HUMAN HEALTH RISK ASSESSMENT

MARINA COVE SUBDIVISION
1801 HIBBARD STREET
ALAMEDA, CALIFORNIA
AND
PARK PARCEL
1521 BUENA VISTA AVENUE
ALAMEDA, CALIFORNIA

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SOMA Project No. 02-2325

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Definition of Acronyms

ACEH	Alameda County Environmental Health
COPC	Chemicals of Potential Concern
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
Fugro	Fugro West, Inc.
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
ICES	Innovative & Creative Environmental Solutions
IRIS	Integrated Risk Information Systems
MCS	Marina Cove Subdivision
Minter & Fahy	Minter & Fahy Construction Company, Inc.
NCEA	National Center for Environment
PEF	Particulate Emission Factors
PRG	Preliminary Remediation Goals
REL	Reference Exposure Levels
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RWQCB	Regional Water Quality Control Board
SF	Slope Factors
SOMA	SOMA Corporation
SQL	Sample Quantitation Limit

Definition of Acronyms

UCL	Upper Confidence Limit
VF	Volatilization Factors
VOC	Volatile Organic Compound
West & Associates	West & Associates Environmental Engineers, Inc.

HUMAN HEALTH RISK ASSESSMENT
Marina Cove Subdivision and Park Parcel
Alameda, California

1.0 INTRODUCTION

At the request of KB Home South Bay, Inc., SOMA Corporation (SOMA) has prepared this human health risk assessment (HHRA) for the Marina Cove Subdivision (MCS), formerly occupied by the Weyerhaeuser Paper Company (Weyerhaeuser), and the adjacent Park Parcel, formerly known as the Encinal Terminal. MCS and the Park Parcel are collectively referred to as "the Site" in this report, but were evaluated separately for risk. The MCS and Park Parcel locations are shown in Attachment A, Sheet 1 (Bellecci & Associates, Inc., 2003).

MCS is located at 1801 Hibbard Street, and the Park Parcel is located at 1521 Buena Vista Avenue in Alameda, California. This risk assessment is part of a comprehensive documentation effort required by the Alameda County Environmental Health (ACEH) to determine whether environmental problems related to past industrial activities have been addressed appropriately for current and future land use.

This evaluation is a follow-up to an earlier risk assessment that was prepared by West & Associates Environmental Engineers, Inc. (West & Associates) for Weyerhaeuser in August, 1999. The risk assessment prepared by West & Associates (1999a) was submitted to ACEH as part of documentation for Site closure based on industrial use. Due to a change in the land use of the former Weyerhaeuser property from industrial to residential, ACEH found the risk assessment (1999a) to be inappropriate for a residential development. The documentation requirements for Site closure based on residential use are detailed in an ACEH letter dated October 2, 2002 (ACEH 2002). The Park Parcel, where residential development is not anticipated, was evaluated for use as a public park.

This risk assessment is intended to supplement the risk assessment performed by West & Associates (1999a) and should be considered in addition to existing environmental information and reports developed for the Site. A summary of previous investigations performed at MCS and the Park Parcel is presented in Section 2.1.

1.1 Risk Assessment Objectives

This HHRA was developed to assess potential human health risks based on potential future land use and current subsurface conditions at MCS and the Park Parcel. As stated earlier, the two portions of the Site were evaluated separately for risk.

1.2 Organization of the Human Health Risk Assessment

The primary focus of this HHRA is to evaluate potential exposures at MCS and the Park Parcel under baseline conditions. This includes the development of estimates of exposure and corresponding theoretical cancer risk and risk of adverse non-cancer health effects. A four-step process was used to complete the HHRA:

1. Data Evaluation and Selection of Chemicals of Potential Concern (COPCs). This step included an identification of applicable data to use in the remaining steps of the HHRA process. This information was incorporated into the selection of COPCs, as well as the exposure assessment (Step 2). The analytical chemical data included in the data evaluation consisted of all existing soil data (excluding excavated soil) and groundwater data collected at MCS and the Park Parcel.

2. Exposure Assessment. This step characterized the nature and magnitude of potential exposures to COPCs at MCS and the Park Parcel. Specifically, it included preparing a description of the assumed exposure setting and land use, identifying potential exposure scenarios and complete exposure pathways, identifying hypothetical exposure points, estimating exposure point concentrations (EPC), and estimating hypothetical chemical intakes.

3. Toxicity Assessment. This step consisted of compiling toxicity values (slope factors [SF] and reference doses [RFD]) for COPCs.

4. Risk Characterization. Site-related health risks were characterized using potential theoretical excess lifetime cancer risk estimates and hazard indices (HI) for adverse non-cancer health affects associated with potential upperbound exposure to COPCs at MCS and the Park Parcel. Uncertainties associated with the overall risk assessment were identified.

These four steps, including the qualitative uncertainly evaluation and follow up soil gas analyses, are discussed in Section 2.0 through Section 7.0 of this report. Conclusions of the HHRA are summarized in Section 8.0, and the cited references are presented in Section 9.0. Figures, tables, and appendices to the HHRA follow Section 9.0 of this report.

2.0 DATA EVALUATION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Information on the evaluation of analytical data for use in the HHRA is summarized in this Section 2.0, including a summary of previous site investigations that were conducted at MCS and the Park Parcel. The data from these investigations comprise the data set used in the HHRA and provide the basis for selecting COPCs and estimating EPCs for the risk assessment. Summaries of data evaluated in the HHRA are presented in tables in Appendix A (MCS) and Appendix B (Park Parcel).

2.1 Previous Site Investigations

The Site was undeveloped prior to 1948. In 1948, Kieckhefer Container Company (Kieckhefer) and Stokely Foods, Inc. (Stokely) occupied the areas that are referred to in this report as MCS and the Park Parcel, respectively. In 1987, Weyerhaeuser replaced Kieckhefer on the current MCS lot; and Del Monte replaced Stokely, and the CPC International Tank Farm (CPC) was constructed adjacent to Del Monte on the current Park Parcel lot. Chipman Moving and Storage International (Chipman) later replaced Del Monte.

Marina Cove Subdivision

In early 1991, a cluster of three 1,000-gallon gasoline underground storage tanks (USTs) and one 10,000-gallon diesel UST were removed from the Weyerhaeuser facility (West & Associates, 1998, as cited in ICES, 1998), which was located in the area that is referred to in this report as MCS. Subsequent confirmation sampling in the removal area on February 7 (at soil sampling locations DIESEL-NE, DIESEL-SW, DIESEL-SE, DIESEL-NW, GAS-N, GAS-S, GAS-E, and GAS-W) and on February 28 (at soil sampling locations Soil #1 through Soil #7 and groundwater sampling location WATER-1) resulted in additional overexcavation in the vicinity of the removal area. The sampling locations listed above were all removed in the overexcavation. No additional excavation was conducted after a third round of confirmation sampling in the removal area on April 3 (at soil sampling locations SOIL-8 through SOIL-11 and groundwater sampling location WATER-2).

Soil Tech Engineering (Soil Tech) performed additional soil and groundwater investigations in the vicinity of the former gasoline USTs in December 1991, April 1992, December 1992, and January 1993. Soil and groundwater samples were collected from locations STMW-1 through STMW-7 during the investigations and analyzed for petroleum constituents. In 1995, remedial activities were initiated following the conclusion of on-site investigations. Specifically, impacted soil was excavated from the vicinity of the former gasoline USTs. Air sparging lines were installed in the open excavations prior to backfilling operations in October and November 1995. After air sparging activities were initiated in March 1996, a decrease in soil gas and groundwater concentrations was observed. In March 1998, ACEH approved the cessation of air sparging activities (ICES, 1998).

In January 1994, the last remaining UST – a 20,000-gallon diesel UST – was removed from the property. No evidence of any leakage from the diesel tank was observed (West & Associates, 1995). Beginning on January 13, West & Associates installed 12 soil borings during the course of its site investigation. Ten of the borings were completed in January 1994 – B-1 through B-5, and MW-8 through MW-11. Additional samples were also collected from locations called N. END WALL, Trench 1, North Tank Pit, Pit Middle, South Tank Pit, Dispenser, and Trench 2 in January. Soil samples were analyzed for metals, petroleum constituents, and volatiles (West & Associates, 1995).

On February 3, 1994, West & Associates collected groundwater samples from MW-1 through MW-11 during a site investigation. The samples were analyzed for metals, petroleum constituents, and volatiles (West & Associates, 1995). Quarterly groundwater monitoring was conducted at these wells on June 8, 1994, and the samples were analyzed for petroleum constituents and volatiles. MW-12 was added during the quarterly groundwater monitoring event on December 7, 1994, when the samples were analyzed for petroleum constituents. All 12 monitoring wells were sampled on March 7, 1995; May 17, 1995; and September 26, 1995, for petroleum constituents and volatiles. Starting on February 7, 1996, MW-3B, MW-4B, MW-5 through MW-7, and MW-10 through MW-12 were sampled quarterly until August 13, 1998.

In August 1998, ICES conducted a limited site investigation that involved soil and groundwater sampling for metals, petroleum constituents, and volatiles. On August 31, soil samples were collected from sampling locations S-1 through S-3, S-6 and S-7, and B-1 through B-5, and submitted for metals, petroleum constituents, and volatiles analysis. All sampling locations were located in the current MCS except for S-6, which was located in the current Park Parcel. A groundwater sample was collected from location W-1 and analyzed for petroleum constituents. Based on analytical results, ICES concluded that (1) impacted soil was limited to railroad tracks located along the southern perimeter and through the site, and contained elevated concentrations of TPH-motor oil, and copper, lead, and zinc that exceeded their respective background levels. SVOCs were not detected; (2) surface soil located adjacent to and west of the Pennzoil facility contained detectable concentrations of TPH-diesel and TPH-motor oil that were below 1,000 mg/kg and considered acceptable by ACEH for residential development; and (3) groundwater adjacent to and west of the Pennzoil facility was impacted by TPH-diesel and TPH-motor oil, the extent of which had to be determined (ICES, 1998).

In March 1999, ICES conducted a limited site investigation to assess the potential presence of petroleum hydrocarbons in the immediate vicinity of the abandoned Pennzoil pipeline that ran through the current MCS and Park Parcel portions of the Site. On March 12, soil and groundwater samples were collected from locations SB-1 through SB-12 and analyzed for petroleum constituents. SB-1 through SB-5 were located in the current MCS portion, SB-7 through SB-12 were located in the current Park Parcel, and SB-6 was located at the edge of both and therefore included in the data sets for both portions of the Site. At MCS, soil samples were collected from borings SB-1 through SB-6 at depths of approximately 2 feet ("A" suffix) and 4.5 feet ("B" suffix) bgs. Groundwater samples were collected from borings SB-1 and SB-5 (referred to as GW-1 and GW-2, respectively). Based on the analytical results, ICES concluded that surface soil and underlying groundwater in the immediate vicinity of the abandoned Pennzoil pipeline had not been significantly impacted by petroleum constituents. Furthermore, groundwater containing detectable concentrations of TPH-diesel and TPH-motor oil appeared to be limited to the area adjacent to and west of the Pennzoil facility based on the results of this investigation and the site investigation conducted in August 1998 (ICES, 1999).

In July 1999, West & Associates conducted additional site characterization. On July 16, soil and groundwater samples were collected from locations B-9 and B-10 and analyzed for petroleum constituents and volatiles.

In April and July 2001, E & LC Company conducted soil remedial activities at the railroad ballast, located in the current MCS. The purpose of the remedial activities was to remove soil containing elevated concentrations of TPH-motor oil and lead, which were detected in the railroad ballast during a previous site investigation. Approximately 2,620 cubic yards of affected soil were removed from the railroad ballasts. Confirmation soil samples collected from locations SS-1 through SS-9 on the excavation floor were analyzed for metals, petroleum constituents, and volatiles. Based on analytical results, ICES concluded that it appeared that the impacted surficial soil within the railroad ballasts had been adequately removed (ICES 2002d).

Park Parcel

In January 1988 and February 1989, Trace Environmental Services removed three gasoline USTs and one waste oil above-ground storage tank (AST), respectively, from the Encinal Terminals (referred to in this report as the Park Parcel). Blymyer Engineers, Inc., (Blymyer) documented the removal of the tanks. According to Blymyer's report, limited releases of petroleum hydrocarbons may have occurred in the vicinity of two of the gasoline USTs and the waste oil AST (Blymyer, 1993, as cited in Geomatrix, 1995).

In July 1993, Blymyer performed a subsurface soil investigation. Soil samples were collected from locations B-6 through B-8 and analyzed for metals, petroleum constituents, and volatiles. The investigation reportedly indicated that detectable concentrations of TPH-diesel were encountered in the area adjacent to the AST located at the southeast corner of CPC (Blymyer, 1993, as cited in ICES, 1998).

In September 1993, Fugro West, Inc. (Fugro), performed a Phase II Environmental Site Assessment. Soil samples were collected near (1) near Sumps A and B, at sampling locations SA and SB; (2) a 2,000-gallon diesel UST, at sampling locations TA-1 through TA-3; (3) former drum storage locations, at sampling locations FDB-1, FDB-2, FOC-1, and FOC-2, (4) a caustic tank, at sampling locations AGT-1 and AGT-2; and (5) a sulfuric acid tank, at sampling locations AGT-3 and AGT-4. Groundwater samples were collected at SA, SB, FDB-2, TA-2, AGT-2, and AGT-4. The samples were analyzed for metals and volatiles. The investigation indicated that the soil samples collected beneath a 2,000-gallon diesel UST located on the western portion of CPC contained TPH-diesel concentrations ranging from 300 mg/kg to 1,000 mg/kg, and a groundwater concentration of 15 mg/L. Fugro concluded that the soil underlying the ASTs, which contained acid and caustic chemicals, were considered to be nonhazardous based on the pH values (Fugro, 1994, as cited in ICES, 1998).

In April 1994, SEMCO Environmental Contractors & General Engineering (SEMCO) removed the 2,000-gallon diesel UST. After the excavation, confirmation soil sampling was conducted at locations #1 SOUTH WALL and #2 NORTH WALL and confirmation groundwater sampling was conducted at location #3 Pit Water. TPH-diesel, benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in the 2,000-gallon UST area. Based on the results of the site investigations and samples collected during UST removal activities, ACEH issued a remedial action completion certification for the 2,000-gallon UST in February 1996 (SEMCO, 1994, as cited in ICES, 1998).

In February 1995, Geomatrix Consultants (Geomatrix) conducted a soil and groundwater investigation near the former diesel UST area. The purpose of the investigation was to characterize soil and groundwater in that area and determine whether petroleum hydrocarbons were migrating toward Alameda Harbor. Soil samples were collected from borings P-15 through P-17 and analyzed for petroleum constituents. Based on analytical results, Geomatrix recommended that this portion of the site be considered for case closure with regard to the former diesel UST (Geomatrix, 1995). Based on the results of the site investigations and samples collected during UST removal activities, ACEH issued a remedial action completion certification for the 2,000-gallon UST on February 6, 1996.

In August 1998, ICES conducted a limited site investigation that involved soil and groundwater sampling for metals, petroleum constituents, and volatiles. On August 31, soil samples were collected from sampling locations S-1 through S-3, S-6 and S-7, and B-1 through B-5, and submitted for metals, petroleum constituents, and volatiles analysis. All sampling locations were located in the current MCS except for S-6, which was located in the current Park Parcel. Based on analytical results, ICES concluded that (1) impacted soil was limited to railroad tracks located along the southern perimeter and through the site, and contained elevated concentrations of TPH-motor oil, and copper, lead, and zinc that exceeded their respective background levels. SVOCs were not detected; (2) surface soil located adjacent to and west of the Pennzoil facility contained detectable concentrations of TPH-diesel and TPH-motor oil that were below 1,000 mg/kg and considered acceptable by ACEH for residential development; and (3) groundwater adjacent to and west of the Pennzoil facility was impacted by TPH-diesel and TPH-motor oil, the extent of which had to be determined (ICES, 1998).

In March 1999, ICES conducted a limited site investigation to assess the potential presence of petroleum hydrocarbons in the immediate vicinity of the abandoned Pennzoil pipeline that ran through the current MCS and Park Parcel portions of the Site. On March 12, soil and groundwater samples were collected from locations SB-1 through SB-12. SB-1 through SB-5 were located in the current MCS portion, SB-7 through SB-12 were located in the current Park Parcel, and SB-6 was located at the edge of both and therefore included in the data sets for both portions of the Site. In the Park Parcel, soil samples were collected from borings SB-6 through SB-12 at depths of approximately 2 feet ("A" suffix) and 4.5 feet ("B" suffix) bgs. Groundwater samples were collected from borings SB-7 and SB-12 (referred to as GW-3 and GW-4, respectively). Based on the analytical results, ICES concluded that surface soil and underlying groundwater in the immediate vicinity of the abandoned Pennzoil pipeline had not been significantly impacted by petroleum constituents. Furthermore, groundwater containing detectable concentrations of TPH-diesel and TPH-motor oil appeared to be limited to the area adjacent to and west of the Pennzoil facility based on the results of this investigation and the site investigation conducted in August 1998 (ICES, 1999).

In July 2001, six ASTs containing caustic acid soda and one 1,500-gallon AST containing sulfuric acid was removed by Decon Environmental Services, Inc. (Decon) of Hayward, California. A leak in the sulfuric acid tank was observed during removal activities. Approximately 20 cubic yards of visibly stained acid-impacted soil underlying the AST was excavated to a depth of approximately 4 feet below the existing ground surface (bgs). The process of excavating and sampling was repeated until soil and groundwater samples contained a pH of 7. Approximately 126 tons of acid-affected soil was excavated.

The final excavated area was 18 feet long by 18 feet wide and extended to a depth of approximately 8 to 9 feet bgs (Decon, 2001).

In October 2001, ICES conducted follow-up soil sampling as part of site mitigation activities. Ten soil samples (EW-1 through EW-8; and EF-1 and EF-2) were collected from ten test pit locations at the approximately limits of the sulfuric acid excavation. At the request of ACEH, two supplementary soil samples (TR-1 and TR-2) were collected from discolored soil that was observed in the trench located directly adjacent to and south of the excavation. Volatile analysis of the 10 soil samples from the test pit locations indicated that pH levels ranged from 6.41 to 7.34. Analysis of the samples collected from the trench indicated that pH levels ranged from 5.18 to 6.63, and there were detectable concentrations of acetone, carbon disulfide, methyl butyl ketone, and methyl ethyl ketone. The detected concentrations of the VOCs were below the respective U.S. Environmental Protection Agency (U.S. EPA) Region 9 preliminary remediation goals (PRGs) for residential landuse (ICES, 2002a).

Also in October 2001, Environmental Construction Services removed a 1,500-gallon diesel UST. Approximately 294 tons of petroleum-affected soil were also removed. After the excavation, ICES collected confirming soil samples from borings SWN-1A and SWS-2, located approximately 2 feet below each end of the UST (and 9.5 feet bgs), and analyzed them for petroleum constituents. Analytical results indicated that the soil samples contained low concentrations of TPH-diesel and BTEX. Based on analytical results, ICES recommended that no further action be required and requested closure of the UST removal activities (ICES, 2001).

In January, 2002, ICES conducted a limited site investigation of the 13,313 square-foot parcel of land (i.e., the southern portion of the former CPC) that was transferred to KB Homes by Encinal Terminals. On January 24, soil samples were collected from locations P-1 and P-2 and analyzed for metals, petroleum constituents, and volatiles. Analytical results indicated that the soil samples collected contained non-detectable concentrations of TPH-gasoline, BTEX, methyl tert-butyl ether (MTBE), VOCs, and SVOCs. Detectable concentrations of TPH-diesel and TPH-motor oil were below their respective California Regional Water Quality Control Board (RWQCB)'s risk-based screening levels (RBSLs) for residential development. Detected metal concentrations were generally below background levels for soil in the San Francisco Bay Area and below U.S. EPA Region 9 PRGs for residential development. Based on analytical results, ICES concluded that it appeared that the surficial soil at the site contained contaminant levels that are considered to be non-hazardous in the State of California for residential development (ICES 2002b).

In July 2002, ICES conducted a supplementary site investigation consisting of soil and grab groundwater samples in the trench located directly adjacent to and south of the sulfuric acid excavation, at soil sampling locations B-1A through B-4A, and groundwater sampling locations B-1W through B-3W. The samples were analyzed for volatiles. Analytical results indicated that soil samples contained non-detectable concentrations of VOCs, with the exception of one sample (B-1A), which contained a detectable concentration of 2-butanone of 0.012 mg/kg. This concentration was below the RWQCB's RBSL of 13 mg/kg for residential soil. The grab groundwater samples contained non-detectable to low concentrations of chloroform, 1,1-dichloroethane (DCA), 2-butanone, carbon disulfide, 1,2-DCA, and MTBE. The detectable concentrations of the VOCs in groundwater were below the respective RWQCB RBSLs for groundwater and/or U.S. EPA Region 9 PRGs for tap water (ICES, 2002c).

2.1.1 Groundwater Flow Direction

Information on groundwater flow direction was summarized by ICES (2003a), based on groundwater monitoring data collected by West and Associates (1995b,c; 1996a-d; 1997a-d; 1998a-c). Groundwater flow direction generally trends in a northwest direction towards San Francisco Bay, as shown in the rose diagram presented in Attachment B.

2.1.2 Geologic Cross-Section

A geologic cross-section showing contaminant concentrations, conduits, well screens, and lithology was prepared by ICES (2003b) and is presented in Attachment C.

2.2 Data Evaluation

Chemical data evaluated were initially identified by including matrix-specific chemicals that were reported as detected in shallow groundwater and subsurface soil (0 to 10 feet below ground surface [bgs]). The quantitative evaluation of risk considered data from MCS and the Park Parcel separately. This section presents the sources of data for each of the two areas. Soil and groundwater sampling locations are shown in Attachment A, Sheet 1 (Bellecci & Associates, Inc., 2003).

2.2.1 Marina Cove Subdivision

Soil and groundwater data from MCS were derived from the following sources, presented in chronological order:

- Minter & Fahy Construction Company, Inc. (Minter & Fahy). 1991a. UST Removal: One 10,000-gallon Diesel UST; Three 1,000-gallon Gasoline UST. February
- Minter & Fahy. 1991b. Overexcavation of Former Three 1,000-gallon Gasoline UST Pit." February.
- Minter & Fahy. 1991c. Overexcavation of Former Three 1,000-gallon Gasoline UST Pit." April.
- Soil Tech. 1991. Preliminary Site Investigation at Former Underground Gasoline Tank Area. December.
- Soil Tech. 1992. Additional Subsurface Investigation at Former Underground Gasoline Tank Area. April.
- Soil Tech. 1992-1993. Additional Subsurface Investigation at Former Underground Diesel Tank Area. December-January.
- West & Associates. 1994a. UST Removal: One 20,000-gallon Diesel UST. January.
- West & Associates. 1994b. Site Investigation. January.
- West & Associates. 1994c. Site Characterization. February.
- West & Associates. 1994d. Quarterly Monitoring. June.
- West & Associates. 1994e. Quarterly Monitoring. December.
- West & Associates. 1995a. Quarterly Monitoring. March.
- West & Associates. 1995b. Quarterly Monitoring. May.
- West & Associates. 1995c. Quarterly Monitoring. September.
- West & Associates. 1996a. Quarterly Monitoring. February.
- West & Associates. 1996b. Quarterly Monitoring. June.
- West & Associates. 1996c. Quarterly Monitoring. September.
- West & Associates. 1996d. Quarterly Monitoring. November
- West & Associates. 1997a. Quarterly Monitoring. February.
- West & Associates. 1997b. Quarterly Monitoring. June.
- West & Associates. 1997c. Quarterly Monitoring. September.
- West & Associates. 1997d. Quarterly Monitoring. December.
- West & Associates. 1998a. Quarterly Monitoring. February.
- West & Associates. 1998b. Quarterly Monitoring. May.
- West & Associates. 1998c. Quarterly Monitoring. August.
- ICES. 1998. Limited Site Investigation. August.
- ICES. 1999. Limited Site Investigation – Abandoned Pennzoil Pipeline. March.
- West & Associates. 1999. Additional Site Characterization. July.
- ICES. 2001. Soil Remedial Activities: Railroad Ballast. April.

The soil data collected by Minter & Fahy (1991a, b) and ICES (1998) were excluded from the risk assessment because those sample collection areas were subsequently excavated. Tables A-1, A-2, and A-3 in Appendix A present the metals, petroleum constituents, and VOCs & SVOCs, respectively, from soil samples collected from MCS. Tables A-4, A-5, and A-6 present metals, petroleum constituents, and VOCs & SVOCs, respectively, from groundwater samples collected from MCS. Each data table contains statistical information, including maximum detected concentrations, averages, standard deviation, and 95th percentile upper confidence limit of the arithmetic mean (95 UCL) concentrations.

2.2.2 Park Parcel

Soil and groundwater data from the Park Parcel were derived from the following sources, presented in chronological order:

- Blymyer Engineers, Inc. 1993. Subsurface Soil Investigation. July.
- Fugro West, Inc. (Fugro). 1993a. Phase II Environmental Site Investigation: Former Drum Storage Locations. September.
- Fugro. 1993b. Phase II Environmental Site Investigation: Caustic Tank. September.
- Fugro. 1993c. Phase II Environmental Site Investigation: Sulfuric Acid Tank. September.
- Fugro. 1993d. Phase II Environmental Site Investigation: Sumps A and B. September.
- Fugro. 1993e. Phase II Environmental Site Assessment: 2,000-gallon Diesel UST. September.
- SEMCO, Inc.. 1994. UST Removal: One 2,000-gallon Diesel UST. April.
- Geomatrix. 1995a. Soil Investigation. February.
- Geomatrix. 1995b. Groundwater Investigation. February.
- ICES. 1998. Limited Site Investigation. August.
- ICES. 1999. Limited Site Investigation – Abandoned Pennzoil Pipeline. March.
- ICES. 2001a. UST Removal: One 1,500-gallon Diesel UST. October.
- ICES. 2001b. Site Mitigation Activities: Sulfuric Acid AST Removal. October.
- ICES. 2001c. Site Mitigation Activities: Trench Parcel. October.
- ICES. 2002. Soil Sampling. January.
- ICES. 2002. Supplementary Site Investigation: Trench Parcel. July.

Tables B-1, B-2, and B-3 in Appendix B present the metals, petroleum constituents, and VOCs & SVOCs, respectively, from soil samples collected from the Park Parcel. Tables B-4, B-5, and B-6 present metals, petroleum constituents, and VOCs & SVOCs data, respectively, from groundwater samples collected from the Park Parcel. Each data table contains statistical information, including maximum detected concentrations, averages, standard deviation, and 95 UCL concentrations.

2.3 Selection of Chemicals of Potential Concern

The COPCs selected for further evaluation in the HHRA were media-dependent. The media of concern at MCS and the Park Parcel are soil, groundwater, and air. Air was selected as a medium of concern due to potential fugitive dust/particulate emissions and volatilization of volatile organic compounds from soil to air.

Selection of COPCs involved three steps:

1. Media-specific chemicals detected in at least one sample were initially selected as COPCs.

2. The maximum and 95 UCL concentrations of detected chemicals were compared to Regional Water Quality Control Board risk-based screening levels (RBSLs). Soil RBSLs for residential

land use and groundwater RBSLs were obtained from Table B in *Application of Risk-based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater* (RWQCB, 2001). These RBSLs apply to surface soil (<3 meters [9.8 feet] below ground surface) and groundwater that is not a current or potential source of drinking water.

3. Detected chemicals that exceeded RBSLs were compared to background concentrations. Background concentrations exist only for metals in soil. All background metal concentrations were taken from a Lawrence Berkeley National Laboratory study (1995). In the case of arsenic, a second value – taken from a study of San Francisco Bay sediments by Scott, Jenkins, Sanders, and Associates (1994) – was also presented because of greater geographical relevance (i.e., study had been conducted closer to the Site). Arsenic is known to be naturally elevated in California, including the San Francisco Bay Area.

Detected chemicals with maximum or 95 UCL concentrations exceeding (1) soil or groundwater RBSLs and (2) background concentrations were further evaluated quantitatively in the baseline risk assessment. This section presents the results of COPC selection in MCS and the Park Parcel.

2.3.1 Marina Cove Subdivision

Soil

As shown in Table 1, chemicals detected in at least one soil sample at MCS included metals, petroleum constituents, and VOCs & SVOCs. When the maximum and 95 UCL concentrations of detected chemicals in soil were compared to RBSLs, arsenic, chromium, TPH-gasoline, benzene, methylnaphthalene, naphthalene, and xylenes exceeded their respective soil RBSLs. The background comparison indicated that arsenic and chromium in soil at MCS were below background concentrations. As a result, these two metals were excluded from further evaluation.

The remaining chemicals that exceeded the RBSLs and background concentrations were further evaluated quantitatively in the baseline risk assessment. Exceptions included TPH-gasoline and methylnaphthalene, which could not be evaluated quantitatively due to lack of toxicity data. The COPCs in soil at MCS that were evaluated quantitatively in the risk assessment included the following:

- Benzene
- Naphthalene
- Xylenes

Groundwater

As shown in Table 1, chemicals detected in at least one groundwater sample at MCS included metals, petroleum constituents, and VOCs & SVOCs. When the maximum and 95 UCL concentrations of detected chemicals in soil were compared to RBSLs, barium, lead, nickel, zinc, TPH-gasoline, TPH-diesel (maximum only), TPH-motor oil, benzene, 1,1-dichloroethane (1,1-DCA), ethylbenzene (maximum only), methylnaphthalene, naphthalene, toluene, and xylenes exceeded their respective groundwater RBSLs.

These chemicals were further evaluated quantitatively in the baseline risk assessment. TPH-gasoline, TPH-diesel, TPH-motor oil, and methylnaphthalene (a component of TPH-gasoline) were excluded as COPCs because they could not be evaluated quantitatively due to lack of toxicity data. TPH consists of a group of compounds for which specific toxicity data are not available. Certain toxic constituents of TPH (for example, metals, methyl-tert-butyl ether (MTBE), benzene, toluene, ethylbenzene, and xylenes) were evaluated. Based on the oral LD_{50} for methylnaphthalene, this compound is considered to be relatively nontoxic (U.S. Department of Energy, 1989).

The COPCs in groundwater at MCS that were evaluated quantitatively in the risk assessment included the following:

- Barium
- Lead (evaluated using LeadSpread, Version 7 [Cal EPA, 2000])
- Nickel
- Zinc
- Benzene
- 1,1-DCA
- Ethylbenzene
- Naphthalene
- Toluene
- Xylenes

Air

Although air samples were not collected from MCS, VOCs in air were modeled from VOC concentrations in soil and groundwater. Specifically, the COPCs in air at MCS that were evaluated quantitatively in the risk assessment included benzene, naphthalene, and xylenes in soil; and benzene, 1,1-DCA, ethylbenzene, naphthalene, toluene, and xylenes in groundwater.

2.3.2 Park Parcel

Soil

As shown in Table 2, chemicals detected in at least one soil sample at the Park Parcel included metals and petroleum constituents. When the maximum and 95 UCL concentrations of detected chemicals in soil were compared to residential RBSLs, arsenic, chromium, lead, and TPH-diesel (maximum only) exceeded their respective soil RBSLs. The background comparison indicated that chromium in soil at the Park Parcel was below the background concentration. As a result, chromium was excluded from further evaluation.

Arsenic was further evaluated quantitatively in the baseline risk assessment. Lead was evaluated using LeadSpread, Version 7 (Cal EPA, 2000). TPH-diesel could not be evaluated quantitatively due to lack of toxicity data.

Groundwater

As shown in Table 2, chemicals detected in at least one groundwater sample at the Park Parcel included petroleum constituents. When the maximum and 95 UCL concentrations of detected chemicals in soil were compared to RBSLs, TPH-gasoline, TPH-diesel, and xylenes (maximum only) exceeded their respective groundwater RBSLs.

Only xylenes were further evaluated quantitatively in the baseline risk assessment. TPH-gasoline and TPH-diesel could not be evaluated quantitatively due to lack of toxicity data.

Air

Although air samples were not collected from the Park Parcel, COPCs for air consisted of xylenes, the VOC that had been selected as the COPC in groundwater.

3.0 EXPOSURE ASSESSMENT

Following the selection of COPCs, an exposure assessment was conducted. U.S. EPA identifies three components of an exposure assessment: (1) characterizing the exposure setting, (2) identifying exposure pathways, and (3) quantifying exposures. The exposure setting characterization includes a discussion of current and future land use. The identification of potentially complete exposure pathways includes a discussion of exposed populations, exposure pathways that may be complete, exposure scenarios, and hypothetical receptors. The quantification of exposures includes the development of exposure point concentrations and the estimation of chemical intakes.

3.1 EXPOSURE SETTING

This section describes the exposure setting associated with MCS and the Park Parcel.

3.1.1 Marina Cove Subdivision

MCS is located at 1801 Hibbard Avenue in Alameda, California. This area was formerly occupied by Weyerhaeuser and was used for industrial purposes. It has since been rezoned for residential use and is currently being redeveloped as a residential subdivision. Potentially exposed populations at MCS under current and future land-use settings are construction workers during intrusive activities, resulting in direct exposure to deep soils and groundwater; and single-family residents (adults and children) who may be directly exposed to surface soils.

3.1.2 Park Parcel

The Park Parcel is located at 1521 Buena Vista Avenue in Alameda, California. This area was formerly part of the Encinal Terminal and was used for industrial purposes. The Park Parcel is zoned for Planned Unit Development (PUD). Potentially exposed populations at the Park Parcel under current and future land-use settings are construction workers during intrusive activities, resulting in direct exposure to deep soils and groundwater; and landscape maintenance workers and park visitors, who may be directly exposed to surface soils.

3.2 EXPOSURE PATHWAYS

Mechanisms by which exposures may occur are called exposure pathways. EPA (1989) describes exposure pathways in terms of four primary components:

- A source and mechanism of chemical release
- A retention or transport medium (or media, in cases involving media transfer of chemicals)
- A point of human (receptor) contact with the contaminated medium (known as the exposure point)
- An exposure route (such as ingestion) at the contact point

All four of these components must be present for a potential exposure pathway to be considered complete and for exposure to occur.

3.2.1 Chemical Sources, Release Mechanisms, and Transport Media

The soil and shallow groundwater at the Site are the theoretical sources of release for the COPCs for evaluating exposure in this HHRA. The selection of COPCs at MCS and the Park Parcel is described in Section 2.2 of this HHRA. The soil and groundwater COPCs included metals, petroleum constituents, and VOCs & SVOCs.

The COPCs include chemicals considered to be volatile and nonvolatile (metals). Some of the COPCs adsorb to soil, and some are soluble in water. These varying properties indicate that several release mechanisms may be applicable. COPCs in soil and groundwater could be released to air via volatilization, then migrate into the breathing zone. Under certain soil intrusive activities, groundwater may be available for direct contact. Nonvolatile COPCs sorbed to soil particles might be released to air if the soil particles are suspended in air as dust. Volatile and nonvolatile COPCs sorbed to soil particles might be subject to direct contact (i.e., incidental ingestion and dermal contact). Further discussion of exposure pathways is presented in Section 3.2.4. Soil, groundwater, and air are retention or transport media for the COPCs.

3.2.2 Potential Receptors

This risk assessment used hypothetical exposure cases called "receptors". In general terms, receptors are representative types of potentially exposed populations. Each receptor is evaluated based upon hypothetical exposures developed from an assumed combination of site conditions, potential population activity patterns, chemical properties, chemical distribution and concentrations, and exposure to the chemical(s).

In formal terms, receptors are sets of assumptions that describe "what if" scenarios, but are not actual persons. The assumptions were intended to describe what EPA terms reasonable maximum exposure (RME). Each receptor addresses several "what if" questions that are unlikely to all apply to a single individual. In this way, receptors provide a useful tool for addressing a number of issues at once; however, they are not representative of what exposures might actually happen to any one individual and are considered conservative points of reference.

As stated earlier, potentially exposed populations at MCS under current and future land-use settings are construction workers during development and single-family residents (adults and children). Potentially exposed populations at the Park Parcel under current and future land-use settings are construction workers during development, landscape maintenance workers, and park visitors. This HHRA quantitatively evaluated exposure to these receptors.

This risk assessment uses unique scenario- and site-specific assumptions as well as generic assumptions to address the specific issues raised by the nature and distribution of the COPCs at MCS and the Park Parcel, and the needs of this HHRA. The assumptions were intended to be conservative (overestimating actual exposure) in order to account for the uncertainties associated with them. Similarly, other assumptions might be reasonable and justifiable for use in this or other exposure assessments. Further detail regarding the receptors and assumed activities and exposure pathways is presented in Section 3.2.4.

3.2.3 Exposure Points

"Exposure point" describes a location or area, often hypothetical, at which receptors (e.g., humans) might come in contact with one or more contaminated environmental media. The identification of exposure points was based on future receptor activity patterns for a given area and on the relationship of these activities to the distribution of contaminants in soil and groundwater. The primary assumption for this HHRA is that there is a single exposure point and that a single representative exposure point concentration (see Section 3.3) per chemical is used to estimate exposure.

3.2.4 Exposure Routes and Pathways

Potential uptake routes for the hypothetical receptors were inhalation, ingestion, and direct dermal contact. Because each receptor is assumed to be engaged in different activities under different exposure conditions, media-specific complete exposure pathways are receptor-specific. Figures 1and 2 present the conceptual site models for exposure to each receptor at MCS and the Park Parcel, respectively, under current and future conditions. The following subsections present a description of assumed activities and complete exposure pathways. Exposure parameters used in the development of the estimates of exposure and intake are discussed in Section 3.4. Tables C-1 (Appendix C) and D-1 (Appendix D) present summaries of the exposure pathways evaluated for each receptor at MCS and the Park Parcel, respectively.

Resident (MCS)

For the resident, it is assumed that the adult resident is a 30-year old receptor consisting of 6-years as a child and 24 years as an adult; and the child resident is a 6-year old receptor. It is conservatively assumed that limited direct soil contact is possible, and that fruit and vegetable gardening may be performed at MCS. The exposure pathways considered complete for the adult and child residents include:

- Incidental ingestion of soil
- Ingestion of homegrown produce
- Direct dermal contact with soil
- Inhalation of VOCs released from soil and groundwater to indoor air

The exposure pathway for inhalation of airborne particles as dust in outdoor air was considered. However, it was determined to be incomplete because only VOCs were selected COPCs in soil at MCS. Inhalation of VOCs in outdoor air was not evaluated because of the limited amount of time that residents are assumed to spend outdoors at MCS. Evaluation of the indoor air inhalation pathway was considered to overestimate outdoor air exposure because of the more conservative assumptions associated with indoor air exposure.

No metals were identified as COPCs in soil at MCS. As a result, root uptake of contaminants in soil is limited to VOCs, which are not likely to cause adverse health effects via the ingestion pathway. As a result, risk to residential receptors via the ingestion of homegrown produce exposure pathway was not evaluated.

Construction Worker (MCS and Park Parcel)

For the construction worker, it is assumed that direct soil contact will occur during an assumed 1-year construction period. Open soil and direct soil intrusion with heavy equipment is assumed, with temporary removal of asphalt or other soil cover at the Site. Short-term exposure to shallow groundwater exposed during excavation activities and dewatering may occur.

The exposure pathways considered complete for the construction worker include:

- Incidental ingestion of soil
- Direct dermal contact with soil
- Inhalation of airborne particles as dust (metals and other non-VOCs)
- Inhalation of VOCs released from soil to outdoor air
- Direct dermal contact with groundwater
- Inhalation of VOCs released from exposed groundwater to outdoor air

Landscape Maintenance Worker (Park Parcel)

For the landscape maintenance worker, it is assumed that work may be necessary in areas landscaped or to be landscaped following redevelopment in the Park Parcel. Direct daily intrusive soil work is assumed. It is assumed that the landscape maintenance worker is a full-time worker at the Site. The exposure pathways considered complete for the landscape maintenance worker include:

- Incidental ingestion of soil
- Direct dermal contact with soil
- Inhalation of airborne particles as dust (metals and other non-VOCs)
- Inhalation of VOCs released from soil and groundwater to outdoor air

Park Visitor (Park Parcel)

For the park visitor, it is assumed that the receptor may visit the park 12 times a year for two hours each time. The exposure pathways considered complete for the park visitor include:

- Incidental ingestion of soil
- Direct dermal contact with soil

- Inhalation of airborne particles as dust (metals and other non-VOCs)

- Inhalation of VOCs released from soil and groundwater to outdoor air

3.3 EXPOSURE POINT CONCENTRATIONS

In risk assessments, exposure point concentrations (EPC) are the chemical concentrations to which the receptors (e.g., humans) are assumed to be exposed. Representative concentrations were developed from the chemical data to identify soil and groundwater EPCs. The EPCs of COPCs in air were modeled from the soil and groundwater EPCs. Soil EPCs were used to calculate chemical intake estimates for soil incidental ingestion and soil dermal contact exposure pathways, as well as for the two soil to air exposure pathways: the inhalation of VOCs and the inhalation of airborne particles as dust. Groundwater EPCs were used to calculate chemical intake estimates for inhalation of VOCs and for direct dermal contact (for the construction worker receptor). Tables C-2 (Appendix C) and D-2 (Appendix D) summarize the EPCs for soil at MCS and the Park Parcel, respectively. Tables C-3 (Appendix C) and D-3 (Appendix D) summarize the EPCs for groundwater at MCS and the Park Parcel, respectively. Tables C-4 (Appendix C) and D-4 (Appendix D) summarize the air EPCs from groundwater for the construction worker receptor and the landscape maintenance worker receptor at MCS and the Park Parcel, respectively. Details regarding calculation of air EPCs are presented in Section 3.3.2.

3.3.1 Representative Concentrations

The maximum detected concentration and 95 UCL concentration for each COPC were used in the risk calculations to provide a range of excess cancer and non-cancer risk estimates contributed by each chemical. The use of sample results reported as not detected was conducted according to U.S. EPA. One-half of the sample quantitation limit (SQL) was used as a proxy concentration for samples reported as not detected (U.S. EPA 1989).

3.3.2 Air EPCs

Volatile COPCs may be released as vapors from soil and/or groundwater and diffuse through the pore spaces in subsurface soil and into indoor and outdoor air, to which exposure might occur. For the construction worker receptor, volatile COPCs may be released as vapors from exposed groundwater. For VOCs, the evaluation of inhalation exposures was limited to volatile emissions (exclusion of airborne particulate exposures) because the airborne particulate exposures for VOCs in soil would be insignificant as compared to the volatile emissions exposure. VOCs were considered to be chemicals having a Henry's constant greater than 1E-05 atm-m^3/mole, a vapor pressure greater of 0.001 mm Hg or higher, and a molecular weight less than 200 grams per mole. The following subsections outline the methods used to estimate air EPCs. A lot size of 484 square meters (approximately 1/10 acre) was assumed, based on the typical size of lots at MCS.

Outdoor Air EPCs from Soil

Air EPCs for VOCs that may be released to the air from soil to outdoor air (for the construction worker receptor and the landscape maintenance worker receptor) were estimated using chemical-specific volatilization factors (VF) and corresponding soil EPCs. The volatilization factors for the soil COPC VOCs were derived from values presented in the U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA 2000), which were derived from equations presented in the U.S. EPA Soil Screening Guidance (U.S. EPA 1996). The equations are based upon the volatilization model developed by Jury et. al. (1984). Tables C-2 (Appendix C) and D-2 (Appendix D) include the chemical-specific VFs for the COPCs at MCS and the Park Parcel, respectively.

Outdoor Air EPCs from Exposed Groundwater

Air EPC for VOCs that may be released to the air from exposed groundwater to outdoor air (for the construction worker receptor) were estimated by using a mass transfer equation (U.S. EPA 1993) to estimate the exposed water emission rate to the air and estimating the vapor concentrations in outdoor air. The emission rate was calculated as follows:

$$ER = SA \times Cwater \times K \times CF \qquad (3\text{-}1)$$

where:

ER	=	Emission rate at the surface (milligrams per second)
SA	=	Surface area of water, assumed to be 484 square meters (approximately 1/10 of an acre), equivalent to a standard lot at MCS
Cwater	=	Groundwater EPC (milligrams per liter)
CF	=	Conversion factor 1E+01 liters per cubic centimeter multiplied by square centimeters per square centimeters
K	=	Overall mass transfer coefficient (centimeters per second), calculated as follows:

$$1/K = 1/kl + ((R \times T)/(H \times Kg) \qquad (3\text{-}2)$$

where:

kl	=	liquid mass transfer coefficient of compound (centimeters per second), calculated
R	=	Ideal gas constant 8.2E-05 atmospheres- cubic meters per mol-degrees Kelvin
T	=	Temperature in degrees Kelvin, assumed to be 298
H	=	Chemical-specific Henry's constant (atmospheres per cubic meter per mole)
Kg	=	Gas phase mass transfer coefficient of all compounds (centimeters per second) (U.S. EPA 1993)

The vapor concentration in the breathing zone was estimated my using a near field box model (GRI 1988). The near field box model is a representation of the space within which vapor emissions from a source area are mixed with ambient air. The calculation of the vapor concentration in the breathing zone was as follows:

$$Ca = ER/ (W \times H \times WS) \quad (3\text{-}3)$$

where:

Ca	=	Vapor concentration in the breathing zone in milligrams per cubic meter (calculated)
ER	=	Emission rate to the surface (milligrams per second), calculated from Equation 3-2
W	=	Width of the area perpendicular to wind direction (equivalent to be one side of a 484 square meter [1/10 acre] lot at MCS, equal to 22 meters)
H	=	Mixing height, assumed to be 1.5 meters
WS	=	Average wind speed in the mixing zone, assumed to be 3.88 meter per second (NOAA 2002)

Table C-4 presents the equation parameters and the chemical-specific estimates of outdoor air EPCs from exposed groundwater for the construction worker.

Outdoor Air EPCs from Subsurface Groundwater

Air EPCs for VOCs that may be released to the air from groundwater to soil pore spaces to outdoor air (for the landscape maintenance worker receptor) were estimated by calculating chemical partitioning from groundwater, the vapor emission rate through the soil to the surface, and the vapor concentrations in outdoor air. In the partitioning equation used to estimate the chemical vapor concentration at the source, the groundwater EPC is multiplied by the chemical-specific dimensionless Henry's Law constant. This assumes the maximum amount of chemical that can physically volatilize from groundwater will volatilize, without taking into account adsorption of a chemical to particulates in the groundwater or other factors that may retard volatilization. The rate of vapor migration through soil was estimated using a modified Farmer's emission rate calculation (U.S. EPA 1988 and U.S. EPA 1990). This calculation incorporates the following assumptions:

- No chemical degradation
- No removal by leaching or other processes
- No adsorption to soil
- No capillary zone to retard vapor transport
- Constant source over time
- Zero concentration at the surface (maximizing the concentration gradient driving diffusion)

The emission rate was calculated as follows:

$$ER = (A \times Cvapor - Csurface) \times Deff \times CF)/L \quad (3\text{-}3)$$

where:

ER	=	Emission rate at the surface (milligrams per second)
A	=	Cross sectional area available for diffusion, assumed to be 484 square meters (equivalent to the area of a standard lot at MCS, approximately 1/10 of an acre)
Cvapor	=	Chemical vapor concentration in soil at the source (milligrams per cubic meter), calculated from the groundwater concentration
Csurface	=	Chemical vapor concentration in soil at the surface (milligrams per cubic meter), assumed to be 0.
Deff	=	Effective diffusion coefficient in air at 25 degrees Celsius (square centimeters per second), calculated as Deff = Dair x ($Pa^{3.33}/Pt^2$) (Millington & Quirk, 1961)
L	=	Length of flow from groundwater, assumed to be the shallowest reported depth to groundwater (2.12 feet or 0.65 meter)
CF	=	Conversion factor 1E-04 square meters per square centimeters

The vapor concentration in the breathing zone was estimated my using a near field box model (GRI 1988). The near field box model is a representation of the space within which vapor emissions from a source area are mixed with ambient air. The calculation of the vapor concentration in the breathing zone was as follows:

$$Ca = ER/(W \times H \times WS) \quad (3\text{-}4)$$

where:

Ca	=	Vapor concentration in the breathing zone in milligrams per cubic meter (calculated)
ER	=	Emission rate to the surface (milligrams per second), calculated from Equation 3-3
W	=	Width of the area perpendicular to wind direction (equivalent to be one side of a 484 square meter [1/10 acre] lot at MCS, equal to 22 meters)
H	=	Mixing height, assumed to be 1.5 meters
WS	=	Average wind speed in the mixing zone, assumed to be 3.88 meter per second (NOAA 2002)

Table C-4 presents the equation parameters and the chemical-specific estimates of outdoor air EPCs from groundwater for the landscape maintenance worker.

Indoor Air EPCs for VOCs

An electronic copy (U.S. EPA 2001) of the Johnson and Ettinger model (1991) was used to estimate indoor air concentrations of VOC vapors from soil and groundwater. The Soil Screen Model (Version 2.3) and the Groundwater Screen Model (Version 2.3) were used. Although the models provide a calculation of the excess cancer risk and non-cancer hazard, the models were only used to derive the estimated air concentrations in a building (the indoor air EPC for VOCs). Site-specific key parameters used in the models are presented in Table E-1 and include the following:

L_F	=	Depth below grade to bottom of enclosed space floor, 15 centimeters
L_t	=	Depth below grade to top of contamination, assumed to be 91.44 (3 feet), based on the shallowest soil sample in which at least one VOC was detected
L_{WT}	=	Depth below grade to water table, assumed to be 182.88 cm (6 feet), based on the 95 UCL of historical groundwater sampling depths
Soil Type	=	Vadose zone SCS soil type, assumed to be "SCL" (sandy clay loam)

ρ_b^A	=	Vadose zone bulk density, assumed to be 1.7 grams per cubic centimeter
n^V	=	Vadose zone soil total porosity, assumed to be 0.38 (unitless)
θ_w^V	=	Vadose zone soil water-filled porosity, assumed to be 0.12 cubic centimeters per cubic centimeter
f_{oc}^V	=	Vadose zone soil organic carbon fraction, assumed to be 0.002 (unitless)
Q_{Bldg}	=	Building ventilation rate for a residential building assumed to be 2.5E+05 cubic centimeters per second, equivalent to 2 indoor air exchanges per hour (RWQCB 2001 and City of Oakland 1999)

Soil and groundwater EPCs were used as the initial concentrations and the calculated infinite source building concentrations were used as the indoor air EPCs. Tables C-2 and C-3 (Appendix C) present the EPCs and the calculated indoor air EPCs for VOCs in soil and groundwater at MCS, respectively. The Johnson and Ettinger model spreadsheets are included in Appendix E.

Air EPCs Based Upon Fugitive Dust Emissions

In order to derive the EPCs in air from fugitive dust emissions, particulate emission factors (PEF) were applied to the non-VOC (metals and selected organic compounds) soil EPCs. The PEF is intended to relate the concentration of a chemical in soil to the concentration of the chemical in airborne dust. For the residential receptor, a PEF of 1.32E+09 m^3/kg was used. This value is derived from the U.S. EPA Soil Screening Guidance (U.S. EPA 1996). The emission part of the PEF is based on the "unlimited reservoir" model from Cowherd et al. (1985) developed to estimate particulate emissions due to wind erosion, for a typical hazardous waste site where surface contamination provides a relatively continuous and constant potential for emission over an extended period of time.

For the construction worker and landscape maintenance worker, a different PEF was used to derive the EPCs in air from fugitive dust emissions. The PEF (1.44E+06 m^3/kg) is derived from a "Dust Emission Factor" of 1.2 tons per month per acre developed by U.S. EPA (1974, 1985a,b). The Dust Emission Factor is based on field studies at apartment complex and commercial center developments in semiarid areas.

3.4 CHEMICAL INTAKE ESTIMATES

Estimates of exposure (chemical daily intake) were based on the COPC EPCs (Section 3.3) and scenario-specific assumptions and intake variable values. A chemical daily intake is an estimate of the amount of chemical that might be taken into the human body. These chemical daily intakes were used to estimate potential cancer risks and risk of adverse non-cancer health effects.

A chemical intake is expressed as milligrams of chemical per kilogram body weight per day (mg/kg-day) and is for each exposure scenario. EPA-derived exposure algorithms were used to estimate the chemical intakes for each route of exposure.

The exposure variable values used in the pathway-specific equations were based on a series of reported and assumed factors regarding potential land use patterns at the Site. Exposure variables also accounted for a number of physiological factors such as daily breathing rate and surface area of exposed skin. The exposure variables used for this evaluation are consistent with DTSC and EPA guidance. The following documents were consulted in the selection of exposure variables for the Soil OU HHRA:

- Cal EPA 1994. Preliminary Endangerment Assessment Guidance Manual. January.
- DTSC. 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. July.
- DTSC. 2000. Guidance for the Dermal Exposure Pathway. Draft Memorandum from S. DiZio, M. Wade, and D. Oudiz to Human and Ecological Risk Division. January 17.
- U.S. EPA . 1991. Risk Assessment Guidance for Superfund, Vol. I – Human Health and Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03. March.
- U.S. EPA. 1997a. Exposure Factors Handbook. Volume I, General Factors. Office of Research and Development.
- U.S. EPA. 1999. Exposure Factors Handbook. Office of Research and Development. February.
- U.S. EPA. 2001. Supplemental Guidance for Developing Soil Screening Levels for Superfund Site. Solid Waste and Emergency Response. Peer Review Draft. March.
- Holmes et. al. 1999. Field Measurement of Dermal Soil Loadings in Occupational and Recreational Activities. Environmental Res. 80:148-157.
- Kissel et. al. 1996. Field Measurement of Dermal Soil Loading Attributable to Various Activities: Implications for Exposure Assessment. Risk Analysis. 16(1), 115-126.

For soil adherence factors, empirical data (i.e., Holmes et. al. 1999 and Kissel et. al. 1996) were used to select the values used in the HHRA. For example, the soil adherence factor for children was based upon a geometric mean of the soil loading observed in children in daycare facilities. Tables C-5 (Appendix C) and D-5 (Appendix D) present the exposure variables assumed for each receptor at MCS and the Park Parcel, respectively.

In order to estimate intake for each receptor, exposure factors were developed for each receptor for each exposure pathway evaluated in the HHRA. Tables C-5 (Appendix C) and D-5 (Appendix D) present the exposure factors for MCS and the Park Parcel, respectively. These factors were multiplied by the corresponding soil, groundwater, or air EPC to yield the intake for the given receptor. For the dermal contact intakes, additional factors included in the estimate of intake included chemical-specific soil dermal absorption factors (Cal EPA 1994b) for dermal contact with soil and water permeability factors for dermal contact with water (EPA 1992). The soil dermal absorption factors are presented in Tables C-6 (Appendix C) and D-6 (Appendix D) for MCS and the Park Parcel. The water permeability factors are presented in Tables D-7 (Appendix D) and D-7 (Appendix D) for MCS and the Park Parcel. Formulas for estimating the chemical daily intakes for each receptor evaluated in the HHRA are included in Tables C-8 (Appendix C) and D-8 (Appendix D) for MCS and the Park Parcel, respectively.

4.0 TOXICITY ASSESSMENT

The toxicity assessment for the HHRA included the identification of the toxicity values (RfDs and SF) used to characterize non-cancer health effects and cancer risk, respectively. Tables C-9 (Appendix C) and D-9 (Appendix D) presents the toxicity values used for MCS and the Park Parcel, respectively.

4.1 Reference Doses

The potential for non-cancer health effects resulting from exposure to chemicals was assessed by comparing an exposure estimate (intake) with an RfD. RfDs represent average daily intakes (expressed as mg/kg-day), which are expected to be without appreciable risk of adverse health effects to humans (including sensitive populations) during a lifetime of exposure (for chronic RfDs).

The RfDs are specific to the chemical, exposure route, and duration. Separate RfDs were available to evaluate oral and inhalation exposures. Inhalation RfDs may be cited as reference concentrations (RfCs), expressed as micrograms per cubic meter ($\mu g/m^3$). Unless already presented as inhalation slope factors, RfCs were converted to RfDs by dividing the RfC by 70 kilograms (an assumed body weight), multiplying by the assumed inhalation rate of 20 cubic meters per day (m^3/day), and converting the chemical mass units from micrograms to milligrams. For this assessment, oral RfDs were used to assess dermal exposures in the absence of route-specific dermal RfDs (EPA 1989). The following are the primary sources of RfDs, presented in order of preference:

- EPA's Integrated Risk Information System (IRIS), an on-line database that contains current health risk and regulatory information for a large number of chemicals (EPA 2002)
- EPA Region 9 table of preliminary remediation goals (PRG) (EPA 1999a), EPA Region 9 lists the sources of these additional values as the National Center for Environmental Assessment (NCEA)
- Health Effects Assessment Summary Tables (HEAST), published periodically by the EPA (1997b)
- Cal EPA's chronic reference exposure levels (RELs) (Cal EPA 1997)

Cal EPA RELs are air concentrations expressed as micrograms per cubic meter ($\mu g/m^3$). The RELs were converted to RfDs by dividing the REL by 70 kilograms (an assumed body weight), multiplying by the assumed inhalation rate of 20 cubic meters per day (m^3/day), and converting the chemical mass units from micrograms to milligrams.

4.2 Slope Factors

EPA has developed SFs for the oral and inhalation routes for chemicals that are known or potential human carcinogens. EPA (1989) defines a SF as a plausible upper-bound estimate of the probability of a carcinogenic response in human populations per unit intake of a chemical (averaged over an expected lifetime of 70 years).

The following are the primary sources of SFs, presented in order of preference:

- Cal EPA cancer potency factors on-line at http://www.oehha.ca.gov/risk/chemicalDB/index.asp
- Cal EPA cancer potency factors (Cal EPA 1994)
- EPA's Integrated Risk Information System (IRIS), an on-line database that contains current health risk and regulatory information for a large number of chemicals (EPA 2002)
- EPA Region 9 table of preliminary remediation goals (PRG) (EPA 1999a), EPA Region 9 lists the sources of these additional values as the National Center for Environmental Assessment (NCEA)
- Health Effects Assessment Summary Tables (HEAST), published periodically by the EPA (1997b)

In cases in which SFs were available from both Cal EPA (1994) and IRIS (EPA 2002), the Cal EPA value was used.

4.3 Route-to-Route Extrapolation

For some chemicals, toxicity values have not been developed for either the oral or inhalation exposure pathways. In some cases, route-to-route extrapolations are performed. This process involves using a toxicity value developed for one route of exposure (e.g., ingestion) and applying it to another (e.g., inhalation). Under this approach, it is assumed that the toxicity between the two pathways of exposure is identical. Route-to-route extrapolations were performed as follows:

- When an oral RfD/CSF was available but no inhalation RfD/CSF was available, the oral RfD/CSF was adopted as the inhalation RfD/CSF; or
- When an inhalation RfD/CSF was available but no oral RfD/CSF was available, the inhalation RfD/CSF was adopted as the oral RfD/CSF
- Route-to-route extrapolations were performed for organic compounds only, not metals.

No conversion for gastrointestinal bioavailability was made for the route-to-route extrapolations.

5.0 RISK CHARACTERIZATION

The risk characterization included an estimate of the potential theoretical excess lifetime cancer risks and the risk of adverse non-cancer health effects attributable to potential exposure to COPCs in soil and groundwater for each of the receptors. The excess cancer risks and non-cancer hazard indices estimated for potential exposure to the soil and groundwater COPCs to the receptors evaluated under the various exposure scenarios for each complete exposure pathway are presented in Tables C-10 through C-15 (Appendix C) and Tables D-10 through D-15 (Appendix D) for MCS and the Park Parcel, respectively. Chemical-specific summaries of the excess cancer risks and non-cancer hazards at MCS and the Park Parcel are presented in Tables 3 and 4, respectively. The methodology used for the risk characterization is presented in Sections 5.1 and 5.2 followed by the results of the risk characterization for each exposure scenario.

5.1 Cancer Risk Calculation Methodology

Cancer risks associated with exposure to COPCs classified as carcinogens were characterized as an estimate of the probability (risk) that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens (EPA 1989). This estimated theoretical excess risk was expressed as a unitless probability. For example, a cancer risk of 1×10^{-5} indicates an individual has a one-in-one hundred thousand probability of developing cancer during a 70-year lifetime as a result of the assumed exposure conditions. For COPCs that are classified as carcinogens, the cancer risks resulting from exposure to area COPCs were estimated using the following three steps:

First, to derive a cancer risk estimate for a single chemical and pathway for a given media , the chemical intake was multiplied by the chemical-specific SF:

$$Chemical - Specific\ \ Cancer\ Risk \ = \ Intake \ \ (mg/kg/day) \times SF\ (mg/kg/day)^{-1} \qquad (5\text{-}1)$$

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

$$Pathway - Specific\ \ Cancer\ Risk = \sum\ Chemical - Specific\ \ Cancer\ Risk \qquad (5\text{-}2)$$

Third, pathway-specific risks were then summed to estimate the total excess cancer risk for the given media.

$$Total\ Cancer\ Risk = \sum\ Pathway - Specific\ \ Cancer\ Risk \qquad (5\text{-}3)$$

The total excess cancer risk for each media was then summed to yield the total soil and groundwater excess cancer risks.

5.2 Non-cancer Health Effects Calculation Methodology

The potential for exposure to result in non-cancer adverse health effects was evaluated by comparing the intake estimate with an RfD. When calculated for a single chemical for a given media, this comparison yielded a ratio termed the HQ:

$$Pathway\text{-}Specific\ Hazard\ Quotient\ (HQ) = \frac{Intake\ (mg/kg\text{-}day)}{RfD\ (mg/kg\text{-}day)} \qquad (5\text{-}4)$$

To evaluate the potential for non-cancer adverse health effects from exposure to multiple chemicals, the HQs for all chemicals were summed for a given media, yielding an HI as follows:

$$Pathway\ \text{-}\ Specific\ Hazard\ Index(HI) = \sum Pathway\ \text{-}\ Specific\ HQ \qquad (5\text{-}5)$$

Pathway-specific HIs for a given media were then summed to estimate a total HI for a given media for each receptor.

$$Total\ Hazard\ Index(HI) = \sum Pathway\ \text{-}\ Specific\ HI \qquad (5\text{-}6)$$

The Total HI for each media was then summed to yield the total soil and groundwater HI. The total HI reflects an assumption, generally considered to be conservative, that the effects of the different chemicals are additive. When the total HI exceeds 1, further evaluation in the form of a segregation of HI analysis was performed to determine whether non-cancer health hazards are a concern at the area (EPA 1989). This is done because the non-cancer adverse health effects of chemicals with different target organs are generally not additive. The exception to implementation of a segregation of HI is when individual hazard quotients exceed a value of 1.

For the resident receptor, although an HI is calculated for an adult and child, the child HI is used to evaluate the resident receptor because the child HI is much higher than the adult HI due to relatively low body weight of the child. The lower body weight of the child resident receptor increases the calculated intake per mass of body weight, resulting in a higher estimate of non-cancer hazard than the adult resident receptor.

5.3 Blood Lead Calculation Methodology

Non-cancer health effects associated with exposures to lead were evaluated using the Cal EPA blood-lead model called "Leadspread", Version 7 (Cal EPA, 2000). This is done because most human health effects data are based on blood-lead concentrations rather than on the external dose. The model was used to calculate a blood-lead level in the residential and construction worker receptors at MCS and construction worker, landscape maintenance worker, and park visitor receptors at the Park Parcel, which then may be compared to the target blood-lead level of 10 micrograms per deciliter (μg/dL) of blood. At MCS, the homegrown produce input value was set at the model default value of 7% for the residential receptors. At the Park Parcel, the assumption was made that no homegrown produce would be planted or consumed. For the purposes of reporting in the risk assessment, the calculated blood-lead level at the 99th percentile is used for each receptor. Exposure factors used in the blood-lead calculations are presented in Appendix F.

U.S. EPA has determined that lead exposure can result in neurotoxic and developmental effects. The primary receptors of concern are children, whose nervous systems are undergoing development and who also exhibit behavioral tendencies that increase their likelihood of exposure. These effects, which may occur at exposures so low that they may be considered to have no threshold, are dependent on the blood-lead level. U.S. EPA views it to be inappropriate to develop noncarcinogenic "safe" exposure levels (e.g., RfDs) for lead. Instead, a model is used that relates measured lead concentrations in the environmental media with an estimated blood-lead level.

5.4 Risk Characterization Results

The risk characterization includes estimates of theoretical soil and groundwater excess cancer risks and risk of adverse non-cancer health effects for each of the receptors. Tables 3 and 4 present summaries of the risk characterization results at MCS and the Park Parcel, respectively. Appendix C and D of this HHRA includes the risk calculation tables for each of the receptors at MCS and the Park Parcel, respectively. A range of the calculated risk estimates are presented below, based on maximum and 95 UCL EPCs.

A cancer risk of 1E-06 is generally considered a regulatory target (i.e., total excess cancer risk less than 1E-06 would not be considered significant). A non-cancer hazard greater than 1 indicates a potential for adverse non-cancer health effects to occur.

5.4.1 Resident Receptor (MCS)

For excess cancer risks, the adult and child estimates were summed to yield estimates of total excess cancer risk for the resident. For the adult resident receptor, the soil excess cancer risk was 3E-06, based on maximum and 95 UCL EPCs. For the child resident receptor, the soil excess cancer risk was 2E-06, based on maximum and 95 UCL EPCs. The total resident excess cancer risk for soil was 5E-06.

For the adult resident receptor, the groundwater excess cancer risks were 3E-06 and 4E-05, based on the 95 UCL and maximum EPCs, respectively. For the child resident receptor, the groundwater excess cancer risks were 2E-06 and 2E-05, based on the 95 UCL and the maximum EPCs, respectively. The total resident excess cancer risks for groundwater were 5E-06 and 6E-05, based on the 95 UCL and maximum EPCs, respectively. The total soil and groundwater excess cancer risks for the resident receptor were 9E-06 and 7E-05, based on the 95 UCL and maximum EPCs, respectively. These excess cancer risks for the resident receptor are greater than the regulatory target of 1E-06.

Benzene was the risk driver via the indoor air inhalation pathway. It should be noted, however, that benzene was detected at elevated concentrations in a clustered "hotspot" area comprised of three former monitoring well locations (MW-2, MW-3, and MW-3B), outside the boundary and to the east of MCS Lot #10, in Ohlone Street. This benzene "hotspot" area appears to be isolated because benzene concentrations from samples collected from other parts of MCS are at least one order of magnitude lower. As a result, the EPCs used for benzene in the HHRA may have been biased high and may not appropriately represent conditions in the rest of the Site. Furthermore, the age of the data creates an uncertainty because the current concentration of benzene in soil and groundwater may have markedly reduced over time due to natural attenuation. Exclusion of the "hotspot" data from the cancer risk calculations resulted in a decrease in total resident excess cancer risk estimates from 5E-06 to 8E-07 for soil, and from 6E-05 to 5E-07 for groundwater, based on 95 UCL concentrations. The total resident soil and groundwater excess cancer risk estimates decreased from 7E-05 to 1E-06, based on 95 UCL concentrations.

The soil and groundwater HIs for the adult resident receptor and the soil HI for the child resident receptor were less than the regulatory HI target of 1. The groundwater HIs for the child resident receptor were 0.1 and 2 based on the 95 UCL and maximum EPCs, respectively. The total soil and groundwater HIs for the resident receptor, based on 95 UCL and maximum EPCs, were 0.3 and 2, respectively, the latter of which is greater than the regulatory HI target of 1. A target organ analysis was not conducted because the HI exceedence was due to benzene. As stated above, elevated concentrations of benzene was detected in a clustered "hotspot' area outside the boundary and to the east of MCS Lot #10, in Ohlone Street. As a result, the EPCs used for benzene in the HHRA may have been biased high and may not appropriately represent conditions in the rest of the Site. Furthermore, the age of the data creates an uncertainty because the current concentration of benzene in soil and groundwater may have markedly reduced over time due to natural attenuation. Exclusion of the "hotspot" data from the non-cancer hazard calculations resulted in a decrease in total soil and groundwater HI from 2 to 0.2, based on maximum concentrations.

Tables C-10 and C-11 (Appendix C) present the soil and groundwater calculations for the adult resident receptor, respectively. Tables C-12 and C-13 (Appendix C) present the soil and groundwater calculations for the child resident receptor, respectively.

The estimated blood lead values for the adult and child resident receptors at the 99^{th} percentile ranged from 2.5 to 3.3 μg/dL and 4.9 to 8.0 μg/dL, respectively, all of which are below the target blood lead value of 10 μg/dL for adverse health effects. The blood-lead calculations are presented in Appendix F.

5.4.2 Construction Worker Receptor (MCS and Park Parcel)

MCS

For the construction worker receptor, the soil excess cancer risks were 5E-09 and 5E-08, based on 95 UCL and maximum EPCs, respectively. The groundwater excess cancer risk were 5E-06 and 6E-06, based on 95 UCL and maximum EPCs, respectively. The total soil and groundwater excess cancer risks for the construction worker receptor, based on 95 UCL and maximum EPCs, respectively, were 5E-06 and 6E-06, which are greater than the regulatory target of 1E-06.

Benzene was the risk driver via the dermal and outdoor air inhalation pathways. As stated earlier, it should be noted that benzene was detected at elevated concentrations in a clustered "hotspot" area comprised of three former monitoring well locations (MW-2, MW-3, and MW-3B), outside the boundary and to the east of MCS Lot #10, in Ohlone Street. This benzene "hotspot" area appears to be isolated because benzene concentrations from samples collected from other parts of MCS are at least one order of magnitude lower. As a result, the EPCs used for benzene in the HHRA may have been biased high and may not appropriately represent conditions in the rest of the Site. Furthermore, the age of the data creates an uncertainty because the current concentration of benzene in soil and groundwater may have markedly reduced over time due to natural attenuation.

The soil non-cancer HI was less than the regulatory HI target of 1. The groundwater non-cancer HIs were 1 and 2, based on the 95 UCL and maximum EPCs, respectively, which are greater than the regulatory HI target of 1. A target organ analysis was not conducted because the HI exceedence was due to benzene.

Tables C-14 and C-15 (Appendix C) present the soil and groundwater calculations for the construction worker receptor, respectively.

The estimated blood lead values for the construction worker receptor at the 99^{th} percentile ranged from 2.4 to 3.0 μg/dL, which is below the target blood lead value of 10 μg/dL for adverse health effects. The blood-lead calculations are presented in Appendix F.

Park Parcel

For the construction worker receptor at the Park Parcel, the soil excess cancer risks were 1E-07 and 4E-07, based on the 95 UCL and maximum EPCs, respectively, which is less than the regulatory target of 1E-06. Cancer risk was not evaluated in groundwater because no carcinogens were identified in groundwater. The soil and groundwater non-cancer HIs were less than the regulatory HI target of 1. Tables D-10 and D-11 (Appendix D) present the soil and groundwater calculations for the construction worker receptor, respectively.

The estimated blood lead values for the construction worker receptor at the 99^{th} percentile ranged from 2.8 to 4 μg/dL, which is below the target blood lead value of 10 μg/dL for adverse health effects. The blood-lead calculations are presented in Appendix F.

5.4.3 Landscape Maintenance Worker Receptor (Park Parcel)

For the landscape maintenance worker receptor, the soil excess cancer risks were 7E-07 and 2E-06, based on the 95 UCL and maximum EPCs. The soil excess cancer risk, based on the maximum EPC, is greater than the regulatory target of 1E-06. Arsenic was the risk driver via the incidental ingestion exposure pathway but was detected in only one sample at sampling location P-2 at a depth of 1.5 feet bgs. Exposure at that depth is not anticipated under a landscape maintenance worker scenario. Cancer risk was not evaluated in groundwater because no carcinogens were identified in groundwater. The soil and groundwater non-cancer HIs were less than the regulatory HI target of 1. Tables D-12 and D-13 (Appendix D) presents the soil and groundwater calculations for the landscape maintenance worker receptor.

The estimated blood lead values for the landscape maintenance worker receptor at the 99th percentile ranged from 2.8 to 4.0 μg/dL, which is below the target blood lead value of 10 μg/dL for adverse health effects. The blood-lead calculations are presented in Appendix F.

5.4.4 Park Visitor Receptor (Park Parcel)

For the park visitor receptor, the soil excess cancer risks ranged from 2E-07 to 4E-07, which are less than the regulatory target of 1E-06. Cancer risk was not evaluated in groundwater because no carcinogens were identified in groundwater. The soil and groundwater non-cancer HIs were less than the regulatory HI target of 1. Tables D-14 and D-15 (Appendix D) present the soil and groundwater calculations for the park visitor receptor.

The estimated blood lead values for the park visitor receptor at the 99th percentile was 2.1 μg/dL, based on maximum and 95 UCL EPCs, which is below the target blood lead value of 10 μg/dL for adverse health effects. The blood-lead calculations are presented in Appendix F.

6.0 QUALITATIVE UNCERTAINTY EVALUATION

Some uncertainties are inherent in the estimates of potential soil excess cancer risk and non-cancer health hazard presented in this document. The uncertainties fall into two categories, including uncertainties associated with the general risk assessment methodologies and uncertainties uniquely associated with this HHRA. The following subsections present information related to these uncertainties.

The net effect of these uncertainties is expected to be to yield an overestimate of risks. Even considering the few uncertainties contributing to a small underestimate of risk, the compounding conservatism in the HHRA process is expected to negate the assumptions that may lead to underestimating risks.

6.1 Data Evaluation

The soil and groundwater data used in the HHRA were derived from both historical and recent investigations. At MCS and the Park Parcel, the concentrations of COPCs that exceeded the RBSL screening were associated with samples that had been collected up to 11 years ago. For example, there is a noticeable decreasing trend in benzene concentrations reported from groundwater monitoring well MW-3 (later replaced by MW-3B) from the time it was first sampled in February, 1994 (3900 μg/L), until August, 1998 (99.3 μg/L). The age of the data creates an uncertainty because the current concentration of COPCs in soil and groundwater may have markedly reduced over time due to natural attenuation. For example, TPH, which could not be evaluated quantitatively in the HHRA due to lack of toxicity data, is known to biodegrade in the natural environment. Also, some chemicals such as VOCs were analyzed in groundwater but not in soil. As a result, some of the data used in the HHRA may not appropriately represent current conditions at the Site.

Furthermore, benzene in soil and groundwater at MCS and arsenic in soil at the Park Parcel, the primary risk drivers in the HHRA, were detected at elevated concentrations in "hotspots" or clustered in isolated areas. Benzene was detected at elevated concentrations in a clustered "hotspot" area comprised of three former monitoring well locations (MW-2, MW-3, and MW-3B), outside the boundary and to the east of MCS Lot #10, in Ohlone Street. This benzene "hotspot" area appears to be isolated because benzene concentrations from samples collected from other parts of MCS are at least one order of magnitude lower. Similarly, arsenic was detected slightly above background concentrations in only one sample collected at sampling location P-2 in the Park Parcel. The presence of arsenic in this sample appears to be isolated since arsenic concentrations from other samples collected at the Park Parcel are within natural background concentrations. As a result, the EPCs used for these two COPCs in the HHRA may have been biased high and may not appropriately represent conditions in the rest of the Site.

Arsenic is also known to be naturally elevated in the San Francisco Bay Area. The presence of arsenic at background or slightly higher than background at the Park Parcel may represent this natural phenomenon.

6.2 Selection of Exposure Pathways

The exposure pathways quantified in this risk assessment were identified on the basis of the conceptual model, relevant site characterization data, and contaminant fate and transport considerations. To the extent that these factors may not accurately predict the migration of contaminants within the area, uncertainty is introduced into the exposure assessment.

Although the construction worker receptor includes an evaluation of exposure based upon exposed groundwater, it is possible that much of the redevelopment at MCS and the Park Parcel may occur above the water table. Consequently, the construction worker's groundwater risks may be overestimated.

The landscape maintenance worker scenario as the Park Parcel includes an assumption of direct contact with chemical-affected soil. It is likely that imported clean soil will be used for landscaping, precluding exposure to contaminants in soil. Consequently, the landscape maintenance receptor's soil risks may be overestimated.

6.3 Exposure Points and Estimation of Exposure Point Concentrations

The HHRA included an assumption of a single exposure point to evaluate potential exposures and risks. Because of the potential localized presence of certain COPCs (i.e., arsenic, benzene, lead), the use of a single exposure point may represent an overestimate of risks for a given area of MCS or the Park Parcel. Interpretation of risks must incorporate the knowledge of localized chemicals in soil and groundwater at the Site.

In general, the uncertainties associated with site characterization and the estimation of a representative EPC increase with smaller data sets. The estimation of EPCs is affected by the sampling strategy, the treatment of nondetectable concentrations and high detection limits, assumptions regarding contaminant degradation over time, and the accuracy of modeled estimates of chemical concentrations in air.

The sample collection strategy was designed as a deterministic investigation, whereby samples were collected in areas of suspected or known contamination. The primary objective of this sampling effort was to define the nature and extent of contamination. The EPCs based on these nonrandom soil samples are likely to overestimate the concentrations at the exposure point as well as the actual dose to the receptor.

Proxy concentrations were used for all laboratory analytical results reported as not detected. Although sample detection limits for soil are often relatively high because of matrix interference factors, substitution of one-half the detection limit or sample quantitation limit had no significant effect on the risk assessment results.

Current and future COPC concentrations and by association, the EPCs, are assumed to remain the same as those that were measured during site characterization activities. This assumption ignores the effects of various fate and transport mechanisms that will alter the composition and distribution of chemicals present in the various media. In general, the assumption of steady-state conditions results in overestimated COPC concentrations and exposure doses because contaminant concentrations generally tend to decrease over time as a result of fate and transport processes.

In the absence of direct measurements, mathematical models were applied to estimate contaminant concentrations in air. While models cannot predict true EPCs at different times and locations or in different media, they provide a conservative estimate of the EPC under certain assumed conditions.

6.4 Selection of Exposure Variables

The exposure variables used to estimate chemical intake are standard upperbound estimates. In reality, however, there may be considerable variation in the activity patterns and physiological response of individuals. Therefore, it is possible that the exposure variables used in this evaluation do not represent actual exposure conditions and are considered conservative in nature and are expected to result in an overestimate of exposures.

6.5 Toxicity Assessment

The primary uncertainties associated with the toxicity assessment are related to derivation of toxicity values for COPCs. Standard RfDs and SFs developed by DTSC and EPA were used to estimate potential cancer and non-cancer health effects from exposure to COPCs at the Site. These values are derived by applying conservative (health-protective) assumptions and are intended to protect the most sensitive potentially exposed individuals.

To derive the toxicity values, EPA makes several assumptions that tend to overestimate the actual hazard or risk to human health. Because data from human studies are generally unavailable, the RfDs are typically derived from animal studies. Uncertainty factors and modifying factors are then applied to the data from animal studies to ensure that the RfDs are adequately protective of human health. For many compounds, this approach is anticipated to result in an overestimated potential for non-cancer adverse health effects.

Derivation of SFs used to estimate soil excess cancer risk is also typically based on data from animal studies. These data are taken from studies in which high doses of a test chemical were administered to laboratory animals, and the reported response is extrapolated to the much lower doses to which humans are likely to be subjected. Very little experimental data are available on the nature of the dose-response relationship at low doses (for example, a threshold may exist or the dose-response curve may pass through the origin). Because of this uncertainty, EPA has selected a conservative model to estimate the low-dose relationship, and EPA uses an upperbound estimate (the 95 UCL of the slope predicted by the extrapolation model) as the SF. With this SF, an upperbound estimate of potential soil excess cancer risks is obtained.

A second uncertainty associated with toxicity values is the unavailability of RfDs or SFs for all COPCs at a Site. The soil excess cancer risks and non-cancer health hazards can be assessed only for those COPCs for which the relevant toxicity values are available. For organic COPCs for which a SF or an RfD was available for only one route of exposure, route-to-route extrapolations were made. These extrapolations will introduce some uncertainty into the risk and hazard estimates. Further, the use of oral toxicity values to assess the dermal pathway introduces additional uncertainty into the results; risks may be overestimated or underestimated using this approach. Risks may be underestimated for exposure to metals for which a RfD is unavailable for one or more exposure routes. Using this extrapolation approach, however, a SF was available to assess the oral, dermal, and inhalation risks for most of the carcinogenic COPCs. Similarly, an RfD was available to assess the non-cancer health hazards for most COPCs. Overall, the contribution of the unavailability of RfDs or SFs is not expected to be significant.

6.6 Risk Characterization

Standard EPA methodologies were used for the risk characterization step. Using these methods, the risks from exposure to multiple carcinogens were added to estimate the total excess cancer risk associated with exposures at a site. The underlying assumption with this approach is that the risks from carcinogens with different target organs are additive. This assumption contributes to the uncertainty in the risk assessment and may result in underestimated or overestimated risks, depending on whether there are synergistic or antagonistic interactions between the site COPCs. Information on such interactions, however, is generally not available. Therefore possible interactions were not evaluated in this HHRA.

Finally, the risk assessment process as a whole is composed of a series of four steps, (data evaluation and selection of COPCs, exposure assessment, toxicity assessment, and risk characterization), each with inherent uncertainties, so results of the risk characterization step represent a compilation of all uncertainties linked to that process.

7.0 SOIL GAS ANALYSES

To supplement and update the risk estimates discussed in Sections 5.0, soil gas samples were collected within MCS Lots 9 and 10 around the perimeter of the newly constructed homes on the lots. The additional data was collected because the calculated excess lifetime cancer risks under a residential exposure scenario was greater than the regulatory target level of 1E-06. Furthermore, risks had been calculated using available data dating as far back as 1991 for soil and 1994 to 1998 for groundwater. Current data were needed to more appropriately address risks to residents of the homes at MCS. The soil gas sampling Work Plan and analytical results are presented in Attachment D.

7.1 Soil Gas Sampling Work Plan

A Work Plan (ICES, 2003c) for conducting soil gas sampling, dated February 20, 2003, was submitted to ACEH and approved for implementation. The Work Plan, including Figure 1A which shows proposed soil boring locations, is included in Attachment D-1.

The purpose of the soil gas sampling was to assess the potential presence of VOCs and total petroleum hydrocarbons around the perimeters of the foundations of homes constructed at Lots 9 and 10 at MCS. The Work Plan also specified that if VOC and/or TPH concentrations were detected from the soil gas samples collected along the southern perimeter of the foundation of Lot 10, soil gas samples would be collected along the perimeter of the foundation of Lot 11 (shown on Figure 1A in Attachment D-1).

Soil gas samples would be collected from 13 soil boring locations at a depth of approximately 3 to 5 feet bgs. Additionally, soil gas samples would be collected at the capillary fringe of the vadose zone (if possible), assuming that groundwater is at a depth of approximately 8 feet bgs.

7.2 Soil Gas Sampling Results

On February 26, 2003, 13 soil borings were installed (SV-1 through SV-13) and soil gas samples were analyzed by Transglobal Environmental Geochemistry (TEG) of Sacramento, California. Soil boring locations are shown on Figure 1A (ICES, 2003c). Soil gas samples were collected from the borings at the selected depths by driving a soil gas probe into the ground using an electric rotary hammer. Once inserted to the desired depth, the probe was retracted slightly and a soil gas sample was collected by drawing a sample through 1/8-inch nylaflow tubing using a small calibrated syringe connected via an on-off valve. The first five volumes of gas were discarded to flush the sample tubing; the next 20 cc of soil gas was then drawn into the syringe, plugged, and immediately transferred to the mobile laboratory for analysis.

Samples were analyzed using a gas chromatograph equipped with capillary columns and a combination of mass spectroscopy (MS) and electrolytic conductivity detector [ELCD (Hall)], photoionization detector (PID), and flame ionization detector (FID), as needed. The soil gas samples were analyzed for VOCs using EPA Method 8260 and TPH by Method 8015M.

Soil samples were collected at a depth of approximately 4 feet bgs. At soil borings SV-9 and SV-12, soil gas samples were collected at 3 feet bgs and 6 feet bgs, respectively. At soil boring SV-4, soil gas samples were collected at 1.5 feet bgs. Collection of soil gas at 4 feet bgs had been attempted at SV-4, however, a suitable soil gas sample could not be retrieved due to highly compacted soil at this depth, resulting in poor gas recovery.

Analytical reports of soil gas samples are presented in Attachment D-2. Results of soil gas samples indicated that VOCs and TPH were not detected in any of the soil gas borings installed at MCS Lots 9 and 10. Because soil gas samples at the south property boundary of Lot 10 were not detected, no soil gas samples from Lot 11 were collected, in accordance with the Work Plan (ICES, 2003c). Detection limits for chemicals analyzed were at or below shallow soil gas screening levels for protection of indoor residential air quality (RWQCB, 2002).

At the request of Roger Brewer of the San Francisco Bay Region, Regional Water Quality Control Board (RWQCB) [Telephone conversation between E. Shiroma of SOMA and R. Brewer of the RWQCB on February 20, 2003], one soil sample was collected for analysis of geotechnical parameters. This soil sample was collected in the vicinity of soil boring SV-8 at the eastern boundary between lots 9 and 10 as shown on Sheet 1 in Attachment A (Bellecci & Associates, Inc., 2003). Geotechnical analyses included: soil moisture, soil density, soil porosity, particle size analysis, organic carbon fraction, and gas permeability. Soil analyses were performed by Ninyo & Moore of Oakland, California. Analytical results are presented in Attachment D-3.

8.0 SUMMARY AND CONCLUSIONS

This HHRA was developed to evaluate potential exposure from chemical-affected soil and groundwater based on potential future land use and current subsurface conditions at MCS and the Park Parcel. The two portions of the Site (shown in Attachment A, Sheet 1 [Bellecci & Associates, Inc., 2003]) were evaluated separately for risk.

COPCs were selected based on comparisons of maximum detected concentrations and 95 UCL concentrations with RBSLs and background concentrations. Exposure was evaluated for a resident receptor and construction worker at MCS; and for a construction worker, landscape maintenance worker receptor, and a park visitor receptor at the Park Parcel. The residential receptor was evaluated by conservatively assuming exposure to exposed (uncovered) soil. Soil and groundwater EPCs were developed from available current data. For VOCs, exposure point concentrations in air were developed using transport modeling to estimate indoor and outdoor air concentrations from soil and groundwater EPCs. For metals and other non-VOCs, dust exposure point concentrations in air were developed based upon an assumption of fugitive dust emissions from soil. The risk characterization included both estimates of theoretical excess cancer risk and risk of adverse non-cancer health effects for soil and groundwater.

8.1 Resident Receptor (MCS)

Estimates of excess lifetime cancer risk for the MCS adult and child residential receptors were greater than the target risk of 1E-06 while non-cancer HIs were less than the regulatory target of 1. Soil gas samples collected on February 26, 2003 indicated that VOCs and TPH were not detected. Based on the absence of detectable VOC and TPH concentrations and blood lead values below the target level of 10 µg/dL adverse cancer and non-cancer health effects to the residential receptors at MCS are not anticipated.

8.2 Construction Worker Receptor (MCS and Park Parcel)

MCS

Input exposure parameters used in risk estimates for the MCS residential receptor are more conservative than those used for the construction worker. Therefore, based on the absence of detectable VOC and TPH concentrations in soil gas samples collected on February 26, 2003, adverse cancer and non-cancer health effects to the MCS construction worker are not anticipated. In addition, the estimated blood lead values were below the target blood lead value of 10 µg/dL for adverse health effects.

Park Parcel

Adverse cancer and non-cancer risks to the construction worker at the Park parcel are not anticipated based on estimated cancer risks less than the regulatory target of 1E-06 and non-cancer HIs below the regulatory target HI of 1 using historical soil and groundwater data. In addition, the estimated blood lead values were below the target blood lead value of 10 µg/dL for adverse health effects.

8.3 Landscape Maintenance Worker Receptor (Park Parcel)

For the landscape maintenance worker receptor, the soil excess cancer risks were 2E-06 and 7E-07, based on maximum and 95 UCL EPCs, respectively. The excess cancer risk, based on the maximum EPC was greater than the regulatory criteria of 1E-06 for risk evaluation. Arsenic was the risk driver via the incidental ingestion exposure pathway. It should be noted, however, that arsenic was detected at 15 mg/kg, slightly above the background concentration of 12 mg/kg in only one sample collected at a depth of 1.5 feet bgs at sampling location P-2 in the Park Parcel (shown in Attachment A , Sheet 1 [Bellecci & Associates, Inc., 2003]). The presence of arsenic in this area appears to be isolated since arsenic concentrations from other samples collected at the Park Parcel are within natural background concentrations. Cancer risk was not evaluated in groundwater because no carcinogens were identified in groundwater. The soil and groundwater non-cancer HIs were less than the regulatory HI target of 1.

The estimated blood lead values for the landscape maintenance worker receptor at the 99th percentile ranged were 4.0 and 2.8 µg/dL, based on maximum and 95 UCL EPCs. These blood lead values are below the target blood lead value of 10 µg/dL for adverse health effects.

8.4 Park Visitor Receptor (Park Parcel)

For the park visitor receptor, the soil excess cancer risks were less than the regulatory criteria of 1E-06 for risk evaluation. Cancer risk was not evaluated in groundwater because no carcinogens were identified in groundwater. The soil and groundwater non-cancer HIs were less than the regulatory target of 1.

The estimated blood lead value for the park visitor was below the target blood lead value of 10 µg/dL for adverse health effects.

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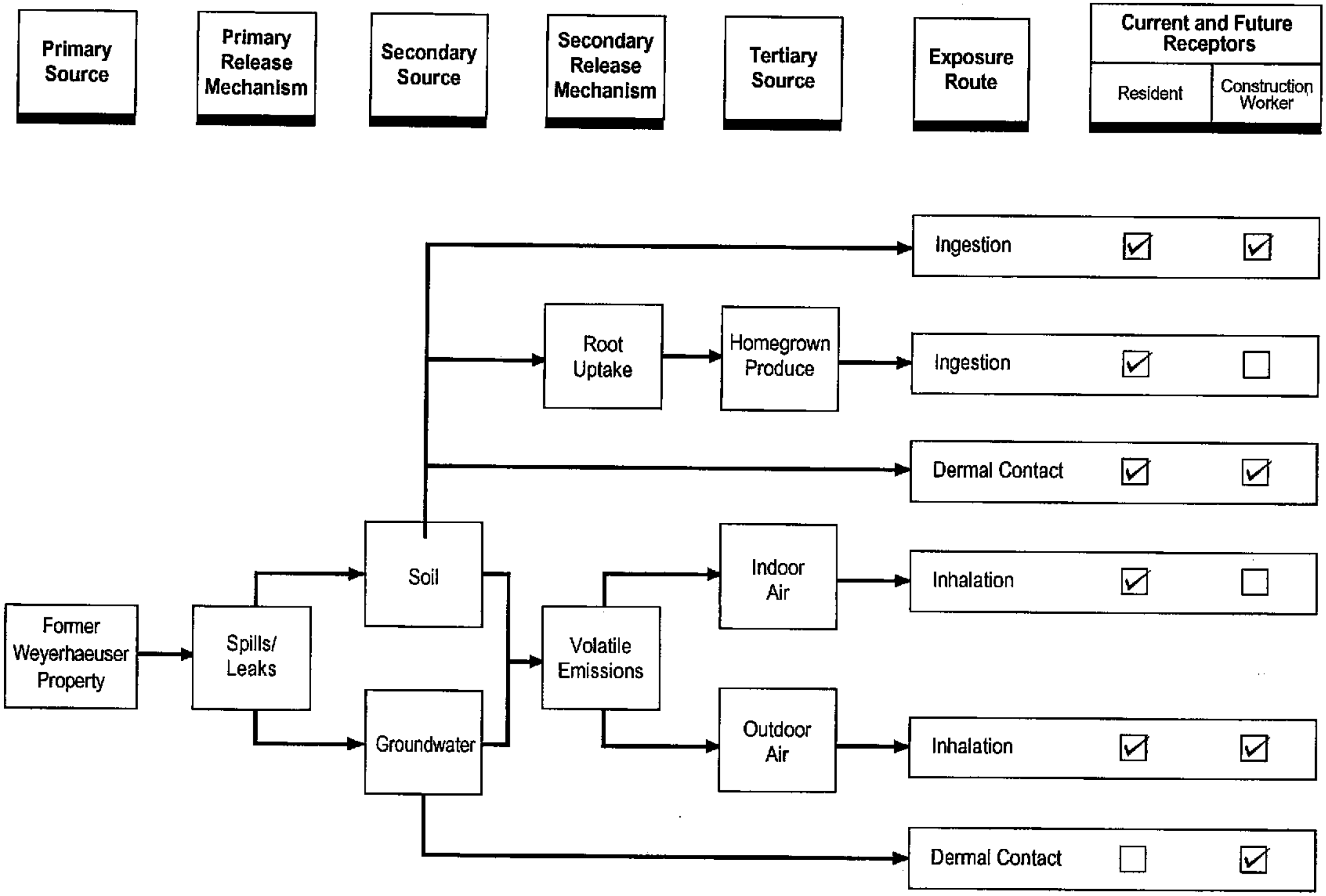
Figures



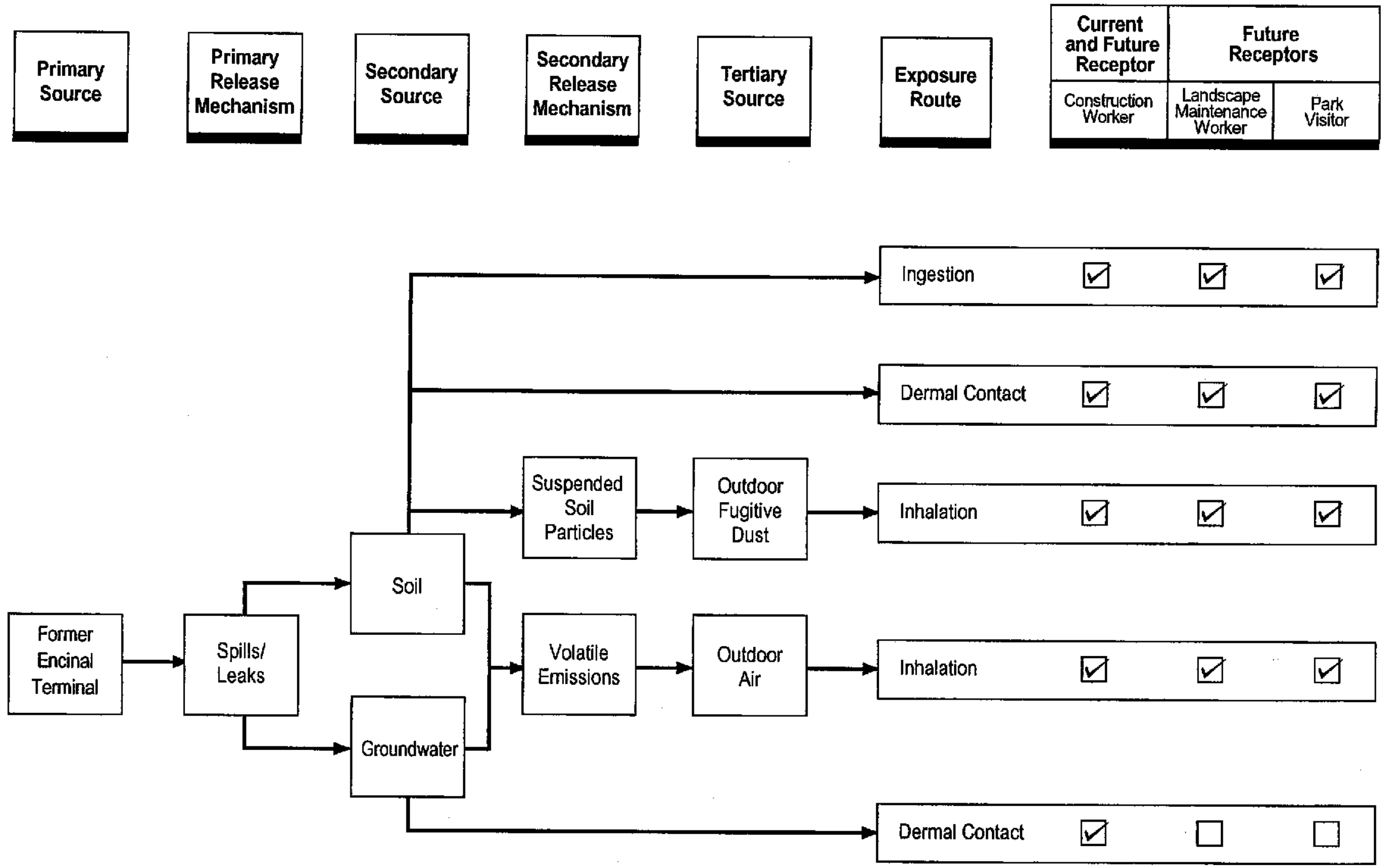
SOMA CORPORATION

RISK ASSESSMENT CONCEPTUAL SITE MODEL

Marina Cove Subdivision

1801 Hibbard Street, Alameda, California

Project No. 02-2325	March 2003	Figure 1



SOMA CORPORATION

RISK ASSESSMENT CONCEPTUAL SITE MODEL
Park Parcel
1521 Buena Vista Avenue, Alameda, California

Project No. 02-2325	March 2003	Figure 2

Tables

TABLE 1
COMPARISON OF SITE CONCENTRATIONS WITH SCREENING CRITERIA
MARINA COVE SUBDIVISION
ALAMEDA, CALIFORNIA

	Soil				Groundwater		
Chemical	**Maximum Concentration[a] (mg/kg)**	**95UCL Concentration[a] (mg/kg)**	**Residential RBSL[b] (mg/kg)**	**Background[c] (mg/kg)**	**Maximum Concentration[a] (µg/L)**	**95UCL Concentration[a] (µg/L)**	**RBSL[b] (µg/L)**
Metals							
Antimony	ND	ND	6.3	5.5	ND	ND	30
Arsenic	6.7	5.0	0.39	12	18000	7127	36
Barium	120	75.2	750	323.6	**170000**	**131989**	3.9
Beryllium	ND	ND	4.0	1.0	ND	ND	5.1
Cadmium	ND	ND	1.7	2.7	ND	ND	1.1
Chromium	33	24.3	13	99.6	160000	59511	180
Cobalt	10	6.9	40	22.2	ND	ND	3
Copper	150	51.5	225	69.4	ND	ND	3.1
Lead	130	47.8	200	16.1	**130000**	**35605**	3.2
Mercury	0.22	0.18	4.7	0.4	ND	ND	0.012
Molybdenum	1.5	1.1	40	7.4	ND	ND	240
Nickel	37	23.0	150	119.8	**200000**	**70070**	8.2
Selenium	ND	ND	10	5.6	ND	ND	5
Silver	ND	ND	20	1.8	ND	ND	0.12
Thallium	ND	ND	1.0	27.1	ND	ND	40
Vanadium	69	35.1	110	74.3	ND	ND	19
Zinc	130	60.6	600	106	**240000**	**98934**	23.

TABLE 1
COMPARISON OF SITE CONCENTRATIONS WITH SCREENING CRITERIA
MARINA COVE SUBDIVISION
ALAMEDA, CALIFORNIA

Chemical	**Soil**				**Groundwater**		
	Maximum Concentration[a] (mg/kg)	**95UCL Concentration[a] (mg/kg)**	**Residential RBSL[b] (mg/kg)**	**Background[c] (mg/kg)**	**Maximum Concentration[a] (µg/L)**	**95UCL Concentration[a] (µg/L)**	**RBSL[b] (µg/L)**
Petroleum Constituents							
TPH-gasoline	**550**	33.7	400	NC	**42000**	**3235**	500
TPH-diesel	58	5.2	500	NC	**6100**	505	640
TPH-motor oil	320	78.4	500	NC	**1800**	**1060**	640
Benzene[d]	**0.56**	0.05	0.18	NC	**9900**	**374**	46
Toluene[d]	1	0.06	8.4	NC	**2900**	96	130
Ethylbenzene[d]	1.5	0.09	24	NC	**1400**	57	290
Xylenes[d]	*8.5*	0.70	1.0	NC	**3500**	**150**	13
Methyl tert-butyl ether	ND	ND	1.0	NC	360	69	1800
Volatile and Semivolatile Organic Compounds							
Benzene[d]	0.017	0.017	0.18	NC	**9900**	*730*	46
Benzoic acid	ND	ND	NC	NC			NC
Carbon Disulfide	NA	NA	NC	NC	120	9	NC
Chloroethane	NA	NA	0.85	NC	1.9	6	12
1,1-Dichloroethane[e]	NA	NA	2.1	NC	**130**	20	47
1,2-Dichloroethane[e]	ND	ND	0.46	NC	33	6	910
1,1-Dichloroethylene[e]	NA	NA	0.028	NC	1.1	5	25
cis-1,2-Dichloroethylene[e]	NA	NA	8.6	NC	150	46	590
trans-1,2-Dichloroethylene[e]	NA	NA	13	NC	18	6	590
Ethylbenzene[d]	0.099	0.038	24	NC	*1600*	126	290
Ethylene dibromide	ND	ND	NC	NC	ND	ND	NC
Methylnaphthalene	**10**	**2.1**	0.25	NC	**160**	**43**	2.1

TABLE 1
COMPARISON OF SITE CONCENTRATIONS WITH SCREENING CRITERIA
MARINA COVE SUBDIVISION
ALAMEDA, CALIFORNIA

Chemical	Soil				Groundwater		
	Maximum Concentration[a] (mg/kg)	95UCL Concentration[a] (mg/kg)	Residential RBSL[b] (mg/kg)	Background[c] (mg/kg)	Maximum Concentration[a] (µg/L)	95UCL Concentration[a] (µg/L)	RBSL[b] (µg/L)
Naphthalene[e]	**35**	**5.6**	4.9	NC	**430**	**115**	24
Tetrachloroethylene[e]	NA	NA	0.95	NC	4.3	5	120
Trichloroethylene[e]	NA	NA	1.7	NC	2.9	5	360
1,1,2-Trichloroethane[e]	NA	NA	0.81	NC	60	6	8200
Toluene[d]	0.011	0.02	8.4	NC	***3000***	**169**	130
Vinyl chloride[e]	NA	NA	0.011	NC	81	8	120
Xylenes[d]	**1.2**	0.18	1.0	NC	***4100***	**414**	13

Notes:

mg/kg	Milligram per kilogram	ND	Not detected
mg/L	Milligram per liter	RBSL	Risk-based screening level
NA	Chemical not analyzed in this medium	95UCL	95th percentile upper confidence limit of the arithmetic mean
NC	No RBSL or background criterion available for this chemical		

[a] **Bolded** cells represent maximum or 95UCL concentrations of detected chemicals that exceeded RBSLs and background concentrations (if available). Chemicals with maximum or 95UCL concentrations exceeding (1) soil or groundwater RBSLs and (2) background concentrations were further evaluated quantitatively in the baseline risk assessment. Exceptions included TPH-gasoline, TPH-diesel, TPH-motor oil, and methylnaphthalene, which were further evaluated qualitatively due to lack of toxicity data.

[b] Soil RBSLs for residential land use and groundwater RBSLs were obtained from Table B in *Application of Risk-based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater* (Regional Water Quality Control Board, 2001). These RBSLs apply to surface soil (<3 meters [9.8 feet] below ground surface) and groundwater that is not a current or potential source of drinking water.

[c] Metals with maximum or 95UCL concentrations exceeding soil RBSLs were compared with background concentrations. All background metal concentrations were taken from a Lawrence Berkeley National Laboratory study (1995), except for arsenic, which was taken from a study of San Francisco Bay sediments by Scott, Jenkins, Sanders, and Associates (1994).

[d] Benzene, toluene, ethylbenzene, and xylenes (BTEX) were analyzed both as petroleum constituents and volatile organic compounds. As a result, the maximum and 95UCL concentrations of these compounds are presented in both analyte groups. If any of these chemicals exceeded the RBSL in both analyte groups, the higher maximum or 95UCL concentration (indicated in ***bold-italics***) from the two analyte groups was used in the baseline risk assessment.

[e] Based on soil boring logs, the RBSLs for fine-grained, silty, clayey loams were used for these chemicals.

TABLE 2
COMPARISON OF SITE CONCENTRATIONS WITH SCREENING CRITERIA
PARK PARCEL
ALAMEDA, CALIFORNIA

	Soil				Groundwater		
Chemical	Maximum Concentration[a] (mg/kg)	95UCL Concentration[a] (mg/kg)	Residential RBSL[b] (mg/kg)	Background[c] (mg/kg)	Maximum Concentration[a] (µg/L)	95UCL Concentration[a] (µg/L)	RBSL[b] (µg/L)
Metals							
Antimony	2.5	0.97	6.3	5.5	NA	NA	30
Arsenic	**15**	5.7	0.39	19.1 (12)	NA	NA	36
Barium	160	82.3	750	323.6	NA	NA	3.9
Beryllium	ND	ND	4.0	1.0	NA	NA	5.1
Cadmium	ND	ND	1.7	2.7	NA	NA	1.1
Chromium	64	45.9	13	99.6	NA	NA	180
Cobalt	15	9.1	40	22.2	NA	NA	3
Copper	68	31.8	225	69.4	NA	NA	3.1
Lead	**260**	76.6	200	16.1	NA	NA	3.2
Mercury	0.43	0.13	4.7	0.4	NA	NA	0.012
Molybdenum	ND	ND	40	7.4	NA	NA	240
Nickel	72	48.5	150	119.8	NA	NA	8.2
Selenium	ND	ND	10	5.6	NA	NA	5.0
Silver	1.2	0.71	20	1.8	NA	NA	0.12
Thallium	7	5.3	1.0	27.1	NA	NA	40
Vanadium	54	32.3	110	74.3	NA	NA	19
Zinc	220	117.1	600	106	NA	NA	23
Petroleum Constituents							
TPH-gasoline	4	1.38	400	NC	**970**	**617**	500
TPH-diesel	**1100**	128.9	500	NC	**26000**	**13592**	640
TPH-motor oil	320	78.2	500	NC	ND	ND	640
Benzene[d]	0.018	0.01	0.18	NC	ND	ND	46
Toluene[d]	0.15	0.02	8.4	NC	3.3	2	130
Ethylbenzene[d]	0.15	0.02	24	NC	3.7	1	290
Xylenes[d]	0.96	0.11	1.0	NC	**26**	8.7	13
Methyl tert-butyl ether	ND	ND	1.0	NC	ND	ND	1800
Volatile and Semivolatile Organic Compounds							
Acetone	0.5	0.16	0.51	NC	21	14	1.5
Benzene[d]	ND	ND	0.18	NC	NA	NA	46

TABLE 2
COMPARISON OF SITE CONCENTRATIONS WITH SCREENING CRITERIA
PARK PARCEL
ALAMEDA, CALIFORNIA

Chemical	Soil				Groundwater		
	Maximum Concentration[a] (mg/kg)	95UCL Concentration[a] (mg/kg)	Residential RBSL[b] (mg/kg)	Background[c] (mg/kg)	Maximum Concentration[a] (µg/L)	95UCL Concentration[a] (µg/L)	RBSL[b] (µg/L)
2-Butanone	0.22	0.11	13	NC	2.4	3.8	14
Carbon Disulfide	0.02	0.02	NC	NC	3	2.5	NC
Chloroform	NA	NA	0.079	NC	8.9	8.2	0.028
1,1-Dichloroethane[e]	NA	NA	2.1	NC	1.3	0.9	47
1,2-Dichloroethane[e]	NA	NA	0.46	NC	3.6	2.3	910
Ethylbenzene[d]	ND	ND	24	NC	NA	NA	290
Methyl butyl ketone	0.016	0.09	NC	NC	NA	NA	NC
Methyl-tert-butyl-ether	NA	NA	1.0	NC	6.3	5.3	1800
Toluene[d]	ND	ND	8.4	NC	NA	NA	130
Xylenes[d]	ND	ND	1.0	NC	NA	NA	13

Notes:

mg/kg Milligram per kilogram
µg/L Microgram per liter
NA Chemical not analyzed in this medium
NC No RBSL or background criterion available for this chemical
ND Not detected
RBSL Risk-based screening level
95UCL 95th percentile upper confidence limit of the arithmetic mean

a **Bolded** cells represent maximum or 95UCL concentrations of detected chemicals that exceeded RBSLs and background concentrations (if available). Chemicals with maximum or 95UCL concentrations exceeding (1) soil or groundwater RBSLs and (2) background concentrations were further evaluated quantitatively in the baseline risk assessment. Exceptions included TPH-gasoline, TPH-diesel, and TPH-motor oil, which were further evaluated qualitatively due to lack of toxicity data.

b Soil RBSLs for residential land use were obtained from Table B in *Application of Risk-based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater* (Regional Water Quality Control Board, 2001). These RBSLs apply to surface soil (<3 meters [9.8 feet] below ground surface) and groundwater that is not a current or potential source of drinking water.

c Metals with maximum or 95UCL concentrations exceeding soil RBSLs were compared with background concentrations. All background metal concentrations were taken from a Lawrence Berkeley National Laboratory study (1995). In the case of arsenic, the lower value in parentheses was taken from a study of San Francisco Bay sediments by Scott, Jenkins, Sanders, and Associates (1994), which was conducted closer to the site.

d Benzene, toluene, ethylbenzene, and xylenes (BTEX) were analyzed both as petroleum constituents and volatile organic compounds. As a result, the maximum and 95UCL concentrations of these compounds are presented in both analyte groups.

e Based on soil boring logs, the RBSLs for fine-grained, silty, clayey loams were used for these chemicals.

TABLE 3
CHEMICAL-SPECIFIC RISK AND HAZARD SUMMARY BASED ON MAXIMUM AND 95UCL CONCENTRATIONS
MARINA COVE SUBDIVISION
ALAMEDA, CALIFORNIA

Based on maximum concentrations:

Soil Chemicals	Adult Resident Excess Cancer Risk	Child Resident Excess Cancer Risk	Total Resident Excess Cancer Risk	Construction Worker Excess Cancer Risk	Adult Resident Noncancer Hazard	Child Resident Noncancer Hazard	Construction Worker Noncancer Hazard
Volatile and Semivolatile Organic Compounds							
Benzene	2.99E-06	1.80E-06	4.79E-06	5.13E-08	0.05	0.12	0.02
Naphthalene	NC	NC	NC	NC	0.05	0.13	0.19
Xylenes	NC	NC	NC	NC	0.001	0.003	0.002
Soil Total	**3E-06**	**2E-06**	**5E-06**	**5E-08**	**0.1**	**0.3**	**0.2**

Groundwater Chemicals	Adult Resident Excess Cancer Risk	Child Resident Excess Cancer Risk	Total Resident Excess Cancer Risk	Construction Worker Excess Cancer Risk	Adult Resident Noncancer Hazard	Child Resident Noncancer Hazard	Construction Worker Noncancer Hazard
Metals							
Barium	NC	NC	NC	NC	NC	NC	0.05
Lead	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	0.03
Zinc	NC	NC	NC	NC	NC	NC	0.007
Volatile and Semivolatile Organic Compounds							
Benzene	3.91E-05	2.28E-05	6.19E-05	5.76E-06	0.7	1.6	1.6
1,1-Dichloroethane	4.34E-09	2.53E-09	6.87E-09	1.46E-09	0.00002	0.00004	0.0002
Ethylbenzene	NC	NC	NC	NC	0.00005	0.0001	0.02
Naphthalene	NC	NC	NC	NC	0.002	0.004	0.02
Toluene	NC	NC	NC	NC	0.0002	0.0004	0.01
Xylenes	NC	NC	NC	NC	0.0002	0.0005	0.003
Groundwater Total	**4E-05**	**2E-05**	**6E-05**	**6E-06**	**0.7**	**2**	**2**

Soil & Groundwater Total	**4E-05**	**2E-05**	**7E-05**	**6E-06**	**0.8**	**2**	**2**

TABLE 3
CHEMICAL-SPECIFIC RISK AND HAZARD SUMMARY BASED ON MAXIMUM AND 95UCL CONCENTRATIONS
MARINA COVE SUBDIVISION
ALAMEDA, CALIFORNIA

Based on 95UCL concentrations:

Soil Chemicals	Adult Resident Excess Cancer Risk	Child Resident Excess Cancer Risk	Total Resident Excess Cancer Risk	Construction Worker Excess Cancer Risk	Adult Resident Noncancer Hazard	Child Resident Noncancer Hazard	Construction Worker Noncancer Hazard
Volatile and Semivolatile Organic Compounds							
Benzene	2.96E-06	1.73E-06	4.69E-06	4.87E-09	0.05	0.12	0.002
Naphthalene	NC	NC	NC	NC	0.04	0.10	0.03
Xylenes	NC	NC	NC	NC	0.001	0.003	0.0002
Soil Total	**3E-06**	**2E-06**	**5E-06**	**5E-09**	**0.1**	**0.2**	**0.03**

Groundwater Chemicals	Adult Resident Excess Cancer Risk	Child Resident Excess Cancer Risk	Total Resident Excess Cancer Risk	Construction Worker Excess Cancer Risk	Adult Resident Noncancer Hazard	Child Resident Noncancer Hazard	Construction Worker Noncancer Hazard
Metals							
Barium	NC	NC	NC	NC	NC	NC	0.05
Lead	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	0.03
Zinc	NC	NC	NC	NC	NC	NC	0.007
Volatile and Semivolatile Organic Compounds							
Benzene	2.88E-06	1.68E-06	4.56E-06	4.68E-06	0.05	0.1	1.1
1,1-Dichloroethane	4.38E-09	2.56E-09	6.94E-09	1.46E-09	0.00002	0.00004	0.0002
Ethylbenzene	NC	NC	NC	NC	0.00005	0.0001	0.02
Naphthalene	NC	NC	NC	NC	0.002	0.004	0.02
Toluene	NC	NC	NC	NC	0.0002	0.0004	0.01
Xylenes	NC	NC	NC	NC	0.0002	0.0005	0.003
Groundwater Total	**3E-06**	**2E-06**	**5E-06**	**5E-06**	**0.05**	**0.1**	**1.2**

Soil & Groundwater Total	**6E-06**	**3E-06**	**9E-06**	**5E-06**	**0.1**	**0.3**	**1.3**

Note:
95UCL — 95th percentile upper confidence limit of the arithmetic mean
NC — Not a carcinogen
-- — No toxicity information available for this chemical (except for lead, which was evaluated separately using the Leadspread model (see Appendix F).

TABLE 4
CHEMICAL-SPECIFIC RISK AND HAZARD SUMMARY BASED ON MAXIMUM AND 95UCL CONCENTRATIONS
PARK PARCEL
ALAMEDA, CALIFORNIA

Based on maximum concentrations:

Chemicals	Construction Worker Excess Cancer Risk	Landscape Worker Excess Cancer Risk	Park Visitor Excess Cancer Risk	Construction Worker Noncancer Hazard	Landscape Worker Noncancer Hazard	Park Visitor Noncancer Hazard
Soil						
Arsenic	3.86E-07	1.95E-06	4.49E-07	0.06	0.01	0.003
Groundwater						
Xylenes	NC	NC	NC	0.0004	0.00000009	0.00000002
Total	**4E-07**	**2E-06**	**4E-07**	**0.06**	**0.01**	**0.003**

Based on 95UCL concentrations:

Chemicals	Construction Worker Excess Cancer Risk	Landscape Worker Excess Cancer Risk	Park Visitor Excess Cancer Risk	Construction Worker Noncancer Hazard	Landscape Worker Noncancer Hazard	Park Visitor Noncancer Hazard
Soil						
Arsenic	1.46E-07	7.36E-07	1.70E-07	0.02	0.005	0.001
Groundwater						
Xylenes	NC	NC	NC	0.0001	0.00000003	0.000000007
Total	**1E-07**	**7E-07**	**2E-07**	**0.02**	**0.005**	**0.001**

Note:
95UCL 95th percentile upper confidence limit of the arithmetic mean
NC Not a carcinogen

Appendix A
Soil and Groundwater Data Summary Tables: Marina Cove Subdivision

TABLE A-1
SOIL MATRIX SAMPLE ANALYTICAL RESULTS – METALS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
SOIL SAMPLING - Overexcavation of Former Three 1,000-Gallon Gasline UST Pit (Minter & Fahy, February 1991)[a]																			
2/28/91	SOIL #1	6	NA	[illegible]	NA	NA	0.064	[illegible]	NA	NA	[illegible]	NA	NA	[illegible]	NA	NA	NA	NA	24
2/28/91	SOIL #2	6	NA	[illegible]	NA	NA	<0.005	[illegible]	NA	NA	[illegible]	NA	NA	[illegible]	NA	NA	NA	NA	15
2/28/91	SOIL #3	5.6	NA	NA	NA	NA	0.081	[illegible]	NA	NA	49	NA	NA	38	NA	NA	NA	NA	20
2/28/91	SOIL #4	5.6	NA	NA	NA	NA	[illegible]	19	NA	NA	5.3	NA	NA	29	NA	NA	NA	NA	20
2/28/91	SOIL #5	5.0	NA	NA	NA	NA	0.0046	20	NA	NA	4.5	NA	NA	31	NA	NA	NA	NA	20
2/28/91	SOIL #6	5	NA	NA	NA	NA	<0.023	20	NA	NA	5.5	NA	NA	30	NA	NA	NA	NA	15
2/28/91	SOIL #7	4	NA	NA	NA	NA	<0.005	17	NA	NA	38	NA	NA	30	NA	NA	NA	NA	19
SOIL SAMPLING - Site Investigation (West & Associates, January 1994)																			
1/13/94	B-4@5.5'	5.5	NA	NA	NA	NA	<0.5	23	NA	NA	8	NA	NA	28	NA	NA	NA	NA	17
1/13/94	N. END WALL		NA	NA	NA	NA	<0.5	21	NA	NA	6	NA	NA	22	NA	NA	NA	NA	16
1/13/94	MW-8@7'	7	NA	NA	NA	NA	<0.5	21	NA	NA	6	NA	NA	27	NA	NA	NA	NA	60
1/13/94	MW-9@5'	5	NA	NA	NA	NA	<0.5	24	NA	NA	6	NA	NA	27	NA	NA	NA	NA	25
1/13/94	MW-9@9'	9	NA	NA	NA	NA	<0.5	24	NA	NA	4	NA	NA	16	NA	NA	NA	NA	21
1/13/94	MW-10@5'	5	NA	NA	NA	NA	<0.5	19	NA	NA	8	NA	NA	10	NA	NA	NA	NA	21
1/13/94	MW-10@9'	9	NA	NA	NA	NA	<0.5	26	NA	NA	6	NA	NA	28	NA	NA	NA	NA	30
SOIL SAMPLING - Limited Site Investigation (ICES, August 1998)[a]																			
8/31/98	S-1	1	NA	5.3	NA	NA	NA	32	NA	150	130	NA	NA	NA	NA	NA	NA	NA	NA
8/31/98	S-2	1	<2.0	4.5	65	<0.5	1.4	[illegible]	[illegible]	[illegible]	290	0.17	[illegible]	23	<2.0	<1.0	<1.0	27	320
8/31/98	S-3	1	<2.0	6.8	52	<0.5	[illegible]	32	[illegible]	430	200	[illegible]	[illegible]	26	<2.0	<1.0	<1.0	23	510
8/31/98	B-3-2	2	<2.0	<1.0	11	<0.5	<0.5	15	1.6	3.4	6.1	<0.05	<1.0	10	<2.0	<1.0	<1.0	11	9.2
8/31/98	B-3-5	5	<2.0	1.6	12	<0.5	<0.5	33	7.8	25	8.7	<0.05	1.5	36	<2.0	<1.0	<1.0	29	40
SOIL SAMPLING - Chipman Site (ICES, September 1998)[b]																			
9/1/1998	S-4	1	2.5	7	85	<0.50	1.1	40	8.7	95	380	0.24	1.3	42	<2.0	<1.0	<1.0	28	240
9/1/1998	S-5	1	2.6	10	99	<0.50	1.1	37	10	100	450	0.19	1.7	50	<2.0	<1.0	<1.0	30	260
SOIL SAMPLING - Soil Remedial Activities: Railroad Ballast (ICES, April 2001)																			
4/13/01	SS-1	3	<2.5	6.7	120	<0.5	<0.5	22	10	29	25	0.11	<2.0	37	<2.5	<1.0	<1.8	36	81
4/13/01	SS-2	3	<2.5	2.9	98	<0.5	<0.5	11	7.2	27	60	0.22	<2.0	10	<2.5	<1.0	<1.8	27	110
4/13/01	SS-3	3	<2.5	6.2	46	<0.5	<0.5	4.1	8.6	25	23	0.14	<2.0	3.6	<2.5	<1.0	<1.8	69	130
4/13/01	SS-4	3	<2.5	<2.5	75	<0.5	<0.5	22	3.6	12	83	0.16	<2.0	12	<2.5	<1.0	<1.8	21	51
4/13/01	SS-5	3	<2.5	2.7	58	<0.5	<0.5	25	7.3	49	98	0.11	<2.0	28	<2.5	<1.0	<1.8	22	79

TABLE A-1
SOIL MATRIX SAMPLE ANALYTICAL RESULTS – METALS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
SOIL SAMPLING - Soil Remedial Activities: Railroad Ballast (ICES, April 2001) (cont'd)																			
4/13/01	SS-6	3	<2.5	<2.5	71	<0.5	<0.5	21	2.8	12	29	0.095	<2.0	15	<2.5	<1.0	<1.8	18	30
4/13/01	SS-7	3	<2.5	<2.5	76	<0.5	<0.5	21	4.1	14	86	0.13	<2.0	12	<2.5	<1.0	<1.8	20	52
4/13/01	SS-8	3	<2.5	<2.5	39	<0.5	<0.5	22	2.1	13	11	0.061	<2.0	10	<2.5	<1.0	<1.8	17	22
4/13/01	SS-9	3	<2.5	<2.5	38	<0.5	<0.5	26	3.9	15	20	<0.06	<2.0	11	<2.5	<1.0	<1.8	23	25
		Minimum	All NDs	<1.0	11	All NDs	All NDs	4.1	1.6	3.4	4	<0.05	<1.0	3.6	All NDs	All NDs	All NDs	11	9.2
		Maximum[c]		6.7	120			33	10	150	130	0.22	1.5	37				69	130
		Average		3.54	58.55			21.69	5.36	31.20	32.83	0.14	1.00	18.87				26.64	45.51
		Standard Deviation		2.59	30.44			6.55	2.80	39.23	37.60	0.07	0.20	10.01				15.53	36.89
		Count		10	11			19	11	12	19	11	11	18				11	18
		Number of Detects		6	11			19	11	12	19	8	1	18				11	18
		t-value		1.833	1.812			1.734	1.812	1.796	1.734	1.812	1.812	1.740				1.812	1.740
		95% Normal UCL		5.04	75.18			24.30	6.89	51.54	47.79	0.18	1.11	22.97				35.12	60.64

Notes:

bgs	Below ground surface	ND	Not detected
ft	Feet	RBSL	Risk-based screening level
mg/kg	Milligram per kilogram	UCL	Upper confidence limit
NA	Sample was not analyzed for this chemical		

[a] Shaded cells represent data from soil borings that have been excavated. These results are included to present a complete historical data summary. However, they were not used in the statistical analysis nor the risk assessment.

[b] Data collected from the Chipman site in September 1998 are not on KB Homes property. These results are included at the request of Alameda County Environmental Health Department. However, they were not used in the statistical analysis nor the risk assessment.

[c] Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment.

TABL[illegible]
SOIL MATRIX ANALYTICAL RESULTS [illegible]ROLEUM CONSTITUENTS (mg/kg)
MARINA COVE [illegible]DIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	Methyl tert-butyl ether	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]	PNAs[a]
SOIL SAMPLING - UST Removal: One 10,000-Gallon Diesel UST; Three 1,000-Gallon Gasoline UST (Minter & Fahy, February 1991)[b]														
2/7/1991	DIESEL-[illegible]	6.0	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
2/7/1991	DIESEL-SW	[illegible]	<10	<10	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
2/7/1991	DIESEL-SE	6.0	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
2/7/1991	DIESEL-NW	6.6	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
2/7/1991	GAS-N	5.6	229	<1.0	NA	0.048	0.058	0.23	0.49	NA	NA	NA	NA	NA
2/7/1991	GAS-S	5.6	2,000	22	NA	15	9.1	16	27	NA	NA	NA	NA	NA
2/7/1991	GAS-E	5.6	770	<1.0	NA	1.6	2.4	1.6	11	NA	NA	NA	NA	NA
2/7/1991	GAS-W	5.6	3,000	<1.0	NA	21	27	27	43	NA	NA	NA	NA	NA
SOIL SAMPLING - Overexcavation of Former Three 1,000-Gallon Gasoline UST Pit (Minter & Fahy, February 1991)[b]														
2/28/1991	SOIL #1	5.6	750	<1.0	NA	3	4.4	5.3	17.8	NA	<1.0	29	NA	NA
2/28/1991	SOIL #2	5.6	44	<1.0	NA	0.038	0.006	0.12	0.17	NA	[illegible]	[illegible]	NA	NA
2/28/1991	SOIL #3	5.6	[illegible]	[illegible]	NA	3.5	[illegible]	8.6	14	NA	[illegible]	55	NA	NA
2/28/1991	SOIL #4	5.6	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	25	NA	[illegible]	50	NA	NA
2/28/1991	SOIL #5	5.6	650	<1.0	NA	1	0.99	2.7	[illegible]	NA	<1.0	<10	NA	NA
2/28/1991	SOIL #6	5.6	410	<1.0	NA	0.17	0.06	2.4	4.2	NA	17	75	NA	NA
2/28/1991	SOIL #7	4	43	<1.0	NA	0.51	2.5	2.2	3.6	NA	<1.0	<10	NA	NA
SOIL SAMPLING - Overexacavation of Former Three 1,000-Gallon Gasoline UST Pit (Minter & Fahy, April 1991)														
4/3/1991	SOIL-8	4.7	1.1	NA	NA	0.038	0.016	<0.005	0.005	NA	NA	NA	NA	NA
4/3/1991	SOIL-9	4.4	<1.0	NA	NA	<0.005	0.021	<0.005	<0.005	NA	NA	NA	NA	NA
4/3/1991	SOIL-10	4.4	1.2	NA	NA	0.1	0.019	0.021	0.026	NA	NA	NA	NA	NA
4/3/1991	SOIL-11	4.5	<1.0	NA	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
SOIL SAMPLING - Preliminary Site Investigation @ Former Underground Gasoline Tank Area (Soil Tech, December 1991)														
12/3/1991	STMW-1-3	3	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<10.0	NA	NA
12/3/1991	STMW-1-7	7	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<10.0	NA	NA
12/3/1991	STMW-2-3	3	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<10.0	NA	NA
12/3/1991	STMW-2-7	7	370	<1.0	NA	0.56	1	1.5	6.7	NA	NA	<10.0	NA	NA
12/4/1991	STMW-3-3	3	74	<1.0	NA	0.16	0.0063	0.24	0.79	NA	NA	<10.0	NA	NA
12/4/1991	STMW-3-7	7	550	<1.0	NA	0.44	1	1.3	8.5	NA	NA	1,000	NA	NA
SOIL SAMPLING - Additional Subsurface Investigation @ Former Underground Gasoline Tank Area (Soil Tech, April 1992)														
4/10/1992	STMW-4-5	5	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<50.0	NA	NA
4/10/1992	STMW-5-5	5	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<50.0	NA	NA
4/10/1992	STMW-6-5	5	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	<50.0	NA	NA
SOIL SAMPLING - Additional Subsurface Investigation @ Former Underground Diesel Tank Area (Soil Tech, December 1992/January 1993)														
12/22/92	STMW-7-3	3	NA	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
12/22/92	STMW-7-5	5	NA	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
SOIL SAMPLING - UST Removal: One 20,000-Gallon Diesel UST (West & Associates, January 1994) *Note: Samples analyzed by EPA 8260 Fuel Fingerprint.														
1/13/1994	Trench 1	?	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
1/13/1994	North Tank Pit	14	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
1/13/1994	Pit Middle	14	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
1/13/1994	South Tank Pit	14	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
1/13/1994	Dispenser	?	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
1/13/1994	Trench 2	?	<1.0	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA

TABL[illegible]
SOIL MATRIX ANALYTICAL RESULTS [illegible]ROLEUM CONSTITUENTS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	Methyl tert-butyl ether	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]	PNAs[a]
SOIL SAMPLING - Site Investigation (West & Associates, January 1994)														
1/13/1992	B-1@5'	5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-1@10'	10	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-2@5'	5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-2@10'	10	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-3@5'	5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-3@11.5'	11.5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	B-4@5.5'	5.5	<50.0	<50.0	NA	NA	NA	NA	NA	NA	NA	<50.0	50	NA
1/13/1992	N. END WALL	?	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	50	NA	NA
1/13/1992	MW-8@7'	7	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	3	NA
1/13/1992	MW-9@5'	5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-9@9'	9	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-10@5'	5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-10@9'	9	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-10b@7.5'	7.5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-10b@11.5'	11.5	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
1/13/1992	MW-11@6'	6	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	50	NA	NA
1/13/1992	MW-11@11'	11	<1.0	<1.0	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA
SOIL SAMPLING - Limited Site Investigation (ICES, August 1998)[b]														
8/31/1998	S-2	[illegible]	NA	[illegible]	2,800	NA	[illegible]	NA	NA	[illegible]	NA	NA	NA	NA
[illegible]	[illegible]	1	NA	[illegible]	640	NA	NA	[illegible]	NA	NA	NA	NA	NA	NA
8/31/1998	S-7	1	NA	<1.0	<50.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
8/31/1998	B-1-2	2	<1.0	7.3	86	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
8/31/1998	B-1-5	5	<1.0	25	180	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
8/31/1998	B-2-2	2	<1.0	58	310	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
8/31/1998	B-2-5	5	<1.0	5.2	39	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
8/31/1998	B-4-8	8	<1.0	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.02	NA	NA	NA	NA
8/31/1998	B-5-2	2	NA	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
8/31/1998	B-5-5	5	NA	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
SOIL SAMPLING - Chipman Site (ICES, September 1998)[c]														
9/1/1998	S-4	1	NA	<2.0	240	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/1/1998	S-5	1	NA	<10	350	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - Limited Site Investigation -Abandoned Pennzoil Pipeline (ICES, March 1999)														
3/12/1999	SB-1A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-1B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-2A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	0.021	<0.005	NA	NA	NA	NA
3/12/1999	SB-2B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-3A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-3B	4.5	2.2	<1.0	<10.0	<0.005	<0.005	<0.005	0.011	<0.005	NA	NA	NA	NA
3/12/1999	SB-4A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-4B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-5A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-5B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-6A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/1999	SB-6B	4.5	3.3	29	320	<0.005	<0.005	<0.005	0.014	<0.005	NA	NA	NA	NA

TAB[illegible]
SOIL MATRIX ANALYTICAL RESULTS [illegible]TROLEUM CONSTITUENTS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	Methyl tert-butyl ether	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]	PNAs[a]
SOIL SAMPLING - Additional Site Characterization (West & Associates, July 1999)														
7/16/1999	B9-8	8	11.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7/16/1999	B10-8	8	1.96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - Soil Remedial Activities: Railroad Ballast (ICES, April 2001)														
4/13/2001	SS-1	3	<1.0	5	29	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-2	3	<1.0	5.3	43	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-3	3	<1.0	3.1	60	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-4	3	<1.0	1.3	9	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-5	3	<1.0	4	25	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-6	3	<1.0	1.9	15	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-7	3	<1.0	4.1	57	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-8	3	<1.0	1.4	8	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
4/13/2001	SS-9	3	<1.0	2.2	21	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
Minimum			<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.005	All NDs				
Maximum[d]			550	58	320	**0.56**	1	1.5	**8.5**					
Average			16.64	3.25	49.31	0.03	0.02	0.04	0.33					
Standard Deviation			82.42	9.05	86.83	0.10	0.14	0.22	1.53					
Count			64	62	26	49	48	48	49					
Number of Detects			9	14	14	5	6	4	8					
t-value			1.658	1.658	1.708	1.671	1.671	1.671	1.671					
95% Normal UCL			33.72	5.15	78.39	0.05	0.06	0.09	0.70					

Notes:

bgs	Below ground surface	ND	Not detected
ft	Feet	PNAs	Polynuclear aromatics
mg/kg	Milligram per kilogram	RBSL	Risk-based screening level
NA	Sample was not analyzed for this chemical	TRPH	Total recoverable petroleum hydrocarbons
NC	No criterion	UCL	Upper confidence limit

a Analytical results for TPH-kerosene, oil & grease, TRPH, and PNAs are presented to complete the historical data summary. However, data for these chemicals were not used in statistical analysis nor the risk assessment.

b Shaded cells represent data from soil borings that have been excavated. These results are included to present a complete historical data summary. However, they were not used in the statistical analysis nor the risk assessment.

c Data collected from the Chipman site in September 1998 are not on KB Homes property. These results are included at the request of Alameda County Environmental Health Department. However, they were not used in the statistical analysis nor the risk assessment.

d Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment. One exception includes TPH-gasoline, which was further evaluated qualitatively due to lack of toxicity data.

TABLE [illegible]-3
SOIL MATRIX SAMPLE ANALYTICAL RESULTS -- VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Benzene	Benzoic Acid	1,2-DCA	Ethyl-benzene	Ethylene dibromide	Methyl-naphthalene	Naphthalene	Toluene	Xylenes	VOCs[a]	SVOCs[a]
SOIL SAMPLING - Overexcavation of Former Three 1,000-Gallon Gasoline UST Pit (Minter & Fahy, February 1991)[b]													
2/28/1991	SOIL #1	5.6	[illegible]	<2.5	ND*	[illegible]	NA	2.2	2.2	4.5	[illegible]	ND*	<0.5-2.5
2/28/1991	SOIL #2	5.6	0.045	[illegible]	ND*	[illegible]	NA	[illegible]	0.7	[illegible]	0.18	ND*	<0.5-2.5
2/28/1991	SOIL #3	5.6	3	[illegible]	ND*	[illegible]	NA	[illegible]	2.4	3.2	13	ND*	<0.5-2.5
2/28/1991	SOIL #4	5.6	4.4	[illegible]	ND*	16	NA	29	35	9.3	27	ND*	<0.5-2.5
2/28/1991	SOIL #5	5.6	0.8	<2.5	ND*	2.6	NA	6.5	7.6	0.96	4.3	ND*	<0.5-2.5
2/28/1991	SOIL #6	5.6	0.12	[illegible]	ND*	2	NA	1.27	30	0.043	4.2	ND*	<0.5-2.5
2/28/1991	SOIL #7	4	0.53	<2.5	ND*	2.3	NA	1.5	2	2.8	4.1	ND*	<0.5-2.5
SOIL SAMPLING - Site Investigation (West & Associates, January 1994)													
1/13/1994	B-1@5'	5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	0.011	<0.005	NA	NA
1/13/1994	B-1@10'	10	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	B-2@5'	5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	B-2@10'	10	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	0.009	<0.005	NA	NA
1/13/1994	B-3@5'	5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	B-3@11.5'	11.5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	B-4@5.5'	5.5	<0.2	NA	<0.3	<0.3	<0.3	10	35	<0.3	1.2	NA	<0.3-10.0
1/13/1994	N. End Wall		<0.005	NA	<0.005	<0.005	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-8@7'	7	<0.005	NA	<0.005	<0.005	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-9@5'	5	<0.005	NA	<0.005	<0.005	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-9@9'	9	0.017	NA	<0.005	0.099	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-10@5'	5	<0.005	NA	<0.005	<0.005	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-10@9'	9	<0.005	NA	<0.005	<0.005	<0.005	<0.5	<0.5	<0.005	<0.005	NA	<0.3-10.0
1/13/1994	MW-10B@7.5'	7.5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	MW-10B@11.5'	11.5	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	MW-11@6'	6	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
1/13/1994	MW-11@11'	11	<0.005	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA	NA
SOIL SAMPLING - Limited Site Investigation (ICES, August 1998) *Note: Sample depth taken from former building floor surface; ~3.5-4.0 above existing ground surface elevation.[b]													
8/31/1998	S-2	[illegible]	NA	[illegible]	NA	[illegible]	NA	<2.5	<2.5	NA	NA	NA	[illegible]
8/31/1998	[illegible]	1	NA	<2.5	NA	NA	NA	<0.5	<0.5	NA	NA	NA	<0.25-10.0
9/1/1998	S-6	1*	NA	<0.5	NA	NA	NA	<0.1	<0.1	NA	NA	NA	<0.05-2.0
8/31/1998	B-3-2	2	NA	<0.5	NA	NA	NA	<0.1	<0.1	NA	NA	NA	<0.05-2.0
8/31/1998	B-3-5	5	NA	<0.5	NA	NA	NA	<0.1	<0.1	NA	NA	NA	<0.05-2.0
SOIL SAMPLING - Chipman Site (ICES, September 1998)[c]													
9/1/1998	S-4	1	NA	<2.5	NA	NA	NA	<0.5	<0.5	NA	NA	NA	<0.5-10
9/1/1998	S-5	1	NA	<2.5	NA	NA	NA	<0.5	<0.5	NA	NA	NA	<0.5-10
SOIL SAMPLING - Additional Site Characterization (West & Associates, July 1999)													
7/16/1999	B9-8	8	0.005	NA	<0.005	0.071	NA	NA	NA	<0.005	0.009	<0.005-0.015	NA
7/16/1999	B10-8	8	<0.005	NA	<0.005	0.049	NA	NA	NA	<0.005	<0.005	<0.005-0.015	NA

TAB[illegible]-3

SOIL MATRIX SAMPLE ANALYTICAL RESULTS -- VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Benzene	Benzoic Acid	1,2-DCA	Ethyl-benzene	Ethylene dibromide	Methyl-naphthalene	Naphthalene	Toluene	Xylenes	VOCs[a]	SVOCs[a]
SOIL SAMPLING - Soil Remedial Activities: Railroad Ballast (ICES, April 2001)													
4/13/2001	SS-1	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-2	3	NA	<40.0	NA	NA	NA	<8.0	<8.0	NA	NA	NA	<8.0-40.0
4/13/2001	SS-3	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-4	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-5	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-6	3	NA	<1.6	NA	NA	NA	<0.33	<0.33	NA	NA	NA	<0.33-1.6
4/13/2001	SS-7	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-8	3	NA	<10.0	NA	NA	NA	<2.0	<2.0	NA	NA	NA	<2.0-10.0
4/13/2001	SS-9	3	NA	<5.0	NA	NA	NA	<1.0	<1.0	NA	NA	NA	<1.0-5.0
		Minimum	<0.005	All NDs	All NDs	<0.005	All NDs	<0.5	<0.33	<0.005	<0.005		
		Maximum[c]	0.02			0.10		**10**	**35**	0.01	**1.2**		
		Average	0.01			0.02		1.17	2.49	0.01	0.07		
		Standard Deviation	0.02			0.04		2.31	7.92	0.03	0.27		
		Count	19			19		19	19	19	19		
		Number of Detects	2			3		1	1	2	2		
		t-value	1.734			1.734		1.734	1.734	1.734	1.734		
		95% Normal UCL	0.02			0.04		2.10	5.64	0.02	0.18		

Notes:

bgs	Below ground surface	ND	Not detected
DCA	Dichloroethane	ND*	Not detected; detection limit unknown
ft	Feet	RBSL	Risk-based screening level
mg/kg	Milligram per kilogram	SVOC	Semivolatile organic compound
NA	Sample was not analyzed for this chemical	UCL	Upper confidence limit
NC	No criterion	VOC	Volatile organic compound

[a] Analytical results for VOCs and SVOCs are presented to complete the historical data summary. However, data for these chemicals were not used in statistical analysis nor the risk assessment.

[b] Shaded cells represent data from soil borings that have been excavated. These results are included to present a complete historical data summary. However, they were not used in the statistical analysis nor the risk assessment.

[c] Data collected from the Chipman site in September 1998 are not on KB Homes property. These results are included at the request of Alameda County Environmental Health Department. However, they were not used in the statistical analysis nor the risk assessment.

[d] Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment. One exception includes methylnaphthalene, which was further evaluated qualitatively due to lack of toxicity data.

TABLE A-4
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- METALS (µg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
2/28/91	WATER-1	8.3	NA	NA	NA	NA	<5	160	NA	NA	130	NA	NA	200	NA	NA	NA	NA	240
2/3/94	MW-1	5.82	<5	<5	170	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-2	5.67	<5	<5	90	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-3	6.31	<5	18	150	<50	<1	<50	<50	<50	6	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-4	6	<5	<5	110	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-5	7.11	<5	<5	140	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-6	7.93	<5	<5	90	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-7	3.06	<5	5	140	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-9	6.39	<5	<5	80	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-10	6.19	<5	<5	<50	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
2/3/94	MW-11	5.4	<5	<5	70	<50	<1	<50	<50	<50	<5	<0.2	<50	<50	<5	<5	<100	<50	<100
		Minimum	All NDs	<5	<50	All NDs	All NDs	<50	All NDs	All NDs	<5	All NDs	All NDs	<50	All NDs	All NDs	All NDs	All NDs	<100
		Maximum[a]		18	**170**			160			**130**			**200**					240
		Average		4.3	106.5			37.3			14.4			40.9					67.3
		Standard Deviation		4.88	43.97			40.70			38.35			52.76					57.29
		Count		10	10			11			11			11					11
		Number of Detects		2	9			1			2			1					1
		t-value		1.83	1.83			1.81			1.83			1.83					1.83
		95% Normal UCL		7.127	131.989			59.511			35.605			70.070					98.934

Notes:

bgs	Below ground surface
ft	Feet
µg/L	Microgram per liter
NA	Sample was not analyzed for this chemical
ND	Not detected
RBSL	Risk-based screening level
UCL	Upper confidence limit

[a] Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment.

TABLE A-5
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]
7/16/1999	B-10	12	4.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7/16/1999	B-9	12	0.392	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3/12/1999	GW-1	5.5	<0.05	<0.05	<0.5	<0.0005	<0.0005	<0.0005	<0.0010	<0.0005	NA	NA	NA
3/12/1999	GW-2	5.5	<0.05	<0.05	<0.5	<0.0005	<0.0005	<0.0005	<0.0010	<0.0005	NA	NA	NA
2/3/94	MW-1	5.82	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-1	5.61	0.05	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-1	5.35	0.093	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-1	4.88	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-1	5.05	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-1	5.58	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/3/94	MW-10	6.19	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/8/94	MW-10	6.07	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
12/7/94	MW-10	4.59	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-10	5.38	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-10	6.25	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-10	6.26	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-10	4.89	0.078	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	<0.005	NA	NA	NA
6/5/96	MW-10	5.52	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
9/4/96	MW-10	6.18	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.025	NA	NA	NA
11/21/96	MW-10	5.7	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/13/97	MW-10	5.2	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-10	5.96	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
9/5/97	MW-10	6.22	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
12/3/97	MW-10	5.47	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-10	4.73	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
5/15/98	MW-10	5.45	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-10	6.03	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/3/94	MW-11	5.4	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-11	5.37	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-11	4.91	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-11	4.11	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-11	6.03	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-11	5.42	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-11	4.39	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	<0.005	NA	NA	NA
6/5/96	MW-11	4.56	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
9/4/96	MW-11	5.21	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.025	NA	NA	NA
11/21/96	MW-11	4.99	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/13/97	MW-11	4.45	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-11	5.03	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
9/5/97	MW-11	5.26	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
12/3/97	MW-11	4.71	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-11	3.7	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA

TABLE A-5
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]
5/15/98	MW-11	4.29	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-11	4.92	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
12/7/94	MW-12	8.32	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-12	7.77	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-12	6.01	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-12	8.9	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-12	6.7	<0.050	NA	NA	0.00086	0.00098	<0.0005	<0.001	<0.005	NA	NA	NA
6/5/96	MW-12	7.9	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
9/4/96	MW-12	8.85	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.025	NA	NA	NA
11/21/96	MW-12	8.1	0.024	NA	NA	0.00055	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/13/97	MW-12	7.63	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-12	8.52	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
9/5/97	MW-12	8.85	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
12/3/97	MW-12	7.88	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-12	6.49	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
5/15/98	MW-12	7.11	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-12	8.15	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/3/94	MW-2	5.67	0.2	<0.1	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-2	5.42	1.3	<0.300	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-2	4.7	3.4	NA	NA	1.1	0.086	0.028	0.19	NA	NA	NA	NA
3/7/95	MW-2	4.55	6.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-2	4.85	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-2	5.3	0.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/3/94	MW-3	6.31	5.4	<0.9	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-3	6.21	23	<2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-3	5.3	41	NA	NA	9.9	2.9	1.4	3.5	NA	NA	NA	NA
3/7/95	MW-3	5.65	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-3	4.85	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-3	5.38	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-3B	4.9	19	NA	NA	2.1	0.38	0.48	1.2	0.36	NA	NA	NA
6/5/96	MW-3B	5.66	11	NA	NA	1.3	0.25	0.37	0.86	NA	NA	NA	NA
9/4/96	MW-3B	6.44	6	NA	NA	0.84	0.098	0.14	0.41	<1.0	NA	NA	NA
11/21/96	MW-3B	5.86	5.5	NA	NA	0.44	0.031	0.05	0.14	NA	NA	NA	NA
2/13/97	MW-3B	5.56	12	NA	NA	1	0.21	0.12	0.69	NA	NA	NA	NA
6/6/97	MW-3B	6.16	2.03	NA	NA	0.293	0.014	0.023	0.033	<0.100	NA	NA	NA
9/5/97	MW-3B	6.44	2.14	NA	NA	0.0337	0.0316	0.0281	0.108	<0.100	NA	NA	NA
12/3/97	MW-3B	5.78	1.2	NA	NA	0.095	<0.005	<0.005	0.006	NA	NA	NA	NA
2/20/98	MW-3B	4.21	2.37	NA	NA	0.176	0.0109	0.0225	0.0209	NA	NA	NA	NA
5/15/98	MW-3B	5.12	3.16	NA	NA	0.17	<0.020	0.0654	0.0342	NA	NA	NA	NA
8/13/98	MW-3B	6.01	1.7	NA	NA	0.132	0.0095	0.0438	0.018	NA	NA	NA	NA
2/3/94	MW-4	6	1	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-4	5.77	0.46	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE A-5
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	TPH-kerosene*	Oil & Grease*	TRPH*
12/7/94	MW-4	4.8	2.4	NA	NA	0.2	0.0075	0.0075	0.028	NA	NA	NA	NA
3/7/95	MW-4	4.68	3.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-4	4.23	3.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-4	6.26	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-4B	5.03	0.52	NA	NA	0.003	0.0024	0.0016	0.001	0.0083	NA	NA	NA
6/5/96	MW-4B	6.09	0.35	NA	NA	<0.0005	<0.0005	0.0016	<0.0005	NA	NA	NA	NA
9/4/96	MW-4B	6.85	0.071	NA	NA	0.0033	<0.0005	0.0018	0.0007	<0.025	NA	NA	NA
11/21/96	MW-4B	6.22	0.17	NA	NA	0.0015	<0.0005	0.001	<0.0005	NA	NA	NA	NA
2/13/97	MW-4B	5.63	0.22	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-4B	6.54	0.177	NA	NA	0.0035	0.0043	0.001	0.0067	0.0112	NA	NA	NA
9/5/97	MW-4B	6.8	0.156	NA	NA	0.0021	<0.0005	<0.0005	0.0009	0.0112	NA	NA	NA
12/3/97	MW-4B	6.35	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-4B	4.26	0.0775	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
5/15/98	MW-4B	5.67	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-4B	6.44	0.065	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/3/94	MW-5	7.11	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-5	6.6	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-5	5.6	0.093	NA	NA	0.003	0.0009	0.0008	0.003	NA	NA	NA	NA
3/7/95	MW-5	5.4	0.079	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-5	5.32	0.051	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-5	6.88	0.067	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-5	4.64	0.12	NA	NA	0.007	<0.0005	<0.0005	<0.001	0.0069	NA	NA	NA
6/5/96	MW-5	5.76	0.1	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
9/4/96	MW-5	6.76	<0.020	NA	NA	0.0024	<0.0005	<0.0005	<0.0005	<0.025	NA	NA	NA
11/21/96	MW-5	6.22	0.062	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/13/97	MW-5	5.14	0.026	NA	NA	0.00058	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-5	6.45	<0.050	NA	NA	0.0007	<0.0005	<0.0005	0.0005	<0.005	NA	NA	NA
9/5/97	MW-5	6.71	<0.050	NA	NA	0.0012	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
12/3/97	MW-5	5.66	<0.050	NA	NA	0.0009	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-5	3.47	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
5/15/98	MW-5	5.02	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-5	6.1	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/3/94	MW-6	7.93	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-6	7.47	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-6	6.5	<0.050	NA	NA	0.0013	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-6	6.47	0.072	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-6	6.35	0.059	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-6	7.59	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-6	5.38	0.06	NA	NA	0.00084	<0.0005	<0.0005	<0.001	<0.005	NA	NA	NA
6/5/96	MW-6	6.59	0.045	NA	NA	0.0012	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
9/4/96	MW-6	7.49	0.04	NA	NA	0.0008	<0.0005	<0.0005	<0.0005	<0.025	NA	NA	NA
11/21/96	MW-6	7.03	<0.020	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA

TABLE A-5
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	TPH-kerosene*	Oil & Grease*	TRPH*
2/13/97	MW-6	6.05	0.025	NA	NA	0.00054	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
6/6/97	MW-6	7.18	<0.050	NA	NA	0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
9/5/97	MW-6	7.41	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	NA	NA	NA
12/3/97	MW-6	6.33	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/20/98	MW-6	4.29	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
5/15/98	MW-6	6.09	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/13/98	MW-6	6.99	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
2/3/94	MW-7	3.06	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-7	2.81	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-7	3.09	<0.050	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	NA	NA	NA	NA
3/7/95	MW-7	3.65	NA	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-7	3.5	NA	6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-7	3.51	NA	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-7	2.48	NA	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/5/96	MW-7	3.55	NA	1.1	<1.0	NA	NA	NA	NA	NA	NA	NA	NA
9/4/96	MW-7	3.13	NA	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA
11/21/96	MW-7	2.59	NA	2.2	<0.50	NA	NA	NA	NA	NA	NA	NA	NA
2/13/97	MW-7	2.6	NA	3.8	<0.50	NA	NA	NA	NA	NA	NA	NA	NA
6/6/97	MW-7	3.58	NA	0.318	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/5/97	MW-7	3.25	NA	0.412	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/3/97	MW-7	2.15	NA	0.382	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/20/98	MW-7	1.76	NA	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/15/98	MW-7	2.51	NA	1.29	NA	NA	NA	NA	NA	NA	NA	NA	NA
8/13/98	MW-7	2.93	NA	0.195	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/3/94	MW-9	6.39	1.9	<0.050	NA	NA	NA	NA	NA	NA	NA	<5.0	NA
6/8/94	MW-9	6.34	5.3	<0.300	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/7/94	MW-9	5.99	12	NA	NA	0.6	0.02	0.12	0.055	NA	NA	NA	NA
3/7/95	MW-9	5.31	9.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5/17/95	MW-9	4.85	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-9	5.67	5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12/23/91	STMW-1	6.77	<0.05	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0010	NA	NA	NA	NA
4/27/92	STMW-1	5.72	0.15	<0.05	NA	0.0015	0.0012	0.0018	0.0027	NA	NA	<0.0005	NA
1/8/93	STMW-1	5.27	0.14	<0.05	NA	0.0006	0.0012	0.0006	0.0022	NA	NA	0.8	NA
12/23/91	STMW-2	6.6	2.3	0.08	NA	0.72	0.066	0.0015	0.24	NA	NA	NA	NA
4/27/92	STMW-2	5.52	1.1	<0.05	NA	0.0094	0.0053	0.002	0.024	NA	NA	<0.0005	NA
1/8/93	STMW-2	5.05	0.07	<0.05	NA	<0.0005	<0.0005	0.0005	0.0014	NA	NA	0.9	NA
12/23/91	STMW-3	7.38	14	1.7	NA	3	0.54	0.37	1.2	NA	NA	NA	NA
4/27/92	STMW-3	6.2	9.4	2	NA	0.057	0.05	0.046	0.22	NA	NA	<0.0005	NA
1/8/93	STMW-3	5.4	15	<0.05	NA	0.038	0.04	0.064	0.14	NA	NA	19	NA
4/27/92	STMW-4	5.66	0.79	<0.05	NA	0.0077	0.0026	0.0023	0.011	NA	NA	<0.0005	NA
1/8/93	STMW-4	4.99	0.86	<0.05	NA	0.0015	0.0045	0.0096	0.017	NA	NA	1.4	NA
4/27/92	STMW-5	6.84	<0.05	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	<0.0005	NA

TABLE A-5
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]
1/8/93	STMW-5	5.6	<0.05	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	<0.5	NA
4/27/92	STMW-6	7.84	<0.05	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	<0.0005	NA
1/8/93	STMW-6	6.78	<0.05	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	<0.5	NA
1/8/93	STMW-7	2.12	NA	<0.05	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	NA	NA
8/31/1998	W-1	5.5	<0.05	1.2	1.8	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	NA	NA	5,480
2/28/91	WATER-1	8.3	22	0.19	NA	0.19	0.57	0.13	0.14	NA	<0.05	5.1	NA
4/3/91	WATER-2	4.8	13	NA	NA	0.58	0.13	0.029	0.4	NA	NA	NA	NA
		Minimum	<0.02	<0.05	<0.5	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			
		Maximum[b]	**42**	**6.1**	**1.8**	**9.9**	**2.9**	**1.4**	**3.5**	**0.36**			
		Average	2.388	0.342	0.550	0.211	0.050	0.033	0.089	0.036			
		Standard Deviation	6.486	0.692	0.620	1.022	0.289	0.150	0.385	0.107			
		Count	159	50	6	109	109	109	109	31			
		Number of Detects	33	2	0	11	2	3	2	0			
		t-value	1.645	1.671	2.015	1.658	1.658	1.658	1.658	1.697			
		95% Normal UCL	3.235	0.505	1.060	0.374	0.096	0.057	0.150	0.069			

Notes:

bgs	Below ground surface
ft	Feet
mg/L	Milligram per liter
NA	Sample was not analyzed for this chemical
NC	No criterion
ND	Not detected
RBSL	Risk-based screening level
TRPH	Total recoverable petroleum hydrocarbons
UCL	Upper confidence limit

a TPH-kerosene, oil & grease, and TRPH are presented to complete the historical data summary. However, data for these chemicals were not used in statistical analysis nor the risk assessment.

b Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment. Exceptions include TPH-gasoline, TPH-diesel, and TPH-motor oil, which were further evaluated qualitatively due to lack of toxicity data.

TABLE A-6
GROUNDWATER MATRIX ANALYTICAL RESULTS – VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Benzene	Carbon Disulfide	Chloroethane	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Ethyl-benzene	Ethylene dibromide	Methyl-naphthalene	Naphthalene	PCE	TCE	1,1,2-TCA	Toluene	Vinyl chloride	Xylenes	m+p-Xylene[a]	o-Xylene[a]	VOCs[a]	SVOCs[a]
7/16/99	B-10	12	0.0137	<0.0005	<0.0005	0.0061	<0.0005	<0.0005	NA	<0.0005	0.0223	NA	NA	NA	<0.0005	<0.0005	<0.0005	0.0038	<0.0005	NA	0.003	<0.0005	<0.0005-0.005	NA
7/16/99	B-9	12	0.0038	<0.0005	<0.0005	0.0347	0.0032	0.0006	NA	<0.0005	0.0012	NA	NA	NA	<0.0005	0.0022	0.0017	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/3/94	MW-1	5.82	0.0015	0.0034	<0.001	0.0025	<0.001	<0.001	<0.001	<0.001	<0.001	NA	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-1	5.61	<0.0005	NA	NA	NA	<0.0005	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-1	4.88	<0.005	*	*	*	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-1	5.05	0.00062	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-1	5.58	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/3/94	MW-10	6.19	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-10	6.07	<0.0005	NA	NA	NA	<0.0005	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-10	5.38	<0.005	*	*	*	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-10	6.25	<0.005	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-10	6.26	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/7/96	MW-10	4.89	<0.005	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-10	6.18	<0.001	NA	<0.001	<0.001	<0.001	<0.0004	NA	<0.001	<0.001	NA	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-10	5.2	<0.001	NA	<0.001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	NA	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-10	6.22	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/20/98	MW-10	4.73	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.015	NA
8/13/98	MW-10	6.03	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.012	NA
2/3/94	MW-11	5.4	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-11	5.37	<0.0005	NA	NA	NA	<0.0005	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-11	4.11	<0.005	*	*	*	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-11	6.03	<0.005	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-11	5.42	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/7/96	MW-11	4.39	<0.005	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-11	5.21	<0.001	NA	<0.001	<0.001	<0.001	<0.0004	NA	<0.001	<0.001	NA	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-11	4.45	<0.001	NA	<0.001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	NA	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-11	5.26	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/20/98	MW-11	3.7	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.015	NA
8/13/98	MW-11	4.92	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.007	NA
3/7/95	MW-12	7.77	<0.005	*	*	0.011	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-12	6.01	0.0017	NA	<0.005	0.0076	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-12	8.9	<0.005	<0.005	<0.010	0.0096	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/7/96	MW-12	6.7	<0.005	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-12	8.85	<0.001	NA	<0.001	0.0024	<0.001	<0.0004	NA	<0.001	<0.001	NA	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-12	7.63	<0.001	NA	<0.001	<0.001	0.0032	<0.001	NA	<0.001	<0.001	NA	NA	NA	0.0043	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-12	8.85	<0.0005	<0.0005	<0.0005	0.0022	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/20/98	MW-12	6.49	<0.0005	<0.0005	<0.0005	0.0014	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.020	NA
8/13/98	MW-12	8.15	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/3/94	MW-2	5.67	0.39	0.0092	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0071	NA	<0.005	0.019	<0.002	<0.002	<0.002	0.025	<0.002	0.05	NA	NA	<0.002-0.050	<0.005-0.200
6/8/94	MW-2	5.42	0.37	NA	NA	NA	<0.003	NA	NA	NA	0.1	<0.003	NA	NA	NA	NA	NA	0.044	NA	0.17	NA	NA	NA	NA
3/7/95	MW-2	4.55	0.14	*	*	*	*	*	*	*	0.052	*	*	0.0024	*	*	*	0.026	*	0.046	NA	NA	*	*
5/17/95	MW-2	4.85	2.3	NA	<0.005	<0.005	<0.005	<0.005	NA	<0.005	0.12	NA	NA	<0.010	<0.005	<0.005	<0.005	0.24	<0.005	0.31	NA	NA	<0.005-0.0069	NA
9/26/95	MW-2	5.3	0.14	<0.005	<0.010	<0.005	<0.005	<0.005	NA	<0.005	0.052	NA	NA	<0.010	<0.005	<0.005	<0.005	0.026	<0.010	0.046	NA	NA	<0.005-0.050	NA
2/3/94	MW-3	6.31	3.9	0.12	<0.020	0.13	<0.020	<0.020	0.095	<0.020	0.39	NA	0.045	0.17	<0.020	<0.020	<0.020	0.68	<0.020	0.84	NA	NA	<0.020-0.200	<0.005-0.200
6/8/94	MW-3	6.21	8.5	NA	NA	NA	<0.020	NA	NA	NA	1.6	<0.020	NA	NA	NA	NA	NA	1.7	NA	3.8	NA	NA	NA	NA
3/7/95	MW-3	5.65	5.3	*	*	0.11	*	*	0.15	*	0.94	*	*	0.12	*	*	*	1.2	0.081	2.2	NA	NA	*	*
5/17/95	MW-3	4.85	9.9	NA	<0.120	<0.120	<0.120	<0.120	NA	<0.120	1.6	NA	NA	0.092	<0.120	<0.120	<0.120	3	<0.120	4.1	NA	NA	<0.120-0.170	NA
9/26/95	MW-3	5.38	5.3	<0.050	<0.100	0.1	<0.050	<0.050	NA	<0.050	0.94	NA	NA	0.31	<0.050	<0.050	<0.050	1.2	<0.100	2.2	NA	NA	<0.050-1.0	NA
2/7/96	MW-3B	4.9	1.7	NA	<0.120	<0.120	<0.120	<0.120	NA	<0.120	0.37	NA	NA	0.13	<0.120	<0.120	<0.120	0.3	<0.120	NA	NA	NA	<0.120-0.170	NA
9/4/96	MW-3B	6.44	0.77	NA	<0.001	0.03	0.005	<0.0004	NA	<0.001	0.19	NA	NA	0.1	<0.001	<0.001	<0.001	0.14	<0.002	0.59	NA	NA	<0.001-0.002	<0.005-0.025
2/13/97	MW-3B	5.56	1.1	NA	<0.020	0.021	0.033	<0.020	NA	<0.020	0.17	NA	NA	0.26	<0.020	<0.020	0.06	0.29	<0.040	1.1	NA	NA	<0.020-0.040	NA
9/5/97	MW-3B	6.44	0.163	<0.005	<0.005	0.0214	<0.005	<0.005	NA	<0.005	0.0194	NA	NA	<0.010	<0.005	<0.005	<0.005	0.0244	<0.005	NA	0.0324	0.0346	<0.005-0.110	NA
2/20/98	MW-3B	4.21	0.147	<0.0005	<0.0005	0.0216	0.0061	<0.0005	NA	<0.0005	0.0325	NA	NA	NA	<0.0005	0.0029	<0.0005	0.009	0.0026	NA	0.0089	0.0112	<0.0005-0.015	NA
8/13/98	MW-3B	6.01	0.0993	<0.010	<0.010	0.0374	<0.010	<0.010	NA	<0.010	0.0519	NA	NA	<0.010	<0.010	<0.010	<0.010	<0.060	<0.010	NA	0.0139	0.011	<0.010-0.100	NA
2/3/94	MW-4	6	0.054	0.0047	0.0019	0.022	<0.001	<0.001	0.018	0.018	0.0014	NA	<0.005	<0.005	<0.001	0.0021	<0.001	0.0027	<0.001	0.0047	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-4	5.77	0.046	NA	NA	NA	0.0084	NA	NA	NA	0.0011	<0.0005	NA	NA	NA	NA	NA	0.0008	NA	0.0019	NA	NA	NA	NA
3/7/95	MW-4	4.68	0.09	*	*	0.011	*	*	0.015	*	0.0089	*	*	*	*	*	*	<0.005	*	0.0057	NA	NA	*	*
5/17/95	MW-4	4.23	0.36	NA	<0.005	0.013	0.0095	<0.005	NA	<0.005	0.033	NA	NA	NA	<0.005	<0.005	<0.005	0.014	<0.005	0.049	NA	NA	<0.005-0.0069	NA
9/26/95	MW-4	6.26	0.09	<0.005	<0.010	0.01	0.0066	<0.005	NA	<0.005	0.0089	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	0.0057	NA	NA	<0.005-0.100	NA
2/7/96	MW-4B	5.03	<0.005	NA	<0.005	0.0074	0.0062	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-4B	6.85	0.0086	NA	<0.001	0.015	0.013	<0.0004	NA	<0.001	<0.001	NA	NA	NA	<0.001	0.0012	<0.001	<0.001	<0.002	0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-4B	5.63	<0.001	NA	<0.001	0.012	0.01	<0.001	NA	<0.001	<0.001	NA	NA	NA	0.0018	0.0014	<0.001	<0.001	<0.002	0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-4B	6.8	0.0014	<0.0005	<0.0005	0.0093	0.0063	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.016	NA
2/20/98	MW-4B	4.26	<0.0005	<0.0005	<0.0005	0.0041	0.0028	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.0009	0.0006	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.010	NA
8/13/98	MW-4B	6.44	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.0013	0.0007	<0.0005	<0.002	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.012	NA
2/3/94	MW-5	7.11	0.0018	<0.002	<0.001	0.011	<0.001	<0.001	<0.001	<0.001	<0.001	NA	<0.005	<0.005	0.0011	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-5	6.6	0.001	NA	NA	NA	<0.0005	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-5	5.4	<0.005	*	*	0.024	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-5	5.32	0.0029	NA	<0.005	0.019	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-5	6.88	<0.005	<0.005	<0.010	0.031	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/7/96	MW-5	4.64	<0.005	NA	<0.005	0.031	<0.005	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-5	6.76	0.037	NA	<0.001	0.028	0.0025	0.0011	NA	<0.001	<0.001	NA	NA	NA	0.0035	0.0014	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-5	5.14	0.001	NA	<0.001	0.017	0.0014	<0.001	NA	<0.001	<0.001	NA	NA	NA	0.0011	<0.001	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-5	6.71	0.0009	<0.0005	<0.0005	0.0195	0.0015	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.0006	0.0007	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/20/98	MW-5	3.47	0.0005	<0.0005	<0.0005	0.0115	0.0008	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.015	NA

TABLE A-6
GROUNDWATER MATRIX ANALYTICAL RESULTS – VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/L)
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Depth (ft bgs)	Benzene	Carbon Disulfide	Chloroethane	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Ethyl-benzene	Ethylene dibromide	Methyl-naphthalene	Naphthalene	PCE	TCE	1,1,2-TCA	Toluene	Vinyl chloride	Xylenes	m+p-Xylene[a]	o-Xylene[a]	VOCs[a]	SVOCs[a]
7/16/99	B-10	12	0.0137	<0.0005	<0.0005	0.0061	<0.0005	<0.0005	NA	<0.0005	0.0223	NA	NA	NA	<0.0005	<0.0005	<0.0005	0.0038	<0.0005	NA	0.003	<0.0005	<0.0005-0.005	NA
8/13/98	MW-5	6.1	<0.0005	<0.0005	<0.0005	0.0076	0.0005	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.016	NA
2/3/94	MW-6	7.93	0.0026	<0.002	<0.001	0.0026	0.0011	<0.001	0.0021	<0.001	<0.001	NA	<0.005	<0.005	0.0013	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-6	7.47	0.0022	NA	NA	NA	0.0042	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-6	6.47	<0.005	*	*	0.094	*	*	*	*	<0.005	*	*	*	*	*	*	<0.005	*	<0.005	NA	NA	*	*
5/17/95	MW-6	6.35	0.0025	NA	<0.005	0.01	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005-0.0069	NA
9/26/95	MW-6	7.59	<0.005	<0.005	<0.010	0.012	<0.005	<0.005	NA	<0.005	<0.005	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	<0.005-0.100	NA
2/7/96	MW-6	5.38	<0.005	NA	<0.005	0.0076	<0.005	<0.005	NA	<0.005	<0.0072	NA	NA	NA	<0.005	<0.005	<0.005	<0.006	<0.005	NA	NA	NA	<0.005-0.0069	NA
9/4/96	MW-6	7.49	0.0014	NA	<0.001	0.016	0.0054	<0.0004	NA	<0.001	<0.001	NA	NA	NA	0.0015	0.002	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
2/13/97	MW-6	6.05	<0.001	NA	<0.001	0.016	0.0041	<0.001	NA	<0.001	<0.001	NA	NA	NA	0.0016	0.0017	<0.001	<0.001	<0.002	<0.001	NA	NA	<0.001-0.002	NA
9/5/97	MW-6	7.41	<0.0005	<0.0005	<0.0005	0.0109	0.0027	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.0007	0.0009	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.005	NA
2/20/98	MW-6	4.29	<0.0005	<0.0005	<0.0005	0.0068	0.001	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	0.001	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.015	NA
8/13/98	MW-6	6.99	<0.0005	<0.0005	<0.0005	0.0041	0.0006	<0.0005	NA	<0.0005	<0.0005	NA	NA	NA	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.012	NA
2/3/94	MW-7	3.06	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-7	2.81	<0.0005	NA	NA	NA	<0.0005	NA	NA	NA	<0.0005	<0.0005	NA	NA	NA	NA	NA	<0.0005	NA	<0.0005	NA	NA	NA	NA
3/7/95	MW-7	3.65	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5/17/95	MW-7	3.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/26/95	MW-7	3.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/7/96	MW-7	2.48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/4/96	MW-7	3.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/13/97	MW-7	2.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/12/97	MW-7		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	NA	<0.010	<0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.0005	<0.0005	<0.0005-0.010	<0.010-0.020
9/5/97	MW-7	3.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/20/98	MW-7	1.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8/13/98	MW-7	2.93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/3/94	MW-9	6.39	0.063	<0.002	0.0016	0.018	0.01	<0.001	0.0079	<0.001	0.022	NA	<0.005	<0.005	<0.001	0.002	<0.001	0.0043	<0.001	0.014	NA	NA	<0.001-0.020	<0.005-0.200
6/8/94	MW-9	6.34	0.15	NA	NA	NA	<0.003	NA	NA	NA	0.38	<0.003	NA	NA	NA	NA	NA	0.02	NA	0.11	NA	NA	NA	NA
3/7/95	MW-9	5.31	0.34	*	*	0.012	*	*	0.014	*	0.053	*	*	*	*	*	*	<0.005	*	0.02	NA	NA	*	*
5/17/95	MW-9	4.85	0.82	NA	<0.005	0.0063	<0.005	<0.005	NA	<0.005	0.23	NA	NA	NA	<0.005	<0.005	<0.005	0.022	<0.005	0.078	NA	NA	<0.005-0.0069	NA
9/26/95	MW-9	5.67	0.34	<0.005	<0.010	0.0087	<0.005	<0.005	NA	<0.005	0.053	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.010	0.02	NA	NA	<0.005-0.100	NA
2/28/91	WATER-1	8.3	1.1	NA	<0.001	<0.001	<0.0005	<0.001	NA	NA	0.13	NA	0.16	0.43	<0.001	<0.001	<0.001	0.53	<0.001	0.5	NA	NA	ND*	<0.01-0.05
Minimum			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	All NDs	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001				
Maximum[b]			**9.9**	0.12	0.0019	**0.13**	0.033	0.0011	0.15	0.018	**1.6**		**0.16**	**0.43**	0.0043	0.0029	0.06	3	0.081	4.1				
Average			0.461	0.005	0.004	0.015	0.005	0.003	0.024	0.004	0.080		0.019	0.073	0.004	0.004	0.004	0.101	0.005	0.251				
Standard Deviation			1.578	0.018	0.011	0.025	0.010	0.010	0.046	0.010	0.271		0.046	0.118	0.010	0.010	0.012	0.397	0.014	0.786				
Count			95	43	75	81	85	75	13	74	95		12	23	75	75	75	95	75	65				
Number of Detects			17	1	0	23	8	0	0	0	8		0	1	5	3	0	4	0	4				
t-value			1.66	1.684	1.67	1.66	1.66	1.67	1.782	1.67	1.66		1.796	1.717	1.67	1.67	1.67	1.66	1.67	1.67				
95% Normal UCL			0.73	0.009	0.006	0.02	0.006	0.005	0.046	0.006	0.126		0.043	0.115	0.005	0.005	0.006	0.169	0.008	0.414				

Notes:

bgs	Below ground surface	NC	No criterion
ft	Feet	ND	Not detected
mg/L	Milligram per liter	RBSL	Risk-based screening level
NA	Sample was not analyzed for this chemical	UCL	Upper confidence limit

a M+p-xylene, o-xylene, VOCs, and SVOCs are presented to complete the historical data summary. However, data for these chemicals (or groups of chemicals) were not used in statistical analysis nor the risk assessment.

b Bolded cells represent maximum concentrations of detected chemicals that exceeded RBSLs. Chemicals with maximum concentrations exceeding soil or groundwater RBSLs were further evaluated quantitatively in the baseline risk assessment. One exception includes methylnaphthalene, which was further evaluated qualitatively due to lack of toxicity data.

Appendix B
Soil and Groundwater Data Summary Tables: Park Parcel

TAB[illegible]
SOIL MATRIX SAMPLE ANALYTICAL RESULTS – METALS (mg/kg)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
SOIL SAMPLING - SUBSURFACE SOIL INVESTIGATION (Blymer, July 1993)																			
7/8/93	B-6	1	NA	<5.0	50	NA	<0.5	9.6	NA	NA	23	0.14	NA	NA	<5.0	<0.5	NA	NA	NA
7/8/93	B-7	1	NA	<5.0	81	NA	<0.5	49	NA	NA	25	0.15	NA	NA	<5.0	<0.5	NA	NA	NA
7/8/93	B-8	1	NA	<5.0	53	NA	<0.5	36	NA	NA	24	0.12	NA	NA	<5.0	<0.5	NA	NA	NA
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Sumps A and B (Fugro, September 1993)																			
9/29/93	SA@5	5	<0.5	1.4	33	<0.5	<0.5	22	3	3.3	4	0.008	<3.0	9	<5.0	0.4	<5.0	16	8
9/29/93	SB@5	5	<1.0	1.3	63	<0.5	<0.5	25	2	4.3	5	0.008	<3.0	9	<5.0	0.3	<5.0	18	11
9/29/93	SB@10	10	<1.0	2.4	140	<0.5	<0.5	50	13	12	10	0.023	<3.0	66	<5.0	0.5	6	25	30
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Former Drum Storage Locations (Fugro, September 1993)																			
9/29/93	FDB-1@5	5	<0.5	7.7	46	<0.5	<0.5	39	10	36	140	<0.004	<3.0	72	<0.5	0.9	6	22	220
9/28/93	FDB-2@5	5	<0.5	8	55	<0.5	<0.5	36	7	68	260	<0.004	<3.0	56	<0.5	1.2	7	20	150
9/28/93	FDB-2@10	10	<0.5	3.7	17	<0.5	<0.5	40	6	12	11	<0.004	<3.0	43	<0.5	0.9	6	28	38
9/29/93	FDC-1@5	5	<0.5	1.7	20	<0.5	<0.5	55	5	22	14	0.05	<3.0	36	<0.5	0.9	6	34	46
9/29/93	FDC-2@5	5	<0.5	1.4	17	<0.5	<0.5	42	3	11	10	0.039	<3.0	28	<0.5	0.7	5	26	32
9/29/93	FDC-2@10	10	<0.5	1.2	59	<0.5	<0.5	29	3	5.2	5	0.016	<3.0	18	<0.5	0.4	<5.0	19	12
SOIL SAMPLING (ICES, January 2002)																			
1/24/02	P-1	1.5	2.5	2.8	80	<0.5	<0.5	51	7.8	18	39	0.091	<2.5	37	<2.5	<1.0	<2.5	31	62
1/24/02	P-2	1.5	<2.5	15	160	<0.5	<0.5	64	15	41	37	0.43	<2.5	35	<2.5	<1.0	<2.5	54	210
		Minimum	<0.5	1.2	17	<0.5	<0.5	9.6	2	3.3	4	<0.004	<2.5	9	<0.5	<0.5	<2.5	16	8
		Maximum	2.5	15	160	All NDs	All NDs	64	15	68	260	0.43	All NDs	72	All NDs	1.2	7	54	220
		Average	0.59	3.86	62.43			39.11	6.80	21.16	43.36	0.08		37.18		0.57	4.18	26.64	74.45
		Standard Deviation	0.70	3.88	42.58			14.47	4.33	19.87	71.30	0.11		21.16		0.30	2.18	10.67	79.80
		Count	11	14	14			14	11	11	14	14		11		14	11	11	11
		Number of Detects	1	11	14			14	11	11	14	11		11		9	6	11	11
		t-value	1.771	1.746	1.746			1.746	1.771	1.771	1.746	1.746		1.771		1.746	1.771	1.771	1.771
		95% Normal UCL	0.97	5.7	82.3			45.9	9.1	31.8	76.6	0.13		48.5		0.71	5.3	32.3	117.1

Notes:

bgs	Below ground surface	ND	Not detected
ft	Feet	RBSL	Risk-based screening level
mg/kg	Milligram per kilogram	UCL	Upper confidence limit
NA	Sample was not analyzed for this chemical		

TABLE 2
SOIL MATRIX ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (mg/kg)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethylbenzene	Xylenes	Methyl tert-butyl ether	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]	PNAs[a]
SOIL SAMPLING - SUBSURFACE SOIL INVESTIGATION (Blymyer, July 1993)														
7/8/93	B-6	1	<1.0	14	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	260	NA
7/8/93	B-7	1	<1.0	130	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	210	NA
7/8/93	B-8	1	<1.0	8.1	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	18	NA
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE ASSESSMENT: 2,000-Gallon Diesel UST (Fugro, September 1993)														
9/30/93	TA-1@5.5	5.5	<1.0	<5.0	NA	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
9/30/93	TA-2@5.5	5.5	4	300	NA	<0.005	0.01	0.005	0.046	NA	NA	NA	NA	NA
9/30/93	TA-3@5.0	5	<10.0	1,100	NA	<0.05	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA
SOIL SAMPLING - UST REMOVAL: One 2,000-Gallon Diesel UST (SEMCO, April 1994)														
4/5/94	#1 SOUTH WALL	6	NA	38	NA	<0.005	0.011	<0.005	0.094	NA	NA	NA	NA	NA
4/5/94	#2 NORTH WALL	6	NA	160	NA	<0.005	<0.005	<0.005	0.018	NA	NA	NA	NA	NA
SOIL SAMPLING - SOIL INVESTIGATION (Geomatrix, February 1995)														
2/3/95	P-15	7.5	NA	20	NA	<0.02	<0.02	<0.02	<0.04	NA	NA	NA	NA	NA
2/3/95	P-16	4	NA	<10.0	NA	<0.02	<0.02	<0.02	<0.04	NA	NA	NA	NA	NA
2/3/95	P-17	7.5	NA	<10.0	NA	<0.02	<0.02	<0.02	<0.04	NA	NA	NA	NA	NA
SOIL SAMPLING - LIMITED SITE INVESTIGATION (ICES, August 1998)														
8/31/98	B-6-2	2	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8/31/98	B-6-5	5	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - LIMITED SITE INVESTIGATION -Abandoned Pennzoil Pipeline (ICES, March 1999)														
3/12/99	SB-6A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-6B	4.5	3.3	29	320	<0.005	<0.005	<0.005	0.014	<0.005	NA	NA	NA	NA
3/12/99	SB-7A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-7B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	0.012	<0.005	NA	NA	NA	NA
3/12/99	SB-8A	2	1.1	<1.0	<10.0	<0.005	<0.005	<0.005	0.019	<0.005	NA	NA	NA	NA
3/12/99	SB-8B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-9A	2	<0.5	57	91	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-9B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-10A	2	<0.5	2	18	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-10B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-11A	2	<0.5	9	31	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-11B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-12A	2	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
3/12/99	SB-12B	4.5	<0.5	<1.0	<10.0	<0.005	<0.005	<0.005	<0.010	<0.005	NA	NA	NA	NA
SOIL SAMPLING - UST REMOVAL One 1,500-GALLON DIESEL UST (ICES, October 2001)														
10/15/01	SWN-1A	9.5	NA	150	NA	0.018	0.048	0.044	0.24	NA	NA	NA	NA	<0.5
10/15/01	SWS-2	9.5	NA	28	NA	0.015	0.15	0.15	0.96	NA	NA	NA	NA	NA

TABLE 2
SOIL MATRIX ANALYTICAL RESULTS – PETROLEUM CONSTITUENTS (mg/kg)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethylbenzene	Xylenes	Methyl tert-butyl ether	TPH-kerosene[a]	Oil & Grease[a]	TRPH[a]	PNAs[a]
SOIL SAMPLING (ICES, January 2002)														
1/24/02	P-1	1.5	<1.0	2.1	34	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
1/24/02	P-2	1.5	<1.0	15	130	<0.005	<0.005	<0.005	<0.005	<0.05	NA	NA	NA	NA
Minimum			<0.5	<1	<10	<0.005	<0.005	<0.005	<0.005	All NDs				
Maximum			4	1100	320	0.018	0.15	0.15	0.96					
Average			0.88	67.12	42.13	0.01	0.01	0.01	0.05					
Standard Deviation			1.35	202.71	82.41	0.01	0.03	0.03	0.18					
Count			22	31	16	29	29	29	29					
Number of Detects			3	16	4	2	4	3	8					
t-value			1.721	1.697	1.753	1.701	1.701	1.701	1.701					
95% Normal UCL			1.38	128.90	78.24	0.01	0.02	0.02	0.11					

Notes:

bgs	Below ground surface
ft	Feet
mg/kg	Milligram per kilogram
NA	Sample was not analyzed for this chemical
ND	Not detected
PNAs	Polynuclear aromatics
RBSL	Risk-based screening level
TRPH	Total recoverable petroleum hydrocarbons
UCL	Upper confidence limit

[a] Analytical results for TPH-kerosene, oil & grease, TRPH, and PNAs are presented to complete the historical data summary. However, data for these chemicals were not used in statistical analysis nor the risk assessment.

TAB[illegible]-3
SOIL MATRIX SAMPLE ANALYTICAL RESULTS – VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	Acetone	Benzene	2-Butanone	Carbon Disulfide	Ethyl-benzene	Methyl butyl ketone	Toluene	Xylenes	VOCs[a]	SVOCs[a]
SOIL SAMPLING - SUBSURFACE SOIL INVESTIGATION (Blymyer, July 1993) *Note: VOCs analyzed using 8240.												
7/8/93	B-6	1	<0.5	<0.1	<0.5	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1-0.5	NA
7/8/93	B-7	1	<0.5	<0.1	<0.5	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1-0.5	NA
7/8/93	B-8	1	<0.5	<0.1	<0.5	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1-0.5	NA
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Former Drum Storage Locations (Fugro, September 1993)												
9/28/93	FDB-1@5.0	5	<0.1	<0.005	<0.05	<0.01	<0.005	NA	<0.005	<0.005	<0.005-0.05	<0.5-10.0
9/28/93	FDB-2@5.0	5	<0.1	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	<0.5-10.0
9/28/93	FDB-2@10	10	<0.1	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	<0.5-10.0
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Caustic Tank (Fugro, September 1993)												
9/29/93	AGT-1@1	1	0.5	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	NA
9/29/93	AGT-1@3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/29/93	AGT-2@1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/29/93	AGT-2@3.5	3.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Sulfuric Acid Tank (Fugro, September 1993)												
9/29/93	AGT-3@0.5	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/29/93	AGT-3@3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/23/93	AGT-4@0.5	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/23/93	AGT-4@4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - PHASE II ENVIRONMENTAL SITE INVESTIGATION: Sumps A and B (Fugro, September 1993)												
9/29/93	SA@5	5	<0.1	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	<0.5-10.0
9/29/93	SB@5	5	<0.1	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	<0.5-10.0
9/29/93	SB@10	10	<0.1	<0.005	<0.05	<0.01	<0.005	<0.03	<0.005	<0.005	<0.005-0.05	<0.5-10.0
SOIL SAMPLING - SITE MITIGATION ACTIVITIES: Sulfuric Acid AST Removal (ICES, October 2001)												
10/15/02	EW-1	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-2	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-3	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-4	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-5	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-6	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-7	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EW-8	4.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EF-1	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/02	EF-2	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SOIL SAMPLING - SITE MITIGATION ACTIVITIES: Trench Parcel (ICES, October 2001)												
10/15/01	TR-1	0.5	0.16	<0.005	0.083	0.02	<0.005	<0.005	<0.005	<0.005	<0.005-0.025	NA
10/15/01	TR-2	0.5	0.13	<0.005	0.22	0.011	<0.005	0.016	<0.005	<0.005	<0.005-0.025	NA

TAB[illegible]3
SOIL MATRIX SAMPLE ANALYTICAL RESULTS -- VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	Acetone	Benzene	2-Butanone	Carbon Disulfide	Ethyl-benzene	Methyl butyl ketone	Toluene	Xylenes	VOCs[a]	SVOCs[a]
SOIL SAMPLING (ICES, January 2002)												
1/24/02	P-1	1.5	<0.025	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.025	<1.0-5.0
1/24/02	P-2	1.5	<0.025	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.025	<4.0-20.0
SOIL SAMPLING - SUPPLEMENTARY SITE INVESTIGATION: Trench Parcel (ICES, July 2002)												
7/18/2002	B-1A	3	<0.080	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.050	NA
7/18/2002	B-2A	3	<0.080	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.050	NA
7/18/2002	B-3A	3	<0.080	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.050	NA
7/18/2002	B-4A	3	<0.080	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.050	NA
		Minimum	<0.025	All NDs	<0.025	<0.025	All NDs	<0.025	All NDs	All NDs		
		Maximum	0.5		0.22	0.02		0.016				
		Average	0.113		0.070	0.013		0.051				
		Standard Deviation	0.127		0.097	0.018		0.095				
		Count	18		18	18		17				
		Number of Detects	3		3	2		1				
		t-value	1.725		1.725	1.725		1.729				
		95% Normal UCL	0.164		0.110	0.020		0.091				

Notes:

bgs	Below ground surface
ft	Feet
mg/kg	Milligram per kilogram
NA	Sample was not analyzed for this chemical
ND	Not detected
SVOC	Semivolatile organic compound
UCL	Upper confidence limit
VOC	Volatile organic compound

[a] Analytical results for VOCs and SVOCs are presented to complete the historical data summary. However, data for these chemicals were not used in statistical analysis nor the risk assessment.

TAB[illegible]4
GROUNDWATER MATRIX SAMPLE ANALYTICAL RESULTS -- PETROLEUM CONSTITUENTS (µg/L)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	TPH-gasoline	TPH-diesel	TPH-motor oil	Benzene	Toluene	Ethyl-benzene	Xylenes	Methyl tert-butyl ether
9/29/93	SA-1	5	<50	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
9/29/93	SB-1	5	<50	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
9/30/93	TA-2	5	970	15000	NA	<0.5	3.3	3.7	26	NA
4/5/1994	#3 Pit Water	6	NA	26000	NA	<0.5	3	0.6	3	NA
2/7/1995	P-15	3.97	NA	100	NA	<0.5	<0.5	<0.5	<0.5	NA
2/7/1995	P-16	5.56	NA	190	NA	<0.5	<0.5	<0.5	<0.5	NA
2/7/1995	P-17	5.43	NA	<50	NA	<0.5	<0.5	<0.5	<0.5	NA
3/12/1999	GW-3	5.5	<50	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5
3/12/1999	GW-4	5.5	<50	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5
		Minimum	<50	<50			<0.5	<0.5	<0.5	
		Maximum	970	26000			3.3	3.7	26	
		Average	214	5909			1	1	3	
		Standard Deviation	423	10461			1	1	8	
		Count	5000	7000			9000	9000	9000	
		Number of Detects	1000	4000			2000	2000	2000	
		t-value	2132	1943			1860	1860	1860	
		95% Normal UCL	617	13592			2	1	9	

Notes:

bgs	Below ground surface
ft	Feet
µg/L	Microgram per liter
NA	Sample was not analyzed for this chemical
UCL	Upper confidence limit

TAB[illegible]5

GROUNDWATER MATRIX ANALYTICAL RESULTS -- VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Sample Date	Sample ID	Sample Depth (ft bgs)	Acetone	2-Butanone	Carbon Disulfide	Chloroform	1,1-DCA	1,2-DCA	Methyl tert-butyl ether	VOCs[a]
10/1/1993	AGT-2	3	NA	NA	NA	NA	NA	NA	NA	NA
10/1/1993	AGT-4	3	NA	NA	NA	NA	NA	NA	NA	NA
9/28/1993	FDB-2	10	21	<10	3	<1	<1	<1	NA	<1-<5
7/18/2002	B-1W	6.5	<5	2	<0.5	8.9	<0.5	<0.5	<0.5	<0.5-<5
7/18/2002	B-2W	6.5	<5	1.3	2.4	<0.5	<0.5	3.6	<0.5	<0.5-<5
7/18/2002	B-3W	6.5	<5	1.7	0.86	7.7	1.3	<0.5	6.3	<0.5-<5
7/18/2002	B-4W	6.5	<5	2.4	0.55	5.4	<0.5	<0.5	<0.5	<0.5-<5
		Minimum	<5	<10	<0.5	<0.5	<0.5	<0.5	<0.5	
		Maximum	21	2.4	3	8.9	1.3	3.6	6.3	
		Average	6.2	2	1	5	1	1	2	
		Standard Deviation	8	1	1	4	0.455	1	3	
		Count	5000	5000	5000	5000	5000	5000	4000	
		Number of Detects	1000	4000	4000	3000	1000	1000	1000	
		t-value	2015	2015	2015	2015	2015	2015	2353	
		95% Normal UCL	14	4	3	8	1	2	5	

Notes:

bgs Below ground surface
DCA Dichloroethane
ft Feet
µg/L Microgram per liter
NA Sample was not analyzed for this chemical
UCL Upper confidence limit
VOCs Volatile organic compounds

a Results for the remaining VOCs are presented to complete the historical data summary. However, this grouped data was not used in statistical analysis nor the risk assessment.

Appendix C
Risk Calculation Tables: Marina Cove Subdivision

TABLE C-1
EXPOSURE PATHWAYS EVALUATED
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Potential Receptor	Medium	Exposure Pathway
Current and Future Adult and Child Resident	Soil	Inhalation - Outdoor Air (Volatiles) Inhalation - Indoor Air (Volatiles) Incidental Ingestion of Soil Ingestion of Homegrown Produce Dermal Contact
	Groundwater	Inhalation - Indoor Air (Volatiles)
Current and Future Construction Worker	Soil	Inhalation - Outdoor Air (Volatiles) Incidental Ingestion Dermal Contact
	Groundwater	Inhalation - Outdoor Air from Exposed Water (Volatiles) Dermal Contact

TABLE C-2
SOIL EXPOSURE POINT CONCENTRATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Based on maximum concentrations:

Chemicals	Soil EPC (ug/kg)	VF (m^3/kg)	PEF (m^3/kg)	Soil Outdoor Air EPC (mg/m^3)	Residential Infinite Source Bldg. Conc. (ug/m^3)	Residential Soil Indoor Air EPC (mg/m^3)
Volatile and Semivolatile Organic Compounds						
Benzene	5.60E+02	3.13E+03	--	1.79E-04	3.15E-01	3.15E-04
Naphthalene	3.50E+04	4.30E+04	--	8.14E-04	1.33E-01	1.33E-04
Xylenes	8.50E+03	4.40E+03	--	1.93E-03	9.50E-01	9.50E-04

Based on 95UCL concentrations:

Chemicals	Soil EPC (ug/kg)	VF (m^3/kg)	PEF (m^3/kg)	Soil Outdoor Air EPC (mg/m^3)	Residential Infinite Source Bldg. Conc. (ug/m^3)	Residential Soil Indoor Air EPC (mg/m^3)
Volatile and Semivolatile Organic Compounds						
Benzene	5.32E+01	3.13E+03	--	1.70E-05	3.15E-01	3.15E-04
Naphthalene	5.64E+03	4.30E+04	--	1.31E-04	1.33E-01	1.33E-04
Xylenes	6.96E+02	4.40E+03	--	1.58E-04	9.50E-01	9.50E-04

Notes:

EPC	Exposure point concentration
mg/kg	Milligram per kilogram
m^3/kg	Cubic meter per kilogram
mg/m^3	Milligram per cubic meter
PEF	Particulate emission factor
ug/kg	Microgram per kilogram
ug/m^3	Microgram per cubic meter
VF	Volatilization factor
VOC	Volatile organic compound
--	Not applicable

Non-VOCs - United States Environmental Protection Agency (EPA), Region 9 defines Volatile Organic Compounds (VOCs) as chemicals having a Henry's Law Constant greater than 1x10-5 (atm-m3/mol) and a molecular weight less than 200 g/mole. The California EPA, Department of Toxic Substances Control defines a VOC as a chemical with a vapor pressure of 0.001 mm Hg or higher and Henry's Law constant of 1x10-5 or higher in the Preliminary Endangerment Assessment Guidance Manual, January 1994.

PEF = A default Particulate Emission Factor (PEF) of 1.316E+09 m3/kg was used for non-VOCs to evaluate particles in air due to fugitive dust emissions from contaminated soils, provided by US EPA, Region 9.

TABL[illegible]-3
GROUNDWATER EXPOSURE POINT CONCENTRATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Based on maximum concentrations:

Chemicals	Groundwater EPC (ug/L)	Residential Infinite Source Bldg. Conc. (ug/m^3)	Residential Groundwater Indoor Air EPC (mg/m^3)	Groundwater Outdoor Air EPC (mg/m^3)
Metals				
Barium	1.70E+05	Non-VOC	--	--
Lead	1.30E+05	Non-VOC	--	--
Nickel	2.00E+05	Non-VOC	--	--
Zinc	2.40E+05	Non-VOC	--	--
Volatile and Semivolatile Organic Compounds				
Benzene	9.90E+03	4.16E+00	4.16E-03	7.99E-02
1,1-Dichloroethane	1.30E+02	8.11E-03	8.11E-06	1.18E-03
Ethylbenzene	1.60E+03	5.67E-02	5.67E-05	1.03E-02
Naphthalene	4.30E+02	5.71E-03	5.71E-06	2.66E-03
Toluene	3.00E+03	7.49E-02	7.49E-05	2.13E-02
Xylenes	4.10E+03	1.49E-01	1.49E-04	2.74E-02

TABL[illegible]-3
GROUNDWATER EXPOSURE POINT CONCENTRATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Based on 95UCL concentrations:

Chemicals	Groundwater EPC (ug/L)	Residential Infinite Source Bldg. Conc. (ug/m^3)	Residential Groundwater Indoor Air EPC (mg/m^3)	Groundwater Outdoor Air EPC (mg/m^3)
Metals				
Barium	1.32E+02	Non-VOC	--	--
Lead	3.56E+01	Non-VOC	--	--
Nickel	7.01E+01	Non-VOC	--	--
Zinc	9.89E+01	Non-VOC	--	--
Volatile and Semivolatile Organic Compounds				
Benzene	7.23E+02	3.04E-01	3.04E-04	5.83E-03
1,1-Dichloroethane	1.96E+01	8.11E-03	8.11E-06	1.77E-04
Ethylbenzene	1.25E+02	5.67E-02	5.67E-05	8.06E-04
Naphthalene	1.15E+02	5.71E-03	5.71E-06	7.12E-04
Toluene	1.67E+02	7.49E-02	7.49E-05	1.18E-03
Xylenes	4.14E+02	1.49E-01	1.49E-04	2.76E-03

Notes:

EPC	Exposure point concentration
mg/L	Milligram per liter
mg/m^3	Milligram per cubic meter
ug/L	Microgram per liter
ug/m^3	Microgram per cubic meter
VOC	Volatile organic compound
--	Not applicable

Non-VOCs - United States Environmental Protection Agency (EPA), Region 9 defines Volatile Organic Compounds (VOCs) as chemcials having a Henry's Law Constant greater than 1x10-5 (atm-m3/mol) and a molecular weight less than 200 g/mole. The California EPA, Department of Toxic Substances Control defines a VOC as a chemical with a vapor pressure of 0.001 mm Hg or higher and Henry's Law constant of 1x10-5 or higher in the Preliminary Endangerment Assessment Guidance Manual, January 1994.

TABLE C-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Based on maximum concentrations:

Outdoor Air Parameters for Construction Worker	Benzene	1,1-DCA	Ethylbenzene	Naphthalene	Toluene	Xylenes
GW EPC (mg/L)	9.9	0.13	1.6	0.43	3	4.1
Gas Phase mass transfer coefficient of compound (cm/sec)	0.83	0.83	0.83	0.83	0.83	0.83
Henry's Law Constant (atm-m^3/mol)	5.60E-03	5.60E-03	7.69E-03	1.98E-02	6.60E-03	7.50E-03
Temperature (K) - 21 degrees Celsius	294.00	294.00	294.00	294.00	294.00	294.00
Ideal Gas Constant (R) - atm-m^3/mol-degrees-Kelvin	8.20E-05	8.20E-05	8.20E-05	8.20E-05	8.20E-05	8.20E-05
Diffusivity in water (cm^2/sec)	9.80E-06	1.10E-05	7.80E-06	7.50E-06	8.60E-06	8.10E-06
Liquid phase mass transfer coefficient of compund (cm/sec)	2.14E-04	2.40E-04	1.70E-04	1.64E-04	1.88E-04	1.77E-04
Overall mass transfer coefficient (cm/sec)	2.14E-04	2.40E-04	1.70E-04	1.64E-04	1.87E-04	1.77E-04
Surface Area of water (m^2)	4.84E+02	4.84E+02	4.84E+02	4.84E+02	4.84E+02	4.84E+02
Conversion Factor (liters/cm^3 x cm^2/m^2)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01
Emission Rate (mg/sec)	1.02E+01	1.51E-01	1.32E+00	3.40E-01	2.72E+00	3.50E+00
Average wind Speed in Mixing Zone (m/sec)	3.88	3.88	3.88	3.88	3.88	3.88
Width of Area perpendicular to wind direction (m)	22.00	22.00	22.00	22.00	22.00	22.00
Mixing Height (m)	1.5	1.5	1.5	1.5	1.5	1.5
GW Outdoor Air EPC (mg/m^3)	**7.99E-02**	**1.18E-03**	**1.03E-02**	**2.66E-03**	**2.13E-02**	**2.74E-02**

Based on 95UCL concentrations:

Outdoor Air Parameters for Construction Worker	Benzene	1,1-DCA	Ethylbenzene	Naphthalene	Toluene	Xylenes
GW EPC (mg/L)	0.72	0.02	0.13	0.12	0.17	0.41
Gas Phase mass transfer coefficient of compound (cm/sec)	0.83	0.83	0.83	0.83	0.83	0.83
Henry's Law Constant (atm-m^3/mol)	5.60E-03	5.60E-03	7.69E-03	1.98E-02	6.60E-03	7.50E-03
Temperature (K) - 21 degrees Celsius	294.00	294.00	294.00	294.00	294.00	294.00
Ideal Gas Constant (R) - atm-m^3/mol-degrees-Kelvin	8.20E-05	8.20E-05	8.20E-05	8.20E-05	8.20E-05	8.20E-05
Diffusivity in water (cm^2/sec)	9.80E-06	1.10E-05	7.80E-06	7.50E-06	8.60E-06	8.10E-06
Liquid phase mass transfer coefficient of compund (cm/sec)	2.14E-04	2.40E-04	1.70E-04	1.64E-04	1.88E-04	1.77E-04
Overall mass transfer coefficient (cm/sec)	2.14E-04	2.40E-04	1.70E-04	1.64E-04	1.87E-04	1.77E-04
Surface Area of water (m^2)	4.84E+02	4.84E+02	4.84E+02	4.84E+02	4.84E+02	4.84E+02
Conversion Factor (liters/cm^3 x cm^2/m^2)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01
Emission Rate (mg/sec)	7.47E-01	2.27E-02	1.03E-01	9.12E-02	1.52E-01	3.54E-01
Average wind Speed in Mixing Zone (m/sec)	3.88	3.88	3.88	3.88	3.88	3.88
Width of Area perpendicular to wind direction (m)	22.00	22.00	22.00	22.00	22.00	22.00
Mixing Height (m)	1.5	1.5	1.5	1.5	1.5	1.5
GW Outdoor Air EPC (mg/m^3)	**5.83E-03**	**1.77E-04**	**8.06E-04**	**7.12E-04**	**1.18E-03**	**2.76E-03**

TABLE C-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Notes:

atm-m^3/mol	Atmosphere-cubic meter per mole
cm/sec	Centimeter per second
1,1-DCA	1,1-Dichloroethane
K	Kelvin
m	Meter
mg/L	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/sec	Milligram per second

Reference:

U.S. Environmental Protection Agency. 1996. *Soil Screening Guidance: User's Guide*. EPA Document Number: EPA540/R-96/018. July.

TABLE C-5
EXPOSURE FACTORS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Exposure Parameters and Factors	Acronym	Units	Values	Source
Adult Resident Exposure Parameters				
Inhalation Rate - Adult Resident	AdRes IR	m^3/day	20	Cal EPA 1992 - default residential total indoor and outdoor combined daily inhalation rate
Ingestion Rate - Adult Resident	AdRes Ing	mg/day	100	Cal EPA 1992 - Default adult residential rate - equivalent to an agricultural worker
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Adult Resident	AdRes SA	cm^2/day	5800	Cal EPA 1992
Skin adherence factor - Adult Resident	SAF	mg/cm^2	0.07	DTSC 2000 / U.S. EPA 2001 - Default adult residential value
Dermal absorption factor - Adult Resident	DAF	Unitless	Chem-spec	see Table B6
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Exposure Frequency - Adult Resident	AdRes EF	days/year	350	Cal EPA 1992 / U.S. EPA 1991
Exposure Duration - Adult Resident	AdRes ED	years	24	Cal EPA 1992 / U.S. EPA 1991 - default adult residential when child resident is 6 years (30 years total)
Body Weight - Adult Resident	AdRes BW	kg	70	U.S. EPA 1991 / Cal EPA 1992 - default adult value
Averaging Time-Non-carcinogenic - Adult Resident	AdRes ATnon-carc	days	8760	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992
Adult Resident Exposure Factors				
Inhalation Non-carcinogenic - Adult Resident	Inh Ad Res NC Factor	m^3/kg-day	2.74E-01	Calculated
Ingestion Non-Carcinogenic - Adult Resident	Ing Ad Res NC Factor	day^{-1}	1.37E-06	Calculated
Dermal Non-Carcinogenic - Adult Resident	Der Ad Res Der Factor	day^{-1}	5.56E-06	Calculated
Inhalation Carcinogenic - Adult Resident	Inh Ad Res C Factor	m^3/kg-day	9.39E-02	Calculated
Ingestion Carcinogenic - Adult Resident	Ing Ad Res C Factor	day^{-1}	4.70E-07	Calculated
Dermal Carcinogenic - Adult Resident	Der Ad Res Der C Factor	day^{-1}	1.91E-06	Calculated
Child Resident Exposure Parameters				
Inhalation Rate - Child Resident	ChRes IR	m^3/day	10	U.S. EPA 1997 - default child 6-8 years of age mean recommended inhalation rate
Ingestion Rate - Child Resident	ChRes Ing	mg/day	200	Cal EPA 1992 / U.S. EPA 1997
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Child Resident	ChRes SA	cm^2/day	2000	Cal EPA 1992
Skin adherence factor - Child Resident	SAF	mg/cm^2	0.2	DTSC 2000 / U.S. EPA 2001 - Default child residential value
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Exposure Frequency - Child Resident	ChRes EF	days/year	350	Cal EPA 1992 / U.S. EPA 1991 - default residential value
Exposure Duration - Child Resident	ChRes ED	years	6	Cal EPA 1992 / U.S. EPA 1991 - default child residential when adult resident is 6 years (30 years total)
Body Weight - Child Resident	ChRes BW	kg	15	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Child Resident	ChRes ATnon-carc	days	2190	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992

TABLE C-5
EXPOSURE FACTORS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Exposure Parameters and Factors	Acronym	Units	Values	Source
Child Resident Exposure Factors				
Inhalation Non-carcinogenic - Child Resident	Inh Ch Res NC Factor	m^3/kg-day	6.39E-01	Calculated
Ingestion Non-Carcinogenic - Child Resident	Ing Ch Res NC Factor	day^{-1}	1.28E-05	Calculated
Dermal Non-Carcinogenic - Child Resident	Der Ch Res Der Factor	day^{-1}	2.56E-05	Calculated
Inhalation Carcinogenic - Child Resident	Inh Ch Res C Factor	m^3/kg-day	5.48E-02	Calculated
Ingestion Carcinogenic - Child Resident	Ing Ch Res C Factor	day^{-1}	1.10E-06	Calculated
Dermal Carcinogenic - Child Resident	Der Ch Res Der C Factor	day^{-1}	2.19E-06	Calculated
Construction Worker Exposure Parameters				
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	Cal EPA 1992 - Total commercial/industrial work day default value
Ingestion Rate - Construction Worker	CW Ing	mg/day	100	Cal EPA 1992 - Equivalent to an agricultural worker
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	DTSC 2000
Skin adherence factor - Construction Worker	SAF	mg/cm^2	0.24	Holmes et. al. 1999 - Maximum Geometric Mean value for soil loading (hands) for construction workers
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	U.S. EPA 1992
Groundwater Dermal Exposure Duration - Construction Worker	WDED	hours	0.5	Professional Judgement
Unit conversion factor	CF	liters/cm^3	1.00E-03	NA
Exposure Frequency - Construction Worker	CW EF	days/year	250	U.S. EPA 1991, Cal EPA 1992
Exposure Duration - Construction Worker	CW ED	years	1	Professional Judgement
Body Weight - Construction Worker	CW BW	kg	70	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992

TABLE C-5
EXPOSURE FACTORS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Exposure Parameters and Factors	Acronym	Units	Values	Source
Construction Worker Exposure Factors				
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	m^3/kg-day	1.96E-01	Calculated
Ingestion Non-Carcinogenic - Construction Worker	Ing CW NC Factor	day^{-1}	9.78E-07	Calculated
Soil Dermal Non-Carcinogenic - Construction Worker	Soil Der CW Der Factor	day^{-1}	7.42E-06	Calculated
Groundwater Dermal Non-Carcinogenic - Construction Worker	GW Der CW Der Factor	hr-liter/cm-kg-day	1.55E-02	Calculated
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	m^3/kg-day	2.80E-03	Calculated
Ingestion Carcinogenic - Construction Worker	Ing CW C Factor	day^{-1}	1.40E-08	Calculated
Soil Dermal Carcinogenic - Construction Worker	Soil Der CW Der C Factor	day^{-1}	1.06E-07	Calculated
Groundwater Dermal Carcinogenic - Construction Worker	GW Der CW Der C Factor	hr-liter/cm-kg-day	2.21E-04	Calculated

Notes:
m^3 = Cubic meter
ug = Microgram
mg = Milligram
kg = Kilogram
cm^2 = square centimeter

References:
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U.S. EPA. 1992. Dermal Exposure Assessment: Principles and Applications. Interim Report. EPA/600/8-91/011B. January.
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U.S. EPA. 2000. Region 9 Preliminary Remediation Goals (PRGs) 2000. November 1.
U.S. EPA. 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim Review Draft - For Public Comment. EPA/540/R/99-005. September.

TABLE C-6
SOIL DERMAL ABSORPTION FACTORS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Chemicals	Chemical-Specific Soil Dermal Absorption Factor (unitless)
Volatile and Semivolatile Organic Compounds	
Benzene	0.1
Naphthalene	0.15
Xylenes	0.1

Reference:

State of California Environmental Protection Agency. Department of Toxic Substances Control. 1994. Preliminary Endangerment Assessment Guidance Manual. January.

TABLE C-7
GROUNDWATER PERMEABILITY CONSTANTS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Chemicals	Chemical-Specific Water Permeability Coefficient (cm/hr)
Metals	
Barium	1.30E-03
Lead	1.00E-03
Nickel	2.00E-04
Zinc	6.00E-04
Volatile and Semivolatile Organic Compounds	
Benzene	2.10E-02
1,1-Dichloroethane	8.90E-03
Ethylbenzene	7.40E-02
Naphthalene	6.90E-02
Toluene	4.50E-02
Xylenes	8.00E-02

Note:
cm/hr Centimeter per hour

References:

State of California Environmental Protection Agency. Department of Toxic Substances Control. 1994. Preliminary Endangerment Assessment Guidance Manual. January.

U.S. Environmental Protection Agency. 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim Review Draft - For Public Comment. EPA/540/R/99-005. September.

TABLE C-8
RISK EQUATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation
Adult Resident Receptor			
Inhalation Exposure Factor - Noncarcinogenic - Ad Res	Inh Ad Res NC Factor	m^3/kg-day	Inh Ad Res NC Factor = $\frac{\text{Ad Res IR * Ad Res EF * Ad Res ED}}{\text{Ad Res BW * Ad Res AT non-carc}}$
Ingestion Exposure Factor - Noncarcinogenic - Ad Res	Ing Ad Res NC Factor	day^{-1}	Ing Ad Res NC Factor = $\frac{\text{Ad Res Ing * CF * FI * Ad Res EF *Ad Res ED}}{\text{Ad Res BW * Ad Res AT non-carc}}$
Soil Dermal Exposure Factor - Noncarcinogenic - Ad Res	Soil Der Ad Res NC Factor	day^{-1}	Soil Der Ad Res NC Factor = $\frac{\text{Ad Res SA * CF * SAF * Ad Res EF * Ad Res ED}}{\text{Ad Res BW * Ad Res AT non-carc}}$
Inhalation Exposure Factor - Carcinogenic - Ad Res	Inh Ad Res C Factor	m^3/kg-day	Inh Ad Res C Factor = $\frac{\text{Ad Res IR * Ad Res EF * Ad Res ED}}{\text{Ad Res BW * Ad Res AT carc}}$
Ingestion Exposure Factor - Carcinogenic - Ad Res	Ing Ad Res C Factor	day^{-1}	Ing Ad Res C Factor = $\frac{\text{Ad Res Ing * CF * FI * Ad Res EF *Ad Res ED}}{\text{Ad Res BW * Ad Res AT carc}}$
Soil Dermal Exposure Factor - Carcinogenic - Ad Res	Soil Der Ad Res C Factor	day^{-1}	Soil Der Ad Res C Factor = $\frac{\text{Ad Res SA * CF * SAF * Ad Res EF * Ad Res ED}}{\text{Ad Res BW * Ad Res AT carc}}$
Inhalation Noncarcinogenic Hazard Quotient - Ad Res	Soil Inh Ad Res HQ	unitless	Inh Ad Res HQ = Inh Ad Res NC Factor * Air Concentration (Soil, Soil Gas or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - Ad Res	Soil Ing Ad Res HQ	unitless	Ing Ad Res HQ = Ing Ad Res NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - Ad Res	Soil Der Ad Res HQ	unitless	Soil Der Ad Res HQ = Soil Der Ad Res NC Factor * DAF * Soil Concentration / RfDo
Noncarcinogenic Hazard Index - Ad Res	**Ad Res HI**	**unitless**	**Ad Res HI = Inh Ad Res HQ + Ing Ad Res HQ + Soil Der Ad Res HQ for all Chemicals**
Inhalation Carcinogenic Risk - Ad Res	Inh Ad Res RISK	unitless	Inh Ad Res RISK = Inh Ad Res C Factor * Air Concentration (Soil, Soil Gas or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - Ad Res	Soil Ing Ad Res RISK	unitless	Ing Ad Res RISK = Soil Ing Ad Res C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - Ad Res	Soil Der Ad Res RISK	unitless	Soil Der Ad Res RISK = Soil Der Ad Res C factor * DAF * Soil Concentration * CSFo
Carcinogenic Risk - Ad Res	**Ad Res RISK**	**unitless**	**Ad Res RISK = Inh Ad Res Risk + Ing Ad Res Risk + Soil Der Ad Res Risk for all Chemicals**

TABLE C-8
RISK EQUATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation
Child Resident Receptor			
Inhalation Exposure Factor - Noncarcinogenic - Ch Res	Inh Ch Res NC Factor	m^3/kg-day	Inh Ch Res NC Factor = $\frac{\text{Ch Res IR * Ch Res EF * Ch Res ED}}{\text{Ch Res BW * Ch Res AT non-carc}}$
Ingestion Exposure Factor - Noncarcinogenic - Ch Res	Ing Ch Res NC Factor	day^{-1}	Ing Ch Res NC Factor = $\frac{\text{Ch Res Ing * CF * FI * Ch Res EF *Ch Res ED}}{\text{Ch Res BW * Ch Res AT non-carc}}$
Soil Dermal Exposure Factor - Noncarcinogenic - Ch Res	Soil Der Ch Res NC Factor	day^{-1}	Soil Der Ch Res NC Factor = $\frac{\text{Ch Res SA * CF * SAF * Ch Res EF * Ch Res ED}}{\text{Ch Res BW * Ch Res AT non-carc}}$
Inhalation Exposure Factor - Carcinogenic - Ch Res	Inh Ch Res C Factor	m^3/kg-day	Inh Ch Res C Factor = $\frac{\text{Ch Res IR * Ch Res EF * Ch Res ED}}{\text{Ch Res BW * Ch Res AT carc}}$
Ingestion Exposure Factor - Carcinogenic - Ch Res	Ing Ch Res C Factor	day^{-1}	Ing Ch Res C Factor = $\frac{\text{Ch Res Ing * CF * FI * Ch Res EF *Ch Res ED}}{\text{Ch Res BW * Ch Res AT carc}}$
Soil Dermal Exposure Factor - Carcinogenic - Ch Res	Soil Der Ch Res C Factor	day^{-1}	Soil Der Ch Res C Factor = $\frac{\text{Ch Res SA * CF * SAF * Ch Res EF * Ch Res ED}}{\text{Ch Res BW * Ch Res AT carc}}$
Inhalation Noncarcinogenic Hazard Quotient - Ch Res	Soil Inh Ch Res HQ	unitless	Inh Ch Res HQ = Inh Ch Res NC Factor * Air Concentration (Soil, Soil Gas or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - Ch Res	Soil Ing Ch Res HQ	unitless	Ing Ch Res HQ = Ing Ch Res NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - Ch Res	Soil Der Ch Res HQ	unitless	Soil Der Ch Res HQ = Soil Der Ch Res NC Factor * DAF * Soil Concentration / RfDo
Noncarcinogenic Hazard Index - Ch Res	**Ch Res HI**	**unitless**	**Ch Res HI = Inh Ch Res HQ + Ing Ch Res HQ + Soil Der Ch Res HQ for all Chemicals**
Inhalation Carcinogenic Risk - Ch Res	Inh Ch Res RISK	unitless	Inh Ch Res RISK = Inh Ch Res C Factor * Air Concentration (Soil, Soil Gas or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - Ch Res	Soil Ing Ch Res RISK	unitless	Ing Ch Res RISK = Soil Ing Ch Res C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - Ch Res	Soil Der Ch Res RISK	unitless	Soil Der Ch Res RISK = Soil Der Ch Res C factor * DAF * Soil Concentration * CSFo
Carcinogenic Risk - Ch Res	**Ch Res RISK**	**unitless**	**Ch Res RISK = Inh Ch Res Risk + Ing Ch Res Risk + Soil Der Ch Res Risk for all Chemicals**
Residential Noncarcinogenic Risk	**Res NC RISK**	**unitless**	**Res NC RISK = Ch Res HI**
Residential Carcinogenic Risk	**Res RISK**	**unitless**	**Res RISK = Ad Res Risk + Ch Res Risk**

TABLE C-8
RISK EQUATIONS
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation
Construction Worker Receptor			
Inhalation Exposure Factor - Noncarcinogenic - CW	Inh CW NC Factor	m^3/kg-day	Inh CW NC Factor = $\frac{\text{CW IR * CW EF * CW ED}}{\text{CW BW * CW AT non-carc}}$
Ingestion Exposure Factor - Noncarcinogenic - CW	Ing CW NC Factor	day^{-1}	Ing CW NC Factor = $\frac{\text{CW Ing * CF * FI * CW EF *CW ED}}{\text{CW BW * CW AT non-carc}}$
Soil Dermal Exposure Factor - Noncarcinogenic - CW	Soil Der CW NC Factor	day^{-1}	Soil Der CW NC Factor = $\frac{\text{CW SA * CF * SAF * CW EF * CW ED}}{\text{CW BW * CW AT non-carc}}$
Groundwater Dermal Exposure Factor - Noncarcinogenic - CW	GW Der CW NC Factor	hr-liter/cm-kg-day	GW Der CW NC Factor = $\frac{\text{CW SA * WDED *CF * CW EF * CW ED}}{\text{CW BW * CW AT non-carc}}$
Inhalation Exposure Factor - Carcinogenic - CW	Inh CW C Factor	m^3/kg-day	Inh CW C Factor = $\frac{\text{CW IR * CW EF * CW ED}}{\text{CW BW * CW AT carc}}$
Ingestion Exposure Factor - Carcinogenic - CW	Ing CW C Factor	day^{-1}	Ing CW C Factor = $\frac{\text{CW Ing * CF * FI * CW EF *CW ED}}{\text{CW BW * CW AT carc}}$
Soil Dermal Exposure Factor - Carcinogenic - CW	Soil Der CW C Factor	day^{-1}	Soil Der CW C Factor = $\frac{\text{CW SA * CF * SAF * CW EF * CW ED}}{\text{CW BW * CW AT carc}}$
Groundwater Dermal Exposure Factor - Carcinogenic - CW	GW Der CW C Factor	hr-liter/cm-kg-day	GW Der CW C Factor = $\frac{\text{CW SA * WDED *CF * CW EF * CW ED}}{\text{CW BW * CW AT carc}}$
Inhalation Noncarcinogenic Hazard Quotient - CW	Soil Inh CW HQ	unitless	Inh CW HQ = Inh CW NC Factor * Air Concentration (Soil, Soil Gas or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - CW	Soil Ing CW HQ	unitless	Ing CW HQ = Ing CW NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - CW	Soil Der CW HQ	unitless	Soil Der CW HQ = Soil Der CW NC Factor * DAF * Soil Concentration / RfDo
Groundwater Dermal Noncarcinogenic Hazard Quotient - CW	GW Der CW HQ	unitless	GW Der CW HQ = GW Der CW NC Factor * Chem-Specific Kp* Groundwater Concentration / RfDo
Noncarcinogenic Hazard Index - CW	**CW HI**	**unitless**	**CW HI = Inh CW HQ + Ing CW HQ + Soil Der CW HQ + GW Der CW for all Chemicals**
Inhalation Carcinogenic Risk - CW	Inh CW RISK	unitless	Inh CW RISK = Inh CW C Factor * Air Concentration (Soil, Soil Gas or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - CW	Soil Ing CW RISK	unitless	Ing CW RISK = Soil Ing CW C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - CW	Soil Der CW RISK	unitless	Soil Der CW RISK = Soil Der CW C factor * DAF * Soil Concentration * CSFo
Groundwater Dermal Noncarcinogenic Risk - CW	GW Der CW Risk	unitless	GW Der CW Risk = GW Der CW C Factor * Chem-Specific Kp* Groundwater Concentration / CSFo
Carcinogenic Risk - CW	**CW RISK**	**unitless**	**CW RISK = Inh CW Risk + Ing CW Risk + Soil Der CW + GW Der CW Risk for all Chemicals**

Notes:
Ad = Adult
AT = Averaging time
BW = Body weight
CDI = Chronic Daily Intake
CF = Conversion Factor
Ch = Child
CSF = Cancer slope factor
CW = Construction Worker
DAF = Dermal absoption factor
Der = Dermal
ED = Exposure duration
EF = Exposure frequency
FI = Fraction ingested
HI = Hazard Index
HQ = Hazard Quotient
Ing = Ingestion
Inh = Inhalation
IR = Intake rate
Kp = Chemical-Specific Permeability Coefficient
mg/kg-day = millgrams per kilogram-day
RfD = Noncarcinogenic reference dose
SA = Skin surface area
SAF = Skin adherence factor

TABLE C-9
TOXICITY VALUES
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Chemicals	**Oral Cancer Slope Factor [1/(mg/kg-day)]**	**Source Oral Cancer Slope Factor**	**Inhalation Unit Risk Factor [1/(ug/m^3)]**	**Inhalation Cancer Slope Factor [1/(mg/kg-day)]**	**Source Inhalation Unit Risk and Cancer Slope Factors**	**Chronic Inhalation REL (ug/m^3)**	**Source Chronic Inhalation REL**	**Inhalation RfC (mg/m^3)**	**Inhalation RfD (mg/kg-day)**	**Source Inhalation RfD and RfC**	**Oral RfD[a] (mg/kg-day)**	**Source Oral RfD**
Metals												
Barium	NC	NC	NC	NC	IRIS	--	--	5.00E-04	1.43E-04	HEAST	7.00E-02	IRIS
Lead	8.50E-03	OEHHA	1.20E-05	4.20E-02	OEHHA	--	--	--	--	--	--	--
Nickel	--	--	2.60E-04	9.10E-01	OEHHA	5.00E-02	Cal EPA	--	1.43E-05	Cal EPA	2.00E-02	IRIS
Zinc	NC	NC	NC	NC	IRIS	--	--	--	--	--	3.00E-01	IRIS
Volatile and Semivolatile Organic Compounds												
Benzene	1.0E-01	OEHHA	2.9E-05	1.0E-01	OEHHA	60	OEHHA	--	1.7E-03	NCEA	3.0E-03	NCEA
1,1-Dichloroethane	5.7E-03	OEHHA	1.6E-06	5.7E-03	OEHHA	--	--	--	1.4E-01	HEAST	1.0E-01	HEAST
Ethylbenzene	NC	NC	NC	NC	NC	2000	OEHHA	1.0E+00	2.9E-01	IRIS	1.0E-01	IRIS
Naphthalene	NC	--	--	NC	--	9	Cal EPA	3.0E-03	8.6E-04	IRIS	2.0E-02	IRIS
Toluene	NC	NC	NC	NC	NC	--	--	4.0E-01	1.1E-01	IRIS	2.0E-01	IRIS
Xylenes	NC	NC	NC	NC	NC	700	Cal EPA	--	2.0E-01	Cal EPA	2.0E+00	IRIS

Notes:

a	Oral RfD values used as a surrogate for dermal RfDs
--	Not available
mg/kg-day	Milligram per kilogram-day
mg/m^3	Milligram per cubic meter
NC	Chemical is not classified as a carcinogen
RfD	Reference dose
RfC	Reference concentration
ug/m^3	Microgram per cubic meter

References:

California Environmental Protection Agency (CalEPA). 1994. Office of Environmental Health Hazard Assessment (OEHHA). California Cancer Potency Factors. November.

California Environmental Protection Agency (CalEPA). 2001. Toxicity Criteria Database. Office of Environmental Health Hazard Assessment (OEHHA). **Http://www.oehha.ca.gov/risk/chemicalDB/index.asp** October 31.

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TABLE 10
ADULT RESIDENTIAL CALCULATIONS FOR SOIL
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Benzene	Naphthalene	Xylenes	Total
Exposure Parameters							
Soil Concentration	C_s	mg/kg	Chem-Spec	0.56	35	8.5	
Soil Predicted Indoor Air Concentration	C_a	mg/m^3	Chem-Spec	3.15E-04	1.33E-04	9.50E-04	
Unit conversion factor	CF	kg/mg	1.00E-06	--	--	--	
Inhalation Rate - Adult Resident	AdRes IR	m^3/day	20	--	--	--	
Ingestion Rate - Adult Resident	AdRes Ing	mg/day	100	--	--	--	
Skin Surface Area - Adult Resident	AdRes SA	cm^2/day	5800	--	--	--	
Fraction Ingested	FI	Unitless	1	--	--	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.1	0.15	0.1	
Skin adherence factor	SAF	mg/cm^2	0.07	--	--	--	
Exposure Frequency - Adult Resident	AdRes EF	days/year	350	--	--	--	
Exposure Duration - Adult Resident	AdRes ED	years	24	--	--	--	
Body Weight - Adult Resident	AdRes BW	kg	70	--	--	--	
Averaging Time-Non-carcinogenic - Adult Resident	AdRes ATnon-carc	days	8760	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	
Chronic Daily Intakes							
Inhalation Non-carcinogenic - Adult Resident	Inh AdRes NC Factor	mg/kg-day	Chem-Spec	8.62E-05	3.64E-05	2.60E-04	
Ingestion Non-carcinogenic - Adult Resident	Ing AdRes NC Factor	mg/kg-day	Chem-Spec	7.67E-07	4.79E-05	1.16E-05	
Dermal Non-carcinogenic - Adult Resident	Der AdRes NC Factor	mg/kg-day	Chem-Spec	3.11E-07	2.92E-05	4.73E-06	
Inhalation Carcinogenic - Adult Resident	Inh AdRes C Factor	mg/kg-day	Chem-Spec	2.95E-05	1.25E-05	8.92E-05	
Ingestion Carcinogenic - Adult Resident	Ing AdRes C Factor	mg/kg-day	Chem-Spec	2.63E-07	1.64E-05	3.99E-06	
Dermal Carcinogenic - Adult Resident	Der AdRes C Factor	mg/kg-day	Chem-Spec	1.07E-07	1.00E-05	1.62E-06	
Toxicity Criteria							
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	8.57E-04	2.00E-01	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Ingestion	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Noncarcinogenic Hazards							
Soil Inhalation Hazard Quotient - Adult Resident	Inh AdRes HQ	unitless	Chem-Spec	0.0507	0.0424	0.00130	0.09444
Soil Ingestion Hazard Quotient - Adult Resident	Ing AdRes HQ	unitless	Chem-Spec	0.0003	0.0024	0.00001	0.00266
Soil Dermal Hazard Quotient - Adult Resident	Der AdRes HQ	unitless	Chem-Spec	0.0001	0.0015	0.00000	0.00157
Soil Hazard Index - Adult Resident	**Soil AdRes HI**	unitless	Chem-Spec	0.0511	0.046	0.00131	**0.1**
Carcinogenic Risk							
Soil Inhalation Carcinogenic Risk - Adult Resident	Inh AdRes RISK	unitless	Chem-Spec	2.95E-06	--	--	3.0E-06
Soil Ingestion Carcinogenic Risk - Adult Resident	Ing AdRes RISK	unitless	Chem-Spec	2.63E-08	--	--	2.6E-08
Soil Dermal Carcinogenic Risk - Adult Resident	Der AdRes RISK	unitless	Chem-Spec	1.07E-08	--	--	1.1E-08
Soil Carcinogenic Risk - Adult Resident	**Soil AdRes RISK**	unitless	Chem-Spec	2.99E-06	--	--	**3E-06**

TABLE C-11
ADULT RESIDENT CALCULATIONS FOR GROUNDWATER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Barium	Lead	Nickel	Zinc	Benzene	1,1-DCE	Ethylbenzene	Naphthalene	Toluene	Xylenes	Total
Exposure Parameters														
Groundwater Concentration	C_w	mg/L	Chem-Spec	170	130	200	240	9.9	0.13	1.6	0.43	3	4.1	
Groundwater Predicted Indoor Air Concentration	C_a	mg/m^3	Chem-Spec	--	--	--	--	4.16E-03	8.11E-06	5.67E-05	5.71E-06	7.49E-05	1.49E-04	
Inhalation Rate - Adult Resident	AdRes IR	m^3/day	20	--	--	--	--	--	--	--	--	--	--	
Exposure Frequency - Adult Resident	AdRes EF	days/year	350	--	--	--	--	--	--	--	--	--	--	
Exposure Duration - Adult Resident	AdRes ED	years	24	--	--	--	--	--	--	--	--	--	--	
Body Weight - Adult Resident	AdRes BW	kg	70	--	--	--	--	--	--	--	--	--	--	
Averaging Time-Non-carcinogenic - Adult Resident	AdRes ATnon-carc	days	8760	--	--	--	--	--	--	--	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	--	--	--	--	--	--	--	
Chronic Daily Intakes														
Inhalation Non-carcinogenic - Adult Resident	Inh AdRes NC Factor	mg/kg-day	Chem-Spec	--	--	--	--	1.14E-03	2.22E-06	1.55E-05	1.56E-06	2.05E-05	4.07E-05	
Inhalation Carcinogenic - Adult Resident	Inh AdRes C Factor	mg/kg-day	Chem-Spec	--	--	--	--	3.91E-04	7.62E-07	5.33E-06	5.36E-07	7.04E-06	1.40E-05	
Toxicity Criteria														
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.43E-04	--	1.43E-05	--	1.70E-03	1.40E-01	2.86E-01	8.57E-04	1.14E-01	2.00E-01	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	NC	4.2E-02	9.1E-01	NC	1.0E-01	5.7E-03	NC	NC	NC	NC	
Noncarcinogenic Hazards														
Groundwater Inhalation Hazard Quotient - Adult Resident	Inh AdRes HQ	unitless	Chem-Spec	--	--	--	--	0.6707	0.0000159	0.0000544	0.001824	0.000180	0.000204	0.67295
Groundwater Hazard Index - Adult Resident	**Groundwater AdRes HI**	unitless	Chem-Spec	--	--	--	--	0.6707	0.0000159	0.0000544	0.001824	0.000180	0.000204	**0.6729**
Carcinogenic Risk														
Groundwater Inhalation Carcinogenic Risk - Adult Resident	Inh AdRes RISK	unitless	Chem-Spec	--	--	--	--	3.91E-05	4.34E-09	--	--	--	--	3.91E-05
Groundwater Carcinogenic Risk - Adult Resident	**Groundwater AdRes RISK**	unitless	Chem-Spec	--	--	--	--	3.91E-05	4.34E-09	--	--	--	--	**4E-05**

TABLE C-12
CHILD RESIDENT CALCULATIONS FOR SOIL
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Benzene	Naphthalene	Xylenes	Total
Exposure Parameters							
Soil Concentration	C_s	mg/kg	Chem-Spec	0.56	35	8.5	
Soil Predicted Indoor Air Concentration	C_a	mg/m^3	Chem-Spec	3.15E-04	1.33E-04	9.50E-04	
Unit conversion factor	CF	kg/mg	1.00E-06	--	--	--	
Inhalation Rate - Child Resident	ChRes IR	m^3/day	10	--	--	--	
Ingestion Rate - Child Resident	ChRes Ing	mg/day	200	--	--	--	
Skin Surface Area - Child Resident	ChRes SA	cm^2/day	2000	--	--	--	
Fraction Ingested	FI	Unitless	1	--	--	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.1	0.15	0.1	
Skin adherence factor	SAF	mg/cm^2	0.2	--	--	--	
Exposure Frequency - Child Resident	ChRes EF	days/year	350	--	--	--	
Exposure Duration - Child Resident	ChRes ED	years	6	--	--	--	
Body Weight - Child Resident	ChRes BW	kg	15	--	--	--	
Averaging Time-Non-carcinogenic - Child Resident	ChRes ATnon-carc	days	2190	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	
Chronic Daily Intakes							
Inhalation Non-carcinogenic - Child Resident	Inh ChRes NC Factor	mg/kg-day	Chem-Spec	2.01E-04	8.49E-05	6.07E-04	
Ingestion Non-carcinogenic - Child Resident	Ing ChRes NC Factor	mg/kg-day	Chem-Spec	7.16E-06	4.47E-04	1.09E-04	
Dermal Non-carcinogenic - Child Resident	Der ChRes NC Factor	mg/kg-day	Chem-Spec	1.43E-06	1.34E-04	2.17E-05	
Inhalation Carcinogenic - Child Resident	Inh ChRes C Factor	mg/kg-day	Chem-Spec	1.72E-05	7.28E-06	5.20E-05	
Ingestion Carcinogenic - Child Resident	Ing ChRes C Factor	mg/kg-day	Chem-Spec	6.14E-07	3.84E-05	9.32E-06	
Dermal Carcinogenic - Child Resident	Der ChRes C Factor	mg/kg-day	Chem-Spec	1.23E-07	1.15E-05	1.86E-06	
Toxicity Criteria							
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	8.57E-04	2.00E-01	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Ingestion	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Noncarcinogenic Hazards							
Soil Inhalation Hazard Quotient - Child Resident	Inh ChRes HQ	unitless	Chem-Spec	0.1183	0.0990	0.00304	0.22037
Soil Ingestion Hazard Quotient - Child Resident	Ing ChRes HQ	unitless	Chem-Spec	0.0024	0.0224	0.00005	0.02482
Soil Dermal Hazard Quotient - Child Resident	Der ChRes HQ	unitless	Chem-Spec	0.0005	0.0067	0.00001	0.00720
Soil Hazard Index - Child Resident	**Soil ChRes HI**	unitless	Chem-Spec	0.121	0.13	0.0031	**0.25**
Carcinogenic Risk							
Soil Inhalation Carcinogenic Risk - Child Resident	Inh ChRes RISK	unitless	Chem-Spec	1.72E-06	--	--	1.7E-06
Soil Ingestion Carcinogenic Risk - Child Resident	Ing ChRes RISK	unitless	Chem-Spec	6.14E-08	--	--	6.1E-08
Soil Dermal Carcinogenic Risk - Child Resident	Der ChRes RISK	unitless	Chem-Spec	1.23E-08	--	--	1.2E-08
Soil Carcinogenic Risk - Child Resident	**Soil ChRes RISK**	unitless	Chem-Spec	1.80E-06	0.00E+00	0.00E+00	**2E-06**

TABLE C-13
CHILD RESIDENT CALCULATIONS FOR GROUNDWATER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Barium	Lead	Nickel	Zinc	Benzene	1,1-DCE	Ethylbenzene	Naphthalene	Toluene	Xylenes	Total
Exposure Parameters														
Groundwater Concentration	C_w	mg/L	Chem-Spec	170	130	200	240	9.9	0.13	1.6	0.43	3	4.1	
Groundwater Predicted Indoor Air Concentration	C_a	mg/m^3	Chem-Spec	--	--	--	--	4.16E-03	8.11E-06	5.67E-05	5.71E-06	7.49E-05	1.49E-04	
Inhalation Rate - Child Resident	ChRes IR	m^3/day	10	--	--	--	--	--	--	--	--	--	--	
Exposure Frequency - Child Resident	ChRes EF	days/year	350	--	--	--	--	--	--	--	--	--	--	
Exposure Duration - Child Resident	ChRes ED	years	6	--	--	--	--	--	--	--	--	--	--	
Body Weight - Child Resident	ChRes BW	kg	15	--	--	--	--	--	--	--	--	--	--	
Averaging Time-Non-carcinogenic - Child Resident	ChRes ATnon-carc	days	2190	--	--	--	--	--	--	--	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	--	--	--	--	--	--	--	
Chronic Daily Intakes														
Inhalation Non-carcinogenic - Child Resident	Inh ChRes NC Factor	mg/kg-day	Chem-Spec	--	--	--	--	2.66E-03	5.18E-06	3.62E-05	3.65E-06	4.79E-05	9.50E-05	
Inhalation Carcinogenic - Child Resident	Inh ChRes C Factor	mg/kg-day	Chem-Spec	--	--	--	--	2.28E-04	4.44E-07	3.11E-06	3.13E-07	4.11E-06	8.14E-06	
Toxicity Criteria														
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.43E-04	--	1.43E-05	--	1.70E-03	1.40E-01	2.86E-01	8.57E-04	1.14E-01	2.00E-01	
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	NC	4.2E-02	9.1E-01	NC	1.0E-01	5.7E-03	NC	NC	NC	NC	
Noncarcinogenic Hazards														
Groundwater Inhalation Hazard Quotient - Child Resident	Inh ChRes HQ	unitless	Chem-Spec	--	--	--	--	1.565	0.0000370	0.000127	0.00426	0.000419	0.000475	1.570
Groundwater Hazard Index - Child Resident	**Groundwater ChRes HI**	unitless	Chem-Spec	--	--	--	--	1.565	0.0000370	0.000127	0.00426	0.000419	0.000475	**1.570**
Carcinogenic Risk														
Groundwater Inhalation Carcinogenic Risk - Child Resident	Inh ChRes RISK	unitless	Chem-Spec	--	--	--	--	2.28E-05	2.53E-09	--	--	--	--	2.28E-05
Groundwater Carcinogenic Risk - Child Resident	**Groundwater ChRes RISK**	unitless	Chem-Spec	--	--	--	--	2.3E-05	2.5E-09	--	--	--	--	**2E-05**

TABLE C-14
CONSTRUCTION WORKER CALCULATIONS FOR SOIL
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Benzene	Naphthalene	Xylenes	Total
Exposure Parameters							
Soil Concentration	C_s	mg/kg	Chem-Spec	0.56	35.00	8.50	
Soil Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	0.00	0.00	0.00	
Unit conversion factor	CF	kg/mg	0.00	--	--	--	
Inhalation Rate - Construction Worker	CW IR	m^3/day	20.00	--	--	--	
Ingestion Rate - Construction Worker	CW Ing	mg/day	100.00	--	--	--	
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160.00	--	--	--	
Fraction Ingested	FI	Unitless	1.00	--	--	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.10	0.15	0.10	
Skin adherence factor	SAF	mg/cm^2	0.24	--	--	--	
Exposure Frequency - Construction Worker	CW EF	days/year	250.00	--	--	--	
Exposure Duration - Construction Worker	CW ED	years	1.00	--	--	--	
Body Weight - Construction Worker	CW BW	kg	70.00	--	--	--	
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365.00	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550.00	--	--	--	
Chronic Daily Intakes							
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	mg/kg-day	Chem-Spec	3.50E-05	1.59E-04	3.78E-04	
Ingestion Non-carcinogenic - Construction Worker	Ing CW NC Factor	mg/kg-day	Chem-Spec	5.48E-07	3.42E-05	8.32E-06	
Dermal Non-carcinogenic - Construction Worker	Der CW NC Factor	mg/kg-day	Chem-Spec	4.16E-07	3.90E-05	6.31E-06	
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	mg/kg-day	Chem-Spec	5.00E-07	2.28E-06	5.40E-06	
Ingestion Carcinogenic - Construction Worker	Ing CW C Factor	mg/kg-day	Chem-Spec	7.83E-09	4.89E-07	1.19E-07	
Dermal Carcinogenic - Construction Worker	Der CW C Factor	mg/kg-day	Chem-Spec	5.94E-09	5.57E-07	9.01E-08	
Toxicity Criteria							
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	8.57E-04	2.00E-01	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-03	2.00E-02	2.00E+00	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Ingestion	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.0E-01	NC	NC	
Noncarcinogenic Hazards							
Soil Inhalation Hazard Quotient - Construction Worker	Inh CW HQ	unitless	Chem-Spec	0.0206	0.1858	0.00189	0.20830
Soil Ingestion Hazard Quotient - Construction Worker	Ing CW HQ	unitless	Chem-Spec	0.0002	0.0017	0.00000	0.00190
Soil Dermal Hazard Quotient - Construction Worker	Der CW HQ	unitless	Chem-Spec	0.0001	0.0019	0.00000	0.00209
Soil Hazard Index - Construction Worker	**Soil CW HI**	unitless	Chem-Spec	0.02	0.19	0.002	**0.2**
Carcinogenic Risk							
Soil Inhalation Carcinogenic Risk - Construction Worker	Inh CW RISK	unitless	Chem-Spec	5.00E-08	--	--	5.0E-08
Soil Ingestion Carcinogenic Risk - Construction Worker	Ing CW RISK	unitless	Chem-Spec	7.83E-10	--	--	7.8E-10
Soil Dermal Carcinogenic Risk - Construction Worker	Der CW RISK	unitless	Chem-Spec	5.94E-10	--	--	5.9E-10
Soil Carcinogenic Risk - Construction Worker	**Soil CW RISK**	unitless	Chem-Spec	5.1E-08	0.00E+00	0.00E+00	**5E-08**

TABLE C-15
CONSTRUCTION WORKER CALCULATIONS FOR GROUNDWATER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Barium	Lead	Nickel	Zinc	Benzene
Exposure Parameters:								
Groundwater Concentration	C_w	mg/L	Chem-Spec	170	130	200	240	9.9
Groundwater Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	--	--	--	--	4.16E-03
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	--	--	--	--
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	--	--	--	--
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	1.30E-03	1.00E-03	2.00E-04	6.00E-04	2.10E-02
Groundwater Dermal Exposure Duration - Construction Worker	WDED	hours	0.5	--	--	--	--	--
Unit conversion factor	CF	liters/cm^3	1.00E-03	--	--	--	--	--
Exposure Frequency - Adult Resident	CW EF	days/year	250	--	--	--	--	--
Exposure Duration - Adult Resident	CW ED	years	1	--	--	--	--	--
Body Weight - Adult Resident	CW BW	kg	70	--	--	--	--	--
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	--	--	--	--
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	--	--
Chronic Daily Intakes:								
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	m^3/kg-day	Chem-Spec	--	--	--	--	8.14E-04
Dermal Non-carcinogenic - Construction Worker	Der CW NC Factor	mg/kg-day	Chem-Spec	3.42E-03	2.01E-03	6.18E-04	2.23E-03	3.21E-03
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	m^3/kg-day	Chem-Spec	--	--	--	--	1.16E-05
Dermal Carcinogenic - Construction Worker	Der CW C Factor	mg/kg-day	Chem-Spec	4.88E-05	2.87E-05	8.83E-06	3.18E-05	4.59E-05
Toxicity Criteria:								
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.43E-04	--	1.43E-05	--	1.70E-03
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	7.00E-02	--	2.00E-02	3.00E-01	3.00E-03
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	NC	4.2E-02	9.1E-01	NC	1.0E-01
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	NC	8.5E-03	--	NC	1.0E-01
Noncarcinogenic Hazards:								
Groundwater Inhalation Hazard Quotient - Construction Worker	Inh CW HQ	unitless	Chem-Spec	--	--	--	--	0.4790
Groundwater Dermal Hazard Quotient - Construction Worker	Der CW HQ	unitless	Chem-Spec	0.0488	--	0.03092	0.00742	1.0714
Groundwater Hazard Index - Construction Worker	**Groundwater CW HI**	unitless	Chem-Spec	0.05	--	0.03	0.007	1.6
Carcinogenic Risk:								
Groundwater Inhalation Carcinogenic Risk - Construction Worker	Inh CW RISK	unitless	Chem-Spec	--	--	--	--	1.16E-06
Groundwater Dermal Carcinogenic Risk - Construction Worker	Der CW RISK	unitless	Chem-Spec	--	2.44E-07	--	--	4.59E-06
Groundwater Carcinogenic Risk - Construction Worker	**Groundwater CW RISK**	unitless	Chem-Spec	0.00E+00	--	--	--	5.8E-06

TABLE C-15
CONSTRUCTION WORKER CALCULATIONS FOR GROUNDWATER
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	1,1-DCE	Ethylbenzene	Naphthalene	Toluene	Xylenes	Total
Exposure Parameters:									
Groundwater Concentration	C_w	mg/L	Chem-Spec	0.13	1.6	0.43	3	4.1	
Groundwater Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	8.11E-06	5.67E-05	5.71E-06	7.49E-05	1.49E-04	
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	--	--	--	--	
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	--	--	--	--	
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	8.90E-03	7.40E-02	6.90E-02	4.50E-02	8.00E-02	
Groundwater Dermal Exposure Duration - Construction Worker	WDED	hours	0.5	--	--	--	--	--	
Unit conversion factor	CF	liters/cm^3	1.00E-03	--	--	--	--	--	
Exposure Frequency - Adult Resident	CW EF	days/year	250	--	--	--	--	--	
Exposure Duration - Adult Resident	CW ED	years	1	--	--	--	--	--	
Body Weight - Adult Resident	CW BW	kg	70	--	--	--	--	--	
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	--	--	--	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	--	--	--	--	
Chronic Daily Intakes:									
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	m^3/kg-day	Chem-Spec	1.59E-06	1.11E-05	1.12E-06	1.47E-05	2.91E-05	
Dermal Non-carcinogenic - Construction Worker	Der CW NC Factor	mg/kg-day	Chem-Spec	1.79E-05	1.83E-03	4.59E-04	2.09E-03	5.07E-03	
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	m^3/kg-day	Chem-Spec	2.27E-08	1.59E-07	1.60E-08	2.09E-07	4.15E-07	
Dermal Carcinogenic - Construction Worker	Der CW C Factor	mg/kg-day	Chem-Spec	2.56E-07	2.61E-05	6.55E-06	2.98E-05	7.24E-05	
Toxicity Criteria:									
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.40E-01	2.86E-01	8.57E-04	1.14E-01	2.00E-01	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	1.00E-01	1.00E-01	2.00E-02	2.00E-01	2.00E+00	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	5.7E-03	NC	NC	NC	NC	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	5.7E-03	NC	NC	NC	NC	
Noncarcinogenic Hazards:									
Groundwater Inhalation Hazard Quotient - Construction Worker	Inh CW HQ	unitless	Chem-Spec	0.0000113	0.0000388	0.001303	0.000128	0.000145	0.48068
Groundwater Dermal Hazard Quotient - Construction Worker	Der CW HQ	unitless	Chem-Spec	0.0002	0.01830	0.0229	0.0104	0.00254	1.21291
Groundwater Hazard Index - Construction Worker	**Groundwater CW HI**	unitless	Chem-Spec	0.0002	0.02	0.02	0.01	0.003	**1.7**
Carcinogenic Risk:									
Groundwater Inhalation Carcinogenic Risk - Construction Worker	Inh CW RISK	unitless	Chem-Spec	1.29E-10	--	--	--	--	1.16E-06
Groundwater Dermal Carcinogenic Risk - Construction Worker	Der CW RISK	unitless	Chem-Spec	1.46E-09	--	--	--	--	4.84E-06
Groundwater Carcinogenic Risk - Construction Worker	**Groundwater CW RISK**	unitless	Chem-Spec	1.6E-09	--	--	--	--	**6E-06**

Appendix D
Risk Calculation Tables:
Park Parcel

TAB[illegible]-1
EXPOSURE PATHWAYS EVALUATED
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Potential Receptor	Medium	Exposure Pathway
Current and Future Construction Worker	Soil	Inhalation - Outdoor Air (Volatiles) Incidental Ingestion Dermal Contact
	Groundwater	Inhalation - Outdoor Air from Exposed Water (Volatiles) Dermal Contact
Future Landscape Maintenance Worker	Soil	Inhalation - Outdoor Air (Volatiles) Incidental Ingestion Dermal Contact
Future Park Visitor	Soil	Inhalation - Outdoor Air (Volatiles) Incidental Ingestion Dermal Contact

TAB[illegible]-2
SOIL EXPOSURE POINT CONCENTRATIONS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on maximum concentration:

Chemicals	Soil EPC (mg/kg)	Soil EPC (µg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Soil Outdoor Air EPC (mg/m^3)
Arsenic	15	1.5E+04	Non-VOC	1.3E+09	1.1E-08

Based on 95UCL concentration:

Chemicals	Soil EPC (mg/kg)	Soil EPC (µg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Soil Outdoor Air EPC (mg/m^3)
Arsenic	5.7	5.7E+03	Non-VOC	1.3E+09	4.3E-09

Notes:

EPC	Exposure point concentration
mg/kg	Milligram per kilogram
m^3/kg	Cubic meter per kilogram
mg/m^3	Milligram per cubic meter
PEF	Particulate emission factor
ug/kg	Microgram per kilogram
VF	Volatilization factor
VOC	Volatile organic compound

Non-VOCs - United States Environmental Protection Agency (EPA), Region 9 defines Volatile Organic Compounds (VOCs) as chemicals having a Henry's Law Constant greater than 1x10-5 (atm-m3/mol) and a molecular weight less than 200 g/mole. The California EPA, Department of Toxic Substances Control defines a VOC as a chemical with a vapor pressure of 0.001 mm Hg or higher and Henry's Law constant of 1x10-5 or higher in the Preliminary Endangerment Assessment Guidance Manual, January 1994.

PEF = A default Particulate Emission Factor (PEF) of 1.316E+09 m3/kg was used for non-VOCs to evaluate particles in air due to fugitive dust emissions from contaminated soils, provided by US EPA, Region 9.

TAB[illegible]-3
GROUNDWATER EXPOSURE POINT CONCENTRATIONS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on maximum concentration:

Chemicals	Groundwater EPC (mg/L)	Groundwater EPC (ug/L)	Groundwater Outdoor Air EPC - Construction Worker (mg/m^3)	Groundwater Outdoor Air EPC - Landscape Worker and Park Visitor (mg/m^3)
Xylenes	0.026	2.60E+01	1.8E-04	4.7E-07

Based on 95UCL concentration:

Chemicals	Groundwater EPC (mg/L)	Groundwater EPC (ug/L)	Groundwater Outdoor Air EPC - Construction Worker (mg/m^3)	Groundwater Outdoor Air EPC - Landscape Worker and Park Visitor (mg/m^3)
Xylenes	0.0087	8.74E+00	5.9E-05	1.6E-07

Notes:

EPC	Exposure point concentration
mg/L	Milligram per liter
mg/m^3	Milligram per cubic meter
ug/L	Microgram per liter
ug/m^3	Microgram per cubic meter
VOC	Volatile organic compound
--	Not applicable

Non-VOCs - United States Environmental Protection Agency (EPA), Region 9 defines Volatile Organic Compounds (VOCs) as chemcials having a Henry's Law Constant greater than 1x10-5 (atm-m3/mol) and a molecular weight less than 200 g/mole. The California EPA, Department of Toxic Substances Control defines a VOC as a chemical with a vapor pressure of 0.001 mm Hg or higher and Henry's Law constant of 1x10-5 or higher in the Preliminary Endangerment Assessment Guidance Manual, January 1994.

TAB[illegible]-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER, LANDSCAPE MAINTENANCE WORKER, AND PARK VISITOR
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on maximum concentration:

Outdoor Air Parameters for Construction Worker	**Xylenes**
GW EPC (mg/L)	0.026
Gas Phase mass transfer coefficient of compound (cm/sec)	0.83
Henry's Law Constant (atm-m^3/mol)	7.50E-03
Temperature (K) - 21 degrees Celsius	294.00
Ideal Gas Constant (R) - atm-m^3/mol-degrees-Kelvin	8.20E-05
Diffusivity in water (cm^2/sec)	8.10E-06
Liquid phase mass transfer coefficient of compund (cm/sec)	1.77E-04
Overall mass transfer coefficient (cm/sec)	1.77E-04
Surface Area of water (m^2)	4.88E+02
Conversion Factor (liters/cm^3 x cm^2/m^2)	1.00E+01
Emission Rate (mg/sec)	2.24E-02
Average wind Speed in Mixing Zone (m/sec)	3.88
Width of Area perpendicular to wind direction (m)	22.00
Mixing Height (m)	1.5
GW Outdoor Air EPC (mg/m^3) - Construction Worker	**1.8E-04**

TAB[illegible]-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER, LANDSCAPE MAINTENANCE WORKER, AND PARK VISITOR
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on maximum concentration:

Outdoor Air Parameters for Landscape Worker and Park Visitor	**Xylenes**
GW EPC (ug/L)	26
Henry's Law Constant (dimensionless)	3.00E-01
Chemical vapor concentration at the source (mg/m^3)	7.80
Cross-sectional area available for diffusion (m^2)	4.88E+02
Chemical vapor concentration in soil at the surface (mg/m^3)	0
Diffusion coefficient in air at 25C (cm^2/s)	7.00E-02
Total Porosity (cm^3/cm^3)	0.43
Air -filled porosity (cm^3/cm^3)	0.13
Effective diffusion coefficient (cm^2/s)	4.24E-04
Length of flow (m)	2.71
Conversion factor (m^2/cm^2)	1.00E-04
Emission rate to the surface (mg/s)	5.97E-05
Mixing zone height (m)	1.5
GW Outdoor Air EPC (mg/m^3) - Landscape Worker and Park Visitor	**4.7E-07**

TAB[illegible]-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER, LANDSCAPE MAINTENANCE WORKER, AND PARK VISITOR
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on 95UCL concentration:

Outdoor Air Parameters for Construction Worker	**Xylenes**
GW EPC (mg/L)	0.0087
Gas Phase mass transfer coefficient of compound (cm/sec)	0.83
Henry's Law Constant (atm-m^3/mol)	7.50E-03
Temperature (K) - 21 degrees Celsius	294.00
Ideal Gas Constant (R) - atm-m^3/mol-degrees-Kelvin	8.20E-05
Diffusivity in water (cm^2/sec)	8.10E-06
Liquid phase mass transfer coefficient of compund (cm/sec)	1.77E-04
Overall mass transfer coefficient (cm/sec)	1.77E-04
Surface Area of water (m^2)	4.88E+02
Conversion Factor (liters/cm^3 x cm^2/m^2)	1.00E+01
Emission Rate (mg/sec)	7.53E-03
Average wind Speed in Mixing Zone (m/sec)	3.88
Width of Area perpendicular to wind direction (m)	22.00
Mixing Height (m)	1.5
GW Outdoor Air EPC (mg/m^3) - Construction Worker	**5.9E-05**

TAB[illegible]-4
GROUNDWATER AIR CONCENTRATIONS FOR CONSTRUCTION WORKER, LANDSCAPE MAINTENANCE WORKER, AND PARK VISITOR
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Based on 95UCL concentration:

Outdoor Air Parameters for Landscape Worker and Park Visitor	**Xylenes**
GW EPC (ug/L)	8.7
Henry's Law Constant (dimensionless)	3.00E-01
Chemical vapor concentration at the source (mg/m^3)	2.62
Cross-sectional area available for diffusion (m^2)	4.88E+02
Chemical vapor concentration in soil at the surface (mg/m^3)	0
Diffusion coefficient in air at 25C (cm^2/s)	7.00E-02
Total Porosity (cm^3/cm^3)	0.43
Air -filled porosity (cm^3/cm^3)	0.13
Effective diffusion coefficient (cm^2/s)	4.24E-04
Length of flow (m)	2.71
Conversion factor (m^2/cm^2)	1.00E-04
Emission rate to the surface (mg/s)	2.01E-05
Mixing zone height (m)	1.5
GW Outdoor Air EPC (mg/m^3) - Landscape Worker and Park Visitor	**1.6E-07**

Notes:

atm-m^3/mol	Atmosphere-cubic meter per mole
cm/sec	Centimeter per second
1,1-DCA	1,1-Dichloroethane
K	Kelvin
m	Meter
mg/L	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/sec	Milligram per second

Reference:

U.S. Environmental Protection Agency. 1996. *Soil Screening Guidance: User's Guide*. EPA Document Number: EPA540/R-96/018. July.

TABLE D-5
EXPOSURE PARAMETERS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Exposure Parameters and Factors	Acronym	Units	Values	Source
Construction Worker Exposure Parameters				
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	Cal EPA 1992 - Total commercial/industrial work day default value
Ingestion Rate - Construction Worker	CW Ing	mg/day	100	Cal EPA 1992 - Equivalent to an agricultural worker
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	DTSC 2000
Skin adherence factor - Construction Worker	SAF	mg/cm^2	0.24	Holmes et. al. 1999 - Maximum Geometric Mean value for soil loading (hands) for construction workers
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	U.S. EPA 1992
Groundwater Dermal Exposure Duration - Construction Worker	WDED	hours	0.5	Professional Judgement
Unit conversion factor	CF	liters/cm^3	1.00E-03	NA
Exposure Frequency - Construction Worker	CW EF	days/year	250	U.S. EPA 1991, Cal EPA 1992
Exposure Duration - Construction Worker	CW ED	years	1	Professional Judgement
Body Weight - Construction Worker	CW BW	kg	70	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992
Construction Worker Exposure Factors				
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	m^3/kg-day	1.96E-01	Calculated
Ingestion Non-Carcinogenic - Construction Worker	Ing CW NC Factor	day^{-1}	9.78E-07	Calculated
Soil Dermal Non-Carcinogenic - Construction Worker	Soil Der CW Der Factor	day^{-1}	7.42E-06	Calculated
Groundwater Dermal Non-Carcinogenic - Construction Worker	GW Der CW Der Factor	hr-liter/cm-kg-day	1.55E-02	Calculated
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	m^3/kg-day	2.80E-03	Calculated
Ingestion Carcinogenic - Construction Worker	Ing CW C Factor	day^{-1}	1.40E-08	Calculated
Soil Dermal Carcinogenic - Construction Worker	Soil Der CW Der C Factor	day^{-1}	1.06E-07	Calculated
Groundwater Dermal Carcinogenic - Construction Worker	GW Der CW Der C Factor	hr-liter/cm-kg-day	2.21E-04	Calculated
Landscape Maintenance Worker Variables	**Acronym**	**Units**	**Values**	**Source**
Inhalation Rate - Landscape Maintenance Worker	LMW IR	m^3/day	20	U.S. EPA 1997
Ingestion Rate - Landscape Maintenance Worker	LMW Ing	mg/day	100	Cal EPA 1992 - Equivalent to an agricultural worker
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Soil Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Landscape Maintenance Worker	LMW SA	cm^2/day	3160	DTSC 2000
Skin adherence factor - Landscape Maintenance Worker	SAF	mg/cm^2	0.2	Holmes et. al. 1999 - Maximum Geometric Mean value for soil loading (hands) for gardeners
Exposure Frequency - Landscape Maintenance Worker	LMW EF	days/year	52	Professional judgement - one day per week
Exposure Duration - Landscape Maintenance Worker	LMW ED	years	25	Cal EPA 1992
Body Weight - Landscape Maintenance Worker	LMW BW	kg	70	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Landscape Maintenance Worker	LMW ATnon-carc	days	9125	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992

TABLE D-5
EXPOSURE PARAMETERS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Exposure Parameters and Factors	Acronym	Units	Values	Source
Landscape Maintenance Worker Exposure Factors				
Inhalation Non-carcinogenic - Landscape Maintenance Worker	Inh LMW NC Factor	m^3/kg-day	4.07E-02	Calculated
Ingestion Non-Carcinogenic - Landscape Maintenance Worker	Ing LMW NC Factor	day^{-1}	2.04E-07	Calculated
Dermal Non-Carcinogenic - Landscape Maintenance Worker	Der LMW Der Factor	day^{-1}	1.29E-06	Calculated
Inhalation Carcinogenic - Landscape Maintenance Worker	Inh LMW C Factor	m^3/kg-day	1.45E-02	Calculated
Ingestion Carcinogenic - Landscape Maintenance Worker	Ing LMW C Factor	day^{-1}	7.27E-08	Calculated
Dermal Carcinogenic - Landscape Maintenance Worker	Der LMW Der C Factor	day^{-1}	4.59E-07	Calculated
Park Visitor Variables	**Acronym**	**Units**	**Values**	**Source**
Inhalation Rate - Park Visitor	PV IR	m^3/day	20	U.S. EPA 1997
Ingestion Rate - Park Visitor	PV Ing	mg/day	100	Cal EPA 1992 - Equivalent to an agricultural worker
Unit conversion factor	CF	kg/mg	1.00E-06	NA
Soil Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Park Visitor	PV SA	cm^2/day	3160	DTSC 2000
Skin adherence factor - Park Visitor	SAF	mg/cm^2	0.2	Holmes et. al. 1999 - Maximum Geometric Mean value for soil loading (hands) for gardeners
Exposure Frequency - Park Visitor	PV EF	days/year	12	Professional judgement - one day per month
Exposure Duration - Park Visitor	PV ED	years	25	Cal EPA 1992
Body Weight - Park Visitor	PV BW	kg	70	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Park Visitor	PV ATnon-carc	days	9125	Calculated
Averaging Time-Carcinogenic	AT_{carc}	days	25550	U.S. EPA 1991 / Cal EPA 1992
Park Visitor Exposure Factors				
Inhalation Non-carcinogenic - Park Visitor	Inh PV NC Factor	m^3/kg-day	9.39E-03	Calculated
Ingestion Non-Carcinogenic - Park Visitor	Ing PV NC Factor	day^{-1}	4.70E-08	Calculated
Dermal Non-Carcinogenic - Park Visitor	Der PV Der Factor	day^{-1}	2.97E-07	Calculated
Inhalation Carcinogenic - Park Visitor	Inh PV C Factor	m^3/kg-day	3.35E-03	Calculated
Ingestion Carcinogenic - Park Visitor	Ing PV C Factor	day^{-1}	1.68E-08	Calculated
Dermal Carcinogenic - Park Visitor	Der PV Der C Factor	day^{-1}	1.06E-07	Calculated

Notes:
m^3 = Cubic meter
ug = Microgram
mg = Milligram
kg = Kilogram
cm^2 = square centimeter

References:
California Environmental Protection Agency (Cal EPA) 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control, Office of the Science Advisor. July
Department of Toxic Substances Control (DTSC). 2000. Guidance for the Dermal Exposure Pathway. Draft Memorandum from S. DiZio, M. Wade, D. Oudiz to Human and Ecological Risk Division. January 17.
Holmes et. al. 1999. Field Measurements of Dermal Soil Loadings in Occupational and Recreational Activities. Environmental Res. 80:148-157.
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United States Environmental Protection Agency (U.S. EPA). 1991. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Supplemental Guidance: "Standard Default Exposure Parameters". Interim Final. March.
U.S. EPA. 1992. Dermal Exposure Assessment: Principles and Applications. Interim Report. EPA/600/8-91/011B. January.
U.S. EPA. 1997. Exposure Factors Handbook. Volume I: General Factors. Office of Research and Development.
U.S. EPA. 2000. Region 9 Preliminary Remediation Goals (PRGs) 2000. November 1.
U.S. EPA. 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim Review Draft - For Public Comment. EPA/540/R/99-005. September.

TABLE D-6
SOIL DERMAL ABSORPTION FACTORS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Chemicals	Chemical-Specific Soil Dermal Absorption Factor (unitless)
Arsenic	0.03

Reference:

State of California Environmental Protection Agency. Department of Toxic Substances Control. 1994. Preliminary Endangerment Assessment Guidance Manual. January.

TABLE D-7
GROUNDWATER PERMEABILITY CONSTANTS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Chemicals	Chemical-Specific Water Permeability Coefficient (cm/hr)
Xylenes	8.00E-02

Note:
cm/hr Centimeter per hour

References:

State of California Environmental Protection Agency. Department of Toxic Substances Control. 1994. Preliminary Endangerment Assessment Guidance Manual. January.

U.S. Environmental Protection Agency. 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim Review Draft - For Public Comment. EPA/540/R/99-005. September.

TABLE D-8
RISK EQUATIONS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation	
Construction Worker Receptor				
Inhalation Exposure Factor - Noncarcinogenic - CW	Inh CW NC Factor	m^3/kg-day	Inh CW NC Factor =	CW IR * CW EF * CW ED / CW BW * CW AT non-carc
Ingestion Exposure Factor - Noncarcinogenic - CW	Ing CW NC Factor	day^{-1}	Ing CW NC Factor =	CW Ing * CF * FI * CW EF *CW ED / CW BW * CW AT non-carc
Soil Dermal Exposure Factor - Noncarcinogenic - CW	Soil Der CW NC Factor	day^{-1}	Soil Der CW NC Factor =	CW SA * CF * SAF * CW EF * CW ED / CW BW * CW AT non-carc
Groundwater Dermal Exposure Factor - Noncarcinogenic - CW	GW Der CW NC Factor	hr-liter/cm-kg-day	GW Der CW NC Factor =	CW SA * WDED *CF * CW EF * CW ED / CW BW * CW AT non-carc
Inhalation Exposure Factor - Carcinogenic - CW	Inh CW C Factor	m^3/kg-day	Inh CW C Factor =	CW IR * CW EF * CW ED / CW BW * CW AT carc
Ingestion Exposure Factor - Carcinogenic - CW	Ing CW C Factor	day^{-1}	Ing CW C Factor =	CW Ing * CF * FI * CW EF *CW ED / CW BW * CW AT carc
Soil Dermal Exposure Factor - Carcinogenic - CW	Soil Der CW C Factor	day^{-1}	Soil Der CW C Factor =	CW SA * CF * SAF * CW EF * CW ED / CW BW * CW AT carc
Groundwater Dermal Exposure Factor - Carcinogenic - CW	GW Der CW C Factor	hr-liter/cm-kg-day	GW Der CW C Factor =	CW SA * WDED *CF * CW EF * CW ED / CW BW * CW AT carc
Inhalation Noncarcinogenic Hazard Quotient - CW	Soil Inh CW HQ	unitless	Inh CW HQ =	Inh CW NC Factor * Air Concentration (Soil, Soil Gas or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - CW	Soil Ing CW HQ	unitless	Ing CW HQ =	Ing CW NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - CW	Soil Der CW HQ	unitless	Soil Der CW HQ =	Soil Der CW NC Factor * DAF * Soil Concentration / RfDo
Groundwater Dermal Noncarcinogenic Hazard Quotient - CW	GW Der CW HQ	unitless	GW Der CW HQ =	GW Der CW NC Factor * Chem-Specific Kp* Groundwater Concentration / RfDo
Noncarcinogenic Hazard Index - CW	**CW HI**	**unitless**	**CW HI =**	**Inh CW HQ + Ing CW HQ + Soil Der CW HQ + GW Der CW for all Chemicals**
Inhalation Carcinogenic Risk - CW	Inh CW RISK	unitless	Inh CW RISK =	Inh CW C Factor * Air Concentration (Soil, Soil Gas or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - CW	Soil Ing CW RISK	unitless	Ing CW RISK =	Soil Ing CW C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - CW	Soil Der CW RISK	unitless	Soil Der CW RISK =	Soil Der CW C factor * DAF * Soil Concentration * CSFo
Groundwater Dermal Noncarcinogenic Risk - CW	GW Der CW Risk	unitless	GW Der CW Risk =	GW Der CW C Factor * Chem-Specific Kp* Groundwater Concentration / CSFo
Carcinogenic Risk - CW	**CW RISK**	**unitless**	**CW RISK =**	**Inh CW Risk + Ing CW Risk + Soil Der CW + GW Der CW Risk for all Chemicals**

TABLE D-8
RISK EQUATIONS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation
Landscape Maintenance Worker			
Inhalation Exposure Factor - Noncarcinogenic - LMW	Inh LMW NC Factor	m^3/kg-day	Inh LMW NC Factor = $\frac{\text{LMW IR * LMW ER * LMW ED}}{\text{LMW BW * LMW AT non-carc}}$
Ingestion Exposure Factor - Noncarcinogenic - LMW	Ing LMW NC Factor	day^{-1}	Ing LMW NC Factor = $\frac{\text{LMW Ing * CF * FI * LMW EF *LMW ED}}{\text{LMW BW * LMW AT non-carc}}$
Soil Dermal Exposure Factor - Noncarcinogenic - LMW	Soil Der LMW NC Factor	day^{-1}	Soil Der LMW NC Factor = $\frac{\text{LMW SA * CF * SAF * LMW EF * LMW ED}}{\text{LMW BW * LMW AT non-carc}}$
Inhalation Exposure Factor - Carcinogenic - LMW	Inh LMW C Factor	m^3/kg-day	Inh LMW C Factor = $\frac{\text{LMW IR * LMW ER * LMW ED}}{\text{LMW BW * LMW AT carc}}$
Ingestion Exposure Factor - Carcinogenic - LMW	Ing LMW C Factor	day^{-1}	Ing LMW C Factor = $\frac{\text{LMW Ing * CF * FI * LMW EF *LMW ED}}{\text{LMW BW * LMW AT carc}}$
Soil Dermal Exposure Factor - Carcinogenic - LMW	Soil Der LMW C Factor	day^{-1}	Soil Der LMW C Factor = $\frac{\text{LMW SA * CF * SAF * LMW EF * LMW ED}}{\text{LMW BW * LMW AT carc}}$
Inhalation Noncarcinogenic Hazard Quotient - LMW	Soil Inh LMW HQ	unitless	Inh LMW HQ = Inh LMW NC Factor * Air Concentration (Soil or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - LMW	Soil Ing LMW HQ	unitless	Ing LMW HQ = Ing LMW NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - LMW	Soil Der LMW HQ	unitless	Soil Der LMW HQ = Soil Der LMW NC Factor * DAF * Soil Concentration / RfDo
Noncarcinogenic Hazard Index - LMW	**LMW HI**	**unitless**	**LMW HI = Inh LMW HQ + Ing LMW HQ + Soil Der LMW HQ for all Chemicals**
Inhalation Carcinogenic Risk - LMW	Inh LMW RISK	unitless	Inh LMW RISK = Inh LMW C Factor * Air Concentration (Soil or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - LMW	Soil Ing LMW RISK	unitless	Ing LMW RISK = Soil Ing LMW C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - LMW	Soil Der LMW RISK	unitless	Soil Der LMW RISK = Soil Der LMW C factor * DAF * Soil Concentration * CSFo
LMW Carcinogenic Risk	**LMW RISK**	**unitless**	**LMW RISK = Inh LMW Risk + Ing LMW Risk + Soil Der LMW Risk for all Chemicals**

TABLE D-8
RISK EQUATIONS
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Risk Calculation Parameter	Acronym	Units	Risk Equation
Park Visitor			
Inhalation Exposure Factor - Noncarcinogenic - PV	Inh PV NC Factor	m^3/kg-day	Inh PV NC Factor = $\frac{\text{PV IR * PV ER * PV ED}}{\text{PV BW * PV AT non-carc}}$
Ingestion Exposure Factor - Noncarcinogenic - PV	Ing PV NC Factor	day^{-1}	Ing PV NC Factor = $\frac{\text{PV Ing * CF * FI * PV EF *PV ED}}{\text{PV BW * PV AT non-carc}}$
Soil Dermal Exposure Factor - Noncarcinogenic - PV	Soil Der PV NC Factor	day^{-1}	Soil Der PV NC Factor = $\frac{\text{PV SA * CF * SAF * PV EF * PV ED}}{\text{PV BW * PV AT non-carc}}$
Inhalation Exposure Factor - Carcinogenic - PV	Inh PV C Factor	m^3/kg-day	Inh PV C Factor = $\frac{\text{PV IR * PV ER * PV ED}}{\text{PV BW * PV AT carc}}$
Ingestion Exposure Factor - Carcinogenic - PV	Ing PV C Factor	day^{-1}	Ing PV C Factor = $\frac{\text{PV Ing * CF * FI * PV EF *PV ED}}{\text{PV BW * PV AT carc}}$
Soil Dermal Exposure Factor - Carcinogenic - PV	Soil Der PV C Factor	day^{-1}	Soil Der PV C Factor = $\frac{\text{PV SA * CF * SAF * PV EF * PV ED}}{\text{PV BW * PV AT carc}}$
Inhalation Noncarcinogenic Hazard Quotient - PV	Soil Inh PV HQ	unitless	Inh PV HQ = Inh PV NC Factor * Air Concentration (Soil or GW-Based) / RfDi
Soil Ingestion Noncarcinogenic Hazard Quotient - PV	Soil Ing PV HQ	unitless	Ing PV HQ = Ing PV NC Factor * Soil Concentration / RfDo
Soil Dermal Noncarcinogenic Hazard Quotient - PV	Soil Der PV HQ	unitless	Soil Der PV HQ = Soil Der PV NC Factor * DAF * Soil Concentration / RfDo
Noncarcinogenic Hazard Index - PV	**PV HI**	**unitless**	**PV HI = Inh PV HQ + Ing PV HQ + Soil Der PV HQ for all Chemicals**
Inhalation Carcinogenic Risk - PV	Inh PV RISK	unitless	Inh PV RISK = Inh PV C Factor * Air Concentration (Soil or GW-Based)* CSFi
Soil Ingestion Carcinogenic Risk - PV	Soil Ing PV RISK	unitless	Ing PV RISK = Soil Ing PV C Factor * Soil Concentration * CSFo
Soil Dermal Carcinogenic Risk - PV	Soil Der PV RISK	unitless	Soil Der PV RISK = Soil Der PV C factor * DAF * Soil Concentration * CSFo
PV Carcinogenic Risk	**PV RISK**	**unitless**	**PV RISK = Inh PV Risk + Ing PV Risk + Soil Der PV Risk for all Chemicals**

Notes:
Ad = Adult
AT = Averaging time
BW = Body weight
CDI = Chronic Daily Intake
CF = Conversion Factor
Ch = Child
CSF = Cancer slope factor
CW = Construction Worker
DAF = Dermal absoption factor
Der = Dermal
ED = Exposure duration
EF = Exposure frequency
FI = Fraction ingested
HI = Hazard Index
HQ = Hazard Quotient
Ing = Ingestion
Inh = Inhalation
IR = Intake rate
Kp = Chemical-Specific Permeability Coefficient
mg/kg-day = millgrams per kilogram-day
RfD = Noncarcinogenic reference dose
SA = Skin surface area
SAF = Skin adherence factor

TABLE D-9
TOXICITY VALUES
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Chemicals	Oral Cancer Slope Factor [1/(mg/kg-day)]	Source Oral Cancer Slope Factor	Inhalation Unit Risk Factor [1/(ug/m^3)]	Inhalation Cancer Slope Factor [1/(mg/kg-day)]	Source Inhalation Unit Risk and Cancer Slope Factors	Chronic Inhalation REL (ug/m^3)	Source Chronic Inhalation REL	Inhalation RfC (mg/m^3)	Inhalation RfD (mg/kg-day)	Source Inhalation RfD and RfC	Oral RfD[a] (mg/kg-day)	Source Oral RfD
Arsenic	1.50E+00	OEHHA	3.30E-03	1.20E+01	OEHHA	--	--	--	--	--	3.00E-04	IRIS
Xylenes	NC	NC	NC	NC	NC	700	Cal EPA	--	2.0E-01	Cal EPA	2.0E+00	IRIS

Notes:

a Oral RfD values used as a surrogate for dermal RfDs

-- Not available
mg/kg-day Milligram per kilogram-day
mg/m^3 Milligram per cubic meter
NC Chemical is not classified as a carcinogen
RfD Reference dose
RfC Reference concentration
ug/m^3 Microgram per cubic meter

References:
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U.S. EPA. 1999. National Center for Environmental Assessment (NCEA). Region 9 Preliminary Remediation Goals (PRGs).
U.S. EPA. 1997. Health Effects Assessment Summary Tables (HEAST). Office of Soild Waste and Emergency Response. FY 1997 Update. July.

TAB[illegible]0
CONSTRUCTION WORKER CALCULATIONS FOR SOIL
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Arsenic	Total
Exposure Parameters					
Soil Concentration	C_s	mg/kg	Chem-Spec	15	
Soil Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	1.1E-08	
Unit conversion factor	CF	kg/mg	1.00E-06	--	
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	
Ingestion Rate - Construction Worker	CW Ing	mg/day	100	--	
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	
Fraction Ingested	FI	Unitless	1	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.03	
Skin adherence factor	SAF	mg/cm^2	0.24	--	
Exposure Frequency - Construction Worker	CW EF	days/year	250	--	
Exposure Duration - Construction Worker	CW ED	years	1	--	
Body Weight - Construction Worker	CW BW	kg	70	--	
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	mg/kg-day	Chem-Spec	2.23E-09	
Ingestion Non-carcinogenic - Construction Worker	Ing CW NC Factor	mg/kg-day	Chem-Spec	1.47E-05	
Dermal Non-carcinogenic - Construction Worker	Der CW NC Factor	mg/kg-day	Chem-Spec	3.34E-06	
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	mg/kg-day	Chem-Spec	3.19E-11	
Ingestion Carcinogenic - Construction Worker	Ing CW C Factor	mg/kg-day	Chem-Spec	2.10E-07	
Dermal Carcinogenic - Construction Worker	Der CW C Factor	mg/kg-day	Chem-Spec	4.77E-08	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	--	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	1.2E+01	
Cancer Slope Factor, Ingestion	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.5E+00	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	1.5E+00	
Noncarcinogenic Hazards					
Soil Inhalation Hazard Quotient - Construction Worker	Inh CW HQ	unitless	Chem-Spec	--	--
Soil Ingestion Hazard Quotient - Construction Worker	Ing CW HQ	unitless	Chem-Spec	0.0489	0.04892
Soil Dermal Hazard Quotient - Construction Worker	Der CW HQ	unitless	Chem-Spec	0.0111	0.01113
Soil Hazard Index - Construction Worker	**Soil CW HI**	unitless	Chem-Spec	**0.1**	**0.06**
Carcinogenic Risk					
Soil Inhalation Carcinogenic Risk - Construction Worker	Inh CW RISK	unitless	Chem-Spec	3.82E-10	3.8E-10
Soil Ingestion Carcinogenic Risk - Construction Worker	Ing CW RISK	unitless	Chem-Spec	3.15E-07	3.1E-07
Soil Dermal Carcinogenic Risk - Construction Worker	Der CW RISK	unitless	Chem-Spec	7.16E-08	7.2E-08
Soil Carcinogenic Risk - Construction Worker	**Soil CW RISK**	unitless	Chem-Spec	3.9E-07	**3.9E-07**

TAB[illegible]1
CONSTRUCTION WORKER CALCULATIONS FOR GROUNDWATER
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Xylenes	Total
Exposure Parameters					
Groundwater Concentration	C_s	mg/L	Chem-Spec	0.026	
Groundwater Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	1.8E-04	
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	0.08	
Groundwater Dermal Exposure Duration - Construction Worker	WDED	hours	0.5	--	
Unit conversion factor	CF	liters/cm^3	1.00E-03	--	
Exposure Frequency - Construction Worker	CW EF	days/year	250	--	
Exposure Duration - Construction Worker	CW ED	years	1	--	
Body Weight - Construction Worker	CW BW	kg	70	--	
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Construction Worker	Inh CW NC Factor	mg/kg-day	Chem-Spec	3.42E-05	
Dermal Non-carcinogenic - Construction Worker	Der CW NC Factor	mg/kg-day	Chem-Spec	4.02E-04	
Inhalation Carcinogenic - Construction Worker	Inh CW C Factor	mg/kg-day	Chem-Spec	4.89E-07	
Dermal Carcinogenic - Construction Worker	Der CW C Factor	mg/kg-day	Chem-Spec	5.74E-06	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	2.00E-01	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	2.00E+00	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	NC	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	(mg/kg-day)$^{-1}$	Chem-Spec	NC	
Noncarcinogenic Hazards					
Groundwater Inhalation Hazard Quotient - Construction Worker	Inh CW HQ	unitless	Chem-Spec	0.0002	0.0002
Groundwater Dermal Hazard Quotient - Construction Worker	Der CW HQ	unitless	Chem-Spec	0.0002	0.0002
Groundwater Hazard Index - Construction Worker	**Groundwater CW HI**	unitless	Chem-Spec	0.0004	**0.0004**
Carcinogenic Risk					
Groundwater Inhalation Carcinogenic Risk - Construction Worker	Inh CW RISK	unitless	Chem-Spec	--	--
Groundwater Dermal Carcinogenic Risk - Construction Worker	Der CW RISK	unitless	Chem-Spec	--	--
Groundwater Carcinogenic Risk - Construction Worker	**Groundwater CW RISK**	unitless	Chem-Spec	--	--

TAB[illegible]2
LANDSCAPE MAINTENANCE WORK CALCULATIONS FOR SOIL
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Arsenic	Total
Exposure Parameters					
Soil Concentration	C_s	mg/kg	Chem-Spec	15	
Soil Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	1.1E-08	
Unit conversion factor	CF	kg/mg	1.00E-06	--	
Inhalation Rate - Landscape Worker	LW IR	m^3/day	20	--	
Ingestion Rate - Landscape Worker	LW Ing	mg/day	100	--	
Skin Surface Area - Landscape Worker	LW SA	cm^2/day	3160	--	
Fraction Ingested	FI	Unitless	1	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.03	
Skin adherence factor	SAF	mg/cm^2	0.2	--	
Exposure Frequency - Landscape Worker	LW EF	days/year	52	--	
Exposure Duration - Landscape Worker	LW ED	years	25	--	
Body Weight - Landscape Worker	LW BW	kg	70	--	
Averaging Time-Non-carcinogenic - Landscape Worker	LW ATnon-carc	days	9125	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Landscape Worker	Inh LW NC Factor	mg/kg-day	Chem-Spec	4.64E-10	
Ingestion Non-carcinogenic - Landscape Worker	Ing LW NC Factor	mg/kg-day	Chem-Spec	3.05E-06	
Dermal Non-carcinogenic - Landscape Worker	Der LW NC Factor	mg/kg-day	Chem-Spec	5.79E-07	
Inhalation Carcinogenic - Landscape Worker	Inh LW C Factor	mg/kg-day	Chem-Spec	1.66E-10	
Ingestion Carcinogenic - Landscape Worker	Ing LW C Factor	mg/kg-day	Chem-Spec	1.09E-06	
Dermal Carcinogenic - Landscape Worker	Der LW C Factor	mg/kg-day	Chem-Spec	2.07E-07	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	--	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.2E+01	
Cancer Slope Factor, Ingestion	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.5E+00	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.5E+00	
Noncarcinogenic Hazards					
Soil Inhalation Hazard Quotient - Landscape Worker	Inh LW HQ	unitless	Chem-Spec	--	--
Soil Ingestion Hazard Quotient - Landscape Worker	Ing LW HQ	unitless	Chem-Spec	0.0102	0.01018
Soil Dermal Hazard Quotient - Landscape Worker	Der LW HQ	unitless	Chem-Spec	0.0019	0.00193
Soil Hazard Index - Landscape Worker	**Soil LW HI**	unitless	Chem-Spec	0.01	**0.01**
Carcinogenic Risk					
Soil Inhalation Carcinogenic Risk - Landscape Worker	Inh LW RISK	unitless	Chem-Spec	1.99E-09	2.0E-09
Soil Ingestion Carcinogenic Risk - Landscape Worker	Ing LW RISK	unitless	Chem-Spec	1.64E-06	1.6E-06
Soil Dermal Carcinogenic Risk - Landscape Worker	Der LW RISK	unitless	Chem-Spec	3.10E-07	3.1E-07
Soil Carcinogenic Risk - Landscape Worker	**Soil LW RISK**	unitless	Chem-Spec	1.9E-06	**1.9E-06**

TAB[illegible]-13
LANDSCAPE MAINTENANCE WORK CALCULATIONS FOR GROUNDWATER
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Xylenes	Total
Exposure Parameters					
Groundwater Concentration	C_s	mg/L	Chem-Spec	0.026	
Groundwater Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	4.7E-07	
Inhalation Rate - Landscape Worker	LW IR	m^3/day	20	--	
Exposure Frequency - Landscape Worker	LW EF	days/year	52	--	
Exposure Duration - Landscape Worker	LW ED	years	25	--	
Body Weight - Landscape Worker	LW BW	kg	70	--	
Averaging Time-Non-carcinogenic - Landscape Worker	LW ATnon-carc	days	9125	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Landscape Worker	Inh LW NC Factor	mg/kg-day	Chem-Spec	1.90E-08	
Inhalation Carcinogenic - Landscape Worker	Inh LW C Factor	mg/kg-day	Chem-Spec	6.77E-09	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	2.00E-01	
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	NC	
Noncarcinogenic Hazards					
Groundwater Inhalation Hazard Quotient - Landscape Worker	Inh LW HQ	unitless	Chem-Spec	0.00000009	0.00000009
Groundwater Hazard Index - Landscape Worker	**Groundwater LW HI**	unitless	Chem-Spec	0.00000009	**0.00000009**
Carcinogenic Risk					
Groundwater Inhalation Carcinogenic Risk - Landscape Worker	Inh LW RISK	unitless	Chem-Spec	--	--
Groundwater Carcinogenic Risk - Landscape Worker	**Groundwater LW RISK**	unitless	Chem-Spec	--	--

TAB[illegible]14
PARK VISITOR CALCULATIONS FOR SOIL
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Arsenic	Total
Exposure Parameters					
Soil Concentration	C_s	mg/kg	Chem-Spec	15	
Soil Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	1.1E-08	
Unit conversion factor	CF	kg/mg	1.00E-06	--	
Inhalation Rate - Park Visitor	PV IR	m^3/day	20	--	
Ingestion Rate - Park Visitor	PV Ing	mg/day	100	--	
Skin Surface Area - Park Visitor	PV SA	cm^2/day	3160	--	
Fraction Ingested	FI	Unitless	1	--	
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.03	
Skin adherence factor	SAF	mg/cm^2	0.2	--	
Exposure Frequency - Park Visitor	PV EF	days/year	12	--	
Exposure Duration - Park Visitor	PV ED	years	25	--	
Body Weight - Park Visitor	PV BW	kg	70	--	
Averaging Time-Non-carcinogenic - Park Visitor	PV ATnon-carc	days	9125	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Park Visitor	Inh PV NC Factor	mg/kg-day	Chem-Spec	1.07E-10	
Ingestion Non-carcinogenic - Park Visitor	Ing PV NC Factor	mg/kg-day	Chem-Spec	7.05E-07	
Dermal Non-carcinogenic - Park Visitor	Der PV NC Factor	mg/kg-day	Chem-Spec	1.34E-07	
Inhalation Carcinogenic - Park Visitor	Inh PV C Factor	mg/kg-day	Chem-Spec	3.82E-11	
Ingestion Carcinogenic - Park Visitor	Ing PV C Factor	mg/kg-day	Chem-Spec	2.52E-07	
Dermal Carcinogenic - Park Visitor	Der PV C Factor	mg/kg-day	Chem-Spec	4.77E-08	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	--	
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E-04	
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.2E+01	
Cancer Slope Factor, Ingestion	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.5E+00	
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.5E+00	
Noncarcinogenic Hazards					
Soil Inhalation Hazard Quotient - Park Visitor	Inh PV HQ	unitless	Chem-Spec	--	--
Soil Ingestion Hazard Quotient - Park Visitor	Ing PV HQ	unitless	Chem-Spec	0.002	0.002
Soil Dermal Hazard Quotient - Park Visitor	Der PV HQ	unitless	Chem-Spec	0.0004	0.0004
Soil Hazard Index - Park Visitor	**Soil PV HI**	unitless	Chem-Spec	0.003	**0.003**
Carcinogenic Risk					
Soil Inhalation Carcinogenic Risk - Park Visitor	Inh PV RISK	unitless	Chem-Spec	4.59E-10	4.6E-10
Soil Ingestion Carcinogenic Risk - Park Visitor	Ing PV RISK	unitless	Chem-Spec	3.77E-07	3.8E-07
Soil Dermal Carcinogenic Risk - Park Visitor	Der PV RISK	unitless	Chem-Spec	7.16E-08	7.2E-08
Soil Carcinogenic Risk - Park Visitor	**Soil PV RISK**	unitless	Chem-Spec	4.5E-07	**4.5E-07**

TABLE D-15
PARK VISITOR CALCULATIONS FOR GROUNDWATER
PARK PARCEL
1521 BUENA VISTA AVENUE, ALAMEDA, CALIFORNIA

Variables	Acronym	Units	Values	Xylenes	Total
Exposure Parameters					
Groundwater Concentration	C_s	mg/L	Chem-Spec	0.026	
Groundwater Predicted Outdoor Air Concentration	C_a	mg/m^3	Chem-Spec	4.7E-07	
Inhalation Rate - Park Visitor	PV IR	m^3/day	20	--	
Exposure Frequency - Park Visitor	PV EF	days/year	12	--	
Exposure Duration - Park Visitor	PV ED	years	25	--	
Body Weight - Park Visitor	PV BW	kg	70	--	
Averaging Time-Non-carcinogenic - Park Visitor	PV ATnon-carc	days	9125	--	
Averaging Time-Carcinogenic	AT_{carc}	days	25550	--	
Chronic Daily Intakes					
Inhalation Non-carcinogenic - Park Visitor	Inh PV NC Factor	mg/kg-day	Chem-Spec	4.38E-09	
Inhalation Carcinogenic - Park Visitor	Inh PV C Factor	mg/kg-day	Chem-Spec	1.56E-09	
Toxicity Criteria					
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	2.00E-01	
Cancer Slope Factor, Inhalation	CSF_{inh}	(mg/kg-day)$^{-1}$	Chem-Spec	NC	
Noncarcinogenic Hazards					
Groundwater Inhalation Hazard Quotient - Park Visitor	Inh PV HQ	unitless	Chem-Spec	0.00000002	0.00000002
Groundwater Hazard Index - Park Visitor	**Groundwater PV HI**	unitless	Chem-Spec	0.00000002	**0.00000002**
Carcinogenic Risk					
Groundwater Inhalation Carcinogenic Risk - Park Visitor	Inh PV RISK	unitless	Chem-Spec	--	--
Groundwater Carcinogenic Risk - Park Visitor	**Groundwater PV RISK**	unitless	Chem-Spec	--	--

Appendix E
Results of Indoor Air (Johnson & Ettinger) Modeling: Marina Cove Subdivision and Park Parcel

TAB[illegible]-1
PARAMETERS USED IN JOHNSON AND ETTINGER MODEL
MARINA COVE SUBDIVISION
1801 HIBBARD STREET, ALAMEDA, CALIFORNIA

Model Parameter	Acronym	Soil	Groundwater	Units	Source
Depth below grade to bottom of enclosed space floor	L_F	15	15	cm	Site-specific
Depth below grade to top of contamination (soil)	L_t	91.44	–	cm	Site-specific
Depth below grade to water table (groundwater)	L_{WT}	182.88	–	cm	Site-specific
Average soil temperature (soil)	T_s	20	--	°C	Site-specific
Average groundwater temperature (groundwater)	T_s	15	–	°C	Site-specific
Vadose zone SCS soil type	--	SCL	SCL	–	Site-specific
Vadose zone soil dry bulk density	ρ_b^A	1.7	1.7	g/cm^3	Site-specific
Vadose zone soil total porosity	n^v	0.38	0.38	–	Site-specific
Vadose zone soil water-filled porosity	θ_w^v	0.12	0.12	cm^3/cm^3	Site-specific
Vadoze zone soil organic carbon fraction (soil)	$f_{oc}v$	0.002	--	--	Site-specific
Building ventilation rate for a residential building	$Q_{Bldg\text{-}r}$	2.50E+05	2.50E+05	cm^3/second	City of Oakland, 1999; RWQCB, 2001
Averaging time for carcinogens	AT_C	70	70	years	Site-specific
Averaging time for noncarcinogens	AT_{NC}	30	30	years	Site-specific
Exposure duration	ED	30	30	years	Site-specific
Exposure frequency	EF	350	350	days/year	Site-specific
Target risk for carcinogens	TR	1.0E-06	1.0E-06	--	Site-specific
Target hazard quotient for noncarcinogens	THQ	1	1	--	Site-specific

Notes:

°C = Degree celcius

cm = Centimeter

cm^3/cm^3 = Cubic centimeter per cubic centimeter

cm^3/second = Cubic centimeter per second

g/cm^3 = Gram per cubic centimeter

References:

City of Oakland. 1999. Oakland Risk-Based Corrective Action: Technical Guidance Document. May 15.

Regional Water Quality Control Board (RWQCB). 2001. Application of Risk-Based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater. San Francisco Bay Region. Interim Final. December.

Benzene in Soil
Residential Receptor

Benzene in Soil
Residential Receptor
Maximum Concentration

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

SL-SCREEN
Version 2.3; 03/01

YES		

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES	X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
71432	5.60E+02	Benzene

	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vadose zone soil vapor permeability, k_v (cm²)
MORE ↓	15	91.44	20	SCL	OR	

	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
MORE ↓	1.7	0.38	0.12	0.002

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
MORE ↓	70	30	30	350	1.0E-06	1
END					Used to calculate risk-based soil concentration.	

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00	L

END

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Floor-wall seam perimeter,	Initial soil concentration used,	Bldg. ventilation rate,		
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	X_{crack}	C_R	$Q_{building}$		
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(μg/kg)	(cm^3/s)		
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	5.60E+02	2.50E+05		
Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. soil temperature,	Henry's law constant at ave. soil temperature,	Henry's law constant at ave. soil temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Diffusion path length,		
A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	L_d		
(cm^2)	(unitless)	(cm)	(cal/mol)	(atm-m^3/mol)	(unitless)	(g/cm-s)	(cm^2/s)	(cm)		
9.24E+05	4.16E-04	15	8,019	4.41E-03	1.83E-01	1.78E-04	6.87E-03	76.44		
Convection path length,	Soil-water partition coefficient,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	
L_p	K_d	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	exp(Pe^f)	α	$C_{building}$	
(cm)	(cm^3/g)	(μg/m^3)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	(μg/m^3)	
15	1.18E-01	4.75E+05	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	6.98E-06	3.31E+00	
Unit risk factor, URF	Reference conc., RfC									
(μg/m^3)$^{-1}$	(mg/m^3)									
7.8E-06	NA									
END										

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	3.79E+05	NA		1.1E-05	NA	
	MESSAGE SUMMARY BELOW:								
END									

Benzene in Soil
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)					SL-SCREEN	
						Version 2.3; 03/01	
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)						
		YES	X				
	ENTER	ENTER					
	Chemical CAS No. (numbers only, no dashes)	Initial soil conc., C_R (µg/kg)	Chemical				
	71432	5.32E+01	Benzene				
	ENTER	ENTER	ENTER	ENTER		ENTER	
MORE ↓	Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	Depth below grade to top of contamination, L_t (cm)	Average soil temperature, T_S (°C)	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm²)	
	15	91.44	20	SCL			
	ENTER	ENTER	ENTER	ENTER			
MORE ↓	Vadose zone soil dry bulk density, ρ_b^A (g/cm³)	Vadose zone soil total porosity, n^V (unitless)	Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)			
	1.7	0.38	0.12	0.002			
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	
MORE ↓	Averaging time for carcinogens, AT_C (yrs)	Averaging time for noncarcinogens, AT_{NC} (yrs)	Exposure duration, ED (yrs)	Exposure frequency, EF (days/yr)	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)	
	70	30	30	350	1.0E-06	1	
					Used to calculate risk-based soil concentration.		
END							

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00	L

END

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	5.32E+01	2.50E+05	

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)	
9.24E+05	4.16E-04	15	8,019	4.41E-03	1.83E-01	1.78E-04	6.87E-03	76.44	

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	1.18E-01	4.51E+04	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	6.98E-06	3.15E-01

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.8E-06	NA
END	

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	3.79E+05	NA		1.0E-06	NA	
	MESSAGE SUMMARY BELOW:								
END									

Naphthalene in Soil
Residential Receptor

Naphthalene in Soil
Residential Receptor
Maximum Concentration

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box) — SL-SCREEN Version 2.3; 03/01

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
91203	3.50E+04	Naphthalene

MORE ↓	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm²)
	15	91.44	20	SCL		

MORE ↓	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
	1.7	0.38	0.12	0.002

MORE ↓	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
	70	30	30	350	1.0E-06	1
END					Used to calculate risk-based soil concentration.	

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
5.90E-02	7.50E-06	4.83E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	3.0E-03	S

END

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	3.60E+04	2.50E+05	

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)	
9.24E+05	4.16E-04	15	12,809	3.34E-04	1.39E-02	1.78E-04	4.61E-03	76.44	

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	4.00E+00	1.19E+05	0.10	1.78E+00	4.61E-03	3.84E+02	3.62E+06	6.90E-06	8.24E-01

Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.0E-03

END

RESULTS [illegible]halene

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.26E+05	NA		NA	2.6E-01	
	MESSAGE SUMMARY BELOW:								
END									

Naphthalene in Soil
Residential Receptor
95 UCL Concentration

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

SL-SCREEN
Version 2.3; 03/01

YES	

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES	X

ENTER	ENTER	
Chemical CAS No. (numbers only, no dashes)	Initial soil conc., C_R (µg/kg)	Chemical
91203	5.64E+03	Naphthalene

	ENTER	ENTER	ENTER	ENTER		ENTER
MORE ↓	Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	Depth below grade to top of contamination, L_t (cm)	Average soil temperature, T_S (°C)	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm^2)
	15	91.44	20	SCL		

	ENTER	ENTER	ENTER	ENTER
MORE ↓	Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	Vadose zone soil total porosity, n^V (unitless)	Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
	1.7	0.38	0.12	0.002

	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE ↓	Averaging time for carcinogens, AT_C (yrs)	Averaging time for noncarcinogens, AT_{NC} (yrs)	Exposure duration, ED (yrs)	Exposure frequency, EF (days/yr)	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)
	70	30	30	350	1.0E-06	1
END					Used to calculate risk-based soil concentration.	

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
5.90E-02	7.50E-06	4.83E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	3.0E-03	S

END

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	5.64E+03	2.50E+05	

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)	
9.24E+05	4.16E-04	15	12,809	3.34E-04	1.39E-02	1.78E-04	4.61E-03	76.44	

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	4.00E+00	1.92E+04	0.10	1.78E+00	4.61E-03	3.84E+02	3.62E+06	6.90E-06	1.33E-01

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.0E-03

END

RESULTS [illegible]halene

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.26E+05	NA		NA	4.2E-02	
	MESSAGE SUMMARY BELOW:								
END									

Xylenes in Soil
Residential Receptor

Xylenes in Soil
Residential Receptor
Maximum Concentration

	CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)					SL-SCREEN	
						Version 2.3; 03/01	
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)						
		YES	X				

	ENTER	ENTER		
	Chemical CAS No. (numbers only, no dashes)	Initial soil conc., C_R (μg/kg)	Chemical	
	95476	8.50E+03	o-Xylene	

	ENTER	ENTER	ENTER	ENTER		ENTER
MORE ↓	Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	Depth below grade to top of contamination, L_t (cm)	Average soil temperature, T_S (°C)	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm^2)
	15	91.44	20	SCL		

	ENTER	ENTER	ENTER	ENTER
MORE ↓	Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	Vadose zone soil total porosity, n^V (unitless)	Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
	1.7	0.38	0.12	0.002

	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE ↓	Averaging time for carcinogens, AT_C (yrs)	Averaging time for noncarcinogens, AT_{NC} (yrs)	Exposure duration, ED (yrs)	Exposure frequency, EF (days/yr)	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)
	70	30	30	350	1.0E-06	1
END					Used to calculate risk-based soil concentration.	

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.70E-02	1.00E-05	5.20E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E+00	L

END

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	8.50E+03	2.50E+05	
Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)	
9.24E+05	4.16E-04	15	10,291	3.87E-03	1.61E-01	1.78E-04	6.79E-03	76.44	
Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	7.26E-01	1.66E+06	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	6.97E-06	1.16E+01
Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)								
NA	7.0E+00								
END									

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.46E+05	NA		NA	1.6E-03	
	MESSAGE SUMMARY BELOW:								
	MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.								
END									

Xylenes in Soil
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)					SL-SCREEN	
						Version 2.3; 03/01	
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)						
		YES	X				
	ENTER	**ENTER**					
	Chemical CAS No. (numbers only, no dashes)	Initial soil conc., C_R (μg/kg)	Chemical				
	95476	6.96E+02	o-Xylene				

	ENTER	**ENTER**	**ENTER**	**ENTER**		**ENTER**	
MORE ↓	Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	Depth below grade to top of contamination, L_t (cm)	Average soil temperature, T_S (°C)	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm^2)	
	15	91.44	20	SCL			

	ENTER	**ENTER**	**ENTER**	**ENTER**			
MORE ↓	Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	Vadose zone soil total porosity, n^V (unitless)	Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)			
	1.7	0.38	0.12	0.002			

	ENTER	**ENTER**	**ENTER**	**ENTER**	**ENTER**	**ENTER**	
MORE ↓	Averaging time for carcinogens, AT_C (yrs)	Averaging time for noncarcinogens, AT_{NC} (yrs)	Exposure duration, ED (yrs)	Exposure frequency, EF (days/yr)	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)	
	70	30	30	350	1.0E-06	1	
END					Used to calculate risk-based soil concentration.		

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.70E-02	1.00E-05	5.20E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E+00	L

END

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Floor-wall seam perimeter,	Initial soil concentration used,	Bldg. ventilation rate,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	X_{crack}	C_R	$Q_{building}$	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(µg/kg)	(cm^3/s)	
76.44	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	6.96E+02	2.50E+05	
Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. soil temperature,	Henry's law constant at ave. soil temperature,	Henry's law constant at ave. soil temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Diffusion path length,	
A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	L_d	
(cm^2)	(unitless)	(cm)	(cal/mol)	(atm-m^3/mol)	(unitless)	(g/cm-s)	(cm^2/s)	(cm)	
9.24E+05	4.16E-04	15	10,291	3.87E-03	1.61E-01	1.78E-04	6.79E-03	76.44	
Convection path length,	Soil-water partition coefficient,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,
L_p	K_d	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	$\exp(Pe^f)$	α	$C_{building}$
(cm)	(cm^3/g)	(µg/m^3)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	(µg/m^3)
15	7.26E-01	1.36E+05	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	6.97E-06	9.50E-01
Unit risk factor, URF	Reference conc., RfC								
$(\mu g/m^3)^{-1}$	(mg/m^3)								
NA	7.0E+00								
END									

	RISK-BASED SOIL CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.46E+05	NA		NA	1.3E-04	
	MESSAGE SUMMARY BELOW:								
	MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.								
END									

Benzene in Groundwater
Residential Receptor

Benzene in Groundwater
Residential Receptor
Maximum Concentration

							GW-SCREEN Version 2.3; 03/01
	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical	
	71432	9.90E+03	Benzene	

MORE ↓	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
	15	182.88	SCL	15

MORE ↓	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	SCL			1.7	0.38	0.12

MORE ↓	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
	1.0E-06	1	70	30	30	350
	Used to calculate risk-based groundwater concentration.					
END						

CHEMPRO[illegible]nzene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00	
END											

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor-wall seam perimeter,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	L_{cz}	n_{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X_{crack}	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	
Bldg. ventilation rate,	Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	
$Q_{building}$	A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	D^{eff}_{cz}	D^{eff}_T	
(cm^3/s)	(cm^2)	(unitless)	(cm)	(cal/mol)	(atm-m^3/mol)	(unitless)	(g/cm-s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	8,071	3.47E-03	1.47E-01	1.77E-04	6.87E-03	3.45E-05	2.18E-04	
Diffusion path length,	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,
L_d	L_p	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	$exp(Pe^f)$	α	$C_{building}$	URF	RfC
(cm)	(cm)	($\mu g/m^3$)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	($\mu g/m^3$)	$(\mu g/m^3)^{-1}$	(mg/m^3)
167.88	15	1.45E+06	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	2.87E-06	4.16E+00	7.8E-06	NA

RESULT zene

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.75E+06	NA		1.3E-05	NA	
	MESSAGE SUMMARY BELOW:								
END									

Benzene in Groundwater
Residential Receptor
95 UCL Concentration

GW-SCREEN
Version 2.3; 03/01

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES	

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES	X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
71432	7.23E+02	Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	105.76	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	OR				
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

CHEMPRO[illegible]nzene

Diffusivity in air, D_a (cm²/s)	Diffusivity in water, D_w (cm²/s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm³/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (μg/m³)⁻¹	Reference conc., RfC (mg/m³)	
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	8,071	3.47E-03	1.47E-01	1.77E-04	6.87E-03	3.45E-05	1.20E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
90.76	15	1.06E+05	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	2.89E-06	3.06E-01	7.8E-06	NA

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.75E+06	NA		9.8E-07	NA	
	MESSAGE SUMMARY BELOW:								
END									

1,1-DCA in Groundwater
Residential Receptor

1,1-DCA in Groundwater
Residential Receptor
Maximum Concentration

GW-SCREEN
Version 2.3; 03/01

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	1.30E+02	1,1-Dichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	182.88	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	0.0E+00	5.0E-01	
END											

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor-wall seam perimeter,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	L_{cz}	n_{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X_{crack}	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	
Bldg. ventilation rate,	Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	
$Q_{building}$	A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	D^{eff}_{cz}	D^{eff}_T	
(cm^3/s)	(cm^2)	(unitless)	(cm)	(cal/mol)	($atm\text{-}m^3/mol$)	(unitless)	(g/cm-s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	7,395	3.64E-03	1.54E-01	1.77E-04	5.79E-03	3.12E-05	1.97E-04	
Diffusion path length,	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,
L_d	L_p	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	$\exp(Pe^f)$	α	$C_{building}$	URF	RfC
(cm)	(cm)	($\mu g/m^3$)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	($\mu g/m^3$)	($(\mu g/m^3)^{-1}$)	(mg/m^3)
167.88	15	2.00E+04	0.10	1.78E+00	5.79E-03	3.84E+02	1.65E+05	2.69E-06	5.39E-02	NA	5.0E-01

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	5.06E+06	NA		NA	1.0E-04	
	MESSAGE SUMMARY BELOW:								
END									

1,1-DCA in Groundwater
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN
							Version 2.3; 03/01
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	1.96E+01	1,1-Dichloroethane

	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
MORE ↓	15	105.76	SCL	15

	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
MORE ↓		OR				
	SCL			1.7	0.38	0.12

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
MORE ↓	1.0E-06	1	70	30	30	350
	Used to calculate risk-based groundwater concentration.					
END						

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	0.0E+00	5.0E-01
END										

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	7,395	3.64E-03	1.54E-01	1.77E-04	5.79E-03	3.12E-05	1.08E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
90.76	15	3.01E+03	0.10	1.78E+00	5.79E-03	3.84E+02	1.65E+05	2.72E-06	8.19E-03	NA	5.0E-01

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	5.06E+06	NA		NA	1.6E-05	
	MESSAGE SUMMARY BELOW:								
END									

Ethylbenzene in Groundwater
Residential Receptor

Ethylbenzene in Groundwater
Residential Receptor
Maximum Concentration

	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN
							Version 2.3; 03/01
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				
	ENTER	ENTER					
	Chemical CAS No. (numbers only, no dashes)	Initial groundwater conc., C_W (µg/L)	Chemical				
	100414	1.60E+03	Ethylbenzene				
	ENTER	ENTER	ENTER	ENTER			
MORE ↓	Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	Depth below grade to water table, L_{WT} (cm)	SCS soil type directly above water table	Average soil/ groundwater temperature, T_S (°C)			
	15	182.88	SCL	15			
MORE ↓							
	ENTER		ENTER	ENTER	ENTER	ENTER	
	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm²)	Vadose zone soil dry bulk density, ρ_b^V (g/cm³)	Vadose zone soil total porosity, n^V (unitless)	Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	
	SCL			1.7	0.38	0.12	
MORE ↓	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	
	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)	Averaging time for carcinogens, AT_C (yrs)	Averaging time for noncarcinogens, AT_{NC} (yrs)	Exposure duration, ED (yrs)	Exposure frequency, EF (days/yr)	
	1.0E-06	1	70	30	30	350	
	Used to calculate risk-based groundwater concentration.						
END							

		Henry's law constant	Henry's law constant	Enthalpy of vaporization at	Normal		Organic carbon	Pure component	Unit		
Diffusivity in air,	Diffusivity in water,	at reference temperature,	reference temperature,	the normal boiling point,	boiling point,	Critical temperature,	partition coefficient,	water solubility,	risk factor,	Reference conc.,	
D_a	D_w	H	T_R	$\Delta H_{v,b}$	T_B	T_C	K_{oc}	S	URF	RfC	
(cm^2/s)	(cm^2/s)	($atm\text{-}m^3/mol$)	(°C)	(cal/mol)	(°K)	(°K)	(cm^3/g)	(mg/L)	($(\mu g/m^3)^{-1}$)	(mg/m^3)	
7.50E-02	7.80E-06	7.88E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	0.0E+00	1.0E+00	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	10,098	4.36E-03	1.84E-01	1.77E-04	5.85E-03	2.68E-05	1.70E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
167.88	15	2.95E+05	0.10	1.78E+00	5.85E-03	3.84E+02	1.45E+05	2.45E-06	7.23E-01	NA	1.0E+00

RESULTS E[illegible]nzene

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.69E+05	NA		NA	6.9E-04	
	MESSAGE SUMMARY BELOW:								
END									

Ethylbenzene in Groundwater
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN Version 2.3; 03/01
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	1.25E+02	Ethylbenzene

	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
MORE ↓	15	105.76	SCL	15

	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
MORE ↓	SCL			1.7	0.38	0.12

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
MORE ↓	1.0E-06	1	70	30	30	350
	Used to calculate risk-based groundwater concentration.					
END						

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	
7.50E-02	7.80E-06	7.88E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	0.0E+00	1.0E+00	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	10,098	4.36E-03	1.84E-01	1.77E-04	5.85E-03	2.68E-05	9.30E-05	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
90.76	15	2.31E+04	0.10	1.78E+00	5.85E-03	3.84E+02	1.45E+05	2.47E-06	5.72E-02	NA	1.0E+00

RESULTS E[illegible]nzene

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.69E+05	NA		NA	5.5E-05	
	MESSAGE SUMMARY BELOW:								
END									

Naphthalene in Groundwater
Residential Receptor

Naphthalene in Groundwater
Residential Receptor
Maximum Concentration

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN Version 2.3; 03/01
	YES					
		OR				
CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
	YES	X				

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
91203	4.30E+02	Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	182.88	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	
5.90E-02	7.50E-06	4.83E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	3.0E-03	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	12,861	2.27E-04	9.62E-03	1.77E-04	4.61E-03	1.54E-04	8.46E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
167.88	15	4.14E+03	0.10	1.78E+00	4.61E-03	3.84E+02	3.60E+06	5.15E-06	2.13E-02	NA	3.0E-03

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	3.10E+04	NA		NA	6.8E-03	
	MESSAGE SUMMARY BELOW:								
END									

Naphthalene in Groundwater
Residential Receptor
95 UCL Concentration

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
91203	1.15E+02	Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	105.76	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	OR				
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	
5.90E-02	7.50E-06	4.83E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	3.0E-03	
END											

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor-wall seam perimeter,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	L_{cz}	n_{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X_{crack}	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	
Bldg. ventilation rate,	Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	
$Q_{building}$	A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	D^{eff}_{cz}	D^{eff}_T	
(cm^3/s)	(cm^2)	(unitless)	(cm)	(cal/mol)	(atm-m^3/mol)	(unitless)	(g/cm-s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	12,861	2.27E-04	9.62E-03	1.77E-04	4.61E-03	1.54E-04	5.00E-04	
Diffusion path length,	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,
L_d	L_p	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	exp(Pe^f)	α	$C_{building}$	URF	RfC
(cm)	(cm)	($\mu g/m^3$)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	($\mu g/m^3$)	($\mu g/m^3$)$^{-1}$	(mg/m^3)
90.76	15	1.11E+03	0.10	1.78E+00	4.61E-03	3.84E+02	3.60E+06	5.28E-06	5.84E-03	NA	3.0E-03

RESULTS F[illegible]alene

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	3.10E+04	NA		NA	1.9E-03	
	MESSAGE SUMMARY BELOW:								
END									

Toluene in Groundwater
Residential Receptor

Toluene in Groundwater
Residential Receptor
Maximum Concentration

GW-SCREEN
Version 2.3; 03/01

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108883	3.00E+03	Toluene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	182.88	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm²)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

CHEMPRO[illegible]luene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	
8.70E-02	8.60E-06	6.63E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	4.0E-01	
END											

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor-wall seam perimeter,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	L_{cz}	n_{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X_{crack}	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	
Bldg. ventilation rate,	Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	
$Q_{building}$	A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	D^{eff}_{cz}	D^{eff}_T	
(cm^3/s)	(cm^2)	(unitless)	(cm)	(cal/mol)	($atm\text{-}m^3/mol$)	(unitless)	(g/cm-s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	9,100	3.89E-03	1.65E-01	1.77E-04	6.79E-03	3.17E-05	2.00E-04	
Diffusion path length,	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,
L_d	L_p	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	$exp(Pe^f)$	α	$C_{building}$	URF	RfC
(cm)	(cm)	($\mu g/m^3$)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	($\mu g/m^3$)	$(\mu g/m^3)^{-1}$	(mg/m^3)
167.88	15	4.94E+05	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	2.72E-06	1.34E+00	NA	4.0E-01

RESULT[illegible]ene

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	5.26E+05	NA		NA	3.2E-03	
	MESSAGE SUMMARY BELOW:								
END									

Toluene in Groundwater
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN
							Version 2.3; 03/01
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
108883	1.67E+02	Toluene

MORE ↓	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
	15	105.76	SCL	15

MORE ↓	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm²)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)
	SCL			1.7	0.38	0.12

MORE ↓	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
	1.0E-06	1	70	30	30	350
	Used to calculate risk-based groundwater concentration.					
END						

Diffusivity in air, D_a (cm²/s)	Diffusivity in water, D_w (cm²/s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm³/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)	
8.70E-02	8.60E-06	6.63E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	4.0E-01	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm³/cm³)	Vadose zone effective total fluid saturation, S_{te} (cm³/cm³)	Vadose zone soil intrinsic permeability, k_i (cm²)	Vadose zone soil relative air permeability, k_{rg} (cm²)	Vadose zone soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	
2.50E+05	9.24E+05	4.16E-04	15	9,100	3.89E-03	1.65E-01	1.77E-04	6.79E-03	3.17E-05	1.10E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m³)	Unit risk factor, URF (μg/m³)⁻¹	Reference conc., RfC (mg/m³)
90.76	15	2.75E+04	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	2.75E-06	7.56E-02	NA	4.0E-01

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	5.26E+05	NA		NA	1.8E-04	
	MESSAGE SUMMARY BELOW:								
END									

Xylenes in Groundwater
Residential Receptor

Xylenes in Groundwater
Residential Receptor
Maximum Concentration

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES |

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES | X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
95476	3.00E+00	o-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	182.88	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

CHEMPRO[illegible]enes

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)	
8.70E-02	1.00E-05	5.20E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E+00	
END											

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)	
167.88	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	10,348	2.84E-03	1.20E-01	1.77E-04	6.79E-03	3.72E-05	2.35E-04	

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
167.88	15	3.60E+02	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	2.99E-06	1.08E-03	NA	7.0E+00

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.78E+05	NA		NA	1.5E-07	
	MESSAGE SUMMARY BELOW:								
	MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.								
END									

Xylenes in Groundwater
Residential Receptor
95 UCL Concentration

	CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)						GW-SCREEN
							Version 2.3; 03/01
		YES					
			OR				
	CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)						
		YES	X				

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
	95476	4.14E+02	o-Xylene

	ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
MORE ↓	15	105.76	SCL	15

	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm²)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)
MORE ↓	SCL			1.7	0.38	0.12

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
MORE ↓	1.0E-06	1	70	30	30	350
	Used to calculate risk-based groundwater concentration.					
END						

CHEMPRO[illegible]enes

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	
8.70E-02	1.00E-05	5.20E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E+00	
END											

Source-building separation,	Vadose zone soil air-filled porosity,	Vadose zone effective total fluid saturation,	Vadose zone soil intrinsic permeability,	Vadose zone soil relative air permeability,	Vadose zone soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor-wall seam perimeter,	
L_T	θ_a^V	S_{te}	k_i	k_{rg}	k_v	L_{cz}	n_{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X_{crack}	
(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^2)	(cm^2)	(cm^2)	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm)	
90.76	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844	

Bldg. ventilation rate,	Area of enclosed space below grade,	Crack-to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Vadose zone effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	
$Q_{building}$	A_B	η	Z_{crack}	$\Delta H_{v,TS}$	H_{TS}	H'_{TS}	μ_{TS}	D^{eff}_V	D^{eff}_{cz}	D^{eff}_T	
(cm^3/s)	(cm^2)	(unitless)	(cm)	(cal/mol)	($atm\text{-}m^3/mol$)	(unitless)	(g/cm-s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	
2.50E+05	9.24E+05	4.16E-04	15	10,348	2.84E-03	1.20E-01	1.77E-04	6.79E-03	3.72E-05	1.29E-04	

Diffusion path length,	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,
L_d	L_p	C_{source}	r_{crack}	Q_{soil}	D^{crack}	A_{crack}	$\exp(Pe^f)$	α	$C_{building}$	URF	RfC
(cm)	(cm)	($\mu g/m^3$)	(cm)	(cm^3/s)	(cm^2/s)	(cm^2)	(unitless)	(unitless)	($\mu g/m^3$)	($\mu g/m^3)^{-1}$	(mg/m^3)
90.76	15	4.96E+04	0.10	1.78E+00	6.79E-03	3.84E+02	2.82E+04	3.02E-06	1.50E-01	NA	7.0E+00

	RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:						INCREMENTAL RISK CALCULATIONS:		
	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
	NA	NA	NA	1.78E+05	NA		NA	2.1E-05	
	MESSAGE SUMMARY BELOW:								
	MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.								
END									

Appendix F
Results of LeadSpread (Version 7) Modeling: Marina Cove Subdivision and Park Parcel

TABLE F

PARAMETERS USED IN THE LEADSPREAD MODEL
MARINA COVE SUBDIVISION AND PARK PARCEL
ALAMEDA, CALIFORNIA

Parameter	Adult Residential (MCS)	Child Residential (MCS)	Construction Worker (MCS and Park Parcel)	Landscape Worker (Park Parcel)
Lead in Air (μg/m3)[a]	0.005	0.005	0.005	0.005
Lead Conc. in Water (μg/L)[b]	8	8	8	8
Dust Conc. in Air (μg/m^3)	1.5	1.5	1,000[c]	1,000[c]
Exposure Frequency (days per week)	7	7	5	5
Skin Area (cm^2)	5700	2900	3160	2900
Soil Adherence (μg/cm^2)	70	200	240	200
Dermal Uptake Constant ([μg/dL]/[μg/day])	0.00011	0.00011	0.00011	0.00011
Soil Ingestion Rate (mg/day)	50	100	100	100
Soil Ingestion Rate, Pica (mg/day)	--	200	--	--
Ingestion Constant ([μg/dL]/[μg/day])	0.04	0.16	0.04	0.04
Bioavailability (unitless)	0.44	0.44	0.44	0.44
Breathing Rate (m^3/day)	20	6.8	20	20
Inhalation Constant ([μg/dL]/[μg/day])	0.082	0.192	0.082	0.082
Water Ingestion Rate (L/day)	1.4	0.4	1.4	1.4
Food Ingestion Rate (kg/day)	1.9	1.1	1.9	1.9
Lead in Market Basket (μg/kg)	3.1	3.1	3.1	3.1

[a] Lead in air concentration taken from California Air Resources Board annual toxics summary (mean 2000 data at Fremont-Chapel Way monitoring site).
[b] Lead in Water concentration taken from Alameda County Water District 2001 Water Quality Report (90th percentile level of
[c] CalEPA. 1992. Supplemental Guidance for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control, Office of the Science Advisor. July.

LeadSpread Results
Residential Receptor
Marina Cove Subdivision

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
RESIDENTIAL RECEPTOR (0-10 feet bgs) -- MAXIMUM CONCENTRATION
HOMEGROWN PRODUCE AT 7%

VERSION 7

Residential Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	130.0
Lead in Water (ug/l)	8
% Home-grown Produce	7%
Respirable Dust (ug/m^3)	1.5

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	1.1	2.0	2.4	2.9	**3.3**	805	1191
BLOOD Pb, CHILD	2.7	4.9	5.8	7.0	**8.0**	184	285
BLOOD Pb, PICA CHILD	3.6	6.5	7.7	9.4	10.7	118	183
BLOOD Pb, OCCUPATIONAL	0.8	1.4	1.7	2.0	2.3	4117	6102

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	***7***	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	***5700***	***2900***
Skin area occupational	cm^2	2900	
Soil adherence	ug/cm^2	***70***	***200***
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	***50***	***100***
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	***6.8***
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	58.5	

PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.01	0%	1.5E-5	0.00	0%
Soil Ingestion	8.8E-4	0.11	10%	6.3E-4	0.08	11%
Inhalation1		0.01	1%		0.01	1%
Inhalation	2.4E-6	0.00	0%	1.7E-6	0.00	0%
Water Ingestion		0.45	41%		0.45	58%
Food Ingestion1		0.22	20%		0.23	30%
Food Ingestion	2.4E-3	0.31	28%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	0.92	34%	1.4E-2	1.83	51%
Inhalation1	1.5E-6	0.00	0%		0.00	0%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	19%		0.51	14%
Food Ingestion, child		0.50	19%		0.50	14%
Food Ingestion	5.5E-3	0.72	27%		0.72	20%

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
RESIDENTIAL RECEPTOR (0-10 feet bgs) -- 95UCL CONCENTRATION
HOMEGROWN PRODUCE AT 7%

VERSION 7

Residential Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	47.8
Lead in Water (ug/l)	8
% Home-grown Produce	7%
Respirable Dust (ug/m^3)	1.5

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	0.8	1.5	1.8	2.2	**2.5**	805	1191
BLOOD Pb, CHILD	1.6	3.0	3.5	4.3	**4.9**	184	285
BLOOD Pb, PICA CHILD	2.0	3.6	4.2	5.2	5.9	118	183
BLOOD Pb, OCCUPATIONAL	0.7	1.3	1.6	1.9	2.1	4117	6102

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	*7*	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	***5700***	***2900***
Skin area occupational	cm^2	2900	
Soil adherence	ug/cm^2	***70***	***200***
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	***50***	***100***
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	***6.8***
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	21.5	

PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.00	0%	1.5E-5	0.00	0%
Soil Ingestion	8.8E-4	0.04	5%	6.3E-4	0.03	4%
Inhalation1		0.01	1%		0.01	1%
Inhalation	2.4E-6	0.00	0%	1.7E-6	0.00	0%
Water Ingestion		0.45	54%		0.45	62%
Food Ingestion1		0.22	26%		0.23	33%
Food Ingestion	2.4E-3	0.11	14%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.00	0%		0.00	0%
Soil Ingestion	7.0E-3	0.34	21%	1.4E-2	0.67	34%
Inhalation1	1.5E-6	0.00	0%		0.00	0%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	31%		0.51	26%
Food Ingestion, child		0.50	31%		0.50	26%
Food Ingestion	5.5E-3	0.26	16%		0.26	14%

LeadSpread Results
Construction Worker Receptor
Marina Cove Subdivision

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CONSTRUCTION WORKER (0-10 feet bgs) -- MAXIMUM CONCENTRATION

VERSION 7

Construction Scenario (MCS)

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	130.0
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	**1000**

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	1.0	1.9	2.2	2.7	3.1	1038	1539
Blood Pb, CHILD	2.2	3.9	4.6	5.7	6.4	272	425
Blood Pb, PICA CHILD	3.1	5.6	6.6	8.1	9.2	148	231
Blood Pb, **CONSTRUCTION**	1.0	1.8	2.2	2.7	**3.0**	**1071**	1586

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, **construction**		***5***	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **construction**	cm^2	***3160***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **construction**	ug/cm^2	***240***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, **construction**	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	58.5	

PATHWAYS						
ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.00	0%	5.2E-5	0.01	1%
Soil Ingestion	8.8E-4	0.11	11%	1.3E-3	0.16	16%
Inhalation, bkgmd		0.01	1%		0.01	1%
Inhalation	1.6E-3	0.21	21%	1.2E-3	0.15	15%
Water Ingestion		0.45	44%		0.45	44%
Food Ingestion, bkgmd		0.23	23%		0.23	23%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	0.92	43%	1.4E-2	1.83	60%
Inhalation	1.3E-3	0.17	8%		0.17	6%
Inhalation, bkgmd		0.01	0%		0.01	0%
Water Ingestion		0.51	24%		0.51	17%
Food Ingestion, bkgmd		0.54	25%		0.54	18%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CONSTRUCTION WORKER (0-10 feet) - 95UCL Concentration

VERSION 7

Construction Scenario (MCS)

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	47.8
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	**1000**

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	0.8	1.5	1.8	2.1	2.4	1038	1539
Blood Pb, CHILD	1.5	2.7	3.2	3.8	4.4	272	425
Blood Pb, PICA CHILD	1.8	3.3	3.9	4.7	5.4	148	231
Blood Pb, **CONSTRUCTION**	0.8	1.5	1.7	2.1	**2.4**	**1071**	1588

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, **construction**		***5***	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **construction**	cm^2	***3160***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **construction**	ug/cm^2	***240***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, **construction**	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	21.5	

PATHWAYS						
ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.00	0%	5.2E-5	0.00	0%
Soil Ingestion	8.8E-4	0.04	5%	1.3E-3	0.06	7%
Inhalation, bkgrnd		0.01	1%		0.01	1%
Inhalation	1.6E-3	0.08	10%	1.2E-3	0.06	7%
Water Ingestion		0.45	55%		0.45	56%
Food Ingestion, bkgrnd		0.23	29%		0.23	29%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.00	0%		0.00	0%
Soil Ingestion	7.0E-3	0.34	23%	1.4E-2	0.67	37%
Inhalation	1.3E-3	0.06	4%		0.06	3%
Inhalation, bkgrnd		0.01	0%		0.01	0%
Water Ingestion		0.51	35%		0.51	28%
Food Ingestion, bkgrnd		0.54	37%		0.54	30%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LeadSpread Results
Construction Worker Receptor
Park Parcel

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CONSTRUCTION WORKER (0-10 feet bgs) -- MAXIMUM CONCENTRATION

VERSION 7

Construction Scenario (Park Parcel)

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	260
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1000

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	1.4	2.5	2.9	3.6	4.0	1038	1539
Blood Pb, CHILD	3.2	5.9	7.0	8.5	9.7	272	425
Blood Pb, PICA CHILD	5.1	9.3	11.0	13.3	15.2	148	231
Blood Pb, CONSTRUCTION	1.3	2.4	2.9	3.5	**4.0**	**1071**	1588

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, **construction**		***5***	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **construction**	cm^2	***3160***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **construction**	ug/cm^2	***240***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, **construction**	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	117.0	

PATHWAYS						
ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.01	1%	5.2E-5	0.01	1%
Soil Ingestion	8.8E-4	0.23	17%	1.3E-3	0.33	25%
Inhalation, bkgrnd		0.01	1%		0.01	0%
Inhalation	1.6E-3	0.43	31%	1.2E-3	0.30	23%
Water Ingestion		0.45	33%		0.45	34%
Food Ingestion, bkgrnd		0.23	17%		0.23	18%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	1.83	56%	1.4E-2	3.66	72%
Inhalation	1.3E-3	0.34	10%		0.34	7%
Inhalation, bkgrnd		0.01	0%		0.01	0%
Water Ingestion		0.51	16%		0.51	10%
Food Ingestion, bkgrnd		0.54	17%		0.54	11%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CONSTRUCTION WORKER (0-10 feet) - 95UCL Concentration

VERSION 7

Construction Scenario (Park Parcel)

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	95.7
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	**1000**

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	0.9	1.7	2.0	2.5	2.8	1038	1539
Blood Pb, CHILD	1.9	3.4	4.0	4.9	5.6	272	425
Blood Pb, PICA CHILD	2.5	4.6	5.5	6.7	7.6	148	231
Blood Pb, **CONSTRUCTION**	0.9	1.7	2.0	2.4	**2.8**	**1071**	1588

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	7	
Days per week, **construction**		***5***	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **construction**	cm^2	***3160***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **construction**	ug/cm^2	***240***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, **construction**	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	***20***	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	43.1	

PATHWAYS

ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.00	0%	5.2E-5	0.00	1%
Soil Ingestion	8.8E-4	0.08	9%	1.3E-3	0.12	13%
Inhalation, bkgrnd		0.01	1%		0.01	1%
Inhalation	1.6E-3	0.16	17%	1.2E-3	0.11	12%
Water Ingestion		0.45	48%		0.45	48%
Food Ingestion, bkgrnd		0.23	25%		0.23	25%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	0.67	36%	1.4E-2	1.35	53%
Inhalation	1.3E-3	0.12	7%		0.12	5%
Inhalation, bkgrnd		0.01	0%		0.01	0%
Water Ingestion		0.51	27%		0.51	20%
Food Ingestion, bkgrnd		0.54	29%		0.54	21%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LeadSpread Results
Landscape Maintenance Worker
Park Parcel

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
LANDSCAPE MAINTENANCE WORKER (0-10 feet bgs) -- MAXIMUM CONCENTRATION

ERSION 7

Landscape Worker Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	260
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1000

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	1.4	2.5	2.9	3.6	4.1	1036	1537
BLOOD Pb, CHILD	3.2	5.8	6.8	8.3	9.5	282	440
BLOOD Pb, PICA CHILD	5.0	9.1	10.8	13.1	14.9	151	236
BLOOD Pb, OCCUPATIONAL	1.3	2.4	2.9	3.5	**4.0**	1075	1593

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	*7*	
Days per week, occupational		**5**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	*5700*	*2900*
Skin area, landscape	cm^2	**2900**	
Soil adherence	ug/cm^2	*70*	*200*
Soil adherence, landscape	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	*50*	*100*
Soil ingestion, landscape	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
availability	unitless	0.44	
eathing rate	m^3/day	***20***	*6.8*
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	117.0	

PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.01	1%	4.4E-5	0.01	1%
Soil Ingestion	8.8E-4	0.23	17%	1.3E-3	0.33	25%
Inhalation1		0.01	1%		0.01	0%
Inhalation	1.6E-3	0.43	31%	1.2E-3	0.30	23%
Water Ingestion		0.45	33%		0.45	34%
Food Ingestion1		0.23	17%		0.23	18%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.02	1%		0.02	0%
Soil Ingestion	7.0E-3	1.83	58%	1.4E-2	3.66	73%
Inhalation1	1.0E-3	0.26	8%		0.26	5%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	16%		0.51	10%
Food Ingestion, child		0.54	17%		0.54	11%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
LANDSCAPE MAINTENANCE WORKER (0-10 feet bgs) -- 95UCL CONCENTRATION

ERSION 7

Landscape Worker Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	95.7
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1000

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	0.9	1.7	2.0	2.4	2.8	1053	1561
BLOOD Pb, CHILD	1.8	3.4	4.0	4.8	5.5	282	440
BLOOD Pb, PICA CHILD	2.5	4.6	5.4	6.6	7.5	151	236
BLOOD Pb, OCCUPATIONAL	0.9	1.7	2.0	2.4	**2.8**	1088	1612

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	*7*	
Days per week, occupational		**5**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	*5700*	*2900*
Skin area, landscape	cm^2	**2900**	
Soil adherence	ug/cm^2	*70*	*200*
Soil adherence, landscape	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	*50*	*100*
Soil ingestion, landscape	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
availability	unitless	0.44	
eathing rate	m^3/day	***20***	*6.8*
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	43.1	

PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.00	0%	4.4E-5	0.00	0%
Soil Ingestion	8.8E-4	0.08	9%	1.3E-3	0.12	13%
Inhalation1		0.01	1%		0.01	1%
Inhalation	1.6E-3	0.15	16%	1.1E-3	0.11	12%
Water Ingestion		0.45	48%		0.45	49%
Food Ingestion1		0.23	25%		0.23	25%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	0.67	37%	1.4E-2	1.35	54%
Inhalation1	1.0E-3	0.10	5%		0.10	4%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	28%		0.51	20%
Food Ingestion, child		0.54	29%		0.54	22%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LeadSpread Results
Park Visitor
Park Parcel

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
PARK VISITOR (0-10 feet bgs) -- MAXIMUM CONCENTRATION

ERSION 7

Park Visitor Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	260
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1000

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	1.4	2.5	2.9	3.6	4.1	1036	1537
BLOOD Pb, CHILD	3.2	5.8	6.8	8.3	9.5	282	440
BLOOD Pb, PICA CHILD	5.0	9.1	10.8	13.1	14.9	151	236
BLOOD Pb, VISITOR	0.7	1.3	1.5	1.9	**2.1**	23318	34537

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	*7*	
Days per week, visitor		**0.231**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	*5700*	*2900*
Skin area, visitor	cm^2	**2900**	
Soil adherence	ug/cm^2	*70*	*200*
Soil adherence, visitor	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	*50*	*100*
Soil ingestion, visitor	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
availability	unitless	0.44	
eathing rate	m^3/day	***20***	*6.8*
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	117.0	

PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.01	1%	2.0E-6	0.00	0%
Soil Ingestion	8.8E-4	0.23	17%	5.8E-5	0.02	2%
Inhalation1		0.01	1%		0.00	0%
Inhalation	1.6E-3	0.43	31%	5.4E-5	0.01	2%
Water Ingestion		0.45	33%		0.45	63%
Food Ingestion1		0.23	17%		0.23	33%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.02	1%		0.02	0%
Soil Ingestion	7.0E-3	1.83	58%	1.4E-2	3.66	73%
Inhalation1	1.0E-3	0.26	8%		0.26	5%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	16%		0.51	10%
Food Ingestion, child		0.54	17%		0.54	11%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
PARK VISITOR (0-10 feet bgs) -- 95UCL CONCENTRATION

ERSION 7

Park Visitor Scenario

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.005
Lead in Soil/Dust (ug/g)	95.7
Lead in Water (ug/l)	8
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1000

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	0.9	1.7	2.0	2.4	2.8	1053	1561
BLOOD Pb, CHILD	1.8	3.4	4.0	4.8	5.5	282	440
BLOOD Pb, PICA CHILD	2.5	4.6	5.4	6.6	7.5	151	236
BLOOD Pb, VISITOR	0.7	1.3	1.5	1.8	2.1	23591	34940

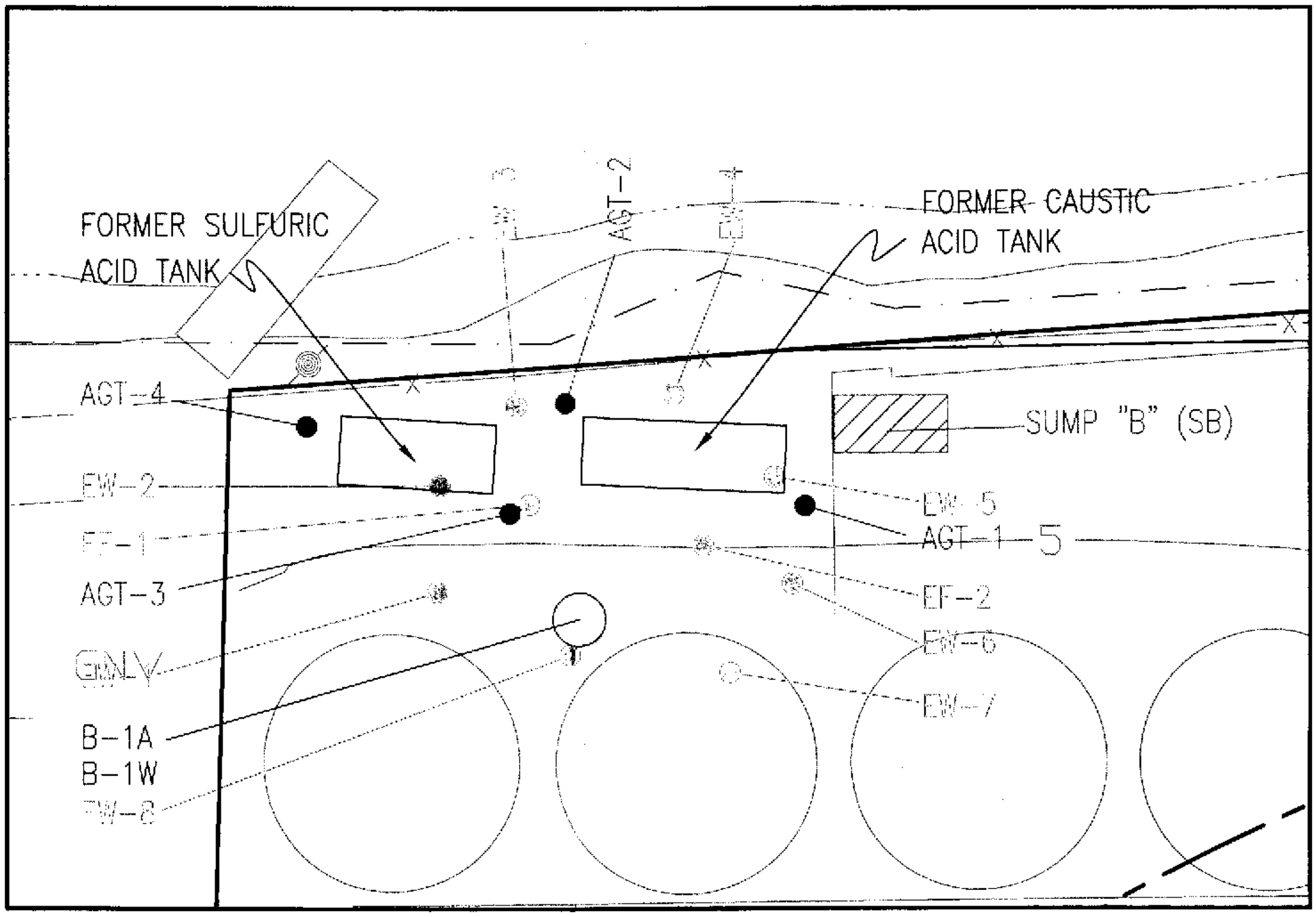
EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	7	
Days per week, visitor		**0.231**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	*5700*	*2900*
Skin area, visitor	cm^2	**2900**	
Soil adherence	ug/cm^2	*70*	*200*
Soil adherence, visitor	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.00011	
Soil ingestion	mg/day	*50*	*100*
Soil ingestion, visitor	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
oavailability	unitless	0.44	
eathing rate	m^3/day	***20***	*6.8*
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in produce	ug/kg	43.1	

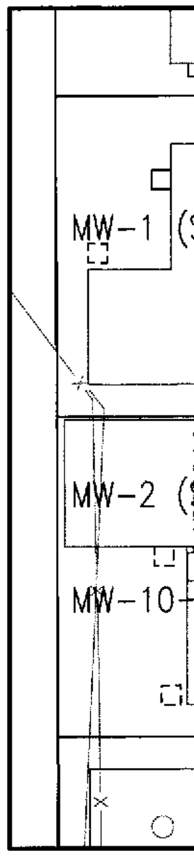
PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.2E-5	0.00	0%	2.0E-6	0.00	0%
Soil Ingestion	8.8E-4	0.08	9%	5.8E-5	0.01	1%
Inhalation1		0.01	1%		0.00	0%
Inhalation	1.6E-3	0.15	16%	5.3E-5	0.01	1%
Water Ingestion		0.45	48%		0.45	65%
Food Ingestion1		0.23	25%		0.23	34%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	6.1E-5	0.01	0%		0.01	0%
Soil Ingestion	7.0E-3	0.67	37%	1.4E-2	1.35	54%
Inhalation1	1.0E-3	0.10	5%		0.10	4%
Inhalation		0.01	0%		0.01	0%
Water Ingestion		0.51	28%		0.51	20%
Food Ingestion, child		0.54	29%		0.54	22%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

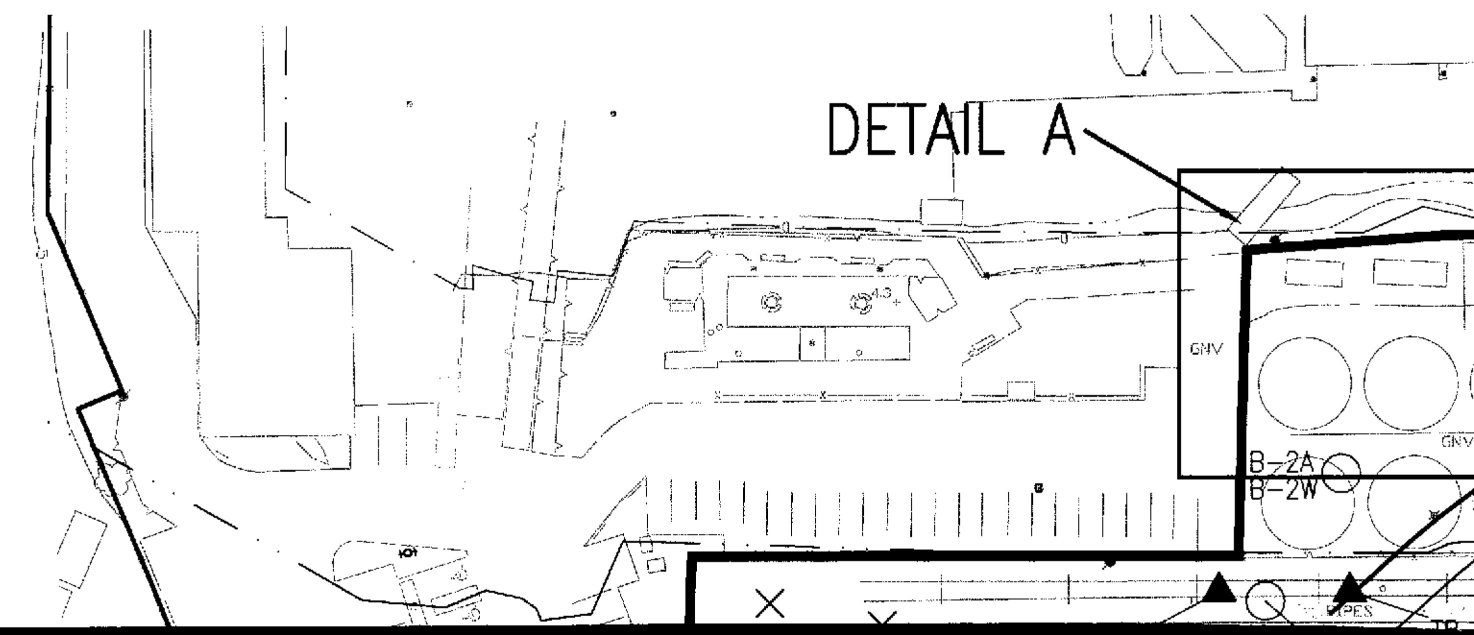
Attachment A
Sheet 1: Sample Locations/Monitoring Wells
(Bellecci & Associates, Inc., 2003)

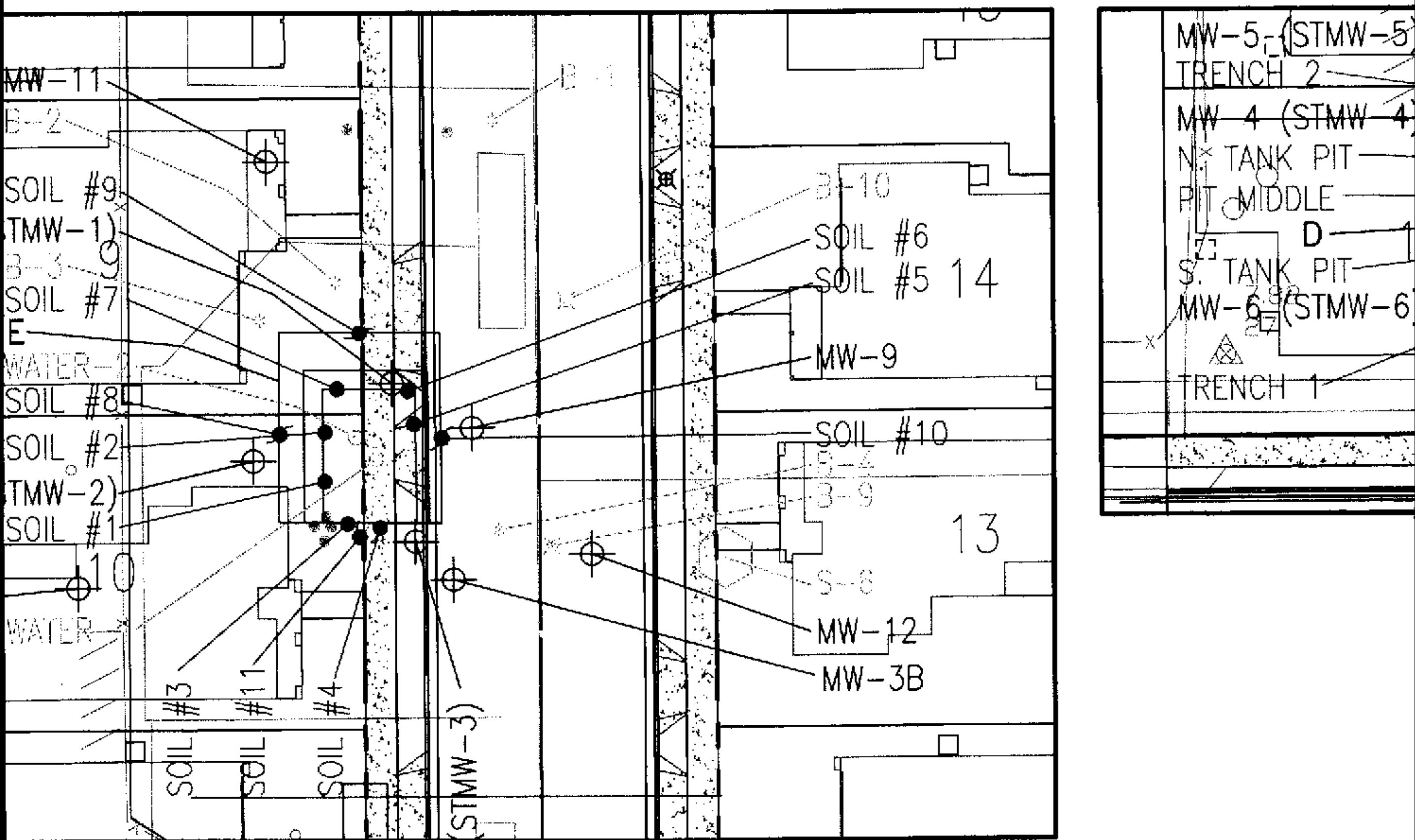




DETAIL A

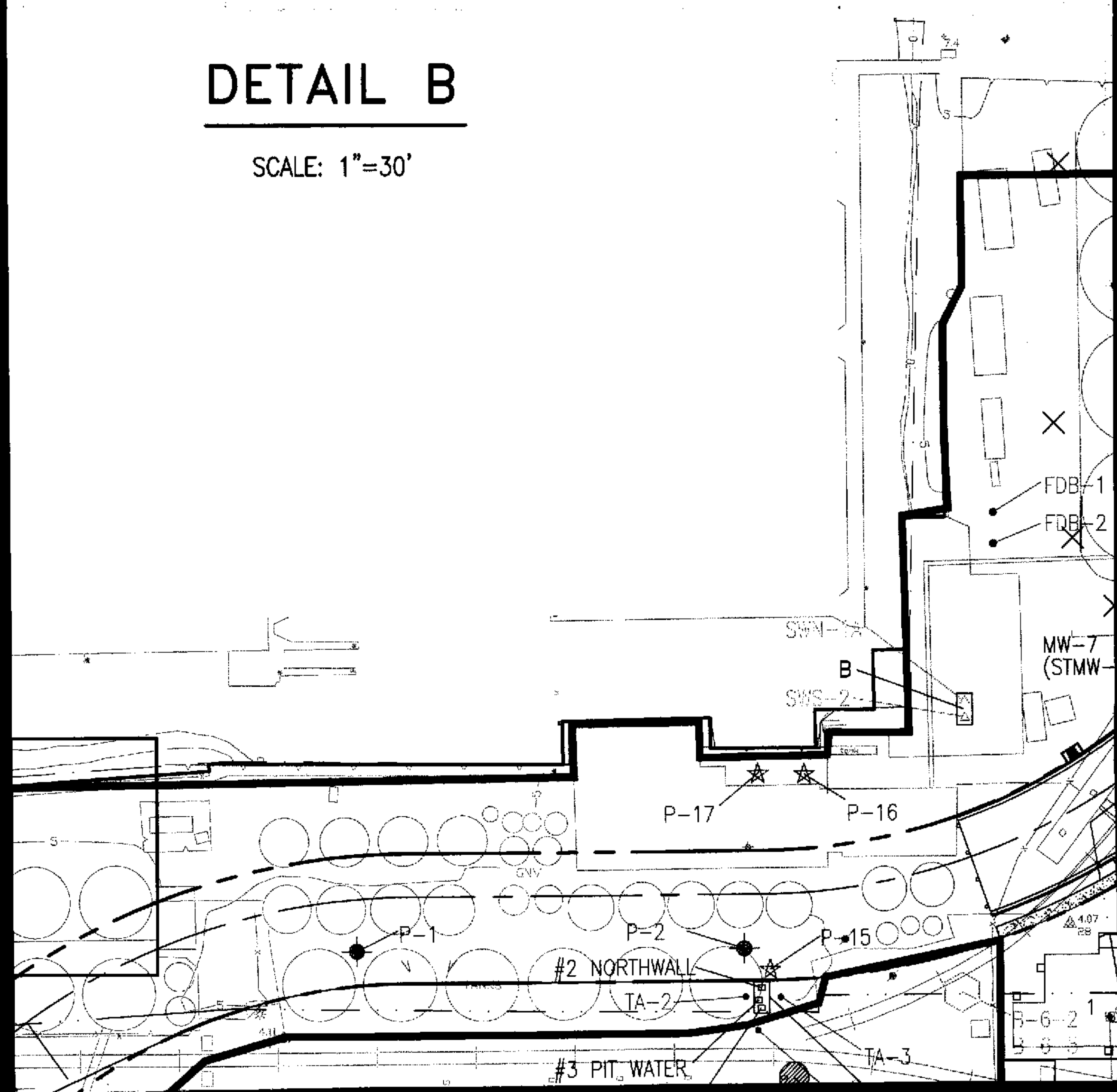
SCALE: 1"=20'

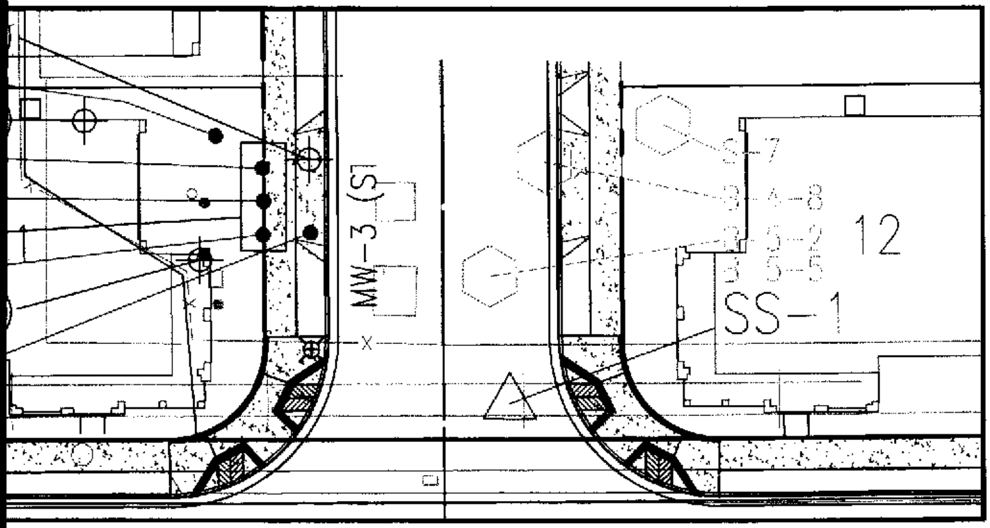




DETAIL B

SCALE: 1"=30'





DETAIL C

SCALE: 1"=30'

A FORMER 10,000-G
B FORMER 1,500-GA
C FORMER 2,000-GA
D FORMER 20,000-G
E FORMER GASOLINE

ICES, LIMITED SITE

ICES, REMEDIAL AC

ICES, LIMITED SITE
PIPELINE, 03/1999

ICES, UST REMOVA

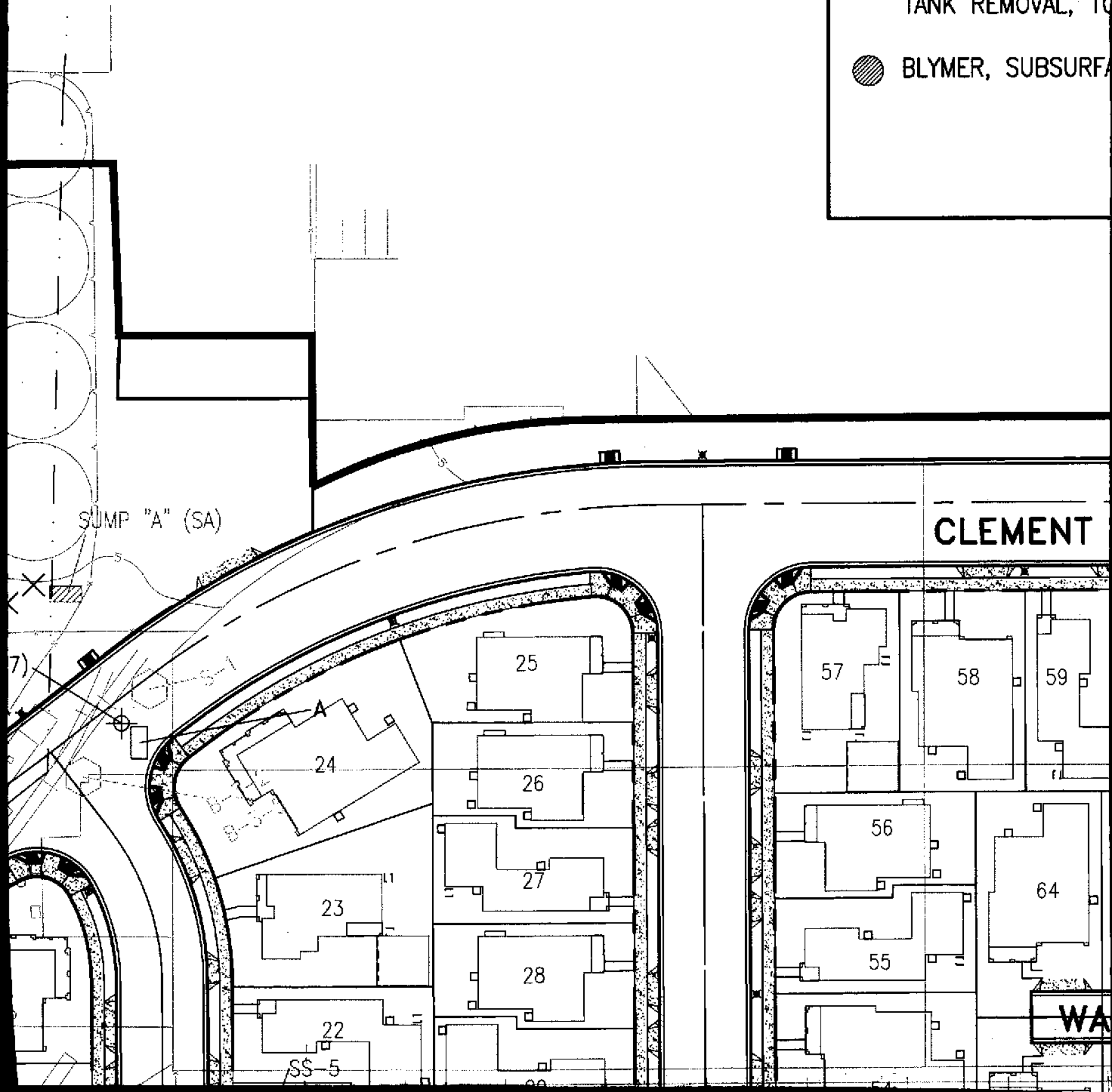
ICES, SOIL SAMPLI

ICES, SITE INVESTI
10/2001

ICES, SUPPLEMENT
PARCEL, 07/2002

ICES, SITE INVESTI
TANK REMOVAL, 10

BLYMER, SUBSURF



LEGEND

ALLON DIESEL UST
LLON DIESEL UST
LLON DIESEL UST
ALLON DIESEL UST
UST CLUSTER

INVESTIGATION, AUGUST 1998

TIVITIES: RAILROAD BALLAST, 04/2001

INVESTIGATION–ABANDONED PENNZOIL

L–1500 GALLON DIESEL UST, 10/2001

NG, 01/2002

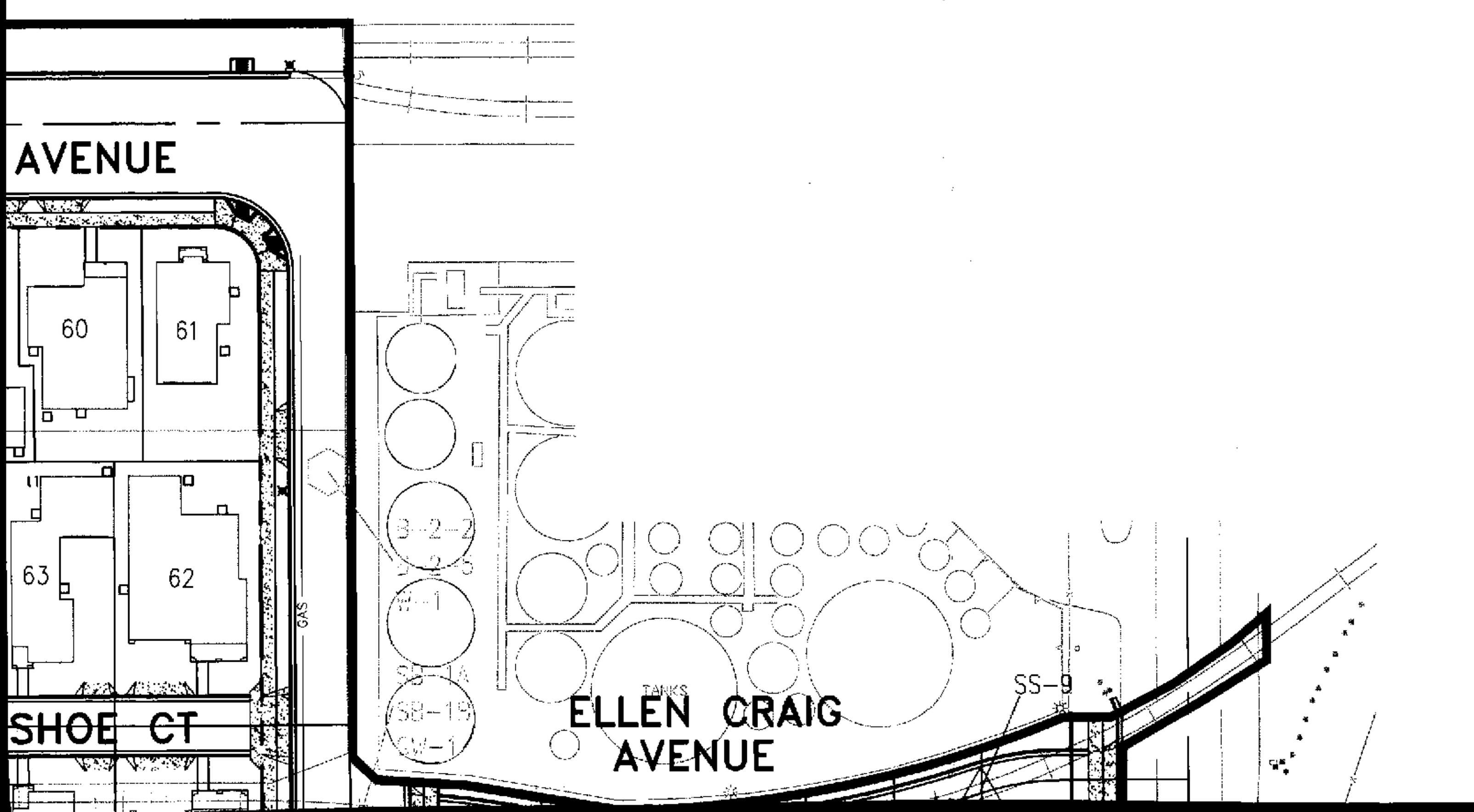
GATION ACTIVITIES: TRENCH PARCEL,

ARY SITE INVESTIGATION: TRENCH

GATION ACTIVITIES: SULFURIC ACID
)/2001

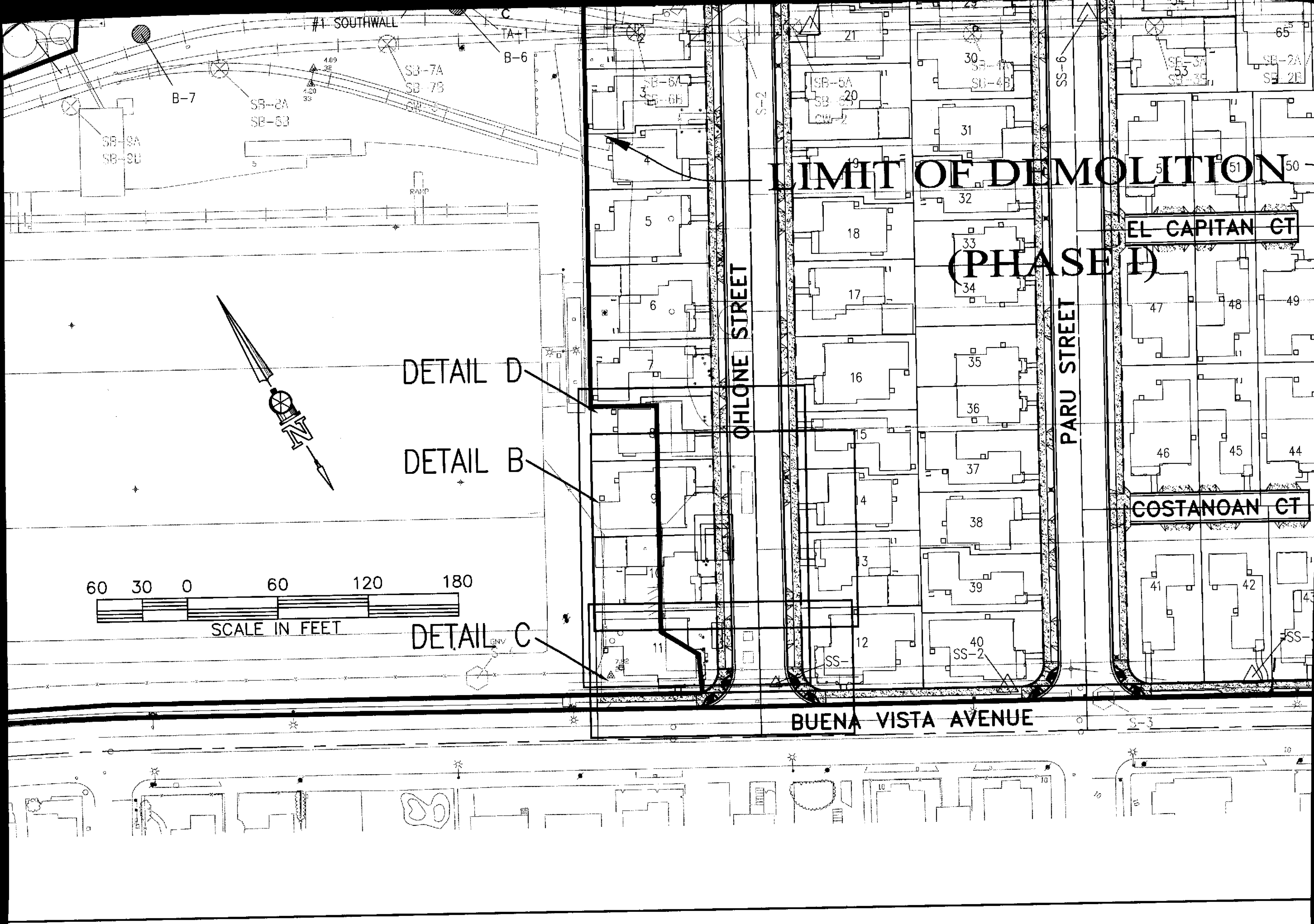
ACE SOIL INVESTIGATION, 07/1993

- FUGRO, PHASE II SITE INVESTIGATION, 09/1993
- GEOMATRIX, SOIL INVESTIGATION, 02/1995
- SEMCO, UST REMOVAL–2000 GALLON DIESEL UST, 04/1994
- WEST & ASSOCIATES, ADDITIONAL SITE CHARACTERIZATION, 07/1999
- WEST & ASSOCIATES, SITE INVESTIGATION, 01/1994
- WEST & ASSOCIATES, UST REMOVAL: 20,000 GALLON DIESEL UST, 01/1994
- MINTER & FAHY, OVEREXCAVATION OF FORMER 3–1000 GALLON GASOLINE UST PIT, 02/1991
- MINTER & FAHY, OVEREXCAVATION OF FORMER 3–1000 GALLON GASOLINE UST PIT, 04/1991
- SOIL TECH, 12/1991, 04/1992, 12/1992–01/1993; WEST & ASSOCIATES, 01/1994
- ICES, SOIL VAPOR SAMPLING, 02/2003



BELLECCI & ASSOCIATES, INC.
•CIVIL ENGINEERING • LAND PLANNING • LAND SURVEYING•
2290 DIAMOND BOULEVARD, SUITE 100 CONCORD, CA. 94520
PHONE (925) 685-4569 FAX (925) 685-4838

TR-1
B-3A
B-3W
B-4A
B-4W
SB-10A
SB-10B
B-8
SB-11A
SB-11B
SB-12A
SB-12B
GW-4
S-5



#1 SOUTHWALL
LIMIT OF DEMOLITION
(PHASE I)
EL CAPITAN CT
COSTANOAN CT
OHLONE STREET
PARU STREET
BUENA VISTA AVENUE
DETAIL D
DETAIL B
DETAIL C
60 30 0 60 120 180
SCALE IN FEET
N
B-7
B-6
SB-7A
SB-7B
SB-8A
SB-8B
SB-9A
SB-9B
SB-6A
SB-6B
SB-5A
SB-5B
SB-4A
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SB-3A
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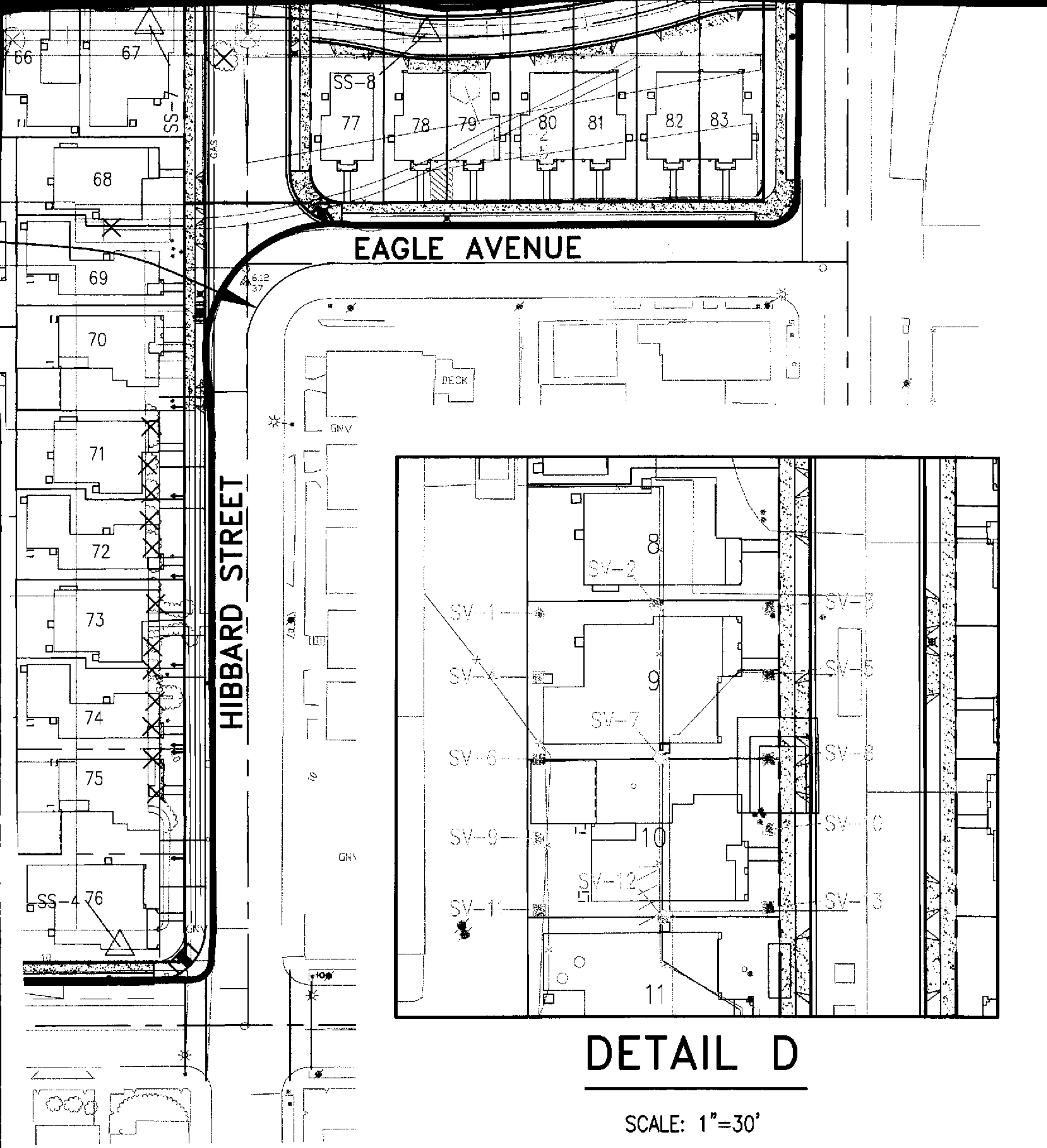
SB-2A
SB-2B
S-2
SS-6
SS-2
S-3
RAMP



SUBDIVISION 7170 KB HOME MARINA COVE

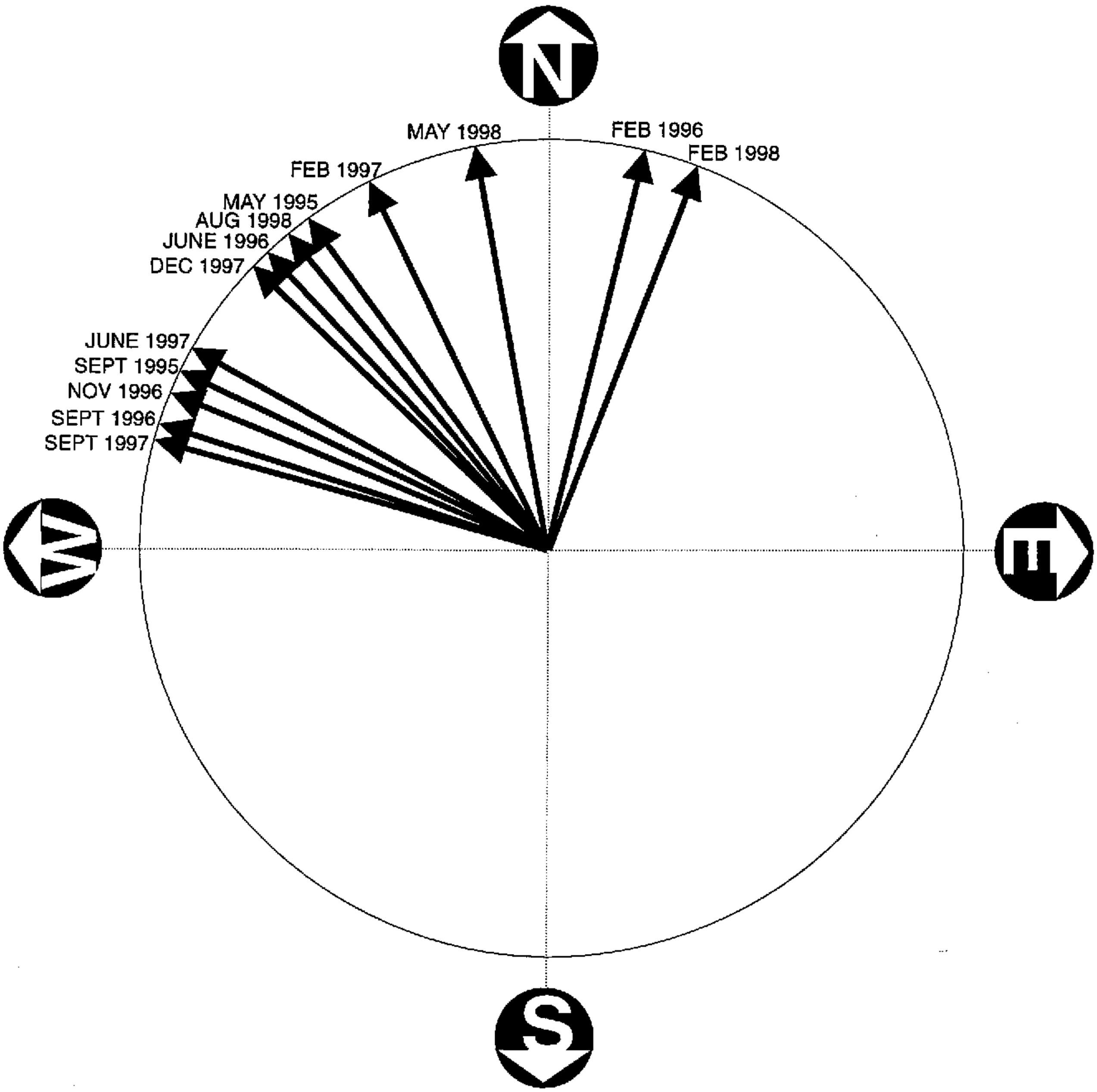
SAMPLE LOCATIONS/MONITORING WELLS

CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA

SHEET 1 OF 1

JOB NO.

Attachment B
Summary of Groundwater Flow Directions
(ICES, 2003a)

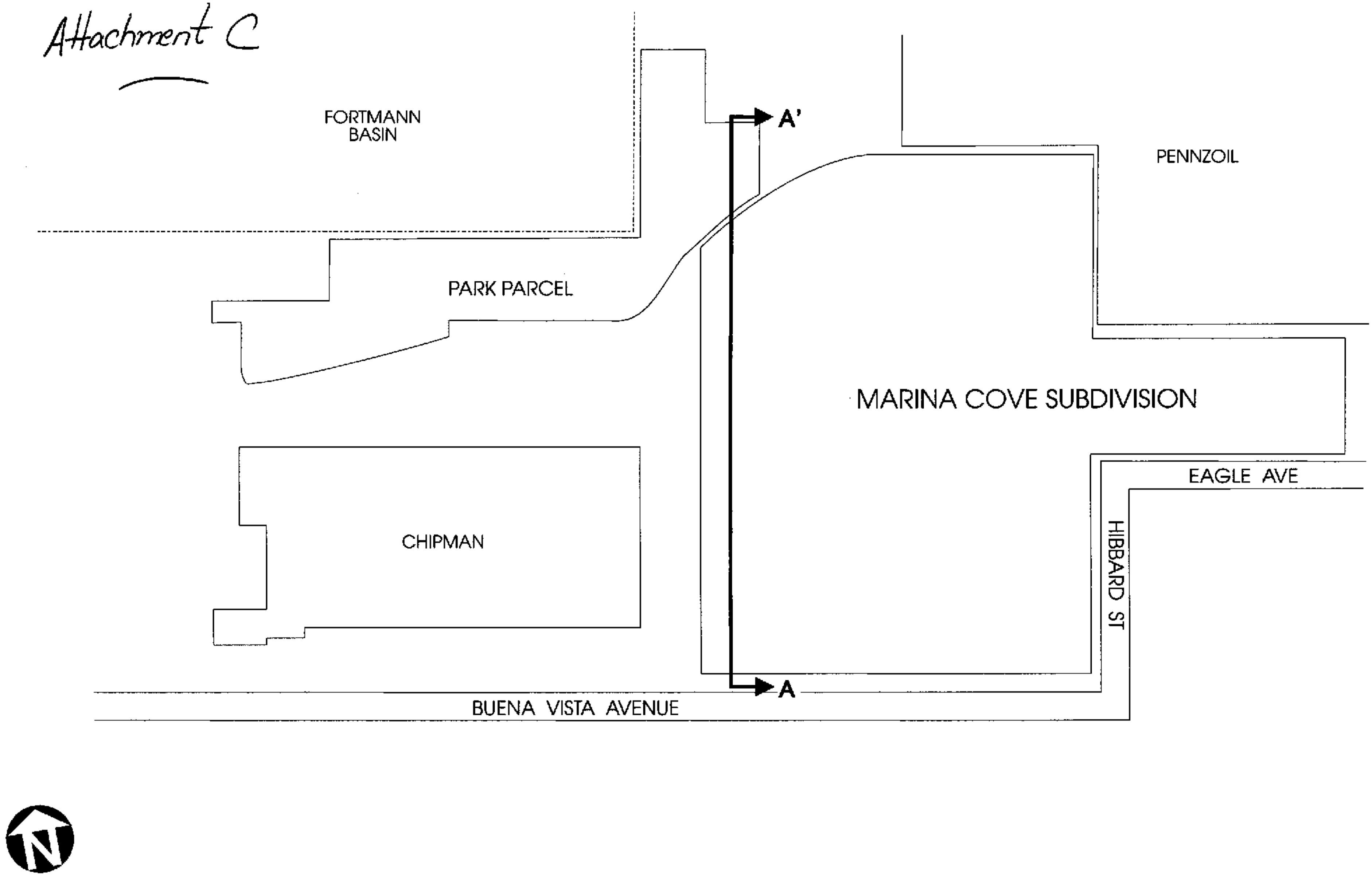


SUMMARY OF GROUNDWATER FLOW DIRECTIONS

Marina Cove Subdivision and Park Parcel
Alameda, California

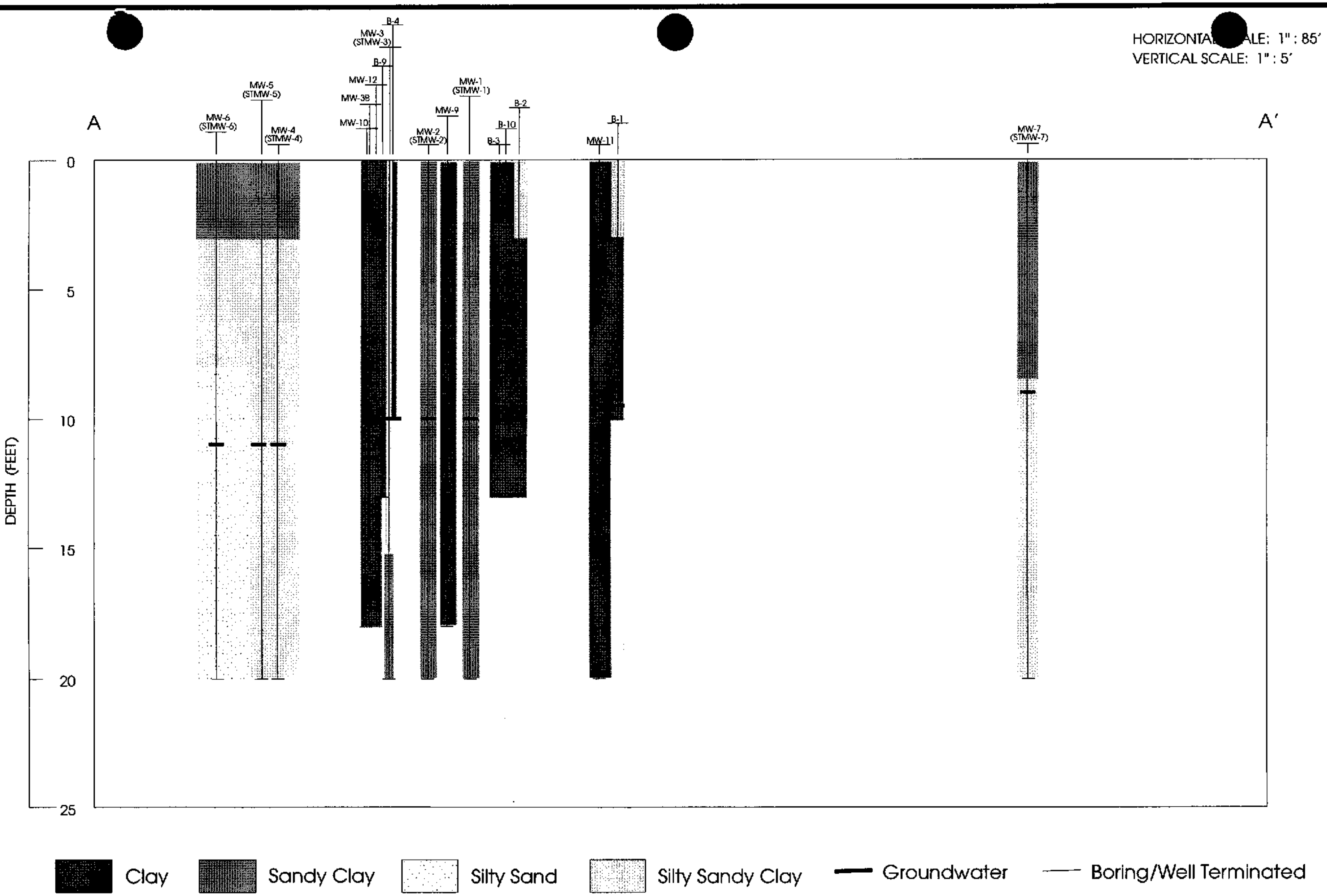
Attachment C
Geologic Cross-Section (ICES, 2003b)

Attachment C



SITE GEOLOGY

Marina Cove Subdivision
Alameda, California



CROSS SECTION A-A'

Marina Cove Subdivision
Alameda, California

Attachment D
Soil Gas Sampling and Analyses

- D-1 Soil Gas Work Plan, including Figure 1A (ICES, 2003c)
- D-2 Soil Gas Analytical Results (TEG, 2003)
- D-3 Geotechnical Analytical Results (Ninyo and Moore, 2003)

D-1 Soil Gas Work Plan, including Figure 1A (ICES, 2003c)

February 20, 2003 ICES 2262

Ms. Eva Chu
Hazardous Materials Specialist
Alameda County Health Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

Subject: Work Plan
Soil Gas Sampling
Marina Cove Subdivision
Alameda, California

Dear Eva:

At the request of KB Homes ("the Client"), Innovative and Creative Environmental Solutions (ICES) has prepared this Work Plan to conduct soil gas sampling at the Marina Cove Subdivision in Alameda, California ("the Site").

OBJECTIVE

The purpose of the soil gas sampling is to assess the potential presence of volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) around the perimeter of the foundations of the homes of Lots 9 and 10 at the Site.

SOIL GAS SAMPLING

Sampling activities will consist of collecting soil gas samples from thirteen boring locations (SV-1 through SV-13) at a depth of approximately 3 to 5 feet below the existing ground surface (bgs). Additionally, soil gas samples will be collected at the capillary fringe of the vadose zone (if possible), assuming that groundwater is at a depth of approximately 8 feet bgs. The approximate boring locations are shown in Figures 1 and 1A.

Soil gas samples will be collected from the borings at the selected depths by driving a soil vapor probe into the ground using an electric rotary hammer. Once inserted to the desired depth, the probe will be retracted slightly, which opens the tip and exposes the vapor sampling ports. Soil vapor will be withdrawn from the 1/8 inch nylaflow tubing, located down the center of the probe, using a small calibrated syringe connected via an on-off valve. The first 5 dead volumes of gas will be discarded to flush the sample tubing and fill it with in-situ soil vapor. The next 20 cc of soil vapor will be withdrawn in the syringe, plugged, and immediately transferred to the mobile lab for analysis.

In the event, VOC and/or TPH concentrations are detected from the soil gas samples collected along the southern perimeter of the foundation of Lot 10, additional soil vapor samples will be installed along the perimeter of the foundation of Lot 11.

LABORATORY ANALYSIS

Soil vapor samples collected from each probe will be transferred directly to the on-site mobile laboratory and analyzed immediately. Samples will be analyzed on a gas chromatograph equipped with capillary columns and a combination of MS, ELCD (Hall), PID, and FID detectors as needed. The samples will be analyzed for VOCs using EPA Method 8260 and TPH using EPA Method 8015M.

DOCUMENTATION

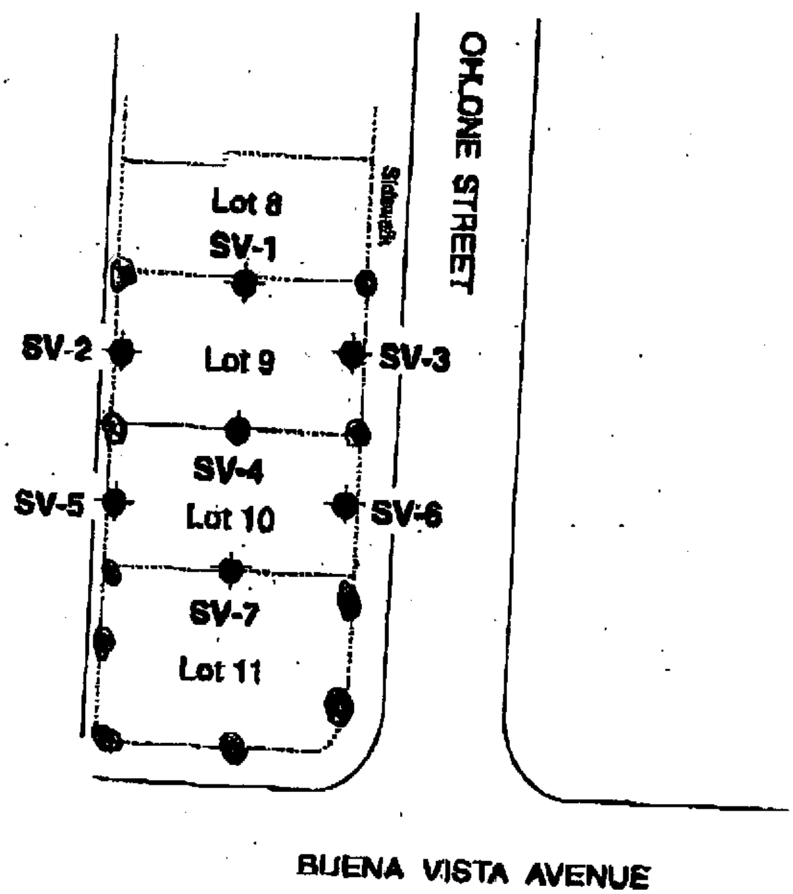
A written report will be prepared following receipt of the laboratory analytical results. The report will describe our field observations, sample collection, laboratory analytical results, and conclusions regarding the sampling activities. The sampling report will be submitted to the Alameda County Health Services within three weeks following completion of field activities and receipt of laboratory analytical results.

If you have any questions or comments, please do not hesitate to contact me.

Sincerely,

Derek Wong
Project Manager

cc: Mr. Joe Sordi, KB Homes



every 30 linear feet

detection limit < $500 \mu g/m^3$ for VOCs in house + mobile labs

EXPLANATION:

SV-1 Proposed Boring Location

Scale: 1" = ±60'	February 2003	
ICE Innovative & Creative Environmental Solutions	**PROPOSED BORING LOCATIONS** Marina Cove Subdivision Alameda, California	Figure **1A**

D-2 Soil Gas Analytical Results (TEG, 2003)

March 4, 2003

Mr. Derek Wong
ICES
1552 Beach Street
Oakland CA 94608

SUBJECT: DATA REPORT - ICES Project # 2262
Marina Cove Subdivision, Alameda, California

TEG Project # 30226E

Mr. Wong:

Please find enclosed a data report for the samples analyzed from the above referenced project for ICES. The samples were analyzed on site in TEG's DHS certified mobile laboratory. TEG conducted a total of 26 analyses on 13 soil vapor samples.

-- 13 analyses on soil vapors for volatile organic hydrocarbons by EPA method 8260B.

-- 13 analyses on soil vapors for total petroleum hydrocarbons by EPA method mod8015.

The results of the analyses are summarized in the enclosed tables. Applicable detection limits and calibration data are included in the tables.

TEG appreciates the opportunity to have provided analytical services to ICES on this project. If you have any further questions relating to these data or report, please do not hesitate to contact us.

Sincerely,

Mark Jerpbak
Director, TEG-Northern California

TEG Project #30226E

ICES Project # 2262
Marina Cove Subdivision, Alameda California

teg

EPA METHOD 8260B ANALYSES OF SOIL VAPOR in ug/L of Vapor & TPH (EPA 8015mod)

SAMPLE NUMBER:	Blank	SV-1 @4'	SV-2 @4'	SV-3 @4'	SV-4 @1.5'	SV-5 @4'	SV-6 @4'
COLLECTION DATE:	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03
COLLECTION TIME:	08:06	14:34	13:36	13:16	14:12	12:55	12:06
DILUTION FACTOR:	1	1	1	1	1	1	1
Dichlorodifluoromethane	nd	nd	nd	nd	nd	nd	nd
Chloromethane	nd	nd	nd	nd	nd	nd	nd
Vinyl Chloride	nd	nd	nd	nd	nd	nd	nd
Bromomethane	nd	nd	nd	nd	nd	nd	nd
Chloroethane	nd	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
Methylene Chloride	nd	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	nd	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
Chloroform	nd	nd	nd	nd	nd	nd	nd
Bromochloromethane	nd	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	nd	nd	nd	nd	nd	nd	nd
Benzene	nd	nd	nd	nd	nd	nd	nd
Trichloroethene	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
Bromodichloromethane	nd	nd	nd	nd	nd	nd	nd
Dibromomethane	nd	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
Toluene	nd	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	nd	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
Tetrachloroethene	nd	nd	nd	nd	nd	nd	nd
Dibromochloromethane	nd	nd	nd	nd	nd	nd	nd
Chlorobenzene	nd	nd	nd	nd	nd	nd	nd
Ethylbenzene	nd	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	nd	nd	nd	nd	nd	nd	nd
m,p-Xylene	nd	nd	nd	nd	nd	nd	nd
o-Xylene	nd	nd	nd	nd	nd	nd	nd
Styrene	nd	nd	nd	nd	nd	nd	nd
Bromoform	nd	nd	nd	nd	nd	nd	nd
Isopropylbenzene	nd	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	nd	nd	nd	nd	nd	nd	nd
n-propylbenzene	nd	nd	nd	nd	nd	nd	nd
Bromobenzene	nd	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	nd	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	nd	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	nd	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	nd	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	nd	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
n-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	nd	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	nd	nd	nd	nd	nd	nd	nd
Naphthalene	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	nd	nd	nd	nd	nd	nd	nd
TPH	nd	nd	nd	nd	nd	nd	nd
Surrogate Recovery (DBFM)	105%	104%	107%	103%	103%	105%	109%
Surrogate Recovery (1,2-DCA-d4)	104%	97%	102%	99%	100%	99%	102%
Surrogate Recovery (Toluene-d8)	104%	106%	107%	105%	107%	107%	108%

REPORTING LIMITS FOR ABOVE COMPOUNDS = 0.2 ug/L of Vapor; TPH = 1ppmV

'nd' NOT DETECTED AT LISTED REPORTING LIMITS ANALYSES PERFORMED by: Mr. Leif Jonsson

11350 Monier Park Place, Rancho Cordova, CA 95742 Phone: (916) 853-8010 Fax: (916) 853-8020

TEG Project #30226E

ICES Project # 2262
Marina Cove Subdivision, Alameda California

teg

EPA METHOD 8260B ANALYSES OF SOIL VAPOR in ug/L of Vapor & TPH (EPA 8015mod)

SAMPLE NUMBER:	SV-7 @4'	SV-8 @4'	SV-9 @3'	SV-10 @4'	SV-11 @4'	SV-12 @6'	SV-13 @4'
COLLECTION DATE:	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03	2/26/03
COLLECTION TIME:	11:20	10:58	12:30	10:37	09:42	09:09	08:49
DILUTION FACTOR:	1	1	1	1	1	1	1
Dichlorodifluoromethane	nd	nd	nd	nd	nd	nd	nd
Chloromethane	nd	nd	nd	nd	nd	nd	nd
Vinyl Chloride	nd	nd	nd	nd	nd	nd	nd
Bromomethane	nd	nd	nd	nd	nd	nd	nd
Chloroethane	nd	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
Methylene Chloride	nd	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	nd	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	nd	nd	nd	nd	nd	nd	nd
Chloroform	nd	nd	nd	nd	nd	nd	nd
Bromochloromethane	nd	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	nd	nd	nd	nd	nd	nd	nd
Benzene	nd	nd	nd	nd	nd	nd	nd
Trichloroethene	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
Bromodichloromethane	nd	nd	nd	nd	nd	nd	nd
Dibromomethane	nd	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
Toluene	nd	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	nd	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	nd	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	nd	nd	nd	nd	nd	nd	nd
Tetrachloroethene	nd	nd	nd	nd	nd	nd	nd
Dibromochloromethane	nd	nd	nd	nd	nd	nd	nd
Chlorobenzene	nd	nd	nd	nd	nd	nd	nd
Ethylbenzene	nd	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	nd	nd	nd	nd	nd	nd	nd
m,p-Xylene	nd	nd	nd	nd	nd	nd	nd
o-Xylene	nd	nd	nd	nd	nd	nd	nd
Styrene	nd	nd	nd	nd	nd	nd	nd
Bromoform	nd	nd	nd	nd	nd	nd	nd
Isopropylbenzene	nd	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	nd	nd	nd	nd	nd	nd	nd
n-propylbenzene	nd	nd	nd	nd	nd	nd	nd
Bromobenzene	nd	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	nd	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	nd	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	nd	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	nd	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	nd	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
n-Butylbenzene	nd	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	nd	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	nd	nd	nd	nd	nd	nd	nd
Naphthalene	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	nd	nd	nd	nd	nd	nd	nd
TPH	nd	nd	nd	nd	nd	nd	nd
Surrogate Recovery (DBFM)	112%	111%	110%	110%	108%	106%	109%
Surrogate Recovery (1,2-DCA-d4)	104%	98%	102%	106%	99%	106%	103%
Surrogate Recovery (Toluene-d8)	106%	108%	107%	109%	106%	109%	107%

REPORTING LIMITS FOR ABOVE COMPOUNDS = 0.2 ug/L of Vapor; TPH = 1ppmV

'nd' NOT DETECTED AT LISTED REPORTING LIMITS ANALYSES PERFORMED by: Mr. Leif Jonsson

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teg

TEG Project #30226E

CALIBRATION DATA - Calibration Check Compounds

	Vinyl Cl	1,1 DCE	Cl-Form	1,2 DCP	Toluene	Ethylbenzene
Midpoint	0.254	0.212	0.431	0.277	0.668	0.534

Continuing Calibration - Midpoint

3/26/03	0.315	0.208	0.453	0.288	0.722	0.608
	124.0%	98.1%	105.1%	104.0%	108.1%	113.9%

ANALYSES PERFORMED BY: Mr. Leif Jonsson

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D-3 Geotechnical Analytical Results (Ninyo and Moore, 2003)

Ninyo & Moore — Transmittal

675 Hegenberger Rd., Ste. 220, Oakland, CA 94621-1919 ♦ Phone 510/633-5640 ♦ Fax 510/633-5646 ♦ www.ninyoandmoore.com

To:	Estelle Shiroma	**Date**	March 19, 2003
Firm:	SOMA Corporation	**Fax No:**	510/654-1960
Address:	1412 62nd Street Emeryville, CA 94608	**Telephone No:**	510/654-3900
From:	Peter Connolly	**Total Pages Including Transmittal:**	3
Subject:	Soil Test Results	**Project No:**	400756002

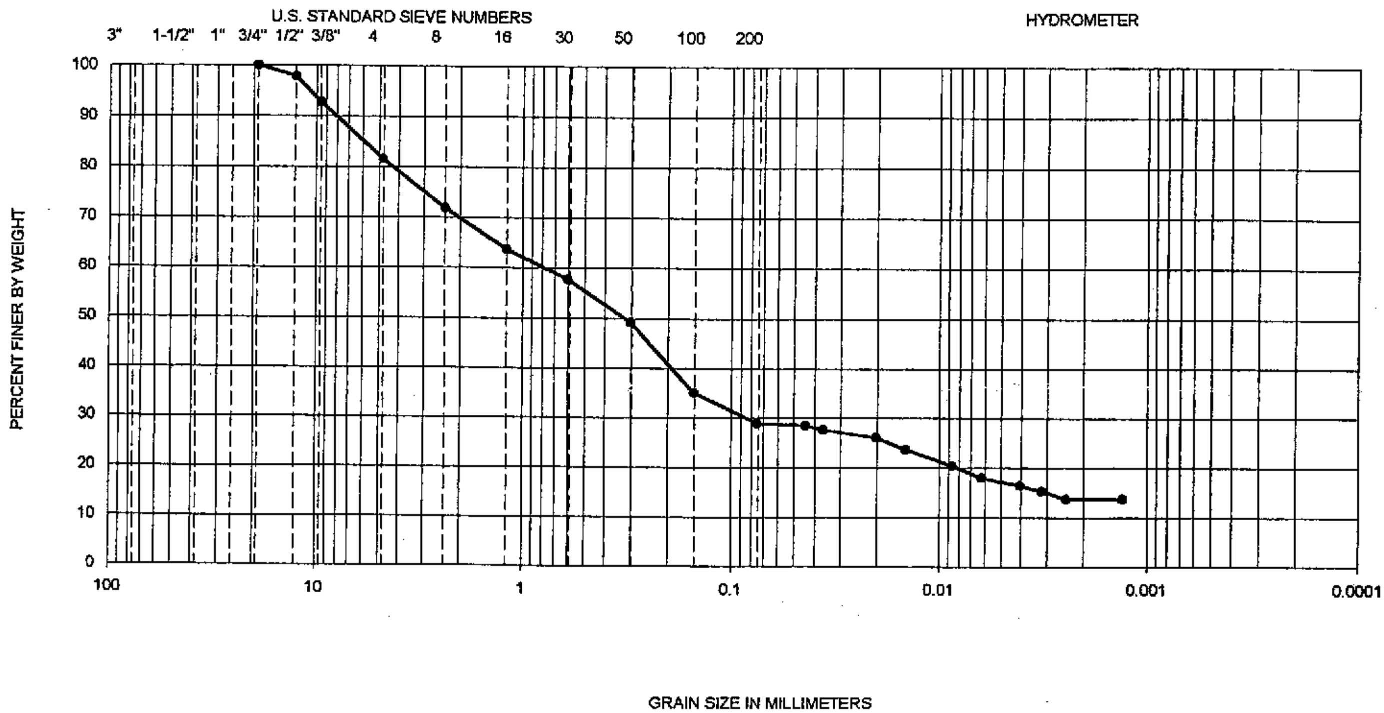
☐ **Urgent** ☐ **For Approval** ☐ **For Your Use** ☐ **Please Reply** ☒ **As Requested**

Original Document: ☐ **Will Not Follow** ☒ **Will Follow** ☒ **By U.S. Mail** ☐ **By Other**

FAXED 3/19/03

- **Geotechnical Engineering**
- **Engineering Geology**
- **Materials Testing and Inspection**
- **Construction Management**
- **Engineering Design**
- **Environmental Engineering**
- **Environmental Site Assessments**
- **Regulatory Compliance and Permitting**
- **Water Quality and Resource Evaluations**
- **Hazardous Waste Management**
- **Soil and Groundwater Remediation**
- **Asbestos and Lead-Based Paint Surveys**
- **Geophysical Studies**
- **Mineral Resource Evaluations**
- **Value Engineering**
- **Forensic Studies**
- **Expert Witness Testimony**

GRAVEL		SAND			FINES
Coarse	Fine	Coarse	Medium	Fine	Silt & Clay



Symbol	Sample Location	Sample Depth	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	N/A	22"-28"	--	--	--	N/A	0.09	0.8	N/A	N/A	29	SC
■												
▲												
○												
□												
△												

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore

GRADATION TEST RESULTS

PROJECT NO.	DATE	FIGURE
400756002	3/2003	

HYDRO1.xls

Ninyo & Moore

PHYSICAL PROPERTIES DATA

PROJECT NAME: n/a
PROJECT NO: 400756002

SAMPLE ID.	DEPTH, in.	SAMPLE ORIENT. (1)	MOISTURE CONTENT (% wt)	DENSITY		POROSITY, %Vb (2)		PORE FLUID SATURATIONS, % Pv (3)		TOTAL ORGANIC CARBON (mg/kg)	25.0 PSI CONFINING STRESS NATIVE STATE EFFECTIVE PERMEABILITY TO AIR (4) (millidarcy)
METHODOLOGY:			ASTM D2216	API RP40		API RP40		API RP40		WALKLEY-BLACK	API RP40
				BULK (g/cc)	GRAIN (g/cc)	TOTAL	AIR FILLED	WATER	NAPL		
n/a	32-38	V	8.2	1.79	2.69	33.5	18.1	41.4	ND	1750	477

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9981 g/cc; Hydrocarbon = 0.7500 g/cc (4) Native State = As received with pore fluids in place Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected