Baseline Human Health Risk Assessment of On-Site Soil and Groundwater

Sierra Pacific Industries

Arcata Division Sawmill

2593 New Navy Base Road

Arcata, California

Prepared for:

Sierra Pacific Industries

November 20, 2003

Project No. 9329 Task 13

Geomatrix Consultants

2101 Webster Street, 12th Floor
Oakland, CA 94612
(510) 663-4100 • Fax (510) 663-4141

GEOMATRIX

November 20, 2003
Project 9329 Task 13

Executive Officer
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Attention: Dean Prat

Subject: Baseline Human Health Risk Assessment
Sierra Pacific Industries
Arcata Division Sawmill
2593 New Navy Base Road
Arcata, California

Dear Mr. Prat:

As requested by Sierra Pacific Industries, we have enclosed a copy of the subject report prepared on behalf of Sierra Pacific Industry Industries.

Sincerely yours,
GEOMATRIX CONSULTANTS, INC.

Ann M. Holbrow
Senior Toxicologist

Ravi Arulanantham, Ph.D.
Principal

Edward P. Conti, C.E.G., C.HG.
Principal Geologist

AMH/ARA/EPC/abr
Enclosure

cc: Bob Ellery, Sierra Pacific Industries (with enclosure)
Gordie Amos, Sierra Pacific Industries (with enclosure)
David Dun, Dun and Martinek, LLP (with enclosure)
Fred Evenson, Law Offices of Frederic Evenson (with enclosure)
Jim Lamport, Ecological Rights Foundation (with enclosure)

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Prepared for:

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Prepared by:

Geomatrix Consultants, Inc.
2101 Webster Street, 12th Floor
Oakland, California 94612

MFG, Inc.
4720 Walnut Street, Suite 200
Boulder, Colorado 80301

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LIST OF ACRONYMS AND ABBREVIATIONS

ADD	Average daily dose
ARB	Air Resources Board
AT	Averaging time
atm/m^3-mol	Atmospheres per cubic meter per mol
BTEX	Benzene, toluene, ethylbenzene and xylenes
BW	Body weight
CA MCL	California maximum contaminant level
CalEPA	California Environmental Protection Agency
COPC	Chemical of potential concern
CSF	Cancer slope factor
Cw	Concentration in water
DL	Detection limit
DRO	Diesel range organic
DTSC	Department of Toxic Substances Control
ED	Exposure duration
EF	Exposure frequency
EPC	Exposure point concentration
ft-bgs	Feet below ground surface
GRO	Gasoline range organic
HEAST	Health Effects Assessment Summary Tables
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
IR	Ingestion rate
IRIS	Integrated Risk Information System
Kp	Partitioning coefficient
LADD	Lifetime average daily dose
MCL	Maximum contaminant level
mg/Kg-day	Milligram chemical per kilogram body weight per day
mg/L	Milligrams per liter
OEHHA	Office of Environmental Health Hazard Assessment
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
PEA	Preliminary Endangerment Assessment
PEF	Particulate emission factor
RAGS	Risk Assessment Guidance for Superfund
RBRG	Risk-based remediation goal
RfC	Reference concentration
RfD	Reference dose
RI	Remedial investigation
RME	Reasonable maximum exposure
RWQCB	Regional Water Quality Control Board
SA	Surface area
SQL	Sample quantitation limit
SVOC	Semi-volatile organic compound
TCDD	Tetrachlorodibenzo-p-dioxin
TCP	Tetrachlorophenol
TEF	Toxicity equivalency factor
TEQ	Toxicity equivalents
TPH	Total petroleum hydrocarbons
UCL	Upper confidence limit
U.S. EPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound
WHO	World Health Organization

BASELINE HUMAN HEALTH RISK ASSESSMENT OF ON-SITE SOIL AND GROUNDWATER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

1.0 INTRODUCTION

This document presents the risk assessment of on-Site soil and groundwater at the Sierra Pacific Industries (SPI), Arcata Division Sawmill (Site). The Arcata Division Sawmill is located at 2593 New Navy Base Road in Arcata, California. A Site location map is provided as Figure 1-1. This risk assessment was prepared by MFG, Inc., and Geomatrix Consultants, Inc., on behalf of SPI for submittal to the California Regional Water Quality Control Board (RWQCB), North Coast Region. The Site has been issued Cleanup and Abatement Order (CAO) No. R1-2001-0200 and CAO No. R1-2003-127 by the RWQCB to address discharges to groundwater and surface water of pentachlorophenol, tetrachlorophenol, and dioxins/furans. These chemicals are constituents of wood surface protection chemicals used historically in the vicinity of the former green chain.

The purpose of this risk assessment is to evaluate baseline current and future human health risks associated with exposure to Site-related constituents in the absence of remediation. Because investigation is on going at the Site, risk-based remediation goals (RBRGs) based on Site-specific exposure scenarios were calculated to evaluate data collected in the future. This risk assessment was prepared based on the *Revised Work Plan for Performing a Human Health and Ecological Risk Assessment at the Sierra Pacific Industries, Arcata Division Sawmill, Arcata, California* (Environ, 2002), and focuses on the potentially complete human health exposure pathways presented by the chemicals detected in on-Site media (e.g., soil and groundwater). Chemicals detected in, or potentially migrating to, off-Site media will be addressed in a separate risk assessment.

The data used in this risk assessment were collected as part of the Remedial Investigation (RI; EnviroNet, 2003) and other investigations of on-Site soil and groundwater. The Remedial Investigation was conducted following a work plan (EnviroNet, 2001a; 2001b) that was reviewed and approved by the Regional Water Quality Control Board. The Remedial Investigation was conducted following the sporadic detection of pentachlorophenol (PCP) and

tetrachlorophenol (TCP) in stormwater runoff during monitoring. As part of the Remedial Investigation, the primary area of historical use of PCP-containing materials was identified and investigated. This "source area" is in the vicinity of the former green chain at the Site. The nature and extent of PCP in soil and groundwater were delineated through implementation of an extensive sampling plan. The results of the Remedial Investigation are summarized in Section 2.0 of this report. Other investigations have been performed at the Site in the vicinity of a former ditch containing hydrocarbon impacted soil (the former plywood-covered ditch), a former waste oil underground storage tank, a former teepee burner (MFG, 2003a, 2003b, and 2003c, respectively).

The following sections provide a summary of the Risk Assessment Objectives, Site Background, and Report Organization.

1.1 RISK ASSESSMENT OBJECTIVES

A human health risk assessment is "*the systematic, scientific characterization of potential adverse health effects resulting from human exposures to hazardous agents or situations"* (NRC, 1983). This type of assessment includes qualitative information on the strength of the risk evidence and the nature of the risk evaluation outcomes, quantitative assessment of the relevant Site-specific exposures and the potential magnitude of the risks, a description of the uncertainties in the risk/hazard estimates, and conclusions (Klaassen, 1996). This Baseline Human Health Risk Assessment was developed based on potential exposure under existing Site conditions in the absence of remedial action. The results can be used to support risk management decisions and determine if remediation or further action is warranted at the Site. Risk-based remediation goals, i.e., concentrations that are acceptable for the protection of Site-specific exposure conditions, also were calculated as part of this Baseline Human Health Risk Assessment. Calculating risk-based remediation goals is an objective of this report even if risks associated with the existing data are acceptable. On-going data collection is occurring at the facility, and risk-based remediation goals will provide a basis for determining whether additional analytical results are within acceptable risk levels.

1.2 SITE BACKGROUND

The SPI Arcata Division Sawmill is situated along the west shore of Mad River Slough where the slough joins Arcata Bay to the south (Figure 1-1). As noted in the Remedial Investigation Report (EnviroNet, 2003), prior to its development as a lumber mill in approximately 1950, the Site consisted of undeveloped sand dunes and mud flats. The Site has been an active mill since approximately 1950. After initial construction of the mill, and expansion of the mill property

including filling of portions of the Mad River Slough continued into the 1960s. Wood surface protection operations that used products containing pentachlorophenol (PCP) and tetrachlorophenol (TCP) began in the early to mid-1960s and were discontinued in 1987. The wood surface protection products were applied to a small amount of milled lumber to provide cosmetic protection against mold and sap stains. The wood surface protection solution was stored and used in a dip tank that was located at the former green chain (Figure 1-2; Boring #49 is approximately at the former dip tank location) and in an aboveground storage tank located near the former green chain. The former green chain location was south of the current sorter building and west of the current sawmill building. The area where the wood surface protection solutions were stored and used now is covered with concrete or asphalt and equipment.

1.3 REPORT ORGANIZATION

As indicated in the work plan (Environ, 2002), this Baseline Human Health Risk Assessment was conducted in accordance with risk assessment methodologies described by the U.S. Environmental Protection Agency in *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A* (U.S. Environmental Protection Agency, 1989), supplemental U.S. Environmental Protection Agency guidance, and risk assessment guidance from the California Environmental Protection Agency (1996, 1999).

The organization of this Baseline Human Health Risk Assessment follows the general steps of the U.S. EPA guidelines (1989), which are:

Section 2: Data Evaluation (Identification of chemicals of potential concern);

Section 3: Exposure Assessment, (including identification of potentially exposed populations, exposure pathways, and chemical intakes);

Section 4: Toxicity Assessment;

Section 5: Risk Characterization;

Section 6: Uncertainty Analysis;

Section 7: Risk-based Remediation Goals;

Section 8: Conclusions; and

Section 9: References

2.0 DATA EVALUATION

The initial step of a human health risk assessment is to evaluate the available data and identify the chemicals of potential concern to be evaluated. Chemicals of potential concern are typically those constituents that make the most significant contribution to overall risk, which may include all or a subset of chemicals detected. Data from the following reports was evaluated to identify chemicals of potential concern:

- Results of the Remedial Investigation for Sierra Pacific Industries—Arcata Division Sawmills, Arcata, California (EnviroNet, 2003);
- Plywood Covered Ditch Investigation Report (MFG, Inc., 2003a);
- Waste Oil Underground Storage Tank Investigation and Closure Report (MFG, 2003b); and
- Former Teepee Burner Investigation Report (MFG, 2003c)

This section summarizes the Site characterization data for soil and groundwater and identifies chemicals of potential concern for evaluation.

2.1 SITE CHARACTERIZATION

Several subsurface investigations have been performed at the Site to characterize the presence of chlorinated phenols in soil and groundwater in the former green chain, which are summarized in the Remedial Investigation Report (Environet, 2003). Other investigations have been performed at the Site in the vicinity of a former ditch containing hydrocarbon impacted soil (the former plywood-covered ditch), a former waste oil underground storage tank, a former teepee burner (MFG, 2003a, 2003b, and 2003c, respectively). Figure 2-1 is a Site plan that shows the Remedial Investigation sample locations. Figures A-1 to A-3 in Appendix A show the other locations where soil samples were collected for the former ditch, former tepee burner, and former waste oil tank respectively. Appendix A also contains the analytical results tables (Table A-1 to A-7) for data collected at the Site that was used in this risk assessment.

The chronology of the investigations was as follows:

- In July and August 2001, soil samples were collected from borings B-1 to B-38 in the vicinity of the former green chain to delineate the extent of PCP in soil and chlorinated phenols in groundwater.

- In March 2002, soil samples from borings B-39 to B-47 were collected to characterize the lateral extent of affected soil. Nine monitoring wells (MW-1 to MW-9) were installed to further characterize groundwater conditions. The nine monitoring wells were sampled on a quarterly basis beginning in March 2002.

- In November 2002, an additional 10 monitoring wells, MW-10 to MW-19D, were installed at the Site; soil samples were collected from each boring prior to well installation. In addition to the well installation, borings B-48 to B-60 were advanced, and soil and grab groundwater samples were collected from these borings.

- After the new wells were installed and developed, groundwater samples were collected from the new and existing monitoring wells in December 2002, and March and May 2003 (MFG, 2003d).

- In April 2003, a petroleum underground storage tank was removed. Soil samples were collected from the excavation in May 2003 (MFG, 2003b).

- In April 2003, soil samples were collected from an excavation for electrical conduit (the former plywood covered ditch) (MFG, 2003a)

- In June 2003, soil samples were collected from the location of the former teepee burner (MFG, 2003c).

2.1.1 Site Hydrogeology and Lithology

Site lithology consists primarily of a fine to medium fine-grained sand (Environet, 2003) to a depth of approximately 22 feet below ground surface (the maximum depth drilled at the Site) (MFG, 2003c). Thin lenses of "Bay Mud," a mixture of sand and silt, were detected sporadically. A thicker layer of "Bay Mud" was encountered in B-47 near the Mad River Slough. "Bay Mud" may be indicative of historic marshes or other features before the Site elevation was raised for construction in approximately 1950.

Shallow groundwater was observed at depths ranging from 1.5 to 6.5 feet below ground surface in the former green chain area. Water levels ranged from 1.35 to 5.28 feet below top of well casing in monitoring wells MW-1 to MW-9 in September 2002. In May 2003, water levels measured in monitoring wells at the Site ranged from 0.05 to 5.74 feet below top of well casing. The lateral hydraulic gradient is to the east and northeast toward Mad River Slough (MFG, 2003d).

2.1.2 Soil Data in the Former Green Chain

In July and August 2001, soil samples were collected from borings B-1 to B-38 at various depths and analyzed in a mobile laboratory for PCP. These sample results were used to determine whether further sample collection was needed to delineate the lateral and vertical extent of PCP in soil. Selected soil samples were also submitted to an off-site laboratory to confirm the mobile laboratory results. Concentrations of PCP in soil were generally found to be confined to the upper 3 feet of soil with the higher detections of PCP found in borings B-3 (69.5 mg/kg) at 3 feet below ground surface and B-38 (59 mg/kg) at 2 feet below ground surface.

In March 2002, additional soil samples were collected and analyzed for PCP and other chlorinated phenols to define the lateral extent of affected soil. Samples were collected from borings B-39 to B-47 at various depths to a maximum depth of 7 feet. The analytical results from these nine borings were non-detect for all chlorinated phenols.

In November 2002, borings B-48 to B-60 were advanced and monitoring wells MW-11 to MW-19D were installed. Soil samples were collected from all the borings at various depths and analyzed for chlorinated phenols. In addition, the sample collected from B-57 at 3 feet below ground surface (B-57-3) was analyzed for the metals and samples B-57-3, B-57-5, and B-58-5 were analyzed for dioxins/furans. Soil samples also were collected from the monitoring well borings; three soil samples from each shallow well location, and three to four soil samples from each deep well location. The only chlorinated phenol detected in these samples was PCP in samples B-57-3 (1.9 mg/kg) and B-58-5 (1.2 mg/kg). Concentrations of dioxins/furans, which refers to a complex mixture of various dioxin and furan congeners, are summarized in terms of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) equivalent concentrations based on toxicity equivalence factors (TEFs) adopted by the California Environmental Protection Agency's (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) (Appendix B). Dioxin results ranged from 0.5 to 58.4 picograms per gram (pg/g). The metals results for sample B-57-3 were either not detected or within background ranges (Kearny, 1996) as presented in Appendix A.

Soil analytical results for analytes detected at the former green chain are presented Tables A-1 through A-4 in Appendix A. Figures 2-2 presents the analytical results for PCP in soil.

2.1.3 Additional Soil Data

2.1.3.1 Soil Data at the Plywood Covered Ditch

A total of four soil samples were collected from two locations (PD-1 and PD-2) in a ditch excavated for electrical conduit on the southwestern portion of the property near the truck shop in April 2003 (Appendix A). Soil samples were collected from two depths: at ground surface and approximately 2 to 2.5 feet below ground surface. Samples were analyzed for oil and grease, total petroleum hydrocarbons as diesel and motor oil, chlorinated phenols, and volatile organic compounds. Chlorinated phenols were not detected in any samples. Oil and grease, TPH as diesel, and TPH as motor oil were detected in all four samples but at higher concentrations in the 2-foot samples than in the shallow samples. For example, TPH as motor oil was detected at 160 and 250 milligrams per kilogram in the shallow samples and at 850 and 1,300 mg/kg in the deeper samples. Chlorobenzene, 1,4-dichlorobenzene, naphthalene, and 1,2,4-trimethylbenzene were detected in one deeper sample [PD-1(2-2.5)] and 1,4-dichlorobenzene was also detected in the other deeper sample [PD-2(2-2.5)]. All VOC detections were less than 0.5 milligrams per kilogram. Table A-5 in Appendix A summarizes the results of the volatile organic compound analyses. Figure A-1 in Appendix A shows sample locations.

2.1.3.2 Soil Data at the Former Teepee Burner

A total of 17 soil samples were collected from five locations (TP-1 to TP-5) in the vicinity of the former teepee burner located in the southeastern portion of the property adjacent to the lunchroom and the wood chipper (Figure 1-2). The former teepee burner was approximately 90 feet in diameter. The location was identified based on employee interviews and aerial photographs (MFG, 2003c; Appendix A). Soil samples were collected from two to four depths at each location. Samples were analyzed for chlorinated phenols and dioxin/furans. Chlorinated phenols were not detected in any samples. Dioxin/furans were detected in all three samples analyzed at 21.2 to 306 picograms per gram (pg/g) 2,3,7,8-TCDD toxic equivalent concentrations. Tables A-1, A-2, and A-3 in Appendix A summarize the results of these sample analyses. Figure A-2 in Appendix A shows sample locations.

2.1.3.3 Soil Data at the Former Petroleum Underground Storage Tank

A petroleum underground storage tank (UST) in the southwest portion of the facility, near the Truck Shop, was removed in April 2003. The soils around the underground storage tank excavation were sampled in May 2003. Two soil samples were collected along the excavation sidewalls (NE-1-4' and SW-1-4'), and two samples were collected from the bottom of the

excavation (NW-1-6' and SE-1-6') after tank removal. All four of these samples were submitted for total petroleum hydrocarbons (TPH) as diesel, TPH as motor oil and TPH as gasoline analyses. The samples from the bottom of the excavation were also analyzed for oil and grease, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), creosote, and five metals (cadmium, chromium, lead, nickel, and zinc). Semi volatile organic compounds, PCBs, and creosote were not detected. Low levels of three volatile organic compounds (1,2,4-trimethylbenzene, acetone, and methyl ethyl ketone) and metals consistent with background concentrations were detected. Concentrations of TPH as diesel ranged from 74 to 5,000 mg/kg. Concentrations of TPH as motor oil ranged from 250 to 4,500 mg/kg. Concentrations of TPH as gasoline ranged from 14 to 980 mg/kg. Oil/grease ranged from 540 to 4,000 mg/kg. Analytical results for detected metals and volatile organic compounds are presented in Tables A-4 and A-5 in Appendix A, respectively. Figure A-3 in Appendix A shows sample locations.

2.1.4 Groundwater Data

During the subsurface investigation in July and August 2001, grab groundwater samples were collected from borings B-1 to B-38 at various depths to determine the extent of PCP and other chlorinated phenols in groundwater. The highest detections of PCP were found in borings at the eastern end of the Sorter Building. The sample from boring B-38 had the highest concentration of PCP (100 milligrams per liter (mg/L)). Tetrachlorophenols were detected in several grab groundwater samples; the sample from boring B-33 had the highest combined concentration of 2,3,4,6-tetrachlorophenol and 2,3,5,6-tetrachlorophenol (6.9 mg/L).

In March 2002, grab groundwater samples were collected from borings B-39 to B-47 and from newly installed monitoring wells, MW-1 to MW-9. These samples were analyzed for chlorinated phenols. Grab groundwater samples from borings B-39 to B-47, collected in March 2002, were all non-detect for PCP and other chlorinated phenols. The nine monitoring wells were sampled three times in 2002 (March, July, and September). Chlorinated phenols were detected in five of the monitoring wells but not in the grab groundwater samples; the highest concentrations of PCP and other chlorinated phenols were detected in monitoring well MW-7 during all three sampling events.

In November 2002, an additional ten monitoring wells, MW-10 to MW-19D, were installed, along with additional borings, B-48 to B-60, to a maximum depth of 6.5 feet. Four wells were classified as deeper wells (the "D" series wells, which are screened at approximately 15-20 feet below ground surface). Grab groundwater samples were collected from the borings in

November, and from the newly installed and existing monitoring wells in December 2002, and March and May 2003. PCP was only detected two monitoring wells, MW-7 and MW-16D. Concentrations of PCP in monitoring well MW-7 over this period were significantly higher than concentrations in other wells. The maximum concentration of PCP detected was 51 mg/L.

Concentrations of chlorinated phenols in groundwater have been detected in a limited area of the Site near the source (within 150 feet). The maximum detected concentrations of PCPs have been consistently from monitoring well MW-7 (14,000 to 51,000 mg/L). Tetrachlorophenols and trichlorophenols also have been detected at the highest concentrations in monitoring well MW-7. Dioxins/furans have been analyzed in two samples from monitoring well MW-7 (September 2002 and May 2003). Concentrations ranged from 0.407 to 2.66 pg/L 2,3,7,8-TCDD toxic equivalents. Chemicals of potential concern have not been detected in groundwater samples collected from deeper wells except for one detection of PCP in one round from monitoring well MW-16D. This PCP detection was very close to the Maximum Contaminant Level (0.0013 vs. the Maximum Contaminant Level of 0.001 mg/L).

Groundwater analytical data are presented in Appendix A, Tables A-6 and A-7. Figure 2-3 presents the concentrations of PCP detected in the May 2003 sampling round from each monitoring well.

2.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern are identified for evaluation in the risk assessment. Not all chemicals detected at a site warrant a quantitative evaluation. In many cases, chemicals are detected at so low a concentration as to pose a negligible risk and may be eliminated from further consideration. Chemicals of potential concern were selected for each environmental medium on Site by comparing detected concentrations to natural background levels and eliminating chemicals consistent with background concentrations. It is also possible to eliminate chemicals from evaluation based on a comparison to regulatory screening levels appropriate to the environmental medium and site conditions. Chemicals were not eliminated based on comparison to screening levels so that risk-based screening levels could be developed for all chemical detected using the results of the risk evaluation. The following sections summarize the selection of chemicals of potential concern for each medium.

2.2.1 Soil

Chemicals of potential concern in soil were identified based on comparison to background concentrations and in consideration of chemical mixtures. As shown in Appendix A, Table

A-4, concentrations of metals detected at the Site are consistent with background concentrations. Thus, metals were not considered chemicals of potential concern. There also are background levels of dioxin/furans in the environment resulting from non-Site-specific human activities. However, dioxins/furans were retained as chemicals of potential concern because there is also a site-specific source (wood surface protection chemicals). In addition, total petroleum hydrocarbons, and oil and grease analysis results represent complex mixtures of compounds with varying toxicities. As is the practice in California (Cal-EPA, 1999), critical constituents of these petroleum mixtures (e.g., polycyclic aromatic hydrocarbons, other aromatic hydrocarbons) were used to represent the toxicity of the mixture as a whole. In this report, potential human health risk was evaluated quantitatively using constituent data. Risk-based remediation goals were developed for TPH mixtures based on regulatory screening levels (Section 7.0). All other chemicals detected in soil were classified as chemicals of potential concern.

In addition, three trichlorophenols that were not detected in soil but were detected in groundwater have been added as chemicals of potential concern in soil. These chemicals were not included as analytes for samples collected before November 2002. Since risk-based remediation goals for these chemical may be required for evaluating results of future investigations, these chemicals were included in the quantitative evaluation.

The chemicals of potential concern in soil are:

- Acetone;
- Chlorobenzene;
- 1,4-Dichlorobenzene;
- Dioxins/furans;
- Methyl ethyl ketone;
- Naphthalene;
- Pentachlorophenol;
- 2,3,4,5-; 2,3,4,6-; and 2,3,5,6-Tetrachlorophenol;
- 2,3,4-; 2,4,5-; and 2,4,6-Trichlorophenol; and
- 1,2,4-Trimethylbenzene

Table 2-1 summarizes soil data for the chemicals of potential concern.

2.2.2 Water

All chemicals detected in monitoring well samples are considered chemicals of potential concern, which include:

- Dioxins/furans
- Pentachlorophenol;
- 2,3,4,5-; 2,3,4,6-; and 2,3,5,6-Tetrachlorophenol;
- 2,3,4-; 2,4,5-; and 2,4,6-Trichlorophenol;

Grab groundwater sample results were not considered because the data is subject to interference from sediment in the samples and an extensive groundwater monitoring well network is in place that has been sampled over several quarters. Table 2-2 summarizes groundwater data for the chemicals of potential concern.

3.0 EXPOSURE ASSESSMENT

The exposure assessment estimates the extent of human contact with chemicals of potential concern by characterizing potentially exposed populations (especially potentially sensitive ones such as residential receptors), identifying actual or potential routes of exposure, and estimating the extent of human exposure. The exposure assessment identifies possible exposure pathways that are appropriate for each relevant receptor and whether a qualitative or quantitative exposure assessment is needed. The subsequent sections discuss the conceptual site model, a sensitive receptor survey, potential receptors, exposure pathways, exposure concentrations, and exposure calculations.

3.1 CONCEPTUAL SITE MODEL

Exposure assessment is conducted within the context of a conceptual site model. As described in U.S. Environmental Protection Agency's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (U.S. Environmental Protection Agency, 1988), the purpose of the conceptual site model is to describe what is known about chemical sources, migration pathways, exposure routes, and possible exposure scenarios. An overall conceptual site model for the Site was presented in the work plan (Environ, 2002), which includes on-Site historical sources, migration pathways on Site and off Site, potential exposure media, and exposure routes for on-Site and off-Site receptors. This report focuses on on-Site soil and groundwater and related exposure pathways. Off-Site exposures to Site-related constituents in surface water and sediment will be considered in a separate risk assessment. The conceptual

site model presented in this report (Figure 3-1) has been limited to those elements related to Site soil and groundwater.

The primary sources of Site-related chemicals to the environment were the historic dip tank and wood surface protection practices in the former green chain area. In addition, operations at the truck shop, including a former UST, and the former teepee burner have resulted in chemicals in the environment. Spills and leaks are the assumed release mechanisms to surface and subsurface soil for all sources. Currently, the former green chain, the truck shop area, and former teepee burner are paved with asphalt or concrete that prevents contact with soil. Under some future conditions, it is possible that the soils could be uncovered resulting in potential exposure to Site-related constituents in soil.

Site-related constituents in soil appear to have migrated from soil to shallow groundwater through infiltration. The Remedial Investigation data indicated that impacted groundwater (i.e., concentrations exceeding the California and federal Maximum Contaminant Levels [MCLs]) is within a relatively small area of the facility in the shallow groundwater zone. The lateral extent is limited to within 150 feet of the source area and the vertical extent appears limited to less than 15 to 20 feet bgs. The shallow groundwater at the Site is not currently used as a drinking water source, and it is unlikely to be used in the foreseeable future. Therefore, there are no current or future receptors exposed to Site groundwater as a drinking water source.[1] However, it is possible that during future excavations, incidental direct contact with Site-related constituents in groundwater could occur.

The shallow groundwater flow direction in the vicinity of the historical source area is to the east and northeast toward Mad River Slough (MFG; 2003d). Based on available data, affected groundwater has not migrated to Mad River Slough. The risk assessment for off-Site media will consider this pathway further in a separate document.

3.2 SENSITIVE RECEPTOR SURVEY

EnviroNet conducted a sensitive receptor survey for the Site during the summer of 2002 (EnviroNet, 2003). The results of this survey are summarized herein.

The areas adjacent to the facility and to the south and east are estuaries. Across the Mad River Slough to the east of the facility is the Arcata Bottoms, a flat expanse of land, primarily in

[1] In addition, water quality objectives based on drinking water criteria have been established as a long-term remediation goals for groundwater by the Regional Water Quality Control Board in CAO No. R1-2003-127.

agricultural use, extending east approximately 3 miles to the City of Arcata. To the north and west of the Site are forested areas that progress to barrier coastal dunes (called the Manila Dunes), and the Pacific Ocean beyond.

The only developed areas within 1,000 feet of the facility lie to the southwest. There are two clusters of residences, one on each side of Samoa Boulevard approximately 500 feet from the Site boundary.

The Manila Community Service District provides water to all of the residences. Based on interviews with the water utility and the local residents, no water supply wells are known to exist within 1,000 feet of the Site.

There are two water supply wells on Site, both located north of the saw shop (Figure 1-2, location #11). The well that is in service is approximately 140 feet deep and is used exclusively for dust control and sprinkling the log deck. No Site-related constituents have been identified in this well; therefore, it does not represent a complete exposure pathway to constituents in groundwater. An older, out-of-service supply well is located near the in-service well. PCP and tetrachlorophenol were not detected in this well in samples collected in April 2003. The older well is not anticipated to be used in the future.

3.3 POTENTIAL RECEPTORS AND EXPOSURE ROUTES

Future industrial land use is assumed for the Site based on the long-term, continuous industrial use of the property. Therefore, various industrial scenarios were evaluated in this Baseline Human Health Risk Assessment for on-Site soil. A future industrial worker was evaluated assuming continued operation of the mill or other industrial operation after paving in the source area is removed. We evaluated workers that were predominantly indoors (e.g., office workers) separately from workers who were predominately outdoors (e.g., workers at the mill) to clearly identify the pathway contributing most significantly to potential exposure. A future construction worker was evaluated assuming new construction occurs in the former green chain area. A future trench/utility worker was evaluated assuming subsurface maintenance activities occur in the former green chain area. This receptor is also likely to be a sawmill employee, and this exposure also addresses personnel working in sediment ponds. If affected soil were uncovered in the future, it also is possible for on-Site soil particles to migrate to off-Site residential areas via wind erosion and/or to be dispersed off Site during construction activities. As such, a future off-Site resident was also evaluated.

As shown in the Conceptual Site Model (Figure 3-1), soil and shallow groundwater are the on-Site environmental media that may have been affected by constituents released from historic activities at the Site. On-Site receptors may be exposed to chemicals in soil via direct contact, volatilization of chemicals to air, and emission of particulates to air. Off-Site receptors may be exposed to particulates in air that disperse off Site.

On-Site receptors also may be exposed to chemicals in exposed groundwater in excavations, but other potential groundwater pathways are considered incomplete or insignificant. Direct contact with groundwater is possible during excavation work because groundwater at the Site is very shallow (between 1 and 5 feet below ground surface). Incidental ingestion of groundwater during excavation was not quantitatively evaluated because it would be insignificant compared with dermal exposure. Potential incidental exposure when groundwater levels rise to the surface was not evaluated quantitatively as it would be significantly less than the utility or construction worker's direct exposures. Workers are not likely to spend any significant time in the source area because the area of affected groundwater is beneath the sorter and not conducive to long-term occupancy. Volatile chemicals that volatize to ambient air from exposed groundwater have not been detected in groundwater so this exposure pathway is considered incomplete.

3.4 IDENTIFICATION OF EXPOSURE PATHWAYS

This section describes the potential pathways by which the receptors described above could be exposed to chemicals of potential concern in soil or groundwater at the Site. An exposure pathway is a description of the mechanism by which an individual may come into contact with chemicals of potential concern in the environment. In accordance with U.S. Environmental Protection Agency, risk assessment guidance (U.S. Environmental Protection Agency, 1989), all potential exposure pathways applicable to the Site have been identified and addressed. An exposure pathway is defined by four elements (U.S. Environmental Protection Agency, 1989):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport medium (e.g., soil, air) for the released constituents;
- A point of potential human contact with the medium of interest (e.g., exposed surface soil in the source area); and
- An exposure route (e.g., ingestion, dermal contact, or inhalation) at the contact point.

An exposure pathway is considered "complete" if all elements are present. If complete and significant, these pathways were quantitatively evaluated.

Table 3-1 summarizes the current and future exposure pathways that are potentially complete and evaluated in the risk assessment for the relevant receptors. To summarize, it is assumed that there are no current complete exposure pathways for on-Site soil or groundwater. The ground surface is covered by asphalt or concrete in the areas of affected soil, preventing direct contact. Affected groundwater has not migrated beyond the former green chain for use as a potential drinking water source, and on-grade buildings are not located over areas where volatile organic compounds were detected. Future conditions (e.g., removal of the ground cover during construction or maintenance activities or construction buildings over areas where volatile organic compounds were detected) could result in the following complete exposure pathways for the respective receptors:

Future On-Site Outdoor Industrial Worker

- Incidental ingestion of surface soil
- Dermal contact with surface soil
- Inhalation of particulates released from surface soil via wind erosion and during construction activities

Future On-Site Indoor Industrial Worker

- Inhalation of volatile organic compounds migrating to indoor air

Future On-Site Construction Worker

- Incidental ingestion of surface/subsurface soil
- Dermal contact with surface/subsurface soil
- Inhalation of particulates released from surface/subsurface soil during construction
- Incidental dermal contact with groundwater

Future On-Site Trench/Utility Worker

- Incidental ingestion of surface/subsurface soil
- Dermal contact with surface/subsurface soil
- Inhalation of particulates released from surface/subsurface soil during construction
- Incidental dermal contact with groundwater

Future Off-Site Residents

- Inhalation of particulates released from surface soil via wind erosion and during construction activities transported to off-Site residents

3.5 QUANTIFICATION OF EXPOSURE

The following paragraphs describe how exposure was quantified for the above exposure scenarios. The assumptions and approaches to be used are consistent with a reasonable maximum exposure (RME) approach as defined by U.S. Environmental Protection Agency (1989). The reasonable maximum exposure is defined by U.S. Environmental Protection Agency as the "highest exposure that is reasonably expected to occur at the site." Exposure is quantified as an average daily dose of a chemical from an environmental medium and is normalized for body weight. The result is expressed as a dose in units of milligram of chemical per kilogram of body weight per day (mg/kg-day; U.S. Environmental Protection Agency, 1989). This section describes the exposure point concentrations used to represent conditions in the environmental medium and exposure assumptions used to quantify exposure.

3.5.1 Exposure Point Concentrations

The concentrations of chemicals that characterize exposure will vary over space and time. However, a single concentration estimate (i.e., an exposure point concentration) is used in risk assessment calculations as described in U.S. Environmental Protection Agency guidance (1989, 1992a). This single value must be representative of the average concentration to which a person would be exposed over the duration of the exposure.

U.S. Environmental Protection Agency and California Environmental Protection Agency risk assessment guidance recommends that the 95 percent upper confidence limit of the mean be used as the exposure point concentration (U.S. EPA, 1992b, Cal-EPA, 1999). The underlying distribution of the data was used to determine how the 95 percent upper confidence limit was calculated. In cases where insufficient data was available to evaluate the distribution of the data, a normal distribution was assumed. In cases were the 95 percent upper confidence limit exceeded the maximum detected concentration, the maximum detected concentration was used as the exposure point concentration.

To consider results below the detection limit in the calculation of the 95 percent upper confidence limit, the current default position of the U.S. Environmental Protection Agency (1989) is to substitute one-half the sample quantitation limit for all non-detects. U.S. Environmental Protection Agency guidance (1992c) indicates that the substitution of one-half

the sample quantitation limit is adequate when the proportion of non-detects is less than 10 to 15%. If the fraction of non-detects becomes large, then assuming that the value of each non-detect is equal to one-half the sample quantitation limit will nearly always result in a substantial over-estimation of the mean of such data sets, with the degree of overestimation increasing with increasing proportions of non-detects.

3.5.1.1 Soil

The soil data were evaluated based on the specific exposure routes associated with each receptor. Soil data collected throughout the Site was used to estimate exposure because it is reasonable to assume that workers could be present at any location within the active area of the facility during the workday. For future industrial workers, potential exposure is limited to surface soils. Soil samples collected from the shallowest soil interval were selected to represent possible future "surface" soil conditions (less than 2.5 feet below ground surface). During excavations for construction or utility trenches, deeper soils may be contacted. Data for surface and surface/subsurface soil for chlorinated phenols was identified (Tables A-1 and A-2).[2] Insufficient data was available for other chemicals of potential concern to make this distinction. It should be noted that surface and subsurface exposure point concentrations for PCP are very similar (T able 3-2).

To identify the data distribution, distribution testing was conducted independently for surface and surface/subsurface data using detected values of PCP only. The number of samples in which other chemicals were detected was insufficient to conduct distribution testing. Both surface and surface/subsurface PCP data was considered lognormally distributed based on output from ProUCL (Appendix C). The method for calculating the 95% upper confidence limit of a lognormal dataset using all data was used (U.S. Environmental Protection Agency, 1992b) and the results are presented in Table 3-2.

The exposure point concentration for all other detected chemicals was the 95% upper confidence limit based on a normal distribution or the maximum value, whichever was lower. Results for 2,3,4-trichlorophenol were not reported for any soil samples; 2,4,5-trichlorophenol and 2,4,6-trichlorophenol were reported below detection limits but were not analyzed in samples collected before November 2002. To account for the possibility that these chemicals may be in future samples (they were detected in groundwater) and to calculate risk-based

[2] Per the boring logs from the Remedial Investigation, some samples consisted of fill material (e.g., buried wood, concrete, asphalt, gravel bed, etc.). These results were not used in exposure point concentration calculations.

remediation goals, concentrations equivalent to one-half the highest detection limit were used as exposure point concentrations for all three trichlorophenols in soil.

Table 3-2 presents the exposure point concentrations in soil that were used in this report.

3.5.1.2 Groundwater

Exposure to groundwater evaluated in this assessment is based on groundwater being exposed during construction or in a utility trench. Since the exposure would occur in a limited area, the maximum concentrations detected in groundwater were used as exposure point concentrations to be conservative. Only data collected from monitoring wells was used in the evaluation because grab groundwater sample results can be affected by the presence of sediment in the sample for many of the chemicals of potential concern and because an extensive network of monitoring wells has been installed in the source area. Table 3-2 presents the exposure point concentrations in groundwater that were used in this evaluation.

3.5.1.3 Particulates in Air

Particulates containing non-volatile chemicals of potential concern may be generated from surface soil via wind-erosion or from surface/subsurface soil during construction activities. The exposure point concentrations for airborne particulates were based on U.S. Environmental Protection Agency guidance for both wind-generation of particulates and construction generation of particulates (2001b). Appendix E presents the exposure point concentrations in air that were used in this evaluation.

A particulate emission factor based on U.S. Environmental Protection Agency guidance (2002) was calculated to estimate concentrations of particulate in air generated by wind. Under a construction worker or trench/utility worker scenario, fugitive dusts also may be generated from surface soils by construction vehicle traffic on temporary unpaved surfaces and other construction activities. For particulate emissions during construction, U.S. Environmental Protection Agency guidance (2002) was used to estimate concentrations of particulates in air from affected soil ($3.4x10^6$ kg/m^3). A more detailed description of the calculations is provided in Appendix D. For on-Site workers and off-Site residents, the particulate emission factor was a time-weighted average of particulates generated by wind erosion and particulates generated during construction ($8.2x10^8$ for the on-Site outdoor industrial worker and $9.8x10^8$ for the off-Site resident). This approach is conservative for the off-Site resident since dilution would occur as particulates in on-Site air are dispersed at least 500 feet down wind.

3.5.1.4 Volatile Compounds in Air

Exposure point concentrations in indoor air from volatile chemicals of potential concern in soil were estimated using the Johnson & Ettinger model. The Johnson & Ettinger model was parameterized by U.S. EPA (2003) to evaluate potential emissions from subsurface soil or groundwater to indoor air. A more detailed description of the model is presented in Appendix D. The exposure point concentrations are presented in Appendix E.

3.5.2 Intake Equations

Average daily dose (ADD) was calculated following U.S. Environmental Protection Agency guidance (U.S. Environmental Protection Agency, 1989; 1997). For noncarcinogens, an annual average daily dose (AADD) is calculated based on an averaging time equivalent to exposure duration. For potentially carcinogenic constituents, a lifetime average daily dose (LADD) is calculated based on an averaging time of a lifetime, or 70 years.

As an example, the following equation was used to estimate exposure for incidental ingestion of soil (U.S. Environmental Protection Agency, 1989):

$$ADD_{ing} = (C \times IR \times EF \times ED \times CF)/(BW \times AT)$$

Where:

ADD_{ing}	=	average daily dose of compound (mg/kg-day);
C	=	exposure concentration in media (mg/kg);
IR	=	ingestion rate (mg/day);
EF	=	exposure frequency (days/year);
ED	=	exposure duration (years);
CF	=	conversion factor (kg/mg);
BW	=	body weight (kg); and
AT	=	averaging time (days).

This equation was modified when estimating dermal and inhalation exposure and included pathway-specific parameters such as skin surface area, soil-to-skin adherence factor, absorption factor, etc. Many of these factors are receptor- and/or scenario-specific. The inputs for body weight and averaging time, however, are common to all dose equations. For adult receptors, body weight was assumed to be 70 kg (U.S. Environmental Protection Agency, 1991b). The default body weight for a young child (which is relevant to the off-Site residential scenario) is 15 kg (U.S. Environmental Protection Agency, 1991b). Averaging time inputs differ for carcinogenic and non-carcinogenic effects. For the lifetime average daily dose used to assess carcinogens, the averaging time (ATc) is a lifetime, assumed to be 70 years (i.e., 70 years x 365

days/year = 25,550 days). For the annual average daily dose used to assess noncarcinogens, the averaging time (ATnc) is equal to the exposure duration in days (i.e., ED years x 365 days/yr).

Cal-EPA and U.S. Environmental Protection Agency have published several documents that contain statistical data on the various factors used to assess exposure (Cal-EPA, 1996 and 1999; and U.S. Environmental Protection Agency, 1989, 1991a, 1991b, 1997a, and 2001). Cal-EPA and/or U.S. Environmental Protection Agency-recommended default exposure assumptions were used in this report to estimate exposure in the absence of Site-specific data. When default exposure factors were not available, professional judgment was used to develop an appropriate exposure factor.

3.5.3 Exposure Assumptions

The exposure assumptions for each receptor incorporated into the dose calculations are discussed in more detail below. The assumptions are presented for soil, groundwater, and air exposure pathways. Section 6.0, the uncertainty analysis, discusses the conservatism of many of these assumptions.

3.5.3.1 Soil Exposure Assumptions

Incidental ingestion and dermal contact are the two direct exposure routes to soil that are quantitatively evaluated in this report.

Future On-Site Outdoor Industrial Worker. This receptor was assumed to be a full-time employee with the potential to contact surface soil during daily work activities. Standard default exposure assumptions were applied for this receptor. This worker was assumed to be exposed for 250 days per year (i.e., 50-week work year with two weeks of vacation) over a 25-year exposure period. The default soil ingestion rate for this receptor was 100 mg/day. For dermal contact with soil, the default skin surface area (SA) available for exposure was 3,300 cm^2 (head, hands, and forearms, as this receptor is assumed to wear pants, work boots, and a short-sleeved shirt) and the default soil adherence factor is 0.2 mg/cm^2. Chemical-specific dermal absorbance factors are presented in Appendix C. Exposure parameters and references are summarized in Table 3-3.

Future On-Site Indoor Industrial Worker. This receptor is not directly exposed to chemicals of potential concern in soil, but is exposed to chemicals in indoor air (Section 3.5.3.3).

Future On-Site Construction Worker. This receptor was assumed to be engaged in soil movement and building activities in areas of recently excavated soil. For the purpose of this assessment, their exposure was assumed to occur during a single construction period. The duration of the construction project was assumed to be 90 days, which is equivalent to a 3 to 4 month project with a 5 to 6 day workweek. The default incidental ingestion rate for this receptor was 330 mg/day. For dermal contact with soil, the default skin surface area was 3,300 cm^2 and the default soil adherence factor was 0.3 mg/cm^2. Exposure parameters and references are summarized in Table 3-5.

Future On-Site Trench/Utility Worker. The trench/utility worker also was assumed to be engaged in excavation activities, but this receptor is assumed to be a facility employee who could be involved in a number of such projects over a 25-year employment period. For the purposes of this report, the exposure frequency for the trench/utility worker in areas affected by chemicals of potential concern was assumed to be 10 days per year, every five years. So over 25 years of employment, this would amount to five trench/utility projects for a single employee, for an overall total exposure frequency of 50 days. This exposure frequency also addresses workers who may contact material in the sediment ponds at the Site. The remaining exposure factors for the on-Site trench/utility worker were the same as for the construction worker (Table 3-6).

3.5.3.2 Groundwater Exposure Factors

Direct contact with groundwater exposed during construction or in a trench is evaluated quantitatively in this report for future on-Site construction workers and trench/utility workers. For dermal exposure to constituents in water, a chemical-specific partitioning coefficient (Kp) in units of centimeters per hour is incorporated into the standard intake equation as shown in Appendix E. It should be noted that this is a very conservative model, especially for highly lipophilic constituents like PCP and dioxins/furans, and this is highlighted in the discussion of uncertainty (Section 6.0). Partitioning coefficients for the chemicals of potential concern are presented in Appendix B.

Construction Worker: While the length of the construction project is assumed to be 90 working days, the period during which there is potential for incidental contact with shallow groundwater would be less than the entire construction project. It is reasonable to assume that in this shallow groundwater setting, sub-grade building levels would not be likely (which is consistent with existing construction at the Site). However, excavation may be needed to place footers and support pilings, and grading activities could occur over the extent of the building

footprint to level the surface and remove materials that would not provide geotechnical support for the building base. If shallow groundwater were encountered during excavation of footers and/or pilings, "dewatering" procedures would likely need to be implemented. Therefore, during the first week or so of the construction project, the workers would have the potential to contact shallow groundwater during dewatering procedures. Based on these assumptions, the groundwater exposure could occur over a period of 10 days (i.e., the first two weeks of the construction project) and daily exposure may occur for a period of an hour. The skin surface area was assumed to be 3,100 cm^2 representing hands, forearms, and feet since these are the most likely to contact water. The exposure factors and references are summarized in Table 3-7.

Trench/Utility Worker: As discussed in Section 3.4.1, the trench/utility worker scenario assumes that the worker is a plant employee who is employed for 25 years at this location, and may be engaged in multiple, shorter-duration excavation projects over the 25-year employment tenure. Similar to the construction scenario, it is reasonable to assume that dewatering procedures would be undertaken before commencing with repair/maintenance or installation of a buried feature. The exposure frequency assumed for each trenching project is 10 days, and it is assumed that the trench/utility worker has the potential for contacting shallow groundwater for an hour each day of the project while dewatering occurs in newly excavated locations. It is assumed that five trench/utility projects occur over the 25-year employment duration, for a total of 50 days of exposure. The skin surface area for exposure to shallow groundwater in a trench was assumed to be 3,100 cm^2, representing hands, forearms, and feet. This exposure frequency overestimates any incidental groundwater contact when groundwater is present at the surface. The exposure factors and references are summarized in Tables 3-7.

3.5.3.3 Air Exposure Factors

Inhalation of particles in ambient air or volatile organic compounds in indoor air was evaluated quantitatively in this report for all on-Site workers and off-Site residents.

Future On-Site Indoor or Outdoor Industrial Worker. These receptors are assumed to be full-time employees working at the Site. With regard to inhalation exposure, no distinction has been made between indoor and outdoor exposure assumptions; standard default exposure assumptions have been applied in this report. This worker was assumed to be exposed for 250 days per year (i.e., 50-week work year with two weeks of vacation) over a 25-year exposure period. The inhalation rate for all worker receptors was conservatively assumed to be 2.5 m^3/hr, representing a heavy activity level sustained over the work period of 8 hours. Exposure parameters and references are summarized in Tables 3-3 and 3-4.

Future On-Site Construction Worker. This receptor was assumed to be exposed to particulates in air over the 90-day construction period. The construction worker exposure was assumed to occur in one year. The inhalation rate for construction worker receptors was conservatively assumed to be 2.5 m^3/hr, representing a heavy activity level sustained over the work period of 8 hours. Exposure parameters and references are summarized in Table 3-5.

Future On-Site Trench/Utility Worker. This receptor was assumed to be exposed to particulates in air for 10 days per year every 5 years for a period of 25 years. The inhalation rate for trench/utility workers was conservatively assumed to be 2.5 m^3/hr, representing a heavy activity level sustained over the work period of 8 hours. Exposure parameters and references are summarized in Table 3-6.

Future Off-Site Resident. The resident was evaluated as a child for the first 6 years and as an adult for the remaining 24 years of a 30-year exposure period. Residents are assumed to be present for 350 days per year. The inhalation rate for the off-Site residential adult was 20 m^3/day, which converts to 0.83 m^3/hr for a 24-hour day. The inhalation rate for the off-Site residential child was 10 m^3/day, which is equivalent to 0.42 m^3/hr for a 24-hour day. The exposure factors and references are summarized in Table 3-8.

4.0 TOXICITY ASSESSMENT

The toxicity assessment provides a description of the relationship between a dose of a chemical and the anticipated incidence of an adverse health effect. Toxicity values are derived from the quantitative dose response association and are correlated with the quantitative exposure assessment in the risk characterization. The primary source for toxicity information (i.e., cancer slope factors [CSF] for potentially carcinogenic effects or reference doses [RfDs] for noncarcinogenic effects) in this report was Cal-EPA's Office of Environmental Health Hazard Assessment (OEHHA) on-line database of recommended toxicity values <www.oehha.ca.gov>. If Cal-EPA values were not available, then the U.S. Environmental Protection Agency's on-line Integrated Risk Information System <www.epa.gov.iris> was consulted for toxicity criteria. If values were not available from these resources, U.S. Environmental Protection Agency's Health Effects Assessment Summary Tables (HEAST) (1997) or Preliminary Remediation Goals (2003) were used as a third and fourth tier sources for toxicity information for this report.

For risk assessment purposes, toxic constituent effects are separated into two categories of toxicity: carcinogenic effects and noncarcinogenic effects. This division relates to the currently held U.S. Environmental Protection Agency policy position that the mechanisms of

action for these endpoints differ. Generally, the U.S. Environmental Protection Agency has required that potentially carcinogenic chemicals be treated as if minimum threshold doses do not exist (U.S. Environmental Protection Agency, 1989), whereas noncarcinogenic effects are recognized as threshold phenomena. The bases of the toxicity criteria for noncarcinogenic and carcinogenic effects are discussed below.

4.1 HEALTH EFFECTS CRITERIA FOR NONCARCINOGENIC CONSTITUENTS

It is widely accepted that noncarcinogenic biological effects of chemical substances occur only after a threshold dose is achieved (Klaassen, 1996). This threshold concept of noncarcinogenic effects assumes that a range of exposures up to some defined threshold can be tolerated without appreciable risk of adverse health effects. Adverse effects may be minimized at concentrations below the threshold by pharmacokinetic processes, such as decreased absorption, distribution to non-target organs, metabolism to less toxic chemical forms, and excretion (Klaassen, 1996).

Reference dose values and reference concentrations have been developed by the U.S. Environmental Protection Agency Reference Dose Work Group on the basis of a wide array of noncarcinogenic health effects. The reference dose and reference concentration are estimates of the daily maximum level of exposure to human populations (including sensitive subpopulations) that are likely to be without an appreciable risk of deleterious effects during a lifetime (U.S. Environmental Protection Agency, 1989). Reference doses are expressed in units of daily dose (mg/kg-day) while reference concentrations are expressed as an air concentration (mg/m3) and apply to inhalation exposures. Both incorporate uncertainty factors to account for limitations in the quality or quantity of available data. In this report, reference concentrations (ug/m^3) were converted to reference doses (mg/kg-day) following standard assumptions for inhalation rate (20 m^3/day) and body weight (70 kg). Table 4-2 presents the reference doses for the chemicals of potential concern.

Chronic reference doses were applied to exposure scenarios with durations of 7 years or greater, and subchronic reference doses (if available) are applied to scenarios with durations of less than 7 years (EPA, 1989). The construction scenario is a shorter-duration exposure scenario, and subchronic reference doses, if available, were applied to this scenario. Chronic reference doses were applied to all other exposure scenarios.

4.2 TOXICITY CRITERIA FOR POTENTIAL CARCINOGENIC CONSTITUENTS

Potential carcinogenic effects resulting from human exposure to constituents are estimated quantitatively using cancer slope factors, which represent the theoretical increased risk per

milligram of constituent intake per kilogram body weight per day $(mg/Kg\text{-}day)^{-1}$ or unit risks, which are the theoretical increased risk per unit concentration. Cancer slope factors or unit risks are typically derived for "known or probable" human carcinogens. Cancer slope factors or unit risks were used to estimate a theoretical upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular lifetime daily dose of a potential carcinogen. Table 4-1 presents the cancer slope factors for the chemicals of potential concern.

5.0 RISK CHARACTERIZATION

Risk characterization represents the final step in the risk assessment process. In this step, the results of the exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. Potential noncarcinogenic health effects and carcinogenic health risks are characterized separately.

5.1 NONCARCINOGENIC EFFECTS

Potential adverse noncarcinogenic health effects were evaluated using the hazard index (also called HI) approach as recommended by U.S. EPA (1989). The first step in this approach is to compare the average annual daily dose (AADD) for each chemical to the appropriate reference dose (RfD). This comparison is expressed in terms of a "hazard quotient," which is calculated as follows:

$$\text{Hazard Quotient}_i = \frac{\text{AADD}_i}{\text{RfD}_i}$$

A hazard quotient less than or equal to 1 indicates that the predicted exposure to that chemical should not result in an adverse noncarcinogenic health effect (U.S. EPA, 1989). In cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), potential additive effects may be addressed by calculating a hazard index as follows:

$$\text{Hazard Index} = \sum_{i=1}^{n} \text{Hazard Quotient}_i$$

A hazard index of less than or equal to 1 indicates acceptable levels of exposure for chemicals having an additive effect. In this Baseline Human Health Risk Assessment, a screening-level hazard index was calculated by summing the hazard quotients for all chemicals, regardless of

toxic endpoint, as recommended by agency guidance (U.S. EPA, 1989). This approach is generally believed to overestimate the potential for noncarcinogenic health effects due to simultaneous exposure to multiple chemicals because it does not account for different toxic endpoints (U.S. EPA, 1989; NRC, 1988; Risk Commission, 1997; Seed, et al., 1995). Although conservative, it can be used as a screening tool to rapidly identify those exposure scenarios for which exposure to multiple chemicals does not pose a noncarcinogenic health risk.

It should be noted that hazard quotients or hazard indices greater than 1 do not necessarily mean that adverse health effects will be observed. As discussed in Section 4.0, a substantial margin of safety has been incorporated into some of the reference doses developed for the chemicals of potential concern. Therefore, for these chemicals, adverse health effects may not be observed even if the hazard quotient or hazard index is much larger than 1. If the screening hazard index is greater than 1, a target organ-specific hazard index may be calculated to more accurately assess the potential for noncarcinogenic effects to specific target organs.

The following sections summarize the results of the noncarcinogenic risk characterization for the receptors evaluated. The summary hazard indices are presented in Tables 5-1 through 5-5; the calculations supporting these values are presented in Appendix E.

Future On-Site Outdoor Industrial Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the chemicals of potential concern in soil by the future on-Site outdoor industrial worker are summarized in Table 5-1; the calculation spreadsheets are presented in Appendix E. The total hazard index is 0.04, indicating that exposure to chemicals in soil should not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Future On-Site Indoor Industrial Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the Chemicals of potential concern in soil by the future on-Site indoor industrial worker are summarized in Table 5.2; the calculation spreadsheets are presented in Appendix E. The total hazard index is 0.6, indicating that exposure to chemicals in soil should not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Future On-Site Construction Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the Chemicals of potential concern in soil and groundwater by the future on-Site construction worker are summarized in Table 5-3 the calculation spreadsheets are presented in Appendix E. The total hazard index is 1, indicating that exposure to chemicals in soil and groundwater should not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Future On-Site Trench/Utility Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the Chemicals of potential concern in soil and groundwater by the future on-Site trench/utility worker are summarized in Table 5-4; the calculation spreadsheets are presented in Appendix E. The total hazard index is 1, indicating that exposure to chemicals in soil and groundwater should not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Future Off-Site Resident

The potential noncancer hazard quotients and hazard indexes associated with exposure to the Chemicals of potential concern in soil by the future off-Site resident are summarized in Table 5-5; the calculation spreadsheets are presented in Appendix D. The total hazard index is 0.00002, indicating that exposure to chemicals in soil should not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

5.2 CARCINOGENIC EFFECTS

Carcinogenic health risks are defined in terms of the increased probability of an individual developing cancer as the result of exposure to a given chemical at a given concentration. As required by Cal-EPA (1992) and U.S. EPA (1989), lifetime excess cancer risks are estimated as follows:

$$\text{Lifetime Excess Cancer Risk}_i = \text{LADD}_i \times \text{SF}_i$$

As with hazard indices, the estimated excess cancer risks for each chemical and exposure route are summed regardless of toxic endpoint to estimate the total excess cancer risk for the exposed individual.

Regulatory agencies such as Cal-EPA and U.S. EPA have defined what is considered an acceptable level of risk in similar though slightly different ways. The U.S. EPA considers $1x10^{-6}$ to $1x10^{-4}$ to be the target range for acceptable risks at sites where remediation is

considered (U.S. EPA, 1990a and 1990b). Estimates of lifetime excess cancer risk associated with exposure to chemicals of less than one-in-one-million ($1x10^{-6}$) are considered to be so low as to not warrant any further investigation or analysis (U.S. EPA, 1990a). Within the State of California, Cal-EPA also tends to work within the same target range for acceptable risks. Pursuant to the California Safe Drinking Water & Toxic Enforcement Act of 1986, the Office of Environmental Health Hazard Assessment has established a no significant risk level at $1x10^{-5}$ (CCR Division 21.5, Title 22, э 12703). In fact, many air management districts consider $1x10^{-5}$ to be an acceptable risk level for managing air emissions under the Toxics Hot Spots program.

It should be noted that cancer risks in the $1x10^{-6}$ to $1x10^{-4}$ range or higher do not necessarily mean that adverse health effects will be observed. Current methodology for estimating the carcinogenic potential of chemicals is believed to not underestimate the true risk, but could overestimate the true risk by a considerable degree. In fact, the range of possible risks includes zero.

The following sections summarize the results of the carcinogenic risk characterizations for the receptors evaluated. The summary of estimated lifetime excess cancer risks are presented in Tables 5-6 through 5-11; the calculations supporting these values are presented in Appendix E.

Future On-Site Outdoor Industrial Worker

The estimated theoretical lifetime excess cancer risks associated with exposure to the Chemicals of potential concern in soil by future on-Site outdoor industrial worker are summarized in Table 5-6; the calculation spreadsheets are presented in Appendix E. The total estimated cancer risk is $1x10^{-5}$, which is within the range of $1x10^{-4}$ to $1x10^{-6}$.

Future On-Site Indoor Industrial Worker

Volatile chemicals of potential concern in soil were not considered carcinogenic so there is no exposure to carcinogenic chemicals for this receptor.

Future On-Site Construction Worker

The estimated theoretical lifetime excess cancer risks associated with exposure to the chemicals of potential concern in soil and groundwater by future on-Site construction workers are summarized in Table 5-7; the calculation spreadsheets are presented in Appendix E. The total estimated cancer risk is $6x10^{-5}$, which is within the range of $1x10^{-4}$ to $1x10^{-6}$. Dermal contact with PCP in groundwater accounts for over 95 percent of the risk for this receptor. The

potential exposure was conservatively based on the maximum PCP concentration in groundwater, but recent concentrations are lower.

Future On-Site Trench/Utility Workers

The estimated theoretical lifetime excess cancer risks associated with exposure to the chemicals of potential concern in soil and groundwater by future on-Site trench/utility workers are summarized in Table 5-8; the calculation spreadsheets are presented in Appendix E. The total estimated cancer risk is $3x10^{-4}$, which is above the range of $1x10^{-4}$ to $1x10^{-6}$. Dermal contact with PCP in groundwater accounts for over 95 percent of the risk for this receptor. The potential exposure was conservatively based on the maximum PCP concentration in groundwater, but recent concentrations are lower.

Future Off-Site Residents

The estimated theoretical lifetime excess cancer risks associated with exposure to the chemicals of potential concern in soil by future off-Site residents are summarized in Tables 5-9 and 5-10 the calculation spreadsheets are presented in Appendix E. The total estimated cancer risk is $4\ x10^{-9}$, which is below the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. Therefore, exposure to chemicals in soil should not result in an unacceptable cancer risk under the conditions evaluated for this receptor.

6.0 UNCERTAINTY ANALYSIS

Uncertainty is inherent in many aspects of the risk assessment process, and generally arises from a lack of knowledge of (1) site conditions, (2) toxicity and dose-response of the COPCs, and (3) the extent to which an individual will be exposed to those chemicals. This lack of knowledge means that assumptions must be made based on information presented in the scientific literature or professional judgment. While some assumptions have significant scientific basis, others have much less. The assumptions that introduce the greatest amount of uncertainty and their effect on the noncarcinogenic and carcinogenic risk estimates are discussed below. This discussion is generally qualitative in nature, reflecting the difficulty in quantifying the uncertainty in specific assumptions. In general, assumptions were selected in a manner that purposefully biases the process toward health conservatism.

6.1 UNCERTAINTY IN DATASETS

A large dataset is available for PCP in soil; Figure 2-1 shows the general density of soil sampling. The dataset for other chemicals of potential concern is smaller, which may

underestimate the risks calculated if higher concentrations of chemicals are present in soil. For example, only PCP was analyzed in the immediate source area near the former green chain. However, the calculation of the risk-based remediation goals provides a tool for evaluating the significance of data that will be collected during on going Site investigations.

6.2 UNCERTAINTY IN EXPOSURE ASSESSMENT

Use of Maximum Detected Concentrations. For groundwater, maximum concentrations were selected as exposure point concentrations for purposes of evaluating human health risks if groundwater were contacted during excavation activities. The maximum concentration was used since excavations involving groundwater are likely to be in a limited area. This is an overestimation of the actual groundwater concentration over the majority of the site since groundwater contamination appears to be confined to a localized area.

Use of Default Exposure Factors. Although care has been taken to apply Site- or receptor-specific exposure factors, U.S. Environmental Protection Agency defaults were used in many cases for the exposure scenarios. For example, the U.S. Environmental Protection Agency default values were used for exposure frequency and duration for the industrial worker and these may result in an overestimation of actual exposure and risks. In the default exposure scenario used for the industrial worker in this report (8 hours per day, 5 days per week, 50 weeks per year, for 25 years), no time is allowed for holidays, sick leave, inclement weather, or working in locations other than the portions of the facility with affected soil and groundwater (which is not the majority of the Site). The actual time spent working exclusively in potentially impacted portions of the facility is likely to be less than the exposure time in the default assumptions. It is also unlikely that a worker would remain in the same job for the entire exposure duration. Therefore, the standard exposure factors used for this Baseline Human Health Risk Assessment tend to overestimate the potential exposure. In addition, when multiplied together, the conservative assumptions are compounded and result in estimated intakes that likely overestimate exposure.

Particulate Emission Factor for On-Site Emissions/Dispersion Used for Off-Site. It should be noted that an on-Site particulate emission factor was used to conservatively estimate off-Site air particulate concentrations at residences approximately 500 feet from the site. This does not take into account dispersion as the particulates migrate off Site. Risks and noncarcinogenic hazards were shown to be acceptable even with this conservative approach.

Inclusion of Dermal Exposure to Soil Pathway. Dermal exposures often do not contribute a substantive risk due to low bioavailability, low moisture content of surface soils, and short exposure periods for actual adherence of soil to skin. However, dermal contact with soil was evaluated as a complete exposure pathway for all applicable receptors in this assessment.

Dermal Exposure Model for Intake from Water. It should be noted that the modeling of dose from dermal contact with groundwater predicts a daily dose for a short dermal exposure to hands and feet that is similar to the dose from ingesting 2 liters/day of water with the same concentration of the chemical of potential concern. For example, the dermal daily intake calculated for groundwater exposure to PCP by for the trench/utility worker for contact for one hour per day is 2% of the daily intake from ingesting 2 liters per day. There is a great deal of uncertainty in the dermal model, but it appears to err significantly on the side of conservatism if it predicts such large intakes compared with the ingestion pathway.

The U.S. Environmental Protection Agency acknowledges that the equation for calculating the permeability coefficient (Kp) for absorption of chemicals in groundwater was not derived using chemicals with octanol/water partition coefficients greater than 4 (U.S. EPA, 2001). Pentachlorophenol and dioxins/furans were specifically identified as such chemicals by U.S. EPA (2001). Tetrachlorophenols also have partition coefficients greater than 4. However, with no other data presently available for chemicals with very large partition coefficients, U.S. EPA recommends using the estimated of the partition coefficient. This approach introduces uncertainty into the estimate of dermal exposure to chemicals in groundwater that likely overestimates potential risk.

6.3 UNCERTAINTY IN TOXICITY ASSESSMENT

Toxicity assessments for all of the chemicals of potential concern in the Baseline Human Health Risk Assessment involve the extrapolation of results from studies on animals. Safety factors or other conservative assumptions are used so as not to underestimate the potential for health effects in humans based on animal studies at high doses. The following are standard assumptions applied by the U.S. Environmental Protection Agency when extrapolating the results of studies of carcinogenicity in animals to humans (HWCP, 1993).

- Any constituent showing carcinogenic activity in any animal species will also be a human carcinogen;
- There is no threshold dose for carcinogens;
- The results of the most sensitive animal study are appropriate to apply to humans; and

- Humans are more sensitive than the most sensitive animal species on a body weight basis.

These assumptions are conservatively incorporated into the toxicity criteria used to assess risk. These assumptions and other elements of uncertainty in toxicity assessments include the following:

Animal to Human and High to Low Dose Extrapolations—Carcinogens. Uncertainties are introduced in animal to human extrapolation and high to low dose extrapolation. Mathematical models are used to estimate the possible responses due to exposure to chemicals at levels far below those tested in animals. These models contain several limitations, which should be considered when the results (e.g., risk estimates) are evaluated. Primary among these limitations is the uncertainty in extrapolation of results obtained in animal research to humans and the shortcomings in extrapolating responses obtained from high-dose research studies to estimate responses at very low doses. For example, humans are typically exposed to environmental chemicals at levels that are less than a thousandth of the lowest dose tested in animals. Such doses may be easily degraded or eliminated by physiological mechanisms that are present in humans (Ames, 1987; Abelson, 1990).

Dose Response Assessment—Noncarcinogens. Approaches typically utilized for designating reference doses (RfDs) are highly conservative. For example, the U.S. Environmental Protection Agency (1989) applies a safety factor of 10 to a no observed adverse effect level (NOAEL) for a constituent in an animal study for animal-to-human extrapolation. An additional factor of 10 is applied for sensitive persons within the human population, and additional factors of 10 may be applied to account for limitations in data quality or incomplete studies. Frequently, reference doses are derived from animal studies that have little quantitative bearing on potential adverse effects in humans. Some of this uncertainty may be reduced if the absorption, distribution, metabolic fate, and excretion parameters of a constituent are known.

Reference doses and reference concentrations used to quantify noncarcinogenic hazards are generally derived from the degree of chemical exposure that produces no adverse effects in animals. The chemical concentration at which no adverse effect is noted is referred to as a NOAEL. This value is then further reduced with "safety factors" to increase the margin of safety for the potentially exposed population. For example, a safety factor of 100 was applied to the NOAEL to derive the oral reference dose for PCP.

Confidence in the database from which reference doses and reference concentrations are derived is evaluated by U.S. Environmental Protection Agency and ranked as "high, medium, or low." Similar to the weight of evidence associated with each cancer slope factor, a non-quantitative confidence statement cannot be carried forward in the report, and all reference doses and reference concentrations are treated equally, (i.e., as all being of high confidence). The estimated hazard indexes are not numerically qualified with this uncertainty in mind.

6.4 UNCERTAINTY IN RISK CHARACTERIZATION

One source of uncertainty that is unique to risk characterization is the assumption that the total risk associated with exposure to multiple chemicals is equal to the sum of the individual risks for each chemical (i.e., the risks are additive). Other possible interactions include synergism, where the total risk is higher than the sum of the individual risks, and antagonism, where the total risk is lower than the sum of the individual risks. Relatively little data are available regarding potential chemical interactions following environmental exposure to chemical mixtures. Some studies have been carried out in rodents given simultaneous doses of multiple chemicals. The results of these studies indicated that no interactive effects were observed for mixtures of chemicals affecting different target organs (i.e., each chemical acted independently), whereas antagonism was observed for mixtures of chemicals affecting the same target organ, but by different mechanisms (Risk Commission, 1997).

While there are no data on chemical interactions in humans to chemical mixtures at the dose levels typically observed in environmental exposures, animal studies suggest that synergistic effects will not occur at levels of exposure below their individual effect levels (Seed, et al., 1995). As exposure levels approach the individual effect levels, a variety of interactions may occur, including additive, synergistic and antagonistic (Seed, et al., 1995).

Current U.S. EPA guidance for risk assessment of chemical mixtures (U.S. EPA, 1989) recommends assuming an additive effect following exposure to multiple chemicals. Subsequent recommendations by other parties, such as the National Academy of Sciences (NRC, 1988) and the Presidential/Congressional Commission on Risk Assessment and Risk Management (Risk Commission, 1997) have also advocated a default assumption of additivity. As currently practiced, risk assessments of chemical mixtures generally sum cancer risks regardless of tumor type and sum non-cancer hazard indices regardless of toxic endpoint or mode of action. Given the available experimental data, this approach likely overestimates potential risks associated with simultaneous exposure to multiple chemicals.

7.0 RISK-BASED REMEDIATION GOAL CALCULATIONS

To expedite the risk evaluation of additional soil and groundwater data that are being collected during on-going investigations, Site-specific soil and groundwater risk-based remediation goals have been calculated for the chemicals of potential concern. Water quality objectives for long-term protection of the water resource set by the Regional Water Quality Control Board also are applicable. The risk-based remediation goals are based on the exposure scenarios that were quantitatively evaluated in this Baseline Human Health Risk Assessment.

Concentrations of chemicals of potential concern in soil in the vicinity of the former green chain were compared with the risk-based remediation goals for soil to address this source area. The results of this Baseline Human Health Risk Assessment incorporated the maximum historical concentration of chemicals in groundwater so further comparison of the existing groundwater data to risk-based remediation goals is not necessary.

7.1 RISK-BASED REMEDIATION GOAL CALCULATIONS

Risk-based remediation goals (RBRGs) were calculated using the following equations for all the exposure scenarios from this Baseline Human Health Risk Assessment. Risk-based remediation goals were calculated separately for soil and groundwater. The equations for carcinogens and non-carcinogens, are:

$$\mathbf{RBRG_{carc}} = \frac{\mathbf{EPC \times Target\ Risk}}{\mathbf{Calculated\ Risk}}$$

And

$$\mathbf{RBRG_{noncarc}} = \frac{\mathbf{EPC \times Target\ Hazard\ Index}}{\mathbf{Calculated\ Hazard\ Index}}$$

Table 7-1 presents scenario-specific risk-based remediation goals for chemicals of potential concern in soil. These risk-based remediation goals were calculated for target risks of $1x10^{-6}$, $1x10^{-5}$, and $1x10^{-4}$, and a target hazard index of 1. For each chemical of potential concern, the lowest risk-based remediation goal for noncarcinogens and the lowest risk-based remediation goal for carcinogens based on a $1x10^{-5}$ risk are highlighted (Table 7-1).

Table 7-2 provides the scenario-specific groundwater risk-based remediation goals based on incidental dermal contact with chemicals of potential concern during excavation. Again, the

lowest of the risk-based remediation goals for noncarcinogens or risk-based remediation goal for carcinogens based on a $1x10^{-5}$ risk is highlighted.

Risk-based remediation goals are developed to evaluate concentrations in soil and groundwater. For the purpose of evaluating future data collected at the Site, these concentrations will be based on a limited source area (e.g., a maximum value) or an exposure area for a specific receptor (e.g., an average concentration). Because risk-based remediation goals are based on single chemicals, cumulative effects of exposure to multiple chemicals also should be evaluated when more than one carcinogen or noncarcinogenic is detected. Cumulative effects are evaluated by dividing the exposure point concentration for each chemical by the risk-based remediation goal, separately for noncarcinogens and carcinogens. If the sum for all noncarcinogenic or carcinogenic chemicals exceeds one, potential cumulative effects should be evaluated further.

7.2 HISTORICAL PCP AREA CONCENTRATIONS COMPARED WITH RISK-BASED REMEDIATION GOALS

Risk-based remediation goals were used to assess further PCP concentrations in soil in the source area. This risk assessment evaluated site-wide concentrations of PCP in soil; however concentrations of PCP were highest in the source area. The maximum concentration in groundwater in the source area was evaluated in the risk assessment so groundwater concentrations were not evaluated further.

To evaluate concentrations of chemicals of potential concern in soil in the source area, the maximum concentration in soil from this area (Appendix A) was compared with the Site-specific risk-based remediation goals for an on-Site industrial worker. These risk-based remediation goals were the most restrictive (i.e., lowest) for soil among the receptors evaluated. The maximum PCP concentration in soil (51 milligrams per kilogram) was below the risk-based remediation goal for a $1x10^{-5}$ risk and above the risk-based remediation goal for a $1x10^{-6}$ risk for an on-site industrial worker (Table 7-1). Cumulative risks were evaluated by the methodology outlined in Section 7.1. Carcinogenic risk from potential exposure to maximum concentrations of all carcinogens in soil in the former green chain area (dioxins/furans, PCP, and 2,4,6-trichlorophenol) was at a $1x10^{-5}$ risk for an on-site industrial worker.

8.0 CONCLUSIONS

A Baseline Human Health Risk Assessment was conducted to evaluate potential health risks for on-site and off-site human receptors to concentrations of chemicals detected in soil and

groundwater at the Site. Currently, there are no exposures for on-site workers or off-site residents in areas where chemicals of potential concern have been detected. The areas of affected soil are paved, preventing direct contact. Groundwater has not migrated beyond the former green chain for use as a potential drinking water source, and on-grade buildings are not located over areas with volatile organic compounds in soil or groundwater. Future potential exposures to chemicals in soil and groundwater were quantitatively evaluated for the following receptors: an indoor industrial worker, an outdoor industrial worker, a construction worker, a trench/utility worker, and an off-site resident.

The estimated cancer risks and hazard indexes based on potential exposure to chemicals in soil and groundwater were as follows:

- For the outdoor industrial worker, the carcinogenic risk was at $1x10^{-5}$, and the noncarcinogenic hazard index was less than 1.
- For the indoor industrial worker, the carcinogenic risk was not quantified because no volatile carcinogenic chemicals were detected in soil or groundwater. The noncarcinogenic hazard index was less than 1.
- For the construction worker, the potential carcinogenic risk was less than $1x10^{-4}$, and the noncarcinogenic hazard index was 1.
- For the trench/utility worker, the potential carcinogenic risk was greater than $1x10^{-4}$ ($3x10^{-4}$), and the noncarcinogenic hazard index was 1.
- For the off-site resident, potential carcinogenic risk was less than $1x10^{-6}$, and the noncarcinogenic hazard index was significantly less than 1.

Potential dermal exposure to PCP in groundwater accounts for over 95 percent of the carcinogenic risk and noncarcinogenic hazard index for the construction and trench/utility workers. It should be noted that exposure to PCP in groundwater via dermal contact may be overestimated based on the assumed permeability of PCP through the skin as acknowledged in U.S. EPA's dermal exposure guidance (2001). In addition, current (May 2003) PCP concentrations in groundwater at monitoring well MW-7 are about three times lower than the exposure point concentration, which was the maximum historical concentration detected. The current PCP concentration in groundwater at monitoring well MW-7 was below the lowest risk-based remediation goal for groundwater based on a $1x10^{-4}$ risk.

Potential exposure to PCP in groundwater can be mitigated through a health and safety program until groundwater concentrations are below the risk-based remediation goal. Because the PCP

plume is within the boundaries of the SPI property, SPI is able to control how and where excavation and potential contact with chemicals of potential concern in subsurface soil and groundwater would occur. To minimize exposure, workers possibly contacting shallow groundwater in the vicinity of monitoring well MW-7 (former green chain) should wear personal protective equipment (e.g., gloves, waterproof clothing).

Risk-based remediation goals were developed for chemicals detected in soil and groundwater for all five receptors evaluated in this report. Risk-based remediation goals were quantified for a noncarcinogenic hazard index of 1 and carcinogenic risks of $1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$. Additional data collected during on-going investigations can be compared to these risk-based remediation goals to evaluate potential health risks and risk management controls, if necessary.

The exposure point concentration for PCP in soil considered all data collected at the Site. To evaluate PCP in the former green chain source area, the maximum concentration of PCP detected in soil in the vicinity of the former green chain was compared to the risk-based remediation goal for an on-site industrial worker. These risk-based remediation goals were the most restrictive (i.e., lowest) for soil among the receptors evaluated. The maximum PCP concentration in soil was below the risk-based remediation goal for a $1x10^{-5}$ risk and above the risk-based remediation goal for a $1x10^{-6}$ risk for an on-site industrial worker. Cumulative risks were evaluated by the methodology outlined in this report, and exposure to all carcinogens in soil in the former green chain area (dioxins/furans, PCP, and 2,4,6-trichlorophenol) were at a $1x10^{-5}$ risk for an on-site industrial worker.

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TABLES

TABLE 2-1
DATA SUMMARY FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in milligrams per kilogram (mg/kg)

Chemicals of Potential Concern	Number of Samples	Number of Detections	Frequency Of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Minimum Detection Limit	Maximum Detection Limit
Acetone	6	1	17%	0.13	0.13	0.02	0.87
Chlorobenzene	6	1	17%	0.49	0.49	0.005	0.22
1,4-Dichlorobenzene	6	2	33%	0.35	0.39	0.005	0.22
Methyl ethyl ketone	6	1	17%	0.031	0.031	0.015	0.65
Naphthalene	6	1	17%	0.24	0.24	0.005	0.22
PCP - all "surface" data	76	9	12%	1	59	1	1
PCP - all surf/subsurf data	219	25	11%	1	69.5	1	8
2,3,7,8-TCDD equivalents	6	6	100%	0.0000005	0.000305	NA	NA
2,3,4,5-Tetrachlorophenol	66	0	0%	0	0	1	1
2,3,4,6-Tetrachlorophenol	66	0	0%	0	0	1	1
2,3,5,6-Tetrachlorophenol	66	0	0%	0	0	1	1
2,4,5-Trichlorophenol	2	0	0%	0	0	0.33	1.6
2,4,6-Trichlorophenol	68	0	0%	0	0	0.33	1.6
1,2,4-Trimethylbenzene	6	2	33%	0.23	0.33	0.005	0.22

Notes:

NA = Not applicable

TABLE 2-2
DATA SUMMARY FOR CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in milligrams per liter (mg/L)

Chemical	Number of Samples	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Minimum Detection Limit	Maximum Detection Limit	Chemical of Potential Concern for Baseline HHRA?
Dioxins/furans (TCDD TEQs) [1]	3	3	100%	4.07E-10	2.66E-09	NA	NA	Yes
PCP	109	30	28%	0.0012	51	0.001	0.001	Yes
2,3,4,5-Tetrachlorophenol	109	12	11%	0.13	1.3	0.001	0.001	Yes
2,3,4,6-Tetrachlorophenol	109	6	6%	0.021	0.076	0.001	0.001	Yes
2,3,5,6-Tetrachlorophenol	109	9	8%	0.0055	0.064	0.001	0.001	Yes
2,3,4-Trichlorophenol	1	1	100%	0.28	0.28	NA	NA	Yes
2,4,5-Trichlorophenol	1	1	100%	0.19	0.19	NA	NA	Yes
2,4,6-Trichlorophenol	109	2	2%	0.0024	0.0031	0.001	0.001	Yes

Notes:

1. TCDD TEQs = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalents

TABLE 3-1
SELECTION OF EXPOSURE PATHWAYS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Exclusion of Exposure Pathway
Current	On-Site Surface Soil	Surface Soil	None	Industrial Worker	Adult	None	None	Surface of investigation areas are covered by asphalt or concrete. Therefore, no current complete exposure pathways with soil.
	Dispersion of Particulates to On-Site Air	Air	None	Industrial Worker	Adult	None	None	Surface of investigation areas are covered by asphalt or concrete. Therefore, no current means for soil particles to be generated to air.
	Volatilization to Ambient Air	Air	Air	Industrial Worker	Adult	Inhalation of Volatiles	None	Volatile chemicals detected in soil and groundwater; potential volatilization to future indoor air will be quantified and sufficently protective of ambient air.
	On-Site Shallow Groundwater	Groundwater	None	Industrial Worker	Adult	None	None	Shallow groundwater (i.e., groundwater zone containing PCP>Maximum Contaminant Level) is not used for potable purposes.
	Off-Site Groundwater	Groundwater	None	Off-Site Receptor	NA	None	None	Groundwater concentrations of PCP attenuate laterally and vertically to <Maximum Contaminant Level before reaching property boundary.
	Dispersion of Particulates to Off-Site Air	Air	None	Off-Site Resident	Adult	None	None	Surface of investigation areas are covered by asphalt or concrete. Therefore, no current means for soil particles to be generated to air.
	Dispersion of Particulates to Off-Site Air	Air	None	Off-Site Resident	Child	None	None	Surface of investigation areas are covered by asphalt or concrete. Therefore, no current means for soil particles to be generated to air.
Future	On-Site Surface Soil	Surface Soil	Surface Soil	Industrial Worker	Adult	Incidental Ingestion	Quantitative	
						Dermal Contact	Quantitative	
	Dispersion of Particulates to On-Site Air	Air	Air	Industrial Worker	Adult	Inhalation of Particulate	Quantitative	
	Volatilization to Indoor Air	Air	Indoor Air	Industrial Worker	Adult	Inhalation of Volatiles	Quantitative	
	On-Site Surface/ Subsurface Soil	Surface/ Subsurface Soil	Surface/ Subsurface Soil	Construction Worker	Adult	Incidental Ingestion	Quantitative	
						Dermal Contact	Quantitative	
	Dispersion of Particulates to On-Site Air	Air	Air	Construction Worker	Adult	Inhalation of Particulate	Quantitative	
	On-Site Surface/ Subsurface Soil	Surface/ Subsurface Soil	Surface/ Subsurface Soil	Trench Utility Worker	Adult	Incidental Ingestion	Quantitative	
						Dermal Contact	Quantitative	
	Dispersion of Particulates to On-Site Air	Air	Air	Trench Utility Worker	Adult	Inhalation of Particulate	Quantitative	
	On-Site Shallow Groundwater	Exposed Groundwater	Excavation	Construction Worker	Adult	Dermal Contact	Quantitative	
	Volatilization to Ambient Air	Exposed Groundwater	Excavation	Construction Worker	Adult	None	None	No volatiles reported in groundwater.
	On-Site Shallow Groundwater	Exposed Groundwater	Excavation	Trench Utility Worker	Adult	Dermal Contact	Quantitative	No volatiles reported in groundwater.
	Volatilization to Ambient Air	Exposed Groundwater	Excavation	Trench Utility Worker	Adult	None	None	No volatiles reported in groundwater.
	Off-Site Groundwater	Groundwater	None	Off-Site Receptor	NA	None	None	Groundwater concentrations attenuate laterally and vertically to <Maximum Contaminant Level before reaching property boundary. Steady-state conditions appear to have been reached given time elapsed since release; therefore, would not expect future conditions to differ from current.
	Particulates in Off-Site Air	Air	Off-site	Off-Site Resident	Adult	Inhalation of Particulate	Quantitative	
	Particulates in Off-Site Air	Air	Off-site	Off-Site Resident	Child	Inhalation of Particulate	Quantitative	

Abbreviations
PCP = Pentachlorophenol

TABLE 3-2
EXPOSURE POINT CONCENTRATIONS FOR SOIL AND GROUNDWATER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

COPCs	Soil			Groundwater
	Distribution of Detections	95% Upper Confidence Limit (mg/kg)	Exposure Point Concentration[4] (mg/kg)	Exposure Point Concentration (mg/L)
Acetone	Normal[1]	0.41	0.13	NA
Chlorobenzene	Normal[1]	0.28	0.28	NA
1,4-Dichlorobenzene	Normal[1]	0.29	0.29	NA
Methyl ethyl ketone	Normal[1]	0.31	0.031	NA
Naphthalene	Normal[1]	0.16	0.16	NA
PCP - all "surface" data	Lognormal[2]	1.2	1.2	51.0
PCP - all surf/subsurf data	Lognormal[2]	1.1	1.1	
2,3,7,8-TCDD equivalents	Normal[1]	0.000196	0.000196	2.66E-09
2,3,4,5-Tetrachlorophenol	NA	ND[3]	0.5	1.3
2,3,4,6-Tetrachlorophenol	NA	ND[3]	0.5	0.076
2,3,5,6-Tetrachlorophenol	NA	ND[3]	0.5	0.064
2,3,4-Trichlorophenol	NA	ND[3]	0.8	0.28
2,4,5-Trichlorophenol	NA	ND[3]	0.8	0.19
2,4,6-Trichlorophenol	NA	ND[3]	0.8	0.0031
1,2,4-Trimethylbenzene	Normal[1]	0.23	0.23	NA

Notes:

[1] Insufficient number of detections for normality test; upper confidence limit calculated assuming a normal distribution.

[2] Detections were lognormal according to the Lilliefors test, ProUCL, June 2003, U.S. EPA; Appendix A.

[3] Not detected in soil, half the maximum detection limit is used as the exposure point concentration.

[4.] Maximum used as exposure point concentratin when less than 95% upper confidence limit.

NA = Not applicable

TABLE 3-3
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS—CONTACT WITH SOIL
FUTURE ON-SITE OUTDOOR WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: On-Site Surface Soil
Exposure Point: On-Site Surface Soil/Air
Receptor: Future On-Site Outdoor Industrial Worker
Receptor Age: Adult

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
All	Concentration in Soil	Cs	mg/kg	Chemical specific	Table 3-2
	Exposure Duration - Overall Exposure	ED	years	25	EPA 1991b
	Body Weight - Adult	BW	Kg	70	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - noncarcinogen	AT-N	days	9125	Cal-EPA, 1996; EPA 1991b
Incidental Ingestion of Surface Soil	Ingestion Rate of Soil - adult	IR	mg/day	100	EPA 1997a
	Conversion Factor	CF1	kg/mg soil	1.E-06	
	Exposure Frequency-ingestion	EF_{ing}	days/yr	250	Cal-EPA, 1996; EPA 1991b
Dermal Contact	Exposed Skin Surface Area - Adult	SA	cm^2/event	3300	EPA 2002
	Adherence Factor - Adult Worker	AF	mg soil/cm^2	0.2	EPA 2001
	Exposure Frequency-dermal	EF_{derm}	events/yr	250	Cal-EPA, 1996; EPA 1991b
	Absorbance	Abs	%	Chemical specific [2]	
	Conversion Factor	CF1	kg/mg soil	1.E-06	
Inhalation of Particulates	Concentration in Air	Ca	mg/m^3	Chemical specific	Appendix D and E
	Exposure Frequency-inhalation	EF_{inh}	days/yr	250	Cal-EPA, 1996; EPA 1991b
	Inhalation Rate - Adult Worker	InhR	m^3/hr	2.5	Cal-EPA, 1996; EPA 1997a
	Exposure Time	ET	hr/day	8	Cal-EPA, 1996; EPA 1991b
	Particulate Emission Factor	PEF	m^3/kg	8.17E+08	EPA 2002

1. References are found in reference section of Report.
2. Dermal absorbance factor for soil: 0.25 for chlorinated phenols, 0.03 dioxins/furans (Department of Toxic Substances Control, Preliminary Endangerment Assessment Manual, 1999).

TABLE 3-4
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS—INHALATION
FUTURE ON-SITE INDOOR WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: On-Site Subsurface Soil
Exposure Point: Indoor Air
Receptor: Future On-Site Indoor Industrial Worker
Receptor Age: Adult

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
All	Concentration in Soil	Cs	mg/kg	Chemical specific	Table 3-2
	Exposure Duration - Overall Exposure	ED	years	25	EPA 1991b
	Body Weight - adult	BW	Kg	70	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - noncarcinogen	AT-N	days	9125	Cal-EPA, 1996; EPA 1991b
Inhalation of Volatiles	Concentration in Air	Ca	mg/m^3	Chemical specific	Appendix D and E
	Exposure Frequency-inhalation	EF_{inh}	days/yr	250	Cal-EPA, 1996; EPA 1991b
	Inhalation Rate - adult worker	InhR	m^3/hr	2.5	Cal-EPA, 1996; EPA 1997a
	Exposure Time	ET	hr/day	8	Cal-EPA, 1996; EPA 1991b

1. References are found in reference section of Report.

TABLE 3-5
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS - CONTACT WITH SOIL
FUTURE ON-SITE CONSTRUCTION WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: On-Site Surface/Subsurface Soil
Exposure Point: On-Site Surface/Subsurface Soil/Air
Receptor: Future On-Site Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
All	Concentration in Soil	Cs	mg/kg	Chemical specific	Table 3-2
	Exposure Duration - Overall exposure	ED	years	1	Professional Judgment
	Body Weight - adult	BW	Kg	70	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - noncarcinogen	AT-N	days	365	Cal-EPA, 1996; EPA 1991b
Incidental Ingestion of Surface Soil	Ingestion Rate of soil	IR_{ew}	mg/day	330	EPA 2002
	Conversion Factor	CF1	kg/mg soil	1.E-06	
	Exposure Frequency-ingestion	EF_{ing}	days/yr	90	Professional Judgment
Dermal Contact	Exposed Skin Surface Area - adult	SA	cm^2/event	3300	EPA 2002
	Adherence Factor - excavation worker	AF_{ew}	mg soil/cm^2	0.3	EPA 2002
	Exposure Frequency-dermal	EF_{derm}	events/yr	90	Professional Judgment
	Absorbance	Abs	%	Chemical specific [2]	EPA 2001
	Conversion Factor	CF1	kg/mg soil	1.E-06	
Inhalation of Particulates	Concentration in Air	Ca	mg/m^3	Chemical specific	Appendix D and E
	Exposure Frequency-inhalation	EF_{inh}	days/yr	90	Professional Judgment
	Inhalation Rate - adult worker	$InhR_{ew}$	m^3/hr	2.5	Cal-EPA 1996; EPA 1997a
	Exposure Time	ET	hr/day	8	Professional Judgment
	Particulate Emission Factor	PEF	m^3/kg	3.40E+06	Appendix D

1. References are found in reference section of Report.

2. Dermal absorbance factor for soil: 0.25 for chlorinated phenols, 0.03 dioxins/furans (Department of Toxic Substances Control, 1992).

TABLE 3-6
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS - CONTACT WITH SOIL
FUTURE ON-SITE TRENCH/UTILITY WORKER
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: On-Site Surface/Subsurface Soil
Exposure Point: On-Site Surface/Subsurface Soil/Air
Receptor: Future On-Site Trench/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
All	Concentration in Soil	Cs	mg/kg	Chemical specific	Table 3-2
	Exposure Duration (Total Exposure)	ED	years	5 [(2)]	Professional Judgment
	Body Weight - Adult	BW	Kg	70	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - non-carcinogen	AT-N	days	1825	Cal-EPA, 1996; EPA 1991b
Incidental Ingestion of Surface Soil	Ingestion Rate of Soil - adult	IRcw	mg/day	330	EPA 2002
	Conversion Factor	CF1	kg/mg soil	1.E-06	
	Exposure Frequency-ingestion	EF_{ing}	days/yr	10 [(3)]	Professional Judgment
Dermal Contact	Exposed Skin Surface Area - adult	SA	cm^2/event	3300	EPA 2002
	Adherence Factor - excavation worker	AF	mg soil/cm^2	0.3	EPA 2002
	Exposure Frequency-dermal	EF_{derm}	events/yr	10	Professional Judgment
	Absorbance	Abs	%	Chemical specific[4]	EPA 2001
	Conversion Factor	CF1	kg/mg soil	1.E-06	
Inhalation of Particulates	Concentration Air	Ca	mg/m^3	Chemical specific	Appendix D and E
	Exposure Frequency-inhalation	EF_{inh}	days/yr	10	Professional Judgment
	Inhalation Rate - excavation worker	InhR-ew	m^3/hr	2.5	Cal-EPA 1996; EPA 1997a
	Exposure Time	ET	hr/day	8	Professional Judgment
	Particulate Emission Factor	PEF	m^3/kg	3.40E+06	Appendix D and E

1. References are found in reference section of Report.
2. This exposure scenario assumes a full-time employee (25 years employment duration) who is engaged in a trenching project every five years for a total of five
3. Each trenching project is assumed to take 10 days to complete.
4. Dermal absorbance factor for soil: 0.25 for chlorinated phenols, 0.03 dioxins/furans (Department of Toxic Substances Control, 1992).

TABLE 3-7
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATION - INCIDENTAL CONTACT WITH GROUNDWATER, FUTURE ON-SITE EXCAVATION WORKERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: On-Site Shallow Groundwater
Exposure Point: On-Site Shallow Groundwater
Receptor: Future On-Site Excavation Worker
Receptor Age: Adult

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
Both Receptors Dermal Contact	Body Weight - Adult	BW	Kg	70	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - noncarcinogen	AT-nc	days	ED*365	Cal-EPA, 1996; EPA 1991b
	Partition Coefficient	Kp	cm/hr	Chemical Specific	Appendix B
	Conversion Factor	CF2	L/cm^3	1.E-03	
	Concentration in Water	Cw	mg/L	Chemical specific	Table 3-2
	Dermal Absorbed Dose per Event	DAevent	mg/cm^2	Chemical Specific	Appendix E
Construction Worker	Exposure Duration	EF	yr	1	Professional Judgment
	Exposed Skin Surface Area - Adult hands, forearms and feet	SA	cm^2/event	3100	EPA 1997a
	Exposure Frequency	EF	days/yr	10	Professional Judgment
	Exposure Time	ET	hr	1	Professional Judgment
Trench Utility Worker	Exposure Duration (Total Exposure)	ED	years	5	Professional Judgment
	SA - Adult hands, forearms, and feet	SA	cm^2/event	3100	EPA 1997a
	Exposure Frequency	EF	days/yr	10	Professional Judgment
	Exposure Time	ET	hr	1	Professional Judgment

1. References are found in reference section of Report.

TABLE 3-8
EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE OFF-SITE RESIDENT

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Scenario Timeframe: Future
Medium: Deposition from On-Site
Exposure Point: Off-Site Surface Soil/Air
Receptor: Future Off-Site Resident
Receptor Age: Carcinogenic (Lifetime) Exposure - Child and Adult
Noncarcinogenic exposure - 0 - 6 years

Exposure Route	Parameter Definition	Parameter Code	Units	RME Value	RME Rationale/ Reference[1]
All	Concentration in Soil	Cs	mg/kg	Chemical specific	Table 3-2
	Exposure Duration - Overall Exposure	ED	years	30	EPA 1997a
	Exposure Duration - adult	ED_A	years	24	Cal-EPA, 1996; EPA 1991b
	Exposure Duration - child	ED_c	years	6	Cal-EPA, 1996; EPA 1991b
	Body Weight - adult	BW-A	Kg	70	Cal-EPA, 1996; EPA 1991b
	Body Weight - child	BW-C	Kg	15	Cal-EPA, 1996; EPA 1991b
	Averaging Time - carcinogen	AT-C	days	25550	Cal-EPA, 1996; EPA 1991b
	Averaging Time - noncarcinogen	ATnc	days	2190	Cal-EPA, 1996; EPA 1991b
Inhalation of Particulates	Inhalation Rate - adult	InhR-A	m^3/day	20	Cal-EPA, 1996; EPA 1997a
	Inhalation Rate - child	InhR-C	m^3/day	10	Cal-EPA, 1999; EPA 1997a
	Concentration in Air	Ca	mg/m^3	Chemical specific	Appendix D and E
	Exposure Frequency-Inh	EF_{inh}	days/yr	350	Cal-EPA, 1996; EPA 1991b
	Particulate Emission Factor	PEF_{res}	m^3/kg	9.8E+08	EPA 2002

1. References are found in reference section of Report.

TABLE 4-1
TOXICITY CRITERIA FOR POTENTIAL CARCINOGENIC EFFECTS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California

Concentrations in milligrams per kilogram per day (mg/kg/day).

Chemical of Potential Concern	Carcinogenic Classification	Oral Cancer Slope Factor [1]	Note	Inhalation Cancer Slope Factor [1]	Note	Target Organ
Pentachlorophenol (PCP)	B2	0.12	1	0.018	1	liver
Tetrachlorodibenzodioxin (TCDD)	A - B2	130,000	1	130,000	1	various
Tetrachlorophenols	NA	--	2	--	2	NA
2,4,6-Trichlorophenol [3]	B2	0.07	1	0.07	1	liver/lymphoma/ leukemia

Notes:
1. California Environmental Protection Agency, 2003, Office of Environmental Health Hazard Assessment, Toxicity Criteria Database, accessed October via <www.oehha.ca.gov/risk/chemicaldb/start.asp>.
2. Integrated Risk Information System for 2,3,4,6-tetrachlorophenol. There are inadequate carcinogenic toxicity data for 2,3,4,5- and 2,3,5,6-tetrachlorophenol.
3. 2,4,6-trichlorophenol is classified as B2, probable human carcinogen; however, 2,4,5-trichlorophenol has no available classification in Integrated Risk Information System.

Abbreviation:
NA = Not applicable

TABLE 4-2
TOXICITY CRITERIA FOR POTENTIAL NONCARCINOGENIC EFFECTS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California

Concentrations in milligrams per kilogram per day (mg/kg/day).

Chemical of Potential Concern	Chronic Oral Reference Dose	Note	Subchronic Oral Reference Dose	Note	Inhalation Reference Dose	Note	Target Organ
Acetone	0.1	1	1	2	0.1	3	liver, kidney
Chlorobenzene	0.02	1	0.02	4	0.017	8	liver, kidney
1,4-Dichlorobenzene	0.03	8	0.71	2	0.23	1	liver
Methyl ethyl ketone	0.6	1	2	2	0.29	1	birth weight
Naphthalene	0.02	1	0.02	4	0.00086	1	nasal, respiratory, birth weight
Pentachlorophenol (PCP)	0.03	1	0.03	2	0.03	3	liver
Tetrachlorodibenzodioxin (TCDD)	0.00000001	5	0.00000001	4	0.000000011	5	immune system
Tetrachlorophenols [6]	0.03	1	0.3	2	0.03	3	liver
2,3,4-Trichlorophenol	0.1	7	1	7	0.1	7	NA
2,4,5-Trichlorophenol	0.1	1	1	2	0.1	3	liver, kidney
2,4,6-Trichlorophenol	0.0001	8	0.0001	4	0.0001	3	NA
1,2,4-Trimethylbenzene	0.05	8	0.05	4	0.0017	8	NA

Notes:
1. Integrated Risk Information System (USEPA, 2003)
2. Health Effects Assessment Summary Tables (USEPA, 1997b)
3. Route extrapolation
4. Chronic oral reference dose used.
5. Air Toxics Hot Spots Program Risk Assessment Guidelines (California Environmental Protection Agency, 2003)
6. Values for 2,3,4,6-tetrachlorophenol used for a tetrachlorophenols.
7. 2.4.5.-Trichlorophenol used as a surrogate.
8. Preliminary Remediation Goals (U.S. EPA, 2003c)

Abbreviation:
NA = Not available

TABLE 5-1
SUMMARY OF NONCARCINOGENIC HAZARD INDEXES:
FUTURE OUTDOOR INDUSTRIAL WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Hazard Index	Percent Contribution
Acetone	1.4E-07	9.3E-08	NA	2.3E-07	0.0%
Chlorobenzene	1.4E-05	9.0E-06	NA	2.3E-05	0.1%
1,4-Dichlorobenzene	9.5E-06	6.2E-06	NA	1.6E-05	0.0%
Methyl ethyl ketone	5.1E-08	3.3E-08	NA	8.4E-08	0.0%
Naphthalene	7.8E-06	7.7E-06	NA	1.6E-05	0.0%
Pentachlorophenol	3.8E-05	6.4E-05	9.4E-09	1.0E-04	0.2%
TCDD	1.9E-02	3.8E-03	4.3E-06	2.3E-02	52.2%
2,3,4,5-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05	0.1%
2,3,4,6-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05	0.1%
2,3,5,6-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05	0.1%
2,3,4-Trichlorophenol	7.8E-06	1.3E-05	1.9E-09	2.1E-05	0.0%
2,4,5-Trichlorophenol	7.8E-06	1.3E-05	1.9E-09	2.1E-05	0.0%
2,4,6-Trichlorophenol	7.8E-03	1.3E-02	1.9E-06	2.1E-02	47.1%
1,2,4-Trimethylbenzene	4.5E-06	3.0E-06	NA	7.5E-06	0.0%
Total	2.7E-02	1.7E-02	6.2E-06	4E-02	100%
Percent Contribution	61.6%	38.4%	0.0%	100%	

NA = not applicable

TABLE 5-2
SUMMARY OF NONCARCINOGENIC HAZARD INDEXES:
FUTURE INDOOR INDUSTRIAL WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Inhalation of Volatiles in Indoor Air from Soil	Hazard Index	Percent Contribution
Acetone	3.7E-04	3.7E-04	0.1%
Chlorobenzene	2.3E-01	2.3E-01	35.9%
1,4-Dichlorobenzene	4.4E-03	4.4E-03	0.7%
Methyl ethyl ketone	3.3E-04	3.3E-04	0.1%
Naphthalene	3.1E-02	3.1E-02	5.0%
Pentachlorophenol	NA	NA	NA
TCDD	NA	NA	NA
2,3,4,5-Tetrachlorophenol	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA
1,2,4-Trimethylbenzene	3.7E-01	3.7E-01	58.3%
Total	6E-01	6E-01	100%
Percent Contribution	100.0%		

NA = not applicable

TABLE 5-3
SUMMARY OF NONCARCINOGENIC HAZARD INDEXES:
FUTURE CONSTRUCTION WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil				Groundwater		Hazard Index	Percent Contribution
	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Hazard Index - Soil	Dermal Contact with Groundwater	Hazard Index - Groundwater		
Acetone	1.5E-07	4.5E-08	NA	2.0E-07	NA	NA	2.E-07	0.0%
Chlorobenzene	1.6E-05	4.9E-06	NA	2.1E-05	NA	NA	2.E-05	0.0%
1,4-Dichlorobenzene	4.7E-07	1.4E-07	NA	6.2E-07	NA	NA	6.E-07	0.0%
Methyl ethyl ketone	1.8E-08	5.4E-09	NA	2.3E-08	NA	NA	2.E-08	0.0%
Naphthalene	9.3E-06	4.2E-06	NA	1.3E-05	NA	NA	1.E-05	0.0%
Pentachlorophenol	4.1E-05	3.1E-05	7.4E-07	7.3E-05	1.1E+00	1.1E+00	1.E+00	95.8%
TCDD	2.3E-02	2.1E-03	3.7E-04	2.5E-02	8.8E-04	8.8E-04	3.E-02	2.3%
2,3,4,5-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	3.4E-06	1.0E-03	1.0E-03	1.E-03	0.1%
2,3,4,6-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	3.4E-06	8.5E-05	8.5E-05	9.E-05	0.0%
2,3,5,6-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	3.4E-06	3.0E-05	3.0E-05	3.E-05	0.0%
2,3,4-Trichlorophenol	9.3E-07	7.0E-07	1.7E-08	1.6E-06	3.8E-05	3.8E-05	4.E-05	0.0%
2,4,5-Trichlorophenol	9.3E-07	7.0E-07	1.7E-08	1.6E-06	2.6E-05	2.6E-05	3.E-05	0.0%
2,4,6-Trichlorophenol	9.3E-03	7.0E-03	1.7E-04	1.6E-02	4.2E-03	4.2E-03	2.E-02	1.8%
1,2,4-Trimethylbenzene	5.3E-06	1.6E-06	NA	7.0E-06	NA	NA	7.E-06	0.0%
Total	3.2E-02	9.1E-03	5.4E-04	4.2E-02	1.1E+00	1.1E+00	1.E+00	100.0%
Percent Contribution	2.8%	0.8%	0.0%	3.7%	96.3%	96.3%	100.0%	

NA = not applicable

TABLE 5-4
SUMMARY OF NONCARCINOGENIC HAZARD INDEXES:
FUTURE TRENCH/UTILITY WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil				Groundwater		Hazard Index	Percent Contribution
	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Hazard Index - Soil	Dermal Contact with Groundwater	Hazard Index - Groundwater		
Acetone	1.9E-08	5.6E-09	NA	2.4E-08	NA	NA	2.E-08	0.0%
Chlorobenzene	1.8E-06	5.4E-07	NA	2.4E-06	NA	NA	2.E-06	0.0%
1,4-Dichlorobenzene	1.2E-06	3.7E-07	NA	1.6E-06	NA	NA	2.E-06	0.0%
Methyl ethyl ketone	6.7E-09	2.0E-09	NA	8.7E-09	NA	NA	9.E-09	0.0%
Naphthalene	1.0E-06	4.6E-07	NA	1.5E-06	NA	NA	1.E-06	0.0%
Pentachlorophenol	4.6E-06	3.5E-06	8.2E-08	8.1E-06	1.1E+00	1.1E+00	1.E+00	98.0%
TCDD	2.5E-03	2.3E-04	4.1E-05	2.8E-03	8.8E-04	8.8E-04	4.E-03	0.3%
2,3,4,5-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	3.8E-06	1.0E-02	1.0E-02	1.E-02	0.9%
2,3,4,6-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	3.8E-06	8.5E-04	8.5E-04	9.E-04	0.1%
2,3,5,6-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	3.8E-06	3.0E-04	3.0E-04	3.E-04	0.0%
2,3,4-Trichlorophenol	1.0E-06	7.7E-07	1.8E-08	1.8E-06	3.8E-04	3.8E-04	4.E-04	0.0%
2,4,5-Trichlorophenol	1.0E-06	7.7E-07	1.8E-08	1.8E-06	2.6E-04	2.6E-04	3.E-04	0.0%
2,4,6-Trichlorophenol	1.0E-03	7.7E-04	1.8E-05	1.8E-03	4.2E-03	4.2E-03	6.E-03	0.5%
1,2,4-Trimethylbenzene	5.9E-07	1.8E-07	NA	7.7E-07	NA	NA	8.E-07	0.0%
Total	3.6E-03	1.0E-03	6.0E-05	4.7E-03	1.1E+00	1.1E+00	1.E+00	100.0%
Percent Contribution	0.3%	0.1%	0.0%	0.4%	99.6%	99.6%	100.0%	

NA = not applicable

GEOMATRIX

TABLE 5-5

SUMMARY OF NONCARCINOGENIC HAZARD INDEXES: FUTURE OFF-SITE CHILD RESIDENT

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil		
	Inhalation of Particulates	Hazard Index	Percent Contribution
Acetone	NA	NA	NA
Chlorobenzene	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA
Naphthalene	NA	NA	NA
Pentachlorophenol	2.3E-08	2.3E-08	0.1%
TCDD	1.2E-05	1.2E-05	68.7%
2,3,4,5-Tetrachlorophenol	1.1E-08	1.1E-08	0.1%
2,3,4,6-Tetrachlorophenol	1.1E-08	1.1E-08	0.1%
2,3,5,6-Tetrachlorophenol	1.1E-08	1.1E-08	0.1%
2,3,4-Trichlorophenol	5.3E-09	5.3E-09	0.0%
2,4,5-Trichlorophenol	5.3E-09	5.3E-09	0.0%
2,4,6-Trichlorophenol	5.3E-06	5.3E-06	30.9%
1,2,4-Trimethylbenzene	NA	NA	NA
Total	1.7E-05	2E-05	100.0%
Percent Contribution	100%	100%	

NA = not applicable

TABLE 5-6

SUMMARY OF EXCESS LIFETIME CANCER RISKS:
FUTURE OUTDOOR INDUSTRIAL WORKER

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Excess Cancer Risk	Percent Contribution
Acetone	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA
Pentachlorophenol	4.9E-08	8.2E-08	1.8E-12	1.3E-07	1.2%
TCDD	8.9E-06	1.8E-06	2.2E-09	1.1E-05	98.3%
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	2.0E-08	3.2E-08	4.8E-12	5.2E-08	0.5%
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Total	9.0E-06	1.9E-06	2.2E-09	1E-05	100.0%
Percent Contribution	82.7%	17.3%	0.0%	100%	

NA = not applicable

TABLE 5-7
SUMMARY OF EXCESS LIFETIME CANCER RISKS:
FUTURE CONSTRUCTION WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil				Groundwater		Excess Cancer Risk	Percent Contribution
	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Excess Cancer Risk - Soil	Dermal Contact with Groundwater	Excess Cancer Risk - Groundwater		
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	2.1E-09	1.6E-09	5.7E-12	3.7E-09	5.6E-05	5.6E-05	6.E-05	99.1%
TCDD	4.2E-07	3.8E-08	7.5E-09	4.7E-07	1.6E-08	1.6E-08	5.E-07	0.9%
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	9.3E-10	7.0E-10	1.7E-11	1.6E-09	4.2E-10	4.2E-10	2.E-09	0.0%
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Total	4.3E-07	4.0E-08	7.6E-09	4.7E-07	5.6E-05	5.6E-05	6.E-05	100.0%
Percent Contribution	0.8%	0.1%	0.0%	0.8%	99.2%	99.2%	100.0%	

NA = not applicable

TABLE 5-8
SUMMARY OF EXCESS LIFETIME CANCER RISKS:
FUTURE TRENCH/UTILITY WORKER
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil				Groundwater		Excess Cancer Risk	Percent Contribution
	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Excess Cancer Risk - Soil	Dermal Contact with Groundwater	Excess Cancer Risk - Groundwater		
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1.2E-09	8.9E-10	3.2E-12	2.1E-09	2.8E-04	2.8E-04	3.E-04	99.9%
TCDD	2.4E-07	2.1E-08	4.2E-09	2.6E-07	8.2E-08	8.2E-08	3.E-07	0.1%
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	5.2E-10	3.9E-10	9.2E-12	9.1E-10	2.1E-09	2.1E-09	3.E-09	0.0%
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Total	2.4E-07	2.2E-08	4.2E-09	2.6E-07	2.8E-04	2.8E-04	3.E-04	100.0%
Percent Contribution	0.1%	0.0%	0.0%	0.1%	99.9%	99.9%	100.0%	

NA = not applicable

TABLE 5-9
SUMMARY OF EXCESS LIFETIME CANCER RISKS:
FUTURE OFF-SITE CHILD RESIDENT
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil	Excess Cancer Risk - Child	Percent Contribution
	Inhalation of Particulates		
Acetone	NA	NA	NA
Chlorobenzene	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA
Naphthalene	NA	NA	NA
Pentachlorophenol	1.1E-12	1.1E-12	0%
TCDD	1.4E-09	1.4E-09	100%
2,3,4,5-Tetrachlorophenol	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA
2,4,6-Trichlorophenol	3.2E-12	3.2E-12	0%
1,2,4-Trimethylbenzene	NA	NA	NA
Total	1.4E-09	1E-09	100%
Percent Contribution	100%		

TABLE 5-10
SUMMARY OF EXCESS LIFETIME CANCER RISKS:
FUTURE OFF-SITE ADULT RESIDENT
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Soil	Excess Cancer Risk - Adult	Excess Cancer Risk - Total	Percent Contribution
	Inhalation of Particulates			
Acetone	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA
Pentachlorophenol	1.8E-12	1.8E-12	2.9E-12	0%
TCDD	2.4E-09	2.4E-09	3.9E-09	100%
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA
2,4,6-Trichlorophenol	5.3E-12	5.3E-12	8.5E-12	0%
1,2,4-Trimethylbenzene	NA	NA	NA	NA
Total	2.4E-09	2.4E-09	4E-09	100%
Percent Contribution	63%	63%	100%	

NA = not applicable

TABLE 5-11
SUMMARY OF HUMAN HEALTH RISKS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Receptor	Theoretical Excess Lifetime Cancer Risk	Non-cancer Hazard Index
Outdoor Industrial Worker	1E-05	0.04
Indoor Industrial Worker	NA	0.6
Construction Worker	6E-05	1
Trench/Utility Worker	3E-04	1
Off-site Resident	4E-09	0.00002

GEOMATRIX

TABLE 7-1

RISK-BASED REMEDIATION GOALS FOR SOIL FOR ALL RECEPTORS[1]

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in units of milligrams per kilogram (mg/kg)

Chemical	Cancer														
	Off-site Resident			Construction Worker			Trench/Utility Worker			Indoor Industrial Worker			Outdoor Industrial Worker		
	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	4.0E+05	4.0E+06	4.0E+07	2.9E+02	2.9E+03	2.9E+04	5.2E+02	5.2E+03	5.2E+04	NA	NA	NA	9.0.E+00	**9.0E+01**	9.0E+02
TCDD	5.1E-02	5.1E-01	5.1E+00	4.2E-04	4.2E-03	4.2E-02	7.5E-04	7.5E-03	7.5E-02	NA	NA	NA	1.8.E-05	**1.8E-04**	1.8E-03
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	9.4E+04	9.4E+05	9.4E+06	4.9E+02	4.9E+03	4.9E+04	8.8E+02	8.8E+03	8.8E+04	NA	NA	NA	1.5.E+01	**1.5E+02**	1.5E+03
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Chemical	Noncancer			
Acetone	NA	6.6E+05	5.4E+06	**3.5E+02**	6.E+05
Chlorobenzene	NA	1.3E+04	1.2E+05	**1.2E+00**	1.E+04
1,4-Dichlorobenzene	NA	4.7E+05	1.8E+05	**6.6E+01**	2.E+04
Methyl ethyl ketone	NA	1.3E+06	3.6E+06	**9.5E+01**	4.E+05
Naphthalene	NA	1.2E+04	1.1E+05	**5.1E+00**	1.E+04
Pentachlorophenol	5.0E+07	1.5E+04	1.3E+05	NA	**1.E+04**
TCDD	1.7E+01	**7.8E-03**	7.0E-02	NA	9.E-03
2,3,4,5-Tetrachlorophenol	4.6E+07	1.5E+05	1.3E+05	NA	**1.E+04**
2,3,4,6-Tetrachlorophenol	4.6E+07	1.5E+05	1.3E+05	NA	**1.E+04**
2,3,5,6-Tetrachlorophenol	4.6E+07	1.5E+05	1.3E+05	NA	**1.E+04**
2,3,4-Trichlorophenol	1.5E+08	4.9E+05	4.4E+05	NA	**4.E+04**
2,4,5-Trichlorophenol	1.5E+08	4.9E+05	4.4E+05	NA	**4.E+04**
2,4,6-Trichlorophenol	1.5E+05	4.9E+01	4.4E+02	NA	**4.E+01**
1,2,4-Trimethylbenzene	NA	3.3E+04	3.0E+05	**6.3E-01**	3.E+04

NA = not applicable

[1] Lowest Risk-Based Remediation Goal is presented in **bold** for each chemical; $1x10^{-5}$ risk level used for carcinogens.

GEOMATRIX

TABLE 7-2

RISK-BASED REMEDIATION GOALS FOR GROUNDWATER FOR ALL RECEPTORS[1]

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in units of milligrams per liter (mg/L)

Chemical	Cancer														
	Off-site Resident			Construction Worker			Trench/Utility Worker			Indoor Industrial Worker			Outdoor Industrial Worker		
	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	9.1E-01	9.1E+00	9.1E+01	1.8E-01	**1.8E+00**	1.8E+01	NA	NA	NA	NA	NA	NA
TCDD	NA	NA	NA	1.6E-07	1.6E-06	1.6E-05	3.2E-08	**3.2E-07**	3.2E-06	NA	NA	NA	NA	NA	NA
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	7.4E+00	7.4E+01	7.4E+02	1.5E+00	**1.5E+01**	1.5E+02	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Noncancer															
Acetone	NA			NA			NA			NA			NA		
Chlorobenzene	NA			NA			NA			NA			NA		
1,4-Dichlorobenzene	NA			NA			NA			NA			NA		
Methyl ethyl ketone	NA			NA			NA			NA			NA		
Naphthalene	NA			NA			NA			NA			NA		
Pentachlorophenol	NA			**4.7E+01**			~~**9.2E-01**~~[2] **4.7E+01**			NA			NA		
TCDD	NA			**3.0E-06**			~~1.1E+03~~ **3.0E-06**			NA			NA		
2,3,4,5-Tetrachlorophenol	NA			1.3E+03			~~**9.9E+01**~~ **1.3E+02**			NA			NA		
2,3,4,6-Tetrachlorophenol	NA			9.0E+02			~~1.2E+03~~ **9.0E+01**			NA			NA		
2,3,5,6-Tetrachlorophenol	NA			2.1E+03			~~3.3E+03~~ **2.1E+02**			NA			NA		
2,3,4-Trichlorophenol	NA			7.4E+03			~~2.6E+03~~ **7.4E+02**			NA			NA		
2,4,5-Trichlorophenol	NA			**7.4E+03**			~~3.9E+03~~ **7.4E+02**			NA			NA		
2,4,6-Trichlorophenol	NA			**7.4E-01**			~~2.4E+02~~ **7.4E-01**			NA			NA		
1,2,4-Trimethylbenzene	NA			NA			NA			NA			NA		

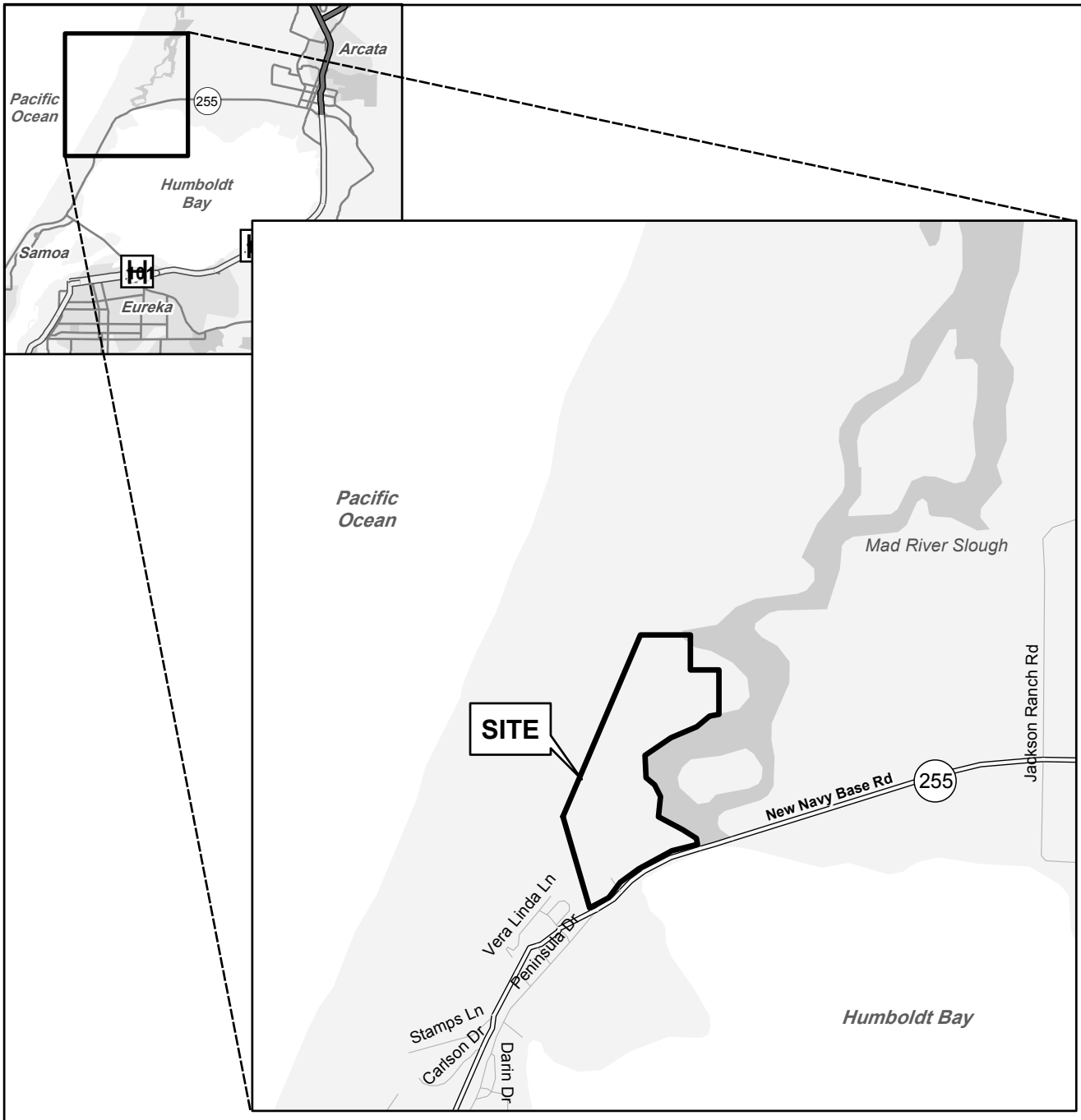
Notes:

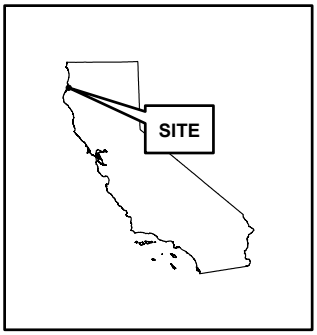
1. Lowest Risk-Based Remediation Goal is presented in **bold** for each chemical; $1x10^{-5}$ risk level used for carcinogens.

2. Strikeout text represents values in Baseline Human Health Risk Assessment Report dated November 20, 2003. Regular text represents corrected values.

NA = not applicable

FIGURES





California

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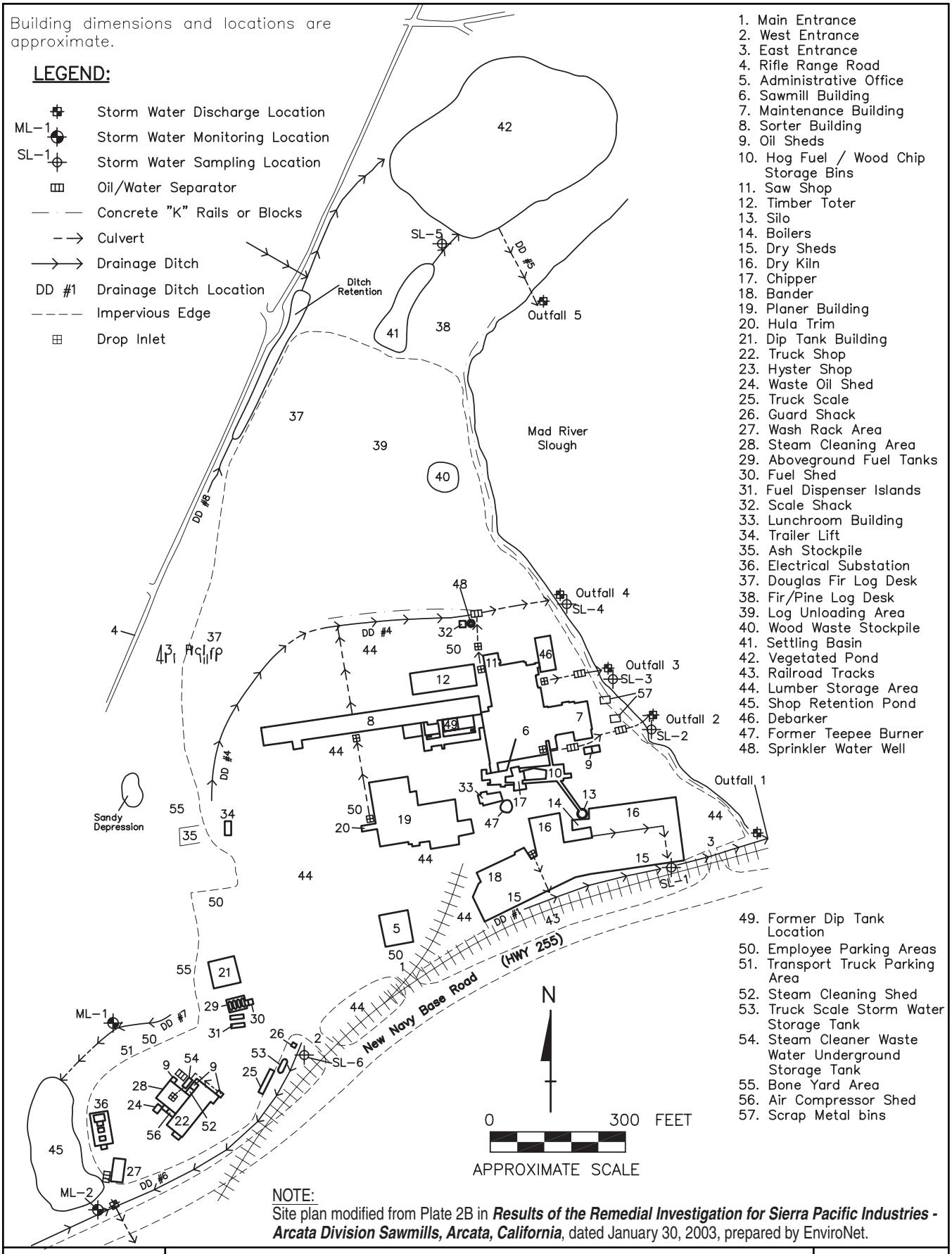
GEOMATRIX

SITE LOCATION MAP
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No.
9329

Figure No.
1-1



NOTE:
Site plan modified from Plate 2B in ***Results of the Remedial Investigation for Sierra Pacific Industries - Arcata Division Sawmills, Arcata, California***, dated January 30, 2003, prepared by EnviroNet.

GEOMATRIX

SITE PLAN
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No.
9329

Figure
1-2

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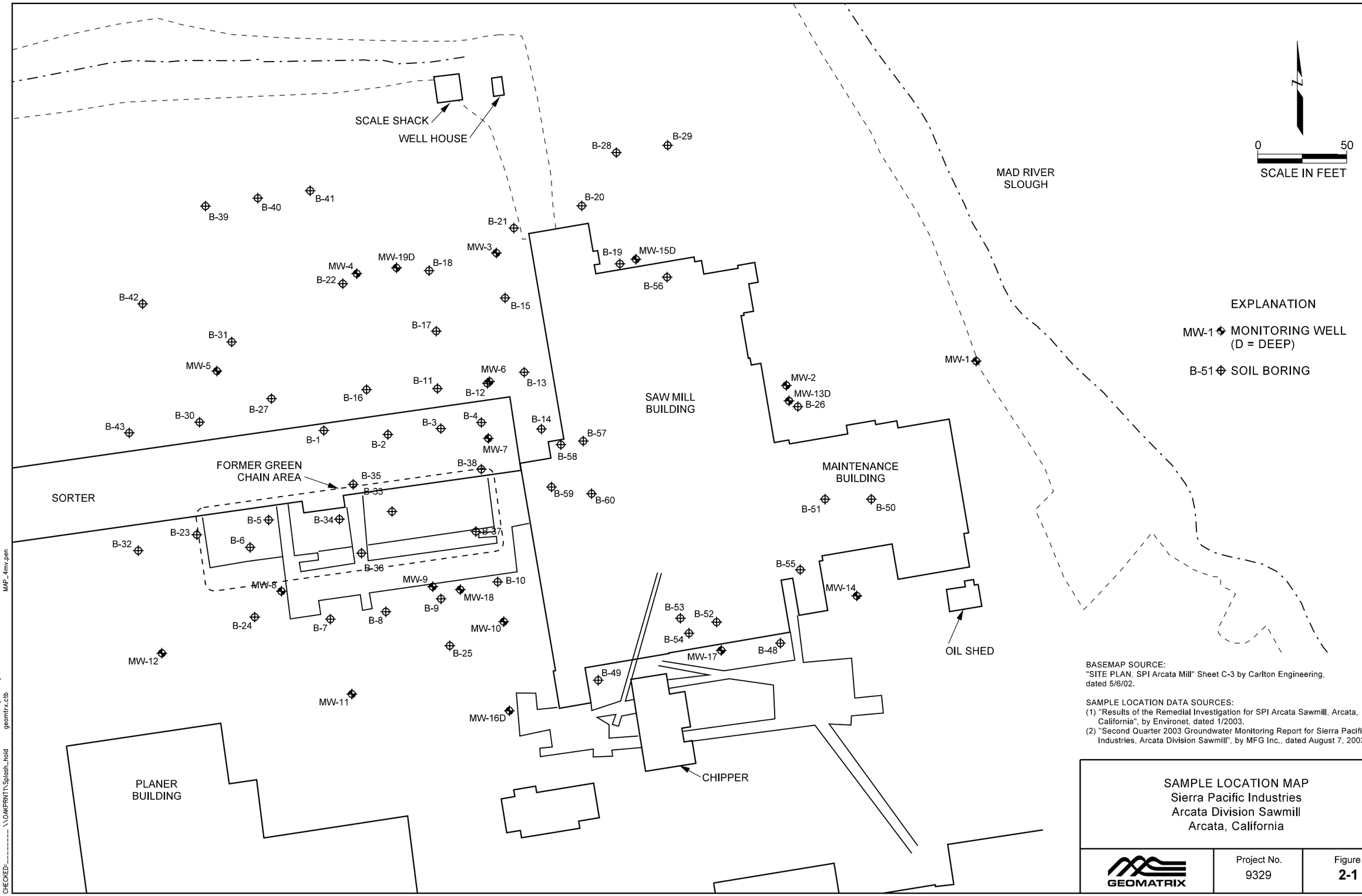

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SAMPLE LOCATION DATA SOURCES:
(1) "Results of the Remedial Investigation for SPI Arcata Sawmill, Arcata, California", by Environet, dated 1/2003.
(2) "Second Quarter 2003 Groundwater Monitoring Report for Sierra Pacific Industries, Arcata Division Sawmill", by MFG Inc., dated August 7, 2003.

SAMPLE LOCATION MAP
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

GEOMATRIX

Project No. 9329

Figure **2-1**

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\\OAKPRNT\Splash_hold geomtrx.ctb
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B-19	
Depth	PCP
1.5'	1
3'	ND

B-3	
Depth	PCP
1.5'	50
3'	71/68
5'	ND
6.5'	ND

B-4	
Depth	PCP
1'	3.1
3'	20
5'	ND
6.5'	ND

B-11	
Depth	PCP
1'	1
3'	ND

B-27	
Depth	PCP
2'	1.4/ND
3'	ND

B-14	
Depth	PCP
1'	ND
3'	5.5/3.3
5'	2.4
6.5'	ND

B-57	
Depth	PCP
3'	1.9

B-58	
Depth	PCP
5'	1.2

B-34	
Depth	PCP
4'	2.2
5'	1.9
6.5'	ND

B-2	
Depth	PCP
1.5'	3.2
3'	ND

B-33	
Depth	PCP
4'	4.7
5'	ND
6.5'	ND

MW-7	
Depth	PCP
1.5'	20
3'	19
5.5'	ND

B-38	
Depth	PCP
2'	59
3'	27
4.5'	ND

B-6	
Depth	PCP
3.5'	1/ND
5'	ND
7'	ND
9'	ND

B-36	
Depth	PCP
2'	1.3
3'	ND

B-9	
Depth	PCP
1.5'	ND
3'	7.6/1.3
5'	ND

B-28 B-29 B-20 B-21 B-39 B-40 B-41 MW-3 MW-19D MW-4 B-18 B-22 MW-15D B-56 B-42 B-15 B-17 B-31 MW-5 MW-6 B-13 B-12 B-16 MW-2 MW-13D B-26 MW-1 B-30 B-43 B-1 B-35 B-59 B-60 B-51 B-50 B-23 B-32 B-5 B-37 B-55 MW-14 MW-8 MW-9 B-10 MW-18 B-53 B-52 B-54 B-24 B-7 B-8 MW-10 B-25 MW-17 B-48 B-49 MW-12 MW-11 MW-16D

0 50

SCALE IN FEET

EXPLANATION

B-2 ⊕ SOIL BORING WHERE SOIL SAMPLES WERE ANALYZED FOR CHLORINATED PHENOLS

B-1 ⊕ ALL SAMPLE RESULTS WERE NOT DETECTED AT OR BELOW LABORATORY REPORTING LIMIT

B-9 — SAMPLE LOCATION

PENTACHLOROPHENOL IN SOIL (mg/kg)

SAMPLE DEPTH (feet)

ND NOT DETECTED AT OR ABOVE LABORATORY REPORTING LIMIT

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SOIL BORING DATA SOURCE:
"Results of the Remedial Investigation for SPI Arcata Sawmill, Arcata, California", by Environet, dated 1/2003.

PENTACHLOROPHENOL IN SOIL
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

GEOMATRIX | Project No. 9329 | Figure 2-2

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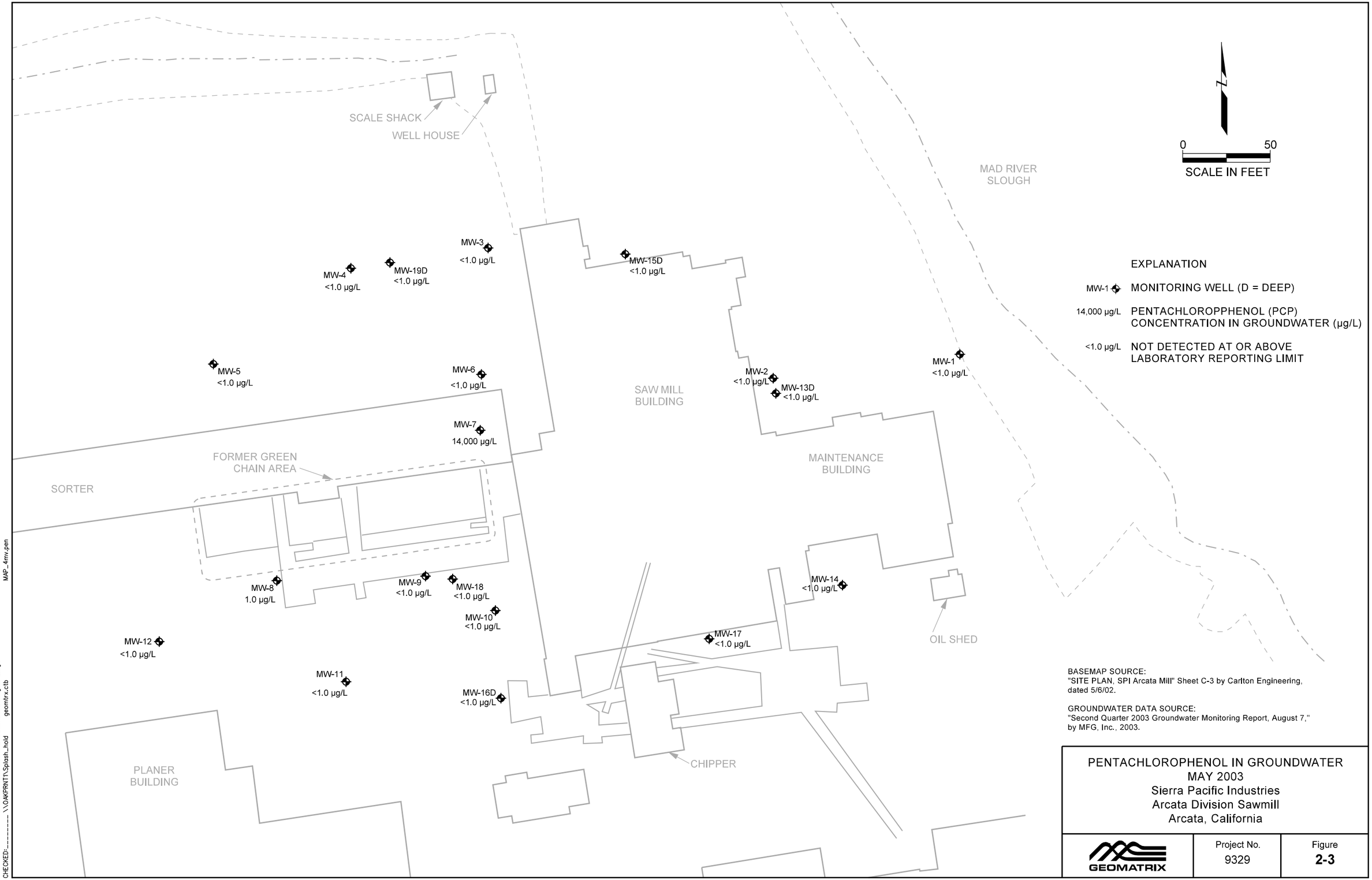

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

GROUNDWATER DATA SOURCE:
"Second Quarter 2003 Groundwater Monitoring Report, August 7," by MFG, Inc., 2003.

PENTACHLOROPHENOL IN GROUNDWATER
MAY 2003
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

GEOMATRIX | Project No. 9329 | Figure 2-3

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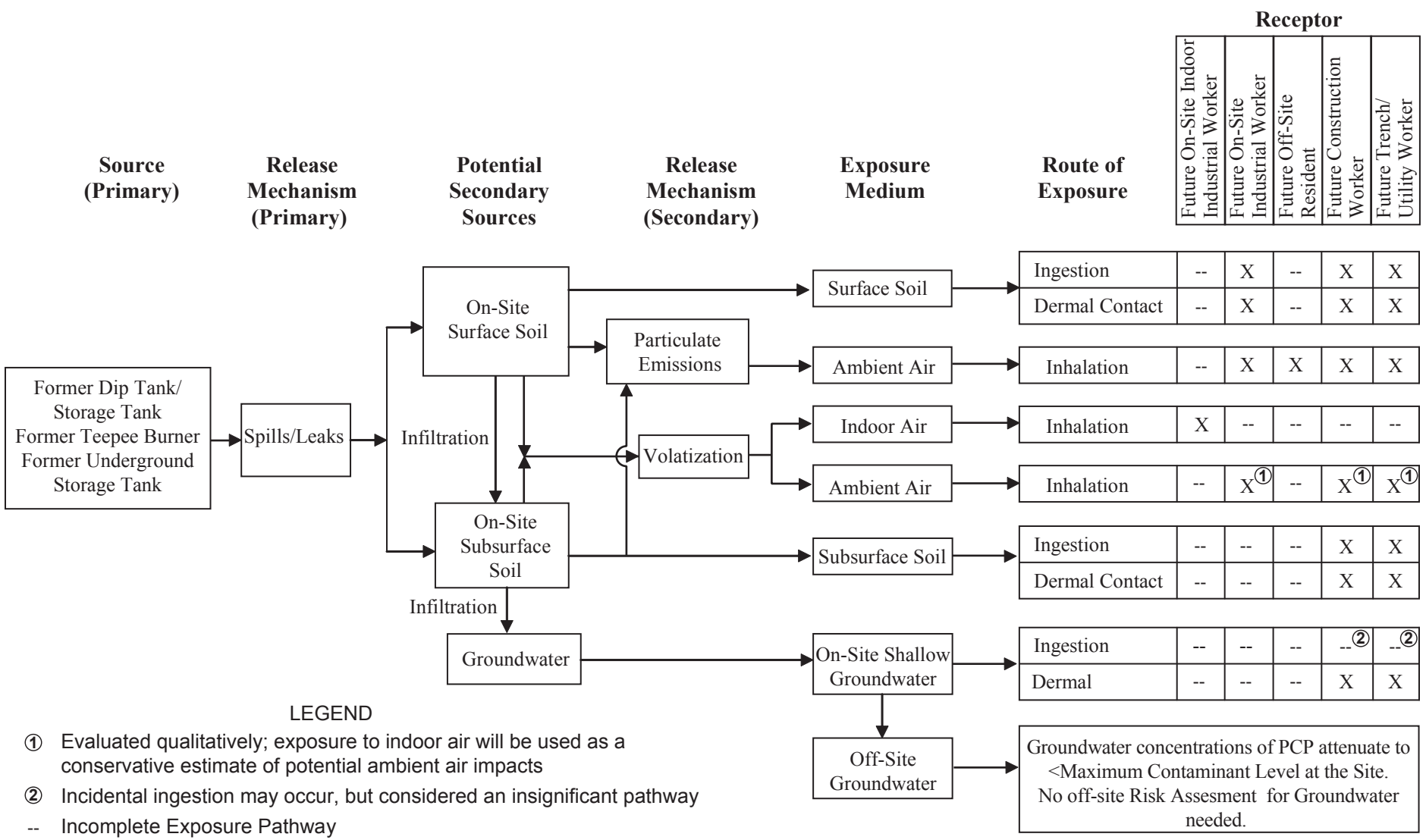


LEGEND

① Evaluated qualitatively; exposure to indoor air will be used as a conservative estimate of potential ambient air impacts

② Incidental ingestion may occur, but considered an insignificant pathway

-- Incomplete Exposure Pathway

X Potentially Complete Exposure Pathway

GEOMATRIX
MFG, Inc.
consulting scientists and engineers

CONCEPTUAL SITE MODEL – ON-SITE MEDIA
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No.
9329

Figure
3-1

APPENDIX A

Soil and Groundwater Data

APPENDIX A-1
SURFACE SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs)		Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri-chloro-phenol	2,3,5,6-Tetra-chloro-phenol	2,3,4,6-Tetra-chloro-phenol	2,3,4,5-Tetra-chloro-phenol
				top	bottom							
B-1-1	Y	S	B-01	1	1.5	07/23/01	-1 [2]	--[3]	--	--	--	--
B-2-1.5	Y	S	B-02	1.5	2	07/23/01	3.2	--	--	--	--	--
B-3-1.5	Y	S	B-03	1.5	2	07/23/01	50	--	--	--	--	--
B-4-1	Y	S	B-04	1	1.5	07/23/01	3.1	--	--	--	--	--
B-7-1.5	Y	S	B-07	1.5	2	07/24/01	-1	--	--	--	--	--
B-8-2	Y	S	B-08	2	2.5	07/24/01	-1	--	--	--	--	--
B-9-1.5	Y	S	B-09	1.5	2	07/24/01	-1	--	--	--	--	--
B-10-1.5	Y	S	B-10	1.5	2	07/24/01	-1	--	--	--	--	--
B-11-1	Y	S	B-11	1	1.5	07/24/01	1	--	--	--	--	--
B-12-1.5	Y	S	B-12	1.5	2	07/24/01	-1	--	--	--	--	--
B-13-1.5	Y	S	B-13	1.5	2	07/25/01	-1	--	--	--	--	--
B-14-1	Y	S	B-14	1	1.5	07/25/01	-1	--	--	--	--	--
B-15-1.5	Y	S	B-15	1.5	2	07/25/01	-1	--	--	--	--	--
B-16-1.5	Y	S	B-16	1.5	2	07/25/01	-1	--	--	--	--	--
B-17-2	Y	S	B-17	2	2.5	07/25/01	-1	--	--	--	--	--
B-18-1	Y	S	B-18	1	1.5	07/25/01	-1	--	--	--	--	--
B-19-1.5	Y	S	B-19	1.5	2	07/26/01	1	--	--	--	--	--
B-22-2	Y	S	B-22	2	2.5	07/26/01	-1	--	--	--	--	--
B-23-2	Y	S	B-23	2	2.5	07/26/01	-1	--	--	--	--	--
B-24-1.5	Y	S	B-24	1.5	2	07/26/01	-1	--	--	--	--	--
B-25-2	Y	S	B-25	2	2.5	07/26/01	-1	--	--	--	--	--
B-26-2	Y	S	B-26	2	2.5	07/26/01	-1	--	--	--	--	--
B-27-2	Y	S	B-27	2	2.5	07/26/01	1.4	--	--	--	--	--
B-35-2	Y	S	B-35	2	2.5	08/01/01	-1	--	--	--	--	--
B-36-2	Y	S	B-36	2	2.5	08/01/01	1.3	--	--	--	--	--
B-37-1.5	Y	S	B-37	1.5	2	08/01/01	-1	--	--	--	--	--
B-38-2	Y	S	B-38	2	2.5	08/01/01	59	--	--	--	--	--
B-39-1.5	Y	S	B-39	1.5	2	03/06/02	-1	--	--	--	--	--
B-39-2	Y	S	B-39	2	2.5	03/06/02	-1	--	--	--	--	--
B-40-1	Y	S	B-40	1	1.5	03/06/02	-1	--	--	--	--	--
B-40-2	Y	S	B-40	2	2.5	03/06/02	-1	--	--	--	--	--
B-41-1	Y	S	B-41	1	1.5	03/06/02	-1	--	--	--	--	--
B-41-2	Y	S	B-41	2	2.5	03/06/02	-1	--	--	--	--	--
B-42-2	Y	S	B-42	2	2.5	03/06/02	-1	--	--	--	--	--
B-43-2	Y	S	B-43	2	2.5	03/06/02	-1	--	--	--	--	--
B-44-1	Y	S	B-44	1	1.5	03/06/02	-1	--	--	--	--	--
B-44-2	Y	S	B-44	2	2.5	03/06/02	-1	--	--	--	--	--
B-45-1	Y	S	B-45	1	1.5	03/06/02	-1	--	--	--	--	--
B-45-2	Y	S	B-45	2	2.5	03/06/02	-1	--	--	--	--	--
B-47-2	Y	S	B-47	2	2.5	03/06/02	-1	--	--	--	--	--
B-48-2	Y	S	B-48	2	2.5	11/13/02	-1	--	-1	-1	-1	-1
B-49-2	Y	S	B-49	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-50-2	Y	S	B-50	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-51-2	Y	S	B-51	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-52-1.5	Y	S	B-52	1.5	2	11/14/02	-1	--	-1	-1	-1	-1
B-53-1	Y	S	B-53	1	1.5	11/14/02	-1	--	-1	-1	-1	-1
B-54-1	Y	S	B-54	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
B-55-1.5	Y	S	B-55	1.5	2	11/15/02	-1	--	-1	-1	-1	-1

APPENDIX A-1
SURFACE SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs) top	Sample Depth (ft-bgs) bottom	Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri-chloro-phenol	2,3,5,6-Tetra-chloro-phenol	2,3,4,6-Tetra-chloro-phenol	2,3,4,5-Tetra-chloro-phenol
B-57-1	Y	S	B-57	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
B-58-1	Y	S	B-58	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
MW-5-2	Y	S	MW-05	2	2.5	03/07/02	-1	--	--	--	--	--
MW-6-1.5	Y	S	MW-06	1.5	2	03/07/02	-1	--	--	--	--	--
MW-7-1.5	Y	S	MW-07	1.5	2	03/07/02	10	--	--	--	--	--
MW-8-1.5	Y	S	MW-08	1.5	2	03/08/02	-1	--	--	--	--	--
MW-10-2	Y	S	MW-10	2	2.5	11/11/02	-1	--	-1	-1	-1	-1
MW-11-2	Y	S	MW-11	2	2.5	11/12/02	-1	--	-1	-1	-1	-1
MW-14-1.5	Y	S	MW-14	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
MW-16D-2	Y	S	MW-16	2	2.5	11/13/02	-1	--	-1	-1	-1	-1
MW-17-1.5	Y	S	MW-17	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
MW-18-1.5	Y	S	MW-18	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
PD-1(0-0.5)	Y	S	PD-1	0	0.5	04/08/03	-1	--	-1	-1	-1	-1
PD-1(2-2.5)	Y	S	PD-1	2	2.5	04/08/03	-1	--	-1	-1	-1	-1
PD-2(0-0.5)	Y	S	PD-2	0	0.5	04/08/03	-1	--	-1	-1	-1	-1
PD-2(2-2.5)	Y	S	PD-2	2	2.5	04/08/03	-1	--	-1	-1	-1	-1
TP-1A	Y	S	TP-1	0.75	1.25	04/03/03	-1	--	-1	-1	-1	-1
TP-1B	Y	S	TP-1	2	2.5	04/03/03	-1	--	-1	-1	-1	-1
1.0)A[4]	Y	S	TP-1A	1.5	2.5	04/16/03	-1	--	-1	-1	-1	-1
TP-2A	Y	S	TP-2	0.5	1	04/03/03	-1	--	-1	-1	-1	-1
TP-2(0-0.5)	Y	S	TP-2	1.7	2.2	04/16/03	-1	--	-1	-1	-1	-1
TP-3A	Y	S	TP-3	0.5	1	04/03/03	-1	--	-1	-1	-1	-1
TP-3(0-0.5)	Y	S	TP-3	1.9	2.4	04/16/03	-1	--	-1	-1	-1	-1
TP-4A	Y	S	TP-4	0.6	0.8	04/03/03	-1	--	-1	-1	-1	-1
TP-4 CHIP	Y	S	TP-4	1.25	--	04/16/03	-1	--	-1	-1	-1	-1
TP-4(0-0.5)	Y	S	TP-4	1.5	2	04/16/03	-1	--	-1	-1	-1	-1
TP-5A	Y	S	TP-5	0.5	0.7	04/03/03	-1	--	-1	-1	-1	-1
TP-5(0-0.5)	Y	S	TP-5	1.5	2	04/16/03	-1	--	-1	-1	-1	-1
Count							75	0	32	32	32	32
Number of Detections							9	0	0	0	0	0
Minimum							1	0	0	0	0	0
Maximum							59	0	0	0	0	0
Minimum Detection Limit							1	0	1	1	1	1
Maximum Detection Limit							1	0	1	1	1	1
Mean							NA[5]	NA	NA	NA	NA	NA
Standard Deviation							NA	NA	NA	NA	NA	NA
tvalue							NA	NA	NA	NA	NA	NA
95% Upper Confidence Limit[6]							NA	NA	NA	NA	NA	NA

Notes:

1. S = surface; Sub = subsurface
2. - 1 = Target analyte was not reported at or above detection limit shown.
3. -- = Not available or not analyzed.
4. Composite sample.
5. NA = Not applicable
6. ProUCL calculation results are presented in Appendix C.

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs)		Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
				top	bottom							
B-1-1	Y	S	B-01	1	1.5	07/23/01	-1[2]	--[3]	--	--	--	--
B-1-3	Y	Sub	B-01	3	3.5	07/23/01	-1	--	--	--	--	--
B-2-1.5	Y	S	B-02	1.5	2	07/23/01	3.2	--	--	--	--	--
B-2-3	Y	Sub	B-02	3	3.5	07/23/01	-1	--	--	--	--	--
B-3-1.5	Y	S	B-03	1.5	2	07/23/01	50	--	--	--	--	--
B-3-3	Y	Sub	B-03	3	3.5	07/23/01	69.5	--	--	--	--	--
B-3-5	Y	Sub	B-03	5	5.5	07/23/01	5.5	--	--	--	--	--
B-3-6.5	Y	Sub	B-03	6.5	7	07/23/01	4.8	--	--	--	--	--
B-4-1	Y	S	B-04	1	1.5	07/23/01	3.1	--	--	--	--	--
B-4-3	Y	Sub	B-04	3	3.5	07/23/01	20	--	--	--	--	--
B-4-5	Y	Sub	B-04	5	5.5	07/23/01	-1	--	--	--	--	--
B-4-6.5	Y	Sub	B-04	6.5	7	07/23/01	-1	--	--	--	--	--
B-5-3.5	Y	Sub	B-05	3.5	4	07/24/01	-1	--	--	--	--	--
B-5-5	Y	Sub	B-05	5	5.5	07/24/01	-1	--	--	--	--	--
B-6-3.5	Y	Sub	B-06	3.5	4	07/24/01	1	--	--	--	--	--
B-6-5	Y	Sub	B-06	5	5.5	07/24/01	-1	--	--	--	--	--
B-6-7	Y	Sub	B-06	7	7.5	07/24/01	-1	--	--	--	--	--
B-6-9 (BM)	Y	Sub	B-06	9	9.5	07/24/01	-1	--	--	--	--	--
B-7-1.5	Y	S	B-07	1.5	2	07/24/01	-1	--	--	--	--	--
B-7-3	Y	Sub	B-07	3	3.5	07/24/01	-1	--	--	--	--	--
B-8-2	Y	S	B-08	2	2.5	07/24/01	-1	--	--	--	--	--
B-8-4	Y	Sub	B-08	4	4.5	07/24/01	-1	--	--	--	--	--
B-9-1.5	Y	S	B-09	1.5	2	07/24/01	-1	--	--	--	--	--
B-9-3	Y	Sub	B-09	3	3.5	07/24/01	4.45	--	--	--	--	--
B-9-5	Y	Sub	B-09	5	5.5	07/24/01	-1	--	--	--	--	--
B-10-1.5	Y	S	B-10	1.5	2	07/24/01	-1	--	--	--	--	--
B-10-3	Y	Sub	B-10	3	3.5	07/24/01	-1	--	--	--	--	--
B-11-1	Y	S	B-11	1	1.5	07/24/01	1	--	--	--	--	--
B-11-3	Y	Sub	B-11	3	3.5	07/24/01	-1	--	--	--	--	--
B-12-1.5	Y	S	B-12	1.5	2	07/24/01	-1	--	--	--	--	--
B-12-3	Y	Sub	B-12	3	3.5	07/24/01	-1	--	--	--	--	--
B-13-1.5	Y	S	B-13	1.5	2	07/25/01	-1	--	--	--	--	--
B-13-3	Y	Sub	B-13	3	3.5	07/25/01	-1	--	--	--	--	--
B-14-1	Y	S	B-14	1	1.5	07/25/01	-1	--	--	--	--	--
B-14-3	Y	Sub	B-14	3	3.5	07/25/01	4.4	--	--	--	--	--
B-14-5	Y	Sub	B-14	5	5.5	07/25/01	2.4	--	--	--	--	--
B-14-6.5	Y	Sub	B-14	6.5	7	07/25/01	-1	--	--	--	--	--
B-15-1.5	Y	S	B-15	1.5	2	07/25/01	-1	--	--	--	--	--
B-15-3	Y	Sub	B-15	3	3.5	07/25/01	-1	--	--	--	--	--
B-16-1.5	Y	S	B-16	1.5	2	07/25/01	-1	--	--	--	--	--
B-16-3	Y	Sub	B-16	3	3.5	07/25/01	11	--	--	--	--	--
B-16-5	Y	Sub	B-16	5	5.5	07/25/01	-1	--	--	--	--	--
B-17-2	Y	S	B-17	2	2.5	07/25/01	-1	--	--	--	--	--
B-17-4	Y	Sub	B-17	4	4.5	07/25/01	-1	--	--	--	--	--

GEOMATRIX

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs)		Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
				top	bottom							
B-18-1	Y	S	B-18	1	1.5	07/25/01	-1	--	--	--	--	--
B-18-3	Y	Sub	B-18	3	3.5	07/25/01	-1	--	--	--	--	--
B-19-1.5	Y	S	B-19	1.5	2	07/26/01	1	--	--	--	--	--
B-19-3	Y	Sub	B-19	3	3.5	07/26/01	-1	--	--	--	--	--
B-20-2.5	Y	Sub	B-20	2.5	3	07/26/01	-1	--	--	--	--	--
B-20-4	Y	Sub	B-20	4	4.5	07/26/01	-1	--	--	--	--	--
B-21-3	Y	Sub	B-21	3	3.5	07/26/01	-1	--	--	--	--	--
B-21-4	Y	Sub	B-21	4	4.5	07/26/01	-1	--	--	--	--	--
B-22-2	Y	S	B-22	2	2.5	07/26/01	-1	--	--	--	--	--
B-22-3	Y	Sub	B-22	3	3.5	07/26/01	-1	--	--	--	--	--
B-23-2	Y	S	B-23	2	2.5	07/26/01	-1	--	--	--	--	--
B-23-3	Y	Sub	B-23	3	3.5	07/26/01	-1	--	--	--	--	--
B-24-1.5	Y	S	B-24	1.5	2	07/26/01	-1	--	--	--	--	--
B-24-3	Y	Sub	B-24	3	3.5	07/26/01	-1	--	--	--	--	--
B-25-2	Y	S	B-25	2	2.5	07/26/01	-1	--	--	--	--	--
B-25-3	Y	Sub	B-25	3	3.5	07/26/01	-1	--	--	--	--	--
B-26-2	Y	S	B-26	2	2.5	07/26/01	-1	--	--	--	--	--
B-26-3	Y	Sub	B-26	3	3.5	07/26/01	-1	--	--	--	--	--
B-27-2	Y	S	B-27	2	2.5	07/26/01	1.4	--	--	--	--	--
B-27-3	Y	Sub	B-27	3	3.5	07/26/01	-1	--	--	--	--	--
B-28-4.5	Y	Sub	B-28	4.5	5	07/27/01	-1	--	--	--	--	--
B-30-2.5	Y	Sub	B-30	2.5	3	07/27/01	-1	--	--	--	--	--
B-30-4	Y	Sub	B-30	4	4.5	07/27/01	-1	--	--	--	--	--
B-31-3.5	Y	Sub	B-31	3.5	4	07/27/01	-1	--	--	--	--	--
B-31-5	Y	Sub	B-31	5	5.5	07/27/01	-1	--	--	--	--	--
B-32-2.5	Y	Sub	B-32	2.5	3	07/27/01	-1	--	--	--	--	--
B-32-4	Y	Sub	B-32	4	4.5	07/24/01	-1	--	--	--	--	--
B-33-4	Y	Sub	B-33	4	4.5	08/01/01	4.7	--	--	--	--	--
B-33-5	Y	Sub	B-33	5	5.5	08/01/01	-1	--	--	--	--	--
B-33-6.5	Y	Sub	B-33	6.5	7	08/01/01	-1	--	--	--	--	--
B-34-4	Y	Sub	B-34	4	4.5	08/01/01	2.2	--	--	--	--	--
B-34-5	Y	Sub	B-34	5	5.5	08/01/01	1.9	--	--	--	--	--
B-34-6.5	Y	Sub	B-34	6.5	7	08/01/01	-1	--	--	--	--	--
B-35-2	Y	S	B-35	2	2.5	08/01/01	-1	--	--	--	--	--
B-35-3	Y	Sub	B-35	3	3.5	08/01/01	-1	--	--	--	--	--
B-36-2	Y	S	B-36	2	2.5	08/01/01	1.3	--	--	--	--	--
B-36-3	Y	Sub	B-36	3	3.5	08/01/01	-1	--	--	--	--	--
B-37-1.5	Y	S	B-37	1.5	2	08/01/01	-1	--	--	--	--	--
B-37-2.5	Y	Sub	B-37	2.5	3	08/01/01	-1	--	--	--	--	--
B-38-2	Y	S	B-38	2	2.5	08/01/01	59	--	--	--	--	--
B-38-3	Y	Sub	B-38	3	3.5	08/01/01	27	--	--	--	--	--
B-38-4.5	Y	Sub	B-38	4.5	5	08/01/01	-1	--	--	--	--	--
B-39-1.5	Y	S	B-39	1.5	2	03/06/02	-1	--	--	--	--	--
B-39-2	Y	S	B-39	2	2.5	03/06/02	-1	--	--	--	--	--

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs)		Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
				top	bottom							
B-39-4	Y	Sub	B-39	4	4.5	03/06/02	-1	--	--	--	--	--
B-39-4.5	Y	Sub	B-39	4.5	5	03/06/02	-1	--	--	--	--	--
B-39-5	Y	Sub	B-39	5	5.5	03/06/02	-1	--	--	--	--	--
B-40-1	Y	S	B-40	1	1.5	03/06/02	-1	--	--	--	--	--
B-40-2	Y	S	B-40	2	2.5	03/06/02	-1	--	--	--	--	--
B-40-3	Y	Sub	B-40	3	3.5	03/06/02	-1	--	--	--	--	--
B-40-4	Y	Sub	B-40	4	4.5	03/06/02	-1	--	--	--	--	--
B-40-5	Y	Sub	B-40	5	5.5	03/06/02	-1	--	--	--	--	--
B-41-1	Y	S	B-41	1	1.5	03/06/02	-1	--	--	--	--	--
B-41-2	Y	S	B-41	2	2.5	03/06/02	-1	--	--	--	--	--
B-41-3	Y	Sub	B-41	3	3.5	03/06/02	-1	--	--	--	--	--
B-41-4	Y	Sub	B-41	4	4.5	03/06/02	-1	--	--	--	--	--
B-41-5	Y	Sub	B-41	5	5.5	03/06/02	-1	--	--	--	--	--
B-42-2	Y	S	B-42	2	2.5	03/06/02	-1	--	--	--	--	--
B-42-2.5	Y	Sub	B-42	2.5	3	03/06/02	-1	--	--	--	--	--
B-42-3	Y	Sub	B-42	3	3.5	03/06/02	-1	--	--	--	--	--
B-42-4	Y	Sub	B-42	4	4.5	03/06/02	-1	--	--	--	--	--
B-42-5	Y	Sub	B-42	5	5.5	03/06/02	-1	--	--	--	--	--
B-43-2	Y	S	B-43	2	2.5	03/06/02	-1	--	--	--	--	--
B-43-2.5	Y	Sub	B-43	2.5	3	03/06/02	-1	--	--	--	--	--
B-43-3	Y	Sub	B-43	3	3.5	03/06/02	-1	--	--	--	--	--
B-43-4	Y	Sub	B-43	4	4.5	03/06/02	-1	--	--	--	--	--
B-43-5	Y	Sub	B-43	5	5.5	03/06/02	-1	--	--	--	--	--
B-44-1	Y	S	B-44	1	1.5	03/06/02	-1	--	--	--	--	--
B-44-2	Y	S	B-44	2	2.5	03/06/02	-1	--	--	--	--	--
B-44-3	Y	Sub	B-44	3	3.5	03/06/02	-1	--	--	--	--	--
B-44-4	Y	Sub	B-44	4	4.5	03/06/02	-1	--	--	--	--	--
B-44-5	Y	Sub	B-44	5	5.5	03/06/02	-1	--	--	--	--	--
B-45-1	Y	S	B-45	1	1.5	03/06/02	-1	--	--	--	--	--
B-45-2	Y	S	B-45	2	2.5	03/06/02	-1	--	--	--	--	--
B-45-3.5	Y	Sub	B-45	3.5	4	03/06/02	-1	--	--	--	--	--
B-45-4	Y	Sub	B-45	4	4.5	03/06/02	-1	--	--	--	--	--
B-45-5	Y	S	B-45	5	5.5	03/06/02	-1	--	--	--	--	--
B-46-3	Y	Sub	B-46	3	3.5	03/06/02	-1	--	--	--	--	--
B-46-3.5	Y	Sub	B-46	3.5	4	03/06/02	-1	--	--	--	--	--
B-46-4	Y	Sub	B-46	4	4.5	03/06/02	-1	--	--	--	--	--
B-46-5	Y	Sub	B-46	5	5.5	03/06/02	-1	--	--	--	--	--
B-46-5.5	Y	Sub	B-46	5.5	6	03/06/02	-1	--	--	--	--	--
B-47-2	Y	S	B-47	2	2.5	03/06/02	-1	--	--	--	--	--
B-47-3	Y	Sub	B-47	3	3.5	03/06/02	-1	--	--	--	--	--
B-47-3.5	Y	Sub	B-47	3.5	4	03/06/02	-1	--	--	--	--	--
B-47-4.5	Y	Sub	B-47	4.5	5	03/06/02	-1	--	--	--	--	--
B-47-5.5	Y	Sub	B-47	5.5	6	03/06/02	-1	--	--	--	--	--
B-48-2	Y	S	B-48	2	2.5	11/13/02	-1	--	-1	-1	-1	-1

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs)		Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
				top	bottom							
B-48-4	Y	Sub	B-48	4	4.5	11/13/02	-1	--	-1	-1	-1	-1
B-48-6	Y	Sub	B-48	6	6.5	11/13/02	-1	--	-1	-1	-1	-1
B-49-2	Y	S	B-49	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-49-4	Y	Sub	B-49	4	4.5	11/14/02	-1	--	-1	-1	-1	-1
B-50-2	Y	S	B-50	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-50-4	Y	Sub	B-50	4	4.5	11/14/02	-1	--	-1	-1	-1	-1
B-51-2	Y	S	B-51	2	2.5	11/14/02	-1	--	-1	-1	-1	-1
B-51-4	Y	Sub	B-51	4	4.5	11/14/02	-1	--	-1	-1	-1	-1
B-52-1.5	Y	S	B-52	1.5	2	11/14/02	-1	--	-1	-1	-1	-1
B-52-3.5	Y	Sub	B-52	3.5	4	11/14/02	-1	--	-1	-1	-1	-1
B-53-1	Y	S	B-53	1	1.5	11/14/02	-1	--	-1	-1	-1	-1
B-53-3	Y	Sub	B-53	3	3.5	11/14/02	-1	--	-1	-1	-1	-1
B-54-1	Y	S	B-54	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
B-54-3	Y	Sub	B-54	3	3.5	11/15/02	-1	--	-1	-1	-1	-1
B-55-1.5	Y	S	B-55	1.5	2	11/15/02	-1	--	-1	-1	-1	-1
B-55-3.5	Y	Sub	B-55	3.5	4	11/15/02	-1	--	-1	-1	-1	-1
B-56-4	Y	Sub	B-56	4	4.5	11/15/02	-1	--	-1	-1	-1	-1
B-57-1	Y	S	B-57	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
B-57-3	Y	Sub	B-57	3	3.5	11/15/02	1.9	--	-1	-1	-1	-1
B-57-5	Y	Sub	B-57	5	5.5	11/15/02	-1	--	-1	-1	-1	-1
B-58-1	Y	S	B-58	1	1.5	11/15/02	-1	--	-1	-1	-1	-1
B-58-3	Y	Sub	B-58	3	3.5	11/15/02	-1	--	-1	-1	-1	-1
B-58-5	Y	Sub	B-58	5	5.5	11/15/02	1.2	--	-1	-1	-1	-1
MW-1-2.5	No	Sub	MW-01	2.5	3	03/05/02	-1	--	--	--	--	--
MW-1-4.5	No	Sub	MW-01	4.5	5	03/05/02	-1	--	--	--	--	--
MW-2-2.5	Y	Sub	MW-02	2.5	3	03/05/02	-1	--	--	--	--	--
MW-2-4	Y	Sub	MW-02	4	4.5	03/05/02	-1	--	--	--	--	--
MW-3-4	Y	Sub	MW-03	4	4.5	03/05/02	-1	--	--	--	--	--
MW-3-5	Y	Sub	MW-03	5	5.5	03/05/02	-1	--	--	--	--	--
MW-4-2.5	Y	Sub	MW-04	2.5	3	03/07/02	-1	--	--	--	--	--
MW-4-3.5	Y	Sub	MW-04	3.5	4	03/07/02	-1	--	--	--	--	--
MW-5-2	Y	S	MW-05	2	2.5	03/07/02	-1	--	--	--	--	--
MW-5-3.5	Y	Sub	MW-05	3.5	4	03/07/02	-1	--	--	--	--	--
MW-6-1.5	Y	S	MW-06	1.5	2	03/07/02	-1	--	--	--	--	--
MW-6-3	Y	Sub	MW-06	3	3.5	03/07/02	-1	--	--	--	--	--
MW-7-1.5	Y	S	MW-07	1.5	2	03/07/02	10	--	--	--	--	--
MW-7-3	Y	Sub	MW-07	3	3.5	03/07/02	19	--	--	--	--	--
MW-7-5.5	Y	Sub	MW-07	5.5	6	03/07/02	-1	--	--	--	--	--
MW-7-6.5	Y	Sub	MW-07	6.5	7	03/07/02	-1	--	--	--	--	--
MW-8-1.5	Y	S	MW-08	1.5	2	03/08/02	-1	--	--	--	--	--
MW-8-3	Y	Sub	MW-08	3	3.5	03/08/02	-1	--	--	--	--	--
MW-9-2.5	Y	Sub	MW-09	2.5	3	03/08/02	-1	--	--	--	--	--
MW-9-4	Y	Sub	MW-09	4	4.5	03/08/02	-1	--	--	--	--	--
MW-10-2	Y	S	MW-10	2	2.5	11/11/02	-1	--	-1	-1	-1	-1

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs) top	Sample Depth (ft-bgs) bottom	Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
MW-10-4	Y	Sub	MW-10	4	4.5	11/11/02	-1	--	-1	-1	-1	-1
MW-11-2	Y	S	MW-11	2	2.5	11/12/02	-1	--	-1	-1	-1	-1
MW-11-4	Y	Sub	MW-11	4	4.5	11/12/02	-1	--	-1	-1	-1	-1
MW-12-4	Y	Sub	MW-12	4	4.5	11/12/02	-1	--	-1	-1	-1	-1
MW-12-4	Y	Sub	MW-12	4	4.5	11/12/02	-1	--	-1	-1	-1	-1
MW-13D-10	Y	Sub	MW-13	10	10.5	11/12/02	-1	--	-1	-1	-1	-1
MW-14-1.5	Y	S	MW-14	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
MW-14-3.5	Y	Sub	MW-14	3.5	4	11/13/02	-1	--	-1	-1	-1	-1
MW-14-5.5	Y	Sub	MW-14	5.5	6	11/13/02	-1	--	-1	-1	-1	-1
MW-15D-2.5	Y	Sub	MW-15	2.5	3	11/13/02	-1	--	-1	-1	-1	-1
MW-15D-4.5	Y	Sub	MW-15	4.5	5	11/13/02	-1	--	-1	-1	-1	-1
MW-16D-2	Y	S	MW-16	2	2.5	11/13/02	-1	--	-1	-1	-1	-1
MW-16D-4	Y	Sub	MW-16	4	4.5	11/13/02	-1	--	-1	-1	-1	-1
MW-17-1.5	Y	S	MW-17	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
MW-17-3.5	Y	Sub	MW-17	3.5	4	11/13/02	-1	--	-1	-1	-1	-1
MW-17-5.5	Y	Sub	MW-17	5.5	6	11/13/02	-1	--	-1	-1	-1	-1
MW-18-1.5	Y	S	MW-18	1.5	2	11/13/02	-1	--	-1	-1	-1	-1
MW-18-3.5	Y	Sub	MW-18	3.5	4	11/13/02	-1	--	-1	-1	-1	-1
MW-19D-7	Y	Sub	MW-19	7	--	11/14/02	-1	--	-1	-1	-1	-1
MW-19D-10	Y	Sub	MW-19	10	10.5	11/13/02	-1	--	-1	-1	-1	-1
NW-1-6'	Y	Sub	NW-1	6	--	04/22/03	-8	-1.6	-1.6	--	--	--
PD-1(0-0.5)	Y	S	PD-1	0	0.5	04/08/03	-1	--	-1	-1	-1	-1
PD-1(2-2.5)	Y	S	PD-1	2	2.5	04/08/03	-1	--	-1	-1	-1	-1
PD-2(0-0.5)	Y	S	PD-2	0	0.5	04/08/03	-1	--	-1	-1	-1	-1
PD-2(2-2.5)	Y	S	PD-2	2	2.5	04/08/03	-1	--	-1	-1	-1	-1
SE-1-6'	Y	Sub	SE-1	6	--	04/22/03	-1.6	-0.33	-0.33	--	--	--
TP-1A	Y	S	TP-1	0.75	1.25	04/03/03	-1	--	-1	-1	-1	-1
TP-1B	Y	S	TP-1	2	2.5	04/03/03	-1	--	-1	-1	-1	-1
TP-1A(0-1.0)A[4]	Y	S	TP-1A	1.5	2.5	04/16/03	-1	--	-1	-1	-1	-1
TP-1A(0-2.0)A[4]	Y	Sub	TP-1A	2.5	3.5	04/16/03	-1	--	-1	-1	-1	-1
TP-2A	Y	S	TP-2	0.5	1	04/03/03	-1	--	-1	-1	-1	-1
TP-2(0-0.5)	Y	S	TP-2	1.7	2.2	04/16/03	-1	--	-1	-1	-1	-1
TP-2(2.0-2.5)	Y	Sub	TP-2	3.7	4.2	04/16/03	-1	--	-1	-1	-1	-1
TP-3A	Y	S	TP-3	0.5	1	04/03/03	-1	--	-1	-1	-1	-1
TP-3(0-0.5)	Y	S	TP-3	1.9	2.4	04/16/03	-1	--	-1	-1	-1	-1
TP-3(2.0-2.5)	Y	Sub	TP-3	3.9	4.4	04/16/03	-1	--	-1	-1	-1	-1
TP-4A	Y	S	TP-4	0.6	0.8	04/03/03	-1	--	-1	-1	-1	-1
TP-4 CHIP	Y	S	TP-4	1.25	--	04/16/03	-1	--	-1	-1	-1	-1
TP-4(0-0.5)	Y	S	TP-4	1.5	2	04/16/03	-1	--	-1	-1	-1	-1
TP-4(2.0-2.5)	Y	Sub	TP-4	3.5	4	04/16/03	-1	--	-1	-1	-1	-1
TP-5A	Y	S	TP-5	0.5	0.7	04/03/03	-1	--	-1	-1	-1	-1
TP-5(0-0.5)	Y	S	TP-5	1.5	2	04/16/03	-1	--	-1	-1	-1	-1

APPENDIX A-2
SOIL DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in micrograms per kilogram (µg/kg)

Sample ID	Paved?	Soil Zone[1]	Boring	Sample Depth (ft-bgs) top	Sample Depth (ft-bgs) bottom	Date	PCP	2,4,5-Tri-chloro-phenol	2,4,6-Tri chloro-phenol	2,3,5,6-Tetra chloro-phenol	2,3,4,6-Tetra chloro-phenol	2,3,4,5-Tetra-chloro-phenol
TP-5(2.0-2.5)	Y	Sub	TP-5	3.5	4	04/16/03	-1	--	-1	-1	-1	-1
Count							218	2	68	66	66	66
Number of Detections							25	0	0	0	0	0
Minimum							1	0	0	0	0	0
Maximum							69.5	0	0	0	0	0
Minimum detection limit							1	0.33	0.33	1	1	1
Maximum detection limit							8	1.6	1.6	1	1	1
Mean							NA[5]	NA	NA	NA	NA	NA
Standard Deviation							NA	NA	NA	NA	NA	NA
tvalue							NA	NA	NA	NA	NA	NA
95% Upper Confidence Limit [6]							NA	NA	NA	NA	NA	NA

Notes:

1. S = surface; Sub = subsurface
2. - 1 = Target analyte was not reported at or above detection limit shown.
3. -- = Not available or not analyzed.
4. Composite sample.
5. NA = Not applicable
6. ProUCL calculation results are presented in Appendix C.

APPENDIX A-3
SOIL DATA SUMMARY - DIOXINS AND FURANS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in picograms per gram (pg/g)

WELL NO.	SAMPLE DEPTH feet bgs	DATE SAMPLED	DIOXINS							FURANS										TOTAL [1, 2] TEQ
			2, 3, 7, 8-TCDD	1, 2, 3, 7, 8-PeCDD	1, 2, 3, 4, 7, 8-HxCDD	1, 2, 3, 6, 7, 8-HxCDD	1, 2, 3, 7, 8, 9-HxCDD	1, 2, 3, 4, 6, 7, 8-HpCDD	OCDD	2, 3, 7, 8-TCDF	1, 2, 3, 7, 8-PeCDF	2, 3, 4, 7, 8-PeCDF	1, 2, 3, 4, 7, 8-HxCDF	1, 2, 3, 6, 7, 8-HxCDF	2, 3, 4, 6, 7, 8-HxCDF	1, 2, 3, 7, 8, 9-HxCDF	1, 2, 3, 4, 6, 7, 8-HpCDF	1, 2, 3, 4, 7, 8, 9-HpCDF	OCDF	
B-57	3	15-Nov-02	0.618	6.45	11.8	98.8	23.1	2460	25600	-0.245	0.98	0.7123	10.8	11.5	19	3.15	520	57.2	2070	58.4
B-57	5	15-Nov-02	-0.181	-0.580	-0.501	1.24	-0.518	27.8	359	-0.252	-0.35	-0.361	-0.179	-0.201	-0.228	-0.253	6.17	-0.436	23.9	0.50
B-58	5	15-Nov-02	-0.189	1.09	1.95	16.9	2.46	365	3270	-0.262	-0.476	-0.483	1.59	1.39	2.38	-0.306	87.1	9.71	310	8.73
TP-1	0.75-1.25	03-Apr-03	10.2	47.6	44.2	517	177	4,370	5,170	5.38	2.99	3.11	2.89	4.20	5.49	0.967	102	4.06	188	181
TP-1A	1.5-2.5	16-Apr-03	19.6	89.5	77.8	835	297	6,670	6,060	11.1	5.05	5.62	4.68	7.37	8.48	1.83	111	5.44	198	305
TP-1A	2.5-3.5	16-Apr-03	1.25	4.96	4.47	57.1	21.2	524	495	2.39	1.09	1.33	0.88	1.36	1.40	-0.337 [3]	8.6	-0.623	13.5	21.1
		TEF [4]	1	1	0.1	0.1	0.1	0.01	0.0001	0.1	0.05	0.5	0.1	0.1	0.1	0.1	0.01	0.01	0.0001	NA
Count																				6
Number of Detections																				6
Minimum Detected Concentration																				0.502
Maximum Detected Concentration																				305
Minimum Detection Limit																				NA
Maximum Detection Limit																				NA
Mean																				95.7
Standard Deviation																				122
t value																				2.02
95% Upper Confidence Limit																				196

Notes:
TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCDD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlorodibenzofuran
OCDF = Octachlorodibenzofuran
TEQ = Toxic equivalent.
NA = Not applicable.
< = Target analyte was not detected at or above the laboratory reporting limit shown.
J = Analyte concentration was below the calibration range.

1. Calculated by multiplying the congener concentration by its TEF and summing for all cogeners.
2. When an analyte concentration was not detected, it was assigned a concentration of 0 pg/g to calculate TEQ.
3. -0.337; Target analyte was not detected at or above the laboratory reporting limit shown.
4. Toxicity equivalency factor (unitless); See Appendix B.

APPENDIX A-4
SOIL DATA SUMMARY - METALS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in milligrams per kilogram (mg/kg)

Sample Location	Sample Depth bottom	Date	Barium	Chromium	Cobalt	Nickel	Lead	Vanadium	Zinc
NE-1	4	4/22/2003	--[1]	--	--	--	--	--	--
SW-1	4	4/22/2003	--	--	--	--	--	--	--
NW-1	6	4/22/2003	--	14	--	19	26	--	75
SE-1	6	4/22/2003	--	29	--	39	9.3	--	30
B-57	3	11/15/2002	12	22	20	24	-5[2]	9.2	17
Background Concentration Ranges[3]			133-1400	23-1579	2.7-46.9	9-509	12.4-97.1	39-288	88-236

Notes:

1. -- = Not analyzed
2. -5 = Target analyted was not reported at or above detection limit shown.
3. Kearny Foundation of Soil Science, 1996, Background Concentrations of Trace and Major Elements in California Soils, March.

APPENDIX A-5
SOIL DATA SUMMARY - VOLATILE CHEMICALS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in milligrams per kilogram (mg/kg)

Sample Location	Sample Depth (ft-bgs) top	bottom	Date	Acetone	Chloro benzene	1,4-Dichlorobenzene	Methyl Ethyl Ketone	Naphthalene	1,2,4-Trimethylbenzene
NE-1		4	4/22/2003	--[1]	--	--	--	--	--
SW-1		4	4/22/2003	--	--	--	--	--	--
NW-1		6	4/22/2003	-0.87[2]	-0.22	-0.22	-0.65	-0.22	0.23
SE-1		6	4/22/2003	0.13	-0.005	-0.005	0.031	-0.005	-0.005
PD-1	0	0.5	4/8/2003	-0.02	-0.005	-0.005	-0.015	-0.005	-0.005
PD-1	2	2.5	4/8/2003	-0.87	0.49	0.39	-0.65	0.24	0.33
PD-2	0	0.5	4/8/2003	-0.02	-0.005	-0.005	-0.015	-0.005	-0.005
PD-2	2	2.5	4/8/2003	-0.87	-0.22	0.35	-0.65	-0.22	-0.22
Count				5	6	6	6	6	6
Number of Detections				1	1	2	1	1	2
Minimum				0.13	0.49	0.35	0.031	0.24	0.23
Maximum				0.13	0.49	0.39	0.031	0.24	0.33
Minimum Detection Limit				0.02	0.005	0.005	0.015	0.005	0.005
Maximum Detection Limit				0.87	0.22	0.22	0.65	0.22	0.22
Mean				0.204	0.120	0.143	0.170	0.078	0.113
Standard Deviation				0.216	0.189	0.181	0.170	0.095	0.140
tvalue				2.132	2.015	2.015	2.015	2.015	2.015
95% Upper Confidence Limit (UCL)				0.410	0.275	0.292	0.310	0.156	0.228
Exposure Point Concentration				Use Max	Use 95% UCL	Use 95% UCL	Use Max	Use 95% UCL	Use 95% UCL

Notes:

1. -- = Not available or not analyzed.
2. - 1 = Target analyte was not reported at or above detection limit shown.

APPENDIX A-6
GROUNDWATER DATA SUMMARY - PHENOLS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/l).

WELL NO.	DATE SAMPLED	PCP	2,3,4-Trichloro-phenol	2,4,5-Trichloro-phenol	2,4,6-Trichloro-phenol	2,3,5,6-Tetrachloro-phenol	2,3,4,6-Tetrachloro-phenol	2,3,4,5-Tetrachloro-phenol
MW-1	14-Mar-02	< 1.0[1]	--[2]	--	-1	-1	-1	-1
	18-Jul-02	< 1.0	--	--	-1	-1	-1	-1
	16-Sep-02	1.8	--	--	-1	-1	-1	-1
	03-Oct-02 [3]	< 1.0	--	--	-1	-1	-1	-1
	02-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-2	14-Mar-02	7.4	--	--	-1	-1	-1	-1
	18-Jul-02	< 1.0	--	--	-1	-1	-1	-1
	16-Sep-02	2.5	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-3	14-Mar-02	1.2	--	--	-1	-1	-1	-1
	18-Jul-02	< 1.0	--	--	-1	-1	-1	-1
	16-Sep-02	5.0	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-4	14-Mar-02	8.6	--	--	-1	-1	-1	-1
	18-Jul-02	< 1.0	--	--	-1	-1	-1	-1
	16-Sep-02	5.7	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-5	14-Mar-02	4.3	--	--	-1	-1	-1	-1
	18-Jul-02	9.1	--	--	-1	-1	-1	-1
	16-Sep-02	25	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03 [4]	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-6	14-Mar-02	4.5	--	--	-1	-1	-1	-1
	18-Jul-02	< 1.0	--	--	-1	-1	-1	-1
	16-Sep-02	6.3	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1

GEOMATRIX

APPENDIX A-6
GROUNDWATER DATA SUMMARY - PHENOLS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/l).

WELL NO.	DATE SAMPLED	PCP	2,3,4-Trichloro-phenol	2,4,5-Trichloro-phenol	2,4,6-Trichloro-phenol	2,3,5,6-Tetrachloro-phenol	2,3,4,6-Tetrachloro-phenol	2,3,4,5-Tetrachloro-phenol
MW-7	14-Mar-02	31,000	--	--	-1	41	650	24
	18-Jul-02	33,000	--	--	-1	-1	990	56
	16-Sep-02	44,000	--	--	-1	-1	920	64
	03-Dec-02	46,000	--	--	-1.3	76	1,300	52
	14-Jan-03	51,000	280	190	2.4	-1	970	52
	20-Mar-03	19,000	--	--	-1	36	460	22
	22-May-03	19,000	--	--	-1	-1	470	-100
	22-May-03 [4]	16,000	--	--	-1	-1	400	-100
	22-May-03 [5]	14,000	--	--	-1	-1	400	-100
MW-8	14-Mar-02	22	--	--	-1	-1	-1	-1
	18-Jul-02	31	--	--	-1	-1	-1	-1
	16-Sep-02	4.8	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	21-May-03	1.0	--	--	-1	-1	-1	-1
MW-9	14-Mar-02	94	--	--	3.1	21	130	5.5
	18-Jul-02	2.1	--	--	-1	-1	-1	-1
	16-Sep-02	3.1	--	--	-1	-1	-1	-1
	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	23-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-10	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	23-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-11	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	21-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-12	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	21-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-13D	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-14	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-15D	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1

APPENDIX A-6

GROUNDWATER DATA SUMMARY - PHENOLS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/l).

WELL NO.	DATE SAMPLED	PCP	2,3,4-Trichloro-phenol	2,4,5-Trichloro-phenol	2,4,6-Trichloro-phenol	2,3,5,6-Tetrachloro-phenol	2,3,4,6-Tetrachloro-phenol	2,3,4,5-Tetrachloro-phenol
MW-16D	03-Dec-02	1.3	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	23-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-17	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-18	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	18-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	23-May-03	< 1.0	--	--	-1	-1	-1	-1
MW-19D	03-Dec-02	< 1.0	--	--	-1	-1	-1	-1
	20-Mar-03	< 1.0	--	--	-1	-1	-1	-1
	22-May-03	< 1.0	--	--	-1	-1	-1	-1
Count		109	1	1	109	109	109	109
Number of Detections		31	1	1	2	6	12	9
Minimum Detected Conc.		1	280	190	2.4	21	130	5.5
Maximum Detected Conc.		51000	280	190	3.1	76	1300	64
Minimum Detection Limit		1	0	0	1	1	1	1
Maximum Detection Limit		1	0	0	1	1	1	1

NOTES:

PCP Pentachlorophenol.
TCP Tetrachlorophenol.
µg/L Micrograms per liter.
1. -- = Not analyzed/reported.
2 -1 = Target analyte was not detected at or above the laboratory reporting limit shown.
3 Confirmation sample collected due to detection of PCP on September 16, 2002.
4 Duplicate sample.
5. Filtered sample.

Chlorinated phenols were analyzed using the Canadian Pulp Method.

GEOMATRIX

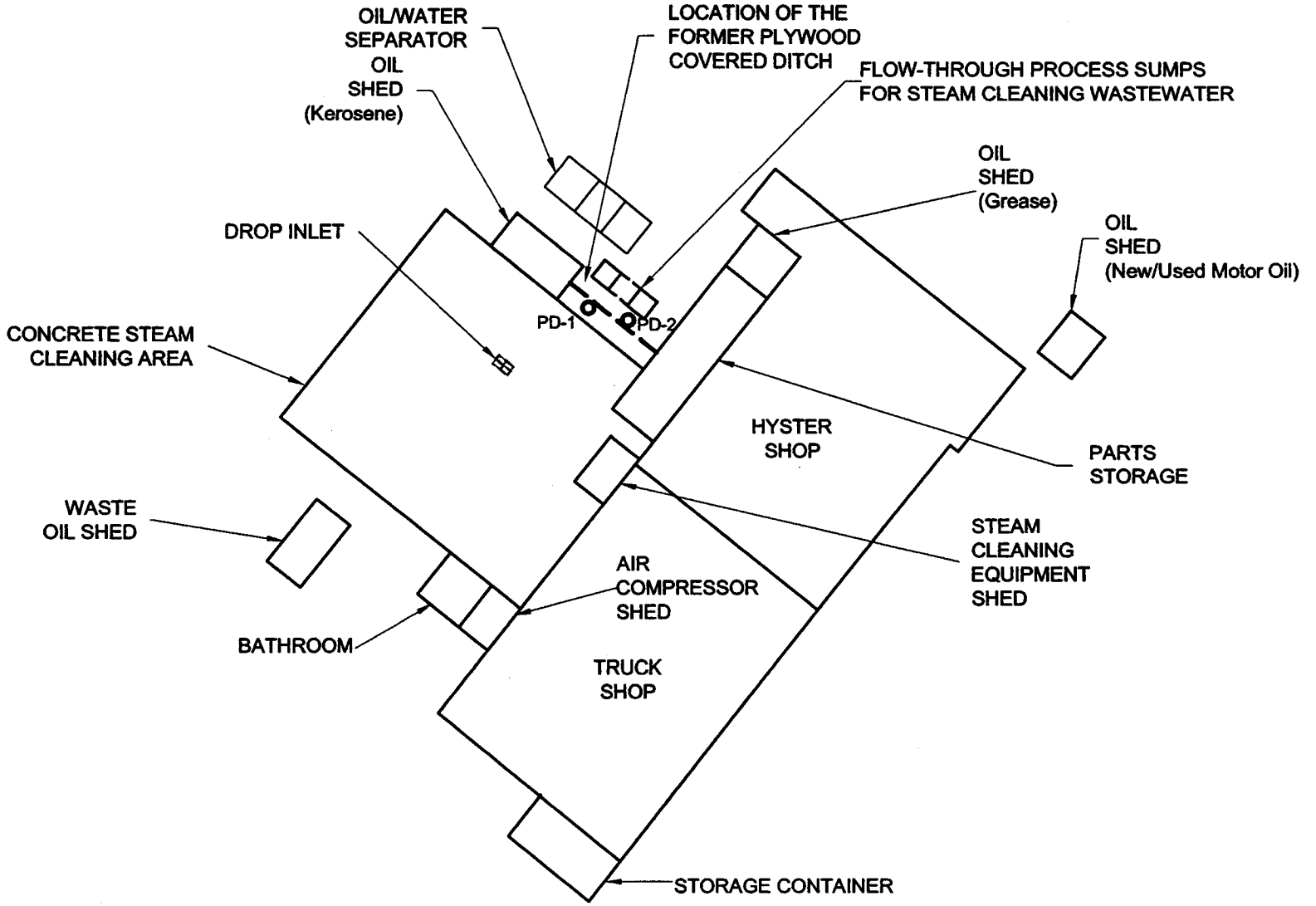
APPENDIX A-7
GROUNDWATER DATA SUMMARY - DIOXINS AND FURANS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations reported in picograms per liter (pg/L)

WELL NO.	DATE SAMPLED	DIOXINS							FURANS									TOTAL [1,2] TEQ
		2, 3, 7, 8-TCDD	1, 2, 3, 7, 8-PeCDD	1, 2, 3, 4, 7, 8-HxCDD	1, 2, 3, 6, 7, 8-HxCDD	1, 2, 3, 7, 8, 9-HxCDD	1, 2, 3, 4, 6, 7, 8-HpCDD	OCDD	2, 3, 7, 8-TCDF	1, 2, 3, 7, 8-PeCDF	2, 3, 4, 7, 8-PeCDF	1, 2, 3, 4, 7, 8-HxCDF	1, 2, 3, 6, 7, 8-HxCDF	2, 3, 4, 6, 7, 8-HxCDF	1, 2, 3, 7, 8, 9-HxCDF	1, 2, 3, 4, 6, 7, 8-HpCDF	1, 2, 3, 4, 7, 8, 9-HpCDF	OCDF	
MW-7	16-Sep-02	-3.12 [3]	-3.45	-5.82	-6.31	-5.32	32.4	144	-3.36	-4.21	-4.59	-2.38	-2.81	-2.86	-2.99	6.59	-6.67	22.2	0.407
	22-May-03	-1.62	-4.05	22.6 J [4]	-3.83	-3.1	30.2	449	-1.26	-2.04	-2.02	-1.02	-1.17	-1.19	-1.15	4.97 J	-0.807	20.7 J	2.66
	22-May-03 [5]	-1.27	-2	7.89 J	-2.47	-1.97	16.3 J	231	-1.01	-1.66	-1.64	-1.09	-1.28	-1.4	-1.67	2.09 J	-1.19	7.05 J	0.996
	TEF [6]:	1	1	0.1	0.1	0.1	0.01	0.0001	0.1	0.05	0.5	0.1	0.1	0.1	0.1	0.01	0.01	0.0001	NA
Count																			3
Number of Detections																			3
Minimum Detected Concentration																			0.407
Maximum Detected Concentration																			2.66
Minimum Detection Limit																			NA
Maximum Detection Limit																			NA

Notes:
TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCDD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlorodibenzofuran
OCDF = Octachlorodibenzofuran
TEQ = Toxic equivalent
NA = Not applicable
1. Calculated by multiplying the congener concentration by its TEF and summing for all cogeners.
2. When an analyte concentration was not detected, it was assigned a concentration of 0 pg/L to calculate TEQ.
3. -3.12; Target analyte was not detected at or above the laboratory reporting limit shown.
4. J; Analyte concentration was below the calibration range.
5. Filtered sample.
6. Toxicity equivalency factor (unitless); See Appendix B.

J:\030229\Task 08\Soil Investigation Report\plywood ditch.dwg PLOT SCALE 1:1



LEGEND

PD-1 — APPROXIMATE LOCATION AND DESIGNATION OF SOIL SAMPLES

— — — APPROXIMATE LOCATION OF ELECTRICAL CONDUIT IN THE FORMER PLYWOOD COVERED DITCH

N

0 15 30

APPROXIMATE SCALE

NOTE:
Site plan modified from Plate 2B in *Results of the Remedial Investigation for Sierra Pacific Industries - Arcata Division Sawmills, Arcata, California*, dated January 30, 2003, prepared by EnviroNet.

PLYWOOD COVERED DITCH SAMPLE LOCATIONS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No. 030229.8	By: M. Hillyard	**Figure**
Date: 5/27/03	Checked: CGS	A-1

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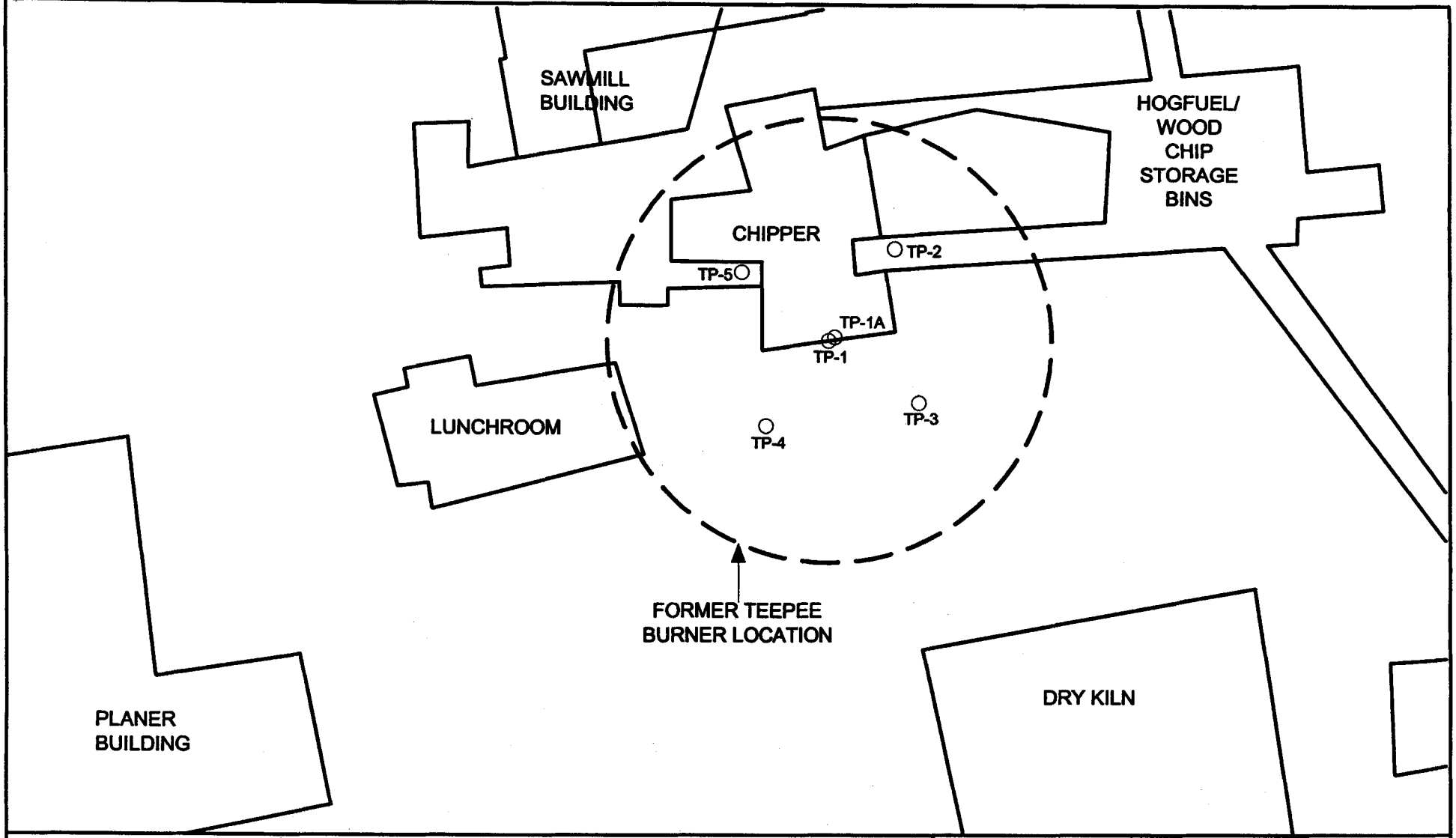
J:\030229\Task 10\Teepee Report\samplinglocs.dwg PLOT SCALE 1:1



LEGEND

TP-1 — APPROXIMATE LOCATION AND DESIGNATION OF SOIL BORING

N

0 15 30

APPROXIMATE SCALE

NOTE:
Site plan modified from Plate 2B in *Results of the Remedial Investigation for Sierra Pacific Industries - Arcata Division Sawmills, Arcata, California,* dated January 30, 2003, prepared by Environet Consulting.

FORMER TEEPEE BURNER SAMPLING LOCATIONS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No. 030229.10	By: M. Hillyard	**Figure** A-2
Date: 7/3/03	Checked: CCS	

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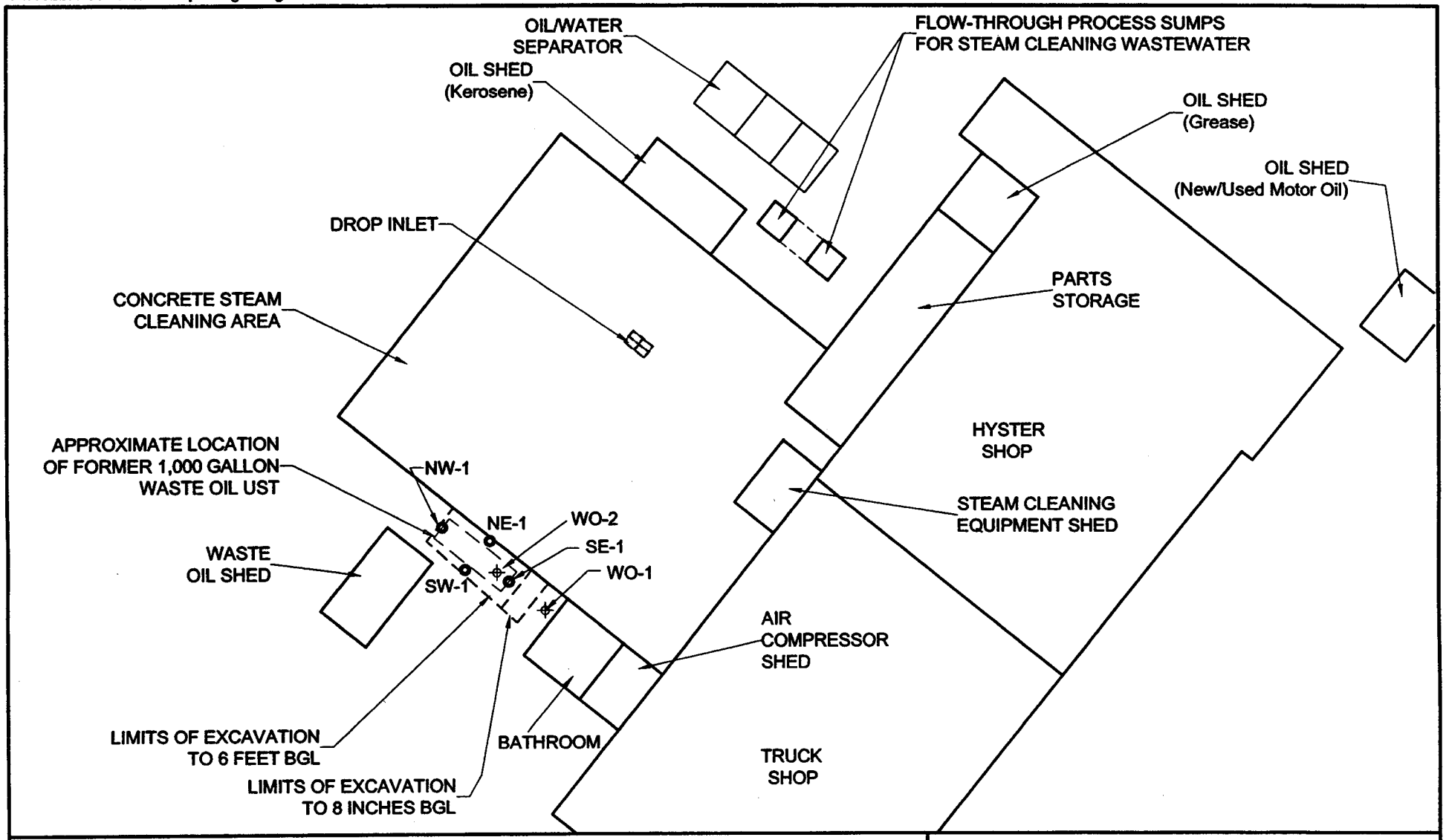
J:\030229\Task 07\UST Report\Fig 3.dwg PLOT SCALE 1:1



LEGEND

WO-1 ⌖ APPROXIMATE LOCATION AND DESIGNATION OF SOIL BORING

SE-1 ⊙ APPROXIMATE LOCATION AND DESIGNATION OF CONFIRMATION SOIL SAMPLE

N

0 10 20

APPROXIMATE SCALE

NOTE:
Site plan modified from Plate 2B in *Results of the Remedial Investigation for Sierra Pacific Industries - Arcata Division Sawmills, Arcata, California*, dated January 30, 2003, prepared by Environet Consulting.

LOCATIONS OF UST CONFIRMATION SAMPLES AND SOIL BORINGS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No. 030229.7	By: M. Hillyard	**Figure** A-3
Date: 6/4/03	Checked: CGS	

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APPENDIX B

Physical Chemical Constants

Table B-1

Physical Chemical Constants For Chemicals Of Potential Concern

Table B-2

Toxicity Equivalency Factors for Chlorinated Dibenzo-P-Dioxins and Dibenxofurans

TABLE B-1
PHYSICAL CHEMICAL CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Chemical	Log Octanol Water Partition Coefficient (log Kow)		Henry's Law Constant (H)		Henry's Law Constant (H')	Aqueous Solubility (S)		Diffusivity in Air (Di)			Diffusivity in Water (Dw)		Organic Carbon Partition Coefficient (Koc)		Permeability Constant Kp (USEPA)		Steady-state Time t* (USEPA)		Molecular Weight (MW)
								(cm^2/sec)	calculated (cm2/sec)		(cm^2/sec)								
	(--)		(atm-m^3/mole)		(unitless)	(mg/l)							(l/kg)		(cm/hr)		(hr)		(g/mole)
Acetone	-0.24	(1)	3.88E-05	(1)	1.59E-03	1.00E+06	(1)	1.24E-01	NA	(1)	1.14E-05	(1)	5.75E-01	(1)	--		--		58.08
Chlorobenzene	2.86	(1)	3.70E-03	(1)	1.52E-01	4.72E+02	(1)	7.30E-02	NA	(1)	8.70E-06	(1)	2.19E+02	(1)	--		--		112.56
1,4-Dichlorobenzene	3.42	(1)	2.39E-03	(1)	9.80E-02	7.90E+01	(1)	6.90E-02	NA	(1)	7.90E-06	(1)	6.17E+02	(1)	--		--		147.00
Methyl ethyl ketone	0.40	(1)	5.58E-05	(1)	2.29E-03	2.23E+05	(1)	8.08E-02	NA	(1)	9.80E-06	(1)	2.30E+00	(1)	--		--		72.11
Naphthalene	2.39	(1)	4.82E-04	(1)	1.98E-02	3.10E+01	(1)	5.90E-02	NA	(1)	7.50E-06	(1)	2.00E+03	(1)	--		--		167.85
Pentachlorophenol	5.09	(2)	2.44E-08	(2)	1.00E-06	1.95E+03	(2)	5.60E-02	NA	(2)	6.10E-06	(2)	5.21E+02	(3)	0.39	(4)	13.82	(4)	266.40
TCDD	6.80	(4)	5.40E-23	(5)	2.21E-21	3.17E-04	(5)	--			--		1.90E+06	(5)	0.81	(4)	30.09	(4)	322.00
2,3,4,5-Tetrachlorophenol	4.21	(6)	3.50E-07	(6)	1.44E-05	1.00E+03	(7)	--			--		3.33E+03	(3)	--		--		231.89
2,3,4,6-Tetrachlorophenol	4.45	(6)	1.30E-06	(6)	5.33E-05	1.00E+03	(6)	--			--		2.13E+02	(3)	--		--		231.89
2,3,5,6-Tetrachlorophenol	3.88	(6)	3.50E-07	(6)	1.44E-05	1.00E+03	(7)	--			--		2.72E+04	(6)	--		--		231.89
2,3,4-Trichlorophenol	3.90	(2)	4.34E-06	(8)	1.78E-04	1.20E+03	(8)	2.91E-02	NA	(8)	6.20E-06	(8)	1.60E+03	(8)	0.035	(9)	3.27	(9)	197.45
2,4,5-Trichlorophenol	3.90	(2)	4.34E-06	(3)	1.78E-04	1.20E+03	(3)	2.91E-02	NA	(3)	6.20E-06	(5)	1.60E+03	(3)	0.035	(9)	3.27	(9)	197.45
2,4,6-Trichlorophenol	3.70	(2)	7.78E-06	(3)	3.19E-04	8.00E+02	(3)	3.18E-02	NA	(3)	6.20E-06	(8)	3.81E+02	(3)	0.035	(4)	3.27	(4)	197.45
1,2,4-Trimethylbenzene	3.72	(1)	6.14E-03	(1)	2.52E-01	5.70E+01	(1)	6.06E-02	NA	(1)	7.92E-06	(1)	1.35E+03	(1)	--		--		120.19

References:

(1) U.S. EPA, 2003b, User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings.
(2) U.S. EPA, 1996, Soil Screening Guidance, User's Guide and Technical Background Document.
(3) U.S. EPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.
(4) U.S. EPA, 2001, Risk Assessment Guidance for Superfund, Part E, Dermal Guidance.
(5) Montgomery, 2000, Groundwater Chemicals Desk Reference, Third Edition.
(6) Hazardous Substance Data Bank (HSDB), 2003.

(7) 2,3,4,6-Tetrachlorophenol was used as a surrogate.
(8) 2,4,5-Trichlorophenol was used as a surrogate.
(9) 2,4,6-Trichlorophenol was used as a surrogate.

TABLE B-2

GEOMATRIX

TOXICITY EQUIVALENCY FACTORS FOR CHLORINATED DIBENZO-P-DIOXINS AND DIBENXOFURANS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Congener	1989 TEF[a]	Toxicity Equivalency Factor[1]
Mono, Di, and TriCDDs	0	0
2,3,7,8-TCDD	1	1
Other TCDDs	0	0
2,3,7,8-PeCDD	0.5	1
Other PeCDDs	0	0
2,3,7,8-HxCDDs	0.1	0.1
Other HxCDDs	0	0
2,3,7,8-HpCDD	0.01	0.01
Other HpCDDs	0	0
OCDD	0.001	0.0001
Mono, Di, and TriCDFs	0	0
2,3,7,8-TCDF	0.1	0.1
Other TCDFs	0	0
1,2,3,7,8-PeCDF	0.05	0.05
2,3,4,7,8-PeCDFs	0.5	0.5
Other PeCDFs	0	0
2,3,7,8-HxCDFs	0.1	0.1
Other HxCDFs	0	0
2,3,7,8-HpCDFs	0.01	0.01
Other HpCDFs	0	0
OCDF	0.001	0.0001

Note:

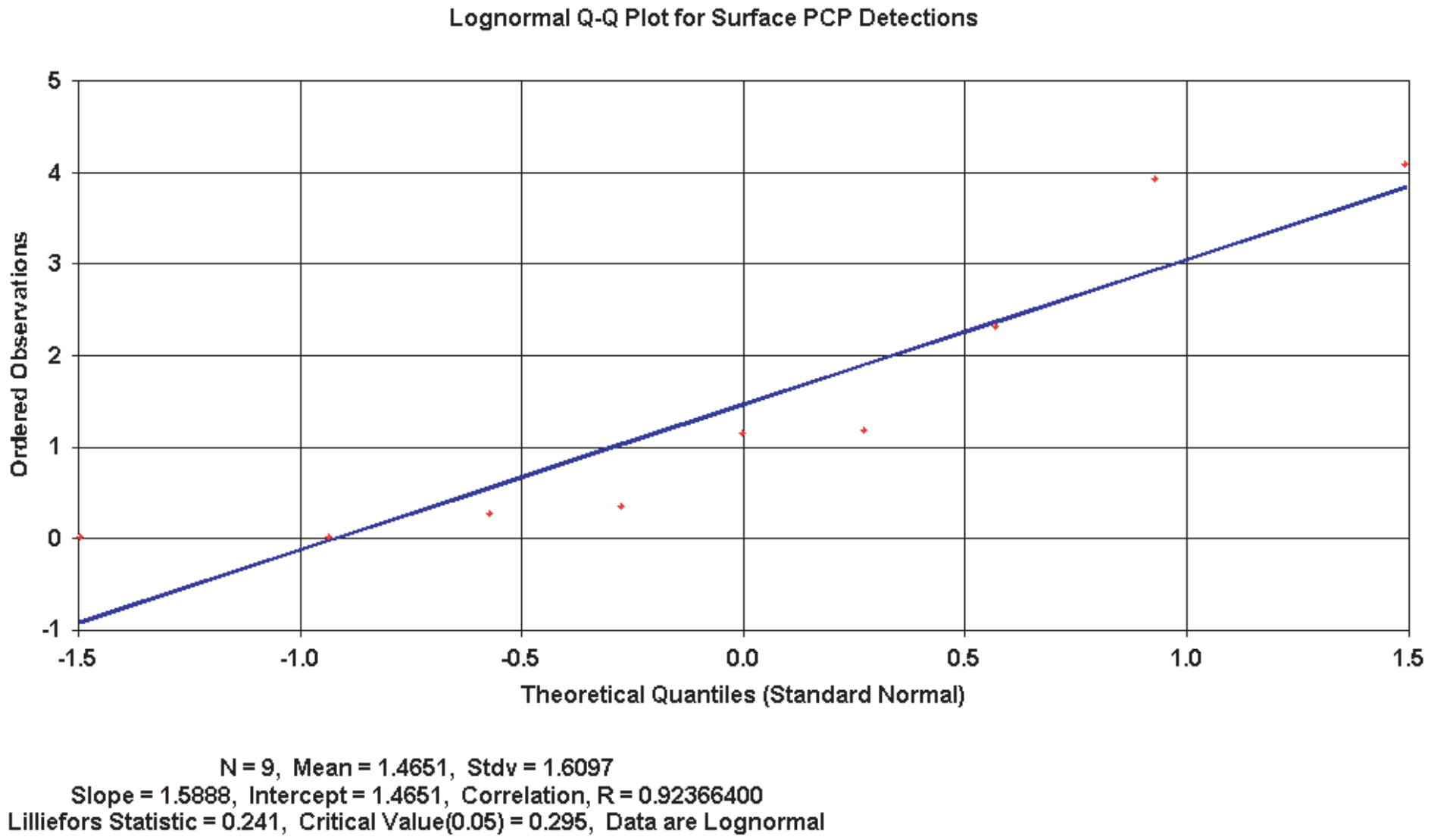
1. Toxicity equivalency factors adopted by Office of Environmental Health Hazard Assessment from World Health Organization (2003). 2,3,7,8-TCDD TEQ = Σ [Congener x TEF].

Abbreviations:
TCDD/F = tetrachlorodibenzo-p-dioxin/furan
PeCDD/F = pentachlorodibenzo-p-dioxin/furan
HxCDD/F = hexachlorodibenzo-p-dioxin/furan
HpCDD/F = heptachlorodibenzo-p-dioxin/furan
OCDD/F = octachlorodibenzo-p-dioxin/furan

APPENDIX C

Distribution of Pentachlorophenol Data

S:\9300\9329\task_02\03_1119_hhra_fig_c-01(01).ai



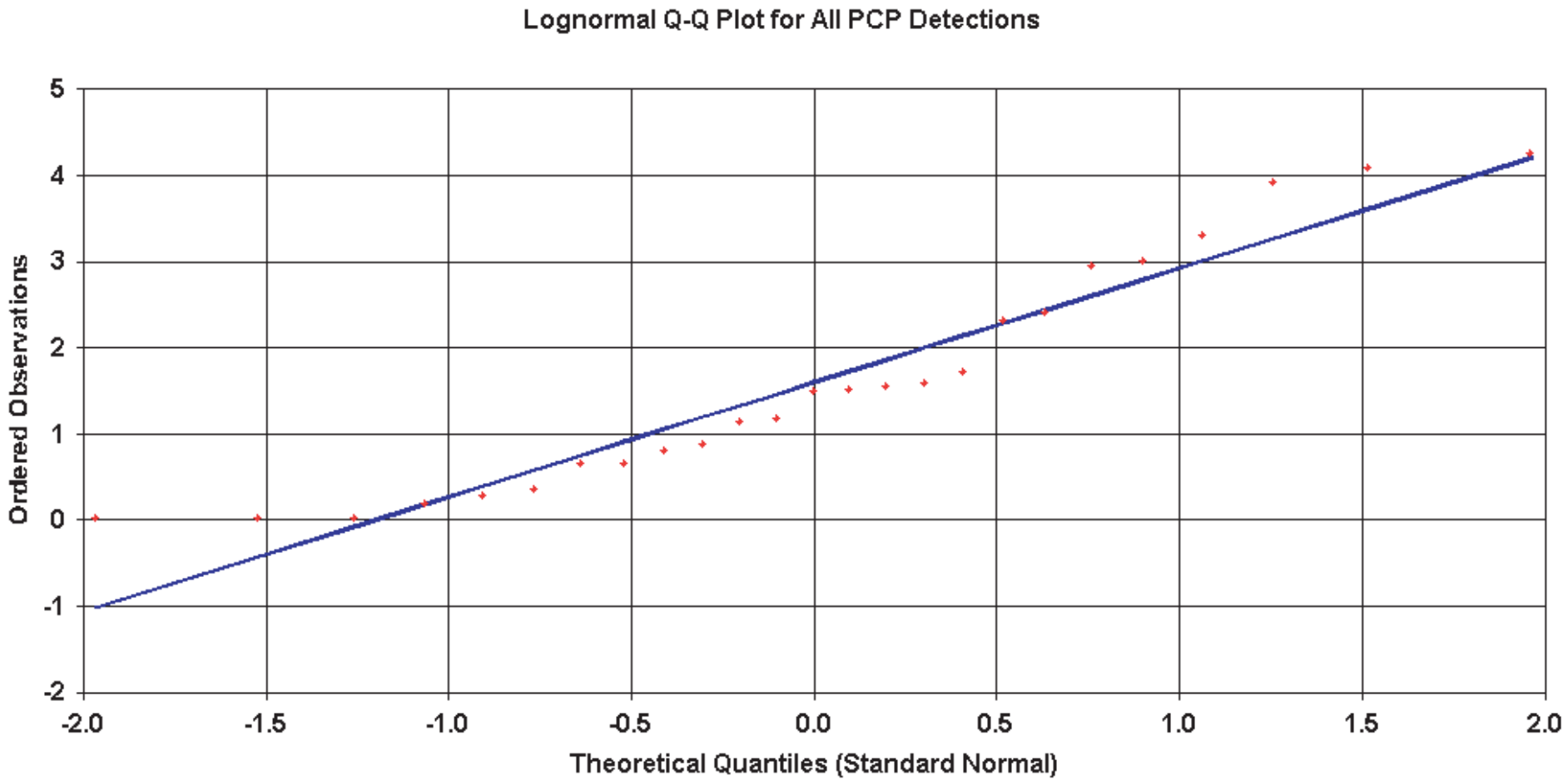
GEOMATRIX

DISTRIBUTION OF SURFACE PCP DATA
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No.
9329

Figure
C-1

S:\9300\9329\task_02\03_1119_hhra_fig_c-02(02).ai



N = 25, Mean = 1.5994, Stdv = 1.3349
Slope = 1.3273, Intercept = 1.5994, Correlation, R = 0.96334400
Lilliefors Statistic = 0.149, Critical Value(0.05) = 0.177, Data are Lognormal

GEOMATRIX

DISTRIBUTION OF ALL PCP DATA
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Project No.
9329

Figure
C-2

APPENDIX D

Estimation of Air Concentrations and Particulate Emission Factors

APPENDIX D

ESTIMATION OF AIR CONCENTRATIONS AND PARTICULATE EMISSION FACTORS

To address the soil/groundwater-to-air pathways, the following models were used to evaluate volatilization of chemicals and fugitive dust emissions:

1. Johnson & Ettinger Model to estimate indoor air concentrations from soil and groundwater,
2. Particulate emission factor calculation to relate the concentration of respirable particles in the air to fugitive dust emission from soil.

These models are described in the following paragraphs. Chemical-specific input parameters are provided in Appendix E; Johnson and Ettinger model output files, including the predicted indoor air chemical concentrations, and particulate emission factor calculations are attached to this Appendix.

Johnson and Ettinger Model

Inhabitants of future buildings on-site could be exposed to volatile organic chemicals (VOCs) that may infiltrate the indoor environment from subsurface soils or shallow groundwater. Volatile organic compound concentrations in indoor air of future structures were estimated using the Johnson and Ettinger model, as parameterized by U.S. EPA (2003). The model incorporates both convective and diffusive mechanisms for estimating the transport of chemical vapors emanating from either subsurface soils or groundwater into indoor spaces located directly above or in close proximity to a source of chemicals. The model is a one-dimensional analytical solution to convective and diffusive vapor transport into indoor spaces and provides an estimated attenuation coefficient that relates the vapor concentration in the indoor space to the vapor concentration at the source. The Johnson and Ettinger model has two levels called tiers. Tier 1 is a screening model in which most model parameters have been set equal to central tendency or upper bound values; values for the most sensitive parameters may be user-defined. In Tier 2, site-specific data may be input for all model parameters. Results from the Tier 1 model are therefore generally more conservative than results obtained from the more refined Tier 2 model. The Tier 2 model was used to estimate the indoor air concentration for the potential future receptors evaluated in this Baseline Human Health Risk Assessment. The

predicted air concentrations for each of the COPCs were then used to estimate the dose and the resulting risks.

Inputs to the Tier 2 model used for this assessment include chemical properties, saturated and unsaturated zone soil properties, and exposure frequency and duration values. The input parameters to the model used for the scenarios evaluated are presented in Table D-1.

Particulate Emission Factor Calculation

Inhalation of chemicals adsorbed to respirable particles (PM10) were assessed by calculating a particulate emission factor that relates the concentration of respirable particles in the air resulting from fugitive dust emission from soil. Three particulate emission factors were developed: a particulate emission factor applicable to construction and utility trench workers during their activities, a particulate emission factor applicable to industrial workers, and a particulate emission factor applicable to residents. The particulate emission factor for industrial workers and residents considers a time-weighted contribution from wind erosion and construction activities.

For wind erosion, the relationship was derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface chemical concentration provides a relatively continuous and constant potential for emission over an extended period of time. The following equation, as described in U.S. EPA (2002), was used:

$$PEF = \frac{Q/C \times 3600}{0.036 \times (1 - V) \times (Um/Ut)^3 \times F(x)} \quad (1)$$

Where:

Q/C	=	Dispersion factor (g/m^2-sec per kg/m^3)
V	=	Fraction of vegatative cover (0.5; U.S. EPA, 2002)
Um	=	Mean annual windspeed (4.69 m/sec; U.S. EPA, 2002)
Ut	=	Equivalent threshold value of windspeed at 7 meters (11.32 m/sec; U.S. EPA, 2002)
F(x)	=	Function of Um/Ut (0.2; U.S. EPA, 2002)

The dispersion factor (Q/C) is calculated as follows based on empirical data developed by U.S. EPA (2002) for various climatic zones.

$$Q/C = A_{site} \times \exp[(\ln A_{site} - B)^2/C] \quad (2)$$

Where:

Q/C	=	Dispersion factor (g/m^2-s/kg/m^3)
A_{site}	=	Area of source (acres)
A, B, C	=	Constants for air dispersion based on specific climatic zones

The particulate emission factor during construction was calculated based on dust generated by traffic on unpaved portions of affected soil. The equation used for this calculation is as follows (U.S. EPA, 2002):

$$PEFsc = Q/Csr \times 1/Fd \times [(TxAr)/(556 \times (W/3)^{0.4} \times ((365-p)/365) \times \Sigma VKT)] \quad (3)$$

Where:

PEFsc	=	Particulate emission factor for subchronic exposure (m^3/kg)
Q/Csr	=	Dispersion factor (23.02 g/m^2-s/kg/m^3 based on 0.5 acre site)
Fd	=	Dispersion correction factor (0.185)
T	=	Duration of construction (seconds)
Ar	=	Surface area of contaminated road segment (m^2)
W	=	Mean vehicle weight (tons)
p	=	Number of days with at least 0.1 inches of precipitation (unitless)
ΣVKT	=	Sum of fleet vehicle kilometers traveled (km)

To estimate the particulate emission factor for off-site residents and on-site industrial workers during construction, a time-weighted average particulate emission factor was developed based on wind erosion and construction emissions as follows:

$$PEF_{off} = Q/C_{off} \times 1/[(M_{road}+M_{wind})/(A_{site} \times ED \times (3.1536x10^7)] \quad (4)$$

Where:

PEFoff	=	Off-site particulate emission factor (m^3/kg)
Q/Coff	=	Dispersion factor (g/m^2-s/kg/m^3 based on 0.5 acre site)
M_{road}	=	Unit mass emitted from unpaved road traffic (g)
M_{wind}	=	Unit mass emitted from wind erosion (g)
A_{site}	=	Areal extent of the site (m^2)
ED	=	Exposure duration (years)

The assumptions used to estimate the particulate emission factors for construction activities and the on-site industrial worker and off-site resident are presented in Tables D-2 and D-3, respectively.

TABLE D-1

JOHNSON AND ETTINGER MODEL INPUT PARAMETERS

Morton International, Inc.

Reading, Ohio

Parameter	Symbol	Units	Industrial Value	Rationale
Depth below grade to bottom of enclosed floor space	L_F	(cm)	15	Slab-on-grade
Depth to top of affected soil	L_t	(cm)/(ft)	60/2	One foot of clean soil below construction and none foot of native material.
Soil type	–	–	S	Sand
Soil dry bulk density	ρ_b	(g/cm^3)	1.66	U.S. EPA, 2003
Soil total porosity	P_T	(cm^3/cm^3)	0.375	U.S. EPA, 2003
Soil water-filled porosity	P_w	(cm^3/cm^3)	0.054	U.S. EPA, 2003
Soil organic carbon fraction	f_{oc}	(unitless)	0.002	U.S. EPA, 2003
Length of building	L_B	(cm)/(ft)	1000/33	Small building
Width of building	W_B	(cm)/(ft)	1000/33	Small building
Height of building	H_B	(cm)/(ft)	366/12	Typical building height
Fraction of building above plume	–	%	100	Default
Indoor air exchange rate	ER	(1/hr)	2	SFRWQCB, 2003

TABLE D-2
Particulate Emission Factor (PEF)
Construction Scenario - Construction and Utility Trench Worker Scenarios[1]
Sierra Pacific Industries - Arcata Division Sawmill
Arcata, California

Variable	Description	Construction Worker	Reference
A	constant (unitless)	12.9351	Default
B	constant (unitless)	5.7383	Default
C	constant (unitless)	71.7711	Default
A_s	acres (areal extent of site surface soil contamination)	0.50	Approximate affected area in the green chain
Q/C_{sr}	g/m^2-s per kg/m^3	2.30E+01	Default for 0.5 acre site.
t_c	Duration of construction (hrs)	900	90 days for 10 hours per day
F_D	Dispersion correction factor (unitless)	0.1877	Equation 5-6 of Appendix E.
T	Total time over which construction occurs (s)	3240000	90 days for 10 hours per day
A_R	Surface area of contaminated road segment (m^2)	348.38	Road across affected area 25 feet wide
p	Number of days with at least 0.01" of precipitation (days/yr)	120	Exhibit 5-2
W	Mean vehicle weight (tons)	15	Average of 2 cars and 5 trucks
VKT	Sum of fleet vehicle kilometers traveled during the exposure duration (km)	57.61	Each car and truck makes one roundtrip per day across affected soil..
PEF	Particulate emission factor (m^3/kg)	3.40E+06	

[1] U.S. EPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Research and Development. OSWER 9355.4-24, March

TABLE D-3
Particulate Emission Factor (PEF)
Construction Scenario - On-Site Industrial Worker and Off-Site Resident[1]
Sierra Pacific Industries - Arcata Division Sawmill
Arcata, California

Variable	Description	Off-Site Resident	On-Site Workers	Reference
Q/Coff	Dispersion factor (g/m2-sec/kgm3)	88.43	88.43	Appendix D, site-specific
Jt	Total time-averaged emission flux (g/m2-s)	9.02262E-08	1.08271E-07	Equation 5-9
Mroad	Mass emitted duirng construction (g)	40771.04294	40771.04294	Equation 5-10
Mwind	Mass emitted from wind erosion (g)	1.32E+05	1.32E+05	Default
Asite	Area extent of the site (m2)	2024	2024	0.5 acre site
ED	Exposure duration (years)	30	25	Scenario specific
PEF	Particulate emission factor (m^3/kg)	9.80E+08	8.17E+08	

[1] U.S. EPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Research and Development. OSWER 9355.4-24, March.

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Version 3.0; 02/03

Reset to Defaults

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

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)	Chemica
67641	1.30E+02	Acetone

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
13	15	30.4	0	30.4	0	0	S		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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)
1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.5E-01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.4	0.321	0.321	0.321	0.003	9.98E-08	0.998	9.96E-08	4,000	1.30E+02	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	7,522	2.27E-05	9.68E-04	1.76E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	15.4	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.15E-03	3.71E+03	0.10	9.95E+01	2.01E-02	4.00E+02	6.99E+80	4.55E-04	1.69E+00	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	3.5E-01

END

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Reset to Defaults

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

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)	Chemica
108907	2.80E+02	Chlorobenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
13	15	30.4	0	30.4	0	0	S		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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)
7.30E-02	8.70E-06	3.69E-03	25	8,410	404.87	632.40	2.19E+02	4.72E+02	0.0E+00	1.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.4	0.321	0.321	0.321	0.003	9.98E-08	0.998	9.96E-08	4,000	2.80E+02	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	9,773	1.85E-03	7.87E-02	1.76E-04	1.18E-02	0.00E+00	0.00E+00	1.18E-02	15.4	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
4.38E-01	4.54E+04	0.10	9.95E+01	1.18E-02	4.00E+02	2.29E+137	4.33E-04	1.97E+01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E+00

END

SL-ADV
Version 3.0; 02/03

Reset to Defaults

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

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)	Chemica
106467	2.90E+02	1,4-Dichlorobenzene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	15	30.4	0	30.4	0	0	S		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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)
6.90E-02	7.90E-06	2.39E-03	25	9,271	447.21	684.75	6.17E+02	7.90E+01	1.1E-05	8.0E-01	S

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.4	0.321	0.321	0.321	0.003	1.00E-07	0.998	9.99E-08	4,000	2.90E+02	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	11,192	1.24E-03	5.26E-02	1.77E-04	1.12E-02	0.00E+00	0.00E+00	1.12E-02	15.4	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.23E+00	1.19E+04	0.10	9.95E+01	1.12E-02	4.00E+02	2.10E+145	4.30E-04	5.14E+00	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	1.1E-05	8.0E-01

END

METHYL ETHYL KETONE

SL-ADV
Version 3.0; 02/03

Reset to Defaults

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

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)	Chemica
78933	3.10E+01	Methylethylketone (2-butanone)

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
13	15	30.4	0	30.4	0	0	S		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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)
8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	2.30E+00	2.23E+05	0.0E+00	1.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.4	0.321	0.321	0.321	0.003	9.98E-08	0.998	9.96E-08	4,000	3.10E+01	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	8,382	3.08E-05	1.31E-03	1.76E-04	1.31E-02	0.00E+00	0.00E+00	1.31E-02	15.4	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
4.60E-03	1.09E+03	0.10	9.95E+01	1.31E-02	4.00E+02	1.17E+124	4.38E-04	4.77E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E+00

END

SL-ADV
Version 3.0; 02/03

Reset to Defaults

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

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)	Chemica
91203	1.60E+02	Naphthalene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
13	15	30.4	0	30.4	0	0	S		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	9.0E-03	S

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.4	0.321	0.321	0.321	0.003	9.98E-08	0.998	9.96E-08	4,000	1.60E+02	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	12,882	1.94E-04	8.24E-03	1.76E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	15.4	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
4.00E+00	3.27E+02	0.10	9.95E+01	9.54E-03	4.00E+02	8.84E+169	4.22E-04	1.38E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	9.0E-03

END

SL-ADV
Version 3.0; 02/03

Reset to Defaults

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

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)	Chemica
95636	2.30E+02	1,2,4-Trimethylbenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
13	15	60.96	0	60.96	0	0	S		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	1000	1000	366	0.1	2	

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	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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 (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	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)
6.06E-02	7.92E-06	6.14E-03	25	9,369	442.30	649.17	1.35E+03	5.70E+01	0.0E+00	6.0E-03	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.321	0.321	0.321	0.003	9.98E-08	0.998	9.96E-08	4,000	2.30E+02	2.03E+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)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	11,654	2.69E-03	1.15E-01	1.76E-04	9.80E-03	0.00E+00	0.00E+00	9.80E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.70E+00	9.56E+03	0.10	9.95E+01	9.80E-03	4.00E+02	2.92E+165	3.34E-04	3.19E+00	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	6.0E-03

END

APPENDIX E

Human Health Risk Assessment Calculations

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

RISK EQUATIONS

INCIDENTAL INGESTION OF SOIL

AADD =	$\frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$	Hazard Quotient =	$\frac{AADD}{RfDo}$
LADD =	$\frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$	Excess Cancer Risk =	LADD x SFo

DERMAL CONTACT WITH SOIL

AADD =	$\frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$	Hazard Quotient =	$\frac{AADD}{RfDo}$
LADD =	$\frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$	Excess Cancer Risk =	LADD x SFo

INHALATION OF VOLATILES IN INDOOR AIR

AADD =	$\frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATnc)}$	Hazard Quotient =	$\frac{AADD}{RfDi}$
LADD =	$\frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATca)}$	Excess Cancer Risk =	LADD x SFi

INHALATION OF RESUSPENDED SOIL PARTICULATES

AADD =	$\frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)}$	Hazard Quotient =	$\frac{AADD}{RfDi}$
LADD =	$\frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)}$	Excess Cancer Risk =	LADD x SFi

DERMAL CONTACT WITH GROUNDWATER

AADD =	$\frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATnc)}$	Hazard Quotient =	$\frac{AADD}{RfDo}$
LADD =	$\frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATca)}$	Excess Cancer Risk =	LADD x SFo

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

CONSTANTS

Parameter	Symbol	Value	Units
SITE-SPECIFIC PROPERTIES			
Wind Speed	WS	2.25	m/sec
Mixing Height	MH	2	m
Particulate Emission Factor - construction	PEF	3.4E+06	m^3/kg
SOIL PROPERTIES			
Fraction Organic Carbon	foc	0.006	unitless
Bulk Density	pb	1.5	g/cm^3
Water Filled Soil Porosity	Pw	0.15	unitless
Air Filled Soil Porosity	Pa	0.28	unitless
Total Porosity	Pt	0.43	unitless
Temperature	T	298	K
PHYSICAL CONSTANTS			
Universal Gas Constant	R	0.000082	atm-m^3/mole-K
UNITS CONVERSION FACTORS			
Conversion Factor from mg to kg	CF_{mg-kg}	1.E-06	kg/mg
Conversion Factor from m^2 to cm^2	CF_{m2-cm2}	1.E+04	cm^2/m^2
Conversion Factor from g to kg	CF_{g-kg}	1.E-03	kg/g
Conversion Factor from cm^3 to L	CF_{cm3-L}	1.E-03	L/cm^3
Conversion Factor from kg to mg	CF_{kg-mg}	1.E+06	mg/kg
Conversion Factor from g to mg	CF_{g-mg}	1.E+03	mg/g

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

EXPOSURE PARAMETERS

Parameter	Symbol	Units	Industrial Worker	Construction Worker	Trench/Utility Worker	Adult Resident	Child Resident
ALL PATHWAYS							
Exposure Frequency	EF	d/yr	250	90	10	350	350
Exposure Duration	ED	yr	25	1	5	24	6
Body Weight	BW	kg	70	70	70	70	15
Averaging Time-Non-cancer	ATnc	days	9,125	365	1,825	8,760	2,190
Averaging Time-Cancer	ATca	days	25,550	25,550	25,550	25,550	25,550
INCIDENTAL INGESTION OF SOIL							
Exposure Frequency	EFig	d/yr	250	90	10	350	350
Ingestion Rate	IRs	mg/d	100	330	330	100	200
DERMAL CONTACT WITH SOIL							
Exposure Frequency	EFdc	d/yr	250	90	10	350	350
Surface Area	SAs	cm^2	3300	3,300	3,300	5,700	2,800
Soil-to-Skin Adherence Factor	SAF	mg/cm^2	0.2	0.3	0.3	0.07	0.2
INHALATION OF VOLATILES IN INDOOR AIR							
Exposure Frequency	EFia	d/yr	250	NA	NA	NA	NA
Inhalation Rate	IHRia	m^3/hr	2.5	NA	NA	NA	NA
Exposure Time	ETia	hr/d	8	NA	NA	NA	NA
INHALATION OF RESUSPENDED SOIL PARTICULATES							
Exposure Frequency	EFpe	d/yr	250	90	10	350	350
Inhalation Rate	IHRpe	m^3/hr	2.5	2.5	2.5	0.83	0.42
Exposure Time	ETpe	hr/d	8	8	8	24	24
DERMAL CONTACT WITH GROUNDWATER							
Event Duration	tevent	hr/day	NA	1	1	NA	NA
Event Frequency	EVswr	evt/day	NA	1	1	NA	NA
Exposure Frequency	EFswr	d/yr	NA	10	10	NA	NA
Surface Area	SAswr	cm^2	NA	3,100	3,100	NA	NA

1) Assuming that construction/utility workers' forearms, hands, and feet are exposed, U.S. EPA 1997.

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

REPRESENTATIVE CONCENTRATIONS

Chemical	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)	Indoor Air -Soil mg/m^3	Groundwater (mg/l)	Indoor Air - Groundwater mg/m^3
Acetone	1.30E-01	1.30E-01	1.69E-03	NA	NA
Chlorobenzene	2.80E-01	2.80E-01	1.97E-02	NA	NA
1,4-Dichlorobenzene	2.90E-01	2.90E-01	5.14E-03	NA	NA
Methyl ethyl ketone	3.10E-02	3.10E-02	4.77E-04	NA	NA
Naphthalene	1.60E-01	1.60E-01	1.38E-04	NA	NA
Pentachlorophenol	1.18E+00	1.07E+00	NA	51	NA
TCDD	1.96E-04	1.96E-04	NA	2.66E-09	NA
2,3,4,5-Tetrachlorophenol	5.00E-01	5.00E-01	NA	1.3	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	5.00E-01	NA	0.076	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	5.00E-01	NA	0.064	NA
2,3,4-Trichlorophenol	8.00E-01	8.00E-01	NA	0.28	NA
2,4,5-Trichlorophenol	8.00E-01	8.00E-01	NA	0.19	NA
2,4,6-Trichlorophenol	8.00E-01	8.00E-01	NA	0.0031	NA
1,2,4-Trimethylbenzene	2.30E-01	2.30E-01	3.19E-03	NA	NA

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

TOXICITY CRITERIA

Chemical	Slope Factors (SF)			Reference Doses (RfD)				
	oral SFo $(mg/kg\text{-}d)^{-1}$	dermal SFd $(mg/kg\text{-}d)^{-1}$	inhalation SFi $(mg/kg\text{-}d)^{-1}$	chronic oral RfDo (mg/kg-d)	chronic dermal RfDd (mg/kg-d)	chronic inhalation RfDi (mg/kg-d)	subchronic oral sRfDo (mg/kg-d)	subchronic inhalation sRfDi (mg/kg-d)
Acetone	NA	NA	NA	0.9	0.9	0.9	1	1
Chlorobenzene	NA	NA	NA	0.02	0.02	0.017	0.02	0.017
1,4-Dichlorobenzene	NA	NA	NA	0.03	0.03	0.23	0.71	0.71
Methyl ethyl ketone	NA	NA	NA	0.6	0.6	0.29	2	2
Naphthalene	NA	NA	NA	0.02	0.02	0.00086	0.02	0.00086
Pentachlorophenol	0.12	0.12	0.018	0.03	0.03	0.03	0.03	0.03
TCDD	130000	130000	130000	0.00000001	0.00000001	0.000000011	0.00000001	0.000000011
2,3,4,5-Tetrachlorophenol	NA	NA	NA	0.03	0.03	0.03	0.3	0.3
2,3,4,6-Tetrachlorophenol	NA	NA	NA	0.03	0.03	0.03	0.3	0.3
2,3,5,6-Tetrachlorophenol	NA	NA	NA	0.03	0.03	0.03	0.3	0.3
2,3,4-Trichlorophenol	NA	NA	NA	0.1	0.1	0.1	1	1
2,4,5-Trichlorophenol	NA	NA	NA	0.1	0.1	0.1	1	1
2,4,6-Trichlorophenol	0.07	0.07	0.07	0.0001	0.0001	0.0001	0.0001	0.0001
1,2,4-Trimethylbenzene	NA	NA	NA	0.05	0.05	0.0017	0.05	0.0017

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

ABSORPTION FACTORS

Chemical	Oral soil ABSos (--)	Oral Water ABSow (--)	Oral Produce ABSop (--)	Inhalation VOC ABSiv (--)	Inhalation Dust ABSip (--)	Dermal Soil ABSds (--)	Permeability Constant Kp (USEPA) (cm/hr)	Steady-state Time t* (USEPA) (hr)
Acetone	1	1	1	1	1	0.1	NA	NA
Chlorobenzene	1	1	1	1	1	0.1	NA	NA
1,4-Dichlorobenzene	1	1	1	1	1	0.1	NA	NA
Methyl ethyl ketone	1	1	1	1	1	0.1	NA	NA
Naphthalene	1	1	1	1	1	0.15	NA	NA
Pentachlorophenol	1	1	1	1	1	0.25	0.39	13.82
TCDD	1	1	1	1	1	0.03	0.81	30.09
2,3,4,5-Tetrachlorophenol	1	1	1	1	1	0.25	NA	NA
2,3,4,6-Tetrachlorophenol	1	1	1	1	1	0.25	NA	NA
2,3,5,6-Tetrachlorophenol	1	1	1	1	1	0.25	NA	NA
2,3,4-Trichlorophenol	1	1	1	1	1	0.25	0.035	3.27
2,4,5-Trichlorophenol	1	1	1	1	1	0.25	0.035	3.27
2,4,6-Trichlorophenol	1	1	1	1	1	0.25	0.035	3.27
1,2,4-Trimethylbenzene	1	1	1	1	1	0.1	NA	NA

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

PHYSICOCHEMICAL PROPERTIES

Chemical	Log Octanol Water Partition Coefficient (log Kow) (--)	Henry's Law Constant (H) (atm-m^3/mole)	Henry's Law Constant (H') (unitless)	Aqueous Solubility (S) (mg/l)	Diffusivity in Air (Di) (cm^2/sec)	Diffusivity in Water (Dw) (cm^2/sec)	Organic Carbon Partition Coefficient (Koc) (l/kg)	Molecular Weight (MW) (g/mole)	VOC?[1]
Acetone	-0.24	3.88E-05	1.59E-03	1.00E+06	1.24E-01	1.14E-05	5.75E-01	58.08	Yes
Chlorobenzene	2.86	3.70E-03	1.52E-01	4.72E+02	7.30E-02	8.70E-06	2.19E+02	112.56	Yes
1,4-Dichlorobenzene	3.42	2.39E-03	9.80E-02	7.90E+01	6.90E-02	7.90E-06	6.17E+02	147.00	Yes
Methyl ethyl ketone	0.40	5.58E-05	2.29E-03	2.23E+05	8.08E-02	9.80E-06	2.30E+00	72.11	Yes
Naphthalene	2.39	4.82E-04	1.98E-02	3.10E+01	5.90E-02	7.50E-06	2.00E+03	167.85	Yes
Pentachlorophenol	5.09	2.44E-08	1.00E-06	1.95E+03	5.60E-02	6.10E-06	5.21E+02	266.40	No
TCDD	6.80	5.40E-23	2.21E-21	3.17E-04	NA	NA	1.90E+06	322.00	No
2,3,4,5-Tetrachlorophenol	4.21	3.50E-07	1.44E-05	1.00E+03	NA	NA	3.33E+03	231.89	No
2,3,4,6-Tetrachlorophenol	4.45	1.30E-06	5.33E-05	1.00E+03	NA	NA	2.13E+02	231.89	No
2,3,5,6-Tetrachlorophenol	3.88	3.50E-07	1.44E-05	1.00E+03	NA	NA	2.72E+04	231.89	No
2,3,4-Trichlorophenol	3.90	4.34E-06	1.78E-04	1.20E+03	2.91E-02	6.20E-06	1.60E+03	197.45	No
2,4,5-Trichlorophenol	3.90	4.34E-06	1.78E-04	1.20E+03	2.91E-02	6.20E-06	1.60E+03	197.45	No
2,4,6-Trichlorophenol	3.70	7.78E-06	3.19E-04	8.00E+02	3.18E-02	6.20E-06	3.81E+02	197.45	No
1,2,4-Trimethylbenzene	3.72	6.14E-03	2.52E-01	5.70E+01	6.06E-02	7.92E-06	1.35E+03	120.19	Yes

$H' = H / RT$

[1] A chemical is considered volatile if H is greater than 0.00001 and if MW is less than 200.

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

DISPERSION FACTOR (Q/C)

Source	Scenario	Area of Source (acre)	Q/C (g/m^2-sec) per (kg/m^3)
Soil	Industrial	0.50	88.43
	Residential	0.50	88.43

Parameter	Symbol	Value	Units	Source(s)
Inverse of Dispersion Factor	Q/C	see above	g/m^2-sec per kg/m^3	estimated
Area of Source	A	see above	acre	site-specific
Source Location	--	5	--	site-specific

Location				$Q/C = A \times \exp[(\ln A_c - B)^2 \div C]$ (g/m^2-sec) / (kg/m^3)				
Selection	Zone	State	City	A Constant	B Constant	C Constant	Industrial Soil	Residential Soil
5	**2**	**CA**	**San Francisco**	**13.81**	**20.16**	**234.29**	**88.43**	**88.43**
1	1	WA	Seattle	14.2253	18.84	218.18	81.71	81.71
2	1	OR	Salem	12.3783	18.97	218.21	72.79	72.79
3	2	CA	Fresno	10.2152	19.27	220.06	62.43	62.43
4	2	CA	Los Angeles	11.911	18.44	209.78	68.18	68.18
5	2	CA	San Francisco	13.8139	20.16	234.29	88.43	88.43
6	3	NV	Las Vegas	13.3093	19.84	230.17	83.1	83.1
7	3	AZ	Phoenix	10.2871	18.71	212.71	60.42	60.42
8	3	NM	Albuquerque	14.9421	17.99	205.18	81.85	81.85

APPENDIX E
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PARTICULATE EMISSION FACTOR (PEF)

Source	Scenario	Q/C (g/m^2-sec) per (kg/m^3)	PEF (mg/kg) per (mg/m^3)
Soil	Industrial	88.43	8.17E+08
	Residential	88.43	9.80E+08
	Construction	23	3.40E+06

PEF =	Appendix D
Source:	USEPA, 2001

Parameter	Symbol	Value	Units	Source(s)
Inverse of Dispersion Factor	Q/C	see above	g/m^2-sec per kg/m^3	estimated
Fraction of Vegetative Cover	V	0.5	--	site-specific
Mean Annual Windspeed	Um	4.69	m/sec	USEPA, 2002
Equivalent Threshold Value of Windspeed at 7 m	Ut	11.32	m/sec	USEPA, 2002
Function of Um/Ut	F(x)	2.E-01	--	USEPA, 2002

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CALCULATION OF SOIL SATURATION CONCENTRATIONS (Csat)

Chemical	Organic Carbon Partition Coefficient (Koc) (l/kg)	Aqueous Solubility (S) (mg/l)	Henry's Law Constant (H') (unitless)	Soil-Organic Partition Coefficient (Kd) (l/kg)	Saturation Concentration (Csat) (mg/kg)	Maximum Concentration Soil (Cs) (mg/kg)	Free Phase?
Acetone	5.75E-01	1.00E+06	1.59E-03	3.45E-03	1.04E+05	1.30E-01	No
Chlorobenzene	2.19E+02	4.72E+02	1.52E-01	1.31E+00	6.81E+02	2.80E-01	No
1,4-Dichlorobenzene	6.17E+02	7.90E+01	9.80E-02	3.70E+00	3.02E+02	2.90E-01	No
Methyl ethyl ketone	2.30E+00	2.23E+05	2.29E-03	1.38E-02	2.55E+04	3.10E-02	No
Naphthalene	2.00E+03	3.10E+01	1.98E-02	1.20E+01	3.75E+02	1.60E-01	No
Pentachlorophenol	5.21E+02	1.95E+03	1.00E-06	3.13E+00	6.29E+03	1.18E+00	No
TCDD	1.90E+06	3.17E-04	2.21E-21	1.14E+04	3.61E+00	1.96E-04	No
2,3,4,5-Tetrachlorophenol	3.33E+03	1.00E+03	1.44E-05	2.00E+01	2.01E+04	5.00E-01	No
2,3,4,6-Tetrachlorophenol	2.13E+02	1.00E+03	5.33E-05	1.28E+00	1.38E+03	5.00E-01	No
2,3,5,6-Tetrachlorophenol	2.72E+04	1.00E+03	1.44E-05	1.63E+02	1.63E+05	5.00E-01	No
2,3,4-Trichlorophenol	1.60E+03	1.20E+03	1.78E-04	9.60E+00	1.16E+04	8.00E-01	No
2,4,5-Trichlorophenol	1.60E+03	1.20E+03	1.78E-04	9.60E+00	1.16E+04	8.00E-01	No
2,4,6-Trichlorophenol	3.81E+02	8.00E+02	3.19E-04	2.29E+00	1.91E+03	8.00E-01	No
1,2,4-Trimethylbenzene	1.35E+03	5.70E+01	2.52E-01	8.10E+00	4.70E+02	2.30E-01	No

$$Csat = S/pb \times (Kd \times pb + Pw + H' \times Pa)$$

$$Kd = Koc \times foc$$

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Fraction Organic Carbon	foc	0.006	unitless
Bulk Density	pb	1.5	g/cm^3
Water Filled Soil Porosity	Pw	0.15	unitless
Air Filled Soil Porosity	Pa	0.28	unitless

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CALCULATION OF DERMALLY ABSORBED DOSE PER EVENT (DAevent)

Chemical	Molecular Weight (MW) (g/mole)	Log Octanol Water Partition Coefficient (log Kow)	Permeability Constant (Kp) (cm/hr)	Fraction Absorbed (FA) (--)	Permeability Ratio (B) (--)	Diffusivity Through Skin (Dsc) (cm^2/hr)	Lag Time (tau) (hr)	Constant b (--)	Constant c (--)	Steady-state Time (t*) (hr)	Concentration Groundwater (Cgw) (mg/cm^3)	Dermal Absorbed Dose Per Event (DAevent) Construction (mg/cm^2-event)	Dermal Absorbed Dose Per Event (DAevent) Trench/Utility (mg/cm^2-event)
Acetone	58.08	-0.24	0.001	1	2.93E-03	7.49E-07	2.22E-01	3.05E-01	3.35E-01	0.53	NA	NA	NA
Chlorobenzene	112.56	2.86	0.029	1	1.18E-01	3.71E-07	4.49E-01	3.80E-01	4.16E-01	1.08	NA	NA	NA
1,4-Dichlorobenzene	147	3.42	0.043	1	2.01E-01	2.38E-07	7.00E-01	4.39E-01	4.78E-01	1.68	NA	NA	NA
Methyl ethyl ketone	72.11	0.40	0.001	1	3.27E-03	6.25E-07	2.66E-01	3.05E-01	3.36E-01	0.64	NA	NA	NA
Naphthalene	167.85	2.39	0.007	1	3.49E-02	1.82E-07	9.16E-01	3.25E-01	3.57E-01	2.20	NA	NA	NA
Pentachlorophenol	266.4	5.09	0.117	0.9	2.45E+00	5.11E-08	3.26E+00	5.02E+00	2.54E+00	13.82	5.1E-02	2.7E-02	2.7E-02
TCDD	322	6.80	0.767	0.5	5.59E+00	2.49E-08	6.68E+00	2.20E+01	5.64E+00	30.09	2.7E-12	7.3E-12	7.3E-12
2,3,4,5-Tetrachlorophenol	231.89	4.21	0.048	1	2.81E-01	7.97E-08	2.09E+00	5.04E-01	5.41E-01	5.02	1.3E-03	2.5E-04	2.5E-04
2,3,4,6-Tetrachlorophenol	231.89	4.45	0.069	1	4.04E-01	7.97E-08	2.09E+00	6.14E-01	6.42E-01	5.02	7.6E-05	2.1E-05	2.1E-05
2,3,5,6-Tetrachlorophenol	231.89	3.88	0.029	1	1.70E-01	7.97E-08	2.09E+00	4.16E-01	4.55E-01	5.02	6.4E-05	7.4E-06	7.4E-06
2,3,4-Trichlorophenol	197.45	3.90	0.035	1	1.89E-01	1.24E-07	1.34E+00	4.31E-01	4.69E-01	3.27	2.8E-04	3.1E-05	3.1E-05
2,4,5-Trichlorophenol	197.45	3.90	0.035	1	1.89E-01	1.24E-07	1.34E+00	4.31E-01	4.69E-01	3.27	1.9E-04	2.1E-05	2.1E-05
2,4,6-Trichlorophenol	197.45	3.70	0.035	1	1.89E-01	1.24E-07	1.34E+00	4.31E-01	4.69E-01	3.27	3.1E-06	3.5E-07	3.5E-07
1,2,4-Trimethylbenzene	120.19	3.72	0.096	1	4.05E-01	3.36E-07	4.95E-01	6.14E-01	6.42E-01	1.19	NA	NA	NA

For Organics: If tevent $DAevent = 2 * FA * Kp * Cgw * (6 * tau * tevent/Pi)^{1/2}$

or

If tevent > t* $DAevent = FA * Kp * Cgw * [tevent/(1+B) + 2*tau*(1 + 3*B + 3*B^2) / (1+B)^2]$

For Inorganics: $DAevent = Kp * Cgw * tevent$

If log Kow < 4

Kp = Kp USEPA, 2001a, Exhibit B-3 if available, or
$10^{(-2.8 + 0.66*logKow - 0.0056*MW)}$

If log Kow >4

$Kp = 10^{(-2.8 + 0.66*logKow - 0.0056*MW)}$

Source: USEPA, 2001a

$B = \frac{Kp * (MW)^{1/2}}{2.6}$

t* = USEPA, 2001a Exhibit B-3, or

If B < 0.6, $t^* = 2.4 * tau$

If B > 0.6, $t^* = \frac{(b - (b2 - c2)^{1/2})*1E-6}{Dsc}$

$Dsc = Lsc * 10^{(-2.8 - 0.0056*MW)}$

$tau = \frac{1E-6}{6 * Dsc}$

$b = \frac{2*(1 + B)^2}{Pi} - c$

$c = \frac{1 + 3*B + 3*B^2}{3*(1 + B)}$

Parameter	Symbol	Value	Units
Event Duration - Construction	tevent	1.0	hr
Event Duration - Trench/Utili	tevent	1.0	hr
Thickness of stratum corneum	Lsc	0.001	cm

APPENDIX E
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INHALATION OF VOCS IN INDOOR AIR FROM SOIL EMISSIONS: INDOOR WORKER

Chemical	Concentration Air (Cia) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.69E-03	1	3.3E-04	0.9	3.7E-04	1.2E-04	NA	NA
Chlorobenzene	1.97E-02	1	3.8E-03	0.017	2.3E-01	1.4E-03	NA	NA
1,4-Dichlorobenzene	5.14E-03	1	1.0E-03	0.23	4.4E-03	3.6E-04	NA	NA
Methyl ethyl ketone	4.77E-04	1	9.3E-05	0.29	3.3E-04	3.3E-05	NA	NA
Naphthalene	1.38E-04	1	2.7E-05	0.00086	3.1E-02	9.6E-06	NA	NA
Pentachlorophenol	NA	1	NA	0.03	NA	NA	0.018	NA
TCDD	NA	1	NA	0.000000011	NA	NA	130000	NA
2,3,4,5-Tetrachlorophenol	NA	1	NA	0.03	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	1	NA	0.03	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	1	NA	0.03	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	1	NA	0.1	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	1	NA	0.1	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	1	NA	0.0001	NA	NA	0.07	NA
1,2,4-Trimethylbenzene	3.19E-03	1	6.2E-04	0.0017	3.7E-01	2.2E-04	NA	NA
					6E-01			0E+00

$$AADD = \frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATnc)} \qquad Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATca)} \qquad Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFia	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRia	m^3/hr	2.5
Exposure Time	ETia	hr/d	8

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
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SUMMARY RISK CHARACTERIZATION: INDOOR WORKER

Chemical	Inhalation of Volatiles in Indoor Air from Soil	Excess Cancer Risk
Acetone	NA	NA
Chlorobenzene	NA	NA
1,4-Dichlorobenzene	NA	NA
Methyl ethyl ketone	NA	NA
Naphthalene	NA	NA
Pentachlorophenol	NA	NA
TCDD	NA	NA
2,3,4,5-Tetrachlorophenol	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA
2,3,4-Trichlorophenol	NA	NA
2,4,5-Trichlorophenol	NA	NA
2,4,6-Trichlorophenol	NA	NA
1,2,4-Trimethylbenzene	NA	NA
Total	NA	NA

NA = not applicable

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SUMMARY RISK CHARACTERIZATION: INDOOR WORKER

Chemical	Inhalation of Volatiles in Indoor Air from Soil	Hazard Index
Acetone	3.7E-04	3.7E-04
Chlorobenzene	2.3E-01	2.3E-01
1,4-Dichlorobenzene	4.4E-03	4.4E-03
Methyl ethyl ketone	3.3E-04	3.3E-04
Naphthalene	3.1E-02	3.1E-02
Pentachlorophenol	NA	NA
TCDD	NA	NA
2,3,4,5-Tetrachlorophenol	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA
2,3,4-Trichlorophenol	NA	NA
2,4,5-Trichlorophenol	NA	NA
2,4,6-Trichlorophenol	NA	NA
1,2,4-Trimethylbenzene	3.7E-01	3.7E-01
Total	6.3E-01	6E-01

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
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INCIDENTAL INGESTION OF SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Oral Absorption Factor-Soil (ABSos) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	0.13	1	1.3E-07	0.9	1.4E-07	4.5E-08	NA	NA
Chlorobenzene	0.28	1	2.7E-07	0.02	1.4E-05	9.8E-08	NA	NA
1,4-Dichlorobenzene	0.29	1	2.8E-07	0.03	9.5E-06	1.0E-07	NA	NA
Methyl ethyl ketone	0.031	1	3.0E-08	0.6	5.1E-08	1.1E-08	NA	NA
Naphthalene	0.16	1	1.6E-07	0.02	7.8E-06	5.6E-08	NA	NA
Pentachlorophenol	1.18	1	1.2E-06	0.03	3.8E-05	4.1E-07	0.12	4.9E-08
TCDD	0.000196	1	1.9E-10	0.00000001	1.9E-02	6.8E-11	130000	8.9E-06
2,3,4,5-Tetrachlorophenol	0.5	1	4.9E-07	0.03	1.6E-05	1.7E-07	NA	NA
2,3,4,6-Tetrachlorophenol	0.5	1	4.9E-07	0.03	1.6E-05	1.7E-07	NA	NA
2,3,5,6-Tetrachlorophenol	0.5	1	4.9E-07	0.03	1.6E-05	1.7E-07	NA	NA
2,3,4-Trichlorophenol	0.8	1	7.8E-07	0.1	7.8E-06	2.8E-07	NA	NA
2,4,5-Trichlorophenol	0.8	1	7.8E-07	0.1	7.8E-06	2.8E-07	NA	NA
2,4,6-Trichlorophenol	0.8	1	7.8E-07	0.0001	7.8E-03	2.8E-07	0.07	2.0E-08
1,2,4-Trimethylbenzene	0.23	1	2.3E-07	0.05	4.5E-06	8.0E-08	NA	NA
					3E-02			9E-06

$$AADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Value	Units
Exposure Frequency	EFig	250	d/yr
Exposure Duration	ED	25	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	9,125	days
Averaging Time-Cancer	ATca	25,550	days
Ingestion Rate	IRs	100	mg/d
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

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DERMAL CONTACT WITH SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Dermal Absorption Factor-Soil (ABSds) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	0.13	0.1	8.4E-08	0.9	9.3E-08	3.0E-08	NA	NA
Chlorobenzene	0.28	0.1	1.8E-07	0.02	9.0E-06	6.5E-08	NA	NA
1,4-Dichlorobenzene	0.29	0.1	1.9E-07	0.03	6.2E-06	6.7E-08	NA	NA
Methyl ethyl ketone	0.031	0.1	2.0E-08	0.6	3.3E-08	7.1E-09	NA	NA
Naphthalene	0.16	0.15	1.5E-07	0.02	7.7E-06	5.5E-08	NA	NA
Pentachlorophenol	1.18	0.25	1.9E-06	0.03	6.4E-05	6.8E-07	0.12	8.2E-08
TCDD	0.000196	0.03	3.8E-11	0.00000001	3.8E-03	1.4E-11	130000	1.8E-06
2,3,4,5-Tetrachlorophenol	0.5	0.25	8.1E-07	0.03	2.7E-05	2.9E-07	NA	NA
2,3,4,6-Tetrachlorophenol	0.5	0.25	8.1E-07	0.03	2.7E-05	2.9E-07	NA	NA
2,3,5,6-Tetrachlorophenol	0.5	0.25	8.1E-07	0.03	2.7E-05	2.9E-07	NA	NA
2,3,4-Trichlorophenol	0.8	0.25	1.3E-06	0.1	1.3E-05	4.6E-07	NA	NA
2,4,5-Trichlorophenol	0.8	0.25	1.3E-06	0.1	1.3E-05	4.6E-07	NA	NA
2,4,6-Trichlorophenol	0.8	0.25	1.3E-06	0.0001	1.3E-02	4.6E-07	0.07	3.2E-08
1,2,4-Trimethylbenzene	0.23	0.1	1.5E-07	0.05	3.0E-06	5.3E-08	NA	NA
					2E-02			2E-06

$$AADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFdc	250	d/yr
Exposure Duration	ED	25	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	9,125	days
Averaging Time-Cancer	ATca	25,550	days
Surface Area	SAs	3,300	cm^2
Soil-to-Skin Adherence Factor	SAF	0.2	mg/cm^2
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
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INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.9	NA	NA	NA	NA
Chlorobenzene	NA	1	NA	0.017	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1	NA	0.23	NA	NA	NA	NA
Methyl ethyl ketone	NA	1	NA	0.29	NA	NA	NA	NA
Naphthalene	NA	1	NA	0.00086	NA	NA	NA	NA
Pentachlorophenol	1.18	1	2.8E-10	0.03	9.4E-09	1.0E-10	0.018	1.8E-12
TCDD	0.000196	1	4.7E-14	0.000000011	4.3E-06	1.7E-14	130000	2.2E-09
2,3,4,5-Tetrachlorophenol	0.5	1	1.2E-10	0.03	4.0E-09	4.3E-11	NA	NA
2,3,4,6-Tetrachlorophenol	0.5	1	1.2E-10	0.03	4.0E-09	4.3E-11	NA	NA
2,3,5,6-Tetrachlorophenol	0.5	1	1.2E-10	0.03	4.0E-09	4.3E-11	NA	NA
2,3,4-Trichlorophenol	0.8	1	1.9E-10	0.1	1.9E-09	6.8E-11	NA	NA
2,4,5-Trichlorophenol	0.8	1	1.9E-10	0.1	1.9E-09	6.8E-11	NA	NA
2,4,6-Trichlorophenol	0.8	1	1.9E-10	0.0001	1.9E-06	6.8E-11	0.07	4.8E-12
1,2,4-Trimethylbenzene	NA	1	NA	0.0017	NA	NA	NA	NA
					6E-06			2E-09

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	2.5
Exposure Time	ETpe	hr/d	8
Particulate Emission Factor	PEF	m^3/kg	8.2E+08

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: OUTDOOR INDUSTRIAL WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Excess Cancer Risk
Acetone	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA
Pentachlorophenol	4.9E-08	8.2E-08	1.8E-12	1.3E-07
TCDD	8.9E-06	1.8E-06	2.2E-09	1.1E-05
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA
2,4,6-Trichlorophenol	2.0E-08	3.2E-08	4.8E-12	5.2E-08
1,2,4-Trimethylbenzene	NA	NA	NA	NA
Total	9.0E-06	1.9E-06	2.2E-09	1E-05

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: OUTDOOR INDUSTRIAL WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Hazard Index
Acetone	1.4E-07	9.3E-08	NA	2.3E-07
Chlorobenzene	1.4E-05	9.0E-06	NA	2.3E-05
1,4-Dichlorobenzene	9.5E-06	6.2E-06	NA	1.6E-05
Methyl ethyl ketone	5.1E-08	3.3E-08	NA	8.4E-08
Naphthalene	7.8E-06	7.7E-06	NA	1.6E-05
Pentachlorophenol	3.8E-05	6.4E-05	9.4E-09	1.0E-04
TCDD	1.9E-02	3.8E-03	4.3E-06	2.3E-02
2,3,4,5-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05
2,3,4,6-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05
2,3,5,6-Tetrachlorophenol	1.6E-05	2.7E-05	4.0E-09	4.3E-05
2,3,4-Trichlorophenol	7.8E-06	1.3E-05	1.9E-09	2.1E-05
2,4,5-Trichlorophenol	7.8E-06	1.3E-05	1.9E-09	2.1E-05
2,4,6-Trichlorophenol	7.8E-03	1.3E-02	1.9E-06	2.1E-02
1,2,4-Trimethylbenzene	4.5E-06	3.0E-06	NA	7.5E-06
Total	2.7E-02	1.7E-02	6.2E-06	4E-02

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INCIDENTAL INGESTION OF SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Oral Absorption Factor-Soil (ABSos) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Subchronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.30E-01	1	1.5E-07	1	1.5E-07	2.2E-09	NA	NA
Chlorobenzene	2.80E-01	1	3.3E-07	0.02	1.6E-05	4.6E-09	NA	NA
1,4-Dichlorobenzene	2.90E-01	1	3.4E-07	0.71	4.7E-07	4.8E-09	NA	NA
Methyl ethyl ketone	3.10E-02	1	3.6E-08	2	1.8E-08	5.1E-10	NA	NA
Naphthalene	1.60E-01	1	1.9E-07	0.02	9.3E-06	2.7E-09	NA	NA
Pentachlorophenol	1.07E+00	1	1.2E-06	0.03	4.1E-05	1.8E-08	0.12	2.1E-09
TCDD	1.96E-04	1	2.3E-10	0.00000001	2.3E-02	3.3E-12	130000	4.2E-07
2,3,4,5-Tetrachlorophenol	5.00E-01	1	5.8E-07	0.3	1.9E-06	8.3E-09	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	5.8E-07	0.3	1.9E-06	8.3E-09	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	5.8E-07	0.3	1.9E-06	8.3E-09	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	9.3E-07	1	9.3E-07	1.3E-08	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	9.3E-07	1	9.3E-07	1.3E-08	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	9.3E-07	0.0001	9.3E-03	1.3E-08	0.07	9.3E-10
1,2,4-Trimethylbenzene	2.30E-01	1	2.7E-07	0.05	5.3E-06	3.8E-09	NA	NA
					3E-02			4E-07

$$AADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFig	90	d/yr
Exposure Duration	ED	1	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	365	days
Averaging Time-Cancer	ATca	25,550	days
Ingestion Rate	IRs	330	mg/d
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

DERMAL CONTACT WITH SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Dermal Absorption Factor-Soil (ABSds) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Subchronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.30E-01	0.1	4.5E-08	1	4.5E-08	6.5E-10	NA	NA
Chlorobenzene	2.80E-01	0.1	9.8E-08	0.02	4.9E-06	1.4E-09	NA	NA
1,4-Dichlorobenzene	2.90E-01	0.1	1.0E-07	0.71	1.4E-07	1.4E-09	NA	NA
Methyl ethyl ketone	3.10E-02	0.1	1.1E-08	2	5.4E-09	1.5E-10	NA	NA
Naphthalene	1.60E-01	0.15	8.4E-08	0.02	4.2E-06	1.2E-09	NA	NA
Pentachlorophenol	1.07E+00	0.25	9.3E-07	0.03	3.1E-05	1.3E-08	0.12	1.6E-09
TCDD	1.96E-04	0.03	2.1E-11	0.00000001	2.1E-03	2.9E-13	130000	3.8E-08
2,3,4,5-Tetrachlorophenol	5.00E-01	0.25	4.4E-07	0.3	1.5E-06	6.2E-09	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	0.25	4.4E-07	0.3	1.5E-06	6.2E-09	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	0.25	4.4E-07	0.3	1.5E-06	6.2E-09	NA	NA
2,3,4-Trichlorophenol	8.00E-01	0.25	7.0E-07	1	7.0E-07	1.0E-08	NA	NA
2,4,5-Trichlorophenol	8.00E-01	0.25	7.0E-07	1	7.0E-07	1.0E-08	NA	NA
2,4,6-Trichlorophenol	8.00E-01	0.25	7.0E-07	0.0001	7.0E-03	1.0E-08	0.07	7.0E-10
1,2,4-Trimethylbenzene	2.30E-01	0.1	8.0E-08	0.05	1.6E-06	1.1E-09	NA	NA
					9E-03			4E-08

$$AADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFdc	90	d/yr
Exposure Duration	ED	1	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	365	days
Averaging Time-Cancer	ATca	25,550	days
Surface Area	SAs	3,300	cm^2
Soil-to-Skin Adherence Factor	SAF	0.3	mg/cm^2
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Subchronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	1	NA	NA	NA	NA
Chlorobenzene	NA	1	NA	0.017	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1	NA	0.71	NA	NA	NA	NA
Methyl ethyl ketone	NA	1	NA	2	NA	NA	NA	NA
Naphthalene	NA	1	NA	0.00086	NA	NA	NA	NA
Pentachlorophenol	1.07E+00	1	2.2E-08	0.03	7.4E-07	3.2E-10	0.018	5.7E-12
TCDD	1.96E-04	1	4.1E-12	0.000000011	3.7E-04	5.8E-14	130000	7.5E-09
2,3,4,5-Tetrachlorophenol	5.00E-01	1	1.0E-08	0.3	3.5E-08	1.5E-10	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	1.0E-08	0.3	3.5E-08	1.5E-10	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	1.0E-08	0.3	3.5E-08	1.5E-10	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	1.7E-08	1	1.7E-08	2.4E-10	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	1.7E-08	1	1.7E-08	2.4E-10	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	1.7E-08	0.0001	1.7E-04	2.4E-10	0.07	1.7E-11
1,2,4-Trimethylbenzene	NA	1	NA	0.0017	NA	NA	NA	NA
					5E-04			8E-09

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)} \qquad Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)} \qquad Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	90
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	2.5
Exposure Time	ETpe	hr/d	8
Particulate Emission Factor	PEF	m^3/kg	3.4E+06

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

DERMAL CONTACT WITH GROUNDWATER: CONSTRUCTION WORKER

Chemical	Dermal Absorbed Dose Per Event (DAevent) (mg/cm^2-event)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Subchronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	NA	1	NA	NA	NA	NA
Chlorobenzene	NA	NA	0.02	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	0.71	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	2	NA	NA	NA	NA
Naphthalene	NA	NA	0.02	NA	NA	NA	NA
Pentachlorophenol	2.68E-02	3.3E-02	0.03	1.1E+00	4.6E-04	0.12	5.6E-05
TCDD	7.29E-12	8.8E-12	0.00000001	8.8E-04	1.3E-13	130000	1.6E-08
2,3,4,5-Tetrachlorophenol	2.49E-04	3.0E-04	0.3	1.0E-03	4.3E-06	NA	NA
2,3,4,6-Tetrachlorophenol	2.10E-05	2.5E-05	0.3	8.5E-05	3.6E-07	NA	NA
2,3,5,6-Tetrachlorophenol	7.42E-06	9.0E-06	0.3	3.0E-05	1.3E-07	NA	NA
2,3,4-Trichlorophenol	3.14E-05	3.8E-05	1	3.8E-05	5.4E-07	NA	NA
2,4,5-Trichlorophenol	2.13E-05	2.6E-05	1	2.6E-05	3.7E-07	NA	NA
2,4,6-Trichlorophenol	3.47E-07	4.2E-07	0.0001	4.2E-03	6.0E-09	0.07	4.2E-10
1,2,4-Trimethylbenzene	NA	NA	0.05	NA	NA	NA	NA
				1E+00			6E-05

$$AADD = \frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATnc)} \qquad Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATca)} \qquad Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Units	Value
Event Frequency	EVswr	evt/day	1
Exposure Frequency	EFswr	d/yr	10
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Skin Surface Area	SAswr	cm^2	3,100

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: CONSTRUCTION WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Dermal Contact with Groundwater	Excess Cancer Risk
Acetone	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA
Pentachlorophenol	2.1E-09	1.6E-09	5.7E-12	5.6E-05	5.6E-05
TCDD	4.2E-07	3.8E-08	7.5E-09	1.6E-08	4.9E-07
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	9.3E-10	7.0E-10	1.7E-11	4.2E-10	2.1E-09
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Total	4.3E-07	4.0E-08	7.6E-09	5.6E-05	6E-05

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: CONSTRUCTION WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Dermal Contact with Groundwater	Hazard Index
Acetone	1.5E-07	4.5E-08	NA	NA	2.0E-07
Chlorobenzene	1.6E-05	4.9E-06	NA	NA	2.1E-05
1,4-Dichlorobenzene	4.7E-07	1.4E-07	NA	NA	6.2E-07
Methyl ethyl ketone	1.8E-08	5.4E-09	NA	NA	2.3E-08
Naphthalene	9.3E-06	4.2E-06	NA	NA	1.3E-05
Pentachlorophenol	4.1E-05	3.1E-05	7.4E-07	1.1E+00	1.1E+00
TCDD	2.3E-02	2.1E-03	3.7E-04	8.8E-04	2.6E-02
2,3,4,5-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	1.0E-03	1.0E-03
2,3,4,6-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	8.5E-05	8.8E-05
2,3,5,6-Tetrachlorophenol	1.9E-06	1.5E-06	3.5E-08	3.0E-05	3.3E-05
2,3,4-Trichlorophenol	9.3E-07	7.0E-07	1.7E-08	3.8E-05	4.0E-05
2,4,5-Trichlorophenol	9.3E-07	7.0E-07	1.7E-08	2.6E-05	2.7E-05
2,4,6-Trichlorophenol	9.3E-03	7.0E-03	1.7E-04	4.2E-03	2.1E-02
1,2,4-Trimethylbenzene	5.3E-06	1.6E-06	NA	NA	7.0E-06
Total	3.2E-02	9.1E-03	5.4E-04	1.1E+00	1E+00

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INCIDENTAL INGESTION OF SOIL: TRENCH/UTILITY WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Oral Absorption Factor-Soil (ABSos) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.30E-01	1	1.7E-08	0.9	1.9E-08	1.2E-09	NA	NA
Chlorobenzene	2.80E-01	1	3.6E-08	0.02	1.8E-06	2.6E-09	NA	NA
1,4-Dichlorobenzene	2.90E-01	1	3.7E-08	0.03	1.2E-06	2.7E-09	NA	NA
Methyl ethyl ketone	3.10E-02	1	4.0E-09	0.6	6.7E-09	2.9E-10	NA	NA
Naphthalene	1.60E-01	1	2.1E-08	0.02	1.0E-06	1.5E-09	NA	NA
Pentachlorophenol	1.07E+00	1	1.4E-07	0.03	4.6E-06	9.9E-09	0.12	1.2E-09
TCDD	1.96E-04	1	2.5E-11	0.00000001	2.5E-03	1.8E-12	130000	2.4E-07
2,3,4,5-Tetrachlorophenol	5.00E-01	1	6.5E-08	0.03	2.2E-06	4.6E-09	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	6.5E-08	0.03	2.2E-06	4.6E-09	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	6.5E-08	0.03	2.2E-06	4.6E-09	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	1.0E-07	0.1	1.0E-06	7.4E-09	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	1.0E-07	0.1	1.0E-06	7.4E-09	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	1.0E-07	0.0001	1.0E-03	7.4E-09	0.07	5.2E-10
1,2,4-Trimethylbenzene	2.30E-01	1	3.0E-08	0.05	5.9E-07	2.1E-09	NA	NA
					4E-03			2E-07

$$AADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFig	10	d/yr
Exposure Duration	ED	5	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	1,825	days
Averaging Time-Cancer	ATca	25,550	days
Ingestion Rate	IRs	330	mg/d
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

DERMAL CONTACT WITH SOIL: TRENCH/UTILITY WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Dermal Absorption Factor-Soil (ABSds) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.30E-01	0.1	5.0E-09	0.9	5.6E-09	3.6E-10	NA	NA
Chlorobenzene	2.80E-01	0.1	1.1E-08	0.02	5.4E-07	7.7E-10	NA	NA
1,4-Dichlorobenzene	2.90E-01	0.1	1.1E-08	0.03	3.7E-07	8.0E-10	NA	NA
Methyl ethyl ketone	3.10E-02	0.1	1.2E-09	0.6	2.0E-09	8.6E-11	NA	NA
Naphthalene	1.60E-01	0.15	9.3E-09	0.02	4.6E-07	6.6E-10	NA	NA
Pentachlorophenol	1.07E+00	0.25	1.0E-07	0.03	3.5E-06	7.4E-09	0.12	8.9E-10
TCDD	1.96E-04	0.03	2.3E-12	0.00000001	2.3E-04	1.6E-13	130000	2.1E-08
2,3,4,5-Tetrachlorophenol	5.00E-01	0.25	4.8E-08	0.03	1.6E-06	3.5E-09	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	0.25	4.8E-08	0.03	1.6E-06	3.5E-09	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	0.25	4.8E-08	0.03	1.6E-06	3.5E-09	NA	NA
2,3,4-Trichlorophenol	8.00E-01	0.25	7.7E-08	0.1	7.7E-07	5.5E-09	NA	NA
2,4,5-Trichlorophenol	8.00E-01	0.25	7.7E-08	0.1	7.7E-07	5.5E-09	NA	NA
2,4,6-Trichlorophenol	8.00E-01	0.25	7.7E-08	0.0001	7.7E-04	5.5E-09	0.07	3.9E-10
1,2,4-Trimethylbenzene	2.30E-01	0.1	8.9E-09	0.05	1.8E-07	6.4E-10	NA	NA
					1E-03			2E-08

$$AADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFdc	10	d/yr
Exposure Duration	ED	5	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	1,825	days
Averaging Time-Cancer	ATca	25,550	days
Surface Area	SAs	3,300	cm^2
Soil-to-Skin Adherence Factor	SAF	0.3	mg/cm^2
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: TRENCH/UTILITY WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.9	NA	NA	NA	NA
Chlorobenzene	NA	1	NA	0.017	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1	NA	0.23	NA	NA	NA	NA
Methyl ethyl ketone	NA	1	NA	0.29	NA	NA	NA	NA
Naphthalene	NA	1	NA	0.00086	NA	NA	NA	NA
Pentachlorophenol	1.07E+00	1	2.5E-09	0.03	8.2E-08	1.8E-10	0.018	3.2E-12
TCDD	1.96E-04	1	4.5E-13	0.000000011	4.1E-05	3.2E-14	130000	4.2E-09
2,3,4,5-Tetrachlorophenol	5.00E-01	1	1.2E-09	0.03	3.8E-08	8.2E-11	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	1.2E-09	0.03	3.8E-08	8.2E-11	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	1.2E-09	0.03	3.8E-08	8.2E-11	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	1.8E-09	0.1	1.8E-08	1.3E-10	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	1.8E-09	0.1	1.8E-08	1.3E-10	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	1.8E-09	0.0001	1.8E-05	1.3E-10	0.07	9.2E-12
1,2,4-Trimethylbenzene	NA	1	NA	0.0017	NA	NA	NA	NA
					6E-05			4E-09

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)} \qquad Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)} \qquad Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	10
Exposure Duration	ED	yr	5
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	1,825
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	2.5
Exposure Time	ETpe	hr/d	8
Particulate Emission Factor	PEF	m^3/kg	3.4E+06

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

DERMAL CONTACT WITH GROUNDWATER: TRENCH/UTILITY WORKER

Chemical	Dermal Absorbed Dose Per Event (DAevent) (mg/cm^2-event)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	NA	0.9	NA	NA	NA	NA
Chlorobenzene	NA	NA	0.02	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	0.03	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	0.6	NA	NA	NA	NA
Naphthalene	NA	NA	0.02	NA	NA	NA	NA
Pentachlorophenol	2.68E-02	3.3E-02	0.03	1.1E+00	2.3E-03	0.12	2.8E-04
TCDD	7.29E-12	8.8E-12	0.00000001	8.8E-04	6.3E-13	130000	8.2E-08
2,3,4,5-Tetrachlorophenol	2.49E-04	3.0E-04	0.03	1.0E-02	2.2E-05	NA	NA
2,3,4,6-Tetrachlorophenol	2.10E-05	2.5E-05	0.03	8.5E-04	1.8E-06	NA	NA
2,3,5,6-Tetrachlorophenol	7.42E-06	9.0E-06	0.03	3.0E-04	6.4E-07	NA	NA
2,3,4-Trichlorophenol	3.14E-05	3.8E-05	0.1	3.8E-04	2.7E-06	NA	NA
2,4,5-Trichlorophenol	2.13E-05	2.6E-05	0.1	2.6E-04	1.8E-06	NA	NA
2,4,6-Trichlorophenol	3.47E-07	4.2E-07	0.0001	4.2E-03	3.0E-08	0.07	2.1E-09
1,2,4-Trimethylbenzene	NA	NA	0.05	NA	NA	NA	NA
				1E+00			3E-04

$$\text{AADD} = \frac{(\text{DAevent} \times \text{SAswr} \times \text{EVswr} \times \text{EFswr} \times \text{ED})}{(\text{BW} \times \text{ATnc})} \qquad \text{Hazard Quotient} = \frac{\text{AADD}}{\text{RfDo}}$$

$$\text{LADD} = \frac{(\text{DAevent} \times \text{SAswr} \times \text{EVswr} \times \text{EFswr} \times \text{ED})}{(\text{BW} \times \text{ATca})} \qquad \text{Excess Cancer Risk} = \text{LADD} \times \text{SFo}$$

Parameter	Symbol	Units	Value
Event Frequency	EVswr	evt/day	1
Exposure Frequency	EFswr	d/yr	10
Exposure Duration	ED	yr	5
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	1,825
Averaging Time-Cancer	ATca	days	25,550
Skin Surface Area	SAswr	cm2	3,100

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: TRENCH/UTILITY WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Dermal Contact with Groundwater	Excess Cancer Risk
Acetone	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA
Pentachlorophenol	1.2E-09	8.9E-10	3.2E-12	2.8E-04	2.8E-04
TCDD	2.4E-07	2.1E-08	4.2E-09	8.2E-08	3.4E-07
2,3,4,5-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	5.2E-10	3.9E-10	9.2E-12	2.1E-09	3.0E-09
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Total	2.4E-07	2.2E-08	4.2E-09	2.8E-04	3E-04

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY RISK CHARACTERIZATION: TRENCH/UTILITY WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Dermal Contact with Groundwater	Hazard Index
Acetone	1.9E-08	5.6E-09	NA	NA	2.4E-08
Chlorobenzene	1.8E-06	5.4E-07	NA	NA	2.4E-06
1,4-Dichlorobenzene	1.2E-06	3.7E-07	NA	NA	1.6E-06
Methyl ethyl ketone	6.7E-09	2.0E-09	NA	NA	8.7E-09
Naphthalene	1.0E-06	4.6E-07	NA	NA	1.5E-06
Pentachlorophenol	4.6E-06	3.5E-06	8.2E-08	1.1E+00	1.1E+00
TCDD	2.5E-03	2.3E-04	4.1E-05	8.8E-04	3.7E-03
2,3,4,5-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	1.0E-02	1.0E-02
2,3,4,6-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	8.5E-04	8.5E-04
2,3,5,6-Tetrachlorophenol	2.2E-06	1.6E-06	3.8E-08	3.0E-04	3.0E-04
2,3,4-Trichlorophenol	1.0E-06	7.7E-07	1.8E-08	3.8E-04	3.8E-04
2,4,5-Trichlorophenol	1.0E-06	7.7E-07	1.8E-08	2.6E-04	2.6E-04
2,4,6-Trichlorophenol	1.0E-03	7.7E-04	1.8E-05	4.2E-03	6.0E-03
1,2,4-Trimethylbenzene	5.9E-07	1.8E-07	NA	NA	7.7E-07
Total	3.6E-03	1.0E-03	6.0E-05	1.1E+00	1E+00

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: OFF-SITE ADULT RESIDENT

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.9	NA	NA	NA	NA
Chlorobenzene	NA	1	NA	0.017	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1	NA	0.23	NA	NA	NA	NA
Methyl ethyl ketone	NA	1	NA	0.29	NA	NA	NA	NA
Naphthalene	NA	1	NA	0.00086	NA	NA	NA	NA
Pentachlorophenol	1.07E+00	1	3.0E-10	0.03	9.9E-09	1.0E-10	0.018	1.8E-12
TCDD	1.96E-04	1	5.5E-14	0.000000011	5.0E-06	1.9E-14	130000	2.4E-09
2,3,4,5-Tetrachlorophenol	5.00E-01	1	1.4E-10	0.03	4.6E-09	4.8E-11	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	1.4E-10	0.03	4.6E-09	4.8E-11	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	1.4E-10	0.03	4.6E-09	4.8E-11	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	2.2E-10	0.1	2.2E-09	7.6E-11	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	2.2E-10	0.1	2.2E-09	7.6E-11	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	2.2E-10	0.0001	2.2E-06	7.6E-11	0.07	5.3E-12
1,2,4-Trimethylbenzene	NA	1	NA	0.0017	NA	NA	NA	NA
					7E-06			2E-09

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	350
Exposure Duration	ED	yr	24
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	0.83
Exposure Time	ETpe	hr/d	24
Particulate Emission Factor	PEF	m^3/kg	9.8E+08

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: OFF-SITE CHILD RESIDENT

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.9	NA	NA	NA	NA
Chlorobenzene	NA	1	NA	0.017	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1	NA	0.23	NA	NA	NA	NA
Methyl ethyl ketone	NA	1	NA	0.29	NA	NA	NA	NA
Naphthalene	NA	1	NA	0.00086	NA	NA	NA	NA
Pentachlorophenol	1.07E+00	1	7.0E-10	0.03	2.3E-08	6.0E-11	0.018	1.1E-12
TCDD	1.96E-04	1	1.3E-13	0.000000011	1.2E-05	1.1E-14	130000	1.4E-09
2,3,4,5-Tetrachlorophenol	5.00E-01	1	3.3E-10	0.03	1.1E-08	2.8E-11	NA	NA
2,3,4,6-Tetrachlorophenol	5.00E-01	1	3.3E-10	0.03	1.1E-08	2.8E-11	NA	NA
2,3,5,6-Tetrachlorophenol	5.00E-01	1	3.3E-10	0.03	1.1E-08	2.8E-11	NA	NA
2,3,4-Trichlorophenol	8.00E-01	1	5.3E-10	0.1	5.3E-09	4.5E-11	NA	NA
2,4,5-Trichlorophenol	8.00E-01	1	5.3E-10	0.1	5.3E-09	4.5E-11	NA	NA
2,4,6-Trichlorophenol	8.00E-01	1	5.3E-10	0.0001	5.3E-06	4.5E-11	0.07	3.2E-12
1,2,4-Trimethylbenzene	NA	1	NA	0.0017	NA	NA	NA	NA
					2E-05			1E-09

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	350
Exposure Duration	ED	yr	6
Body Weight	BW	kg	15
Averaging Time-Non-cancer	ATnc	days	2,190
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	0.42
Exposure Time	ETpe	hr/d	24
Particulate Emission Factor	PEF	m^3/kg	9.8E+08

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY NON-CANCER RISK CHARACTERIZATION: RESIDENT

Child		
Chemical	**Inhalation of Particulates**	**Hazard Index**
Acetone	NA	NA
Chlorobenzene	NA	NA
1,4-Dichlorobenzene	NA	NA
Methyl ethyl ketone	NA	NA
Naphthalene	NA	NA
Pentachlorophenol	2.3E-08	2.3E-08
TCDD	1.2E-05	1.2E-05
2,3,4,5-Tetrachlorophenol	1.1E-08	1.1E-08
2,3,4,6-Tetrachlorophenol	1.1E-08	1.1E-08
2,3,5,6-Tetrachlorophenol	1.1E-08	1.1E-08
2,3,4-Trichlorophenol	5.3E-09	5.3E-09
2,4,5-Trichlorophenol	5.3E-09	5.3E-09
2,4,6-Trichlorophenol	5.3E-06	5.3E-06
1,2,4-Trimethylbenzene	NA	NA
Total	1.7E-05	2E-05

NA = not applicable

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY CARCINOGENIC RISK CHARACTERIZATION: RESIDENT

Chemical	Child	
	Inhalation of Particulates	Excess Cancer Risk - Child
Acetone	NA	NA
Chlorobenzene	NA	NA
1,4-Dichlorobenzene	NA	NA
Methyl ethyl ketone	NA	NA
Naphthalene	NA	NA
Pentachlorophenol	1.1E-12	1.1E-12
TCDD	1.4E-09	1.4E-09
2,3,4,5-Tetrachlorophenol	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA
2,3,4-Trichlorophenol	NA	NA
2,4,5-Trichlorophenol	NA	NA
2,4,6-Trichlorophenol	3.2E-12	3.2E-12
1,2,4-Trimethylbenzene	NA	NA
Total	1.4E-09	1E-09

APPENDIX E
HUMAN HEALTH RISK ASSESSMENT CALCULATIONS
Sierra Pacific Industries Arcata Division Sawmill
Arcata, California
Project #9329

SUMMARY CARCINOGENIC RISK CHARACTERIZATION: RESIDENT

Chemical	Adult	Excess Cancer Risk - Adult	Excess Cancer Risk - Total
	Inhalation of Particulates		
Acetone	NA	NA	NA
Chlorobenzene	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA
Methyl ethyl ketone	NA	NA	NA
Naphthalene	NA	NA	NA
Pentachlorophenol	1.8E-12	1.8E-12	2.9E-12
TCDD	2.4E-09	2.4E-09	3.9E-09
2,3,4,5-Tetrachlorophenol	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA
2,3,5,6-Tetrachlorophenol	NA	NA	NA
2,3,4-Trichlorophenol	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA
2,4,6-Trichlorophenol	5.3E-12	5.3E-12	8.5E-12
1,2,4-Trimethylbenzene	NA	NA	NA
Total	2.4E-09	2E-09	4E-09

NA = not applicable