Memorandum to Ms. Michele Heffes, Port of Oakland, regarding Analytical Results for Soil Sampling*, 4 October 1995, at Seabreeze Site, Oakland, 16 October.

_____, 1996a, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Quarterly Groundwater Monitoring Report, June-July 1996, Former Seabreeze Yacht Center, Inc. Site, 280 Sixth Avenue, Oakland, California*, 19 August.

_____, 1996b, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Quarterly Groundwater Monitoring Report, September 1996, Former Seabreeze Yacht Center, Inc., Site, 280 Sixth Avenue, Oakland, California*, 18 October.

_____, 1997a, *Concrete Containment Structure Removal and Remediation Oversight, Seabreeze Yacht Center, 280 Sixth Avenue, Oakland, California*, prepared for the Port of Oakland, January.

_____, 1997b, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Quarterly Groundwater Monitoring Report, December 1996, Former Seabreeze Yacht Center, Inc. Site, 280 Sixth Avenue, Oakland, California*, 22 January.

_____, 1997c, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Quarterly Groundwater Monitoring Report, March 1997, Former Seabreeze Yacht Center Inc. Site, 280 Sixth Avenue, Oakland, California*, 14 May.

_____ 1997d, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Quarterly Groundwater Monitoring Report, June 1997, Former Seabreeze Yacht Center Inc. Site, 280 Sixth Avenue, Oakland, California*, 29 July.

_____, 1998, *Memorandum to Ms. Diane Heinze, Port of Oakland, regarding Annual Groundwater Monitoring Report, January 1998, Former Seabreeze Yacht Center Inc. Site, 280 Sixth Avenue, Oakland, California*, 25 February.

Bay Area Air Quality Management District (BAAQMD), 1997, *Contaminant and Weather Survey,* BAAQMD Technical Services Division, December.

Bradford, G.R., Chang, A.C., Page, A.L., Bakhtar, D., Frampton, J.A., and Wright, H, 1996, *Background Concentrations of Trace and Major Elements in California Soils*, Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March.

California Environmental Protection Agency (Cal/EPA), 1994, *Criteria for Carcinogens*, 1 November.

_____, 1997, *Adoption of 27 Public Health Goals for Chemicals in California Drinking Water (1997-98)*, Office of Environmental Health Hazard Assessment, 31 December.

California Health and Safety Code, Section 25249.5 et seq.

Department of Toxic Substances Control (DTSC), 1992a, *Guidance for Risk Assessments for Town Gas Sites*, California Environmental Protection Agency, 7 September.

_____, 1992b, *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Wastes Sites and Permitted Facilities,* California Environmental Protection Agency, October.

_____, 1994a, *Preliminary Endangerment Assessment Guidance Manual,* California Environmental Protection Agency, January.

Groundwater Services Inc (GSI), 1995-1997, *Guidance Manual for Risk-Based Corrective Action and Spreadsheet Version 1.01.*, Texas.

Integrated Risk Information System (IRIS), 1998, Various files reviewed via Internet in May and July 1998.

Smucker, Stanford, Regional Toxicologist, Technical Support Team, 1998, *Memorandum to PRG Table Mailing List regarding Region 9 Preliminary Remediation Goals (PRGs) for 1998*, U.S. Environmental Protection Agency, Region IX.

State Water Resources Control Board, *Resolution No. 88-63.*

Title 22, California Code of Regulations, Maximum Contaminant Limits, Section 64431 and 64444.

USDC, 1989, *Climatological Data Annual Summary*, California.

U.S. Environmental Protection Agency (U.S. EPA), 1989, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final*, December.

_____, 1995, *Exposure Factors Handbook*, Review Draft, EPA/600/P-95/002A, Office of Research and Development, Washington, D.C.

_____, 1997, *Health Effects Assessment Summary Tables, FY 1997 Update,* U.S. Environmental Protection Agency, Solid Waste and Emergency Response, July.

_____, 1998, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance, Dermal Risk Assessment, Interim Guidance*, NCEA-W-0364, Office of Emergency and Remedial Response, Washington, D.C.

Western Regional Climate Center, 1998, *Period of Record Monthly Climate Survey*, 1 July 1948 to 31 July 1986, Oakland WSO Airport, California. Reviewed on the Internet.

Table 1

SUMMARY OF ANALYTICAL RESULTS, SOIL, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)

Seabreeze Yacht Center, Oakland

Chemical	Maximum Concentration (mg/kg)	Sampling Location/ Depth for Maximum Concentration	95th UCL		Residential Soil PRG (mg/kg)	Exceed PRG?	Included as COPC?	Rationale
			Surface Soils (≤3.5 feet bgs)	Subsurface Soils (>3.5 feet bgs)				
Metals								
Antimony	<6.0	NA			30	No	No	ND
Arsenic	13	MW-SB4A/5'			0.38/21[1]	No	No	<PRG (non-cancer endpoint)
Barium	440	MW-SB4A/5'			5,300	No	No	<PRG
Beryllium	1.2	MW-SB5/3'			150	No	No	<PRG
Cadmium	2.4	MW-SB5/3'			9.0	No	No	<PRG
Chromium (total)	140	PW 2/12"			210	No	No	<PRG
Cobalt	11	MW-SB5/3'			3,300	No	No	<PRG
Copper	3,500	SB-12H/1'	292.18	24.3	2,800	Yes	Yes	>PRG
Lead	3,700	SB-6K/0.5'	129.7	75.2	130	Yes	Yes	>PRG
Mercury	0.4	MW-SB5/3'			22	No	No	<PRG
Molybdenum	<2.0	NA			370	No	No	ND
Nickel	180	MW-SB5/3'	35.13	35[2]	150	Yes	Yes	>PRG
Selenium	3	Shore-4/3'			370	No	No	<PRG
Silver	<2	NA			370	No	No	ND
Thallium	<2.5	NA			6	No	No	ND
Vanadium	250	MW-SB5/3'			520	No	No	<PRG
Zinc	300	BD/4'			22,000	No	No	<PRG
Polychlorinated Biphenyls	4.7	Shore-2x/0.5'	0.51[2,3]	NA	0.2	Yes	Yes	>PRG
Petroleum Hydrocarbons								
Gasoline	<1.0	NA			NA	NA	No	ND
Diesel	11,000	MW-SB4A/5'			NA	NA	Yes[4]	Site history
Kerosene	<100	NA			NA	NA	No	ND
Motor oil	4,700	S-16B/7'			NA	NA	Yes[4]	Site history
Nonpolar oil and grease	7,800	SB-15/0.5'			NA	NA	Yes[4]	Site history
Total oil and grease	18,000	SB-15/0.5'			NA	NA	Yes[4]	Site history
Total recoverable petroleum hydrocarbons	370	Shore-4/Surface 0'			NA	NA	Yes[4]	Site history

Table 1: Analytical Results, Soil - *continued*

Chemical	Maximum Concentration (mg/kg)	Sampling Location/ Depth for Maximum Concentration	95th UCL Surface Soils (≤3.5 feet bgs)	95th UCL Subsurface Soils (>3.5 feet bgs)	Residential Soil PRG (mg/kg)	Exceed PRG?	Included as COPC?	Rationale
Total petroleum hydrocarbons as bunker C	57,000	S-16B/4.5'			NA	NA	Yes[4]	Site history
Semi-volatile Organic Compounds								
Acenaphthylene	0.03[5]	Shore-4/3'	0.03[6]	NA	NA	NA	Yes	Site history, no PRG available
Acenaphthene	0.025[5]	Shore-4/3'			2600	No	No	<PRG
Anthracene	0.25[5]	Shore-4/3'			14000	No	No	<PRG
Di-n-butyl phthalate	1.0[5]	Shore-2d/Surface 0'			5500	No	No	<PRG
Bis(2-ethylhexyl)phthalate	20[5]	Shore-2d/Surface 0'			32	No	No	<PRG
Benzo(a)anthracene	0.36[5]	Shore-4/3'			0.56	No	No	<PRG
Benzo(a)pyrene	0.47[5]	Shore-4/3'	0.47[6]	NA	0.056	Yes	Yes	>PRG
Benzo(b)fluoranthene	0.63[5]	Shore-4/3'	0.63[6]	NA	0.56	Yes	Yes	>PRG
Benzo(k)fluoranthene	0.37[5]	Shore-4/3'			0.61	No	No	<PRG
Benzo(g,h,i)perylene	0.31[5]	Shore-4/3'	0.31[6]	NA	NA	NA	Yes	Site history, no PRG available
Chrysene	0.69[5]	Shore-4/3'			56	No	No	<PRG
Dibenz(a,h)anthracene	0.16[5]	Shore-4/3'	0.16[6]	NA	0.056	Yes	Yes	>PRG
Fluoranthene	1.0[5]	Shore-4/3'			2000	No	No	<PRG
Fluorene	0.061[5]	Shore-4/3'			1800	No	No	<PRG
Indeno(1,2,3-cd)pyrene	0.27[5]	Shore-4/3'			0.56	No	No	<PRG
Pyrene	0.99[5]	Shore-4/3'			1500	No	No	<PRG
Butylbenzyphthalate	0.14[5]	Shore-4/3'			930	No	No	<PRG
Di-n-octylphthalate	0.16[5]	Shore-2d/Surface 0'			1100	No	No	<PRG
Phenanthrene	0.67[5]	Shore-4/3'	0.67[6]	NA	NA	NA	Yes	Site history, no PRG available
Volatile Organic Compounds								
Acetone	0.18	SB-11/3'			1400	No	No	<PRG
Carbon disulfide	0.014	SB-6/2'			350	No	No	<PRG
Toluene	0.009	SB-4/3.5'			520	No	No	<PRG
Xylenes	0.34	MW-SB5A/grab			210	No	No	<PRG
2-butanone	0.045	SB-11/3'			NA	NA	No	Lab contaminant; less than 10 x DL (0.01)

Table 1: Analytical Results, Soil - *continued*

Chemical	Maximum Concentration (mg/kg)	Sampling Location/ Depth for Maximum Concentration	95th UCL		Residential Soil PRG (mg/kg)	Exceed PRG?	Included as COPC?	Rationale
			Surface Soils (≤3.5 feet bgs)	Subsurface Soils (>3.5 feet bgs)				
Benzene	<0.005	NA			0.62	No	No	ND
Ethylbenzene	0.15	MW-SB5A/grab			230	No	No	<PRG

Notes: **Bolded chemicals were selected as COPC.**
95th UCL concentrations were only calculated for those chemicals selected as COPC with equal to or greater than 20 samples collected and analyzed (if fewer than 20 analyses, the maximum concentration was used). Ninety-fifth UCL concentrations were not calculated for petroleum hydrocarbons, which were evaluated using an indicator chemical approach.
bgs = Below ground surface.
COPC = Chemicals of potential concern.
DL = Laboratory detection limit.
NA = Not applicable.
ND = Reported at less than laboratory reporting limit.
PRG = U.S. EPA Region IX Preliminary Remediation Goal.

[1] PRG based on cancer endpoint is 0.38 mg/kg, and PRG based on non-cancer endpoint is 21 mg/kg. The cancer endpoint is less than the average background arsenic concentration for background soil in California (Bradford, et al., 1996).
[2] Maximum concentration for subsurface soils used; fewer than 20 samples were collected and analyzed.
[3] As Arochlor 1260 (95th UCL of 0.474 mg/kg) and Arochlor 1254 (95th UCL of 0.037 mg/kg) for a total of 0.51 mg/kg.
[4] To be evaluated using indicator chemical approach (i.e., selected PAHs), in accordance with ASTM (1995).
[5] Sample for PW-1 reported as <1.7 mg/kg, below laboratory reporting limits and was therefore not included in the risk evaluation.
[6] Maximum concentration for surface soil used; fewer than 20 samples were collected and analyzed. Only three of four samples analyzed were reported above the laboratory reporting limit.

Table 2

SUMMARY OF ANALYTICAL RESULTS, GROUNDWATER, AND SELECTION OF CHEMICAL OF POTENTIAL CONCERN (COPC)

Former Seabreeze Yacht Center, Oakland

Chemical	Maximum Concentration (mg/L)	Well Location	Date Sample Collected	95th UCL	Maximum Contaminant Level (MCL) (mg/L)	CA PHG for Drinking Water (mg/L)	Drinking Water PRG	Exceed Threshold?	Included as COPC?	Rationale
Metals										
Antimony	NA								No	NA
Arsenic	0.019	PW-1	2/2/95		0.05			No	No	<MCL
Barium	0.1	PW-2	2/2/95		1			No	No	<MCL
Beryllium	NA								No	NA
Cadmium	<0.005	NA	NA		0.005			No	No	ND; <MCL
Chromium	<0.01	NA	NA		0.05			No	No	ND; <MCL
Cobalt	NA								No	NA
Copper	0.078[1]	MW-SB4	11/28/94		NA	0.17		No	No	<PHG
Lead	0.093[2]	MW-SB4	11/28/94	0.016	0.015[3]			**Yes**	**Yes**	**>MCL**
Mercury	<0.0002	NA	NA		0.002			No	No	ND; <MCL
Molybdenum	NA								No	NA
Nickel	NA								No	NA
Selenium	0.011	PW-2	2/2/95		0.05			No	No	<MCL
Silver	<0.01	NA	NA		NA	NA	0.18	No	No	ND;<PRG
Thallium	NA								No	NA
Vanadium	NA								No	NA
Zinc	NA								No	NA
Petroleum Hydrocarbons										
Gasoline	<0.05				NA	NA	NA	NA	No	ND
Diesel	34	MW-SB5	11/28/94		NA	NA	NA	NA	**Yes[4]**	**Site history**
Kerosene	NA				NA	NA	NA	NA	No	NA
Motor oil	18.1	MW-SB5	3/6/95		NA	NA	NA	NA	**Yes[4]**	**Site history**
Nonpolar oil and grease	<5				NA	NA	NA	NA	No	ND,
Total oil and grease	NA				NA	NA	NA	NA	No	NA
Total recoverable petroleum hydrocarbons	NA				NA	NA	NA	NA	No	NA
Total petroleum hydrocarbons as bunker C	74	MW-SB5	11/28/94		NA	NA	NA	NA	**Yes[4]**	**Site history**

Table 2 - Analytical Results, Groundwater - *continued*

Chemical	Maximum Concentration (mg/L)	Well Location	Date Sample Collected	95th UCL	Maximum Contaminant Level (MCL) (mg/L)	CA PHG for Drinking Water (mg/L)	Drinking Water PRG	Exceed Threshold?	Included as COPC?	Rationale
Semi-volatile Organic Compounds										
Bis 2 ethylhexylphthalate	0.038	PW-1	2/2/95	0.038 [5]	0.004			**Yes**	**Yes**	**>MCL**
Volatile Organic Compounds										
Acetone	0.13	MW-SB5	11/28/94		NA	NA	0.61	No	No	<PRG; lab contaminant less than 10 x DL (0.02 mg/L)
2-butanone	0.1	MW-SB2	1/26/94		NA	NA	NA	NA	No	Lab contaminant; less or equal to 10 x DL (0.01)
Benzene	<0.0005	MW-SB3	12/7/94		0.001			No	No	<MCL; ND
Ethylbenzene	<0.005	MW-SB3	12/7/94		0.15			No	No	<MCL; ND
Toluene	<0.005	MW-SB3	12/7/94		0.7			No	No	<MCL; ND
Xylenes	<0.005	MW-SB3	12/7/94		1.75			No	No	<MCL; ND

Notes: **Bolded chemicals were selected as COPC.**
95th UCL concentrations were only calculated for those chemicals selected as COPC with equal to or greater than 20 samples collected and analyzed (if fewer than 20 analyses, the maximum concentration was used).
95th UCL concentrations were not calculated for petroleum hydrocarbons, which were evaluated using an indicator chemical approach.
COPC = Chemicals of potential concern.
DL = Laboratory detection limit.
MCL = Maximum Contaminant Level for Drinking Water, Title 22 California Code of Regulations.
NA = Not applicable or not analyzed.
ND= Reported at less than laboratory reporting limit.
PHG = California Department of Health Services Public Health Goal for Drinking Water.
PRG = U.S. EPA Region IX Preliminary Remediation Goal.

[1] Another sample analyzed for copper was reported at <0.10 mg/L.
[2] Another sample analyzed for lead was reported at <0.10 mg/L.
[3] Federal limit.
[4] To be evaluated using indicator chemical approach (i.e., selected PAHs), in accordance with ASTM (1995).
[5] 95th UCL value not reported; fewer than 20 samples were collected and analyzed.

Table 3: **Exposure Parameters for Current and Future Use Exposure Scenarios**

Exposure Parameter	Exposure Scenario		
	Current		Future
	Beach Cleanup Worker	Commercial Worker	Occasional Utility Worker
Averaging time for carcinogens (AT) (years)	70	70	70
Averaging time for noncarcinogens (AT) (years)	10[1]	25	25
Body weight (BW) (kg)	70 (adult) 15 (1-6 years)	70	70
Exposure duration (ED) (years)	10[1]	25	25
Exposure frequency (EF) (days/year)	12 (1 day/month x 12 months/year)[2]	250 (5 days/week x 50 weeks/year)	20 (5 days/week x 4 days/year)[3]
Ingestion rate of soil (IRS) (mg/day)	110 (adults)[4] 200 (1-6 years)[4] (default)	50	120[5]
Inhalation rate (IRA) (m^3/day)	20 (adults and children)[6] (default)	20	20
Dermal surface area for contact (SA) (cm^2/day)	5,800 (adults)[7] 2,023 (1-16 years)[7] (defaults)	3,700[5,8] (default)	5,800
Soil to skin adherence factor (AF) (mg/cm^2)	0.08 (adults)[9] 0.65 (children)[9]	0.08[9]	0.27[9]

Note: All default values from GSI, 1995-97 and ASTM, 1995, unless otherwise specified.

1 The exposure duration (ED) for children (EDc) ages 1-6 years was assumed to be six years. The exposure duration for adults (EDa) was assumed to be four years. The total combined ED was therefore assumed to be ten years for beach cleanup workers. Averaging time (AT) is equal to exposure duration.

2 According to the California Coastal Commission, beach cleanup events occur approximately once a month (12 events/year).

3 Occasional utility workers were assumed to be working on the site on an occasional basis for 20 days/year.

4 An age-adjusted ingestion rate of soil (IRS) of 86 mg-year/kg-day was used in the risk calculations. This age-adjusted rate takes into account the ingestion rates of soil for children ages 1-6 years (IRSc) and adults (IRSa), body weights, and exposure durations. The ingestion rate for soil of 110 mg/day for adults is from U.S. EPA, 1995. See Appendix C for calculations.

5 Default from DTSC, 1992b.

6 An age-adjusted inhalation rate (IRA) of 9.14 m^3/kg-day was used in the risk calculations. This age-adjusted rate takes into account the inhalation rate of children (IRAc) and adults (IRAa), body weights, and exposure durations. See Appendix C for calculations.

7 An age-adjusted dermal surface area (SA) of 552 mg-year/kg-day was used in the risk calculations. This age-adjusted rate takes into account the dermal surface area of children (SAc) and adults (SAa), body weights, soil to skin adherence factors, and exposure durations. See Appendix C for calculations.

8 Median of skin area of arms and hands.

9 From U.S. EPA, 1998. The soil to skin adherence factor (mg/cm^2) selected for child beach cleanup workers was the average of adherence factors estimated for children playing with toys in dry soil (0.3 mg/cm^2), and children playing with toys in relatively moist soil (1.0 mg/cm^2). Adult adherence factors are based on a residential gardener exposure scenario (0.08 mg/cm^2) where the gardener completes activities, such as weeding, pruning, picking fruit, digging small irrigation trenches, and cleaning up. The field measurement for the outdoor gardener scenario included various types of clothing, including long pants, shorts, short sleeve shirts, and intermittent use of gloves. The adherence factor of 0.27 mg/cm^2 was for utility workers.

Table 4: **Exposure Parameters for Blood Lead Concentration Calculations**

Exposure Parameters	Receptor Scenario		
	Current Beach Cleanup Workers	Current Commercial Workers	Future Occasional Utility Worker
Lead in ambient air ($\mu g/m^3$)	0.01[1]	0.01[1]	0.01[1]
Lead in soil ($\mu g/g$)	129.7 (95th UCL for surface soils)	129.7	129.7
Lead in drinking water ($\mu g/L$)	15[2]	15[2]	15[2]
Plant update (yes/no)	No	No	No
Respirable dust ($\mu g/m^3$)	50	50	5000
Days per week (days/week)	1[7]	5	5
Skin surface area (cm^2/day)	3,700 (adults)[3] 2,800 (children)[4] 2,800 (pica children)	3,700 (adults)	5,800[5] (adults)
Soil adherence (mg/cm^2)	0.5	0.5	0.5
Soil ingestion (mg/day)	25 (adults) 55 (children) 790 (pica children)	25 (adults)	120 (adults)
Breathing rate (m^3/day)	20 (adults) 10 (children)	20 (adults)	20 (adults)
Water ingestion (L/day)	1.4 (adults) 0.4 (children)	1.4 (adults)	1.4 (adults)
Food ingestion[6] (kg/day)	2.2 (adults) 1.3 (children)	2.2 (adults)	2.2 (adults)

Note: Default values from DTSC 1992b, unless otherwise specified.

1 BAAQMD, 1997. The closest monitoring station is located in San Francisco.
2 Federal Drinking Water Standard.
3 Median skin area of arms and hands.
4 Median skin area of arms, hands, feet, and legs.
5 Average area of adult arms, hands, shoulders, neck, and face.
6 Food is assumed to contain lead at 10 μ/kg (default).
7 Exposure is represented in terms of days/week. One day per week for beach cleanup workers was included in the assessment to estimate potential blood lead concentrations from exposure to lead in soil. However, beach cleanup workers participate in cleanup activities only approximately once a month.

Table 5: **Summary of Risks and Hazards by Exposure Route and Exposure Scenario**

Exposure Scenario	Exposure Route	Individual Excess Lifetime Cancer Risk	Hazard Index
Beach cleanup worker	Inhalation of particulates and vapors from soil and groundwater	2.8×10^{-8}	0.0013
	Dermal contact and incidental ingestion of soil	8.7×10^{-7}	0.024
	Dermal contact with groundwater	NA	NA
Cumulative		9.0×10^{-7}	0.03
Commercial worker	Inhalation of vapors and particulates from soil and groundwater	2.9×10^{-7}	0.005 — indoor?
	Dermal contact and incidental ingestion of soil	3.6×10^{-6}	0.03
	Dermal contact with groundwater	NA	NA
Cumulative		3.9×10^{-6}	0.03
Occasional utility worker	Inhalation of vapors from soil and groundwater	5.8×10^{-10}	5.8×10^{-6}
	Dermal contact and incidental ingestion of soil + p & Metabolite	1.1×10^{-6}	8.1×10^{-3}
	Dermal contact with groundwater	3.6×10^{-8}	3.6×10^{-4}
Cumulative		1.1×10^{-6}	0.008

Notes: NA = Not applicable.
See Appendix C for risk and hazard index calculations.

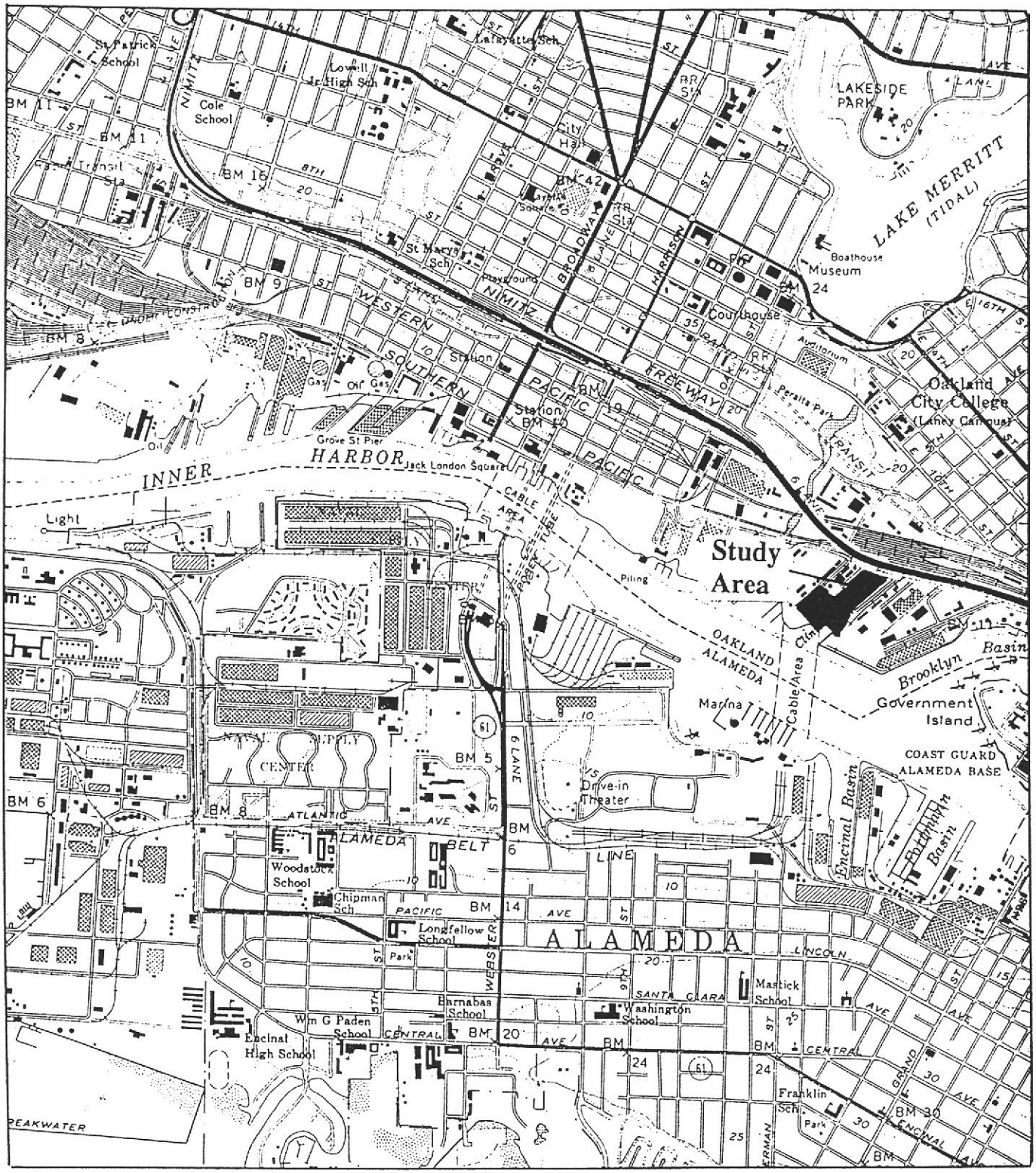
Table 6: **Summary of 99th Percentile Blood Lead Concentrations (μg/dl) for Current and Future Exposure Scenarios**

Exposure Scenario	99th Percentile Blood Lead Level
Current beach cleanup workers	
Adult	3.9
Children	7.1
Pica children	9.2
Current commercial workers	
Adult	4.1
Future occasional utility workers	
Adult	6.1

Note: See Appendix D for blood lead concentration calculations.

REGIONAL LOCATION

Figure 1



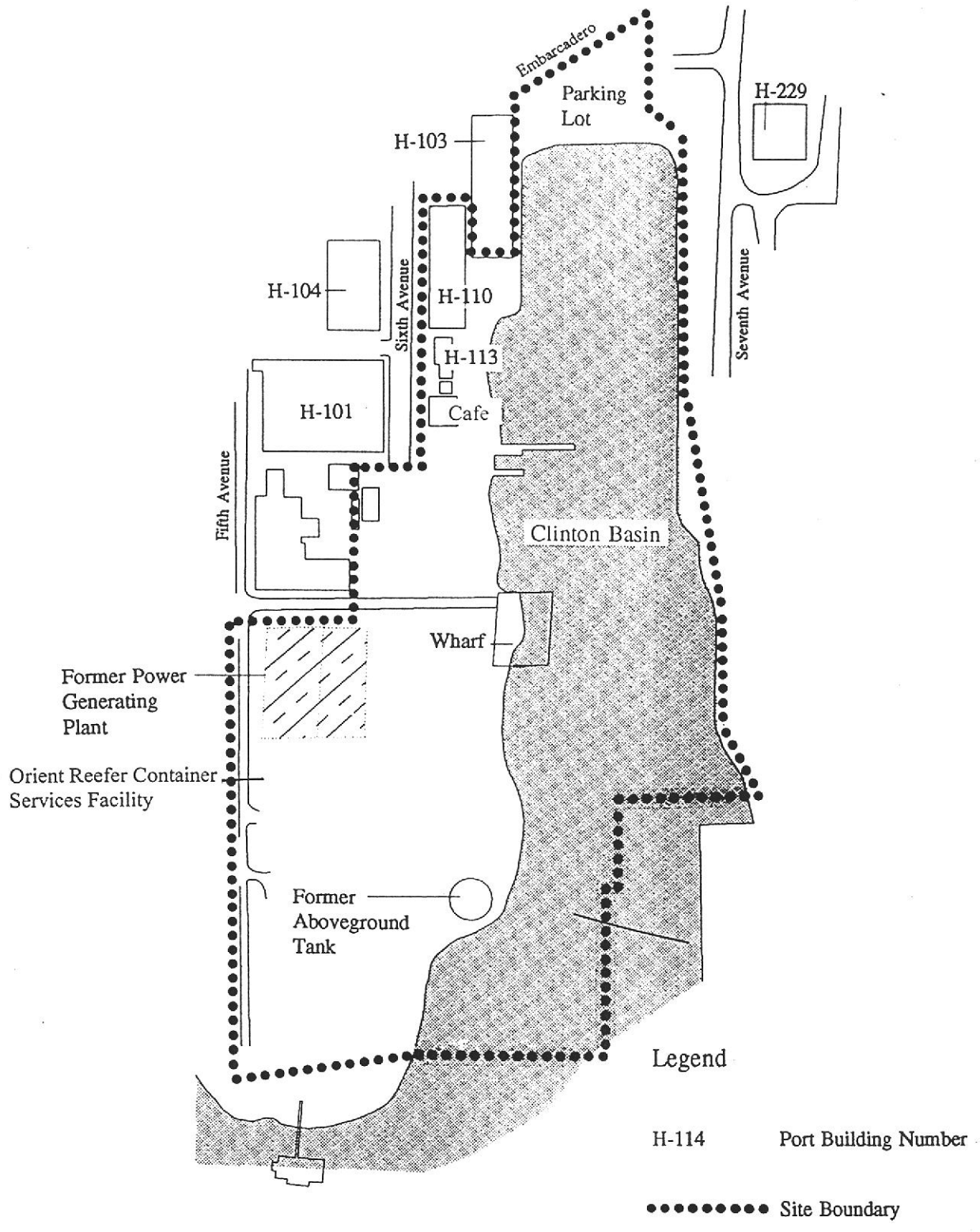
Seabreeze Yacht Center, Inc.
Sixth Avenue
Oakland, California

BASELINE

S9171AO 9/27/94

PROJECT SITE

Figure 2

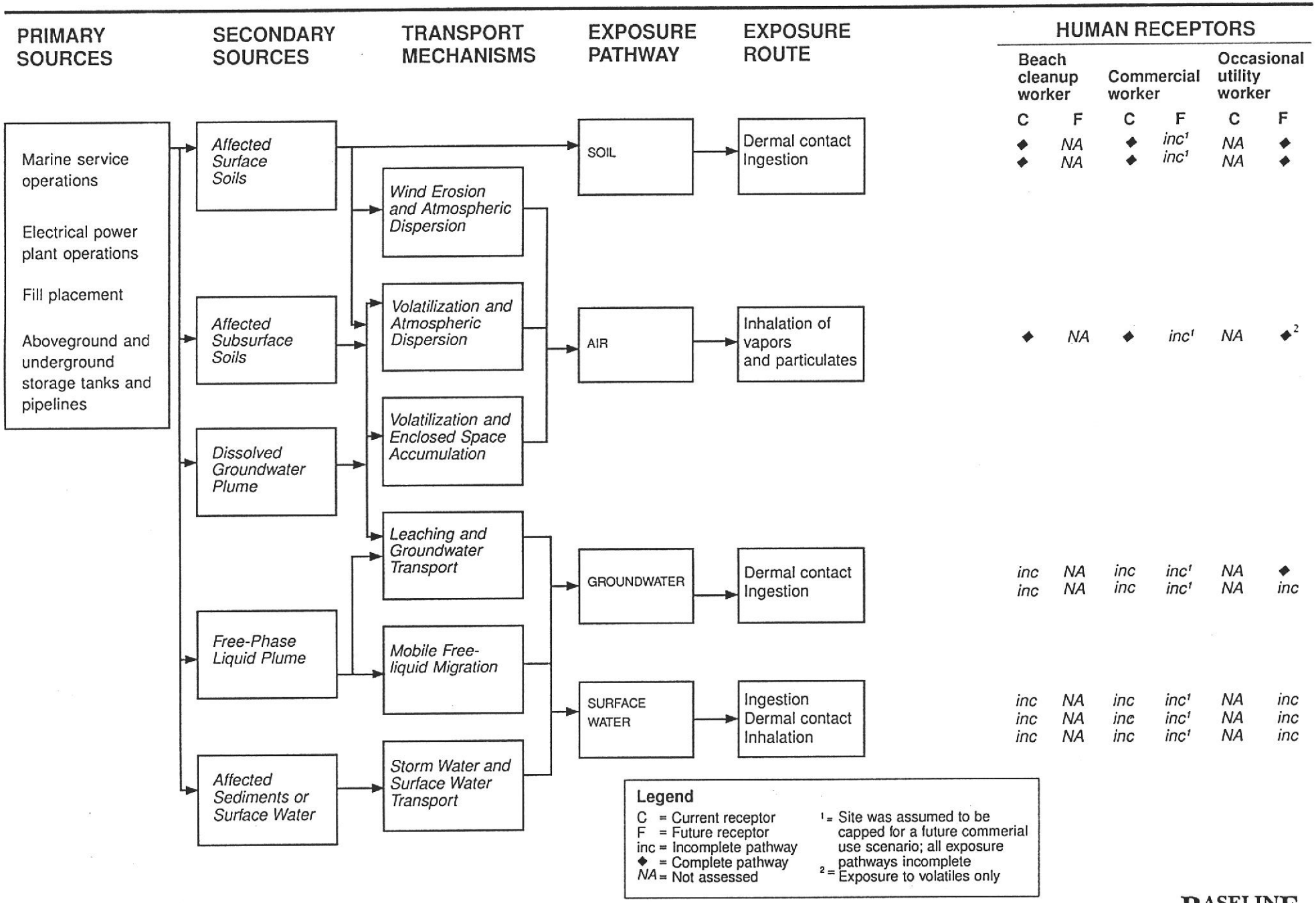


Seabreeze Yacht Center, Inc.
Sixth Avenue
Oakland, California

BASELINE

S9171-00.01 9/27/94 CADD File K S9171AOA

FIGURE 3. Conceptual Site Model, Seabreeze Yacht Center, Oakland



S9171ste.mdl-9/9/98

BASELINE

APPENDIX A

95th UPPER CONFIDENCE LIMIT CALCULATIONS FOR SOIL SAMPLE ANALYTICAL RESULTS

Table A-1
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤ 3.5 feet bgs)
Total Copper and Total Lead
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Adjusted Total Lead (mg/kg)	Total Copper (mg/kg)
SOIL (mg/kg)					
SB-1	09/06/90	0.5	40	40	31
		1.0	36	36	20
SB-2	09/06/90	0.5	<2.5	1.25	17
		1.0	<2.5	1.25	19
		3.0	36	36	19
SB-3	09/06/90	0.5	<2.5	1.25	10
		1.0	3	3	12
SB-4	09/06/90	0.5	69	69	100
		1.0	<2.5	1.25	21
SB-5	09/06/90	0.5	6.5	6.5	34
		1.0	<2.5	1.25	26
SB-6	09/06/90	0.5	650	650	140
		2.0	<2.5	1.25	11
SB-7	09/06/90	1.0	67	67	37
SB-8	09/06/90	0.5	51	51	79
		1.0	2.9	2.9	7.3
		2.5	5.9	5.9	16
SB-9	09/06/90	0.5	200	200	18
		1.0	160	160	12
SB-10	09/06/90	0.5	12	12	130
		1.0	<2.5	1.25	79
		3.0	25	25	18
SB-11	09/07/90	0.5	72	72	33
		1.0	22	22	18
		3.0	5.5	5.5	29
SB-12	09/07/90	0.5	340	340	730
		1.0	17	17	20
		2.5	67	67	19
SB-13	09/07/90	0.5	31	31	10
		1.0	19	19	9.9
		2.5	33	33	76
SB-14	09/07/90	0.5	61	61	47
		1.0	55	55	81
		3.0	<2.5	1.25	18
SB-15	09/07/90	0.5	12	12	8.4
		1.0	39	39	9.8
SB-6A	04/09/91	0.5	990	990	
		1.0	101	101	

Table A-1
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤ 3.5 feet bgs)
Total Copper and Total Lead
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Adjusted Total Lead (mg/kg)	Total Copper (mg/kg)
SB-6B	04/09/91	0.5	145	145	
		1.0	16.8	16.8	
SB-6C	04/09/91	0.5	11.3	11.3	
		1.0	3.5	3.5	
SB-6D	04/09/91	0.5	8.5	8.5	
		1.0	7.9	7.9	
SB-6E	04/09/91	0.5	7.8	7.8	
		1.0	142	142	
SB-6F	04/09/91	0.5	9.3	9.3	
		1.0	8.4	8.4	
SB-6G	04/09/91	0.5	<3.0	1.5	
		1.0	67.3	67.3	
SB-6H	04/09/91	0.5	50.5	50.5	
		1.0	102	102	
SB-9A	04/09/91	0.5	<3.0	1.5	
		1.0	<3.0	1.5	
SB-9B	04/09/91	0.5	60.8	60.8	
		1.0	34.8	34.8	
SB-9C	04/09/91	0.5	483	483	
		1.0	45.3	45.3	
SB-9D	04/09/91	0.5	119	119	
		1.0	82.4	82.4	
SB-9E	04/09/91	0.5	138	138	
		1.0	125	125	
SB-9F	04/09/91	0.5	152	152	
		1.0	509	509	
SB-9G	04/09/91	0.5	217	217	
		1.0	53.7	53.7	
SB-9H	04/09/91	1.0	382	382	
SB-12A	04/09/91	0.5	413	413	1780
		1.0	490	490	40
SB-12B	04/09/91	0.5	116	116	368
		1.0	70.5	70.5	87
SB-12C	04/09/91	0.5	86.8	86.8	237
		1.0	97.0	97.0	55
SB-12D	04/09/91	0.5	82.2	82.2	418
		1.0	68.5	68.5	51
SB-12E	04/09/91	0.5	128	128	2280
		1.0	51.7	51.7	210
SB-12F	04/09/91	0.5	115	115	95
		1.0	17.9	17.9	23

Table A-1
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤ 3.5 feet bgs)
Total Copper and Total Lead
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Adjusted Total Lead (mg/kg)	Total Copper (mg/kg)
SB-12G	04/09/91	0.5	68.6	68.6	164
		1.0	28.1	28.1	33
SB-14A	04/08/91	0.5	52	52	
		1.0	73	73	
SB-14B	04/08/91	0.5	6.4	6.4	
		1.0	51	51	
SB-14C	04/08/91	0.5	105	105	
		1.0	91	91	
SB-14D	04/08/91	0.5	90	90	
		1.0	52	52	
SB-14E	04/08/91	0.5	38.1	38.1	
		1.0	91.3	91.3	
SB-14F	04/08/91	0.5	36.5	36.5	
		1.0	70.1	70.1	
SB-14G	04/09/91	0.5	126	126	
		1.0	79.8	79.8	
SB-6H	01/07/94	1.5	<4.9	2.45	
SB-6I	01/07/94	0.5	80	80	
		1.0	45	45	
SB-6J	01/07/94	0.5	24	24	
SB-6K	01/07/94	0.5	180/3700	3700	
SB-6L	01/07/94	1.0	49	49	
SB-9	01/07/94	1.5	26	26	
SB-9D	01/07/94	1.5	120	120	
SB-9F	01/07/94	1.5	75	75	
SB-9G	01/07/94	1.5	34	34	
SB-9H	01/07/94	1.5	270	270	
SB-9I	01/07/94	0.5	310	310	
SB-9J	01/07/94	0.5	110	110	
		1.0	84	84	
SB-9K	01/07/94	0.5	240	240	
		1.0	93	93	
SB-9L	01/07/94	1.0	<4.9	2.45	
SB-9M	01/07/94	0.5	87	87	
		1.0	74/93	93	
SB-9N	01/07/94	1.0	180	180	
SB-9O	01/07/94	0.5	<5	2.5	
		1.0	<5	2.5	
		1.5	58	58	
SB-12A	01/07/94	1.5	140	140	350
SB-12C	01/07/94	1.5	340	340	360

Table A-1
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤ 3.5 feet bgs)
Total Copper and Total Lead
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Adjusted Total Lead (mg/kg)	Total Copper (mg/kg)
SB-12H	01/07/94	0.5	150	150	190
		1.0	300	300	3500
		1.5	23	23	23
SB-12I	01/07/94	0.5	230	230	100
		1.0	200	200	150
SB-12J	01/07/94	0.5	48	48	86
		1.0	63	63	240
SB-12K	01/07/94	1.0	19	19	170
SB-12L	01/10/94	0.5	220	220	240
		1.0	75	75	120
		1.5	140	140	39
SB-14C	01/07/94	1.5	65	65	
SB-14H	01/07/94	1.0	120	120	
SB-14I	01/07/94	1.0	230	230	
BD-1	11/10/94	2.0	<5.0	2.5	7.6
BD-1A	11/10/94	2.0	21	21	13
BD-2	11/10/94	2.0	230	230	18
BD-2A	11/10/94	2.0	590	590	23
BD-3	11/22/94	2.5	160	160	2300
BD-4	11/10/94	0.0	150	150	53
BD-5	11/22/94	2.5	78	78	38
MW-SB3	11/10/94	2.0	190	190	50
MW-SB4	11/22/94	2.0	79	79	35
MW-SB5	11/22/94	2.0	63	63	24
		3.0	320	320	150
Shore-1-Surface	01/18/95	0	8	8	
Shore-1-3'	01/18/95	3.0	55	55	
Shore-2-Surface	01/18/95	0	230	230	
Shore-2-3'	01/18/95	3.0	34	34	
Shore-2d-Surface	01/18/95	0	600	600	
Shore-2d-3'	01/18/95	3.0	20	20	
Shore-3-Surface	01/19/95	0	240	240	
Shore-3-2.5	01/19/95	2.5	11/11	11	
Shore-4-Surface	01/18/95	0	420	420	
Shore-4-3'	01/18/95	3.0	270	270	
Shore-5-Surface	01/19/95	0	300	300	
Shore-5-3.0	01/19/95	3.0	600	600	
Shore-6-Surface	01/19/95	0	100	100	
Shore-6-2.0	01/19/95	2.0	110	110	

Table A-1
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤ 3.5 feet bgs)
Total Copper and Total Lead
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Adjusted Total Lead (mg/kg)	Total Copper (mg/kg)
PW1 36"	01/31/95	3.0	9.3	9.3	
PW2 12"	01/30/95	1.0	210	210	
PW3 12"	01/30/95	1.0	81	81	
PW4 12"	01/30/95	1.0	43	43	
S-11	08/11/95	1.0	150	150	28
		3.0	210	210	50
S-12	08/11/95	1.0	7.4	7.4	5.4
C-1	NA	0.5	9.36	9.36	22.8
C-2	NA	0.5	5.83	5.83	15.3
C-3	NA	0.5	6.62	6.62	16.1
C-4	NA	0.5	5.72	5.72	14.7
C-5	NA	0.5	6.5	6.5	14.6
C-6	NA	0.5	7.45	7.45	14.1
C-7	NA	0.5	5.59	5.59	14.5
			Number of Samples	174	84
			Average	111.2212139	193.827381
			Standard Deviation	146.7932855	541.7208943
			Standard Error	11.12913461	59.10757166
			95th UCL	129.6955773	292.1823802

Notes:

111 + 111(

bgs = below ground surface
UCL = Upper Confidence Limit
The adjusted values assume one-half the laboratory reporting limit in calculating the 95th UCL for analytical results reported below the laboratory reporting limit
The 95th UCL is calculated as the average + t.95 standard error, where t is obtained from the cumulative t-distribution with n-1 degrees of freedom, where n is the number of samples.

Table A-2
95TH UPPER CONFIDENCE LEVEL CALCULATIONS, SUBSURFACE SOIL SAMPLE ANALYTICAL RESULTS (> 3.5 feet bgs)
Total Lead and Total Copper
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Lead (mg/kg)	Total Copper (mg/kg)
SOIL (mg/kg)				
SB-1	09/06/90	3.5	14	12
SB-2	09/06/90	5.0	87	11
SB-3	09/06/90	3.5	2.5	9.0
SB-4	09/06/90	3.5	14	16
SB-5	09/06/90	3.5	11	19
SB-9	09/06/90	3.5	2.5	9.5
SB-15	09/07/90	3.5	14	11
BD-1	11/10/94	6.0	190	15
BD-1A	11/10/94	4.0	23	14
BD-2	11/10/94	4.0	130	20
BD-2A	11/10/94	4.5	91	28
BD-3	11/22/94	5.0	8.1	19
MW-SB3	11/10/94	4.5	310	53
MW-SB4	11/22/94	5.0	10	15
MW-SB4A	11/10/94	5.0	6.2	13
PW1 B5'	01/31/95	5.0	38	
PW2 4.5-6B	01/30/95	4.5	6.4	
PW3 5.6'	01/30/95	5.6	28	
PW4 42"	01/30/95	3.5	63	
S-12	08/11/95	4.0	79	36
S-12	08/11/95	6.0	13	30
CS-1	11/01/96	5.0	10.9	19.7
CS-2	11/01/96	5.0	19.3	24.4
CS-3	11/01/96	5.0	26.2	27.4
		Number of Samples	24	20
		Average	49.87916667	20.1
		Standard Deviation	72.38781413	10.74405588
		Standard Error	14.80050995	2.415914707
		95th UCL	75.24724073	24.27711653

Notes:

bgs = below ground surface
UCL = Upper Confidence Limit
The 95th UCL is calculated as the average + t.95 standard error, where t.95 is obtained from the cumulative t-distribution with n-1 degrees of freedom, where n is the number of samples.

Table A-3

95TH UPPER CONFIDENCE LIMIT CALCULATIONS,

SHALLOW SOIL SAMPLES (≤3.5 feet bgs)

Total Nickel

Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Nickel
SOIL (mg/kg)			
SB-1	09/06/90	0.5	8.1
SB-1	09/06/90	1	25
SB-2	09/06/90	0.5	1.25
SB-2	09/06/90	1	1.25
SB-2	09/06/90	3	27
SB-3	09/06/90	0.5	1.25
SB-3	09/06/90	1	1.25
SB-4	09/06/90	0.5	24
SB-4	09/06/90	1	15
SB-5	09/06/90	0.5	19
SB-5	09/06/90	1	1.25
SB-6	09/06/90	0.5	120
SB-6	09/06/90	2	21
SB-7	09/06/90	1	27
SB-8	09/06/90	0.5	14
SB-8	09/06/90	1	20
SB-8	09/06/90	2.5	32
SB-9	09/06/90	0.5	26
SB-9	09/06/90	1	15
SB-10	09/06/90	0.5	14
SB-10	09/06/90	1	9.5
SB-10	09/06/90	3	38
SB-11	09/07/90	0.5	38
SB-11	09/07/90	1	69
SB-11	09/07/90	3	28
SB-12	09/07/90	0.5	37
SB-12	09/07/90	1	7.4
SB-12	09/07/90	2.5	26
SB-13	09/07/90	0.5	17
SB-13	09/07/90	1	18
SB-13	09/07/90	2.5	28
SB-14	09/07/90	0.5	35
SB-14	09/07/90	1	25
SB-14	09/07/90	3	20
SB-15	09/07/90	0.5	25
SB-15	09/07/90	1	28
BD-4	11/10/94	0	39
MW-SB5	11/22/94	3	180

Table A-3
95TH UPPER CONFIDENCE LIMIT CALCULATIONS,
SHALLOW SOIL SAMPLES (≤3.5 feet bgs)
Total Nickel
Seabreeze Yacht Center, Oakland, California

Sample Number	Sample Date (mm/dd/yy)	Depth (feet bgs)	Total Nickel
Shore-1-Surface	01/18/95	0	28
Shore-1-3'	01/18/95	3	22
Shore-2-Surface	01/18/95	0	14
Shore-2-3'	01/18/95	3	43
Shore-2d-Surface	01/18/95	0	13
Shore-2d-3'	01/18/95	3	52
Shore-3-Surface	01/19/95	0	13
Shore-3-2.5	01/19/95	2.5	46
Shore-4-Surface	01/18/95	0	24
Shore-4-3'	01/18/95	3	47
Shore-5-Surface	01/19/95	0	27
Shore-5-3.0	01/19/95	3	30
Shore-6-Surface	01/19/95	0	13
Shore-6-2.0	01/19/95	2	26
		Number of sample:	52
		Average	28.44711538
		Standard Deviation	28.74022837
		Standard Error	3.98560926
		95th UCL	35.1269965

Notes:

bgs = below ground surface
UCL = Upper Confidence Limit
The 95th UCL is calculated as the average + t.95 standard error, where t.95 is obtained from the cumulative t-distribution with n-1 degrees of freedom, where n is the number of samples.

Table A-4
95TH UPPER CONFIDENCE LEVEL CALCULATIONS, SHALLOW SOIL SAMPLE ANALYTICAL RESULTS (≤3.5 feet bgs)
Polychlorinated Biphenyls
Seabreeze Yacht Center, Oakland, California

		Concentration (ug/kg)				
Sample ID	Sample Depth (feet bgs)	Arochlor 1260	Arochlor 1260 Adjusted	Arochlor 1254	Arochlor 1254 Adjusted	Arochlor 1221, 1232, 1016, 1242, 1248
S-1	2	<20	10	<20	10	<20
S-1	3	<20	10	<20	10	<20
S-2	2	<20	10	<20	10	<20
S-2	3	<20	10	<20	10	<20
S-3	2	<20	10	<20	10	<20
S-3	3	<20	10	<20	10	<20
S-4	2	<20	10	<20	10	<20
S-4	3	<20	10	<20	10	<20
S-5	2	62	62	<20	10	<20
S-5	3	<20	10	<20	10	<20
S-6	2	21	21	<20	10	<20
S-6	3	<20	10	<20	10	<20
S-7	2	<20	10	<20	10	<20
S-7	3	<20	10	<20	10	<20
S-8	2	<20	10	<20	10	<20
S-8	3	<20	10	<20	10	<20
S-9	2	420	420	<20	10	<20
S-9	3	<20	10	<20	10	<20
S-11	2	290	290	200	200	<20
S-11	3	<20	10	<20	10	<20
S-12	2	<20	10	<20	10	<20
S-12	3	<20	10	<20	10	<20
Shore-2d-Surface	0	2.9/2.6	2.9	NA		NA
Shore-2x	0.5	4700	4700	<100	50	<100
T-1	3	<20	10	<20	10	<20
T-1	3	<20	10	<20	10	<20
T-2	3	65	65	150	150	<20
T-3	3	<20	10	<20	10	<20
T-4	3	<20	10	<20	10	<20
	Number of samples	29			28	
	Average	199.3413793			23.21428571	
	Standard Deviation	870.3210785			44.05834275	
	Standard Error	161.6195132			8.327035107	
	95th UCL	474.2561712			37.3952265	

Notes:

bgs = below ground surface
UCL = Upper Confidence Limit
The adjusted values assume one-half the laboratory reporting limit in calculating the 95th UCL for analytical results reported below the laboratory reporting limit.
The 95th UCL is calculated as: average + t.95 standard error, where t.95 is obtained from the cumulative t-distribution with n-1 degrees of freedom, where n is the number of samples.

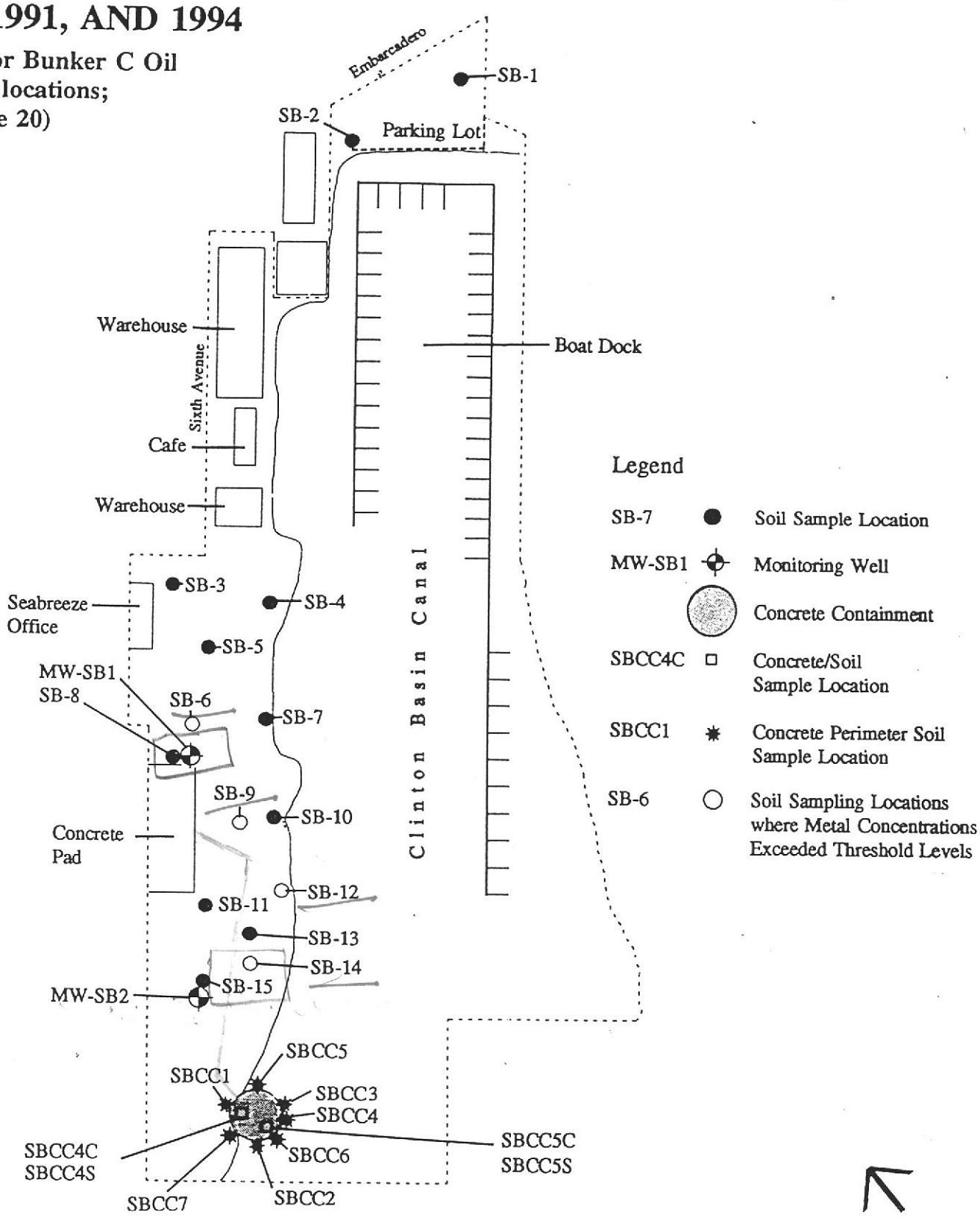
APPENDIX B

SOIL AND GROUNDWATER SAMPLING LOCATIONS, 1990 to 1998

SAMPLING LOCATIONS 1990, 1991, AND 1994

(except for Bunker C Oil sampling locations; see Figure 20)

Figure B-1



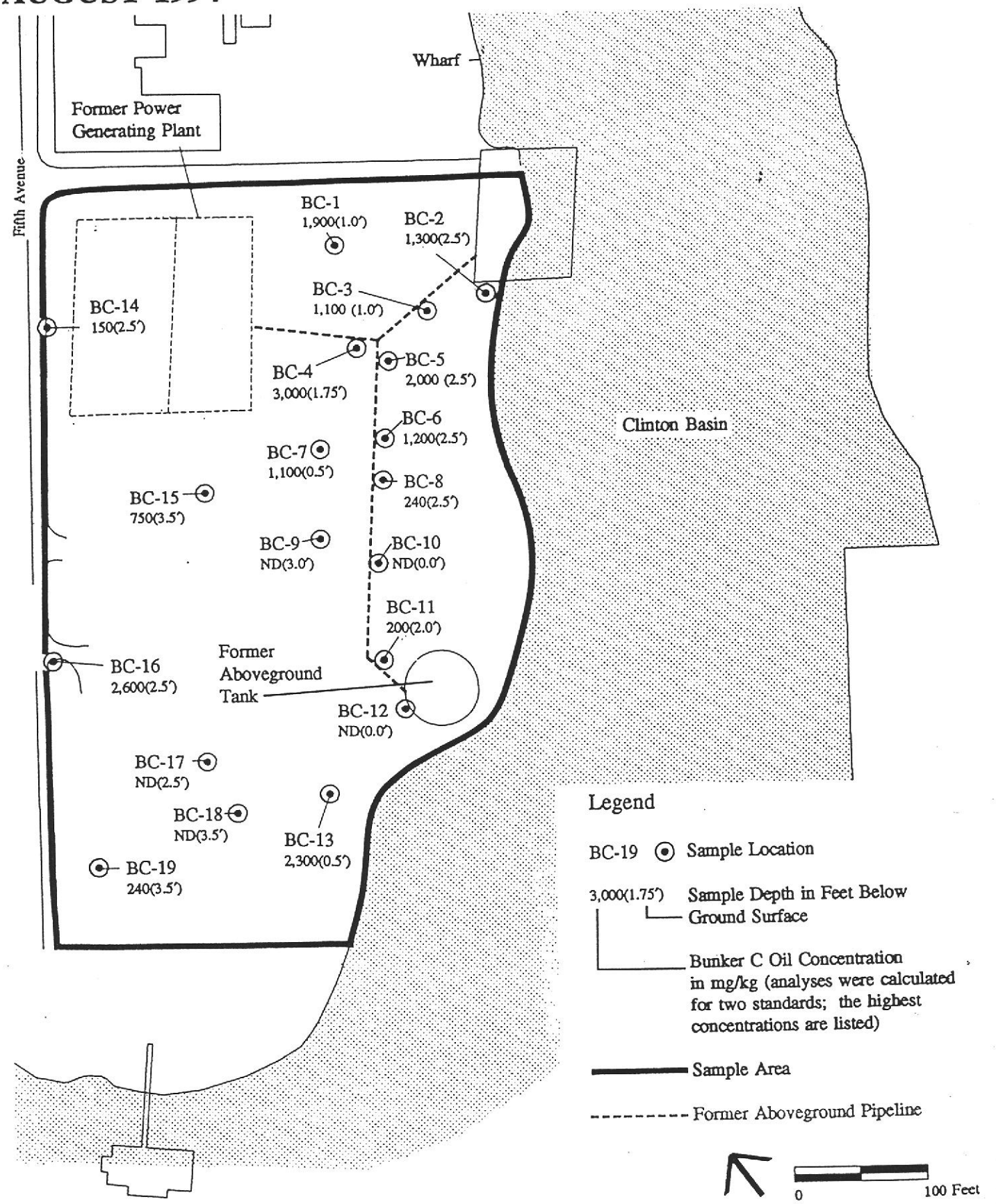
Seabreeze Yacht Center, Inc.
Sixth Avenue
Oakland, California

BASELINE

S9171-00 2/23/94

SAMPLING LOCATIONS
AUGUST 1994

Figure B-2



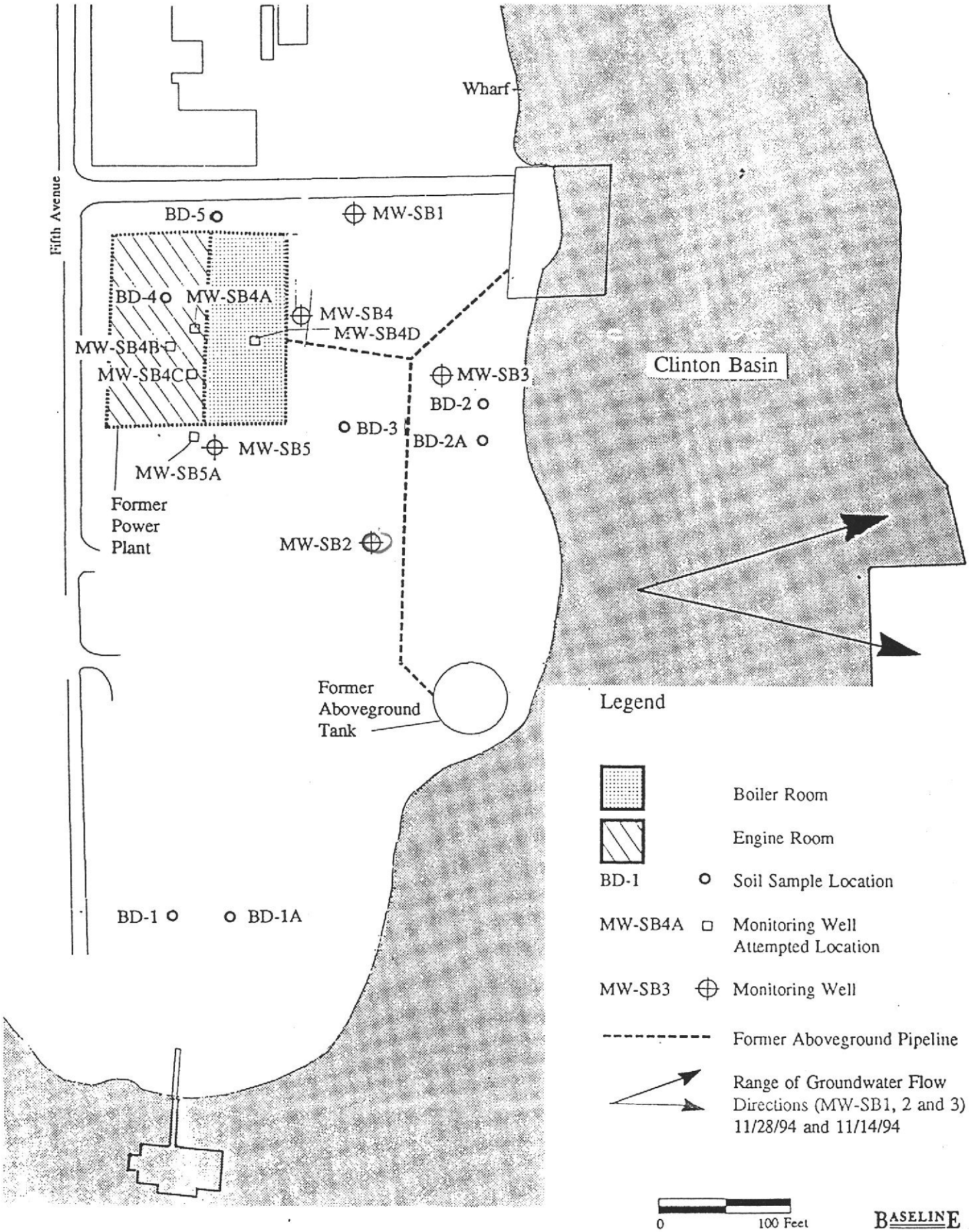
Seabreeze Yacht Center, Inc.

BASELINE

S9171-00.02 8/22/94

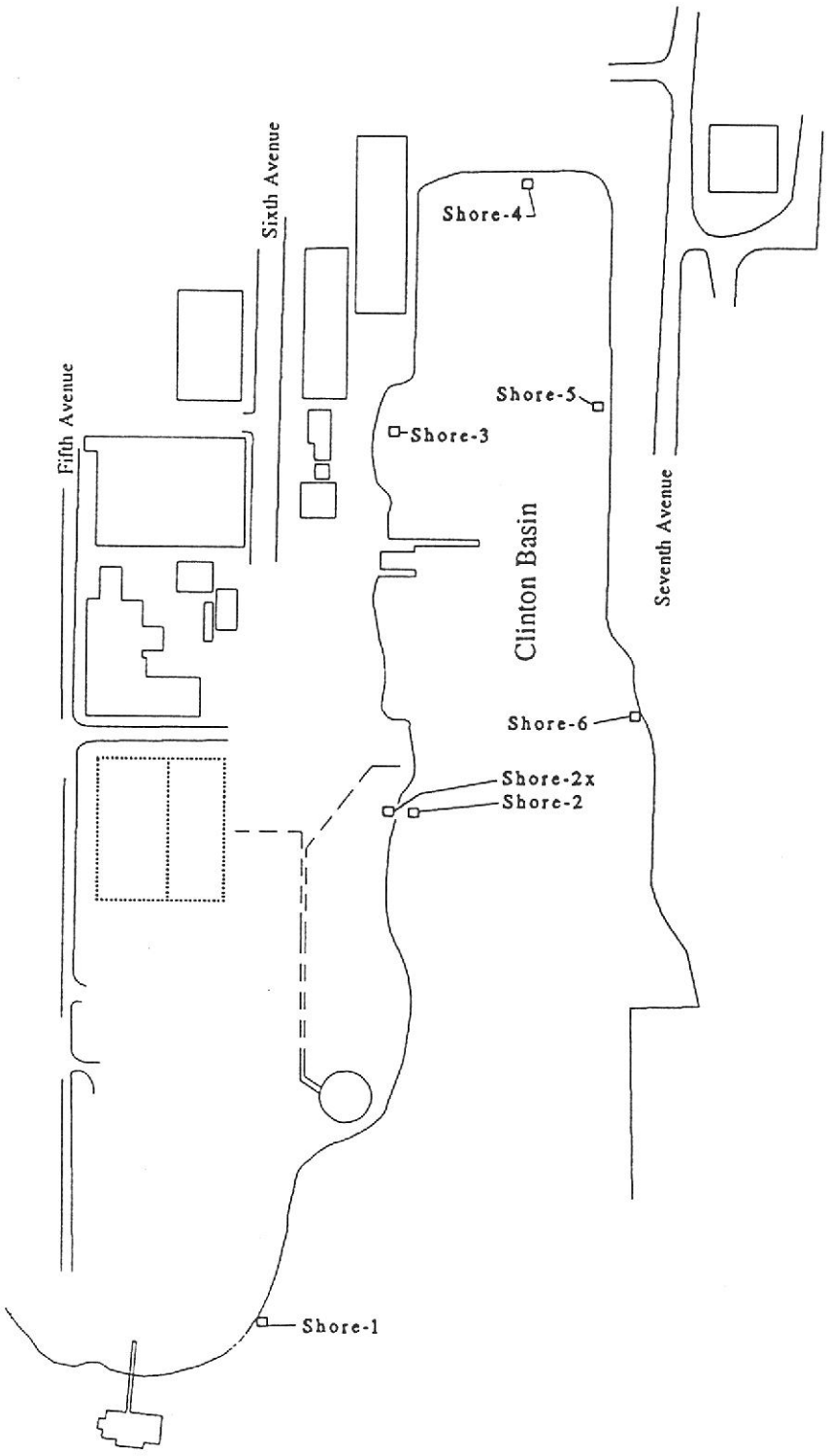
SAMPLING LOCATIONS NOVEMBER 1994

Figure B-3



SHORELINE SAMPLE LOCATIONS
MARCH 1995

Figure B-4



Legend

▫ Shoreline Sampling Location

0 200 Feet

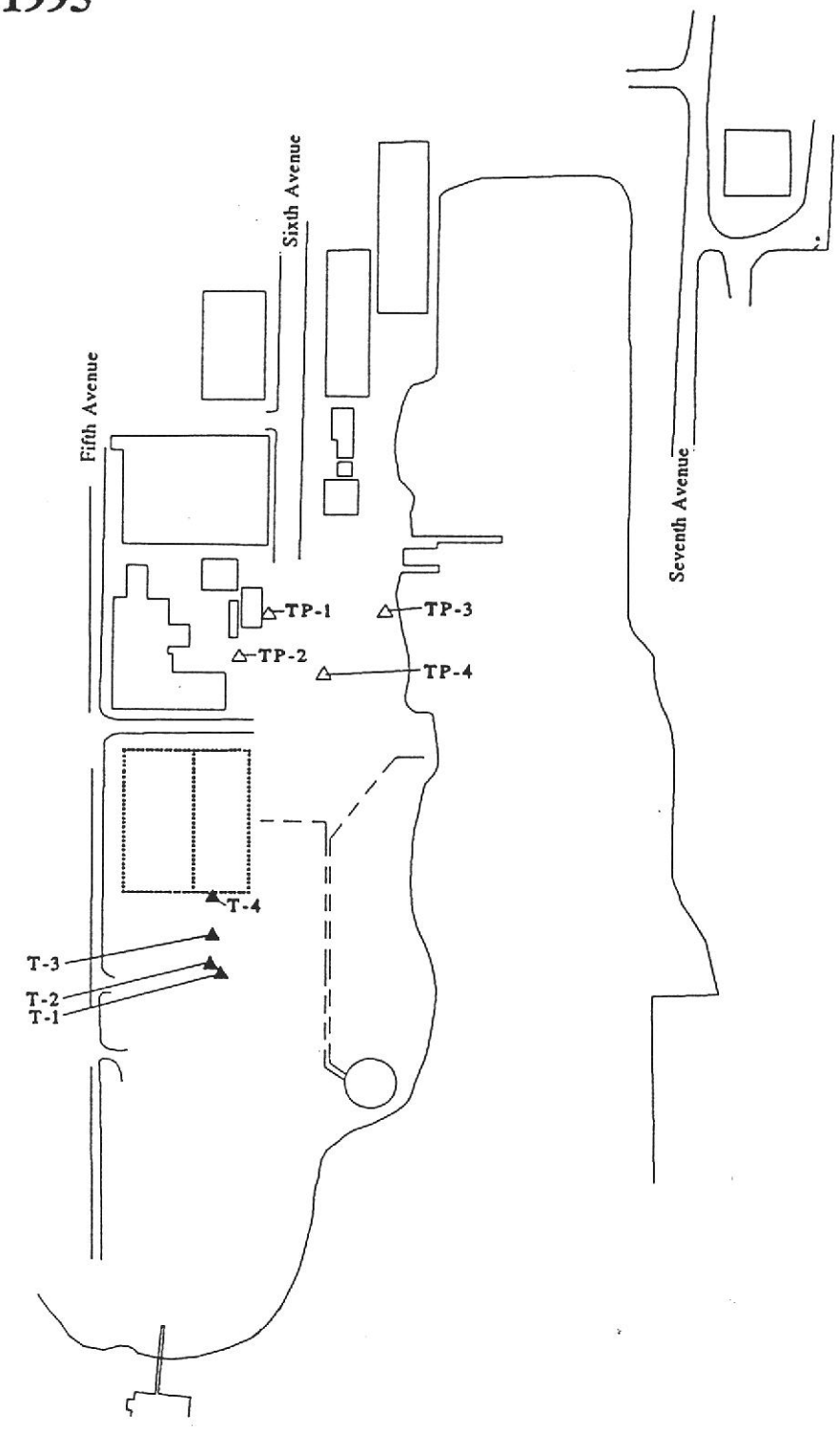
Clinton Basin
Oakland, California

BASELINE

S9171-BO.02 4/4/95 Cadd - SL191

SOIL SAMPLE LOCATIONS
MARCH 1995

Figure B-5



Legend

△ Soil Sampling Location, Petroleum Hydrocarbons

▲ Soil Sampling Location, PCBs

0 200 Feet

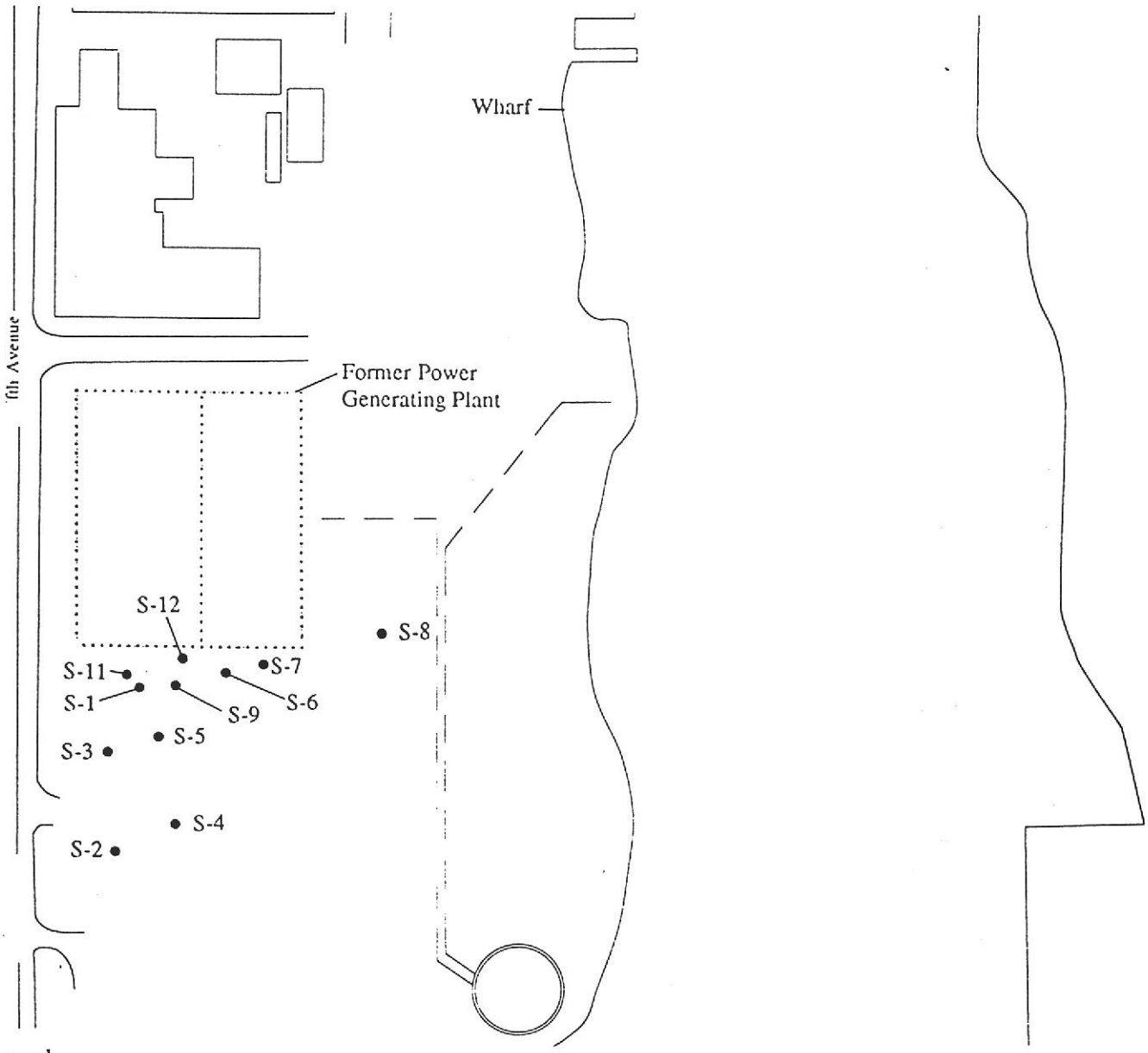
Clinton Basin
Oakland, California

BASELINE

S9171-BO.02 4/4/95 Cadd - SL191

SOIL SAMPLING LOCATIONS AUGUST 1995

Figure B-6



Legend

S-1 • Soil Sample Location

Note: [1]At locations S-1 through S-12 soil samples were collected on 11 August 1995.

[2]At locations S-1 through S-9 soil samples were collected at depths of 2.0 feet and 3.0 feet below ground surface (bgs), and analyzed for Polychlorinated Biphenyls (PCBs), Total Petroleum Hydrocarbons (TPH) as motor oil, and Bunker C.

[3]At location S-11 soil samples were collected at depths of 1.0 foot, 2.0 feet, 3.0 feet bgs. Samples collected at 1.0 foot and 3.0 feet were analyzed for Total Lead and Total Copper; soil samples collected at 2.0 feet and 3.0 Feet were analyzed for PCBs, TPH as motor oil and Bunker C.

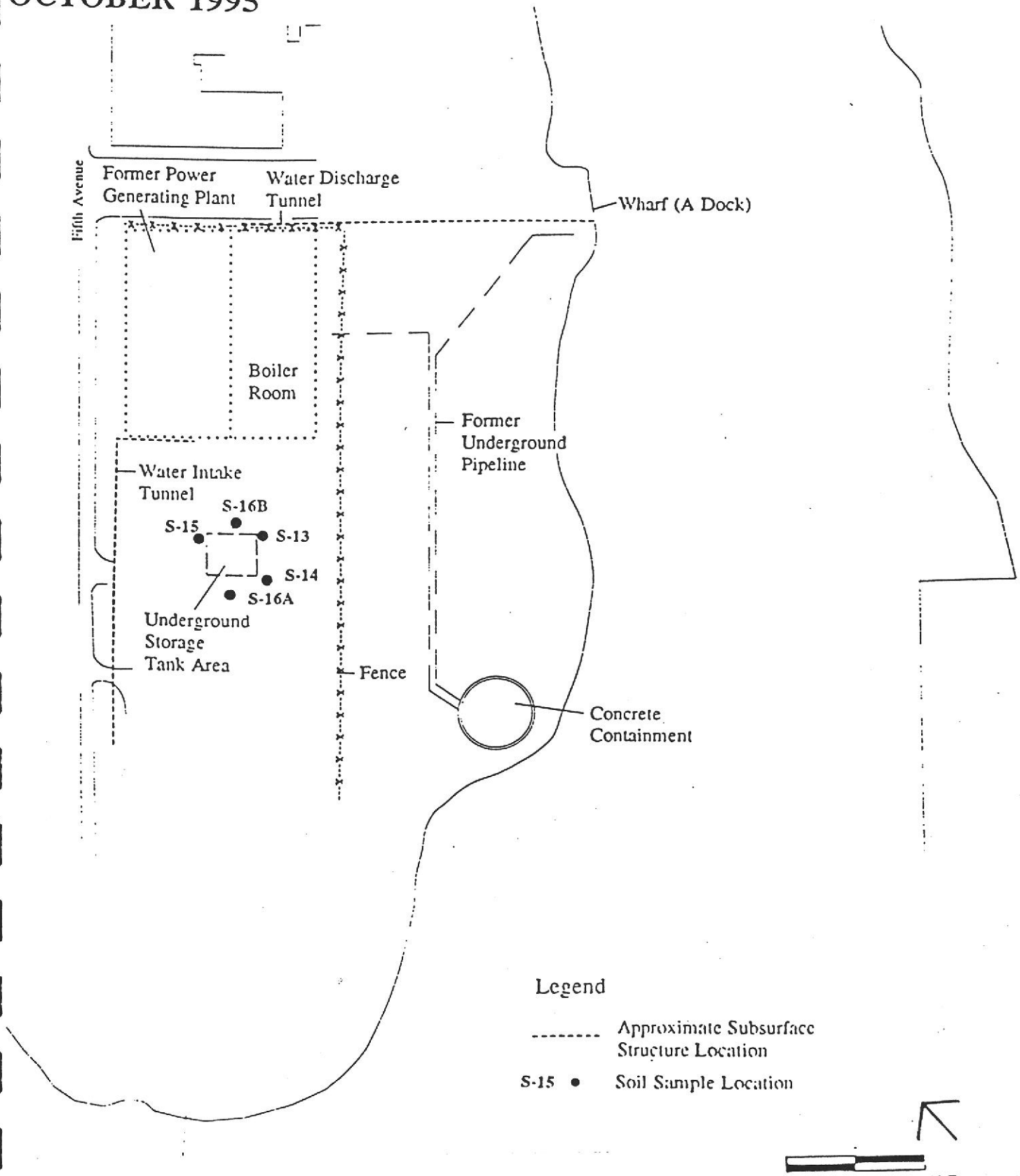
[4]At location S-12 soil samples were collected at depths of 1.0 foot, 2.0 feet, 3.0 feet, 4.0 feet, and 6.0 feet. Soil samples collected at 1.0 foot, 4.0 feet and 6.0 feet were analyzed for PCBs, TPH as motor oil and Bunker C.

0 100 Feet

BASELINE

SOIL SAMPLING LOCATIONS OCTOBER 1995

Figure B-7

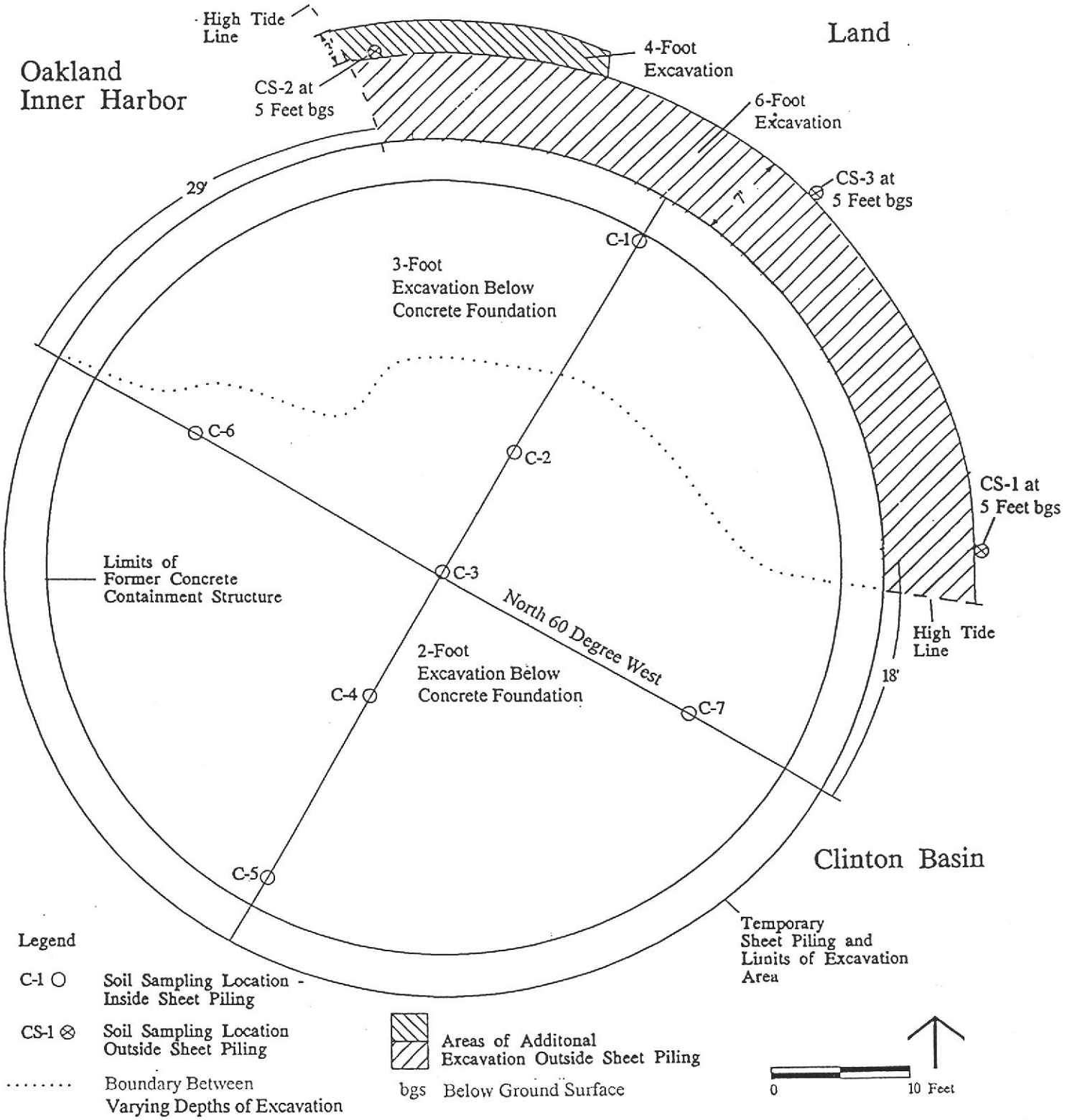


Note: Soil samples were collected on 4 October 1995 at depths from 4.0 to 9.0 feet bgs and analyzed for Total Petroleum Hydrocarbons as diesel, motor oil, and Bunker C.

BASELINE

AREA OF EXCAVATION AND SOIL SAMPLING LOCATIONS NOVEMBER/DECEMBER 1996

Figure B-8



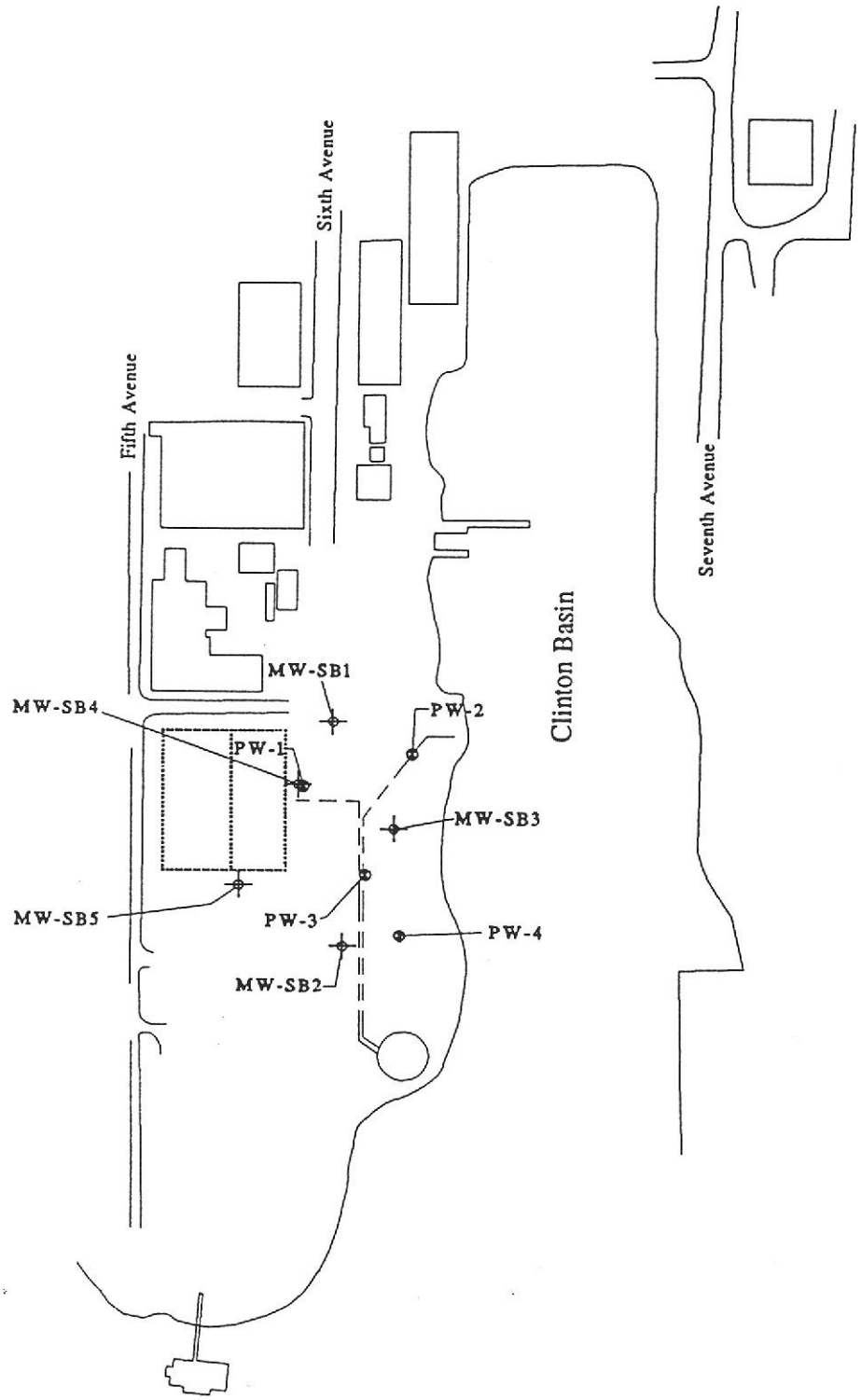
Seabreeze Yacht Center
280 Sixth Avenue
Oakland, California

BASELINE

S9171-C1 12/18/96, Cadd C:\s9171clb

MONITORING WELL LOCATIONS

Figure B-9



Legend

MW-SB2 ⊕ Monitoring Well Location
PW-1 ⊙

0 200 Feet

Clinton Basin
Oakland, California

BASELINE

S9171-BO.02 4/4/95 Cadd - SL191

APPENDIX C

RISK AND HAZARD INDEX CALCULATION SPREADSHEETS

Spreadsheet C-1: Current Beach Cleanup Workers

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA
Lab Identification: S9171-C1
Date Completed: 8/31/98
Completed By: Julie C. Pettijohn
Software: GSI RBCA Spreadsheet
Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non carcinogens (yr)	***10***				
BW	Body weight (kg)	70	15			
ED	Exposure Duration (yr)	***4***	***6***			
t	Averaging time for vapor flux (yr)	10				
EF	Exposure Frequency (days/yr)	***12***				
EF. Derm	Exposure Frequency for dermal exposure	***12***				
IRgw	Ingestion Rate of Water (L/day)	2				
IRS	Ingestion Rate of Soil (mg/day)	***110***	200			
IRSadj	Adjusted soil ing. Rate (mg-yr/kg-d)	***86***				
IRA.in	Inhalation rate indoor (m^3/day)	15				
IRA.out	Inhalation rate outdoor (m^3/day)	20				
SA	Surface area (dermal) (cm^2)	5.8E+3	2.0E+3			
SA	Adjusted dermal area (mg-yr/kg-day)	***5.5E+2***				
M	Soil to skin adherence factor	***0.08***	***0.65***			
AAFs	Age adjustment on soil ingestion	TRUE				
AAFd	Age adjustment on skin surface area	TRUE				
tox	Use EPA tox data for air (or PEL based)	FALSE				
gwMCL?	Use MCL as exposure limit in groundwater	FALSE				

Age-adjusted inhalation rate: 9.14 m^3-year/kg-day

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	TRUE	FALSE	FALSE
S.v	Volatilization from Subsurface Soils	TRUE	FALSE	
GW.v	Volatilization from Groundwater	TRUE	FALSE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	FALSE	
GW.b	Vapors from Groundwater	FALSE	FALSE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	TRUE	FALSE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		FALSE		FALSE
S	Inhalation receptor (cm)		TRUE		FALSE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	***1.0E+07***	
W	Length of affect. soil parallel to wind (cm)	***8.5E+03***	
W.gw	Length of affect. soil parallel to groundwater (cm		
Uair	Ambient air velocity in mixing zone (cm/s)	***4.9E+02***	
delta	Air mixing zone height (cm)	***2.2E+02***	
Lss	Thickness of affected surface soils (cm)	***1.1E+02***	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	
I	Groundwater infiltration rate (cm/yr)	
Ugw	Groundwater Darcy velocity (cm/yr)	
Ugw.tr	Groundwater seepage velocity (cm/yr)	
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***3.0E+01***		
hv	Vadose zone thickness (cm)	***1.1E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***1.4E+02***		
Ls	Depth to top of affected subsurface soil (cm)	***1.1E+02***		
Lsubs	Thickness of affected subsurface soils (cm)	***3.0E+01***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)		
ER	Building air exchange rate (s^-1)		
Lcrk	Foundation crack thickness (cm)		
eta	Foundation crack fraction		

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA

(Complete the following table)

CONSTITUENT	Representative COC Concentration in Groundwater value (mg/L)	note	in Surface Soil value (mg/kg)	note	in Subsurface Soil value (mg/kg)	note
Acenaphthylene			3.0E-2	max		
Benzo (b)Fluoranthene			6.3E-1	max		
Benzo (g,h,i)Perylene			3.1E-1	max		
Benzo(a)Pyrene			4.7E-1	max		
Copper			2.9E+2	95thCL	2.4E+1	95thCL
Dibenzo(a,h) Anthracene			1.6E-1	max		
Nickel			3.5E+1	95thCL	3.5E+1	max
PCBs			5.1E-1	95thCL		
Phenanthrene			6.7E-1	max		
Phthalate, bis(2-Ethylhexyl)	3.8E-2	max		ND		ND

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA

Completed By: Julie C. Pettijohn
Date Completed: 8/31/1998

RBCA CHEMICAL DATABASE

Physical Property Data

CAS Number	Constituent	type	Molecular Weight (g/mole) MW	Diffusion Coefficients in air (cm2/s) Dair	Diffusion Coefficients in water (cm2/s) Dwat	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	Henry's Law Constant (@ 20 - 25 C) (atm-m3)/mol	Henry's Law Constant (@ 20 - 25 C) (unitless)	Vapor Pressure (@ 20 - 25 C) (mm Hg)	Solubility (@ 20 - 25 C) (mg/L)	acid pKa	base pKb	ref
208-96-8	Acenaphthylene	PAH	152.21	4.39E-02	7.53E-06	4.00	1.14E-04	4.74E-03	8.51E-10	3.93E+00			
205-99-2	Benzo (b)Fluoranthene	PAH	252	2.26E-02	5.56E-06	5.74	2.01E-05	8.36E-04	6.67E-07	1.47E-02			
191-24-2	Benzo (g,h,i)Perylene	PAH	276	4.90E-02	5.65E-05	6.20	1.40E-07	5.82E-06	1.00E-09	7.00E-04			
50-32-8	Benzo(a)Pyrene	PAH	252.3	5.00E-02	5.80E-06	5.59	1.39E-09	5.80E-08	5.68E-04	1.20E-03			
7440-50-8	Copper	N	63.546	N/A	N/A	2.47	0.00E+00	0.00E+00	0.00E+00	2.93E+05			
53-70-3	Dibenzo(a,h) Anthracene	PAH	278.35	2.00E-02	5.24E-06	5.87	3.81E-07	1.58E-05	5.20E-10	5.00E-04			
7440-02-0	Nickel	N	58.69	N/A	N/A	1.82	0.00E+00	0.00E+00	0.00E+00	1.73E+05			
1336-36-3	PCBs	PCB	290	1.04E-01	1.00E-05	5.21	2.94E-04	1.22E-02	0.00E+00	2.00E-01			
85-01-8	Phenanthrene	PAH	178.22	3.33E-02	7.47E-06	4.15	6.05E-03	2.52E-01	2.10E-04	1.60E+00			
117-81-7	Phthalate, bis(2-Ethylhexyl)	N	391.07	3.51E-02	3.66E-06	5.21	3.00E-07	1.25E-05	2.00E-07	3.43E-01			

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 8/31/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	Reference Dose (mg/kg/day) Inhalation RfD_inhal	Slope Factors 1/(mg/kg/day) Oral SF_oral	Slope Factors 1/(mg/kg/day) Inhalation SF_inhal	EPA Weight of Evidence	Is Constituent Carcinogenic ?
208-96-8	Acenaphthylene	4.00E-03	4.00E-03	-	-	D	FALSE
205-99-2	Benzo (b)Fluoranthene	-	-	1.20E+00	3.90E-01	B2	TRUE
191-24-2	Benzo (g,h,i)Perylene					D	FALSE
50-32-8	Benzo(a)Pyrene	-	-	1.20E+01	3.90E+00	B2	TRUE
7440-50-8	Copper	3.70E-02	3.70E-02	-	-	D	FALSE
53-70-3	Dibenzo(a,h) Anthracene	-	-	4.10E+00	4.10E+00	B2	TRUE
7440-02-0	Nickel	2.00E-02	-	-	9.10E-01	A	FALSE
1336-36-3	PCBs	2.00E-05	2.00E-05	7.70E+00	7.70E+00	B2	TRUE
85-01-8	Phenanthrene	3.00E-01	3.00E-01			D	FALSE
117-81-7	Phthalate, bis(2-Ethylhexyl)	2.00E-02	2.00E-02	1.40E-02	1.40E-02	B2	TRUE

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 8/31/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level MCL (mg/L)	reference	Permissible Exposure Limit PEL/TLV (mg/m3)	Relative Absorption Factors Oral	Dermal	Detection Limits Groundwater (mg/L)	Soil (mg/kg)	Half Life (First-Order Decay) (days) Saturated	Unsaturated
208-96-8	Acenaphthylene				1	0.15			120	120
205-99-2	Benzo (b)Fluoranthene				1	0.15			1220	1220
191-24-2	Benzo (g,h,i)Perylene				1	0.15			1300	1300
50-32-8	Benzo(a)Pyrene				1	0.15			1060	1060
7440-50-8	Copper				1	0.01				
53-70-3	Dibenzo(a,h) Anthracene				1	0.15			1880	1880
7440-02-0	Nickel				1	0.01				
1336-36-3	PCBs				1	0.15				
85-01-8	Phenanthrene				1	0.15			400	400
117-81-7	Phthalate, bis(2-Ethylhexyl)				1	0.1			389	389

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA

Completed By: Julie C. Pettijohn Date Completed: 8/31/1998

Software version: 1.0.1

Age adjusted inhalation rate (m3-year/kg-day)(EDc X IRAc/BWc + EDa X IRAa/BWa) 9.1E+00
Exposure Multiplier (carcinogen)(m3-year/kg-day) 4.3E-03
Exposure Multiplier (noncarcinogen)(m3-year/kg-day) 3.0E-02

Outdoor Air Exposure Pathway
Surface Soils: Vapor and Dust Inhalation

Constituents of Concern	(1) Source Medium Surface Soil Concentration (mg/kg)	(2) NAF Value (m^3/kg) Receptor	(3)Exposure Medium Outdoor Air: POE Conc. (mg/m^3) (1)/(2)	(4)Exposure Multiplier (IR X EFX ED)/(BW X AT)(mg^3/kg-day)	Average Daily Intake (mg/kg-day)(3) x (4)
Acenaphthylene	3.0E-02	3.8E+05	7.9E-08	3.0E-02	2.4E-09
Benzo(b)fluoranthene	6.3E-01	9.2E+06	6.8E-08	4.3E-03	2.9E-10
Benzo(g,h,I)perylene	3.1E-01	3.2E+07	9.7E-09	3.0E-02	2.9E-10
Benzo(a)pyrene	4.7E-01	5.1E+07	9.2E-09	4.3E-03	4.0E-11
Copper	2.9E+02	1.8E+11	1.6E-09	3.0E-02	4.9E-11
Dibenzo(a,h)Anthracene	1.6E-01	5.6E+07	2.9E-09	4.3E-03	1.2E-11
Nickel	3.5E+01	1.8E+11	2.0E-10	4.3E-03	8.4E-13
PCBS	5.1E-01	6.1E+05	8.4E-07	4.3E-03	3.6E-09
Phenanthrene	6.7E-01	7.1E+04	9.4E-06	3.0E-02	2.8E-07
Phthalate, bis(2-Ethylhexyl)	0.0E+00	2.6E+07	0.0E+00	4.3E-03	0.0E+00

Subsuface Soils: Vapor Inhalation

Constituents of Concern	(1) Source Medium Subsurface Soil Concentration (mg/kg)	(2) NAF Value (m^3/kg) Receptor	(3)Exposure Medium Outdoor Air: POE Conc. (mg/m^3) (1)/(2)	(4)Exposure Multiplier (IR X EFX ED)/(BW X AT)(mg^3/kg-day)	Average Daily Intake (mg/kg-day)(3) x (4)
Acenaphthylene	0.0E+00	8.3E+06	0.0E+00	3.0E-02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	4.9E+09	0.0E+00	4.3E-03	0.0E+00
Benzo(g,h,I)perylene	0.0E+00	6.0E+10	0.0E+00	3.0E-02	0.0E+00
Benzo(a)pyrene	0.0E+00	1.5E+11	0.0E+00	4.3E-03	0.0E+00
Copper	2.4E+01	NA	NA	3.0E-02	NA
Dibenzo(a,h)Anthracene	0.0E+00	1.8E+11	0.0E+00	4.3E-03	0.0E+00
Nickel	3.5E+01	NA	NA	4.3E-03	NA
PCBS	0.0E+00	2.2E+07	0.0E+00	4.3E-03	0.0E+00
Phenanthrene	0.0E+00	2.9E+05	0.0E+00	3.0E-02	0.0E+00
Phthalate, bis(2-Ethylhexyl)	0.0E+00	3.9E+10	0.0E+00	4.3E-03	0.0E+00

Groundwater Vapor Inhalation

Constituents of Concern	(1) Source Medium Groundwater Concentration (mg/L)	(2) NAF Value (m^3/kg) Receptor	(3)Exposure Medium Outdoor Air: POE Conc. (mg/m^3) (1)/(2)	(4)Exposure Multiplier (IR X EF X ED)/(BW X AT)(mg^3/kg-day)	Average Daily Intake (mg/kg-day)(3) x (4)	Total Pathway Intake (mg/kg-day) (Sum of intake (values from surface, subsurface and groundwater routes)
Acenaphthylene	0.0E+00	3.4E+05	0.0E+00	3.0E-02	0.0E+00	2.4E-09
Benzo(b)fluoranthene	0.0E+00	1.2E+06	0.0E+00	4.3E-03	0.0E+00	2.9E-10
Benzo(g,h,I)perylene	0.0E+00	3.8E+06	0.0E+00	3.0E-02	0.0E+00	2.9E-10
Benzo(a)pyrene	0.0E+00	3.9E+07	0.0E+00	4.3E-03	0.0E+00	4.0E-11
Copper	0.0E+00	NA	NA	3.0E-02	NA	4.9E-11
Dibenzo(a,h)Anthracene	0.0E+00	2.4E+07	0.0E+00	4.3E-03	0.0E+00	1.2E-11
Nickel	0.0E+00	NA	NA	4.3E-03	NA	8.4E-13
PCBS	0.0E+00	2.0E+05	0.0E+00	4.3E-03	0.0E+00	3.6E-09
Phenanthrene	0.0E+00	1.5E+05	0.0E+00	3.0E-02	0.0E+00	2.8E-07
Phthalate, bis(2-Ethylhexyl)	3.8E-02	2.5E+07	1.5E-09	4.3E-03	6.5E-12	6.5E-12

Outdoor Air Exposure Pathway

Constituents of Concern	(1) EPA Carcinogen Classification	(2) Total Carcinogen Intake Rate (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)^-1 (3)	Individual COC Risk (2) x (3)	Total Toxicant Intake Rate (mg/kg-day) (5)	Inhalation Reference Dose (mg/kg-day) (6)	Individual COC Hazard Quotient (5)/(6)
Acenaphthylene	D				2.4E-09	4.0E-03	5.9E-07
Benzo(b)fluoranthene	B2	2.9E-10	3.9E-01	1.1E-10			
Benzo(g,h,I)perylene	D				2.9E-10	NA	NA
Benzo(a)pyrene	B2	4.0E-11	3.9E+00	1.5E-10			
Copper	D				4.9E-11	3.7E-02	1.3E-09
Dibenzo(a,h)Anthracene	B2	1.2E-11	4.1E+00	5.0E-11			
Nickel	A	8.4E-13	9.1E-01	7.6E-13			
PCBS	B2	3.6E-09	7.7E+00	2.8E-08	2.5E-08	2.0E-05	1.3E-03
Phenanthrene	D				2.8E-07	3.0E-01	9.5E-07
Phthalate, bis(2-Ethylhexyl)	B2	6.5E-12	1.4E-02	9.1E-14	4.6E-11	2.0E-02	2.3E-09
			Total Pathway Carcinogenic Risk	2.8E-08		Total Pathway Hazard Index	1.3E-03

Age adjusted skin contact (mg-yr/kg-day) ((EDc X AF X SAc)/BWc + (EDa X AFX SAa)/BWa))	5.5E+02
Dermal Exposure multiplier (carcinogen, PNAs)(kg/kg-day)	3.9E-08
Dermal Exposure multiplier (noncarcinogen, PNAs)(kg/kg-day)	2.7E-07
Dermal Exposure multiplier (noncarcinogen, copper& nickel)(kg/kg-day)	1.8E-08
Dermal Exposure multiplier (carcinogen, bis 2-ethylhexylphthalate)(kg/kg-day)	2.6E-08
Age adjusted ingestion (mg-year/kg-day) ((EDc x IRSc)/BWc + (EDa X IRSa)/BWa))	8.6E+01
Ingestion Exposure multiplier (carcinogen)(kg-kg-day)	4.1E-08
Ingestion Exposure multiplier (noncarcinogen)(kg-kg-day)	2.8E-07

Soil Exposure Pathway
Surface Soils: Dermal Contact

Constituents of Concern	(1) Source Medium Surface Soil Concentration (mg/kg)	(2)Exposure Multiplier (SA X AFX ABS X CF X EFX ED)/(BW X AT) (kg/kg-day)	Average Daily Intake (mg/kg-day)(1) x (2)
Acenaphthylene	3.0E-02	2.7E-07	8.2E-09
Benzo(b)fluoranthene	6.3E-01	3.9E-08	2.5E-08
Benzo(g,h,I)perylene	3.1E-01	2.7E-07	8.4E-08
Benzo(a)pyrene	4.7E-01	3.9E-08	1.8E-08
Copper	2.9E+02	1.8E-08	5.3E-06
Dibenzo(a,h)Anthracene	1.6E-01	3.9E-08	6.2E-09
Nickel	3.5E+01	1.8E-08	6.4E-07
PCBS	5.1E-01	3.9E-08	2.0E-08
Phenanthrene	6.7E-01	2.7E-07	1.8E-07
Phthalate, bis(2-Ethylhexyl)	0.0E+00	2.6E-08	0.0E+00

Surface Soils: Ingestion

Constituents of Concern	(1) Source Medium Surface Soil Concentration (mg/kg)	(2) Exposure Multiplier (IR X CF X EF X ED)/(BW X AT)	(3) Average Daily Intake (mg/kg-day) (1) x (2)	Total Pathway Intake (Sum of Intake Values from Dermal and Ingestion Routes) (mg/kg-day)
Acenaphthylene	3.0E-02	2.8E-07	8.5E-09	1.7E-08
Benzo(b)fluoranthene	6.3E-01	4.1E-08	2.6E-08	5.0E-08
Benzo(g,h,I)perylene	3.1E-01	2.8E-07	8.8E-08	1.7E-07
Benzo(a)pyrene	4.7E-01	4.1E-08	1.9E-08	3.7E-08
Copper	2.9E+02	2.8E-07	8.3E-05	8.8E-05
Dibenzo(a,h)Anthracene	1.6E-01	4.1E-08	6.5E-09	1.3E-08
Nickel	3.5E+01	2.8E-07	1.0E-05	1.1E-05
PCBS	5.1E-01	4.1E-08	2.1E-08	4.1E-08
Phenanthrene	6.7E-01	2.8E-07	1.9E-07	3.7E-07
Phthalate, bis(2-Ethylhexyl)	0.0E+00	4.1E-08	0.0E+00	0.0E+00

Soil Exposure Pathways

Constituents of Concern	(1) EPA Carcinogen Classification	(2) Total Carcinogen Intake Rate (mg/kg-day)	Oral Slope Factor (mg/kg-day)^-1 (3)	Individual COC Risk (2) x (3)	Total Toxicant Intake Rate (mg/kg-day) (5)	Oral Reference Dose (mg/kg-day) (6)	Individual COC Hazard Quotier
Acenaphthylene	D				1.7E-08	4.0E-03	4.2E-06
Benzo(b)fluoranthene	B2	5.0E-08	1.2E+00	6.0E-08			
Benzo(g,h,I)perylene	D				1.7E-07		
Benzo(a)pyrene	B2	3.7E-08	1.2E+01	4.5E-07			
Copper	D				8.8E-05	3.7E-02	2.4E-03
Dibenzo(a,h)Anthracene	B2	1.3E-08	4.1E+00	5.2E-08			
Nickel	A			0.0E+00	1.1E-05	2.0E-02	
PCBS	B2	4.1E-08	7.7E+00	3.1E-07	4.4E-07	2.0E-05	2.2E-02
Phenanthrene	D				3.7E-07	3.0E-01	1.2E-06
Phthalate, bis(2-Ethylhexyl)	B2	0.0E+00	1.4E-02	0.0E+00	0.0E+00	2.0E-02	0.0E+00
			Total Pathway Carcinogenic Risk	8.7E-07		Total Pathway Hazard Index	2.4E-02

Spreadsheet C-2: Current Commercial Workers

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA
Lab Identification: S9171-C1
Date Completed: 9/3/98
Completed By: Julie C. Pettijohn
Software: GSI RBCA Spreadsheet
Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)				25	
BW	Body Weight (kg)				70	
ED	Exposure Duration (yr)				25	
t	Averaging time for vapor flux (yr)				25	
EF	Exposure Frequency (days/yr)				250	
EF.Derm	Exposure Frequency for dermal exposure				250	
IRgw	Ingestion Rate of Water (L/day)				1	
IRs	Ingestion Rate of Soil (mg/day)				50	
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)					
IRa.in	Inhalation rate indoor (m^3/day)				20	
IRa.out	Inhalation rate outdoor (m^3/day)				20	
SA	Skin surface area (dermal) (cm^2)				***3.7E+03***	
SAadj	Adjusted dermal area (cm^2-yr/kg)					
M	Soil to Skin adherence factor	***0.08***				
AAFs	Age adjustment on soil ingestion				FALSE	
AAFd	Age adjustment on skin surface area				FALSE	
tox	Use EPA tox data for air (or PEL based)?					
gwMCL?	Use MCL as exposure limit in groundwater?					

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	***1.0E+07***	
W	Length of affect. soil parallel to wind (cm)	***8.5E+03***	
W.gw	Length of affect. soil parallel to groundwater (cm		
Uair	Ambient air velocity in mixing zone (cm/s)	***4.9E+02***	
delta	Air mixing zone height (cm)	***2.2E+02***	
Lss	Thickness of affected surface soils (cm)	***1.1E+02***	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	
I	Groundwater infiltration rate (cm/yr)	
Ugw	Groundwater Darcy velocity (cm/yr)	
Ugw.tr	Groundwater seepage velocity (cm/yr)	
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	FALSE	TRUE	FALSE
S.v	Volatilization from Subsurface Soils	FALSE	TRUE	
GW.v	Volatilization from Groundwater	FALSE	TRUE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	FALSE	
GW.b	Vapors from Groundwater	FALSE	FALSE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	TRUE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***3.0E+01***		
hv	Vadose zone thickness (cm)	***1.1E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***1.4E+02***		
Ls	Depth to top of affected subsurface soil (cm)	***1.1E+02***		
Lsubs	Thickness of affected subsurface soils (cm)	***3.0E+01***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Matrix of Receptor Distance and Location On- or Off-Site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		FALSE		FALSE
S	Inhalation receptor (cm)		FALSE		TRUE

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)		
ER	Building air exchange rate (s^-1)		
Lcrk	Foundation crack thickness (cm)		
eta	Foundation crack fraction		

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA

(Complete the following table)

CONSTITUENT	Representative COC Concentration in Groundwater value (mg/L)	note	in Surface Soil value (mg/kg)	note	in Subsurface Soil value (mg/kg)	note
Acenaphthylene			3.0E-2	max		
Benzo (b)Fluoranthene			6.3E-1	max		
Benzo (g,h,i)Perylene			3.1E-1	max		
Benzo(a)Pyrene			4.7E-1	max		
Copper			2.9E+2	95thCL	2.4E+1	95thCL
Dibenzo(a,h) Anthracene			1.6E-1	max		
Nickel			3.5E+1	95thCL	3.5E+1	max
PCBs			5.1E-1	95thCL		
Phenanthrene			6.7E-1	max		
Phthalate, bis(2-Ethylhexyl)	3.8E-2	max		ND		ND

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA

Completed By: Julie C. Pettijohn
Date Completed: 9/3/1998

RBCA CHEMICAL DATABASE

Physical Property Data

CAS Number	Constituent	type	Molecular Weight (g/mole) MW	Diffusion Coefficients in air (cm2/s) Dair	Diffusion Coefficients in water (cm2/s) Dwat	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	Henry's Law Constant (@ 20 - 25 C) (atm-m3)/mol	Henry's Law Constant (@ 20 - 25 C) (unitless)	Vapor Pressure (@ 20 - 25 C) (mm Hg)	Solubility (@ 20 - 25 C) (mg/L)	acid pKa	base pKb	ref
208-96-8	Acenaphthylene	PAH	152.21	4.39E-02	7.53E-06	4.00	1.14E-04	4.74E-03	8.51E-10	3.93E+00			
205-99-2	Benzo (b)Fluoranthene	PAH	252	2.26E-02	5.56E-06	5.74	2.01E-05	8.36E-04	6.67E-07	1.47E-02			
191-24-2	Benzo (g,h,i)Perylene	PAH	276	4.90E-02	5.65E-05	6.20	1.40E-07	5.82E-06	1.00E-09	7.00E-04			
50-32-8	Benzo(a)Pyrene	PAH	252.3	5.00E-02	5.80E-06	5.59	1.39E-09	5.80E-08	5.68E-04	1.20E-03			
7440-50-8	Copper	N	63.546	N/A	N/A	2.47	0.00E+00	0.00E+00	0.00E+00	2.93E+05			
53-70-3	Dibenzo(a,h) Anthracene	PAH	278.35	2.00E-02	5.24E-06	5.87	3.81E-07	1.58E-05	5.20E-10	5.00E-04			
7440-02-0	Nickel	N	58.69	N/A	N/A	1.82	0.00E+00	0.00E+00	0.00E+00	1.73E+05			
1336-36-3	PCBs	PCB	290	1.04E-01	1.00E-05	5.21	2.94E-04	1.22E-02	0.00E+00	2.00E-01			
85-01-8	Phenanthrene	PAH	178.22	3.33E-02	7.47E-06	4.15	6.05E-03	2.52E-01	2.10E-04	1.60E+00			
117-81-7	Phthalate, bis(2-Ethylhexyl)	N	391.07	3.51E-02	3.66E-06	5.21	3.00E-07	1.25E-05	2.00E-07	3.43E-01			

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE — Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	Reference Dose (mg/kg/day) Inhalation RfD_inhal	Slope Factors 1/(mg/kg/day) Oral SF_oral	Slope Factors 1/(mg/kg/day) Inhalation SF_inhal	EPA Weight of Evidence	Is Constituent Carcinogenic ?
208-96-8	Acenaphthylene	4.00E-03	4.00E-03	-	-	D	FALSE
205-99-2	Benzo (b)Fluoranthene	-	-	1.20E+00	3.90E-01	B2	TRUE
191-24-2	Benzo (g,h,i)Perylene					D	FALSE
50-32-8	Benzo(a)Pyrene	-	-	1.20E+01	3.90E+00	B2	TRUE
7440-50-8	Copper	3.70E-02	3.70E-02	-	-	D	FALSE
53-70-3	Dibenzo(a,h) Anthracene	-	-	4.10E+00	4.10E+00	B2	TRUE
7440-02-0	Nickel	2.00E-02	-	-	9.10E-01	A	FALSE
1336-36-3	PCBs	2.00E-05	2.00E-05	7.70E+00	7.70E+00	B2	TRUE
85-01-8	Phenanthrene	3.00E-01	3.00E-01			D	FALSE
117-81-7	Phthalate, bis(2-Ethylhexyl)	2.00E-02	2.00E-02	1.40E-02	1.40E-02	B2	TRUE

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level MCL (mg/L)	reference	Permissible Exposure Limit PEL/TLV (mg/m3)	Relative Absorption Factors Oral	Dermal	Detection Limits Groundwater (mg/L)	Soil (mg/kg)	Half Life (First-Order Decay) (days) Saturated	Unsaturated
208-96-8	Acenaphthylene				1	0.15			120	120
205-99-2	Benzo (b)Fluoranthene				1	0.15			1220	1220
191-24-2	Benzo (g,h,i)Perylene				1	0.15			1300	1300
50-32-8	Benzo(a)Pyrene				1	0.15			1060	1060
7440-50-8	Copper				1	0.01				
53-70-3	Dibenzo(a,h) Anthracene				1	0.15			1880	1880
7440-02-0	Nickel				1	0.01				
1336-36-3	PCBs				1	0.15				
85-01-8	Phenanthrene				1	0.15			400	400
117-81-7	Phthalate, bis(2-Ethylhexyl)				1	0.1			389	389

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

Site Name: Former Seabreeze Yacht Center | Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 |

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS: VAPOR AND DUST INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium: Surface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor: On-Site Commercial		3) Exposure Medium: Outdoor Air: POE Conc. (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial	
Acenaphthylene	3.0E-2	6.0E+5		5.0E-8		2.0E-1		9.8E-9	
Benzo (b)Fluoranthene	6.3E-1	1.5E+7		4.3E-8		7.0E-2		3.0E-9	
Benzo (g,h,i)Perylene	3.1E-1	5.1E+7		6.1E-9		2.0E-1		1.2E-9	
Benzo(a)Pyrene	4.7E-1	8.1E+7		5.8E-9		7.0E-2		4.1E-10	
Copper	2.9E+2	1.8E+11		1.6E-9		2.0E-1		3.1E-10	
Dibenzo(a,h) Anthracene	1.6E-1	8.8E+7		1.8E-9		7.0E-2		1.3E-10	
Nickel	3.5E+1	1.8E+11		1.9E-10		7.0E-2		1.3E-11	
PCBs	5.1E-1	9.7E+5		5.3E-7		7.0E-2		3.7E-8	
Phenanthrene	6.7E-1	1.1E+5		6.0E-6		2.0E-1		1.2E-6	
Phthalate, bis(2-Ethylhexyl)	0.0E+0	4.1E+7		0.0E+0		7.0E-2		0.0E+0	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center | Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 |

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS: VAPOR INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium: Subsurface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor: On-Site Commercial		3) Exposure Medium: Outdoor Air: POE Conc. (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial	
Acenaphthylene	0.0E+0	8.3E+6		0.0E+0		2.0E-1		0.0E+0	
Benzo (b)Fluoranthene	0.0E+0	4.9E+9		0.0E+0		7.0E-2		0.0E+0	
Benzo (g,h,i)Perylene	0.0E+0	6.0E+10		0.0E+0		2.0E-1		0.0E+0	
Benzo(a)Pyrene	0.0E+0	1.5E+11		0.0E+0		7.0E-2		0.0E+0	
Copper	2.4E+1	NA		NA		2.0E-1		NA	
Dibenzo(a,h) Anthracene	0.0E+0	1.8E+11		0.0E+0		7.0E-2		0.0E+0	
Nickel	3.5E+1	NA		NA		7.0E-2		NA	
PCBs	0.0E+0	2.2E+7		0.0E+0		7.0E-2		0.0E+0	
Phenanthrene	0.0E+0	2.9E+5		0.0E+0		2.0E-1		0.0E+0	
Phthalate, bis(2-Ethylhexyl)	0.0E+0	3.9E+10		0.0E+0		7.0E-2		0.0E+0	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposue area (cm^2/day)

Site Name: Former Seabreeze Yacht Center | Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 3 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER: VAPOR INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium: Groundwater Conc. (mg/L)	2) NAF Value (m^3/L) Receptor: On-Site Commercial		3) Exposure Medium: Outdoor Air: POE Conc. (mg/m^3) (1) / (2): On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day): On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4): On-Site Commercial		TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from surface, subsurface & groundwater routes.): On-Site Commercial	
Acenaphthylene	0.0E+0	3.4E+5		0.0E+0		2.0E-1		0.0E+0		9.8E-9	
Benzo (b)Fluoranthene	0.0E+0	1.2E+6		0.0E+0		7.0E-2		0.0E+0		3.0E-9	
Benzo (g,h,i)Perylene	0.0E+0	3.8E+6		0.0E+0		2.0E-1		0.0E+0		1.2E-9	
Benzo(a)Pyrene	0.0E+0	3.9E+7		0.0E+0		7.0E-2		0.0E+0		4.1E-10	
Copper	0.0E+0	NA		NA		2.0E-1		NA		3.1E-10	
Dibenzo(a,h) Anthracene	0.0E+0	2.4E+7		0.0E+0		7.0E-2		0.0E+0		1.3E-10	
Nickel	0.0E+0	NA		NA		7.0E-2		NA		1.3E-11	
PCBs	0.0E+0	2.0E+5		0.0E+0		7.0E-2		0.0E+0		3.7E-8	
Phenanthrene	0.0E+0	1.5E+5		0.0E+0		2.0E-1		0.0E+0		1.2E-6	
Phthalate, bis(2-Ethylhexyl)	3.8E-2	2.5E+7		1.5E-9		7.0E-2		1.1E-10		1.1E-10	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 1 OF 4

TIER 2 PATHWAY RISK CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAYS ARE ACTIVE)

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Commercial		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
Acenaphthylene	D						9.8E-9		4.0E-3	2.5E-6	
Benzo (b)Fluoranthene	B2	3.0E-9		3.9E-1	1.2E-9						
Benzo (g,h,i)Perylene	D										
Benzo(a)Pyrene	B2	4.1E-10		3.9E+0	1.6E-9						
Copper	D						3.1E-10		3.7E-2	8.4E-9	
Dibenzo(a,h) Anthracene	B2	1.3E-10		4.1E+0	5.2E-10						
Nickel	A	1.3E-11		9.1E-1	1.2E-11						
PCBs	B2	3.7E-8		7.7E+0	2.8E-7		1.0E-7		2.0E-5	5.1E-3	
Phenanthrene	D						1.2E-6		3.0E-1	3.9E-6	
Phthalate, bis(2-Ethylhexyl)	B2	1.1E-10		1.4E-2	1.5E-12		3.0E-10		2.0E-2	1.5E-8	

Total Pathway Carcinogenic Risk = **2.9E-7** **0.0E+0**

Total Pathway Hazard Index = **5.2E-3** **0.0E+0**

Site Name: Former Seabreeze Y Site Location: Oakland, CA | Completed By: Julie C. Pel Date Completed: 9/3/1998 | 6 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:
DERMAL CONTACT

Constituents of Concern	Exposure Concentration 1) Source Medium: Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (SAxAFxABSxCFxEFxED)/(BWxAT) (kg/kg-day): On-Site Residential	2) Exposure Multiplier: On-Site Commercial	3) Average Daily Intake Rate (mg/kg-day) (1) x (2): On-Site Residential	3) Average Daily Intake Rate: On-Site Commercial
Acenaphthylene	3.0E-2		4.3E-7		1.3E-8
Benzo (b)Fluoranthene	6.3E-1		1.6E-7		9.8E-8
Benzo (g,h,i)Perylene	3.1E-1		4.3E-7		1.3E-7
Benzo(a)Pyrene	4.7E-1		1.6E-7		7.3E-8
Copper	2.9E+2		2.9E-8		8.5E-6
Dibenzo(a,h) Anthracene	1.6E-1		1.6E-7		2.5E-8
Nickel	3.5E+1		2.9E-8		1.0E-6
PCBs	5.1E-1		1.6E-7		7.9E-8
Phenanthrene	6.7E-1		4.3E-7		2.9E-7
Phthalate, bis(2-Ethylhexyl)	0.0E+0		1.0E-7		0.0E+0

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr
ET = Exposure time (hrs/day)
IR = Intake rate (mg/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Site Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:
INGESTION

Constituents of Concern	Exposure Concentration: 1) Source Medium — Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (IRxCFxEFxED)/(BWxAT) (kg/kg-day) — On-Site Residential	2) Exposure Multiplier — On-Site Commercial	3) Average Daily Intake Rate (mg/kg-day) (1) x (2) — On-Site Residential	3) Average Daily Intake Rate — On-Site Commercial	TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from dermal & ingestion routes.) — On-Site Residential	TOTAL PATHWAY INTAKE — On-Site Commercial
Acenaphthylene	3.0E-2		4.9E-7		1.5E-8		2.8E-8
Benzo (b)Fluoranthene	6.3E-1		1.7E-7		1.1E-7		2.1E-7
Benzo (g,h,i)Perylene	3.1E-1		4.9E-7		1.5E-7		2.9E-7
Benzo(a)Pyrene	4.7E-1		1.7E-7		8.2E-8		1.6E-7
Copper	2.9E+2		4.9E-7		1.4E-4		1.5E-4
Dibenzo(a,h) Anthracene	1.6E-1		1.7E-7		2.8E-8		5.3E-8
Nickel	3.5E+1		4.9E-7		1.7E-5		1.8E-5
PCBs	5.1E-1		1.7E-7		8.9E-8		1.7E-7
Phenanthrene	6.7E-1		4.9E-7		3.3E-7		6.2E-7
Phthalate, bis(2-Ethylhexyl)	0.0E+0		1.7E-7		0.0E+0		0.0E+0

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (mg/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 3 OF 4

TIER 2 PATHWAY RISK CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAYS ARE ACTIVE)

	CARCINOGENIC RISK						TOXIC EFFECTS				
	(1) EPA	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
Constituents of Concern	Carcinogenic Classification	On-Site Residential	On-Site Commercial	(mg/kg-day)^-1	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	(mg/kg-day)	On-Site Residential	On-Site Commercial
Acenaphthylene	D							2.8E-8	4.0E-3		6.9E-6
Benzo (b)Fluoranthene	B2		2.1E-7	1.2E+0		2.5E-7					
Benzo (g,h,i)Perylene	D										
Benzo(a)Pyrene	B2		1.6E-7	1.2E+1		1.9E-6					
Copper	D							1.5E-4	3.7E-2		4.1E-3
Dibenzo(a,h) Anthracene	B2		5.3E-8	4.1E+0		2.2E-7					
Nickel	A							1.8E-5	2.0E-2		9.1E-4
PCBs	B2		1.7E-7	7.7E+0		1.3E-6		4.7E-7	2.0E-5		2.4E-2
Phenanthrene	D							6.2E-7	3.0E-1		2.1E-6
Phthalate, bis(2-Ethylhexyl)	B2		0.0E+0	1.4E-2		0.0E+0		0.0E+0	2.0E-2		0.0E+0
Total Pathway Carcinogenic Risk =					**0.0E+0**	**3.6E-6**	***Total Pathway Hazard Index =***			**0.0E+0**	**2.9E-2**

Spreadsheet C-3: Future Occasional Utility Workers

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA
Job Identification: S9171-C1
Date Completed: 9/3/98
Completed By: Julie C. Pettijohn
Software: GSI RBCA Spreadsheet
Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)				25	
BW	Body Weight (kg)				70	
ED	Exposure Duration (yr)				25	
t	Averaging time for vapor flux (yr)				25	
EF	Exposure Frequency (days/yr)				***20***	
EF.Derm	Exposure Frequency for dermal exposure				***20***	
IRgw	Ingestion Rate of Water (L/day)				***1.4***	
IRs	Ingestion Rate of Soil (mg/day)				***120***	
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)					
IRa.In	Inhalation rate indoor (m^3/day)				20	
IRa.out	Inhalation rate outdoor (m^3/day)				20	
SA	Skin surface area (dermal) (cm^2)				5.8E+03	
SAadj	Adjusted dermal area (cm^2-yr/kg)					
M	Soil to Skin adherence factor	***0.27***				
AAFs	Age adjustment on soil ingestion				FALSE	
AAFd	Age adjustment on skin surface area				FALSE	
tox	Use EPA tox data for air (or PEL based)?					
gwMCL?	Use MCL as exposure limit in groundwater?					

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	FALSE	FALSE	FALSE
S.v	Volatilization from Subsurface Soils	FALSE	FALSE	
GW.v	Volatilization from Groundwater	FALSE	FALSE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	TRUE	
GW.b	Vapors from Groundwater	FALSE	TRUE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	TRUE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		FALSE		FALSE
S	Inhalation receptor (cm)		FALSE		FALSE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)		
W	Length of affect. soil parallel to wind (cm)		
W.gw	Length of affect. soil parallel to groundwater (cm		
Uair	Ambient air velocity in mixing zone (cm/s)		
delta	Air mixing zone height (cm)		
Lss	Thickness of affected surface soils (cm)		
Pe	Particulate areal emission rate (g/cm^2/s)		

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	
I	Groundwater infiltration rate (cm/yr)	
Ugw	Groundwater Darcy velocity (cm/yr)	
Ugw.tr	Groundwater seepage velocity (cm/yr)	
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***7.6E+00***		
hv	Vadose zone thickness (cm)	***7.6E+00***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***1.5E+01***		
Ls	Depth to top of affected subsurface soil (cm)	***3.0E-02***		
Lsubs	Thickness of affected subsurface soils (cm)	***1.5E+01***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)		***1.2E+02***
ER	Building air exchange rate (s^-1)		***2.8E-04***
Lcrk	Foundation crack thickness (cm)	***1.0E-03***	
eta	Foundation crack fraction	***1***	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA

(Complete the following table)

CONSTITUENT	Representative COC Concentration					
	in Groundwater		in Surface Soil		in Subsurface Soil	
	value (mg/L)	note	value (mg/kg)	note	value (mg/kg)	note
Acenaphthylene			3.0E-2	max		
Benzo (b)Fluoranthene			6.3E-1	max		
Benzo (g,h,i)Perylene			3.1E-1	max		
Benzo(a)Pyrene			4.7E-1	max		
Copper			2.9E+2	95thCL	2.4E+1	95thCL
Dibenzo(a,h) Anthracene			1.6E-1	max		
Nickel			3.5E+1	95thCL	3.5E+1	max
PCBs			5.1E-1	95thCL		
Phenanthrene			6.7E-1	max		
Phthalate, bis(2-Ethylhexyl)	3.8E-2	max		ND		ND

Site Name: Former Seabreeze Yacht Center
Site Location: Oakland, CA

Completed By: Julie C. Pettijohn
Date Completed: 9/3/1998

RBCA CHEMICAL DATABASE

Physical Property Data

CAS Number	Constituent	type	Molecular Weight (g/mole) MW	Diffusion Coefficients in air (cm2/s) Dair	Diffusion Coefficients in water (cm2/s) Dwat	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	Henry's Law Constant (@ 20 - 25 C) (atm-m3/mol)	Henry's Law Constant (@ 20 - 25 C) (unitless)	Vapor Pressure (@ 20 - 25 C) (mm Hg)	Solubility (@ 20 - 25 C) (mg/L)	acid pKa	base pKb	ref
208-96-8	Acenaphthylene	PAH	152.21	4.39E-02	7.53E-06	4.00	1.14E-04	4.74E-03	8.51E-10	3.93E+00			
205-99-2	Benzo (b)Fluoranthene	PAH	252	2.26E-02	5.56E-06	5.74	2.01E-05	8.36E-04	6.67E-07	1.47E-02			
191-24-2	Benzo (g,h,i)Perylene	PAH	276	4.90E-02	5.65E-05	6.20	1.40E-07	5.82E-06	1.00E-09	7.00E-04			
50-32-8	Benzo(a)Pyrene	PAH	252.3	5.00E-02	5.80E-06	5.59	1.39E-09	5.80E-08	5.68E-04	1.20E-03			
7440-50-8	Copper	N	63.546	N/A	N/A	2.47	0.00E+00	0.00E+00	0.00E+00	2.93E+05			
53-70-3	Dibenzo(a,h) Anthracene	PAH	278.35	2.00E-02	5.24E-06	5.87	3.81E-07	1.58E-05	5.20E-10	5.00E-04			
7440-02-0	Nickel	N	58.69	N/A	N/A	1.82	0.00E+00	0.00E+00	0.00E+00	1.73E+05			
1336-36-3	PCBs	PCB	290	1.04E-01	1.00E-05	5.21	2.94E-04	1.22E-02	0.00E+00	2.00E-01			
85-01-8	Phenanthrene	PAH	178.22	3.33E-02	7.47E-06	4.15	6.05E-03	2.52E-01	2.10E-04	1.60E+00			
117-81-7	Phthalate, bis(2-Ethylhexyl)	N	391.07	3.51E-02	3.66E-06	5.21	3.00E-07	1.25E-05	2.00E-07	3.43E-01			

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	Reference Dose (mg/kg/day) Inhalation RfD_inhal	Slope Factors 1/(mg/kg/day) Oral SF_oral	Slope Factors 1/(mg/kg/day) Inhalation SF_inhal	EPA Weight of Evidence	Is Constituent Carcinogenic ?
208-96-8	Acenaphthylene	4.00E-03	4.00E-03	-	-	D	FALSE
205-99-2	Benzo (b)Fluoranthene	-	-	1.20E+00	3.90E-01	B2	TRUE
191-24-2	Benzo (g,h,i)Perylene					D	FALSE
50-32-8	Benzo(a)Pyrene	-	-	1.20E+01	3.90E+00	B2	TRUE
7440-50-8	Copper	3.70E-02	3.70E-02	-	-	D	FALSE
53-70-3	Dibenzo(a,h) Anthracene	-	-	4.10E+00	4.10E+00	B2	TRUE
7440-02-0	Nickel	2.00E-02	-	-	9.10E-01	A	FALSE
1336-36-3	PCBs	2.00E-05	2.00E-05	7.70E+00	7.70E+00	B2	TRUE
85-01-8	Phenanthrene	3.00E-01	3.00E-01			D	FALSE
117-81-7	Phthalate, bis(2-Ethylhexyl)	2.00E-02	2.00E-02	1.40E-02	1.40E-02	B2	TRUE

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level MCL (mg/L)	Maximum Contaminant Level reference	Permissible Exposure Limit PEL/TLV (mg/m3)	Relative Absorption Factors Oral	Relative Absorption Factors Dermal	Detection Limits Groundwater (mg/L)	Detection Limits Soil (mg/kg)	Half Life (First-Order Decay) (days) Saturated	Half Life (First-Order Decay) (days) Unsaturated
208-96-8	Acenaphthylene				1	0.15			120	120
205-99-2	Benzo (b)Fluoranthene				1	0.15			1220	1220
191-24-2	Benzo (g,h,i)Perylene				1	0.15			1300	1300
50-32-8	Benzo(a)Pyrene				1	0.15			1060	1060
7440-50-8	Copper				1	0.01				
53-70-3	Dibenzo(a,h) Anthracene				1	0.15			1880	1880
7440-02-0	Nickel				1	0.01				
1336-36-3	PCBs				1	0.15				
85-01-8	Phenanthrene				1	0.15			400	400
117-81-7	Phthalate, bis(2-Ethylhexyl)				1	0.1			389	389

Site Name: Former Seabreeze Yacht CeSite Location: Oakland, CA

Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

Software version: 1.0.1

Site Name: Former Seabreeze Yacht Center | Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 |

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS:
VAPOR INTRUSION TO BUILDINGS

Constituents of Concern	Exposure Concentration 1) Source Medium: Subsurface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor: On-Site Commercial	3) Exposure Medium: Indoor Air: POE Conc. (mg/m^3) (1) / (2): On-Site Commercial	4) Exposure Multiplier: (IRxEFxED)/(BWxAT) (m^3/kg-day): On-Site Commercial	5) Average Daily Intake Rate: (mg/kg-day) (3) X (4): On-Site Commercial
Acenaphthylene	0.0E+0	1.0E+3	0.0E+0	1.6E-2	0.0E+0
Benzo (b)Fluoranthene	0.0E+0	1.0E+4	0.0E+0	5.6E-3	0.0E+0
Benzo (g,h,i)Perylene	0.0E+0	2.8E+6	0.0E+0	1.6E-2	0.0E+0
Benzo(a)Pyrene	0.0E+0	6.7E+7	0.0E+0	5.6E-3	0.0E+0
Copper	2.4E+1	NA	NA	1.6E-2	NA
Dibenzo(a,h) Anthracene	0.0E+0	6.1E+5	0.0E+0	5.6E-3	0.0E+0
Nickel	3.5E+1	NA	NA	5.6E-3	NA
PCBs	0.0E+0	1.0E+3	0.0E+0	5.6E-3	0.0E+0
Phenanthrene	0.0E+0	1.0E+3	0.0E+0	1.6E-2	0.0E+0
Phthalate, bis(2-Ethylhexyl)	0.0E+0	1.6E+5	0.0E+0	5.6E-3	0.0E+0

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center | Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 5 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER:
VAPOR INTRUSION TO BUILDINGS

Constituents of Concern	Exposure Concentration 1) Source Medium: Groundwater Conc. (mg/L)	2) NAF Value (m^3/L) Receptor: On-Site Commercial	3) Exposure Medium: Indoor Air: POE Conc. (mg/m^3) (1) / (2) — On-Site Commercial	4) Exposure Multiplier: (IRxEFxED)/(BWxAT) (m^3/kg-day) — On-Site Commercial	5) Average Daily Intake Rate: (mg/kg-day) (3) X (4) — On-Site Commercial	TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from subsurface & groundwater routes.) — On-Site Commercial
Acenaphthylene	0.0E+0	1.9E+2	0.0E+0	1.6E-2	0.0E+0	0.0E+0
Benzo (b)Fluoranthene	0.0E+0	4.1E+2	0.0E+0	5.6E-3	0.0E+0	0.0E+0
Benzo (g,h,i)Perylene	0.0E+0	9.2E+2	0.0E+0	1.6E-2	0.0E+0	0.0E+0
Benzo(a)Pyrene	0.0E+0	2.5E+4	0.0E+0	5.6E-3	0.0E+0	0.0E+0
Copper	0.0E+0	NA	NA	1.6E-2	NA	0.0E+0
Dibenzo(a,h) Anthracene	0.0E+0	5.0E+3	0.0E+0	5.6E-3	0.0E+0	0.0E+0
Nickel	0.0E+0	NA	NA	5.6E-3	NA	0.0E+0
PCBs	0.0E+0	1.3E+2	0.0E+0	5.6E-3	0.0E+0	0.0E+0
Phenanthrene	0.0E+0	1.0E+2	0.0E+0	1.6E-2	0.0E+0	0.0E+0
Phthalate, bis(2-Ethylhexyl)	3.8E-2	5.1E+3	7.5E-6	5.6E-3	4.2E-8	4.2E-8

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 2 OF 4

TIER 2 PATHWAY RISK CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK: (2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial	(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Commercial	TOXIC EFFECTS: (5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial	(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial
Acenaphthylene	D				0.0E+0	4.0E-3	0.0E+0
Benzo (b)Fluoranthene	B2	0.0E+0	3.9E-1	0.0E+0			
Benzo (g,h,i)Perylene	D						
Benzo(a)Pyrene	B2	0.0E+0	3.9E+0	0.0E+0			
Copper	D				0.0E+0	3.7E-2	0.0E+0
Dibenzo(a,h) Anthracene	B2	0.0E+0	4.1E+0	0.0E+0			
Nickel	A	0.0E+0	9.1E-1	0.0E+0			
PCBs	B2	0.0E+0	7.7E+0	0.0E+0	0.0E+0	2.0E-5	0.0E+0
Phenanthrene	D				0.0E+0	3.0E-1	0.0E+0
Phthalate, bis(2-Ethylhexyl)	B2	4.2E-8	1.4E-2	5.8E-10	1.2E-7	2.0E-2	5.8E-6

Total Pathway Carcinogenic Risk = 0.0E+0 | 5.8E-10

Total Pathway Hazard Index = 0.0E+0 | 5.8E-6

Site Name: Former Seabreeze Ya Site Location: Oakland, CA | Completed By: Julie C. Pet Date Completed: 9/3/1998 | 6 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:
DERMAL CONTACT

Constituents of Concern	Exposure Concentration 1) Source Medium: Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (SAxAFxABSxCFxEFxED)/(BWxAT) (kg/kg-day): On-Site Residential	2) Exposure Multiplier: On-Site Commercial	3) Average Daily Intake Rate (mg/kg-day) (1) x (2): On-Site Residential	3) Average Daily Intake Rate: On-Site Commercial
Acenaphthylene	3.0E-2		1.8E-7		5.5E-9
Benzo (b)Fluoranthene	6.3E-1		6.6E-8		4.1E-8
Benzo (g,h,i)Perylene	3.1E-1		1.8E-7		5.7E-8
Benzo(a)Pyrene	4.7E-1		6.6E-8		3.1E-8
Copper	2.9E+2		1.2E-8		3.6E-6
Dibenzo(a,h) Anthracene	1.6E-1		6.6E-8		1.1E-8
Nickel	3.5E+1		1.2E-8		4.3E-7
PCBs	5.1E-1		6.6E-8		3.3E-8
Phenanthrene	6.7E-1		1.8E-7		1.2E-7
Phthalate, bis(2-Ethylhexyl)	0.0E+0		4.4E-8		0.0E+0

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr
ET = Exposure time (hrs/day)
IR = Intake rate (mg/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Site Location: Oakland, CA Completed By: Julie C. Pettijohn Date Completed: 9/3/1998

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

INGESTION

Constituents of Concern	Exposure Concentration: 1) Source Medium — Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (IRxCFxEFxED)/(BWxAT) (kg/kg-day) — On-Site Residential	2) Exposure Multiplier — On-Site Commercial	3) Average Daily Intake Rate (mg/kg-day) (1) x (2) — On-Site Residential	3) Average Daily Intake Rate — On-Site Commercial	TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from dermal & ingestion routes.) — On-Site Residential	TOTAL PATHWAY INTAKE — On-Site Commercial
Acenaphthylene	3.0E-2		9.4E-8		2.8E-9		8.3E-9
Benzo (b)Fluoranthene	6.3E-1		3.4E-8		2.1E-8		6.3E-8
Benzo (g,h,i)Perylene	3.1E-1		9.4E-8		2.9E-8		8.6E-8
Benzo(a)Pyrene	4.7E-1		3.4E-8		1.6E-8		4.7E-8
Copper	2.9E+2		9.4E-8		2.7E-5		3.1E-5
Dibenzo(a,h) Anthracene	1.6E-1		3.4E-8		5.4E-9		1.6E-8
Nickel	3.5E+1		9.4E-8		3.3E-6		3.7E-6
PCBs	5.1E-1		3.4E-8		1.7E-8		5.1E-8
Phenanthrene	6.7E-1		9.4E-8		6.3E-8		1.9E-7
Phthalate, bis(2-Ethylhexyl)	0.0E+0		3.4E-8		0.0E+0		0.0E+0

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (mg/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Site Name: Former Seabreeze Yacht Center Site Location: Oakland, CA | Completed By: Julie C. Pettijohn | Date Completed: 9/3/1998 | 3 OF 4

TIER 2 PATHWAY RISK CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK: (2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Residential	On-Site Commercial	(3) Oral Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Residential	On-Site Commercial	TOXIC EFFECTS: (5) Total Toxicant Intake Rate (mg/kg/day) On-Site Residential	On-Site Commercial	(6) Oral Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Residential	On-Site Commercial
Acenaphthylene	D							8.3E-9	4.0E-3		2.1E-6
Benzo (b)Fluoranthene	B2		6.3E-8	1.2E+0		7.5E-8					
Benzo (g,h,i)Perylene	D										
Benzo(a)Pyrene	B2		4.7E-8	1.2E+1		5.6E-7					
Copper	D							3.1E-5	3.7E-2		8.4E-4
Dibenzo(a,h) Anthracene	B2		1.6E-8	4.1E+0		6.5E-8					
Nickel	A							3.7E-6	2.0E-2		1.9E-4
PCBs	B2		5.1E-8	7.7E+0		3.9E-7		1.4E-7	2.0E-5		7.1E-3
Phenanthrene	D							1.9E-7	3.0E-1		6.2E-7
Phthalate, bis(2-Ethylhexyl)	B2		0.0E+0	1.4E-2		0.0E+0		0.0E+0	2.0E-2		0.0E+0
Total Pathway Carcinogenic Risk =					0.0E+0	1.1E-6	*Total Pathway Hazard Index =*			0.0E+0	8.1E-3

Risk and Hazard Calculations for Groundwater Exposure Pathways- Occasional Utility Worker
Dermal Exposure to Groundwater

Skin Surface Area Available for Contact (SA) (cm2/event)		5800	PC values (cm/hr):	Bis-2ethylhexylphthalate	0.1
Chemical-specific permeability constant (PC) (cm/hr)	See PC values above	1			
Exposure Time (hours/day)		4			
Exposure Frequency (events/year)		20			
Exposure Duration (ED)(years)		25			
Volumetric Conversion Factor for water (1 liter/1000 cm3)		0.001			
Body Weight (BW)(kg)		70			
Averaging Time (days)(noncarcinogens, carcinogens)		9125	25550		

COPC	Classification	Groundwater Concentration (mg/L)	Exposure Multiplier SA x PCx ET x EF x ED x CF/ (BW*AT)	Average Daily Intake (absorbed dose) (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Individual COPC Risk	Oral RfD (mg/kg-day)	Individual COPC Hazard Quotient
Bis 2-ethylhexyl phthalate	B2	0.004	1.82E-03	7.26E-06			0.02	3.6E-04
Bis 2-ethylhexyl phthalate	B2	0.004	6.49E-04	2.59E-06	0.014	3.6E-08		

Total Pathway Carcinogenic Risk	3.6E-08	Total Pathway Hazard Index	3.6E-04

APPENDIX D

BLOOD LEAD CONCENTRATION CALCULATION SPREADSHEETS

Spreadsheet D-1: Blood Lead Concentration Calculations for Current Beach Cleanup Workers

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

INPUT

MEDIUM	LEVEL
LEAD IN AIR (ug/m^3)	0.01
LEAD IN SOIL (ug/g)	129.7
LEAD IN WATER (ug/l)	15
PLANT UPTAKE? 1=YES 0=NC	0
RESPIRABLE DUST (ug/m^3)	50

OUTPUT

	percentiles					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT (ug/dl)	1.7	2.7	3.1	3.6	3.9	26298.5	38097.9
BLOOD Pb, CHILD (ug/dl)	3.1	4.9	5.5	6.4	7.1	2338.0	4394.5
BLOOD Pb, PICA CHILD (ug/dl)	4.1	6.4	7.2	8.4	9.2	172.3	323.8
BLOOD Pb, INDUSTRIAL (ug/dl)	1.8	2.8	3.2	3.7	4.1	4539.7	6583.7

EXPOSURE PARAMETERS

	units	residential			industrial
		adults	children	children with pica	adults
General					
Days per week	days/wk	1	1	1	5
Dermal Contact					
Skin area	cm^2	3700	2800	2800	5800
Soil adherence	mg/cm^2	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011
Soil ingestion					
Soil ingestion	mg/day	25	55	790	25
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176
Inhalation					
Breathing rate	m^3/day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082
Water ingestion					
Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Food ingestion					
Food ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	10.0	10.0	10.0	10.0
Lead in produce	ug/kg	10.0	10.0	10.0	

PATHWAYS, ADULTS

Pathway	Residential		Industrial		Concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.00	0%	0.03	2%	130 ug/g
SOIL INGESTION:	0.01	0%	0.04	2%	130 ug/g
INHALATION:	0.00	0%	0.02	1%	0.02 ug/m^3
WATER INGESTION:	0.84	48%	0.84	46%	15 ug/l
FOOD INGESTION:	0.88	51%	0.88	49%	10.0 ug Pb/kg diet

PATHWAYS, CHILDREN

Pathway	Typical		with pica		concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.00	0%	0.00	0%	130 ug/g
SOIL INGESTION:	0.07	2%	1.03	25%	130 ug/g
INHALATION:	0.00	0%	0.00	0%	0.02 ug/m^3
WATER INGESTION:	0.96	31%	0.96	24%	15 ug/l
FOOD INGESTION:	2.08	67%	2.08	51%	10.0 ug Pb/kg diet

Spreadsheet D-2: Blood Lead Concentration Calculations for Current Commercial Workers

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

INPUT

MEDIUM	LEVEL
LEAD IN AIR (ug/m^3)	0.01
LEAD IN SOIL (ug/g)	129.7
LEAD IN WATER (ug/l)	15
PLANT UPTAKE? 1=YES 0=N(	0
RESPIRABLE DUST (ug/m^3)	50

OUTPUT

	percentiles					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT (ug/dl)	1.8	2.9	3.3	3.8	4.1	3737.3	5423.0
BLOOD Pb, CHILD (ug/dl)	3.6	5.6	6.4	7.4	8.1	330.0	623.8
BLOOD Pb, PICA CHILD (ug/dl)	10.3	16.2	18.3	21.2	23.3	24.3	46.0
BLOOD Pb, INDUSTRIAL (ug/dl)	1.8	2.8	3.2	3.7	4.1	5241.4	7601.3

EXPOSURE PARAMETERS

	units	residential			industrial
		adults	children	children with pica	adults
General					
Days per week	days/wk	7	7	7	5
Dermal Contact					
Skin area	cm^2	3700	2800	2800	3700
Soil adherence	mg/cm^2	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011
Soil ingestion					
Soil ingestion	mg/day	25	55	790	25
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176
Inhalation					
Breathing rate	m^3/day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082
Water ingestion					
Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Food ingestion					
Food ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	10.0	10.0	10.0	10.0
Lead in produce	ug/kg	10.0	10.0	10.0	

PATHWAYS, ADULTS

Pathway	Residential		Industrial		
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	Concentration in medium
SOIL CONTACT:	0.03	1%	0.02	1%	130 ug/g
SOIL INGESTION:	0.06	3%	0.04	2%	130 ug/g
INHALATION:	0.03	1%	0.02	1%	0.02 ug/m^3
WATER INGESTION:	0.84	46%	0.84	47%	15 ug/l
FOOD INGESTION:	0.88	48%	0.88	49%	10.0 ug Pb/kg diet

PATHWAYS, CHILDREN

Pathway	Typical		with pica		
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	concentration in medium
SOIL CONTACT:	0.02	1%	0.02	0%	130 ug/g
SOIL INGESTION:	0.50	14%	7.21	70%	130 ug/g
INHALATION:	0.03	1%	0.03	0%	0.02 ug/m^3
WATER INGESTION:	0.96	27%	0.96	9%	15 ug/l
FOOD INGESTION:	2.08	58%	2.08	20%	10.0 ug Pb/kg diet

Spreadsheet D-3: Blood Lead Concentration Calculations for Future Occasional Utility Workers

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

INPUT

MEDIUM	LEVEL
LEAD IN AIR (ug/m^3)	0.01
LEAD IN SOIL (ug/g)	129.7
LEAD IN WATER (ug/l)	15
PLANT UPTAKE? 1=YES 0=N(	0
RESPIRABLE DUST (ug/m^3)	5000

OUTPUT

	percentiles					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT (ug/dl)	2.9	4.5	5.1	5.9	6.5	303.4	440.3
BLOOD Pb, CHILD (ug/dl)	4.8	7.6	8.6	9.9	10.9	99.7	188.5
BLOOD Pb, PICA CHILD (ug/dl)	11.5	18.1	20.5	23.7	26.1	20.8	39.3
BLOOD Pb, INDUSTRIAL (ug/dl)	2.7	4.3	4.8	5.6	6.1	354.1	513.5

EXPOSURE PARAMETERS

	units	residential adults	residential children	residential children with pica	industrial adults
General					
Days per week	days/wk	7	7	7	5
Dermal Contact					
Skin area	cm^2	3700	2800	2800	5800
Soil adherence	mg/cm^2	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011
Soil ingestion					
Soil ingestion	mg/day	25	55	790	120
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176
Inhalation					
Breathing rate	m^3/day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082
Water ingestion					
Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Food ingestion					
Food ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	10.0	10.0	10.0	10.0
Lead in produce	ug/kg	10.0	10.0	10.0	

PATHWAYS, ADULTS

Pathway	Residential Blood Pb ug/dl	Residential percent of total	Industrial Blood Pb ug/dl	Industrial percent of total	Concentration in medium
SOIL CONTACT:	0.03	1%	0.03	1%	130 ug/g
SOIL INGESTION:	0.06	2%	0.20	7%	130 ug/g
INHALATION:	1.08	37%	0.77	28%	0.66 ug/m^3
WATER INGESTION:	0.84	29%	0.84	31%	15 ug/l
FOOD INGESTION:	0.88	31%	0.88	32%	10.0 ug Pb/kg diet

PATHWAYS, CHILDREN

Pathway	Typical Blood Pb ug/dl	Typical percent of total	with pica Blood Pb ug/dl	with pica percent of total	concentration in medium
SOIL CONTACT:	0.02	0%	0.02	0%	130 ug/g
SOIL INGESTION:	0.50	10%	7.21	63%	130 ug/g
INHALATION:	1.26	26%	1.26	11%	0.66 ug/m^3
WATER INGESTION:	0.96	20%	0.96	8%	15 ug/l
FOOD INGESTION:	2.08	43%	2.08	18%	10.0 ug Pb/kg diet