Baseline Human Health Risk Assessment for the Former Westinghouse Electric Corporation Facility

5899 Peladeau Street
Emeryville, California

February 2, 1996

Project No. 96 - 2171

Prepared by

SOMA Environmental Engineering
2680 Bishop Drive, Suite 203
San Ramon, California 94583

CERTIFICATION AND LIMITATIONS

This report has been prepared by SOMA Environmental Engineering, Inc. (SOMA) for the exclusive use of Westinghouse Electric Corporation for their use in evaluating potential human health risks associated with the potential development of the subject property due to chemicals detected in on-site soils and groundwater, as described herein. The evaluation and resulting conclusions are based on data provided to us by Westinghouse Electric Corporation and its consultant, EMCON and Associates, Inc., are believed to be true and accurate. SOMA has provided its professional services using the degree of care and skill ordinarily exercised by other scientists and engineers practicing in this field. No other warranty, express or implied, is made as to the conclusions and professional opinions and recommendations contained in this report.

Nastaran Nazmi for

William S. Bosan Ph.D.
Principal Toxicologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042928
Exp. April 96
CIVIL
STATE OF CALIFORNIA

Mansour Sepehr, Ph.D.
President and Principal Hydrogeologist
California Registered Professional Civil Engineer No. 42928

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FOR THE FORMER WESTINGHOUSE ELECTRIC CORPORATION FACILITY

Emeryville, CALIFORNIA

1.0 EXECUTIVE SUMMARY

Introduction

This human health risk assessment for the former Westinghouse site located at 5899 Peladeau Street in Emeryville, Califorina ("Emeryville facility"), (Figure 1-1) has been prepared by SOMA Environmental Engineering, Inc. (SOMA) on behalf of Westinghouse Electric Corporation (Westinghouse) at the request of the California Regional Water Quality Control Board (RWQCB). This facility has been used for a variety of purposes, including repair and limited manufacturing of transformers and other electric apparatus.

The purpose of this human health risk assessment is to evaluate potential human health impacts associated with soil and groundwater contamination beneath the Westinghouse site. The human health risk assessment (HRA) quantitatively evaluates potential human health risks associated with soil and groundwater contamination.

Site Background

The Emeryville facility has been used for a variety of purposes, including repair and limited manufacturing of transformers and other electrical apparatus. Since 1981, a number of environmental investigations and periodic groundwater monitoring have been performed to assess soil and groundwater quality conditions at the site, particularly with respect to PCBs. Detection of significant PCB contamination in soil and groundwater in the northwest portion of the facility led to the construction of a slurry wall and engineered-cap in this area in the fall 1985. The construction of the slurry wall was in response to an order by USEPA Region 9, with the purposes of limiting the migration of PCBs in groundwater.

Westinghouse discontinued operations at the Emeryville facility in 1992 and all buildings were removed in 1993. Potential future plans for the site call for development over some or all of the property.

Site Characterization

The upper 2 to 4 feet of soil at the site is artificial fill and consists of a sandy clay material. This is underlain by 3 to 6 feet of black, soft, highly compressible, silty clay known locally as "Recent Bay Mud". The nature and extent of soil contamination at the site has been well characterized, specially for PCBs. Besides PCBs, low levels of total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs) have been reported in soil samples.

Based on previous site investigations, groundwater is encountered at depths ranging from 2 to 6 feet below ground surface (BGS). The groundwater flow direction is generally toward the West. Groundwater levels vary seasonally, reaching a maximum in the winter and a minimum in the summer. PCBs, VOCs and SVOCs are the major chemicals of concern detected in groundwater. Elevated levels of VOCs were detected in three out of 11 existing groundwater monitoring wells beneath the site. Well S-5, located on the northern edge of the property at the northeast corner of the containment area, has the highest reported VOC concentrations, including up to 650 ug/l chlorobenzene, 600 ug/l 1,3-dichlorobenzene (1,3-DCB), 450 ug/l 1,4-dichlorobenzene (1,4-DCB) and 1500 ug/l trichlorobenzene (TCE), 196 ug/l 1,2-dichloroethene (*cis* and *trans* isomers), and 44 ug/l vinyl chloride. Reported VOC concentrations in S-7, located approximately 150 feet down gradient of S-5 and adjacent to the containment area, are mostly one to two orders of magnitude less than in S-5. However, benzene has not been detected in S-5 and trans-1,2-dichloroethylene and vinyl chloride have been detected at similar concentrations in both wells. Low levels of Bis(2-ethylhexyl)phthalate (1.3 ug/l) was detected in groundwater.

PCBs as Aroclor 1260 have been detected in the existing monitoring wells, although generally at very low concentrations. The maximum groundwater concentration of Aroclor 1260 has been recently (EMCON, August 1995) reported at TP-2 located at the southeast corner of Building 24 at 34 ug/l.

Conceptual Site Model

The conceptual site model (CSM) was developed for the former Westinghouse Emeryville site based on previous site investigations. The CSM synthesizes site characterization data (geology, hydrogeology, contaminant distribution, migration pathways, and potential human receptors) to provide a framework for selecting pathways for quantitative analysis in the human health risk assessments. The CSM is presented graphically in Figure 1-2.

The CSM identifies soil and groundwater beneath the site as the sources of chemical contaminants. Groundwater, soil gas, and ambient air are identified as transport media in the CSM. Groundwater carries dissolved contaminants from beneath the Westinghouse site westward toward the San Francisco Bay. Volatile contaminants in groundwater can also volatilize into soil gas and travel by diffusion toward the land surface to enter buildings or ambient air. Here they may impact human receptors directly (via inhalation) or be carried downwind to potentially impact downwind receptors. Semivolatiles such as PCBs which have been reported in erodible surface soils can become airborne via wind erosion.

Quantitative Modeling

Quantitative models were used to assess the transport of chemicals in groundwater, soil gas and air, in order to estimate current and future exposure point concentrations for potential human receptors. The following computer modeling and quantitative calculations were performed in the evaluation:

- The U.S. Geological Survey (USGS) Modular Three-Dimensional Finite-Difference Ground-Water Flow Model (MODFLOW) was used to simulate groundwater flow;
- Chemical transport in groundwater was modeled using Model Transport Three-Dimensional (MT3D), a widely used, commercially available three-dimensional finite-difference transport model;
- Volatile chemical emissions from contaminated groundwater to the atmosphere were estimated using a modified Fick's Law approach;
- Volatile chemical emission from contaminated soils to the atmosphere were estimated using the Jury et al., (1990) Model;
- Potential indoor air concentrations of VOCs in future buildings which might be constructed over the groundwater/soil contaminant plume were estimated using a steady-state mass balance indoor air model;
- Outdoor air concentrations of VOCs over the groundwater/soil contaminant plume were estimated using a simple mixing ("box") model;
- The impact of semi-volatile organic compounds on on-site and off-site air quality conditions was evaluated by using the USEPA Fugitive Dust Model (FDM) (1990).

Human Health Risk Assessment

The purpose of the human health risk assessment (HRA) is to quantitatively evaluate potential human health impacts which might result from exposure to chemical contaminants in soil and groundwater in the Study Area as a basis for deciding whether further investigation and/or remedial action is warranted. Key objectives of the HRA include:

- identify chemicals of potential concern (COPCs);

- identify potential human receptors and potential exposure pathways;
- define reasonable maximum exposure scenarios for each complete potential exposure pathway;
- quantitatively evaluate carcinogenic and noncarcinogenic health risks associated with each exposure scenario;
- define soil and groundwater cleanup levels for protecting future household residents and occupational employees.

The potential exposure pathways identified in the HRA are dermal, inhalation, and ingestion. The following exposure scenarios were evaluated quantitatively:

Current Use Potential Exposure Scenarios

- Current on-site, outdoor worker
- Current off-site, outdoor worker
- Current off-site, nearest downwind resident

Future Use Potential Exposure Scenarios

- Future on-site, indoor and outdoor worker
- Future on-site, resident and apartment dweller (adult and child)
- Future construction worker
- Future on-site, utility worker

Both the occupational and residential exposure scenarios were established as reasonable maximum exposure (RME) scenarios, which are defined as the highest exposure that is reasonably expected to occur at the site.

Based on site-specific hydrogeological data, groundwater flow velocity beneath the site is approximately 1.13 ft/yr. Therefore, in the next 30 years, based on the retardation factor of chemicals of potential concern, it is estimated that chemicals will migrate less than 30 feet from the source area(s). In addition to this slow migration, the slurry wall will further impede the migration of chemicals within the slurry wall to off-site areas.

The results of the groundwater flow modeling indicate that groundwater beneath the site would not support significant withdrawal rates (less than 200 gallon a day). This is largely due to the low hydraulic conductivity of the saturated sediments and the presence of the slurry wall surrounding a portion of the site. For this reason, the water bearing zone beneath the site was not considered to be a potential source of drinking water. Therefore, in conducting the HRA, the ingestion of groundwater by a potential future resident and/or occupant was not considered.

The HRA quantified both noncarcinogenic health hazards and carcinogenic health risks. Noncarcinogenic health hazards were evaluated using a hazard index (HI) approach. The HI is defined as the sum of the hazard quotients for each COPC for each route of exposure, where the hazard quotient is the ratio of the predicted dose to a reference dose for each COPC. A total HI less than or equal to unity suggests that adverse health effects would not be expected following a lifetime of exposure, even in sensitive members of the population. Carcinogenic health risks were quantified for each COPC as the probability of developing cancer as a result of the exposure evaluated for each scenario (excess cancer risk). According to the U.S. EPA, where the cumulative carcinogenic risk to an individual based on RME for both current and future land uses is less than 10^{-4} and the noncarcinogenic hazard quotient is less than one, action is generally not warranted unless there are adverse environmental impacts.

Based on this HRA, it was concluded that for a hypothetical on-site indoor worker, the carcinogenic risk (7.6×10^{-6}) from inhalation of volatile emissions in indoor air was well within the range of acceptable risk, as defined by EPA (between 10^{-6} and 10^{-4}). The noncarcinogenic health hazard was negligible (0.23). For a hypothetical on-site, outdoor worker assumed to be exposed to site contaminants through soil ingestion, dermal contact, inhalation of volatile emissions, and inhalation of soil particulates, the carcinogenic risk (6.6×10^{-4}) and noncarcinogenic health hazard (12) were unacceptable and attributable to PCBs from ingestion and dermal contact.

For on-site residents, it was concluded that the RME on-site resident assumed to be exposed to site contaminants through soil ingestion, dermal contact, inhalation of volatile emissions, and inhalation of soil particulates, the carcinogenic risk (3.0×10^{-3}) and noncarcinogenic health hazard (156) were unacceptable and attributable to PCBs from ingestion and dermal contact. For the worst-case, on-site resident, assumed to live directly over the groundwater plume "hot-spot", the incremental carcinogenic risk from inhalation of VOCs in indoor air (9.1×10^{-6}) was well within the range of acceptable risk defined by EPA (between 10^{-6} and 10^{-4}). The incremental noncarcinogenic health hazard was negligible (0.5).

The carcinogenic risk was also calculated for construction and parking garage scenario workers. For a construction worker assumed to have an exposure duration of 3 months, the carcinogenic risk (2.7×10^{-5}) was acceptable and the noncarcinogenic health hazard (48) were unacceptable and primarily attributable to inhalation of PCBs in mechanically suspended (i.e., from heavy equipment) soil. Consequently, health and safety protection is recommended for any construction/excavation activities in PCB-contaminated soils. For the parking garage scenario, the carcinogenic risk for a full-time garage attendant (1.9×10^{-6}) is well within the range of acceptable risk defined by EPA. The incremental noncarcinogenic health hazard was negligible (5.8×10^{-2}).

Based on the carcinogenic risks and noncarcinogenic health hazards summarized above, almost all of the estimated risk and hazard was attributable to PCBs in soil (greater than 99 percent of the overall risk/hazard). The incremental risk from VOCs in groundwater and soil were acceptable for the indoor worker, worst-case resident, and parking garage attendant; the incremental risk for VOCs from soil and groundwater were negligible for the on-site worker, RME resident, and construction worker.

Based on the results of this HRA, removal action/remediation is required only for PCBs in surface soils at the Westinghouse site. A PCB soil cleanup level of .05 mg/Kg for residential use, 0.29 mg/Kg for industrial use, and 5.93 for utility worker use would result in an excess lifetime cancer risk of 1.00E-06. A PCB soil cleanup level of 0.5 mg/Kg for residential use, 2.85 mg/Kg for industrial use, and 59.3 mg/Kg for utility worker use would result in an excess lifetime cancer risk of 1.00E-05. A PCB soil cleanup level of 5.0 mg/Kg for residential use, 28.5 mg/Kg for industrial use, and 593 mg/Kg for utility worker use would result in an excess lifetime cancer risk of 1.00E-04.

2.0 INTRODUCTION

2.1 Background

Westinghouse Electric Corporation owns and formerly operated an Apparatus Service Plant located at 5899 Peladeau Street in Emeryville, California ("Emeryville facility"). The facility was used for a variety of purposes, including repair and limited manufacturing of transformers and other electrical apparatus. Since 1981, a number of environmental investigations and periodic groundwater monitoring have been performed to assess soil and groundwater quality conditions at the site, particularly with respect to PCBs. Detection of significant PCB contamination in soil and groundwater in the northwest portion of the site led to the construction of a slurry wall and engineered-cap in the fall of 1985, with the purposes of limiting the migration of PCBs in groundwater.

Westinghouse discontinued operations at the Emeryville facility in 1992, and all buildings were removed in 1993. Potential future plans for the site call for redevelopment. The California Regional Water Quality Control Board (RWQCB) has requested that Westinghouse submit a human health risk assessment for the property under existing conditions to clarify if excess risk is posed by chemicals at the site and whether additional remediation is necessary. On behalf of Westinghouse, SOMA Environmental Engineering, Inc. (SOMA) has conducted this baseline risk assessment to identify human health risk under current conditions and to define soil and groundwater cleanup levels if warranted.

2.2 Purpose and Scope

The purpose of the HRA is to quantitatively evaluate potential human health risks associated with soil and groundwater contamination, assuming no further remediation, for both existing and hypothetical (future) off-site and on-site land uses. Specific objectives are set forth in Section 5.2.

2.3 Report Organization

This report is organized into five major sections as follows:

1. **Executive Summary** - Provides an overview of the entire report, including site background information and methodology, results, and conclusions and recommendations of the human health risk assessments;
2. **Introduction** - Provides a brief introduction to the Former Westinghouse Electric Corporation Facility, the motivation, purpose and scope of the human health risk assessments, and the organization of this report;

3. **Site Characterization** - Reviews the history and physical setting of the Westinghouse Emeryville facility, including geology and groundwater characterization, and summarizes the nature and extent of groundwater contamination documented at and adjacent to the site. This section also presents a Conceptual Site Model which forms the basis for quantitative chemical transport modeling and the human health risk assessments;

4. **Quantitative Modeling** - Describes the methodology used to model chemical transport in various media (groundwater, soil gas, and air) and to estimate exposure point concentrations of chemicals of potential concern (COPC) which might potentially impact human receptors;

5. **Human Health Risk Assessment** - Evaluates potential human health impacts which might result from exposure to chemical contaminants in groundwater and soil in the vicinity of the former Westinghouse Emeryville site, under current conditions and various future-use scenarios, assuming no remediation of groundwater/soil occurs.

3.0 SITE CHARACTERIZATION

3.1 Location and Setting

The former Westinghouse Apparatus Service Plant is located in Emeryville, California, approximately 2,000 feet east of the eastern shore of San Francisco Bay (Figure 1-1). The site is located in an urban, former industrial area, which in recent years has been undergoing extensive redevelopment for commercial and residential uses. A large building constructed in three stages formerly covered approximately 168,000 square feet (3.9 acres) of the approximately 320,000 square feet (7.3 acres) property area. Presently, the building foundations and concrete floor slabs remain at the site.

3.2 Site History

Westinghouse's operations at the Emeryville facility began in 1924, with the erection of Building 24. Two more buildings, Building 37 and 42, were erected on the property in 1937 and 1942, respectively. In the early days of operation, limited manufacturing of transformers and other electrical apparatus occurred at the Emeryville facility. Operations have also included regional and district administration, engineering services, warehousing, and repair of transformers and other electrical apparatus. Westinghouse ceased using the Emeryville facility for on-site repair of electrical apparatus in 1982, and stopped using the facility entirely in 1992. All three buildings on the property were razed in May and June of 1993.

A portion of the manufacture, repair, and service activities at the Emeryville facility involved the handling, storage and use of dielectric fluids from transformers, some of which contained polychlorinated biphenyls (PCBs). In addition to dielectric fluids, other chemicals were used or stored on-site. Unleaded gasoline was stored in a 3,000-gallon underground storage tank on the site. The repair and service activities required using solvents and degreasing chemicals, such as volatile organic compounds (VOCs) and a caustic wash, for degreasing the parts.

Since 1981, a series of investigations have been conducted to assess surface and subsurface environmental conditions at the site. These investigations identified residual concentrations of various chemicals in soil and groundwater resulting from past activities at the site. Westinghouse built a slurry wall in 1985, in response to an order from USEPA Region 9, which encloses the northwest corner of the site and encircles soil containing PCBs above 50 ppm. An engineered-cap consisting of three inches of asphalt over 6 inches of aggregate base, and 12 inches of compacted imported clay, was installed over the area enclosed by the slurry wall (Woodward-Clyde Consultants, 1985). Semi-annual groundwater monitoring wells continue to monitor groundwater quality.

3.3 Previous Investigations and Remedial Activities

Soil and groundwater investigations have been conducted at the Emeryville facility since 1981. Nine groundwater monitoring wells (W-1 to W-3, W-17 to W-20, W-22 and W-24) were reportedly installed at the site by Brown & Caldwell between 1981 and 1983 (EMCON, 1993a). All nine monitoring wells were sampled in March 1983 and analyzed for PCBs, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). PCBs as Aroclor 1260 were detected in five of the nine wells sampled, and VOCs were detected in eight of the nine wells. (EMCON, 1993a).

Subsequently, two additional monitoring wells, W-42 and W-45, were installed by ERM West in December 1984 (EMCON, 1993a, page 3-2). No sample data are available for these monitoring wells.

Ten of the existing monitoring wells (all except W-24, which was renamed D-6) were decommissioned and sealed during installation of the slurry wall and engineered-cap. To replace these wells, 8 shallow and 5 deeper monitoring wells (S-1 through S-8 and D-1 through D-5, respectively) were installed in February 1986. In addition, two shallow and two deeper piezometers were constructed within the containment area in June 1986. Bimonthly groundwater monitoring was conducted from April 1986 through February 1990. Subsequently, groundwater monitoring has been performed on a semi-annual basis since March 1991.

Fairly extensive soil sampling has been conducted at the site during previous investigations. A summary of the soil sampling activities and monitoring well installation performed at the site by various consultants is presented in Table 3-1, updated from a similar summary by EMCON (1993a).

3.4 Site Hydrogeology

The upper 2 to 4 feet of soil at the site consist of a sandy clay artificial fill. This is underlain by 3 to 6 feet of black, soft, highly compressible silty clay known locally as "Recent Bay Mud." The Recent Bay Mud is thickest in the southwest and becomes thinner to the north and to the east. Underlying the Recent Bay Mud is a layer of predominantly stiff, gray to brown, silty to sandy clay, which extends to a depth of approximately 31 to 39 feet bgs. The depth to the contact between the Recent Bay Mud and the underlying clay ranges from approximately 6 to 21 feet bgs in the area of the engineered-cap. The upper part of this layer is comprised of a stiff, gray silty to sandy clay measuring 1 to 4 feet thick. The middle and most voluminous portion of this layer is a brown silty to sandy clay of low to medium plasticity that contains some thin, apparently discontinuous lenses of sands and gravels. The basal portion of the silty-sandy-clay layer is a 2 to 8 foot thick silty to clayey sand with gravel, that grades to sand and gravelly sand to the north. Generally, within the entire thickness of the silty-sandy-clay layer, the sand and gravel content appears to increase toward the north and east. The silty-sandy-clay layer is underlain by a stiff, over-consolidated silty marine clay known as "Old Bay Mud." The Old Bay Mud is encountered at a depth of about 31 to 39 feet bgs, and it extends to a depth of at least 72 feet bgs at one deep boring location (EMCON, 1993a). The cross-sections A-A' and B-B' are shown in Figure 3-2 and Figure 3-3, respectively. Figure 3-1 shows the locations of cross-sections A-A' and B-B'.

Groundwater is encountered at a depth of approximately 2 to 6 feet bgs at the site. At the northern end of the site, 12 of the 14 groundwater monitoring wells outside the slurry wall, including the destroyed wells S-2 and D-2 (now named S-2R and D-2R), are set as 6 pairs with one shallow well and one deep well. The shallow wells have 10-foot screened intervals that extend from approximately sea level to 10 feet below sea level in the Recent Bay Mud and underlying silty-sandy-clay (Figure 3-4 and Figure 3-5). The deep wells are screened from roughly 15 to 25 feet below sea level at the base of the silty-sandy-clay layer. Static water elevation in the well pairs differ only by an average of 0.2 foot. Generally, the groundwater elevations are slightly lower in the deep wells, but in some pairs the groundwater elevations in the shallow wells are lower than the groundwater elevations in the adjacent deep wells. The small differences in groundwater elevations indicate that the Recent Bay Mud and the various sediment types, considered together as the silty-sandy-clay with sand and gravel lenses, all act as one water-bearing zone. The saturated thickness of the water-bearing zone is 30 to 33 feet.

Before construction of the slurry wall, the groundwater flow direction in the area now enclosed varied from a northwest direction in the northern portion of the area, to a southwest direction in the central and southern portion of the containment area (EMCON, 1993a). The slurry wall was constructed to penetrate a minimum of 5 feet into the Old Bay Mud. Thus the slurry wall impedes groundwater flow across the entire thickness of the water-bearing zone. The results of semi-annual measurements of groundwater elevations from 1987 to 1994 indicate that the groundwater flow direction is generally toward the west with an average gradient of 0.01 feet/feet. Groundwater levels vary seasonally, reaching a maximum in the winter and a minimum in the summer.

Based on the results of pumping tests conducted by Woodward-Clyde Consultants in 1986, the hydraulic conductivity of the saturated sediments beneath the site is about 3.27×10^{-5} centimeter per second (cm/sec). Aquifer tests also indicated that the hydraulic conductivity of the slurry wall ranges between 9.0×10^{-10} to 3.5×10^{-8} cm/sec. Given that the average groundwater gradient is .01 ft/ft and the effective porosity of the water bearing zone is 0.30, the groundwater flow velocity would be .003 ft/day (1.13 ft/year).

The low hydraulic conductivity of the saturated sediments was also reported by EMCON (1995). In August, 1995 EMCON attempted to collect groundwater samples using HydroPunch sampling equipment from six locations beneath the former Westinghouse Buildings 42, 37 and 24. The borings were advanced to over 10 feet bgs and they contained very little or no water after installation. In order to sample groundwater, the borings were left in place overnight. However, in the next day no water was detected in one of the borings, while one of the remaining five borings did not yield sufficient sample volume to be analyzed for all chemicals of concern.

3.5 Nature and Extent of Groundwater Contamination

In early 1980s, Westinghouse conducted a limited groundwater investigation at the site. Eleven groundwater monitoring wells were installed at the site by Brown & Caldwell and ERM West between 1981 and 1984 (Table 3-1). To our knowledge, laboratory analytical reports are not available from the early 1980s groundwater sampling events. However, the results of laboratory analysis on groundwater samples collected from nine monitoring wells in March 1983 have been tabulated in Table 3-2, based on data presented in *Westinghouse Emeryville Data Summary Report* (EMCON, October 1993a). All of these wells except W-24 (subsequently renamed D-6) were decommissioned during installation of the slurry wall and engineered-cap (EMCON, 1993a).

As Table 3-2 shows, polychlorinated biphenyls (PCBs) were detected in the March 1983 groundwater samples from 5 of the 9 groundwater monitoring wells at concentrations ranging from 1 to 71 µg/l. The highest reported concentrations were in the samples from monitoring wells W-19 and W-17 at 32 and 71 µg/l, respectively. W-17 was located within the area now encircled by the slurry wall. W-19 was located at the extreme northwestern (downgradient) corner of the site. Low PCB concentrations were also reported in monitoring wells W-18 (6 µg/l) and W-22 (3 µg/l), both located within the slurry wall. PCBs were also detected at 1 µg/l in upgradient monitoring well W-24 (now D-2) located at the northeastern corner of the property.

Volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were also detected in the March 1983 groundwater samples from 8 of the 9 wells sampled (all except W-1). Maximum concentrations of the chemicals reported included benzene (27 µg/l at W-20), chlorobenzene (2800 µg/l at W-20), chloroform (6.1 µg/l at W-17), dichloromethane (methylene chloride) (340 µg/l at W-19), trans-1,2 dichloroethene (trans-1,2-DCE) (610 µg/l at W-22), ethylbenzene (3 µg/l at W-3 and W-24), toluene (7 µg/l at W-24), trichloroethylene (TCE) (34 µg/l at W-18), vinyl chloride (540 µg/l at W-22), 1,3-dichlorobenzene (1,3-DCB) (130 µg/l at W-17 and W-18), 1,4-dichlorobenzene (1,4-DCB)(58 µg/l at W-20), 1,2,4-trichlorobenzene (130 µg/l at W-17), and bis(2-ethylhexyl)phthalate (620 µg/l at W-18).

The current groundwater monitoring network at the site consists of seven shallow wells (S-1, S-2R, S-3 through S-8) and five deep wells (D-1, D-2R, D-3 through D-6). These wells have been monitored bimonthly for PCBs from April 1986 through February 1990 and semiannually for PCBs since March 1991. Selected wells (S-1, S-5, S-6, S-7, D-1, D-5 and D-6) were monitored for VOCs between March 1991 and September 1992 (4 events), and samples from all accessible wells (S-1, S-3 through S-8, D-3 through D-6) were again analyzed for VOCs in November 1994. Wells S-3, D-3, S-4, D-4, and S-8 have thus been sampled for VOCs only once, in November 1994. Wells S-2 and D-2 were destroyed by the City of Emeryville's contractor during construction activities at the adjacent train station prior to the November 1994 sampling event and have never been sampled for VOCs; these wells have recently been replaced with wells S-2R and D-2R. Table 3-3 presents the historical groundwater quality data at the site.

As Table 3-3 shows, three of the current monitoring wells show elevated concentrations of VOCs: S-5, D-5, and S-7. Both S-5 and S-7 are shallow monitoring wells, screened from approximately

10 to 20 feet bgs. Well S-5, located on the northern edge of the property at the northeast corner of the containment area, has the highest reported VOC concentrations, including up to 650 µg/l chlorobenzene, 600 µg/l 1,3-DCB, 450 µg/l 1,4-DCB, 1500 µg/l TCE, 196 µg/l total 1,2-dichloroethene (*cis* and *trans* isomers), and 44 µg/l vinyl chloride. Reported VOC concentrations in well S-7, located approximately 150 feet west of S-5 and adjacent to the containment area, are approximately one to two orders of magnitude less than in S-5, except for benzene (which has not been detected in S-5) and trans-1,2-DCE and vinyl chloride, which have been detected at similar concentrations in both wells.

Groundwater samples that were analyzed for VOCs from well D-5, located adjacent to S-5 but screened in a deeper zone (approximately 30 to 40 feet bgs) have consistently contained carbon tetrachloride (43 to 1.6 µg/l) and chloroform (20 to 0.6 µg/l) at steadily decreasing concentrations. Neither of these chemicals has been reported in adjacent shallow well S-5, except for 1.2 µg/l of chloroform in the March 1991 sample.

PCBs as Aroclor 1260 (PCB-Aroclor 1260) have been detected in the existing monitoring wells, although generally at very low concentrations and only sporadically in some wells (Table 3-3). In 32 rounds of sampling since April 1986, concentrations exceeding 10 µg/l PCBs have been reported only in wells D-5 (one sample), D-6 (2 samples) and S-1 (one sample) . Since March 1991, when dedicated bailers were reportedly put into use for sampling the wells (EMCON, 1995b), the frequency and magnitude of reported PCB concentrations in the monitoring wells has decreased substantially. Since that time, only two samples have had reported PCB concentrations exceeding 1 µg/l (S-1 at 1.4 µg/l and S-7 at 1.6 µg/l, both in September 1991), and PCBs have not been detected at all above the detection limit of 0.1 µg/l in 5 of the 14 monitoring wells (D-1 through D-4 and S-8).

Five groundwater samples were collected in July 1995 by EMCON (1995c) from depths of 10 to 15 feet bgs beneath former Buildings 24, 37 and 42 using HydroPunch™ sampling equipment. The groundwater sampling locations TP-1 through TP-6 are shown on Figure 3-4. The groundwater sampling attempt at location TP-4 was unsuccessful. The samples were analyzed for VOCs by EPA Method 8240, SVOCs by EPA Method 8270, for PCBs by EPA Method 8080, and for total petroleum hydrocarbons (TPH) as gasoline and benzene, toluene, ethylbenzene and total xylenes (BTEX) by EPA Method 8020. The analytical results are shown in Table 3-4 and Table 3-5. Groundwater sample TP-2, collected from the southeast corner of the site, was analyzed for VOCs, TPH as gasoline and BTEX only, due to a small volume collected. PCB-Aroclor 1260 was detected at 0.4 µg/l in the groundwater sample collected from TP-1 under the northeast corner of former Building 42. PCB-Aroclor 1260 was also detected at 34 µg/l in groundwater sample TP-6 collected at the southwest corner of the site. Groundwater sample TP-6 was also found to contain 2.7 µg/l endosulfan II and 1.6 µg/l endrin aldehyde. VOCs were detected in groundwater samples collected under former Buildings 24 and 37. Acetone was detected at 45 µg/l in sample TP-2. Groundwater sample TP-6 was found to contain 3 µg/l 1,4-DCB. Chloroform and carbon tetrachloride were both detected at 1 µg/l in sample TP-3 located on the west side of former Building 37. No groundwater sample was found to contain SVOCs. However, the groundwater sample collected from TP-2 was not analyzed for SVOCs, and sample TP-6 required a dilution factor of 5, raising the method reporting limits. The groundwater sample collected at TP-6 was found to contain 61 μg/l TPH as gasoline. Groundwater sample TP-2 was found to contain 56 μg/l TPH as gasoline, 0.8 μg/l toluene, 1 μg/l ethylbenzene, and 0.7 μg/l total xylenes. No analytes were detected in the groundwater sample TP-5 collected beneath former Building 37.

3.6 Nature and Extent of Soil Contamination

In general, the nature and extent of soil contamination at the site has been well characterized, especially for PCBs. Previous soil sampling activities conducted at the site are summarized in Table 3-1. Chemical analysis results for soil samples collected between 1981 and 1992 by various consultants in the containment area west of Building 42, the concrete slab area north of Building 42, and from two borings at the south end of Building 24 are summarized in *Westinghouse Emeryville Data Report* (EMCON, October 1993). Analysis results for soil samples collected beneath Buildings 24, 37, and 42 are presented in *Soil Characterization Report* and *Soil Characterization, Building* 42 (EMCON, August 30, 1993 and October 27, 1993, respectively). Additional soil sampling results for the concrete slab area north of Building 42 are given in *Additional Site Assessment, Westinghouse Electric Corporation* (EMCON, March 1995a).

The soil samples collected beneath the buildings by EMCON in June and September 1993 were analyzed for PCBs, halogenated VOCs, TPH as gasoline, high-boiling-point hydrocarbons (HBHC; includes TPH as diesel, jet fuel, hydraulic oil, kerosene, and mineral spirits), and BTEX. These results are presented in Figures 3-5 through 3-8 for PCBs, petroleum hydrocarbons, and VOCs, respectively. Soil samples previously collected by Brown & Caldwell and Woodward-Clyde Consultants beneath the containment area and the concrete slab area west and north of Building 42, presented in Table 3-6, were generally analyzed for PCBs only. Figure 3-6A presents the location and the PCB concentrations reported for these soils samples collected at the northern portion of the Site. However, soil samples collected from the area north of Building 42 by EMCON in February 1995 (Figure 3-4) were analyzed for VOCs by EPA Method 8240 as well as PCBs. Two soil samples collected in 1992 by Hart Crowser, Inc. from borings at the southern end of Building 24 were analyzed for TPH as gasoline and diesel, BTEX , and PCBs (Figures 3-5 through 3-8)

Surface soil samples collected by Brown and Caldwell (1981) in the northwest portion of the site, within the area now enclosed by a slurry wall and covered by an engineered-cap, were reported to contain PCB concentrations of up to 35,000 mg/Kg. Additional soil sampling (149 soil samples from 50 boring; see Table 3-6) indicate that PCB concentrations generally decreased rapidly with depth, from a maximum of 37,000 mg/Kg in the upper one foot of soil (at B-9) to a maximum of 4,700 mg/Kg below a depth of 5 feet (W-17 at 6.0 feet bgs) and a maximum of 430 mg/Kg below a depth of 10 feet (WCC-5 at 11.0 feet bgs). Only 2 of 25 samples collected below a depth of 15 feet were reported to contain PCB concentrations exceeding 15 mg/Kg (170 mg/Kg at B-6 at 27 feet bgs and 70 mg/Kg at W-17 at 21.5 feet bgs). At many locations, PCBs were not detected below a depth of 5 to 10 feet bgs. The reports documenting soil sampling in this area, which have not been reviewed by SOMA at this time, are listed in Table 3-1.

North of Building 42, soil samples from ten soil borings (B-30 through B-36 and ES-1 through ES-3) contained PCBs at concentrations of up to 450 mg/Kg at a depth of approximately two feet. PCB concentrations generally decreased rapidly with depth, although a concentration of 80 mg/Kg was reported at a depth of 5 feet at one location (Table 3-6). Subsequent sampling in this area by EMCON in February 1995 indicated much lower PCB concentrations, not exceeding 15 mg/Kg, as well as low concentrations of acetone, methyl ethyl ketone (MEK), toluene, chlorobenzene, and tetrachloroethene (PCE) (Figure 3-5). EMCON collected its soil samples at a depth of approximately 3 to 5 feet bgs.

Generally, soil samples collected beneath the building slabs at depths of approximately 1.5 and 3 feet bgs did not contain significant concentrations of PCBs, petroleum hydrocarbons, and VOCs. Low concentrations of PCBs (generally less than or equal to 2.2 mg/Kg) were reported in 8 of 16 soil samples collected from beneath Building 42; one sample collected at a depth of 3.5 feet had a reported PCB concentration of 46 mg/Kg (Figure 3-6). Beneath Buildings 37 and 24, only two of 45 soil samples contained detectable concentrations of PCBs, both at 1 mg/Kg or less.

TPH, primarily as hydraulic oil, was reported in 24 of 61 soil samples collected beneath the building slabs at concentrations ranging from 8 to 9400 mg/Kg (Figure 3-7). Three samples contained petroleum hydrocarbons at concentrations exceeding 1000 mg/Kg and three others exceeded 100 mg/Kg. In addition, soils samples collected from two soil borings adjacent to the south end of Building 24 were reported to contain diesel at concentrations of 90 and 1100 mg/Kg at depths of 6.5 and 8.5 feet bgs, respectively (Figure 3-7). Gasoline at 69 mg/Kg was also reported in the former sample.

VOCs were reported only in three of 61 samples collected beneath the building slab (Figure 3-8). Three samples from two borings beneath Building 42 were reported to contain chlorobenzene at concentrations of up to 1.6 mg/Kg, while one sample was reported to contain 1,2-DCB, 1,3-DCB, and 1,4-DCB at concentrations of 0.4, 6.6, and 15 mg/Kg, respectively. Ethylbenzene and xylenes were also reported (at concentrations of 0.097 and 0.022 mg/Kg) in a sample collected from boring EB-1 at the south end of Building 24.

Near surface soil samples collected in July 1995 by EMCON (1995c) beneath the former buildings and the concrete slab at 17 locations (B1 through B17 on Figure 6) were analyzed for SVOCs by EPA Method 8270. The analytical results are presented in Table 3-4 and Table 3-5. The soil sample collection depths, 1.5 to 2.8 feet bgs, are reflected in the sample identifications listed in Table 3-5. SVOCs were detected in the northern half of the site and under former Building 24. Soil sample B2-2.0 was found to contain 0.3 mg/kg of bis(2-ethylhexyl)phthalate. Bis(2-ethylhexyl)phthalate was also detected in soil sample B14-2.8 at 0.5 mg/kg, in soil sample B15-2.0 at 1.3 mg/kg, in soil sample B17-2.5 at 0.7 mg/kg, in soil sample B11-1.5 at 0.3 mg/kg, and in soil sample B10-1.5 at 0.4 mg/kg. Soil sample B11-1.5 was also found to contain 0.5 mg/kg 1,2,4-trichlorobenzene. Soil sample B8-2.0 was found to contain 0.5 mg/kg each fluoranthene and pyrene, and 0.4 mg/kg benzo(g,h,i)perylene. Soil sample B9-1.5 was found to contain 4 mg/kg of 1,3-DCB.

3.7 Conceptual Site Model

The conceptual site model (CSM) developed for the Westinghouse Emeryville facility is based on the previous site investigations and integrates site geology, hydrogeology, contaminant distribution, and migration pathways to potential human receptors.

A potential exposure pathway consists of four principal elements:

- a source and mechanism of chemical release
- one or more retention or transport media (e.g., soil, groundwater, or air)
- a point of potential contact with the contaminated medium (referred to as the exposure point)
- an exposure route at the point of contact (e.g., inhalation, ingestion, or dermal contact) (EPA 1989a)

The potential exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns, to establish the significant and complete pathways of exposure to receptors.

The following section describes the potential exposure pathways identified for the former Westinghouse Emeryville facility. This process provides the framework for selecting pathways for quantitative analysis in the human health risk assessments. Figure 1-2 provides a graphical representation of the source-transport-receptor analysis (i.e., the conceptual site model (CSM) for the former Westinghouse Emeryville facility.

3.7.1 Potential Source and Release Mechanisms

The CSM identifies soil and groundwater beneath the Westinghouse site as the sources of chemical contaminants. Previous releases from the former Westinghouse Emeryville facility resulted in contamination of both the underlying soil and groundwater.

3.7.2 Transport Media

Transport media for chemical contaminants identified in groundwater at the site include groundwater, surface soils, soil gas, and ambient air. Volatile groundwater contaminants can conceivably migrate through soil pores to the land surface (groundwater is only about 2 to 6 feet below the soil surface) and enter buildings or the ambient air. Here they may impact receptors directly or be carried downwind to potentially impact downwind receptors. Field observation notes by EMCON indicate that during the recent field activity (July 1995), they could not collect enough groundwater samples from some of the boreholes for chemical analysis; in order to collect a sufficient volume of groundwater sample they had to wait until the following day. The results of hydraulic test conducted by Woodward-Clyde Consultant in 1986 also agrees with EMCON's field observations. The result of hydraulic tests indicated that the hydraulic conductivity of the saturated sediments beneath the site is about 3.2×10^{-5} cm/sec (.09 ft/day). Given that the average groundwater gradient is about .01 ft/ft and effective porosity of the water bearing zone is .30, the groundwater flow velocity would be .003 ft/day (1.13 ft/year). The results of chemical transport modeling indicated that the off-site migration of the chemicals detected in groundwater, due to low hydraulic conductivity of sediments and existence of slurry wall, is highly unlikely.

PCBs and other semivolatiles such as pyrene, bis(2-ethylhexyl)phthalate, fluoranthene, and benzo (g,h,i)perylene, which have been detected in the erodible surface soils, can enter into the air (at breathing zone) due to wind erosion.

3.7.3 Exposure Points

Due to the proximity of the site to many industrial facilities and because the water bearing zone is composed of fine and low permeable silts and clays, the possibility of using water bearing zone beneath the site as a drinking water source is very low. Drinking water throughout the area is supplied by the East Bay Municipal Utilities District (EBMUD). Based on the field observation during the groundwater sampling event, the results of pumping test, and the thickness of the water bearing zone, the saturated sediments beneath the site is not capable of producing 200 gallon a day. Therefore, based on State Water Board Resolution 88-63, the water bearing zone beneath the site is not classified as a drinking water source. Since the ingestion of chemically-affected groundwater is highly unlikely, the exposure pathway for groundwater contaminants at the former Westinghouse site include only inhalation (indoor and outdoor).

Air is identified as an exposure point because volatile chemical contaminants in groundwater could migrate through the soil and into the ambient air where they can be inhaled by potential human receptors. If contaminated groundwater directly underlies a building, volatile contaminants may accumulate at higher concentrations than in ambient outdoor air due to the semi-confined nature of the indoor atmosphere. Chemicals in surface soil can also become airborne by wind erosion phenomenon and impact human lives.

3.7.4 Exposure Routes and Potential Receptors

Exposure routes and potential receptors for each of the identified exposure points discussed previously are presented in Figure 1-2. These exposure routes are evaluated in the human health risk assessment presented in Sections 5.0. Currently, the former Westinghouse site is vacant and all of the buildings have been removed. Floor slabs remain in place, and the entire site essentially has an engineered-cap and fence. Thus, there is currently no significant potential for exposure to on-site humans or receptors.

Since the potential use of the former Westinghouse Emeryville site is for development as a light commercial or residential use such as apartment complexes, future on-site human receptors will be in an industrial/commercial or possibly residential setting. The land immediately surrounding the former Westinghouse site is zoned for industrial/commercial use. However, the nearest resident is located approximately 600 feet downwind from the site (personal communication by the City of Emeryville). In this risk assessment, the near off-site receptors will be evaluated as residential as well. The only complete pathway of exposure for either the on-site or off-site receptor is inhalation of volatile emissions from groundwater and ingestion of the suspended particulate (PM_{10}) containing PCBs and other semivolatiles from the shallow surface soils. A detailed discussion of the human receptor identification and subsequent definition of the exposure scenarios to be evaluated are presented in Sections 5.4.1 (Identification of Potential Receptors) and 5.5.1 (Exposure Scenarios to be Evaluated), respectively.

4.0 QUANTITATIVE MODELING

Computer models were used to quantitatively assess chemical fate and transport in groundwater, soil gas, and air at the Westinghouse site. The purpose of the modeling was to estimate current and future exposure point concentrations for potential human receptors. The following computer modeling and quantitative calculations were performed in the evaluation:

a) Groundwater flow modeling;

b) Groundwater chemical transport modeling;

c) Estimation of emission rates of VOCs from affected groundwater to the atmosphere;

d) Estimation of emission rates of VOCs and SVOCs from affected soils to the atmosphere;

e) Air quality modeling to estimate on-site and off-site chemical concentrations in ambient outdoor and indoor air from affected groundwater and soils.

This section describes the methodology used and the assumptions made in groundwater flow and chemical transport modeling and air quality simulations.

4.1 Groundwater Flow Modeling

4.1.1 Model Description

The U.S. Geological Survey (USGS) Modular Three-Dimensional Finite-Difference Ground-Water Flow Model (MODFLOW) (USGS 1988) was used to simulate groundwater flow within the model domain beneath the Site. MODFLOW is a finite-difference flow model designed to simulate in two dimensions (and in quasi-3-dimensional form) the response of a water-yielding unit to imposed stress conditions. MODFLOW may be used to simulate confined, unconfined (water table), or a combination of both conditions. This model may also be used to simulate heterogeneous and anisotropic geologic units, as well as geologic units with irregular boundaries. MODFLOW is also capable of simulating a single- or a multi-layer system, permitting leakage from streams and confining beds. MODFLOW was used to evaluate steady-state groundwater flow conditions under ambient conditions. The model domain used in groundwater flow and chemical transport modeling is shown Figure 4-1.

4.1.2 Overview of Modeling Procedures

Groundwater flow modeling was accomplished through the following steps:

1) Conceptualize a hydrogeologic flow regime;

2) Design a finite-difference grid system;
3) Assign model boundary conditions;
4) Assign hydrogeologic properties to aquifer materials;
5) Calibrate the computer model using field-measured data.

These modeling steps are described in the following sections.

4.1.3 Hydrogeologic Flow Regime

The model domain illustrated in Figure 4-1 consists of a 1,800-foot by 1,800-foot area that includes the Westinghouse site and adjacent areas to the south and west.

The depth to groundwater beneath the Westinghouse site ranges from approximately 2 to 6 feet. Groundwater generally flows toward the west. The average groundwater hydraulic gradient is about .01 ft/ft beneath the Study Area. For modeling purposes, a single unconfined aquifer system was simulated as occurring to a depth of approximately 2 to 6 bgs. The rationale behind this assumption is depicted in geological cross-sections Figures 3-2 and 3-3 and Section 3.4. As has been discussed in Section 3.4, there is not enough evidence to believe that the aquifer system is two-layered.

4.1.4 Finite-Difference Grid System

The model domain was subdivided into a uniform finite-difference grid, covering an area with dimensions of 1,800 feet by 1,800 feet (Figure 4-1). The grid is comprised of 50-foot by 50-foot cells arranged in 36 rows and 36 columns. By convention, the model solution nodes are considered to be located at the center of each cell. Cells containing the existing slurry wall surrounding the engineered-cap area were simulated as active cells with lower hydraulic conductivities.

4.1.5 Model Boundary Conditions

Water level data from monitoring wells located within the Study Area indicate that the groundwater flow direction at the Site is generally toward the west. Based on the results of previous water level measurements, the groundwater flow gradient is relatively consistent and has not changed significantly with time.

Accordingly, a second-order general head boundary (GHB) was used along all four boundaries of the model domain. This boundary condition specifies that groundwater enters the model domain at a rate that is a function of the hydraulic conductivity of the sediments at the boundary, the cross-sectional area of the flow through the cell, and the hydraulic gradient at the edge of the model domain. Thus, flow conditions are considered to be continuous across the model boundary. The boundary heads rise and fall based on the flow conditions within the model domain. The GHB along the boundaries of the model domain specifies a hydraulic gradient across each boundary which remains constant.

4.1.6 Hydrogeologic Properties

Hydrogeologic properties were assigned to saturated sediments beneath the Study Area. These hydrogeologic properties consisted of the following:

- Horizontal hydraulic conductivity of the aquifer;
- Elevation of the bottom of the aquifer.

Values of hydraulic parameters used in the model were based on results of hydraulic tests and a lithologic description of sediments in the Study Area. Based on the results of hydraulic testing conducted by Woodward-Clyde in 1986, the hydraulic conductivity of the aquifer was approximated to be 3.27×10^{-5} centimeter per second (cm/sec). Aquifer tests also indicated that the hydraulic conductivity of the slurry wall was approximated to 9.0×10^{-10} to 3.50×10^{-8} cm/sec.

The elevation of the bottom aquifer zone was estimated using geologic cross-sections based on the existing boring logs. As geological cross-sections indicate (see Figures 3-2 and 3-3), the saturated thickness of the water bearing zone ranges between 30 to 33 feet.

4.1.7 Model Calibration

Model calibration was performed to establish the model as adequately representing the groundwater flow system. The model was calibrated using water level measurement data from individual observation wells. Because the groundwater flow model is a steady-state model intended to be representative of average groundwater flow conditions in the Study Area, average water levels were used for model calibration. Average groundwater elevations at each monitoring well location were calculated based on historical water level measurements.

The groundwater flow model was calibrated by adjusting hydraulic input parameters (e.g., hydraulic conductivity values and boundary conditions) and comparing the resulting simulated values with observed groundwater elevations at each monitoring well location. Table 4-1 presents a comparison between the average measured groundwater elevations and simulated groundwater elevations at monitoring well locations predicted by the calibrated groundwater flow model. As indicated in the table, the average difference between simulated and observed water levels at monitoring locations was .29 ft. Appendix A presents a sample MODFLOW output file.

4.2 Groundwater Chemical Transport Modeling

4.2.1 Model Description

Chemical transport in groundwater was simulated using MT3D, a modular three-dimensional transport model for simulation of advection, dispersion and chemical reactions of contaminants in groundwater systems developed by S.S. Papadopulos & Associates, Inc. (Zheng 1992). MT3D is a finite-difference transport model that uses a mixed Eulerian-Lagrangian approach to the solution of the three-dimensional advective-dispersive-reactive equations in the method of characteristics, the modified method of characteristics, and a hybrid of the two methods, making it uniquely suitable for a wide range of field problems.

MT3D can be used in conjunction with any block-centered finite-difference flow model such as MODFLOW, and is based on the assumption that the flow field is not measurably affected by any change in the concentration field, allowing separate conceptualization and calibration of a flow model.

Water-quality simulations were accomplished in two steps. In the first step, MODFLOW was run to generate the potentiometric head distribution for the single-layer system. The simulated hydraulic heads and other related flow terms for the layer were saved to a data file. In the second step, MT3D was run to simulate the chemical transport. MT3D retrieves the hydraulic heads and the flow and sink/source terms saved by the flow model, automatically incorporating the specified boundary conditions.

4.2.2 Chemical Transport Processes

Advection (flow with the groundwater) is the dominant transport mechanism of dissolved chemicals in groundwater. The two other primary processes that can influence the distribution of chemicals in groundwater are dispersion and sorption. Dispersion results from small-scale variations of groundwater flow velocity and causes spreading of chemicals in a transverse direction or in the direction of groundwater flow. The process of sorption of chemicals onto sediments impedes the transport of those chemicals through soil and groundwater. The effects of sorption were simulated using the retardation coefficient, which is the ratio between calculated groundwater velocity and the apparent chemical velocity in a particular porous medium. The following sections describe how dispersion and sorption processes were simulated in the chemical transport modeling.

4.2.2.1 Dispersion

The dispersion process in MT3D is considered the spreading of contaminants over a greater region than would be predicted solely from the groundwater velocity vectors. Dispersion occurs in both longitudinal and transverse directions to the flow direction. In the simulation, the porous medium was assumed to be isotropic, and molecular diffusion was considered to be negligible relative to dispersion. Input data that control the dispersion process include longitudinal and transverse dispersivity of the water-yielding sediments. The actual measurement of dispersivity values requires intensive field studies and such field data were not available. For modeling purposes, the saturated sediments beneath the Site were assigned values of 50 and 25 feet for longitudinal and transverse dispersivity, respectively.

4.2.2.2 Retardation (Sorption)

MT3D assumes that retardation of contaminant transport is mainly due to sorption, which refers to the mass transfer process between the contaminants dissolved in groundwater (aqueous phase) and the contaminants sorbed on the porous medium (sorbed phase). The retardation of a concentration front in groundwater relative to the bulk mass of water is described by the retardation factor R in the following equation (Zheng 1992):

$$R = 1 + \frac{\rho}{\eta} K_d \qquad \textbf{(Eq. 1)}$$

where

- R = retardation factor (dimensionless)
- ρ = bulk mass density (lb/ft^3)
- η = effective porosity (dimensionless)
- K_d = soil-water partition coefficient (ft^3/lb).

The functional relationship between sorbed and dissolved concentrations, called a sorption isotherm, is classified in MT3D into three types: linear, Freundlich and Langmuir. Linear sorption was used in this simulation.

The linear sorption assumes that there is a linear relationship between the sorbed concentration and the dissolved concentration. The partition coefficients for each chemical were calculated from published values of the organic carbon-water partition coefficient using the following formula:

$$K_d = f_{oc} \times K_{oc} \qquad \textbf{(Eq. 2)}$$

where

- f_{oc} is the fraction of organic carbon content in the porous medium
- K_{oc} is the organic carbon-water partition coefficient.

This approach is based on the assumption that the sorption process is controlled by the organic carbon content of the porous medium. The values of K*d*, K*oc*, and R used in modeling are shown in Table 4-2 for each chemical simulated.

4.2.3 Chemical Source Assumptions Used in Transport Modeling

Important factors in simulating chemical transport in groundwater are the identification of the chemical source area(s) and the rate and duration of release of each chemical into the groundwater flow system. Due to the multitude of possible sources and release times during the Site's operational history, it is probably impossible to identify exactly where chemical source areas are located or to estimate the timing and magnitude of past chemical releases. Accordingly, current observed hot spots in the aquifer were assumed to represent source release locations and conservatively assigned the highest detected concentration for each chemical. In order to reach current conditions, it was conservatively assumed that contaminant releases occurred from the initial date of operations at the site, approximately 70 years ago. The model was run for this period, yielding the concentration of chemicals representing current conditions at locations where monitoring wells are not installed.

To simulate future conditions, it was further assumed conservatively that chemical concentrations in groundwater at monitoring well locations, with elevated contaminant concentrations, would stay constant during the next 30 years due to continuing release of chemicals into groundwater from residual contamination within the saturated sediments. As in the existing condition simulations, the constant concentration for each chemical of potential concern at each monitoring well location was assumed to be the maximum (if the number of data points less than 6) or otherwise the 95% UCL of concentration which has been recorded since the beginning of groundwater monitoring program.

4.2.4 Chemical Transport Simulations

MT3D was used to simulate current and future (after 30 years) chemical concentrations in groundwater assuming that concentrations of the chemicals of potential concern (COPCs; see Section 5.3.1) in groundwater at monitoring well locations remain constant. The use of a non-diminishing source term constitutes a conservative assumption which would be expected to result in an overestimation of future chemical concentrations in groundwater. Given this conservative assumption, the estimated future chemical concentrations in groundwater predicted by MT3D in the 30-year simulations represent a worst-case scenario which assumes that no future groundwater remediation or source removal actions will be implemented and neglects natural processes such as biodegradation and volatilization which would tend to cause concentrations to decrease over time.

Appendix A presents an MT-3D sample output file and a figure for each chemical detected showing simulated concentrations in groundwater after 30 years.

4.3 Estimation of Chemical Emission Rates from Groundwater

Steady-state surface vapor emissions from shallow groundwater underlying the Site were estimated for COPCs using a model developed by Farmer et al. (1980). Farmer's model is a modified application of Fick's Law in which the tortuosity factor of Millington and Quirk (1961) takes into account the reduced flow area and the increased flow pathway of diffusing gas in partially saturated soil.

Farmer's model for the emission rate calculation is:

$$E_i = D_{air}\left(\frac{C_v - C_i}{L}\right)\left(\frac{P_a^{\frac{10}{3}}}{P_t^2}\right) \qquad \textbf{(Eq. 3)}$$

where

E_i = estimated emission rate of chemical i in $mg/(m^2\text{-sec})$
D_{air} = chemical air diffusion coefficient in cm^2/sec
C_v = chemical concentration in vapor phase at depth L in mg/cm^3
C_i = gas phase chemical concentration immediately above the soil surface
L = the thickness of the overlying soil cover in cm
P_a = air-filled porosity of the soil cover in cm^3/cm^3
P_t = total porosity of the soil cover in cm^3/cm^3.

Chemical parameter values used in the calculation are listed in Table 4-3, while soil property values are listed in Table 4-4. The site-specific soil porosity and soil moisture values were obtained from a report by EMCON (1995).

In keeping with the conservative nature of this evaluation, it was assumed that C_i was equal to zero. The vapor concentration of VOCs in the unsaturated soils above the capillary fringe, C_v, was estimated from groundwater concentration using Henry's Law:

$$C_v = H \times C_w \qquad \textbf{(Eq. 4)}$$

where

C_w = chemical concentration in groundwater in mg/cm^3
H = dimensionless Henry's Law coefficient.

Table 4-3 lists Henry's Law and air diffusion coefficients for each COPC.

To facilitate chemical vapor emission rate calculations, SOMA developed a computer program to calculate emission rates using the Modified Fick's Law model for each cell in the finite-difference grid used in contaminant transport modeling. The program reads the groundwater chemical concentration calculated by MT3D for each cell in the finite difference grid, and can calculate and sum emission rates over any area(s) of interest (i.e., one or more specified blocks of finite-difference grid cells). This program was used to calculate the average emission rate for each COPC from groundwater.

4.4 Estimation of Chemical Emission Rates from Soil

The volatile and non-volatile chemical compounds were detected in soils at different depths. Table 4-5 presents the list of chemicals and detected maximum concentrations in soils. Based on the nature of chemicals detected in soil, different mechanisms will be involved for their transport into the ambient air. Volatile organic chemicals are defined as those chemicals having a Henry's Law coefficient greater than 1 x 10^{-5} (atm-m^3/mole) and a molecular weight of less than 200 g/mole (USEPA, 1995). Chemicals such as PCBs, bis(2-ethylhexyl)phthalate, benzo(g,h,i)perylene and pyrene, which were detected in surface soils (at the maximum depth of 2 feet), fall into non-volatile category. These chemicals were considered to become airborne due to wind erosion. The emission rate of non-volatile chemicals were calculated using Cowherd et al.(1984). The chemicals which met the definition of the volatile chemicals were treated as volatile chemicals. The emission rate of volatile chemicals from soil were simulated using Jury's model (1990).

4.4.1 Evaluation of Emission Rate of Non-Volatile Chemicals

The chemicals detected in surface soils become airborne due to the wind erosion and pose an inhalation and dermal contact risk. This is particularly an important transport process for the non-volatile chemicals such as PCBs. To evaluate air chemical concentration of PCBs, bis(2-ethylhexyl)phthalate and benzo (g,h,i)perylene emanating from erodible surface soils and becoming respirable, the emission rate of particulates due to the wind erosion was evaluated. Once the emission rate of particulates containing chemicals were determined, the emission rate of chemicals was estimated.

Cowherd et al. (1984) have developed an analytical model to estimate an annual average emission rate of respirable particulate matter from erodible surfaces. This model has been presented in the California Department of Health Services Site Mitigation Decision Tree (1986) (California Decision Tree) document.

For estimation of particulate emission using the Cowherd et al. (1984) model, a five step process outlined in the California Decision Tree is used. These steps are as follows:

1) Determine soil particulate size distribution mode:

The results of grain size distribution analysis on surface soils was used to determine the soil particulate distribution mode. Based on the reported analysis results, the grain size distribution mode was different from one sample location to another. Therefore, a representative sample for each source area was determined.

2) Determine surface roughness height, Z_0 coefficient:

The roughness height, Z_0 is a measure of the size and spacing of surface irregularities such as trees or buildings which obstruct wind flow. Figure 8.6 of California Decision Tree illustrates the roughness height for various surfaces. The roughness of 0.6 meters representing the urban setting was selected for the site.

3) Estimating threshold friction velocity, U_f

The threshold wind velocity is defined as the wind speed at ground level necessary to initiate soil erosion. Threshold friction velocity, U_f, may be estimated using Figure 8.5 of California Decision Tree. Based on a selected grain size distribution mode, the threshold friction velocity. was selected. As Figure 8.5 of California Decision Tree shows, higher wind speeds are necessary to initiate erosion on soils with larger particle sizes.

4) Estimating threshold wind velocity, U_t:

The threshold wind velocity, , is defined as the wind speed necessary to initiate soil erosion as measured at a wind sensor station, generally seven meters above the ground. The threshold wind velocity may be determined from the threshold friction velocity according to Figure 8.7 of the California Decision Tree. Based on the roughness height of 0.6 meters the ratio of U_t/U_f for different source areas were defined. Figure 4-2 shows different chemical source areas

5) Estimating respirable particulate flux rate:

The Cowherd et al. (1984) equation calculates the annual average emission flux for particulate matter with diameters of less than 10 microns ((PM_{10}) :

$$E_{10} = 0.036(1-v)\left(\frac{U}{U_t}\right)^3 F(X) \qquad \textbf{(Eq. 5)}$$

Where:

E_{10} = flux for total respirable particulate matter (PM_{10}), in g/m^2-hr.

V = fraction of exposed contaminated area which is vegetated, for bare soil v=0. (unitless)

U = mean annual wind speed (m/sec)

U_t = threshold wind velocity (m/sec)

F(X) = a function plotted in Figure 8.8 of Cal Decision Tree, where X= 0.886 (U_t/U).

Equation 5 is based on the following assumptions:

- The soils are erodible in an undisturbed state;
- Soil moisture content is negligible;
- Vertical transport of particles less than 10 micron in diameter is proportional to the cube of the wind speed;
- The wind speed distribution over time for a given site may be represented by a chi squared distribution with two degree of freedom.

The percent of vegetation for the Site was assumed to be negligible (v = 0). This assumption is a conservative assumption and will result in over-estimation of the dust emission rate. The mean annual wind speed (U) at the closest meteorological station (City of Alameda) was used as a representative of wind speed at the Site.

The emission rate chemicals were estimated by:

$$Q_i = f * E_i \qquad \textbf{(Eq. 6)}$$

Where:

Q_i = Chemical flux

f = Mass fraction of chemical in soil

Appendix B presents Figures from the California Decision Tree used in performing the various calculations from steps 1 through 5.

4.4.2 Evaluation of Emission Rate of Volatile Chemicals

An analytical model developed by Jury et al. (1990) was used to calculate emission rates of volatile organic chemicals detected in affected soils. The model is appropriate for situations in which the time-dependent vapor emission rates are to be estimated. The soil is assumed to have been affected by an organic chemical to a given depth, L, with specified initial chemical concentration, C_O.

Three phases of the chemical are considered by the model, including vapor phase, the aqueous phase and the sorbed or solid phase. All three phases are assumed to be in equilibrium with each other, as prescribed by Henry's Law (for the liquid-vapor equilibrium) and linear partitioning in the solid-liquid equilibrium.

The estimated vapor emission rates using Jury's model are based on several loss pathways, such as transport of a chemical species through volatilization at the soil surface, advective transport in soil moisture, and diffusion through air-filled soil pores. The model is based on mass conservation principles. The time-varying depletion of the soil concentration must be taken into consideration since there is only a finite amount of chemical initially present.

The partial differential equation governing chemical transport in vadose zone given by Jury et al. (1990) is:

$$\frac{\partial C_T}{\partial t} + \mu C_T = \frac{\partial}{\partial_z}(D_E \frac{\partial C_T}{\partial_z}) - V_E \frac{\partial C_T}{\partial_z} \qquad \textbf{(Eq. 7)}$$

where

C_T = Total concentration (mg/cm^3 soil)

μ = First order biodegradation rate (day^{-1})

T = Time (day)

z = Depth from ground surface (cm)

V_E = Effective solute velocity (cm/day)

D_E = Effective diffusion coefficient (cm^2/day)

Effective solute velocity, V_E is a variable associated with recharge. The effective diffusion coefficient, D_E is a variable which can be expressed as:

$$D_E = \frac{P^{\frac{10}{3}}{}_a D_{ga} K_h + P^{\frac{10}{3}}{}_w D_{lw}}{P_t^2 (\rho_b f_{oc} K_{oc} + P_w + P_a K_H} \qquad \textbf{(Eq. 8)}$$

where:

P_a	=	Air-filled porosity
P_t	=	Total porosity
P_w	=	Water-filled porosity, or volumetric water content
D_{ga}	=	Gaseous diffusion coefficient in air (cm^2/day)
D_{lw}	=	Liquid diffusion coefficient in water (cm^2/day)
ρb	=	Bulk density of soil (g/cm^3)
K_H	=	Dimension less form of Henry's constant
f_{oc}	=	Organic carbon content
K_{oc}	=	Organic carbon partition coefficient (cm^3/g)

The concentration distribution of the organic chemical can be solved for first, and then the emission rate can be calculated using the following equation:

$$E_i = D_E \frac{\partial C_T}{\partial z} \qquad \textbf{(Eq. 9)}$$

where:

E_i = Emission rate for chemical I (mg/cm^2-day).

Table 4-4 presents the parameter values used in evaluation of the emission rate using Jury's model.

4.5 Air Dispersion Modeling

SOMA used three different models to estimate chemical concentrations in ambient outdoor and indoor air associated with volatilization of chemicals from contaminated groundwater based on the chemical emission rates calculated as described above. To estimate chemical concentrations in on-site indoor air for future-use scenarios involving occupational and residential exposure inside buildings constructed over the groundwater contaminant plume, a simple mass-balance indoor mixing model (Daugherty 1991) was. For areas overlying contaminated groundwater, the "box model" described by Pasquill (1975), a steady-state analytical mass-balance model, was used to estimate concentrations of COPCs in ambient outdoor air. To estimate concentrations of PCBs and non-volatile chemicals in ambient in on- and off-site areas emanating from contaminated soils, the Fugitive Dust Model (FDM) of the U.S. EPA (1990) was utilized. These models are described in the following subsections.

4.5.1 Indoor Air Quality Model

Estimated concentrations of COPCs in on-site indoor air were calculated using the emission rates calculated for these chemicals as described in Section 4.3. Indoor air concentrations were estimated using a simple mass-balance mixing model (Daugherty 1991). This model is based on the following assumptions:

- Vapor-phase chemical emission rates from groundwater are constant through time (steady-state assumption);
- Chemical vapors emitted from groundwater beneath a building are uniformly and instantaneously mixed within the entire air space within the building;
- Indoor air is exchanged with clean outdoor air (zero chemical concentration) at a constant rate.

The model uses the following mass balance equation to estimate the chemical concentration in indoor air resulting from vapor-phase soil emissions:

$$C_{in} = \frac{b \times E \times A}{Q} \qquad \textbf{(Eq. 10)}$$

where

C_{in} = chemical concentration in indoor air (mg/m^3)

b = attenuation factor (unitless)
E = chemical emission rate from soil ($mg/m^2 \times s$)
A = area covered by building (m^2)
Q = ventilation rate (m^3/s).

An attenuation factor of 0.1, representing an order-of-magnitude attenuation of chemical emission rates, was used to account for the effects of the building foundation (i.e., concrete slab construction). The ventilation rate, Q, was calculated assuming an exchange rate of 2 exchanges per hour (ASHRAE Standards (1989)):

$$Q = \frac{A \times h \times R}{C_f} \quad \textbf{(Eq. 11)}$$

where

h = interior height of building
R = exchange rate (= 2.0 hr^{-1})
C_f = unit conversion factor (3600 s/hr)

Estimated indoor air concentrations at present time and after 30 years are presented in Table 4-6. These estimates are based on simulated chemical concentrations in groundwater at current time and after 30 years estimated using the MT3D model as described in Section 4.2.4.

4.5.2 Outdoor Air Quality Modeling

The box model is a control volume approach to calculating air concentrations (Pasquill 1975). This model assumes steady and uniform conditions of dispersion, so that emissions are uniformly distributed throughout a "box" defined by the area of the source and the mixing height.

The box model equation is:

$$C_i = \frac{Q_i}{\frac{H}{2} \times W \times U} \quad \textbf{(Eq. 12)}$$

where:

Ci = the on-site air concentration for chemical i (g/m3)
Qi = the mass flux rate of the chemical i (g/sec)
H = height of the box (mixing height) (m)
W = cross wind width of the area source (m)
U = annual average wind speed (m/sec).

The mass flux rate is calculated by:

$$Q_i = E_i \times A_i \qquad \textbf{(Eq. 13)}$$

where:

E_i = emission rate of chemical i (g/m2-sec)
A_i = current or simulated area of chemical i in groundwater.

The mixing height (H) is estimated using the following equation presented by Pasquill (1975):

$$X = 6.25 \times Z_0 \times [\frac{H}{Z_0}\ln(\frac{H}{Z_0}) - 1.58 \times (\frac{H}{Z_0}) + 1.58] \qquad \textbf{(Eq. 14)}$$

where:

X = downwind distance aligned with wind direction along the site (m)

H = height of the box (m)

Z_0 = roughness height which is used to characterize surface roughness

This expression assumes a neutral stability class (D). At lower stability classes (A, B, and C), the mixing height would be larger, resulting in lower ambient concentrations. At higher stability classes (E and F), the mixing height would be smaller, resulting in higher ambient concentrations.

The height of the box represents the mean vertical height that a vapor molecule would attain after traveling across the entire length of the box. Because exposure to emissions could occur anywhere in the box and not just on the downwind edge, the average air concentration was calculated by using one-half of the calculated box height in the box-model equation. Table 4-7 lists the parameters and their selected values in conducting air quality modeling.

In estimating the height of the box, the roughness height, Z_0, was chosen as 0.60 meters, corresponding to a suburban setting with medium size buildings. This descriptor approximates site conditions. The annual average wind speed and the prevailing direction were obtained from the RISKPRO database. The prevailing wind direction is toward west with an average speed of 3.98 meters per second. Table 4-8 presents the on-site chemical air concentrations of those chemicals that were detected in groundwater/soil .

4.5.3 Fugitive Dust Model (FDM)

The Fugitive Dust Model (FDM) is a computerized air quality model specifically designed for computing airborne concentration and deposition impacts from fugitive dust sources. The sources can be of three types: points, lines or areas. The line source and area source algorithms are based on algorithms in the CALINE3 Model (California Department of Transportation, 1979). The model has not been designed to compute the impacts of buoyant point sources, thus it contains no plume-rise algorithm. The model is generally based on the well-known Gaussian Plume formulation for computing concentrations, and has been specifically adapted to incorporate an improved gradient-transfer deposition algorithm. Emissions for each source are input by the user into a series of particle size classes. A gravitational settling velocity and deposition velocity are calculated by FDM for each class. Concentration and deposition are computed at all user-selected receptor locations.

In the application of FDM, only area sources were used, see Figure 4-2. For area sources, the coordinates of the center of the area and dimensions in the x and y directions were supplied. The meteorological data was input to FDM in the form of STability ARray (STAR) data. STAR data for the Alameda meteorological station was used as the representative STAR data for the Site. STAR data for Alameda was obtained from EPA's Personal Computer Graphical Exposure Modeling Service Database. The Rose diagram for the Alameda Meteorological Station is presented in Figure 4-3.

In order to apply the emission algorithms to particles greater than 10 mm, an airborne particle size distribution was assumed. The size distribution of the suspended fraction cannot be related in any simple manner to the size distribution of the in situ material. In absence of applicable on-site airborne measurements, a particle size distribution was taken from the literature. A composite distribution based on fugitive dust measurement at western surface coal mines (Baskett, 1983) was assumed. Therefore, for this study, the following composite particle size distribution was assumed:

- 22.0 % of the mass was from 20 to 30 μm;
- 38.2 % of the mass was from 10 to 20 μm;
- 25.0 % of the mass was from 5 to 10 μm;
- 11.1 % of the mass was from 2 to 5 μm;
- 3.7% of the mass was less than 2 μm.

Consistent with the concepts traditionally employed by the EPA (USEPA, 1985) for emission factor relationships for other fugitive dust sources, only particles less than 30 μm were simulated. Particles greater than 30 μm in size were not included in the simulations since the fraction of the particles in this size range is small and because it is assumed that these particles cannot travel large distances in air.

A total of four chemical source areas and 441 receptor points were input to the model. The emission rate of chemicals from each source was calculated using Cowherd's model. Source area no. 1 represents the engineered-cap area, where elevated levels of PCBs have been reported. Due to the presence of an engineered-cap, no PCB emission from this area was assumed. Therefore, an assumption is made in this risk assessment document that this area will remain capped and PCBs will never get airborne due to wind erosion. Source area no. 2 represents the concrete slab area, containing elevated levels of PCBs concentration. The 95% upper confidence level (95%UCL) for PCB concentration in this area is 188 ppm. Benzo(g,h,i)perylene and pyrene have been reported in source area no. 2 at .4 ppm and .5 ppm, respectively. Source area no. 3 and 4 represent the areas of the former Westinghouse Buildings 42, 37 and 24. The maximum PCB concentration detected in source area no. 3 is 2.2 ppm. No PCB concentration was detected in source area no. 4. Bis(2-ethylhexyl)phthalate was detected in source area no. 2, 3 and 4.

As Figure 4-2 illustrates, the receptors were located in a 21 x 21 meter grid spacing. The x and y coordinates and elevation of each receptor point was supplied through an input file. FDM was run for each chemical to simulate air chemical concentration at breathing zone of 1.5 meter above the ground. Figures 4-4 through 4-8 show the various simulated chemical concentrations at breathing levels emanating from the uncapped areas using FDM. After the simulation, the maximum on-site air chemical concentration and off-site air chemical concentration at 600 feet down wind direction were recorded. Table 4-9 presents the simulated maximum on- and off-site air concentration of chemicals of potential concern. Appendix A presents a sample FDM input and output file.

5.0 HUMAN HEALTH RISK ASSESSMENT

The purpose of this human health risk assessment is to provide a screening-level approach to evaluating the potential impacts to humans that might result from exposure to soil and groundwater contaminants at the Westinghouse Electric Corporation Facility located in Emeryville, California, for a defined set of exposure assumptions. The results of this risk assessment will provide the basis for making one of the following decisions:

1) No further action,

2) Further investigation required, or

3) The need for removal/remedial action.

The following principal guidance documents were utilized in preparation of the human health risk assessment:

- DTSC, Preliminary Endangerment Assessment Guidance Manual, 1994.
- DTSC, Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities, 1992.
- EPA, Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A), 1989.
- EPA, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors, OSWER Directive 9285.6-03, 1991.
- EPA, Exposure Factors Handbook, 1989.

The human health risk assessment for the Westinghouse site is organized into the following sections:

5.1 Site Scoping Information: summarizes the site history and investigations performed, as well as document known spills, releases, and contamination of both soil and groundwater.

5.2 Scope and Objectives of the Human Health Risk Assessment: summarizes the key objectives of the human health risk assessment for the Westinghouse site.

5.3 Data Evaluation: summarizes the methodology used to evaluate site characterization data and the rationale for selection of the human chemicals of potential concern (COPCs).

5.4 Identification of Potential Exposure Pathways: reviews the conceptual site model in light of existing contamination (i.e., COPCs), identifies the receptors of concern, and identifies all relevant potential exposure pathways.

5.5 Exposure Assessment: describes how human receptors come into contact with COPCs and presents the methodology for estimating how much of a contaminant a person contacts.

5.6 Toxicity Assessment: describes the process of characterizing the relationship between the exposure to a chemical and the incidence of adverse health effects in exposed populations.

5.7 Risk Characterization: estimates the carcinogenic risks and noncarcinogenic health hazards for the identified populations of concern from potential exposures to COPCs in soil and groundwater at the Westinghouse site.

5.8 Conclusions and Recommendations: presents the results of the human health risk assessment and provides the framework for using these results in decision making for the Westinghouse site.

5.1 Site Scoping Information

This section summarizes the site history and investigations performed, as well as document known spills, releases, and contamination of both soil and groundwater. Based on available site information, past facility operations resulted in the contamination of surface soils with polychlorinated biphenyls (PCBs) adjacent to the western side of Building 42. Currently, this entire area is covered by an engineered-cap. Consequently, no complete exposure pathway exists for current land use receptors. Future land use plans will likewise not disturb the existing engineered-cap, other than for drilling potential pilings for any above-cap structure.

High levels of PCBs were detected in the area just north of Building 42, (Figure 3-6A). The contaminated soil is covered by a concrete slab and no potential exists for direct exposure to PCBs in soil under current land use conditions. Low levels of PCBs were also detected in soil samples collected beneath Building 42. Since the contaminated soil is covered by concrete slabs, no potential exists for direct exposure to soils beneath the buildings under current land use conditions. However, soil contaminants will be evaluated under future use exposure scenarios, assuming that the concrete slab and building foundations do not exist.

Groundwater beneath the site is shallow and is encountered approximately 2-6 feet bgs. Chemicals detected in groundwater monitoring wells between 1983 and 1995 are presented in Table 5-2. Because volatile organic chemicals (VOCs) occur just below the surface, on-site receptors could be exposed to volatile emissions in the ambient air both outdoors and inside the existing buildings. Future use exposures would include inhalation of volatile emissions from shallow groundwater. Based on the close proximity to the San Francisco Bay, and the restricted water-yielding capacity of saturated sediments (less than 200 gallon a day) the utilization of groundwater as drinking water would not be likely (i.e., there is no beneficial use of groundwater directly beneath and in the vicinity of the Westinghouse site). Thus, there is no complete exposure pathway for PCBs detected in groundwater.

5.2 Scope and Objectives of the Human Health Risk Assessment

The objectives of the human health risk assessment for the Westinghouse site are the following:

- Identify site-specific COPCs
- Establish a final list of COPCs for evaluation in the human health risk assessment (COPC inclusion/exclusion)
- Identify on-site and off-site human receptors of concern that may be exposed to site-related COPCs (receptor analysis)
- Define reasonable maximum exposure (RME) scenarios for each complete exposure pathway
- Integrate information on sources, release, fate and transport, exposure points, and exposure routes (develop Conceptual Site Model (CSM)
- For each defined exposure scenario, estimate the type and magnitude of exposures to COPCs that are present at or migrating from the site (exposure assessment)
- Assimilate, weigh, and quantitate the available evidence regarding the potential for a particular COPC to result in adverse health effects (toxicity assessment)

- Integrate exposure and toxicity data into quantitative and qualitative estimates of carcinogenic risks and noncarcinogenic health hazards (risk characterization)

- Qualitatively evaluate the uncertainties associated with the estimated human health risks (uncertainty analysis)

5.3 Data Evaluation

All available soil and groundwater site characterization data (see Section 3.3, Previous Investigations and Remedial Activities; Section 3.5, Nature and Extent of Groundwater Contamination; and Section 3.6, Nature and Extent of Soil Contamination) were evaluated according to the EPA Guidance for Data Useability in Risk Assessment (Part A, 1992). Specifically, the following data useability criteria were evaluated:

- Data sources (comparability of data sources if data are combined for quantitative use in the risk assessment)

- Documentation (review the workplan and Sampling and Analysis Plan (SAP))

- Analytical methods and detection limits (to ensure the methods and detection limits are adequate for use in the risk assessment)

- Data quality indicators

5.3.1 Identification of Chemicals of Potential Concern

Chemicals of potential concern (COPCs) were included or excluded for further analysis in the risk assessment based on the following criteria:

- Site history and scoping information

- Frequency of detection

- Adequacy of detection limits (practical quantitation limits (PQLs)

- Evaluation of laboratory/field contamination

Analytes that are infrequently detected and not associated with site operations, spills, or releases, may be artifacts of the sampling and/or analytical methods. For this reason, an anaylte may be eliminated from the final list of COPCs if it is detected in one or more environmental media with a medium-specific detection frequency of less than 5 percent (EPA 1989).

Analytical detection limits were evaluated to ensure that they are adequate to support the needs of a quantitative risk assessment (EPA 1989). Chemicals for which the detection limits may be inadequate will be further evaluated in the uncertainty analysis of the risk assessment (Section 5.7.5). Table 5-1 and 5-2 present the inclusion/exclusion matricies for COPCs in soil and groundwater, respectively, at the Westinghouse site.

5.4 Identification of Potential Exposure Pathways

The primary COPCs identified in on-site soil are volatile organic compounds, semivolatile organic compounds, and PCBs. Contaminated soil is covered by engineered-cap and concrete slabs, thereby eliminating any potential for direct exposure under current land use conditions. As discussed previously, the existing engineered-cap will remain in place under all future land use plans. However, in the future, it is conceivable that the concrete slabs may no longer exist. Then, future on-site receptors could be exposed to soil contaminants through incidental ingestion, dermal contact, inhalation of soil particulates, and inhalation of volatile emissions from soil. In addition, future off-site receptors could be exposed to soil contaminants through inhalation of suspended soil particulates and volatile emissions. Based on the surrounding land use and zoning, this site and the surrounding property will most likely remain as industrial/commercial. Future use exposures will be evaluated for an industrial/commercial exposure scenario (i.e., on-site and off-site worker). However, for comparison purposes, future use exposures will also be evaluated for the residential exposure scenario (i.e., on-site and off-site adults and children).

Groundwater occurs approximately 2-6 feet bgs, and currently, there is no potential for direct contact with groundwater (i.e., ingestion and dermal contact) either on-site, or off-site. However, volatile emissions from groundwater can migrate to the soil surface and into the ambient air providing a potentially complete exposure pathway in air through the inhalation route of exposure. Therefore, potential human receptors both on-site and downwind (e.g., off-site) of the Westinghouse site may be impacted from inhalation of volatile emissions from the groundwater. This risk assessment will evaluate potential inhalation of volatile emissions in both indoor and outdoor air for hypothetical workers (industrial/commercial scenario) and residents (hypothetical adults and children).

5.4.1 Identification of Potential Receptors

Based on the conceptual site model (CSM) presented in Section 3.7 and the description of relevant potential exposure pathways presented above, the following section defines the receptors of concern to be evaluated quantitatively in this human health risk assessment.

Currently, the Westinghouse site and the surrounding land are zoned for industrial/commercial use. There are no potential receptors on-site presently, but in the future, it is possible that the property would remain industrial/commercial. A hypothetical worker was therefore evaluated with potential exposure to site contaminants from ingestion of surface soil, dermal contact with surface soil, inhalation of suspended soil particulates, and inhalation of volatile emissions from soil and groundwater. An indoor worker scenario was evaluated assuming that a commercial building was located directly above the groundwater plume "hot-spot", thereby maximizing potential emissions from both soil and groundwater through the foundation and into the indoor air. An indoor worker scenario was also evaluated for a parking garage assumed to be located directly above the groundwater "hot-spot" (i.e., a parking garage attendant). a construction worker scenario was evaluated that assumed a worst-case exposure of an outdoor worker for a period of three months. Finally, a utility worker was evaluated (i.e., someone who would do routine maintenance, yard-work etc.), which assumed occasional direct exposure to site contaminants for 30 days per year for a total of 10 years. All worker scenarios were based on the engineered-cap remaining in place.

In the future, it is also possible that the property could be developed for residential use. To evaluate this scenario, adult and child receptors (i.e., the RME resident) were assumed to be exposed to site contaminants through ingestion of soil, dermal contact with soil, inhalation of soil particulates, and inhalation of volatile emissions from soil and groundwater. A second residential scenario was also evaluated by assuming that a home was located directly above the groundwater plume "hot-spot", thereby maximizing indoor air concentrations of volatile emissions from soil and groundwater. This scenario did not evaluate direct contact with soil contaminants and would be equivalent to an apartment dweller. All residential scenarios were based on the engineered-cap remaining in place.

5.5 Exposure Assessment

This section describes how human receptors come into contact with chemical contaminants and presents the methodology for determining how much of a contaminant a person contacts. This is accomplished by establishing both exposure scenarios and exposure routes.

5.5.1 Exposure Scenarios to be Evaluated

The number of exposure scenarios to be evaluated in this human health risk assessment is based on both current and future land use conditions, as described in detail previously. The following exposure scenarios were evaluated quantitatively:

Current Use Exposure Scenarios

- Current on-site, outdoor worker
- Current off-site, outdoor worker
- Current off-site, nearest downwind resident

Future Use Exposure Scenarios

- Future on-site, indoor and outdoor worker
- Future on-site, resident and apartment dweller (adult and child)
- Future construction worker
- Future utility worker

The occupational and residential exposure scenarios will be established as reasonable maximum exposure (RME) scenarios. The EPA (1989) defines the RME as the highest exposure that is reasonably expected to occur at a site. The intent of the RME is to estimate a conservative exposure that is still within the range of possible exposures. Intake variables and exposure parameters were selected so that the pathway-specific exposure represented a reasonable maximum set of exposure conditions. RME exposure parameters will be consistent with the EPA guidance on default exposure parameters (EPA 1991).

5.5.2 Exposure Point Concentrations

For soil COPCs, maximum reported soil concentrations of VOCs and semivolatiles were used as representative exposure point concentrations for direct contact (incidental soil ingestion and dermal contact). The 95-percent upper confidence limit (95% UCL) of the PCB surface soil concentration was used as the exposure point concentration for direct contact. The PCB concentrations detected in the soil samples and the 95% UCL PCB soil concentration are presented in Table 5-3. Only PCB concentrations outside of the engineered-cap area were used to estimate the 95% UCL PCB soil concentration (188 mg/kg).

Emission rates and subsequent on-site, indoor and outdoor air concentrations of volatile COPCs were estimated according to the fate and transport modeling described in detail in Sections 4.3 (Estimation of Chemical Emission Rates from Groundwater), 4.4 (Estimation of Chemical Emission Rates from Soil) and 4.5 (Air Dispersion Modeling). Suspension of surface soil COPCs and subsequent on-site air concentrations of soil particulates and COPCs adsorbed to soil particulates were estimated according to the fate and transport modeling described in detail in Section 4.5.3 (Fugitive Dust Model (FDM)). Indoor and outdoor air concentrations of VOCs are summarized in Table 4-6 and Table 4-7. Air concentrations of COPCs from suspension of soil particulates are summarized in Table 4-8.

5.5.3 Estimating Chemical Intake (Dose)

The following equations present the chemical intake from incidental ingestion of soil, dermal contact with soil, and inhalation of air-borne COPCs for both the occupational and residential exposure scenarios defined previously.

Incidental Ingestion Intake (mg/kg-day) = $\frac{C_s * IngR * EF * ED * CF_1}{BW * AT}$

Where,

C_s = Representative COPC soil concentration, mg/kg

IngR = Soil ingestion rate, (mg/day)

- 50 mg/day for a worker (EPA 1991b)
- 100 mg/day for a construction worker (professional judgment)
- 100 mg/day for an adult resident (EPA 1991b)
- 200 mg/day for a child resident (EPA 1991b)

EF = Exposure frequency, (days/year)

- 250 days/year for a worker (EPA 1991b)
- 30 days/year for a utility worker (professional judgment)
- 350 days/year for a resident (EPA 1991b)

ED = Exposure duration, (years)

- 25 years for a worker (EPA 1991b)
- 10 years for a utility worker (professional judgment)
- 0.25 years (3 months) for a construction worker (professional judgment)
- 24 years for an adult resident (EPA 1991b)
- 6 years for a child resident (EPA 1991b)

CF_1 = Conversion factor, 1×10^{-6} kg/mg

BW = Body weight, (kg)

- 70 kg for a worker (EPA 1991b)
- 70 kg for an adult resident (EPA 1991b)
- 15 kg for a child resident (EPA 1991b)

AT = Averaging time, days

- ED * 365 days/year for noncarcinogens
- 70 years * 365 days/year for carcinogens

Dermal Contact Intake (mg/kg-day) = $\frac{C_s * SA * AF * CF_1 * EF * ED}{BW * AT}$

Where,

C_s = Representative COPC soil concentration, mg/kg

SA = Occupational skin surface area for exposure, (cm^2)

- 2685 cm^2 for a worker (derivation of this occupational surface area is presented in Appendix C)
- 2685 cm^2 for a construction worker
- 5000 cm^2 for an adult resident (EPA 1991b)
- 2000 cm^2 for a child resident (EPA 1991b)

AF = Soil-to-skin adherence factor, (mg/cm^2)

- 0.2 mg/cm^2 for a worker (EPA 1991b)
- 1.0 mg/cm^2 for a construction worker (professional judgment)
- 0.2 mg/cm^2 for an adult and child resident (EPA 1991b)

CF_1 = Conversion factor, 1×10^{-6} kg/mg

EF = Exposure frequency, (days/year)

- 250 days/year for a worker (EPA 1991b)
- 30 days/year for a utility worker (professional judgment)
- 100 days/year for an adult resident (EPA 1992)
- 350 days/year for a child resident (EPA 1991b)

ED = Exposure duration, (years)

- 25 years for a worker (EPA 1991b)
- 10 years for a utility worker (professional judgment)

- 0.25 years (3 months) for a construction worker (professional judgment)
- 24 years for an adult resident (EPA 1991b)
- 6 years for a child (EPA 1991b)

BW = Body weight, (kg)

- 70 kg for a worker (EPA 1991b)
- 70 kg for an adult resident (EPA 1991b)
- 15 kg for a child resident (EPA 1991b)

AT = Averaging time, days

- ED * 365 days/year for noncarcinogens
- 70 years * 365 days/year for carcinogens

Inhalation Intake (mg/kg-day) = $\frac{C_a * InhR * EF * ED}{BW * AT}$

Where,

C_a = Estimated COPC concentration in air, mg/m^3

InhR = Inhalation rate, (m^3/day)

- 20 m^3/day for a worker (EPA 1991b)
- 20 m^3/day for an adult resident (EPA 1991b)
- 0.63 m^3/hour for an indoor adult resident (EPA 1989b)
- 10 m^3/day for a child resident (EPA 1991b)
- 0.4 m^3/hour for an indoor child resident (EPA 1989b)

EF = Exposure frequency, (days/year)

- 250 days/year for a worker (EPA 1991b)
- 30 days/year for a utility worker (professional judgment)
- 350 days/year for a resident (EPA 1991b)
- 16.4 hours/day indoors for a resident (EPA 1989b)

ED = Exposure duration, (years)

- 25 years for a worker (EPA 1991b)
- 10 years for a utility worker (professional judgment)

- 0.25 years (3 months) for a construction worker (professional judgment)
- 24 years for an adult resident (EPA 1991b)
- 6 years for a child resident (EPA 1991b)

BW = Body weight, (kg)

- 70 kg for a worker (EPA 1991b)
- 70 kg for an adult resident (EPA 1991b)
- 15 kg for a child resident (EPA 1991b)

AT = Averaging time, days

- ED * 365 days/year for noncarcinogens
- 70 years * 365 days/year for carcinogens

5.6 Toxicity Assessment

This section describes the process of characterizing the relationship between the exposure to an agent and the incidence of adverse health effects in exposed populations. In a quantitative carcinogenic risk assessment, the dose-response relationship of a carcinogen is expressed in terms of a slope factor (oral) or unit risk (inhalation), which are used to estimate the probability of risk of cancer associated with a given potential exposure pathway. Cancer slope factors and unit risk factors as published by EPA (Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) were used in this human health risk assessment.

For noncarcinogenic effects, toxicity data developed from animal or human studies are typically used to develop noncancer acceptable levels, or reference doses (RfDs). A chronic RfD is defined as an estimate of a daily exposure for the human population, including sensitive subpopulations, that is likely to be without appreciable risk of deleterious effects during a lifetime. The chronic reference doses, as published in IRIS (1995) or HEAST (1994), were used in this evaluation.

Table 5-4 summarizes the cancer slope factors, reference doses, and data source for each COPC evaluated in this human health risk assessment.

5.7 Risk Characterization

This section describes the approach used to assess the potential carcinogenic risk and noncarcinogenic health hazard for the populations of concern represented by the chemical contaminants in soil and groundwater at the Westinghouse site. Potential carcinogenic effects will be estimated from the predicted intakes and chemical-specific dose-response information. Potential noncarcinogenic effects will be estimated by comparing the predicted intakes of COPCs to their respective toxicity criteria (i.e., inhalation reference doses (RfD_i)).

5.7.1 Noncarcinogenic Health Effects

In order to estimate the potential effects from exposure to multiple COPCs, the hazard index (HI) approach was used. The HI is defined as the summation of the hazard quotients for each COPC, for each route of exposure, and is represented by the following equation:

$$HI = \frac{\text{Predicted Dose}_a}{RfD_a} + \frac{\text{Predicted Dose}_b}{RfD_b} + \ldots + \frac{\text{Predicted Dose}_i}{RfD_i}$$

A total HI less than or equal to unity is indicative of acceptable levels of exposure for chemicals assumed to exhibit additive health effects. To be truly additive in effect, chemicals must affect the same target organ system or result in the same critical toxic endpoint. A HI less than or equal to 1.0 suggests that adverse health effects would not be expected following a lifetime of exposure, even in sensitive members of the population.

5.7.2 Carcinogenic Health Effects

Quantitative estimates of upper-bound incremental cancer risk due to site-related contamination was evaluated for each COPC according to the following equation:

$$R_i = q_i \times E_i$$

Where,

R_i = Estimated incremental risk of cancer associated with the ith chemical

q_i = Cancer slope factor for the ith chemical, $(mg/kg\text{-}day)^{-1}$

E_i = Exposure dose for the ith chemical, mg/kg-day

For the hypothetical residential use scenario, the exposure dose was the lifetime average daily dose (LADD) equivalent to the cumulative adult and child intake. Carcinogenic risk was assumed to be additive and was estimated by summing the upper-limit incremental cancer risk for all carcinogenic COPCs.

5.7.3 Receptor-Specific Risks and Hazards

The following section presents the estimated carcinogenic risks (Table 5-5) and noncarcinogenic health hazards (Table 5-6) for the hypothetical on-site indoor worker, hypothetical on-site outdoor worker, hypothetical on-site resident, nearest off-site worker, nearest off-site resident, resident visiting a parking garage (located directly above the groundwater "hot spot"), parking garage attendant (located directly above the groundwater "hot spot"), hypothetical construction/excavation worker, and hypothetical utility worker. Detailed dose and risk/hazard calculations are presented in Appendix C.

On-Site Outdoor Worker

The total excess cancer risk for a worker assumed to be exposed to site contaminants from ingestion of soil, dermal contact with soil, inhalation of soil particulates and inhalation of volatile emissions is 6.61×10^{-4}. This estimated cancer risk is almost entirely attributable to PCBs from ingestion and dermal contact (99.99 percent of the overall risk). This estimated risk is above the upper end of the acceptable range of risk as defined by EPA (1×10^{-6} to 1×10^{-4}).

The total hazard for a worker from ingestion of soil, dermal contact with soil, and inhalation of soil particles and volatile emissions is 12.0. This estimated hazard index is attributable to PCBs from ingestion and dermal contact (99.97 percent of the overall hazard). This estimated hazard is well above the accepted health effects criterion of 1.0.

On-Site Indoor Worker

This scenario assumed that a commercial building was placed directly over the groundwater plume "hot-spot", thereby maximizing the emissions of volatiles from soil and groundwater into the indoor air. The total excess cancer risk from inhalation of volatile emissions indoors is 7.56×10^{-6}. This estimated risk is primarily attributable to vinyl chloride (approximately 48 percent of the overall risk), trichloroethylene (approximately 20 percent of the overall risk) and carbon tetrachloride (approximately 21 percent of the overall risk). This total risk from volatile emissions is well within the range of acceptable risk defined by EPA (1×10^{-6} to 1×10^{-4}).

The total noncarcinogenic health hazard for an indoor worker is 2.31×10^{-1}. This hazard index is well below 1.0, and would be considered negligible.

On-Site Resident (RME)

The total excess cancer risk for a residential use scenario assuming exposure to site contaminants from ingestion of soil, dermal contact with soil, and inhalation of soil particles and volatile emissions is 3.04×10^{-3}. This estimated risk is almost entirely attributable to PCBs from ingestion and dermal contact (99.99 percent of the overall risk). This risk estimate is well above the upper end the acceptable range of risk defined by EPA (1×10^{-6} to 1×10^{-4}).

The total noncarcinogenic health hazard for a residential use scenario was estimated to be 156. Again, this hazard index was almost entirely attributable to PCBs from ingestion and dermal contact (99.99 percent of the overall hazard). This hazard index is well above the acceptable criterion of 1.0 for noncarcinogenic health effects.

On-Site, Worst-Case Resident

This exposure scenario assumed that a residential dwelling was placed directly over the groundwater plume "hot-spot", thereby maximizing the indoor air concentration of volatile emissions from soil and groundwater. The only difference between this scenario and the RME resident is that inhalation of volatile emissions accounts for both indoor air and outdoor air terms. The incremental carcinogenic risks from inhalation of indoor and outdoor air are 9.14×10^{-6} and 2.85×10^{-8}, respectively. However, when the soil ingestion, dermal contact and inhalation of soil particulate pathways are included, the total excess cancer risk becomes 3.05×10^{-3}, identical to the RME residential scenario. As for the RME resident, this risk is almost entirely attributable to PCBs from ingestion and dermal contact (approximately 99.6 percent of the overall risk).

The incremental hazards associated with inhalation of volatile emissions in indoor and outdoor air are 4.94×10^{-1} and 2.27×10^{-4}, respectively. When the soil ingestion, dermal contact and inhalation of soil particulate pathways are included, the hazard index becomes 157, identical to the RME resident. As for the RME resident, this hazard is almost entirely attributable to PCBs from ingestion and dermal contact (approximately 99.4 percent of the overall hazard).

Off-Site Resident (Nearest Downwind Resident)

Under both current and future uses of the site, off-site receptors could only be exposed to site-related contaminants through inhalation of volatile emissions from soil and groundwater and through inhalation of wind-blown soil particulates. For the on-site RME resident, the total excess cancer risk from inhalation of volatile emissions (1.08×10^{-7}) and soil particulates (2.21×10^{-7}) was 3.29×10^{-7}, which is below the lower end of the acceptable range of risk defined by EPA (1×10^{-6} to 1×10^{-4}), and would be considered negligible. Due to downwind dispersion, the off-site cancer risks from volatile and particulate emissions would be even less, and would not represent a health threat for the nearest downwind residents.

The total noncarcinogenic health hazard from inhalation of on-site volatile emissions (7.45×10^{-4}) and soil particulates (9.75×10^{-3}) is 1.05×10^{-2}, which would be considered negligible. Consequently, off-site residents are not of concern for potential noncarcinogenic health effects from site-related emissions.

Off-Site Workers (Nearest Downwind Workers)

Under both current and future uses of the site, off-site receptors could only be exposed to site-related contaminants through inhalation of volatile emissions from soil and groundwater and through inhalation of wind-blown soil particulates. For the on-site worker, the total excess cancer risk from inhalation of volatile emissions (5.10×10^{-8}) and soil particulates (1.64×10^{-7}) was 2.15×10^{-7}, which is below the lower end of the acceptable range of risk defined by EPA (1×10^{-6} to 1×10^{-4}), and would be considered negligible. Due to downwind dispersion, the off-site cancer risks from volatile and particulate emissions would be even less, and would not represent a health threat for the nearest downwind workers.

The total noncarcinogenic health hazard from inhalation of on-site volatile emissions (2.28×10^{-4}) and soil particulates (2.98×10^{-3}) is 3.21×10^{-3}, which would be considered negligible. Consequently, off-site workers are not of concern for potential noncarcinogenic health effects from site-related emissions.

Construction Worker Scenario

For a construction worker assumed to be exposed to site contaminants through ingestion of soil, dermal contact with soil, and inhalation of volatile emissions and soil particulates, the total excess cancer risk is 2.65×10^{-5}. This estimated risk is primarily attributable to PCBs from inhalation of maximum likely air-borne soil particulate from mechanical suspension, dermal contact with soil and incidental ingestion of soil (approximately 99.8 percent of the overall risk). This risk estimate is well within the range of the acceptable risk defined by EPA (1×10^{-6} to 1×10^{-4}).

The total noncarcinogenic health hazard was 48 and is almost entirely attributable to PCBs from ingestion, dermal contact, and inhalation (99.99 percent of the overall hazard).

Based on the estimated risk and hazard for a construction worker, appropriate health and safety measures would be needed for any construction/excavation activities taking place in PCB-contaminated soils.

Parking Garage Scenario

This scenario assumed that a parking garage was built directly above the groundwater plume "hot-spot". The total cancer risk for a full-time garage attendant from inhalation of VOCs in indoor air is 1.89×10^{-6}, and is primarily attributable to vinyl chloride (approximately 47 percent of the overall risk), trichloroethylene (approximately 20 percent of the overall risk) and carbon tetrachloride (approximately 21 percent of the overall risk). This risk estimate is at the lower end of the acceptable range of risk defined by EPA (1×10^{-6} to 1×10^{-4}). The total noncarcinogenic health hazard (5.83×10^{-2}) is negligible.

For an on-site resident assumed to spend 10 minutes per day inside the parking garage, the incremental cancer risk from inhalation of VOCs is 2.37×10^{-8}, and would be negligible. Likewise, the incremental noncarcinogenic hazard from inhalation of VOCs inside the parking garage (1.28×10^{-3}) is negligible.

Hypothetical Utility Worker

This scenario assumed an on-site worker who performed infrequent maintenance activities, such as cable installation. For a utility worker exposed to soil contaminants from incidental ingestion, dermal contact, and inhalation of volatile and particulate emissions, the total excess cancer risk was calculated to be 3.17×10^{-5}, which is well within the range of acceptable risk defined by EPA (1×10^{-6} to 1×10^{-4}). This estimated cancer risk is primarily attributable to PCBs from ingestion and dermal contact (approximately 99.99 percent of the overall risk).

The noncarcinogenic health hazard was estimated to be 1.44, which is slightly above the criterion of 1.0 for adverse health effects. As for carcinogenic risk, this hazard index is primarily attributable to PCBs from ingestion and dermal contact.

For comparison purposes, if the utility worker spent all of his time indoors, the incremental carcinogenic risk from volatile emissions indoors was estimated to be 1.93×10^{-7}, which would be considered negligible. The noncarcinogenic health hazard from volatile emissions indoors was estimated to be 2.77×10^{-2}, which would be considered negligible. Consequently, if a utility worker spent all of his time indoors, no adverse health impacts would be anticipated.

5.7.4 Regulatory Context

The EPA, through its Memorandum on the Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (OSWER Directive 9355.0-30) states the following:

> *Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the noncarcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts.*

The regulatory point of departure for cumulative site carcinogenic risks has been 1×10^{-6}. Consequently, the range of risk between 1×10^{-6} and 1×10^{-4} is considered the acceptable risk range, depending upon site-specific and surrounding area considerations.

5.7.5 Uncertainty Analysis

The following section discusses the uncertainties inherent in the fate and transport modeling, estimates of potential exposures for receptors of concern, and the subsequent risk characterization for the Westinghouse site.

5.7.5.1 Uncertainty in Site Characterization and Modeling

In conducting contaminant transport modeling to evaluate the exposure point concentration, a series of conservative assumptions were made in estimating the exposure point concentrations. For instance, MT3D was used to simulate current and future (after 30 years) chemical concentrations in groundwater assuming that concentrations of the chemicals of potential concern (COPCs; see Section 5.3.1) in groundwater at monitoring well locations remain constant. The use of a non-diminishing source term is a conservative assumption which would result in an overestimation of future chemical concentrations in groundwater. Given this conservative assumption, the estimated future chemical concentrations in groundwater predicted by MT3D in the 30-year simulations represent a worst-case scenario which assumes no future groundwater remediation or source removal actions. It neglects natural processes such as biodegradation and volatilization, which would tend to cause concentrations to decrease over time.

The greatest over-estimation of the exposure point concentration stem from over-conservative nature of the models used to calculate fugitive dust emission from the source areas. For instance, the Cowherd et al., (1984) model assumes that the soils containing chemicals are continuously being eroded with steady state rate and become airborne. No provision has been given to slow-down the emission rate of dusts during the wet periods, when the surface soils are not erodible. Another source of uncertainty is related to the heterogeneous nature of the soils and the uneven distribution of chemicals (i.e., PCBs) in the near surface soils. It is possible that during the soil sampling events, no sample would have been collected from the "hot spot" and therefore, the available data would not reflect a realistic condition of the site. These assumptions will most likely over-estimate or under-estimate the true exposure point concentrations.

5.7.5.2 Uncertainty in Exposure, Toxicity, and Risk Characterization

The exposure parameters used to develop the on-site worker and residential exposure scenarios at the Westinghouse site are conservative estimates of the true exposures. The assumed duration of exposure is likely to be much greater than the true duration. For instance, an indoor/outdoor worker is assumed to be exposed to site contaminants 8-hours per day, 250-days per year, for 25 years. In reality, based on Department of Labor statistics regarding average job tenure nationwide, this type of worker would be expected to remain in his/her job less than 10 years. Further, the hypothetical indoor worker is assumed to be exposed to VOC emissions that were conservatively estimated from maximum reported groundwater concentrations. Therefore, assuming exposure to air concentrations of COPCs based on maximum groundwater concentrations and using the conservative exposure parameters provided, the indoor/outdoor worker scenarios are health protective and most likely overestimates the true risk/hazard associated with site-related COPCs in soil and groundwater.

Likewise, the RME/worst-case resident is assumed to be exposed to site-related contaminants from infancy until the age of 30 years. In reality, a typical residential family will not spend 24-hours per day, 350-days per year at home for a lifetime duration of 30 years. As for the indoor and outdoor worker scenarios, the residential exposure scenario is considered to be health protective and most likely an overestimate of the true risk/hazard associated with site-related COPCs. As for the indoor worker, the worst-case resident is assumed to live directly over the groundwater plume 'hot-spot" and to be exposed to VOC emissions that were conservatively estimated from maximum reported groundwater concentrations. These assumptions will most likely overestimate the true indoor air concentrations.

5.8 Estimation of Preliminary Cleanup Goals

Based on the carcinogenic risk and noncarcinogenic health hazard summary tables (Tables 5-5 and 5-6, respectively), almost all of the estimated risk and hazard was attributable to PCBs in soil (greater than 99 percent of the overall risk/hazard). The incremental risk from VOCs in groundwater and soil were acceptable for the indoor worker, worst-case resident, and parking garage attendant; the incremental risk for VOCs from soil and groundwater were negligible for the on-site worker, RME resident, construction worker, and utility worker. Consequently, cleanup levels were estimated only for PCBs in soil. Since the incremental risk and hazard from PCBs through inhalation of soil particulates were negligible, only the soil ingestion and dermal contact routes were considered in estimating soil cleanup levels for PCBs.

Following the EPA guidance for estimating preliminary remediation goals (Prigs) (EPA), the chemical intake equations for incidental ingestion of soil and dermal contact with soil (Section 5.5.3) were combined and rearranged to solve for the concentration term. The reduced equations for the carcinogenic and noncarcinogenic soil cleanup levels are presented below.

Residential Soil Cleanup Level

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{Target Risk}}{(2.60 \times 10^{-6} * SF_o)}$$

Industrial/Occupational Soil Cleanup Level

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{Target Risk}}{(4.56 \times 10^{-7} * SF_o)}$$

Utility Worker Soil Cleanup Level

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{Target Risk}}{(2.19 \times 10^{-8} * SF_o)}$$

A described in Sections 3.6 and 4.4, the 95 percent upper confidence level (95% UCL) of the upper two feet of surface soil was used in conducting the quantitative analysis. This is because COPC were largely detected in surface soils at a maximum depth of two feet and chemical concentrations were greatly reduced below two feet of soil. Therefore, the soil clean-up recommendations were made based on the upper two feet of surface soil. However, the exact depth of soil clean-up will ultimately be determined in the field during the removal action based on results obtained from soil sampling and analysis.

The recommended soil clean-up values are the statistical values of PCB concentrations in soil after removal of the PCB affected hot-spots. The 95% UCL of PCB concentrations in the remaining soils will be used as a criteria for soil remediation. If the 95% UCL of the samples collected are less than the indicated cleanup levels, then the excavation will be terminated.

Table 5-7 summarizes the residential and industrial/occupational soil cleanup levels for PCBs at assigned target risks of 1×10^{-4}, 1×10^{-5}, and 1×10^{-6}. A PCB soil cleanup level of .05 mg/kg for residential use, 0.29 mg/kg for industrial use and 5.93 mg/kg for utility worker use would result in an excess lifetime cancer risk of 1.00E-06. A PCB soil cleanup level of 0.5 mg/kg for residential use, 2.85 mg/kg for industrial use and 59.3 mg/kg for utility worker use would result in an excess lifetime cancer risk of 1.00E-05. A PCB soil cleanup level of 5.0 mg/kg for residential use, 28.5

mg/kg for industrial use and 593 mg/kg for utility worker use would result in an excess lifetime cancer risk of 1.00E-04.

5.9 Conclusions and Recommendations

The following specific conclusions were reached for the Westinghouse site:

- Based on the site specific hydrogeological data, the groundwater flow velocity beneath the site is about 1.13 ft/yr. The results of the chemical transport modeling indicate that the off-site migration of the chemicals detected in groundwater during the next 30 years will be negligible.

- The results of the groundwater flow modeling indicate that groundwater beneath the site would not support significant withdrawal rates (less than 200 gallon a day). This is largely due to the low hydraulic conductivity of the saturated sediments and the presence of the slurry wall surrounding a portion of the site. For this reason, the water bearing zone beneath the site was not considered to be a potential source of drinking water. Therefore, in conducting the HRA, the ingestion of groundwater by a potential future resident and/or occupant was not considered.

- For a hypothetical on-site indoor worker, the carcinogenic risk (7.6×10^{-6}) from inhalation of volatile emissions in indoor air was well within the range of acceptable risk, as defined by EPA (between 10^{-6} and 10^{-4}). The noncarcinogenic health hazard was negligible (2.3×10^{-1}).

- For a hypothetical on-site, outdoor worker assumed to be exposed to site contaminants through soil ingestion, dermal contact, inhalation of volatile emissions, and inhalation of soil particulates, the carcinogenic risk (6.6×10^{-4}) and noncarcinogenic health hazard (12) were unacceptable and attributable to PCBs from ingestion and dermal contact.

- For the RME on-site resident assumed to be exposed to site contaminants through soil ingestion, dermal contact, inhalation of volatile emissions, and inhalation of soil particulates, the carcinogenic risk (3.0×10^{-3}) and noncarcinogenic health hazard (156) were unacceptable and attributable to PCBs from ingestion and dermal contact.

- For the worst-case, on-site resident, assumed to live directly over the groundwater plume "hot-spot", the incremental carcinogenic risk from inhalation of VOCs in indoor air (9.1×10^{-6}) was well within the range of acceptable risk defined by EPA (between 10^{-6} and 10^{-4}). The incremental noncarcinogenic health hazard was negligible (0.5).

- For the worst-case, on-site resident, when soil ingestion, dermal contact, and inhalation of particulates are included, the carcinogenic risk (3.1 x 10^{-3}) and noncarcinogenic health hazard (157) were unacceptable and attributable to PCBs from ingestion and dermal contact.

- For a construction worker assumed to have an exposure duration of 3 months, the carcinogenic risk (2.7 x 10^{-5}) was acceptable and the noncarcinogenic health hazard (48) was unacceptable and primarily attributable to inhalation of PCBs in soil. Consequently, health and safety protection is recommended for any construction/excavation activities in PCB-contaminated soils.

- For the parking garage scenario, the carcinogenic risk for a full-time garage attendant (1.9 x 10^{-6}) is well within the range of acceptable risk defined by EPA (between 10^{-6} and 10^{-4}). The incremental noncarcinogenic health hazard was negligible (5.8 x 10^{-2}).

- Based on the carcinogenic risks and noncarcinogenic health hazards summarized above, almost all of the estimated risk and hazard was attributable to PCBs in soil (greater than 99 percent of the overall risk/hazard).

- The incremental risk from VOCs in groundwater and soil were acceptable for the indoor worker, worst-case resident, and parking garage attendant; the incremental risk for VOCs from soil and groundwater were negligible for the on-site worker, RME resident, and construction worker.

- Removal action/remediation was recommended only for PCBs in surface soils extending to a two feet depth at the Westinghouse site. The remedial action should focus on Source Areas 2 and 3 as shown in Figure 4-2, resulting in the 95% UCL concentration of the remaining soils to be no greater than the recommended cleanup levels (Table 5-7).

6.0 REFERENCES

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Table 3-6
PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
Northwest Portion of Site (Inside Containment Area)		
B-6	1.0	12000
	2.5	7400
	4.0	3800
B-7	1.0	27
	4.0	0.73
	5.5	0.14
	7.0	0.05
	8.5	0.14
B-8	1.0	5000
	2.5	130
	4.0	550
B-9	0.5	37000
	2.5	470
	4.0	2500
B-10	4.0	33
	5.5	<0.05
B-11	2.5	130
	3.5	13
	5.5	0.23
B-12	1.5	480
	3.0	49
	5.0	<0.05
	6.5	<0.05
B-13	2.5	250
	3.0	82
	4.5	54
	5.5	23
B-14	2.5	18
	5.5	<0.05
	8.0	20

Table 3-6

PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
	9.0	<0.05
B-15	3.0	304
	5.0	140
	6.0	300
	8.0	5.0
	11.0	98
B-16	1.0	550
	2.5	4500
	5.0	38
	8.5	0.12
	11.0	<0.05
B-26	6.5	<0.05
	12.0	<0.05
	17.0	<0.05
	27.0	170
	32.0	<0.05
W-2	0.0	240
	0.5	70
	1.0	0.66
	1.5	33
	2.0	2.3
	2.5	3.5
	5.0	4.2
	5.5	<0.05
	6.0	0.56
W-17	6.0	4700
	11.5	300
	16.5	70
	21.5	5.5
	26.5	14
	31.5	0.22
	39.5	0.08
WCC-2	1.0	230
	3.5	31
	6.0	800
	8.5	28

Table 3-6

PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
WCC-4	3.5	100
WCC-5	1.0	3200
	6.0	1300
	11.0	430
	16.0	0.6
	26.0	ND
	36.0	ND
WCC-6	1.0	2.6
	6.0	ND
	8.5	ND
	11.0	ND
WCC-7	2.0	ND
	3.5	ND
	6.0	ND
	8.5	ND
	31.0	ND
WCC-11	1.5	ND
	7.5	ND
	12.5	ND
	20.0	ND
	30.0	ND
	40.0	ND
WCC-12	1.5	2.2
	8.5	220
	13.5	100
	16.0	11
	21.0	ND
	32.0	0.83
	37.0	ND
	42.0	ND
WCC-13	1.5	3.7
	6.0	ND
	11.0	ND
	16.0	ND
	26.0	ND

Table 3-6
PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
	31.0	ND
	41.0	ND
Northwest Portion of Site (Outside Containement Area)		
B-5	1.0	96
	4.5	150
	5.5	1.4
	6.5	0.73
	7.5	<0.05
W-1	2.5	0.17
	3.5	<0.05
	4.0	<0.05
	5.0	0.2
	5.5	<0.05
	7.0	<0.05
W-3	0.5	--
	1.0	25
	1.5	330
	2.0	99
	2.5	51
	3.0	1.4
	3.5	22
	4.0	13
	4.5	0.11
	5.5	1.3
	6.0	<0.05
	7.0	<0.05
	7.5	<0.05
	8.0	0.75
	8.5	<0.05
	9.0	<0.05
WCC-1	1.0	100
	3.5	ND
	6.0	ND
	8.5	ND
WCC-3	1.0	44

Table 3-6
PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
	3.5	ND
	6.0	ND
	10.0	ND
WCC-10	6.0	ND
WCC-14	3.5	ND
	16.0	ND
Under Concrete Slab North of Building		
B-4	1.5	2.7
	3.0	0.23
	5.5	20
	7.5	0.57
	9.0	0.08
	10.5	<0.05
	11.5	<0.05
B-30	2.1	2.4
	6.2	0.11
	8.5	0.09
	14.5	0.11
B-31	1.8	63
	3.8	3.0
	5.9	0.07
	12.0	0.2
	16.5	0.07
B-32	1.9	330
	3.6	0.46
	7.7	1.5
	9.7	<0.05
	14.5	<0.05
B-33	1.4	42
	4.2	120
	5.0	80
B-34	1.0	2.2
	2.1	0.7

Table 3-6
PCB Concentrations Reported in Soil Samples in Northern Portion of Site
Former Westinghouse Apparatus Service Plant, Emeryville, California

Boring ID	Depth (feet)	Concentration (ppm)
	6.0	<0.05
	8.2	<0.05
	9.0	0.11
B-35	1.5	77
	6.0	<0.05
	8.0	<0.05
	10.0	<0.05
B-36	0.5	5.9
	3.0	0.07
	4.8	<0.05
	9.5	<0.05
ES-1	1.0	49
ES-2	1.0	260
	2.5	190
ES-3	1.0	450
	2.5	19

Source of Data: EMCON, 1993, Westinghouse Emeryville Data Summary Report, Figure 3-1.

Table 4-1
Measured versus Simulated Water Levels
Former Westinghouse Facility
Emeryville, Ca

Well ID	Average Measured Water Level (ft MSL)	Simulated Water Level (ft MSL)	Measured minus Simulated Water Level
S-1	8.7	8.9	-0.2
S-2	7.5	7.4	0.1
P-1	7.9	7.6	0.3
P-3	6.7	6.2	0.5
S-3	7.4	7	0.4
S-4	9.9	10.2	-0.3
S-5	9.6	9.3	0.3
S-6	11	10.7	0.3
S-7	8.4	8.7	-0.3
S-8	8.6	8.8	-0.2
Mean Difference			**0.29**

S.S. Papadopulos & Associates, Inc., 1992. MT3D, a Modular Three-Dimensional Transport Model (Version 1.5), Documentation and User's Guide, second revision, March 15, 1992.

U.S. Environmental Protection Agency (U.S. EPA), 1989. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final. EPA/540/1-89/002. December.

U.S. Environmental Protection Agency (U.S. EPA), 1990. User's Guide for the Fugitive Dust Model (FDM) (Revised). EPA-910/9-88-202R. May.

U.S. Geological Survey (USGS), 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, *Techniques of Water-Resources Investigations of the United States Geological Survey*, Book 6, Chapter A1.

Winges, K., 1991. User's Guide for The Fugitive Dust Model (FDM) (Revised) User's Instructions. TRC Environmental Consultants, Inc. Mountlake Terrace, WA 98043. Prepared for Region 10 U.S. Environmental Protection Agency 1200 Sixth Avenue Seattle, Washington 98101. EPA Contract No. 86-02-4399/23

Woodward-Clyde Consultants, 1985. Exterior Remedial Action Plan Specifications and Procedures, July 9, 1985.

TABLES

TABLE 3-1

Summary of Previous Well Installation and Soil Sampling Activities

Report	Borings Drilled	Wells Installed	Soil Samples Collected	Analyses Performed
NORTHWEST PORTION				
Briefing Notebook Brown & Caldwell October 29, 1981	B-4 to B-16	W-1 to W-3	49 surface samples and 84 deeper soil samples	PCBs
Data Colllection and Interpretation Phase 1 - Brown & Caldwell May 1983	B-21, B23 B-25 to B-29	W-17 to W-20 W-22, W-24	12 soil samples	PCBs, total organic carbon
ERM West December 1984 No report available	B-30 to B-41 B-43, B-44	W-42,W-45	No samples for analysis	None
Exterior Remedial Action Plan Specifications and Procedures Woodward Clyde Consultants July 1985	WCC-1 to WCC-14		53 soil samples	PCBs
NORTH OF BUILDING				
Letter - "Test Results from Under Concrete Slabs" Brown & Caldwell August 24, 1984	B-30 to B-36 (no logs)		30 soil samples	PCBs
Letter - "Soil Sampling Beneath Concrete Slab" Westinghouse Electric Corp January 22, 1988		ES-1 to ES-3	5 soil samples	PCBs
Additional Site Assessment EMCON, March 1995	SS-1 to SS-3, SS4B, SS-5 to SS-8		8 soil samples	PCBs, VOCs
FORMER UNDERGROUND STORAGE TANK				
Letter - "Sampling for Underground Storage Tank Removal" Brown & Caldwell April 12, 1988	04-165-2 04-165-3		2 soil samples	Petroleum hydrocarbons
UNDER BUILDING				
Soil Characterization Report EMCON, August 30, 1993	SB-1 to SB-24		45 soil samples	PCBs, HVOCs, HBHCs, BTEX
Soil Characterization, Building 42 EMCON, October 27, 1993	SB-25 to SB-32		16 soil samples	PCBs, HVOCs HBHCs, BTEX

TABLE 3-1

Summary of Previous Well Installation and Soil Sampling Activities

Report	Borings Drilled	Wells Installed	Soil Samples Collected	Analyses Performed
SOUTHERN END OF BUILDING				
Geotechnical and Environmental Assesssment for New Wall Construction Hart Crowser, Inc. February 27, 1992	EB-2		2 soil samples	Petroleum hydrocarbons

EXPLANATION OF ABBREVIATIONS

PCBs - Polychlorinated Biphenyls
VOCs - Volatile Organic Compounds by EPA Method 8240
HVOCs - Halogemated Volatile Organic Compounds by EPA Method 8010
BTEX - Benzene, Tolnene, Ethylbenzene & Total Xylenes by EPA Method 8020
HBHCs - High Boiling Point Hydrocarbons; includes Total Petroleum Hydrocarbons (TPH) as hydraulic oil, diesel, kerosene, jet fuel, & mineral spirits

Table 3-2
Analysis of Groundwater Samples
March 1983

Constituent	Concentrations of Priority Pollutant Organic Chemicals (ug/l)								
	Monitoring Well Number								
	W-1	W-2	W-3	W-17	W-18	W-19	W-20	W-22	W-24
PCBs and pesticides [1]	ND	ND	ND	--	--	--	ND	--	--
Arochlor 1260	--	--	--	32	6	71	--	3	1
Purgeable organics [2]									
Benzene	--	--	3	--	--	--	27	29	1
Chlorobenzene	--	140	39	24	45	--	2,800	90	--
Chloroform	--	--	--	6.1	--	--	--	--	--
Dichloromethane	--	--	--	--	--	340	--	--	--
trans-1,2-Dichloroethylene	--	3	330	--	--	--	44	610	--
Ethylebenzene	--	--	3	--	--	--	--	--	3
Toluene	--	2	4	--	--	--	--	--	7
Trichloroethylene	--	--	12	--	34	--	--	--	--
Vinyl chloride	--	6	44	--	--	--	120	540	--
Base /neutral and acid extractables [3]									
1,1-Dichlorobenzene	ND	--	--	--	--	ND	--	--	ND
1,3-Dichlorobenzene	--	--	--	130	130	--	8	--	--
1,4-Dichlorobenzene	--	14	--	30	48	--	58	15	--
1,2,4-Trichlorobenzene	--	24	--	130	110	--	48	--	--
Bis(2-ethylhexyl)phthalate	--	--	--	--	620	--	130	--	--
Detection limit [1]	<1	<1	<1	<25	<5	<50	<5	<1	<1
Detection limit [2]	<5	<1	<1	<5	<5	<5	<5	<5	<1
Detection limit [3]	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table base on Table 4-1 Westinghouse Emeryville Data Summary Report EMCON, October 1993 originally from Data Collection Investigation, Brown & Caldwell, May 1983 certified analytical reports not available to verify reported concentrations or detection limits or to determine what "--" means.

[1] U.S. Environmental Protection Agency method 608

[2] U.S. Environmental Protection Agency method 624

[3] U.S. Environmental Protection Agency method 625

Table 3-3: Historical Groundwater Monitoring Data Summary, April 1986-November 1994

Compound	Date Sampled	Groundwater Monitoring Wells													
		D-1	D-2	D-3	D-4	D-5	D-6	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Benzene	03/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<0.5	<0.5	1.1	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<5	<0.5	0.8	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<5	<0.5	0.7	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<25	<0.5	1	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	1	<5.0	<1.0	<1.0	<1.0
Chlorobenzene	03/91	<0.5	NM	NM	NM	<0.5	<0.5	3.6	NM	NM	NM	590	<0.5	5.3	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	5.6	NM	NM	NM	540	<0.5	8.0	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	2.5	NM	NM	NM	520	<0.5	6.4	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	6.4	NM	NM	NM	650	<0.5	9.5	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	8	610	<1.0	10	<1.0
1,2-Dichlorobenzene	03/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	82	<1.0	<1.0	NM
	09/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	73	<1.0	<1.0	NM
	03/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	70	<1.0	<1.0	NM
	09/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	96	<1.0	<1.0	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	48	<1.0	<1.0	2.0
1,3-Dichlorobenzene	03/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	600	<1.0	<1.0	NM
	09/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	420	<1.0	<1.0	NM
	03/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	320	<1.0	<1.0	NM
	09/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	510	<1.0	<1.0	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	270	<1.0	<1.0	1.0
1,4-Dichlorobenzene	03/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	420	<1.0	<1.0	NM
	09/91	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	300	<1.0	<1.0	NM
	03/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	240	<1.0	<1.0	NM
	09/92	<1.0	NM	NM	NM	<1.0	<1.0	<1.0	NM	NM	NM	450	<1.0	<1.0	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	240	<1.0	<1.0	<1.0
Trichloroethene	03/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	340	<0.5	<0.5	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	1500	<0.5	<0.5	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	460	<0.5	<0.5	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	500	<0.5	<0.5	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	140	<1.0	<1.0	<1.0
cis-1,2-Dichlororoethene	03/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	34	<0.5	14	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	150	<0.5	10	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	43	<0.5	8.1	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	51	<0.5	<0.5	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	13	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	03/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	19	<0.5	19	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	46	<0.5	16	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	17	<0.5	12	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<25	<0.5	15	NM

Table 3-3: Historical Groundwater Monitoring Data Summary, April 1986-November 1994

Compound	Date Sampled	Groundwater Monitoring Wells													
		D-1	D-2	D-3	D-4	D-5	D-6	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	7	<1.0	<1.0	<1.0
Vinyl Chloride	03/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	4.8	<0.5	23	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	44	<0.5	14	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<5	<0.5	95	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<25	<0.5	16	NM
	11/94	NM	NM	<10	<10	<10	<10	<10	NM	<10	<10	<50	<10	<10	<10
Carbon Tetrachloride	03/91	4.1	NM	NM	NM	35	<0.5	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM
	09/91	3.3	NM	NM	NM	43	<0.5	<0.5	NM	NM	NM	<5	<0.5	<0.5	NM
	03/92	5	NM	NM	NM	19	<0.5	<0.5	NM	NM	NM	<5	<0.5	<0.5	NM
	09/92	3.6	NM	NM	NM	1.6	<0.5	<0.5	NM	NM	NM	<25	<0.5	<0.5	NM
	11/94	NM	NM	<1.0	<1.0	2.0	<1.0	<1.0	NM	<1.0	<1.0	<5	<1.0	<1.0	<1.0
Chloroform	03/91	1.0	NM	NM	NM	20	<0.5	<0.5	NM	NM	NM	1.2	<0.5	<0.5	NM
	09/91	<0.5	NM	NM	NM	2.2	<0.5	<0.5	NM	NM	NM	<5	<0.5	<0.5	NM
	03/92	1.2	NM	NM	NM	9.1	<0.5	<0.5	NM	NM	NM	<5	<0.5	<0.5	NM
	09/92	1.2	NM	NM	NM	0.6	<0.5	<0.5	NM	NM	NM	<25	<0.5	<0.5	NM
	11/94	NM	NM	<1.0	<1.0	<1.0	<1.0	<1.0	NM	<1.0	<1.0	<5	<1.0	<1.0	<1.0
Freon 113	03/91	<0.5	NM	NM	NM	1.0	3.8	<0.5	NM	NM	NM	1.2	<0.5	<0.5	NM
	09/91	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM
	03/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM
	09/92	<0.5	NM	NM	NM	<0.5	<0.5	<0.5	NM	NM	NM	<25	<0.5	<0.5	NM
	11/94	NM	NM	<10	<10	<10	<10	<10	NM	<10	<10	<50	<10	<10	<10
Polychlorinated Biphenyls (PCBs)	04/86	ND	ND	ND	ND	ND	14.3	ND	ND	4	ND	ND	ND	ND	ND
	06/86	ND	ND	ND	ND	ND	1.8	0.8	0.8	1.4	0.8	1.9	1.4	1.5	0.7
	08/86	O.1	ND	ND	ND	0.2	6.7	0.7	0.2	0.1	0.3	0.5	2.7	2.4	0.9
	10/86	ND	ND	ND	ND	ND	3.2	0.9	0.7	0.3	0.3	1.6	2.2	0.5	0.8
	12/86	ND	ND	ND	ND	0.8	8.4	0.8	0.5	0.5	0.5	0.7	2.6	2.4	2.3
	02/87	ND	ND	ND	ND	0.5	5.5	0.8	0.3	0.3	0.2	0.2	0.1	1.1	0.4
	04/87	ND	ND	ND	0.3	ND	1.9	0.6	0.2	0.9	0.3	0.4	1.8	0.4	0.1
	06/87	ND	ND	ND	ND	0.2	6	0.3	0.3	ND	ND	0.4	1.3	0.3	0.2
	08/87	0.4	ND	ND	ND	ND	3.1	ND	ND	ND	ND	0.7	1.2	0.7	ND
	10/87	0.1	ND	ND	0.2	0.3	4.4	0.2	0.1	ND	0.1	0.3	2.4	0.4	ND
	12/87	ND	ND	0.1	ND	0.5	1.8	0.3	ND	ND	ND	0.5	1.3	0.8	0.3
	02/88	ND	0.1	ND	ND	0.4	0.6	0.8	ND	ND	0.2	0.5	1.8	6.9	0.5
	04/88	ND	ND	ND	ND	1.9	1.6	0.2	0.2	0.2	ND	0.9	2.1	1.6	0.2
	06/88	ND	0.1	ND	ND	1.5	3.2	0.2	0.1	0.1	ND	5.7	2.1	1.3	0.1
	08/88	ND	1.5	ND	ND	0.7	4.9	0.3	ND	ND	1.2	1.9	1.2	1.3	ND
	10/88	ND	1.8	0.3	0.2	31	1.4	0.4	ND	0.3	ND	4.4	0.7	4	0.2
	12/88	ND	0.3	0.4	ND	5.2	21.9	0.3	0.2	ND	ND	1.5	6	0.4	ND
	02/89	ND	0.3	0.3	ND	2.8	8	0.3	0.2	ND	ND	1.7	5	1.2	1.1
	04/89	ND	0.2	ND	ND	2.1	8.8	0.5	ND	0.1	ND	0.8	1	1.2	0.2
	06/89	ND	0.7	ND	ND	0.5	3.9	0.6	0.2	ND	ND	0.3	1.1	0.5	ND

Table 3-3: Historical Groundwater Monitoring Data Summary, April 1986-November 1994

Compound	Date Sampled	Groundwater Monitoring Wells													
		D-1	D-2	D-3	D-4	D-5	D-6	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
	08/89	ND	ND	ND	0.2	5.3	4.2	19	0.2	0.1	0.2	2.9	4.3	0.6	ND
	10/89	ND	0.1	0.4	ND	2.7	8.4	0.2	0.2	1.5	ND	4	1.8	2.7	0.4
	12/89	ND	0.3	ND	ND	3	6.7	0.3	ND	0.6	ND	4	2.8	1.9	0.9
	02/90	0.2	0.2	0.2	ND	5	4.5	0.6	ND	0.5	ND	2.2	1	0.9	0.1
	03/91	<0.1	0.2	0.1	<0.1	0.2	1	0.6	0.3	0.5	0.1	1	0.2	3	<0.1
	09/91	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	1.4	0.3	0.6	0.2	1	0.2	1.6	<0.1
	03/92	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.4	<0.1	0.2	<0.1	0.2	0.2	0.4	<1
	09/92	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.5	0.2	<0.1	0.2	0.7	0.4	0.4	<0.1
	03/93	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	0.4	<0.1	<0.1	0.4	<0.1	0.8	<0.1
	09/93	NA	NS	<0.1	NA	0.1	0.3	NA	NS	<0.1	NA	0.3	0.2	0.6	NA
	05/94	NA	NS	<0.1	<0.1	<0.1	0.4	0.2	NS	<0.1	<0.1	0.2	0.2	0.2	<0.1
	11/94	NA	NS	<0.1	<0.1	<0.1	0.8	0.1	NS	<0.1	<0.1	0.2	0.2	0.2	<0.1

All Concentrations in ug/l
ND = Not detected; detection limit not specified
NM = Not measured
NS = not sampled. Well appears to have been destroyed.
NA = Not accessible; well not sampled.
Source of data:
4/86-3/93 EMCON, 1993, Westinghouse Emeryville Data Summary Report
9/93-11/94 EMCON, March 28, 1995, November 1994 Groundwater Monitoring for PCBs

Table 3-4
Results of Soil Samples Collected
from Borings Drilled by EMCON, July 1995
Former Westinghouse Facility
Emeryville, California

Chemical Name	B2-2.0'	B8-2.0'	B9-1.5'	B10-1.5'	B11-1.5'	B14-2.8'	B15-2.0'	B17-2.5'
BIS(2-ETHYLHEXYL)PHTHALATE	**0.3**	ND	ND	**0.4**	**0.3**	**0.5**	**1.3**	**0.7**
FLOURANTHENE	ND	**0.5**	ND	ND	ND	ND	ND	ND
PYRENE	ND	**0.5**	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	**4**	ND	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	**0.5**	ND	ND	ND

Concentrations in mg/Kg (ppm)
Chemicals and borings not listed were not detected
ND = Not Detected

Table 3-5
Results of Grab Groundwater Samples
Taken by EMCON, July 1995
Former Westinghouse Facility
Emeryville, California

CHEMICAL NAME	TP-1	TP-2	TP-3	TP-6
ACETONE	ND	**45.0**	ND	ND
CHLOROFORM	ND	ND	**1.0**	ND
CARBON TETRACHLORIDE	ND	ND	**1.0**	ND
1,4-DICHLOROBENZENE	ND	ND	ND	**3.0**
TPH*	ND	**56.0**	ND	**61.0**
TOLUENE	ND	**0.8**	ND	ND
ETHYLBENZENE	ND	**1.0**	ND	ND
XYLENE, TOTAL	ND	**0.7**	ND	ND
PCB- AROCLOR 1260	**0.4**	ND	ND	**34.0**
ENDOSULFAN II	ND	ND	ND	**2.7**
ENDRIN ALDEHYDE	ND	ND	ND	**1.6**

Concentrations in ug/L (ppb)
No analytes were detected in TP-4 and TP-5
Chemicals not listed were not detected
ND = Not Detected
* TPH as Gasoline

Table 4-2
Chemcial Properties used in Modeling
Former Westinghouse Faciltiy
Emeryville, Ca

Chemical	Henry's Law Coefficient (68For 25C) (atm-m3/mol)	log Koc	Reference
Soil			
1,2- dichlorobenzene	2.40E-03	3.23E+00	Montgomery
1,3- dichlorobenzene	4.70E-03	3.23E+00	Montgomery
1,4- dichlorobenzene	4.45E-03	2.20E+00	Montgomery
2-butanone	4.66E-05	8.99E-02	Nyer
acetone	3.97E-05	-4.30E-01	Nyer
benzo(g,h,i)perylene	1.40E-07	6.89E+00	Nyer
bis (2- ethylhexyl)phthlate	1.10E-05	5.00E+00	Nyer
chlorobenzene	3.93E-03	2.52E+00	Nyer
flouranthene	1.69E-02	4.62E+00	Nyer
PCBs (PCB-1260)	7.10E-03	6.42E+00	Montgomery
pyrene	1.09E-05	5.66E+00	Montgomery
tetrachloroethene (PCE)	2.59E-02	2.56E+00	Nyer
toluene	6.74E-03	2.18E+00	Nyer
Groundwater			
1,2- dichlorobenzene	2.40E-03	3.23E+00	Montgomery
1,3- dichlorobenzene	4.70E-03	3.23E+00	Montgomery
1,4- dichlorobenzene	4.45E-03	2.20E+00	Montgomery
benzene	2.30E+02	2.00E+00	Nyer
carbon tetrachloride	1.28E+03	2.64E+00	Nyer
chlorobenzene	1.45E+02	2.52E+00	Nyer
chloroform	1.71E+02	1.64E+00	Nyer
cis- 1,2- dichloroethene (1,2 -DCE)	1.60E+02	1.77E+00	Nyer
freon 113	8.26E-02	2.48E+00	Nyer
PCBs (PCB-1260)	7.10E-03	6.42E+00	Montgomery
trans- 1,2- dichloroethene	5.32E-03	6.74E-03	Nyer
trichloroethene (TCE)	5.44E+02	2.10E+00	Nyer
vinyl chloride	3.55E+05	3.90E-01	Nyer

Table 4-3
Chemical Propertis Used in Vapor Emission Rate Calculations
Former Westinghouse Facility
Emeryville, California

Chemical Name	Henry's Law Coefficient (at 25 oc) (atm-m3/mol)	Ref	Henry's Law Coefficient (at 25 oc) (Dimensionless)	Air Diffusion * Coefficient (at 25 oc) (cm2/sec)	Air Diffusion Coefficient m2/day	Koc (ml/g)
1,2-Dichlorobenzene	2.400E-03	A, ^	9.822E-02	6.353E-02	5.489E-01	1.698E+03
1,3-Dichlorobenzene	4.700E-03	A, ^	1.923E-01	6.353E-02	5.489E-01	1.698E+03
1,4-Dichlorobenzene	4.450E-03	A, ^	1.821E-01	6.353E-02	5.489E-01	1.585E+02
Acetone	3.970E-05	A,^	1.625E-03	1.031E-01	8.908E-01	3.720E-01
Benzene	5.590E-03	B,C	2.288E-01	8.715E-02	7.530E-01	1.000E+02
benzo(g,h,i)perylene	1.400E-07	A,^	5.730E-06	4.330E-02	3.741E-01	7.762E+06
Bis(2-ethylhexyl)phthalate	1.100E-05	A	4.502E-04	3.897E-02	3.367E-01	1.000E+05
Carbon Tetrachloride	2.400E-02	A, #	9.822E-01	7.976E-02	6.891E-01	4.365E+02
Chlorobenzene	3.930E-03	A	1.608E-01	7.198E-02	6.219E-01	3.311E+02
Chloroform	2.900E-03	A	1.187E-01	8.900E-02	7.689E-01	4.365E+01
cis-1,2-Dichloroethylene	2.100E-02	A	8.594E-01	7.914E-02	6.169E-01	5.888E+01
Ethylbenzene	8.680E-03	A, #	3.552E-01	6.672E-02	5.765E-01	2.570E+02
Fluoranthene	1.690E-02	A,^	7.534E-01	6.659E-02	5.753E-01	4.169E+04
Freon 113	8.260E-02	D, ^	3.380E+00	5.627E-02	4.862E-01	3.020E+02
MEK	4.660E-05	A,^	1.908E-03	8.951E-02	7.734E-01	1.230E+00
PCBs (PCB-1260)	7.100E-03	A, ^	2.906E-01	4.004E-02	2.560E-02	2.630E+06
Pyrene	1.090E-05	A,^	4.462E-04	5.062E-02	4.374E-01	4.571E+05
Tetrachloroethylene	2.590E-02	B	1.060E+00	7.294E-02	6.302E-01	3.630E+02
Toluene	6.740E-03	A	2.758E-01	7.834E-02	6.769E-01	1.148E+02
trans-1,2-Dichloroethylene	5.320E-03	A	2.177E-01	7.914E-02	6.169E-01	5.888E+01
Trichloroethylene	1.170E-02	A	4.788E-01	8.122E-02	7.017E-01	1.259E+02
Vinyl chloride	2.700E-02	C	1.105E+00	1.074E-01	9.275E-01	2.450E+00
Xylene	5.270E-03	A	2.157E-01	7.169E-02	6.194E-01	1.288E+02

(A) Groundwater Chemicals Desk Reference, John H. Montgomery and Linda M. Welkom
(B) Basics of Pump-and-Treat, Ground-Water Remediation Technology, EPA 600/8-90/003 March 1990.
(C) Superfund Public Health Evaluation Manual, EPA/540/1-86/060.
(D) EPA's PCGEMS Data Base
(*) Superfund Exposure Assessment Manual, EPA/540/1-88/00, OSWER Directive 9285.5-1, April 1988.
(#) air diffusion coefficient is average at 20oc
(^) air diffusion coefficient calculated by: Di = (D,benzene)*(MW,benzene/MWi)^1/2, at 25oc

Table 4-4
Soil Properites Used in the Vapor Emission Rate Calculations
Former Westinghouse Facility
Emeryville, California

Parameter	Definition	Value	Units
p	Dry Soil Bulk Density	1.569	g/cm3
Pt	Total Soil Porosity	0.408	cm3/cm3
P1	Volumetric Water Content	0.314	cm3/cm3
G	Gravimetric Water Content	0.2	gr/gr
Pa	Air Filled Porosity	0.094	cm3/cm3
foc	Organic Carbon Content	0.00942	gr/gr

Table 4-5
Chemicals Detected in Soil
(from 1991 to 1995)
Former Westinghouse Facility
Emeryville, Ca

Chemical Name	Maximum Concentration (ppm)
1,2-dichlorobenzene	0.4
1,2,4-trichlorobenzne	0.5
1,3-dichlorobenzene	6.6
1,4-dichlorobenzene	15
2-butanone	0.046
acetone	0.1
benzo(g,h,i)perylene	0.4
bis (2- ethylhexyl)phthlate	1.3
chlorobenzene	1.8
flouranthene	0.5
PCBs (PCB-1260)	15
pyrene	0.5
tetrachloroethene (PCE)	0.0007
toluene	0.006

Table 4-6
Simulated Vapor Emission Rates and Indoor Air Concentrations of Chemicals Detected in Groundwater & Soil
Former Westinghouse Facility
Emeryville, Ca

Chemical	Henry's Law Coefficient (dimensionless)	Air Diffusion Coefficient (m2/sec)	Groundwater Maximum concent. (mg/m3)	Groundwater Emission (mg/m2-sec)	Soil Emission (mg/m2-sec)	Indoor Air Concentration (mg/m3)
1,2-Dichlorobenzene	9.820E-02	6.35E-06	9.60E+01	7.426E-08	1.55E-07	5.48E-06
1,3-Dichlorobenzene	1.920E-01	6.35E-06	6.00E+02	9.074E-07	3.15E-07	6.69E-05
1,4-Dichlorobenzene	1.820E-01	6.35E-06	4.20E+02	6.021E-07	8.34E-07	4.44E-05
2-Butanone	1.908E-03	7.73E-06	ND	ND	3.72E-07	2.74E-05
Acetone	1.625E-03	8.91E-06	ND	ND	3.88E-07	2.86E-05
Benzene	2.290E-01	8.72E-06	1.10E+00	2.725E-09	ND	2.01E-07
Carbon Tetrachloride	1.230E+00	7.976E-06	4.30E+01	5.233E-07	ND	3.86E-05
Chlorobenzene	1.610E+00	7.20E-06	6.50E+02	9.346E-06	1.35E-07	6.89E-04
Chloroform	1.190E-01	8.90E-06	2.00E+01	2.627E-08	ND	1.94E-06
cis-1,2-Dichloroethylene	8.590E-01	7.14E-06	1.50E+02	1.141E-06	ND	8.42E-05
Flouranthene	7.534E-01	5.75E-06	ND	ND	2.00E-08	1.48E-06
Freon	3.380E+00	5.63E-06	3.80E+00	8.970E-08	ND	6.62E-06
PCB's	2.910E-01	2.96E-07	2.19E+01	2.340E-09	ND	1.73E-07
Tetrachloroethylene (PCE)	1.060E+00	7.29E-06	ND	ND	8.45E-07	6.23E-05
Toluene	2.076E-01	6.77E-06	ND	ND	8.67E-07	6.40E-05
trans-1,2-Dichloroethylene	2.180E-01	7.14E-06	4.60E+01	8.882E-08	ND	6.55E-06
Trichloroethylene (TCE)	4.760E-01	8.12E-06	1.50E+03	7.192E-06	ND	5.31E-04
Vinyl Chloride	1.100E+00	1.07E-05	4.40E+01	6.424E-07	ND	4.74E-05

ND = Not Detected

Table 4-7
Parameters Used in Box (Ambient Air) Model
Former Westinghouse Facility
Emeryville, California

Parameters	Definition/Source	Value	Units
z	Roughness Height, California Site Mitigation Decision Tree Manual	0.6	m
U	Average Wind Speed at Alameda, California	3.98	m/s
X	Length of Site along the Priamary Wind Direction	147	m
H	Height of the Box in Pasquill Eq.	14.24	m
W	Width of the Site, Perpendicular to the Primary Wind Direction	73.5	m

Table 4-8
Mass Flux Rates and Ambient Air Concentrations of Chemicals Due to Volatilization from Groundwater & Soil
Former Westinghouse Facility
Emeryville, California

Chemical	Soil			Groundwater		
	Emission (mg/m2sec)	Area (m2)	Mass Flux (mg/sec)	Mass flux (mg/sec)	Qi Total Mass Flux (mg/sec)	Outdoor Air Concentration using Box Model (mg/m3)
1,2-Dichlorobenzene	1.55E-07	6.10E+02	9.45E-05	1.64E-05	1.11E-04	5.33E-08
1,3-Dichlorobenzene	3.15E-07	1.21E+03	3.82E-04	1.96E-04	5.78E-04	2.78E-07
1,4-Dichlorobenzene	8.34E-07	6.10E+02	5.08E-04	1.39E-04	6.47E-04	3.11E-07
2-Butanone	3.72E-07	3.05E+03	1.13E-03	ND	1.13E-03	5.45E-07
Acetone	3.88E-07	1.21E+03	4.70E-04	ND	4.70E-04	2.26E-07
Benzene	ND	ND	ND	1.27E-06	1.27E-06	6.10E-10
Carbon Tetrachloride	ND	ND	ND	1.37E-04	1.37E-04	6.58E-08
Chlorobenzene	1.35E-07	4.88E+03	6.58E-04	2.16E-04	8.74E-04	4.20E-07
Chloroform	ND	ND	ND	1.98E-04	1.98E-04	9.51E-08
cis-1,2-Dichloroethylene	ND	ND	ND	3.39E-04	3.39E-04	1.63E-07
Flouranthene	2.00E-08	6.10E+02	1.22E-05	ND	1.22E-05	5.86E-09
Freon	ND	ND	ND	6.22E-06	6.22E-06	2.99E-09
PCB's	ND	ND	ND	1.18E-05	1.18E-05	5.67E-09
Tetrachloroethylene (PCE)	8.45E-07	6.10E+02	5.15E-04	ND	5.15E-04	2.47E-07
Toluene	8.67E-07	6.10E+02	5.29E-04	ND	5.29E-04	2.54E-07
trans-1,2-Dichloroethylene	ND	ND	ND	3.55E-05	2.44E-04	1.17E-07
Trichloroethylene (TCE)	ND	ND	ND	1.70E-03	1.13E-02	5.44E-06
Vinyl Chloride	ND	ND	ND	4.38E-03	4.97E-03	2.39E-06

ND = Not Detected

Table 4-9
Maxiumum On-Site and Off-Site Ambient Air Concentrations
Under Capped and Uncapped Conditions
Former Westinghouse Facility
Emeryville, California

UNDER CURRENT CONDITIONS (WITH CAP)			
Chemical	Maximum On-site Ambient Air Concentration	Maximum Off-Site Ambient Air Concentration at 600' Downwind (closest residential unit)	Units
PCBs	1.61E+00	9.00E-02	ng/m3
Bis(2-ethyhexy)phthalate	7.10E-01	1.00E-01	ng/m3
Fluoranthene	4.36E+00	1.90E-01	pg/m3
Pyrene	4.36E+00	1.90E-01	pg/m3
Benzo(g,h,i)perylene	3.49E+00	1.80E-01	pg/m3

Table 4-10
Mass Flux Rates and Ambient Air Concentrations of Chemicals Due to Volatilization from Soil
Former Westinghouse Facility
Emeryville, California

Chemical	Maximum Concentration (ppm)	Emission (mg/m2sec)	Area (m2)	Mass Flux (mg/sec)
1,2-Dichlorobenzene	4.00E-01	1.55E-07	6.10E+02	9.45E-05
1,3-Dichlorobenzene	6.60E+00	3.15E-07	1.21E+03	3.82E-04
1,4-Dichlorobenzene	1.50E+01	8.34E-07	6.10E+02	5.08E-04
2-Butanone	4.60E-02	3.72E-07	3.05E+03	1.13E-03
Acetone	1.00E-01	3.88E-07	1.21E+03	4.70E-04
Chlorobenzene	1.80E+00	1.35E-07	4.88E+03	6.58E-04
Flouranthene	5.00E-01	2.00E-08	6.10E+02	1.22E-05
Tetrachloroethylene (PCE)	7.00E-03	8.45E-07	6.10E+02	5.15E-04
Toluene	6.00E-03	8.67E-07	6.10E+02	5.29E-04

Table 5-1
Inclusion/Exlusion Matrix for Soil COPCs
Former Westinghouse Facility
Emeryville, California

Chemicals of Potential Concern	Inclusion/Exclusion Matrix
1,2-dichlorobenzene	I
1,2,4-trichlorobenzne	E1
1,3-dichlorobenzene	I
1,4-dichlorobenzene	I
2-butanone	I
acetone	I
benzo(g,h,i)perylene	I
bis (2- ethylhexyl)phthlate	I
chlorobenzene	I
flouranthene	I
PCBs (PCB-1260)	I
pyrene	I
tetrachloroethene (PCE)	I
toluene	I

I = Included as a chemical of potential concern (COPC)

E1 = Excluded as a COPC (infrequency detected (less than 5 percent) and the reported concentration is at or slightly above the detection limit)

Table 5-2
Inclusion/Exlusion Matrix for Groundwater COPCs
Former Westinghouse Facility
Emeryville, California

Chemicals of Potential Concern	Inclusion/Exclusion Matrix
1,2-dichlorobenzene	I
1,3-dichlorobenzene	I
1,4- dichlorobenzene	I
acetone	E1
benzene	I
carbon tetrachloride	I
chlorobenzene	I
chloroform	I
cis- 1,2- dichloroethene (1,2 -DCE)	I
endosulfan II	E2
endrin aldehyde	E2
ethybenzene	E1
freon 113	I
PCBs (PCB-1260)	E2
toluene	E1
trans- 1,2- dichloroethene	I
trichloroethene (TCE)	I
vinyl chloride	I
xylene, total	E1

I = Included as a chemical of potential concern (COPC)

E1 = Excluded as a COPC (infrequency detected (less than 5 percent) and the reported cencentration is at or slightly above the detection limit

E2 = Excluded (analyte is not considerred volatile and there is no complete pathway for the direct contanct)

Table 5-3
PCB Concentrations in Soil Samples in Northern Portion of the Site (Uncapped Area)
95% Upper Confidence Limit for Measurements Between 0 - 2.5 feet
Fomer Westinghouse Facility
Emeryville, California

BORING ID	Depth (ft)	Concentration (ppm)
B-5	1.0	96
B-4	1.5	2.7
B-30	2.1	2.4
B-31	1.8	63
B-32	1.9	330
B-33	1.4	42
B-34	1.0	2.2
B-35	1.5	77
B-36	0.5	5.9
ES-1	1.0	49
ES-2	1.0	260
ES-3	1.0	450
mean		115
std. dev		149
n		12
t(0.95,n-1)		1.70
UCL 95%		188

Soil samples sampled below 2.5 feet are not listed
ND=Not detected; detection limit not specified
Source of Data:
EMCON, 1993, Westinghouse Emeryville Data Summary Report, Figure 3-1.

Table 5-4
Carcinogenic and Noncarcinogenic Human Toxicity Criteria
Westinghouse Site
Emeryville, California

	Criteria for Noncarcinogens				Criteria for Carcinogens			
Chemicals of Potential Concern (COPCs)	Oral RfD (mg/kg-day)	Source	Inhalation RfD (mg/kg-day)	Source	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Source	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Source
Volatiles								
Acetone	1.00E-01	*a*	1.00E-01	*b*	N/A		N/A	
Benzene	ND		ND		1.00E-01	*c*	1.00E-01	*c*
2-Butanone (MEK)	6.00E-01	*a*	2.90E-01	*a*	N/A		N/A	
Chlorobenzene	2.00E-02	*a*	5.70E-03	*d*	N/A		N/A	
Chloroform	1.00E-02	*a*	1.00E-02	*b*	1.90E-02	*c*	3.10E-02	*c*
1,2-Dichlorobenzene (1,2-DCB)	9.00E-02	*a*	5.70E-02	*e*	N/A		N/A	
1,3-Dichlorobenzene (1,3-DCB)	9.00E-02	*f*	5.70E-02	*f*	N/A		N/A	
1,4-Dichlorobenzene (1,4-DCB)	2.30E-01	*b*	2.30E-01	*a*	4.00E-02	*c*	4.00E-02	*c*
cis-1,2-Dichloroethylene (cis-1,2-DCE)	1.00E-02	*d*	1.00E-02	*b*	N/A		N/A	
trans-1,2-Dichloroethylene (trans-1,2-DCE)	2.00E-02	*a*	2.00E-02	*b*	N/A		N/A	
Freon 113	5.70E-02	*b*	5.70E-02	*a*	N/A		N/A	
Tetrachloroethylene (PCE)	1.00E-02	*a*	1.00E-02	*b*	5.10E-02	*c*	2.10E-02	*c*
Trichloroethylene (TCE)	6.00E-03	*g*	6.00E-03	*b*	1.50E-02	*c*	1.00E-02	*c*
Toluene	2.00E-01	*a*	1.10E-01	*d*	N/A		N/A	
Vinyl chloride	ND		ND		2.70E-01	*c*	2.70E-01	*c*
Semivolatiles								
Polychlorinated biphenyls	2.00E-05	*a,h*	2.00E-05	*b,h*	7.70E+00	*c*	7.70E+00	*c*
Benzo(g,h,i-)perylene	ND		ND		ND		ND	
Bis(2-ethylhexyl)phthalate	2.00E-02	*a*	2.00E-02	*b*	8.40E-03	*c*	8.40E-03	*c*
Fluoranthene	4.00E-02	*a*	4.00E-02	*b*	N/A		N/A	
Pyrene	3.00E-02	*a*	3.00E-02	*b*	N/A		N/A	

a USEPA Integrated Risk Information System (IRIS), September 1995.

b Route-to-route extrapolation.

c California Environmental Protection Agency (Cal-EPA), Office of Environmental Health Hazard Assessment (OEHHA)

d USEPA Health Effects Assessment Summary Tables (HEAST), 1994.

e Withdrawn from IRIS; represents last published value.

f Reference doses for 1,2-DCB were used as surrogate criteria for 1,3-DCB.

g USEPA Environmental Criteria and Assessment Office (ECAO)

h Aroclor 1254 was used as a surrogate fpr the oral and inhalation RfDs

ND No published data were available (Cal-EPA, IRIS, HEAST, ECAO)

Table 5-6
Summary Table of Noncarcinogenic Health Hazards for Receptors of Concern at the Westinghouse Site

Receptor of Concern	Hazard Indicies: Inhalation of Volatile Emissions: Indoor Air [1]	Hazard Indicies: Inhalation of Volatile Emissions: Outdoor Air	Hazard Indicies: Inhalation of Soil Particulates	Hazard Indicies: Incidental Ingestion of Soil	Hazard Indicies: Dermal Contact with Soil	Total Hazard Index
Indoor Worker [2]	2.31E-01	N/A	N/A	N/A	N/A	**2.31E-01**
On-Site Outdoor Worker [3]	N/A	2.28E-04	2.98E-03	4.60E+00	7.41E+00	**1.20E+01**
On-Site Resident [4]	5	7.45E-04	9.75E-03	1.20E+02	3.61E+01	**1.56E+02**
On-site, Worst-Case Resident [6]	4.94E-01	2.27E-04	9.75E-03	1.20E+02	3.61E+01	**1.57E+02**
On-Site Resident, Apartment Dweller [7]	4.94E-01	2.27E-04	N/A	N/A	N/A	**4.94E-01**
Construction Worker [8]	N/A	2.28E-04	1.84E+00	9.20E+00	3.70E+01	**4.80E+01**
On-Site Resident/Parking Garage [9]	1.28E-03	N/A	N/A	N/A	N/A	**1.28E-03**
Parking Garage Worker [10]	5.83E-02	N/A	N/A	N/A	N/A	**5.83E-02**
On-Site Utility Worker [11]	2.77E-02 [12]	2.74E-05	3.58E-04	5.52E-01	8.89E-01	**1.44E+00**

[1] Emissions were based on an assumed location directly above the groundwater plume "hot-spot" (just north of the "asphalt cap").
[2] Hypothetical worker inside an assumed structure placed directly above the groundwater plume "hot-spot" (just north of the "asphalt cap").
[3] Hypothetical worker assumed to spend the entire workday outdoors within the boundary of the site.
[4] Hypothetical RME resident assumed to be exposed to soil contaminants and site emissions in ambient air
[5] Indoor air was assumed to be the same as the ambient air concentration of VOCs at the site.
[6] Worst-case hypothetical resident assumed to live directly above the groundwater plume "hot-spot" (just north of the "asphalt cap").
[7] Apartment dweller is assumed to only have exposure to volatile emissions indoors and outdoors.
[8] Construction activities were assumed to occur for a duration of 3 months.
[9] On-site resident was assumed to spend 10-minutes per day inside a garage located directly above the groundwater plume hot-spot (just north of the "asphalt cap").
[10] Hypothetical parking garage attendant assumed to spend an 8-hour workday inside the parking garage located directly above the groundwater plume "hot-spot" (just north of the "asphalt cap").
[11] On-site utility worker was assumed to spend 30 days/year for 10 years for minimal trenching and cable installations.
[12] Assumes that the utility worker spends all his time indoors.

Table 5-7
Risk-Based PCB Soil Cleanup Levels for Residential and Occupational Land-Use Scenarios

Ina Ubes Apartment / no direct soil

Excess Lifetime Cancer Risk	Residential Risk-Based PCB Soil Cleanup Level (mg/kg)	Industrial/Commercial Risk-Based PCB Soil Cleanup Levels (mg/kg)	Utility Worker Risk-Based PCB Soil Cleanup Levels (mg/kg)
1.00E-06	5.00E-02	2.85E-01	5.93E+00
→ 1.00E-05	5.00E-01	2.85	5.93E+01
1.00E-04	5	2.85E+01	5.93E+02

	.5 ppm ↓ walk-away	3 ppm Deed notification.	60 ppm ↓ note

chase down 2 feet.
if still there @ 2ft.
then.

A:\PCBPRG.XLS
Rev. 1: 01/19/96

	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36				
0 1	8.098	8.120	8.148	8.179	8.212	8.244	8.277	8.311	8.346	8.381
	8.417	8.455	8.493	8.532	8.572	8.612	8.653	8.694	8.736	8.777
	8.820	8.863	8.909	8.960	9.020	9.073	9.119	9.154	9.179	9.201
	9.222	9.241	9.258	9.274	9.287	9.296				
0 2	8.054	8.091	8.125	8.159	8.193	8.227	8.262	8.297	8.332	8.369
	8.405	8.443	8.481	8.520	8.559	8.599	8.639	8.679	8.719	8.759
	8.800	8.841	8.885	8.929	8.982	9.036	9.101	9.144	9.165	9.186
	9.207	9.226	9.245	9.262	9.278	9.293				
0 3	8.022	8.063	8.102	8.138	8.174	8.210	8.246	8.282	8.319	8.355
	8.393	8.430	8.469	8.507	8.546	8.586	8.625	8.664	8.703	8.741
	8.779	8.817	8.860	8.919	8.966	8.991	9.065	9.128	9.150	9.171
	9.192	9.213	9.233	9.251	9.269	9.287				
0 4	7.997	8.039	8.080	8.118	8.156	8.193	8.230	8.267	8.304	8.342
	8.380	8.418	8.456	8.495	8.533	8.572	8.611	8.649	8.687	8.723
	8.758	8.788	8.853	8.920	8.950	8.976	9.046	9.112	9.134	9.157
	9.179	9.201	9.222	9.242	9.261	9.280				
0 5	7.975	8.018	8.059	8.099	8.138	8.176	8.214	8.252	8.290	8.328
	8.366	8.404	8.443	8.482	8.520	8.559	8.597	8.635	8.672	8.707
	8.740	8.769	8.840	8.912	8.939	8.965	9.031	9.096	9.119	9.142
	9.166	9.189	9.211	9.233	9.254	9.274				
0 6	7.955	7.998	8.040	8.081	8.121	8.160	8.199	8.237	8.276	8.314
	8.353	8.391	8.430	8.469	8.507	8.546	8.584	8.622	8.658	8.694
	8.726	8.755	8.825	8.902	8.930	8.956	9.018	9.079	9.102	9.128
	9.153	9.178	9.202	9.225	9.247	9.268				
0 7	7.937	7.980	8.023	8.064	8.104	8.144	8.183	8.222	8.261	8.300
	8.339	8.378	8.417	8.456	8.495	8.533	8.572	8.610	8.647	8.682
	8.716	8.745	8.797	8.864	8.907	8.948	9.005	9.058	9.085	9.113
	9.140	9.167	9.193	9.218	9.241	9.264				
0 8	7.920	7.964	8.006	8.047	8.088	8.128	8.168	8.207	8.247	8.286
	8.325	8.364	8.404	8.443	8.482	8.521	8.560	8.598	8.636	8.674
	8.711	8.748	8.792	8.839	8.884	8.930	8.978	9.028	9.065	9.098
	9.129	9.158	9.185	9.212	9.237	9.260				
0 9	7.905	7.948	7.990	8.031	8.072	8.113	8.153	8.193	8.232	8.272
	8.311	8.351	8.390	8.430	8.469	8.509	8.548	8.587	8.626	8.665
	8.704	8.745	8.788	8.832	8.877	8.922	8.967	9.011	9.050	9.086
	9.119	9.150	9.179	9.207	9.233	9.258				
0 10	7.890	7.933	7.975	8.016	8.057	8.098	8.138	8.178	8.218	8.258
	8.297	8.337	8.377	8.417	8.457	8.497	8.537	8.577	8.616	8.657
	8.697	8.739	8.781	8.825	8.869	8.913	8.957	8.999	9.038	9.075
	9.110	9.143	9.174	9.204	9.232	9.258				
0 11	7.876	7.918	7.960	8.001	8.042	8.083	8.123	8.163	8.203	8.243
	8.283	8.324	8.364	8.404	8.444	8.485	8.525	8.566	8.606	8.647
	8.689	8.731	8.774	8.817	8.861	8.905	8.948	8.989	9.029	9.068
	9.104	9.138	9.171	9.202	9.232	9.259				
0 12	7.862	7.904	7.945	7.987	8.027	8.068	8.108	8.149	8.189	8.229
	8.269	8.310	8.350	8.391	8.431	8.472	8.513	8.555	8.596	8.638
	8.680	8.723	8.766	8.810	8.853	8.897	8.940	8.982	9.022	9.062
	9.099	9.135	9.170	9.202	9.233	9.262				
0 13	7.849	7.890	7.931	7.972	8.013	8.053	8.094	8.134	8.174	8.215
	8.255	8.296	8.336	8.377	8.418	8.460	8.501	8.543	8.585	8.628
	8.671	8.714	8.758	8.801	8.845	8.889	8.933	8.975	9.017	9.057
	9.096	9.134	9.170	9.204	9.237	9.268				
0 14	7.836	7.877	7.917	7.958	7.998	8.038	8.079	8.119	8.159	8.200
	8.240	8.281	8.322	8.364	8.405	8.447	8.489	8.531	8.574	8.617
	8.661	8.705	8.749	8.793	8.838	8.882	8.926	8.970	9.012	9.054
	9.094	9.133	9.171	9.208	9.242	9.275				
0 15	7.823	7.863	7.903	7.943	7.983	8.023	8.064	8.104	8.144	8.185
	8.226	8.267	8.308	8.349	8.391	8.433	8.476	8.519	8.563	8.606
	8.651	8.695	8.740	8.785	8.830	8.875	8.920	8.965	9.009	9.052
	9.094	9.135	9.175	9.213	9.249	9.284				
0 16	7.810	7.849	7.889	7.929	7.968	8.008	8.048	8.088	8.129	8.169
	8.210	8.251	8.293	8.335	8.377	8.420	8.463	8.506	8.550	8.595
	8.640	8.685	8.731	8.777	8.823	8.869	8.915	8.961	9.006	9.051
	9.095	9.137	9.179	9.220	9.259	9.296				
0 17	7.796	7.835	7.875	7.914	7.953	7.993	8.032	8.072	8.113	8.153
	8.194	8.236	8.277	8.319	8.362	8.405	8.449	8.493	8.538	8.583
	8.628	8.675	8.721	8.768	8.815	8.863	8.910	8.957	9.004	9.050
	9.096	9.141	9.185	9.228	9.270	9.309				
0 18	7.783	7.821	7.860	7.899	7.938	7.977	8.016	8.056	8.096	8.137
	8.178	8.219	8.261	8.304	8.347	8.390	8.434	8.479	8.524	8.570

	8.617	8.664	8.711	8.759	8.808	8.856	8.905	8.954	9.002	9.051
	9.099	9.146	9.193	9.238	9.282	9.325				
0 19	7.769	7.807	7.845	7.883	7.921	7.960	7.999	8.039	8.079	8.120
	8.161	8.202	8.244	8.287	8.330	8.374	8.419	8.464	8.510	8.557
	8.604	8.652	8.701	8.750	8.799	8.849	8.900	8.950	9.001	9.051
	9.102	9.152	9.201	9.250	9.297	9.343				
0 20	7.755	7.792	7.829	7.867	7.905	7.943	7.982	8.021	8.061	8.102
	8.143	8.184	8.226	8.269	8.313	8.358	8.403	8.449	8.495	8.543
	8.591	8.640	8.690	8.740	8.791	8.843	8.895	8.947	9.000	9.053
	9.105	9.158	9.210	9.262	9.313	9.363				
0 21	7.740	7.776	7.813	7.850	7.887	7.925	7.964	8.003	8.042	8.083
	8.124	8.165	8.208	8.251	8.295	8.340	8.385	8.432	8.479	8.528
	8.577	8.627	8.678	8.729	8.782	8.835	8.889	8.943	8.998	9.054
	9.109	9.165	9.220	9.276	9.330	9.384				
0 22	7.725	7.760	7.796	7.832	7.869	7.907	7.945	7.983	8.023	8.063
	8.104	8.146	8.188	8.232	8.276	8.321	8.367	8.414	8.462	8.512
	8.562	8.613	8.665	8.718	8.772	8.827	8.883	8.939	8.997	9.055
	9.113	9.172	9.231	9.290	9.348	9.407				
0 23	7.709	7.743	7.778	7.814	7.850	7.887	7.925	7.963	8.002	8.042
	8.083	8.125	8.168	8.211	8.256	8.301	8.348	8.396	8.444	8.494
	8.545	8.598	8.651	8.706	8.761	8.818	8.876	8.935	8.995	9.055
	9.117	9.179	9.241	9.304	9.367	9.430				
0 24	7.692	7.726	7.760	7.795	7.830	7.867	7.904	7.942	7.981	8.021
	8.061	8.103	8.146	8.189	8.234	8.280	8.327	8.375	8.425	8.476
	8.528	8.581	8.636	8.692	8.749	8.808	8.868	8.929	8.992	9.055
	9.120	9.185	9.251	9.318	9.386	9.454				
0 25	7.674	7.707	7.741	7.775	7.810	7.846	7.882	7.920	7.958	7.998
	8.038	8.080	8.123	8.166	8.211	8.258	8.305	8.354	8.404	8.456
	8.509	8.563	8.619	8.677	8.736	8.797	8.859	8.923	8.988	9.054
	9.122	9.191	9.261	9.332	9.403	9.476				
0 26	7.656	7.688	7.720	7.754	7.788	7.823	7.859	7.896	7.935	7.974
	8.014	8.055	8.098	8.142	8.187	8.233	8.281	8.331	8.382	8.434
	8.488	8.544	8.601	8.660	8.721	8.784	8.848	8.915	8.982	9.052
	9.123	9.195	9.269	9.344	9.420	9.498				
0 27	7.636	7.667	7.699	7.732	7.765	7.800	7.835	7.872	7.910	7.948
	7.988	8.030	8.072	8.116	8.161	8.208	8.256	8.306	8.357	8.411
	8.466	8.523	8.581	8.642	8.705	8.769	8.836	8.905	8.975	9.048
	9.123	9.199	9.277	9.356	9.436	9.518				
0 28	7.616	7.646	7.677	7.709	7.741	7.775	7.810	7.846	7.883	7.922
	7.961	8.002	8.045	8.088	8.134	8.180	8.229	8.279	8.331	8.385
	8.441	8.499	8.559	8.622	8.686	8.753	8.822	8.893	8.967	9.043
	9.121	9.201	9.283	9.366	9.451	9.537				
0 29	7.594	7.623	7.653	7.684	7.716	7.749	7.784	7.819	7.856	7.894
	7.933	7.973	8.016	8.059	8.104	8.151	8.200	8.251	8.303	8.358
	8.415	8.474	8.535	8.599	8.665	8.734	8.805	8.879	8.956	9.035
	9.117	9.201	9.287	9.375	9.465	9.555				
0 30	7.572	7.600	7.629	7.659	7.690	7.722	7.756	7.791	7.827	7.864
	7.903	7.943	7.985	8.028	8.073	8.120	8.169	8.220	8.273	8.328
	8.386	8.446	8.508	8.574	8.641	8.712	8.786	8.862	8.942	9.025
	9.110	9.198	9.289	9.383	9.478	9.574				
0 31	7.548	7.575	7.604	7.633	7.663	7.694	7.727	7.761	7.796	7.833
	7.871	7.911	7.952	7.995	8.040	8.087	8.136	8.187	8.240	8.296
	8.354	8.415	8.479	8.546	8.615	8.688	8.763	8.843	8.925	9.011
	9.101	9.194	9.289	9.388	9.489	9.592				
0 32	7.524	7.550	7.577	7.605	7.634	7.665	7.696	7.730	7.764	7.800
	7.838	7.877	7.918	7.960	8.005	8.051	8.100	8.151	8.205	8.261
	8.320	8.382	8.447	8.515	8.586	8.660	8.738	8.819	8.905	8.995
	9.088	9.186	9.287	9.391	9.499	9.610				
0 33	7.499	7.524	7.550	7.576	7.604	7.634	7.664	7.697	7.731	7.766
	7.803	7.841	7.882	7.924	7.968	8.014	8.062	8.113	8.167	8.223
	8.283	8.345	8.411	8.480	8.553	8.629	8.708	8.792	8.880	8.974
	9.072	9.174	9.280	9.390	9.504	9.625				
0 34	7.474	7.497	7.521	7.546	7.573	7.601	7.631	7.662	7.695	7.730
	7.766	7.804	7.843	7.885	7.928	7.974	8.021	8.072	8.125	8.182
	8.242	8.305	8.372	8.443	8.517	8.593	8.674	8.759	8.851	8.948
	9.051	9.159	9.270	9.384	9.503	9.631				
0 35	7.449	7.470	7.491	7.514	7.540	7.567	7.596	7.626	7.658	7.692
	7.728	7.765	7.803	7.844	7.886	7.931	7.978	8.028	8.081	8.137
	8.198	8.262	8.330	8.402	8.477	8.554	8.635	8.721	8.815	8.917
	9.026	9.140	9.256	9.374	9.492	9.617				
0 36	7.428	7.441	7.459	7.481	7.505	7.531	7.559	7.589	7.620	7.653
	7.687	7.723	7.761	7.801	7.842	7.886	7.932	7.981	8.033	8.089
	8.149	8.214	8.284	8.358	8.435	8.512	8.591	8.674	8.770	8.878
	8.995	9.118	9.241	9.363	9.476	9.560				

1 DRAWDOWN IN LAYER 1 AT END OF TIME STEP 7 IN STRESS PERIOD 1

FIGURES

Figure 1-1: Site Vicinity Map

ENVIRONMENTAL ENGINEERING

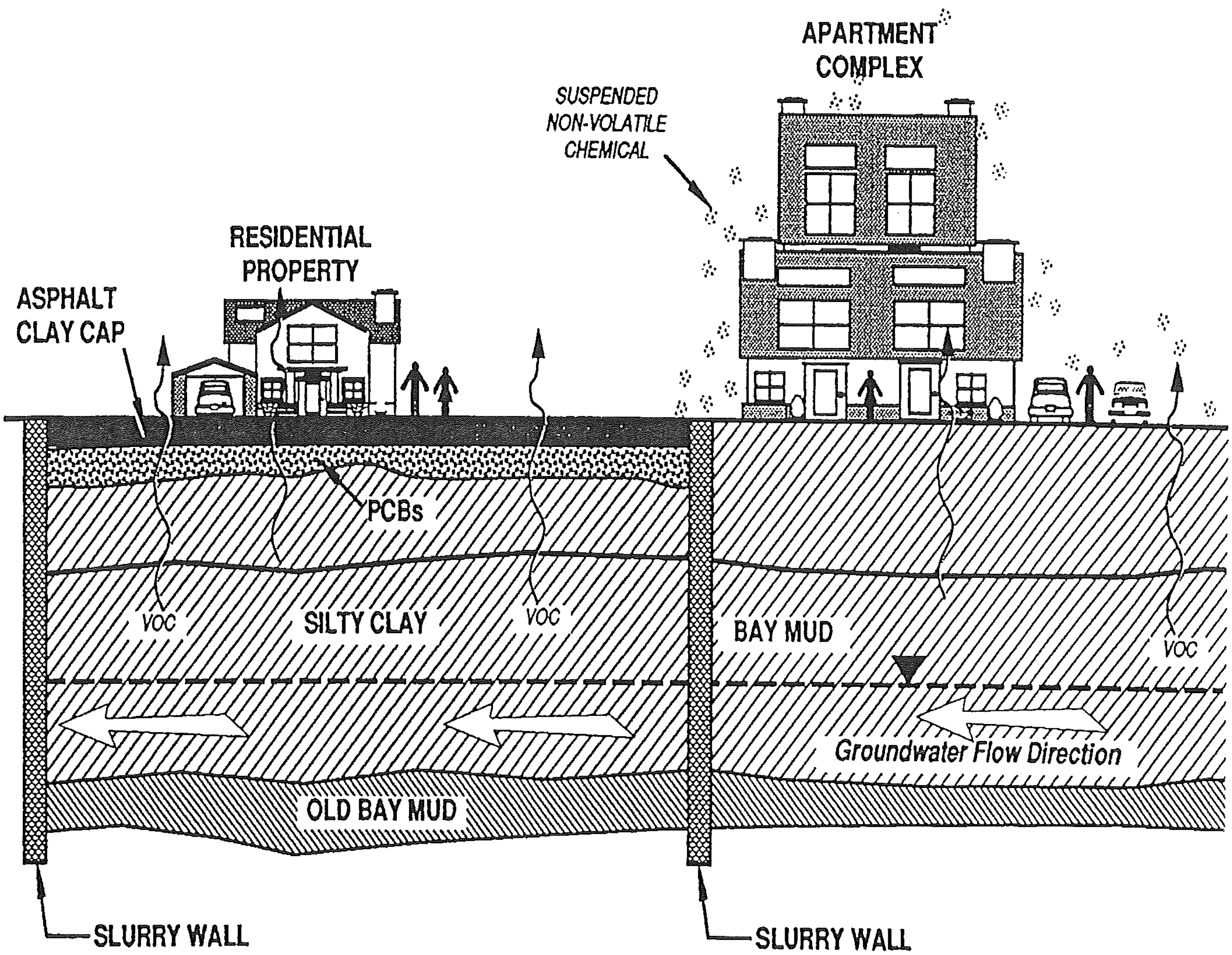


Figure 1-2: Conceptual Site Model

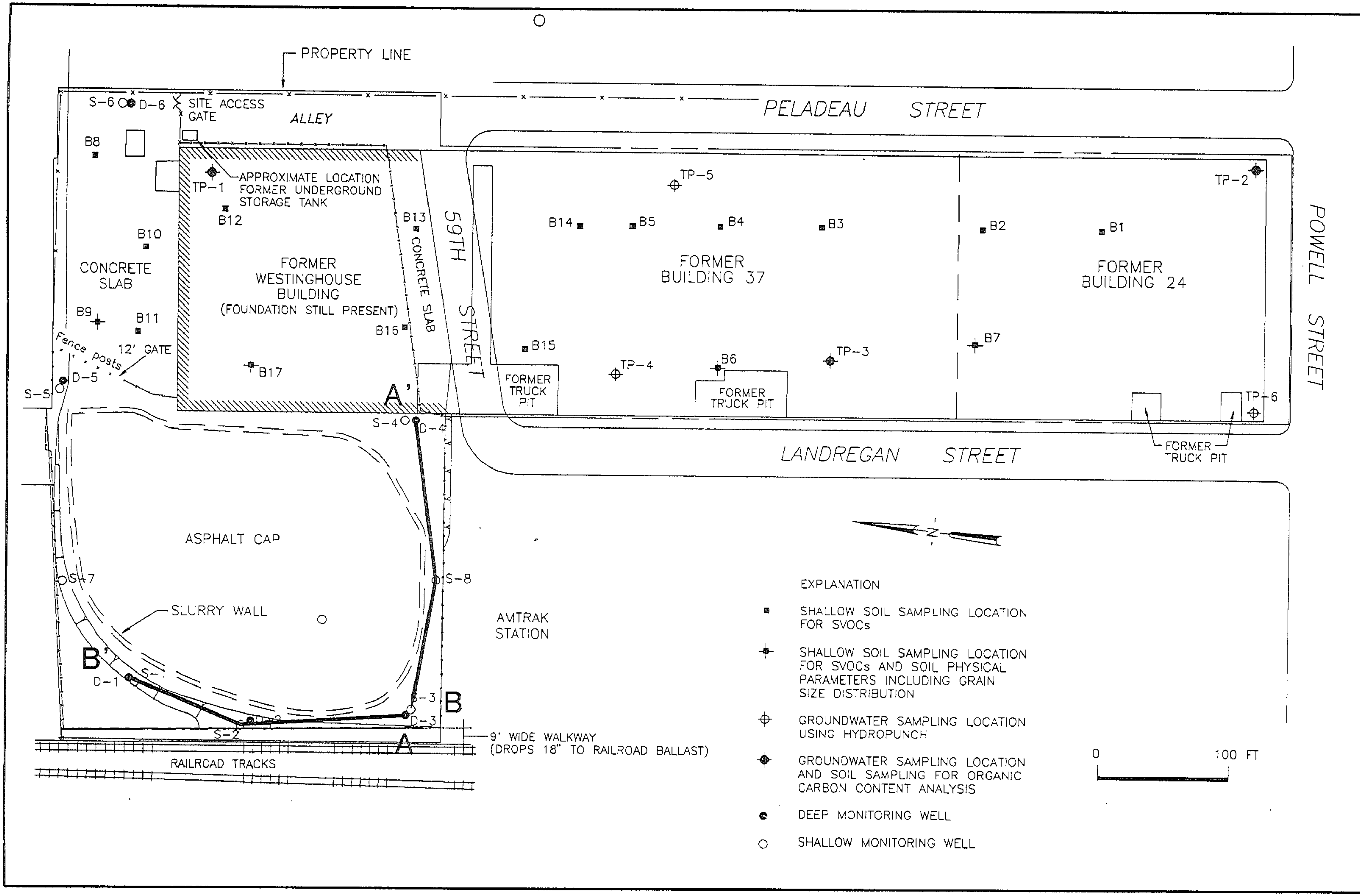


Figure 3-1: The Location of Geologic Cross-Sections

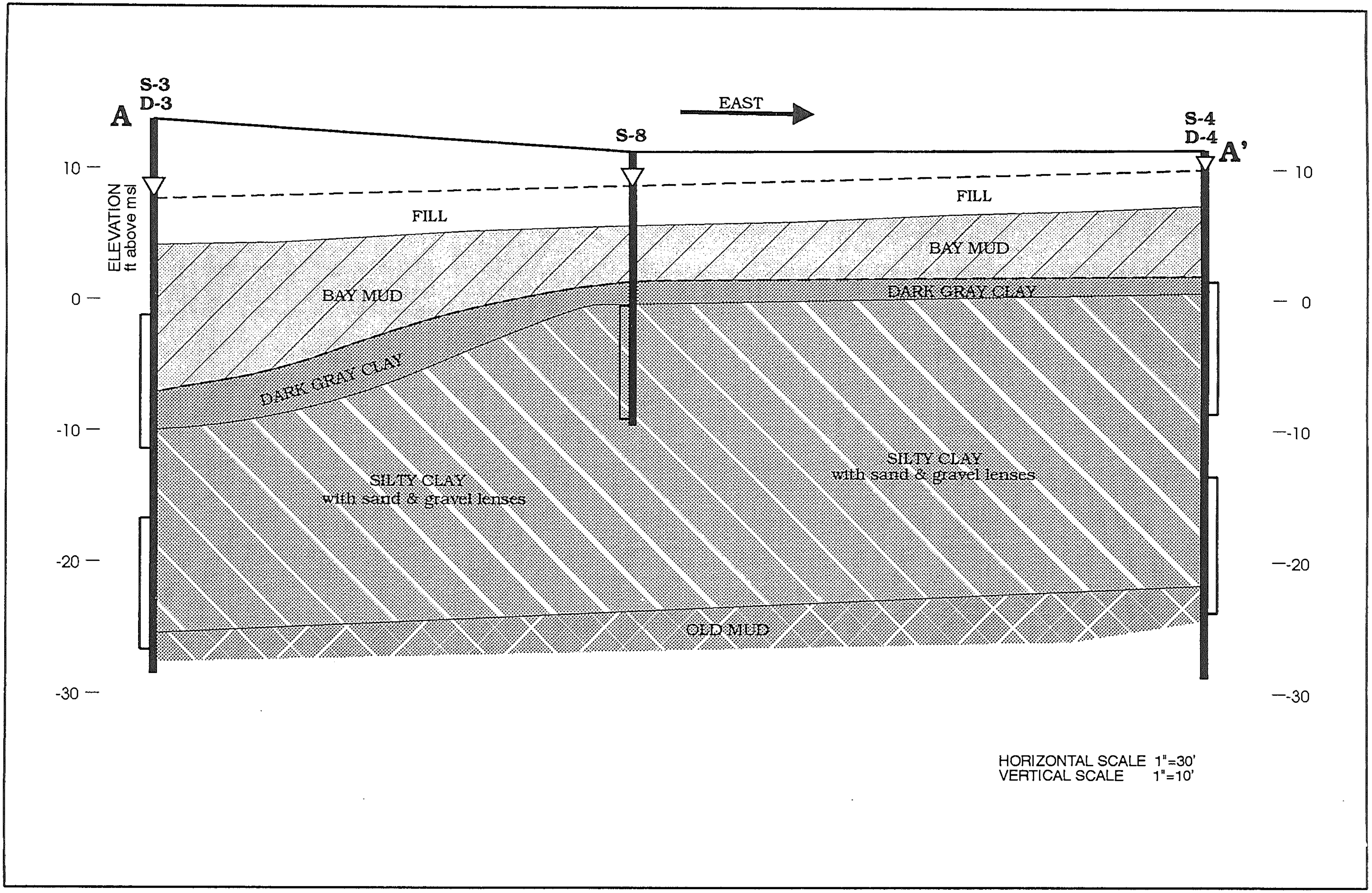


Figure 3-2: Cross-Section A-A'

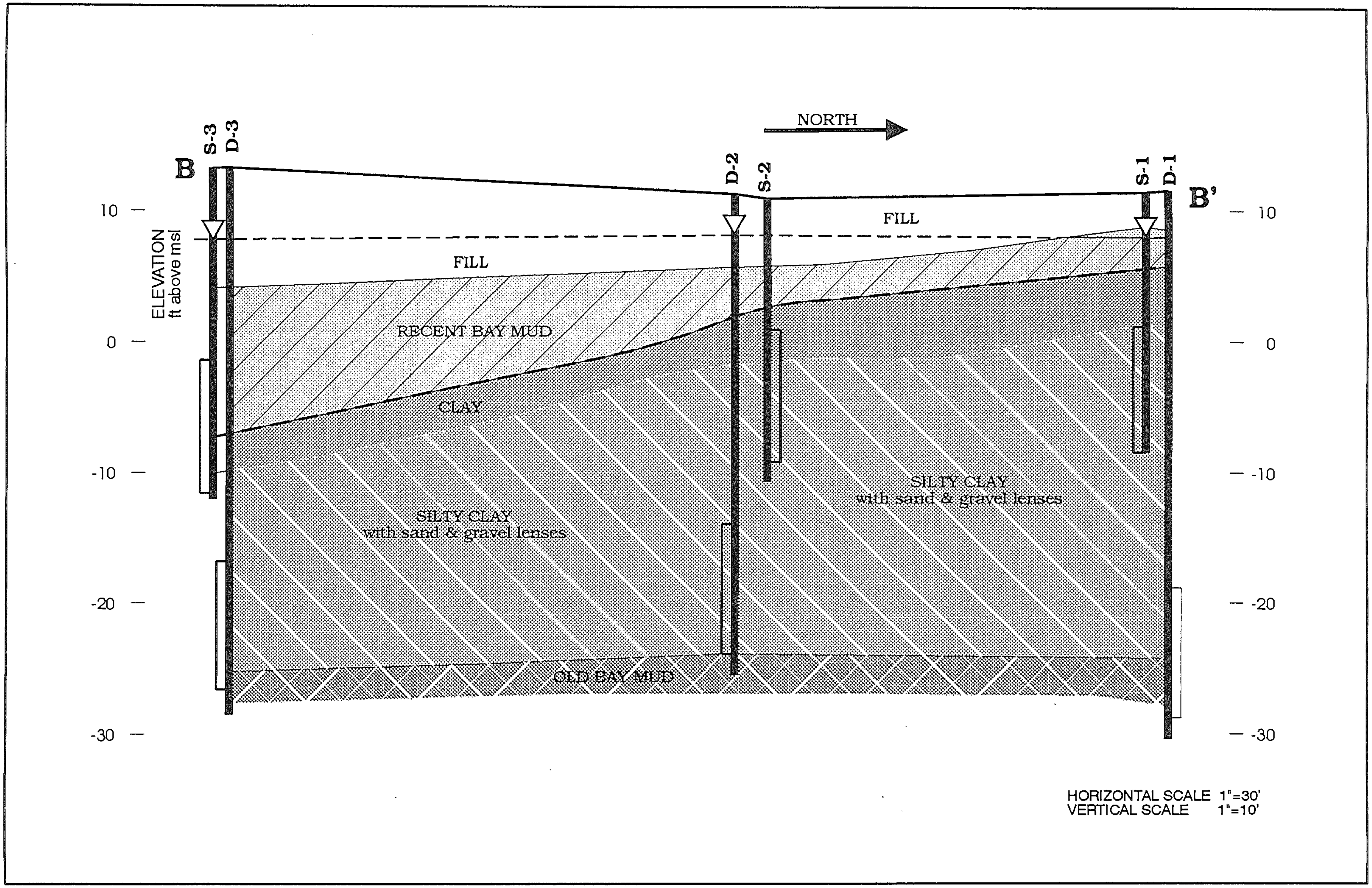


Figure 3-3: Cross-Section B-B'

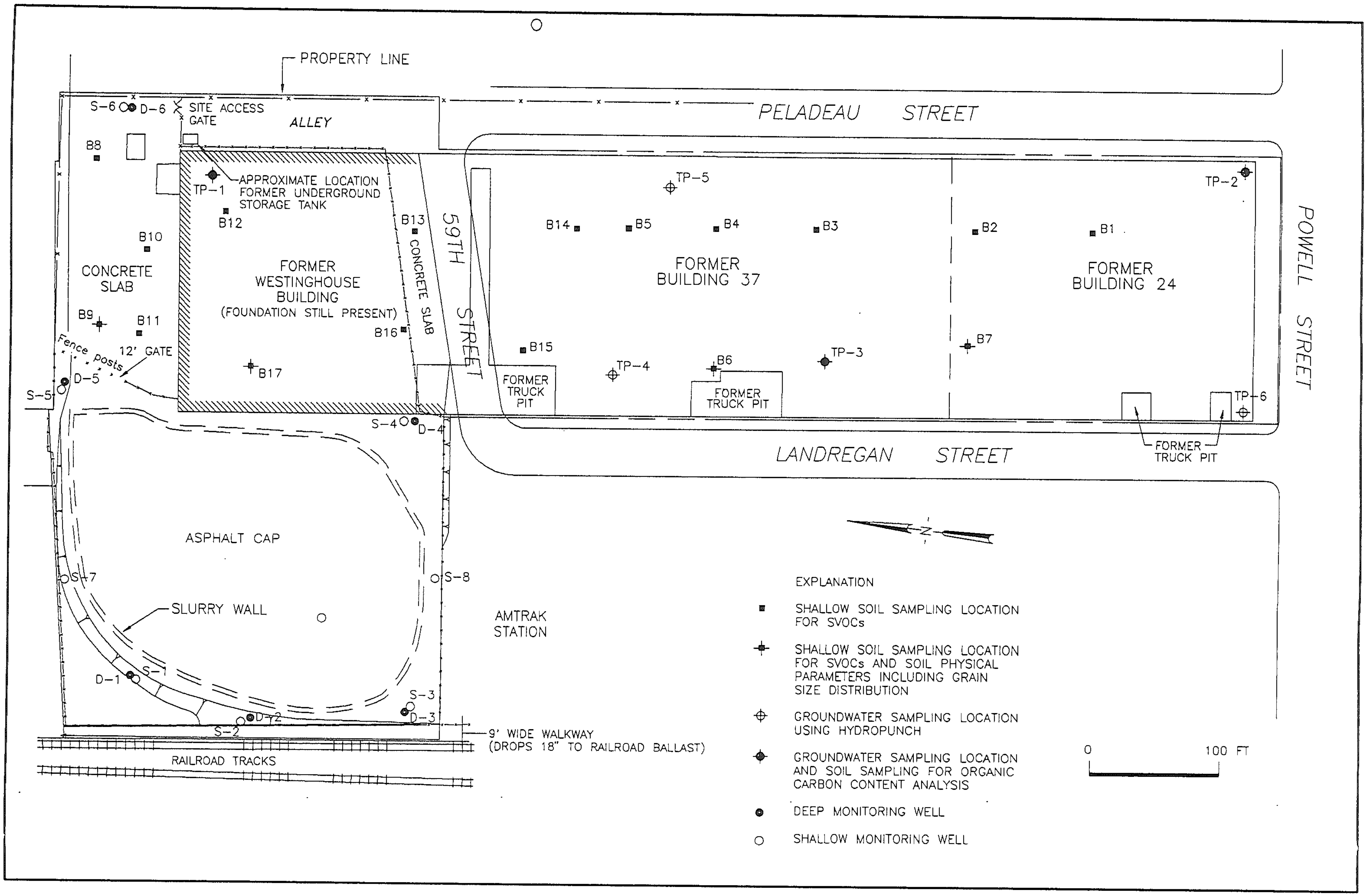


Figure 3-4: July 1995, Additional Soil and Groundwater Sampling Locations

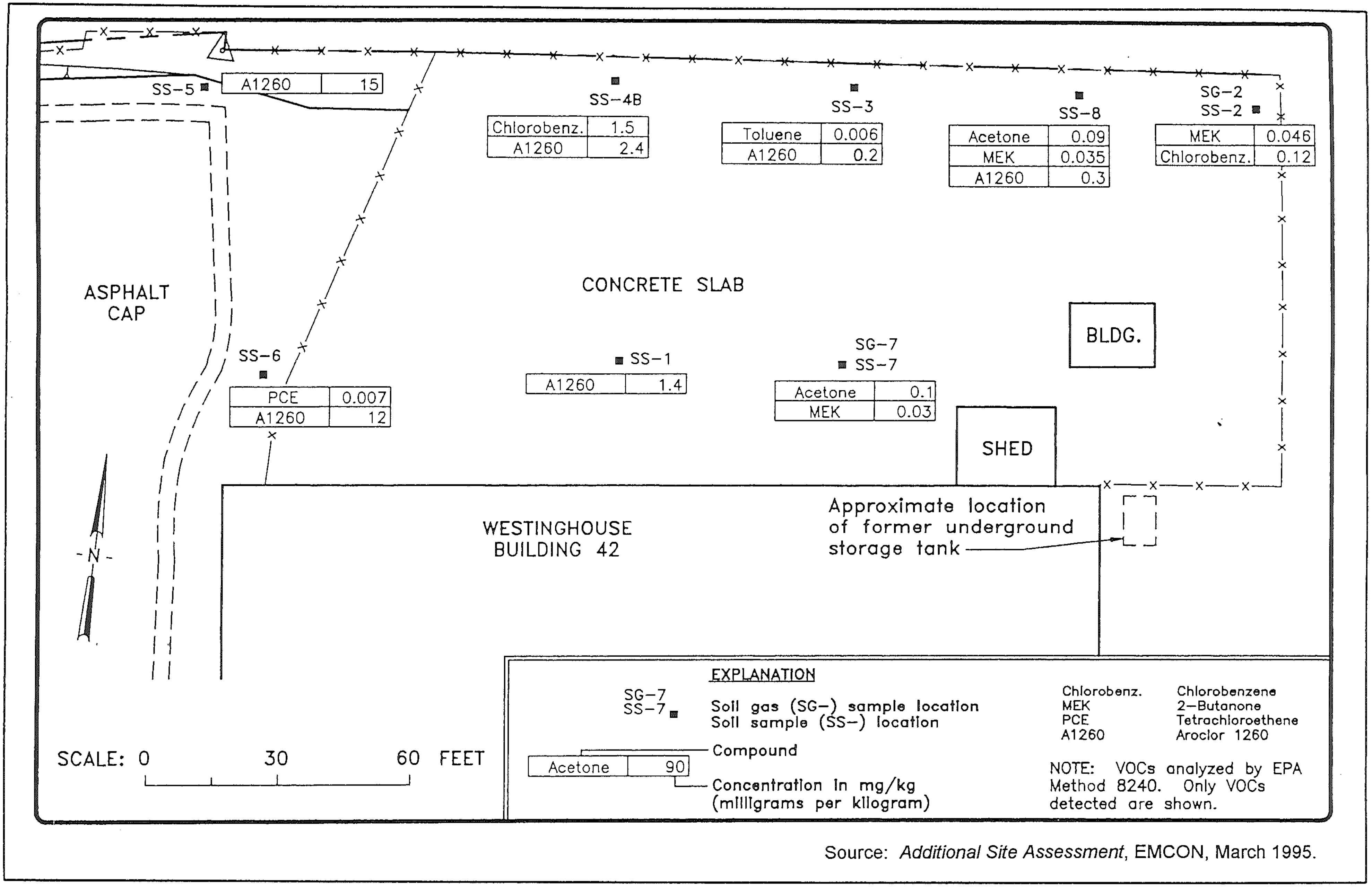


Figure 3-5: PCBs and VOCs Detected in Soils Beneath Concrete Slab North of Building Slab

Source: *Soil Characterization, Building 42, Westinghouse Emeryville Facility*, EMCON, October 27, 1993.

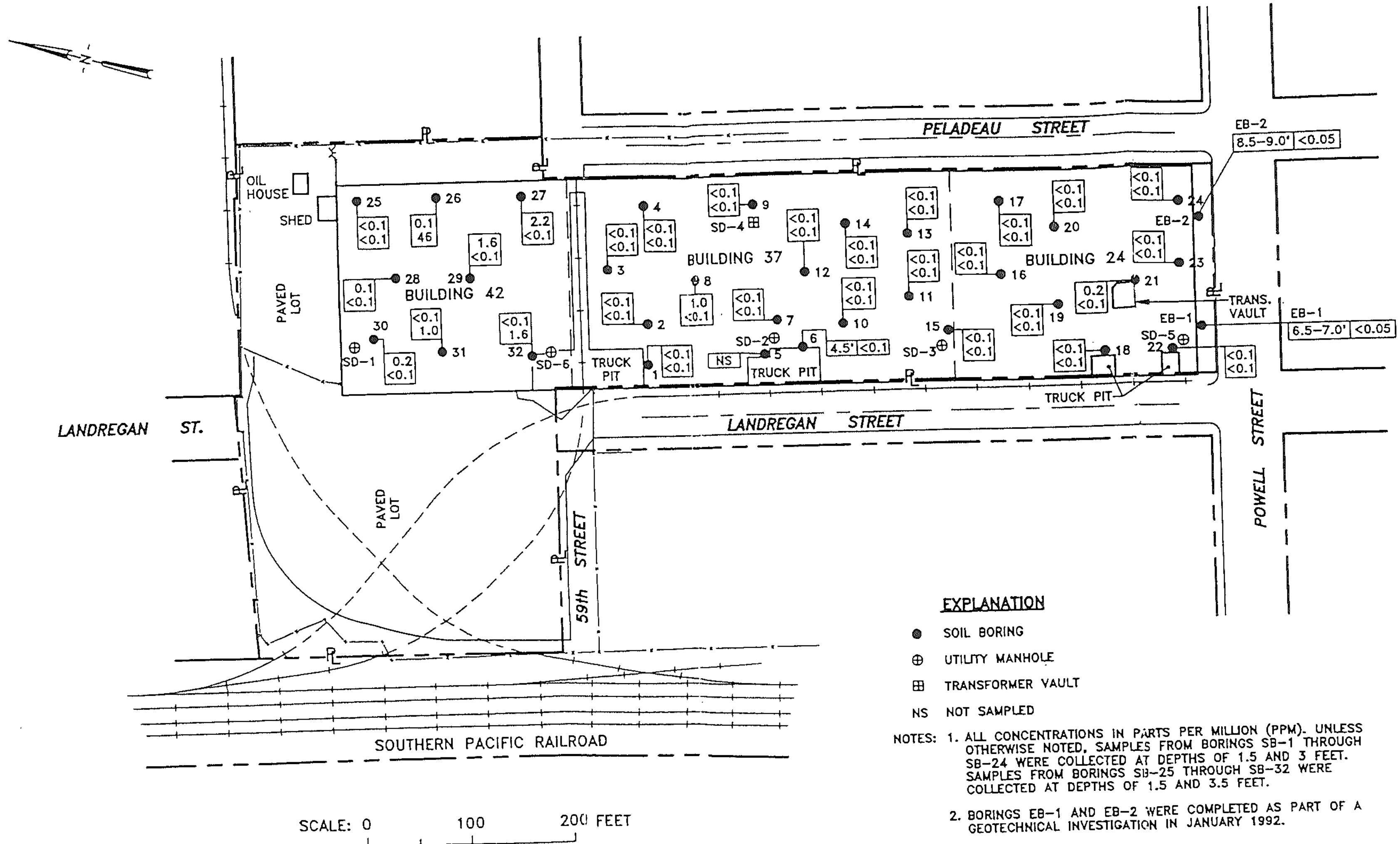


Figure 3-6: PCB Concentrations in Soils Beneath Building Slab

Source: *Soil Characterization, Building 42, Westinghouse Emeryville Facility*, EMCON, October 27, 1993.

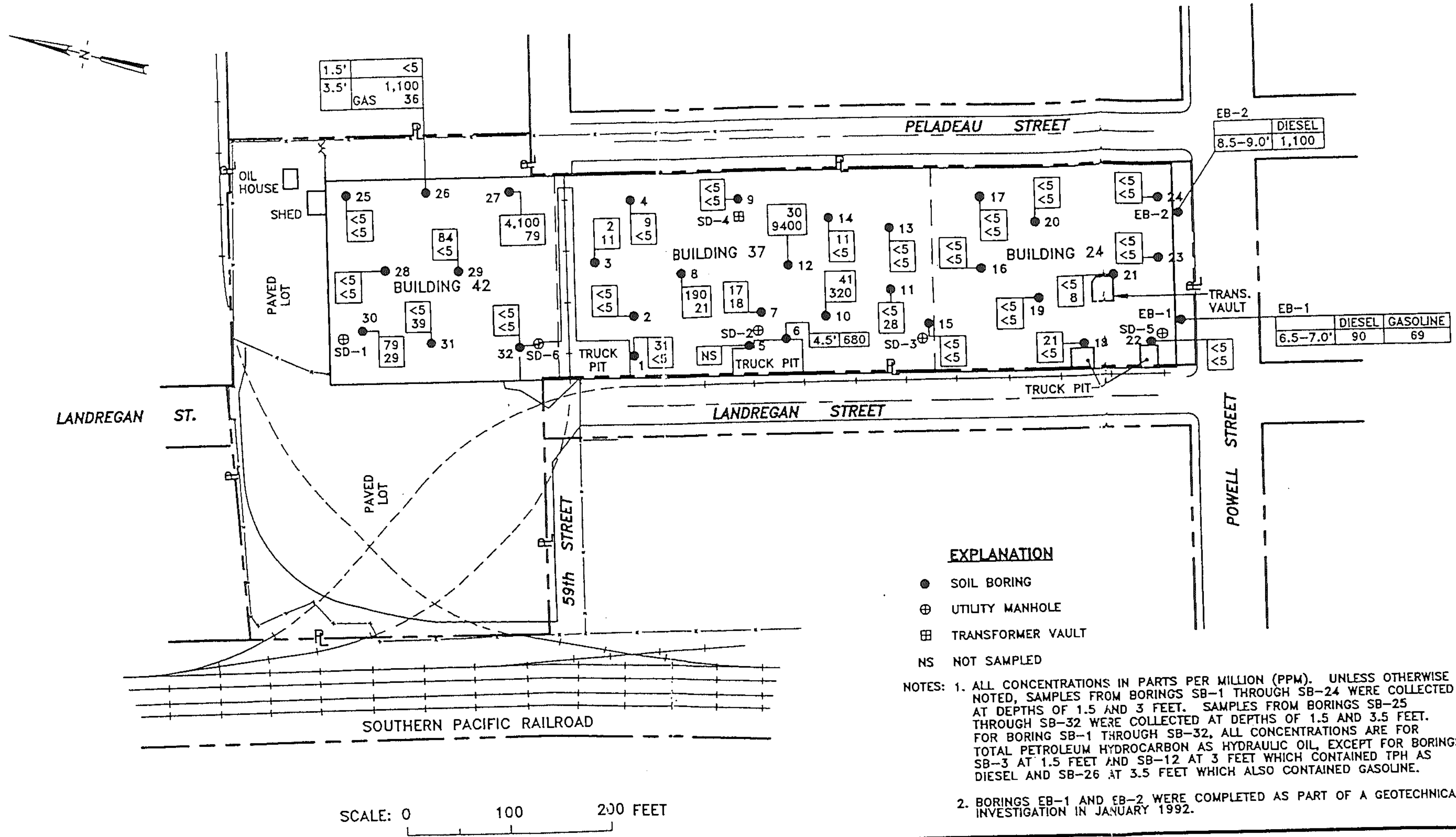


Figure 3-7: Total Petroleum Hydrocarbon Concentrations in Soils Beneath Building Slab

Source: *Soil Characterization, Building 42, Westinghouse Emeryville Facility*, EMCON, October 27, 1993.

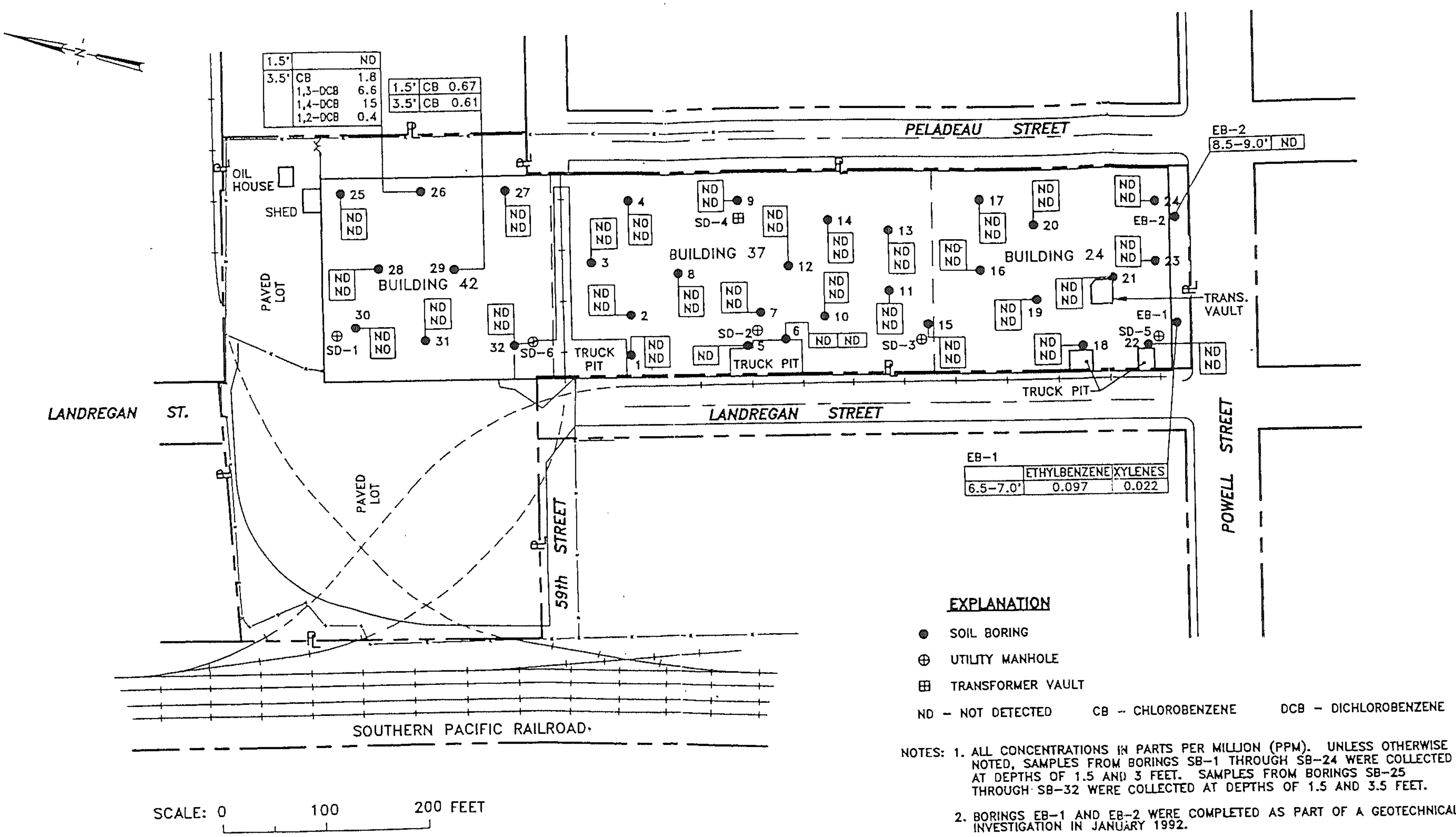


Figure 3-8: VOCs Detected in Soils Beneath Building Slab

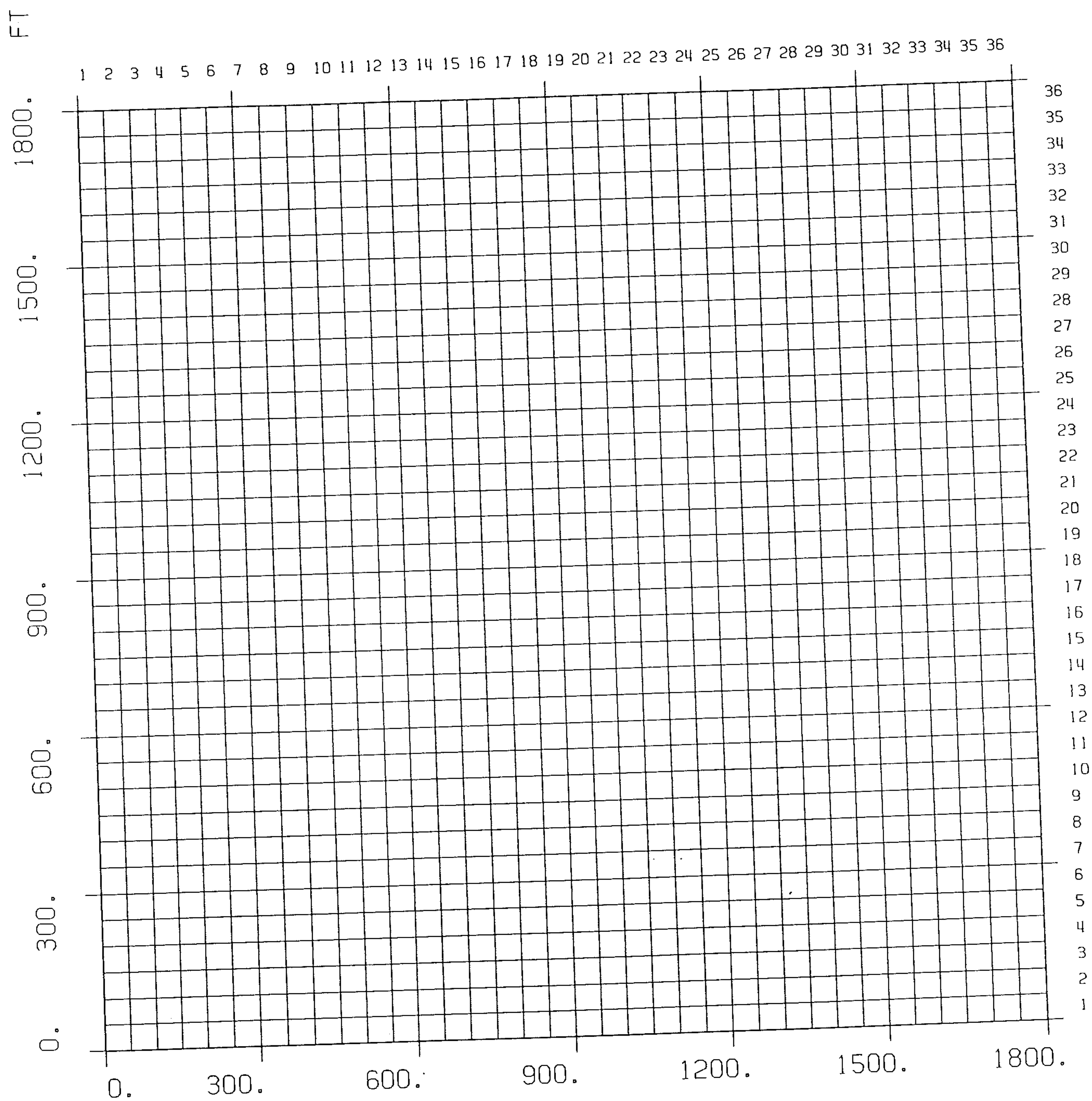


Figure 4-1: Finite Difference Grid and Model Domain

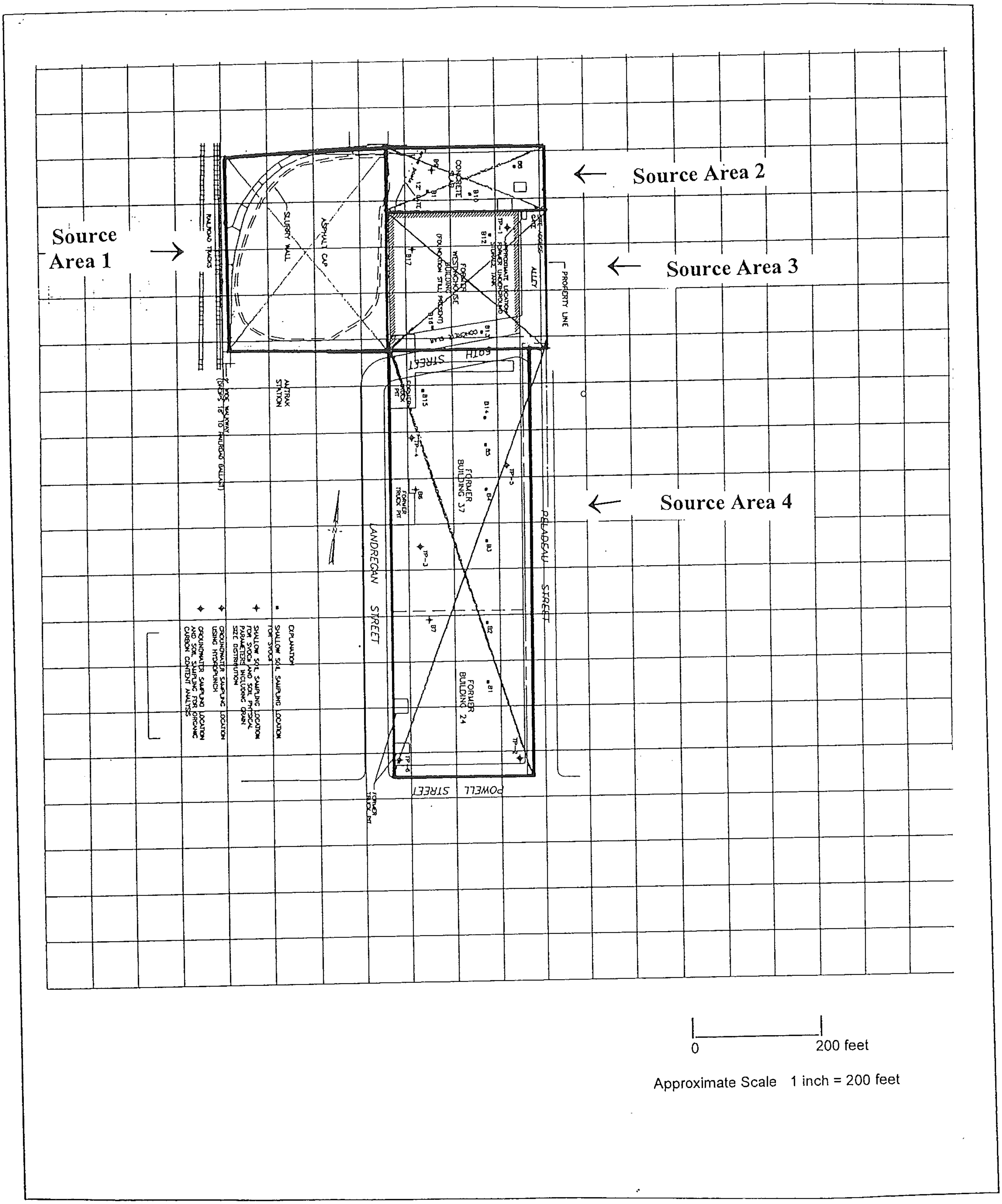


Figure 4-2: Site Map Showing Source Areas Used in FDM

WSW 9.739E-02
WBAN NUMBER 23239 ALAMEDA CA 1966-1970
W 2.446E-01

PLOT TYPE = WIND DIRECTION
WNW 1.153E-01

NW 7.236E-02
SECTOR FREQUENCY

NNW	7.359E-02
N	7.342E-02
NNE	2.036E-02
NE	1.133E-02
ENE	9.651E-03
E	1.915E-02
ESE	3.666E-02
SE	4.677E-02
SSE	4.270E-02
S	4.929E-02
SSW	3.586E-02
SW	5.032E-02

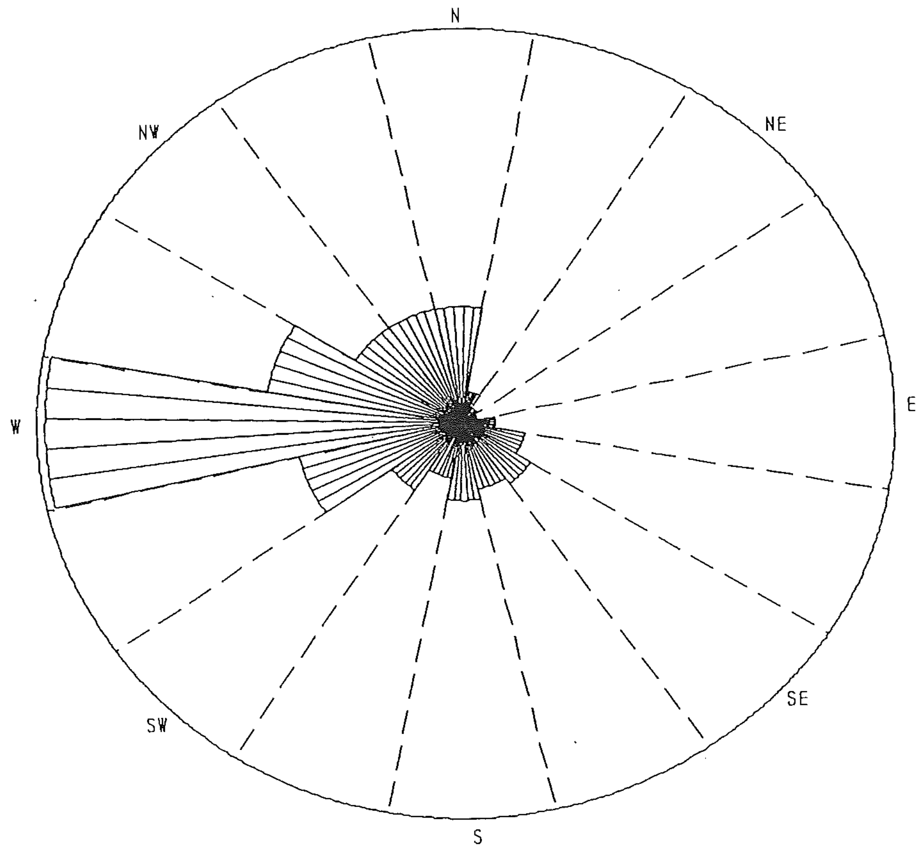
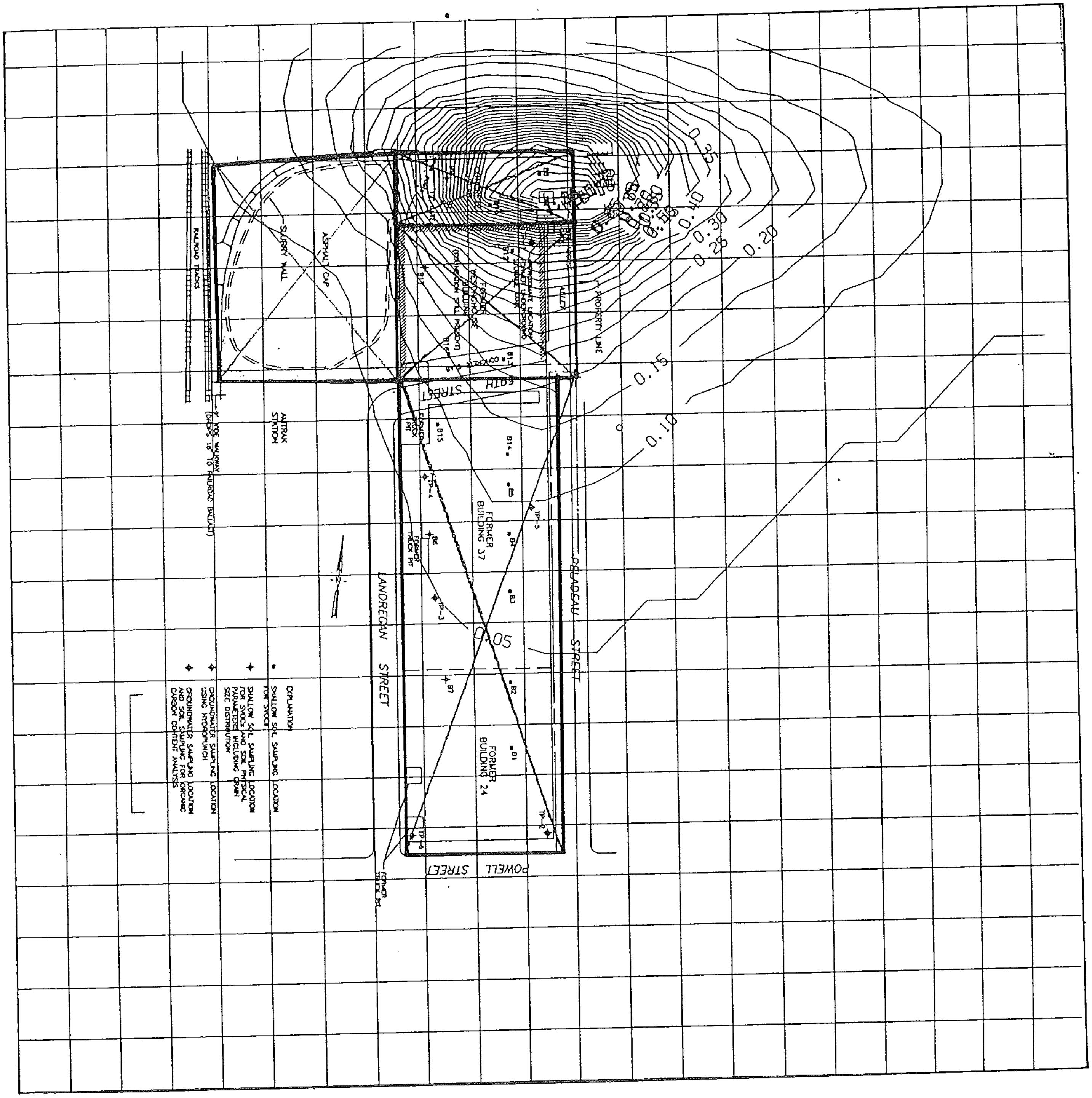


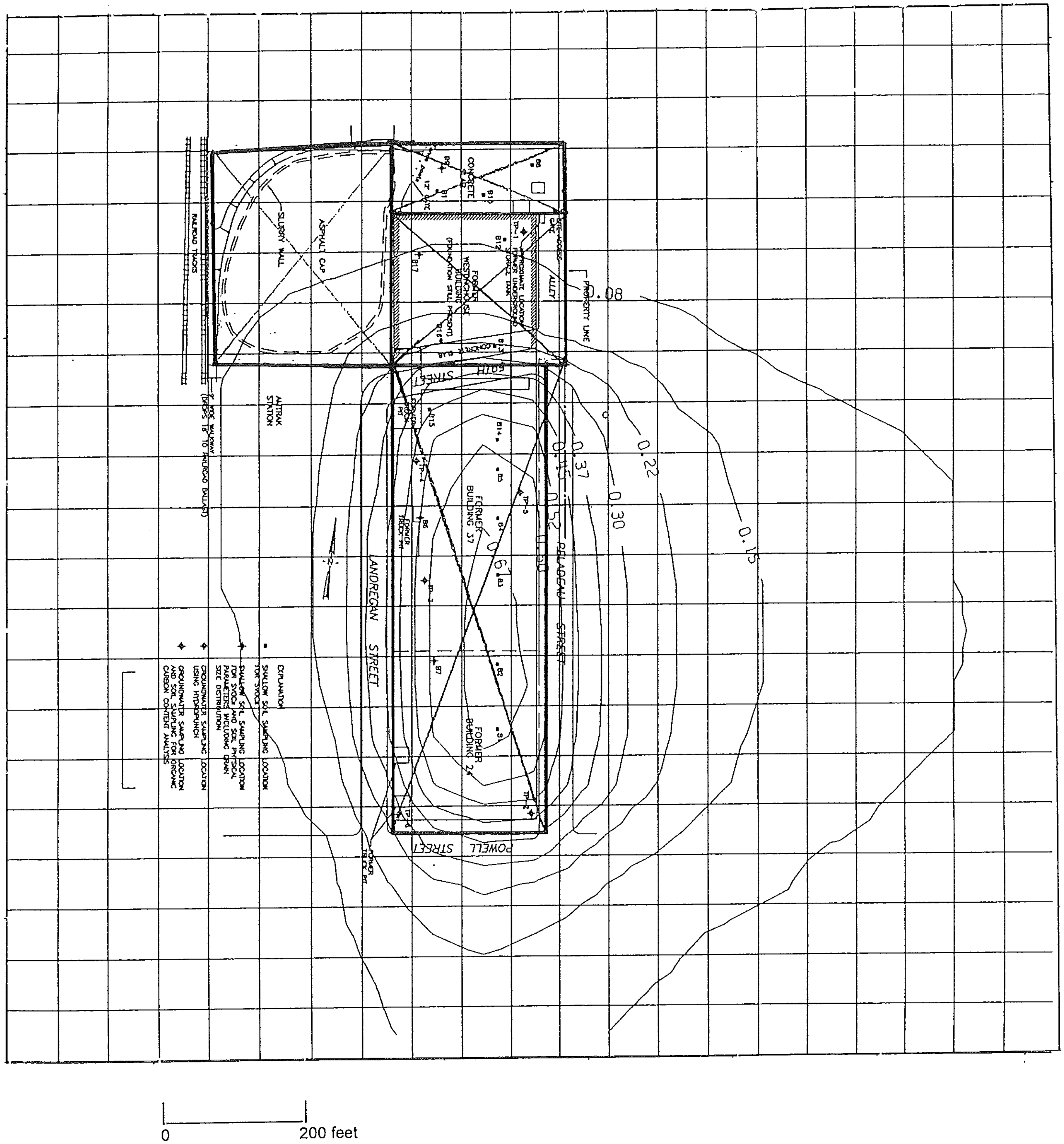
Figure 4-3: Rose Diagram for Alameda, California



0 200 feet

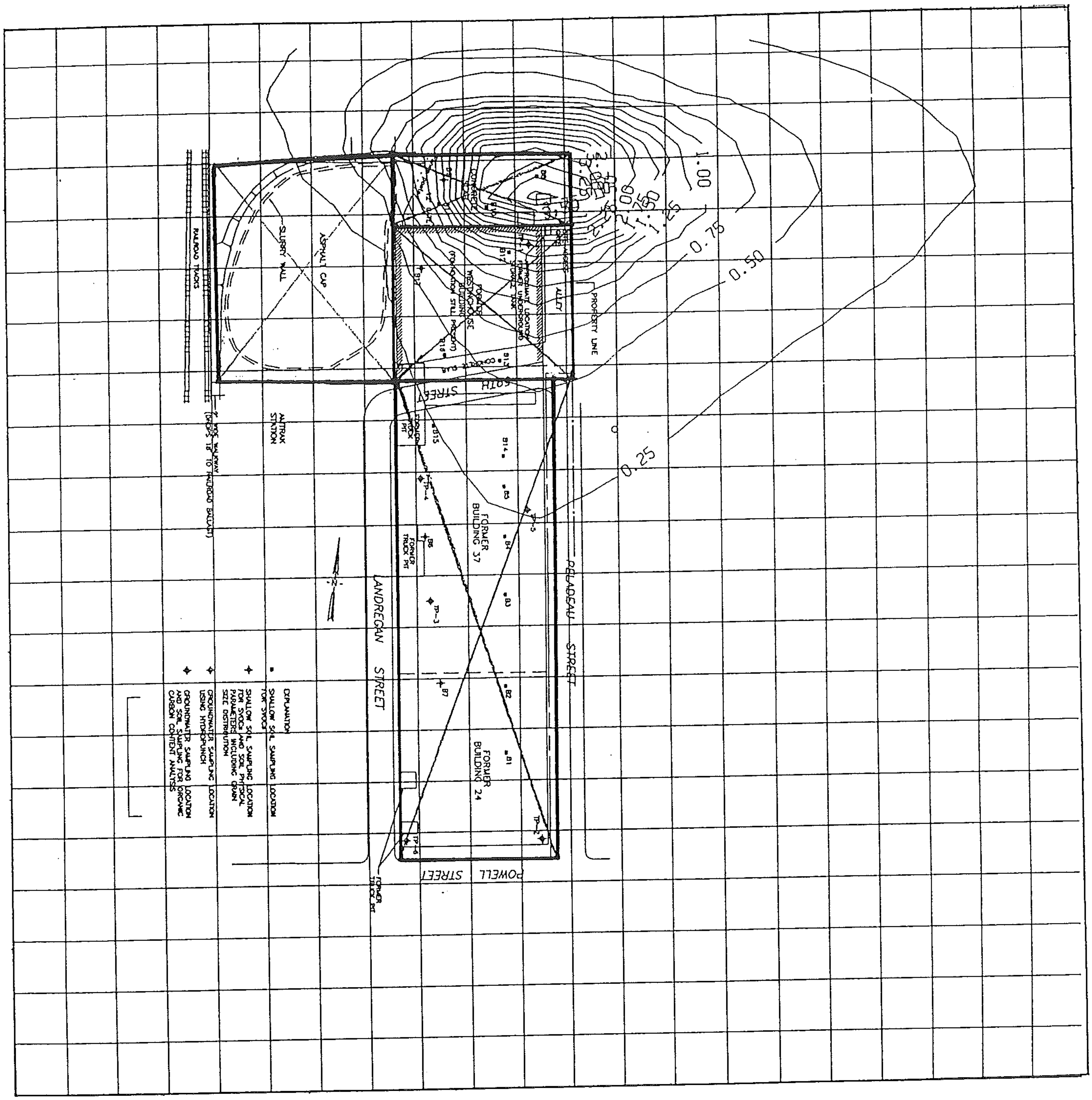
Approximate Scale 1 inch = 200 feet

Figure 4-4: Simulated PCB air concentration (ng/m^3) at breathing level emanating from uncapped area and former Building No. 42 footprint, using Fugitive Dust Model (FDM).



Approximate Scale 1 inch = 200 feet

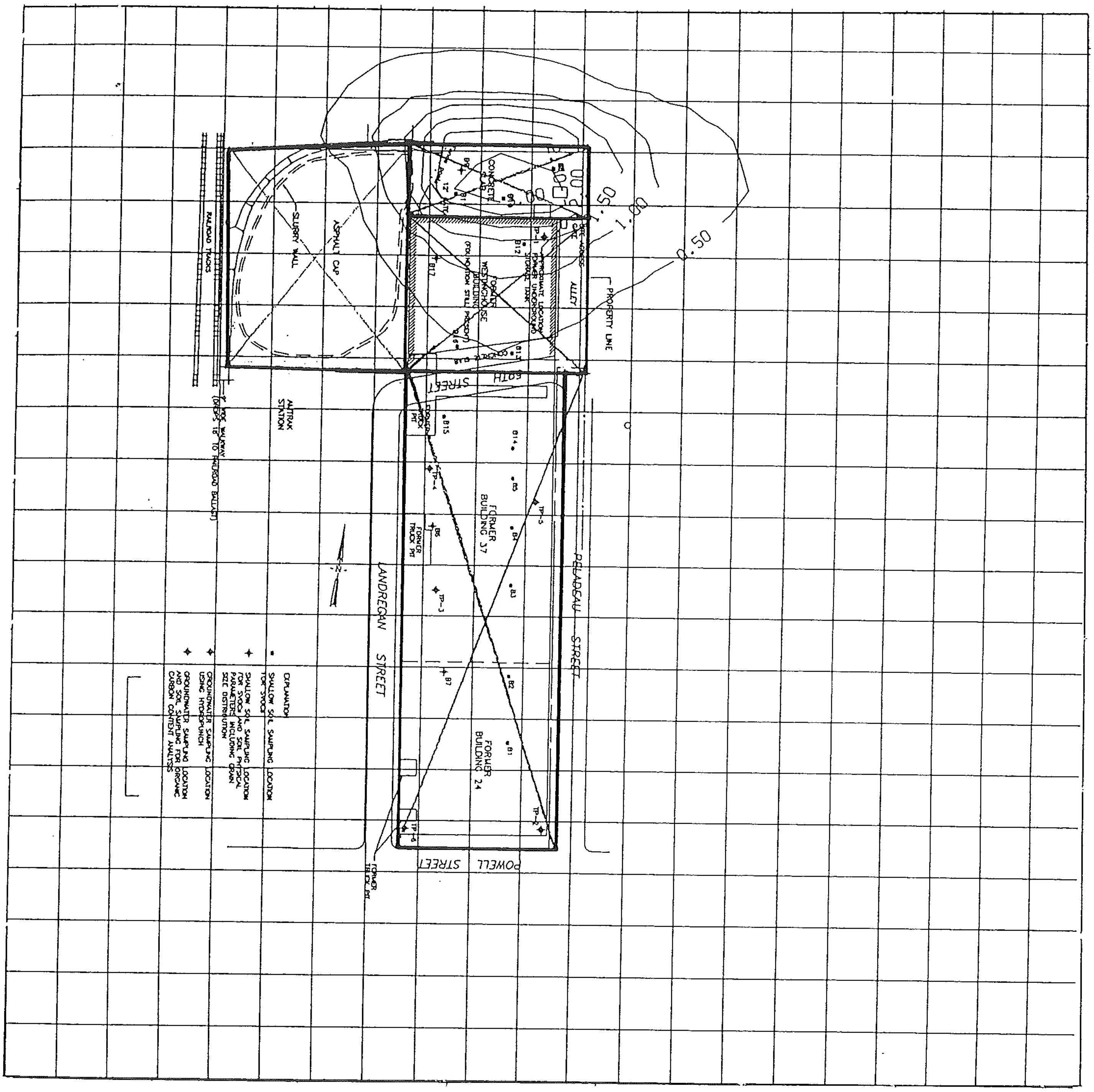
Figure 4-5: Simulated Bis(2-ethylhexyl)phthalate air concentration (ng/m^3) at breathing level emanating from uncapped area and former Building No. 24 and No. 37 footprints using Fugitive Dust Model (FDM).



0 200 feet

Approximate Scale 1 inch = 200 feet

Figure 4-6: Simulated Pyrene air concentration (pg/m^3) at breathing level emanating from uncapped area using Fugitive Dust Model (FDM).



0 200 feet

Approximate Scale 1 inch = 200 feet

Figure 4-7: Simulated Benzo(g,h,i)perylene air concentration (pg/m^3) at breathing level emanating from uncapped area using Fugitive Dust Model (FDM).

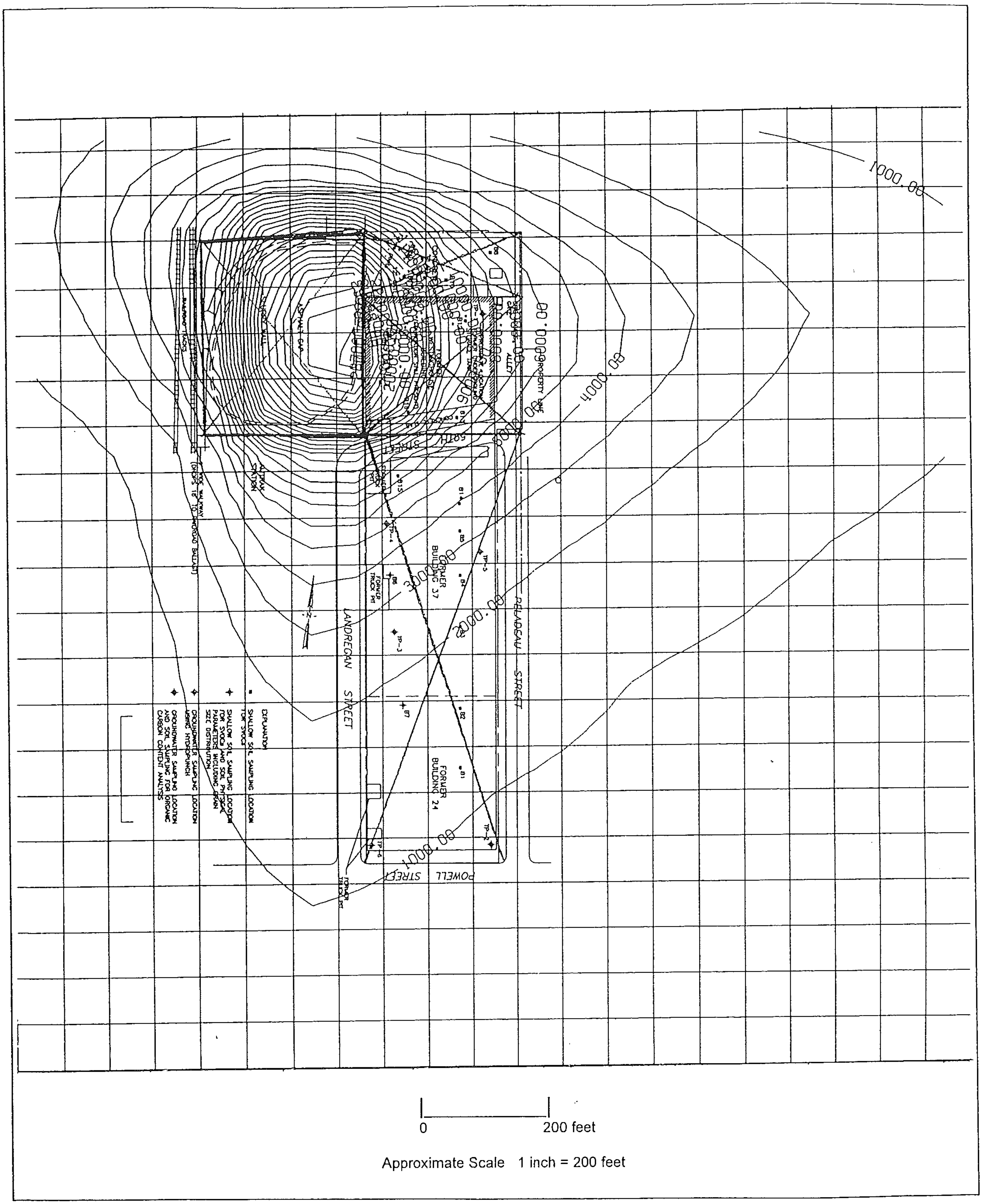


Figure 4-8: Simulated PCB air concentration ($\mu g/m^3$) at breathing level emanating from the currently capped area, assuming conditions without cap, using Fugitive Dust Model (FDM).

APPENDIX A

MODEL OUTPUTS

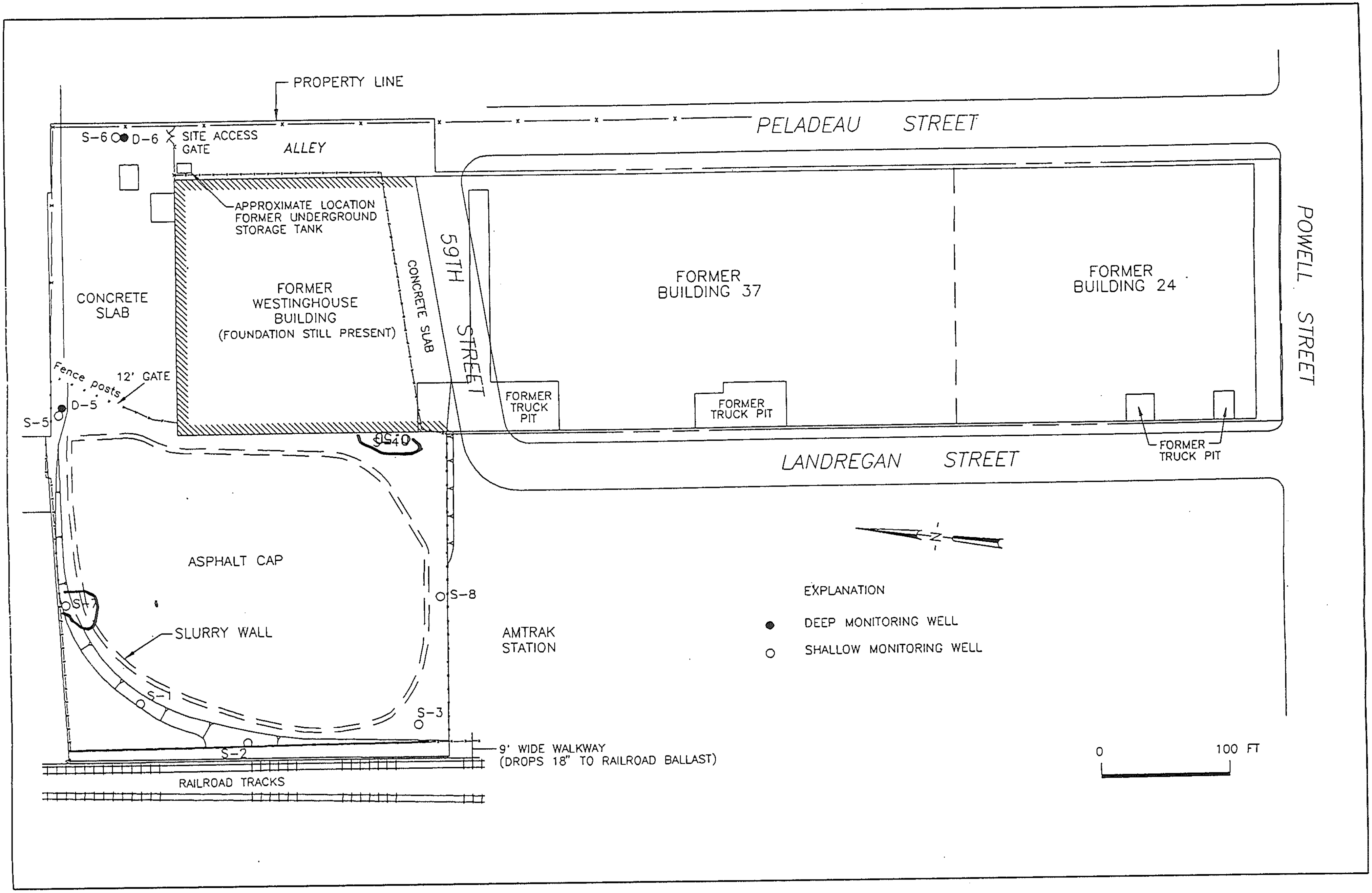


FIGURE A-1: Simulated concentration of Benzene in groundwater after 30 years.

SOMA ENVIRONMENTAL ENGINEERING

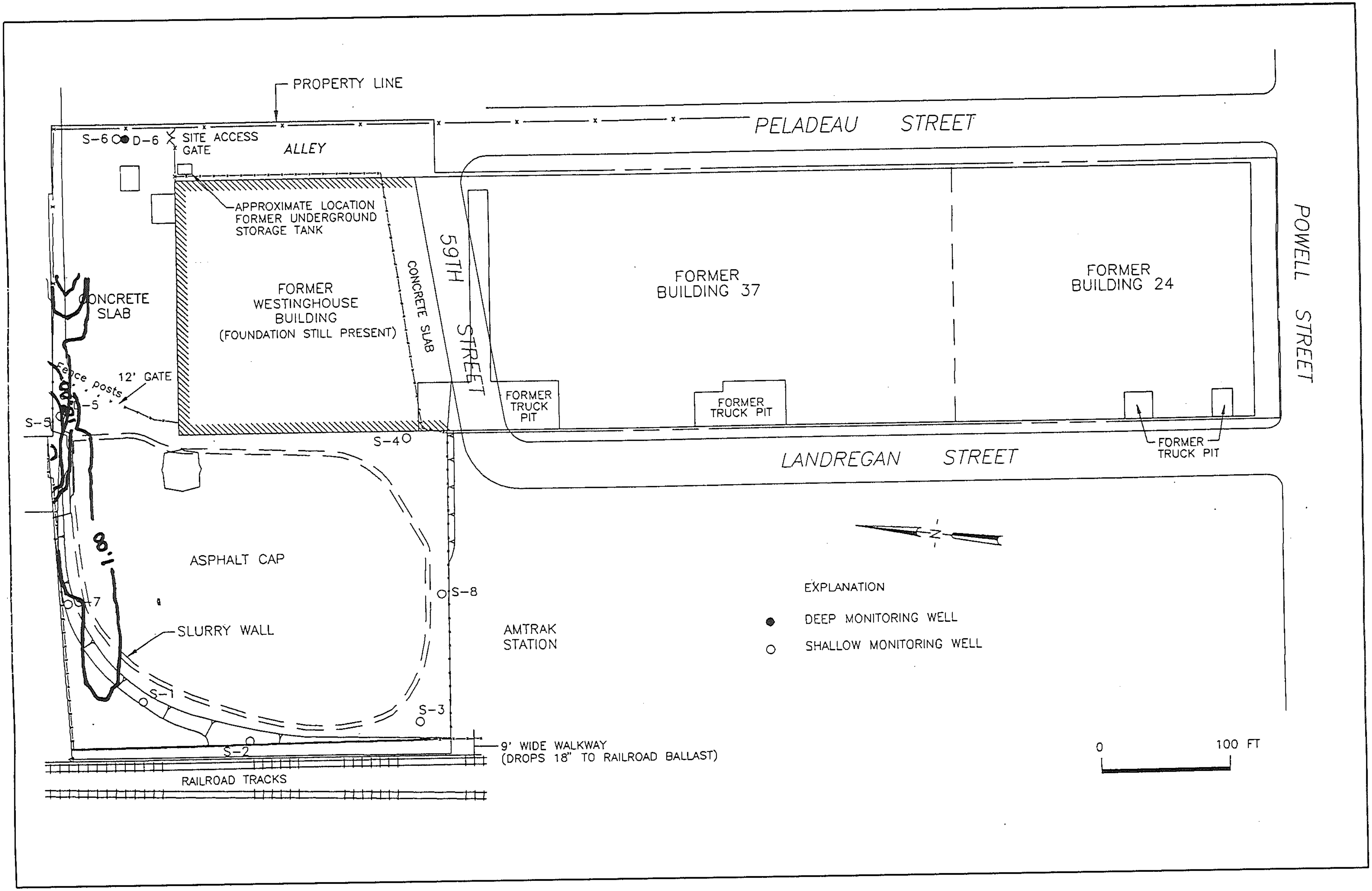


FIGURE A-2: Simulated concentration of Chlorobenzne in groundwater after 30 years.

SOMA ENVIRONMENTAL ENGINEERING

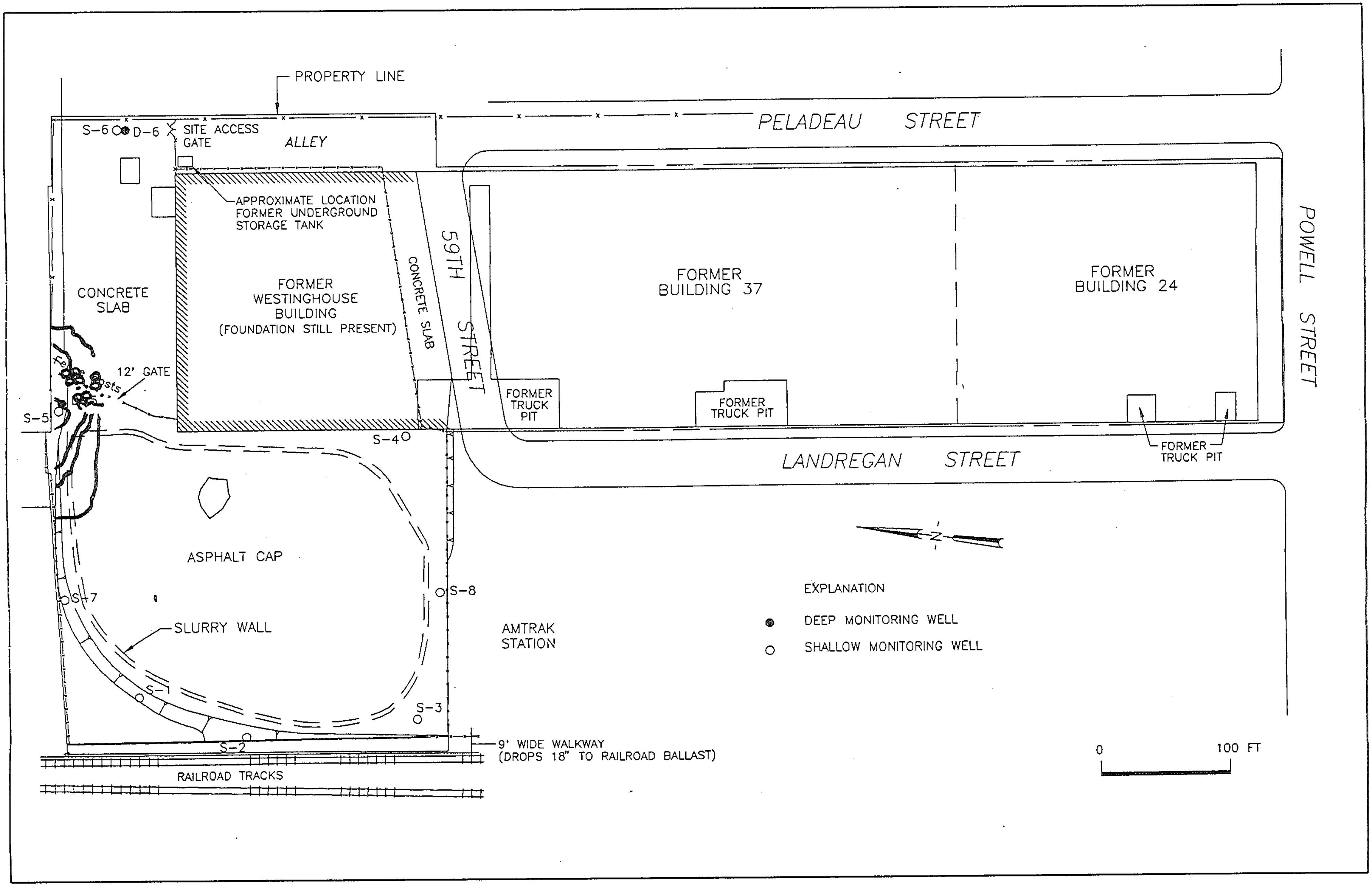


FIGURE A-3: Simulated concentration of 1,2-Dichlorobenzene in groundwater after 30 years.

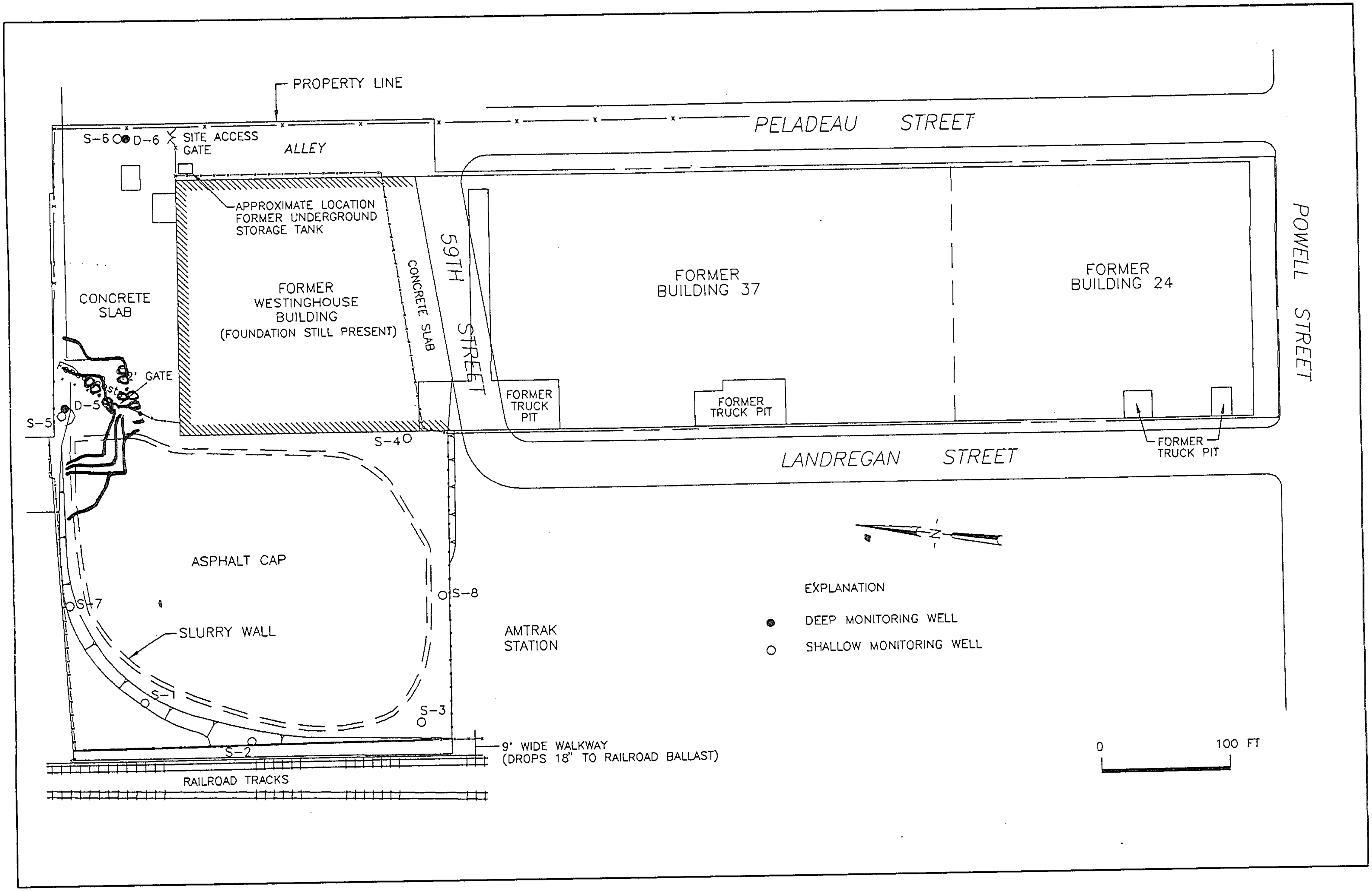


FIGURE A-4: Simulated concentration of 1,3-Dichlorobenzene in groundwater after 30 years.

SOMA ENVIRONMENTAL ENGINEERING

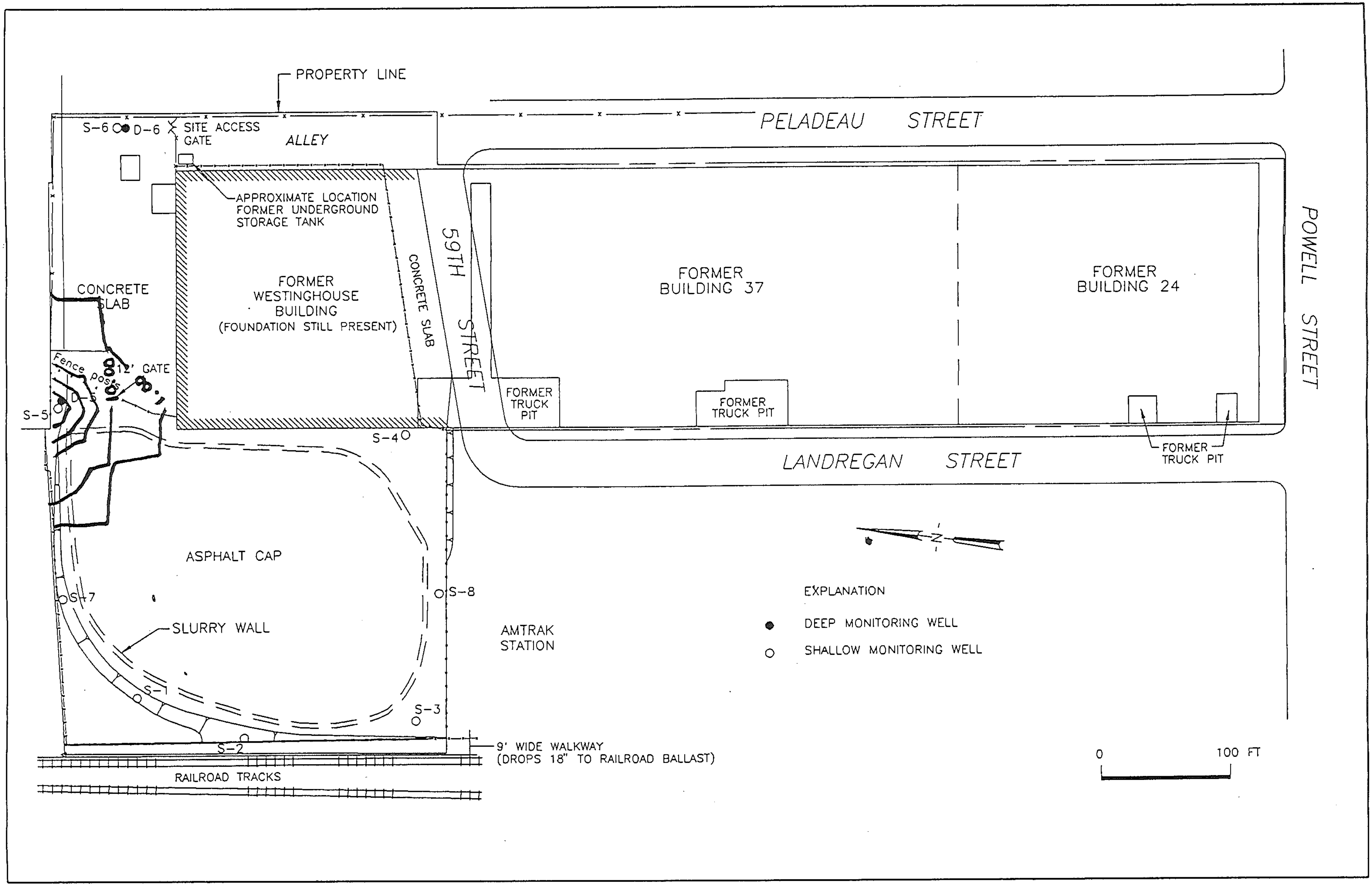


FIGURE A-5: Simulated concentration of 1,4-Dichlorobenzene in groundwater after 30 years.

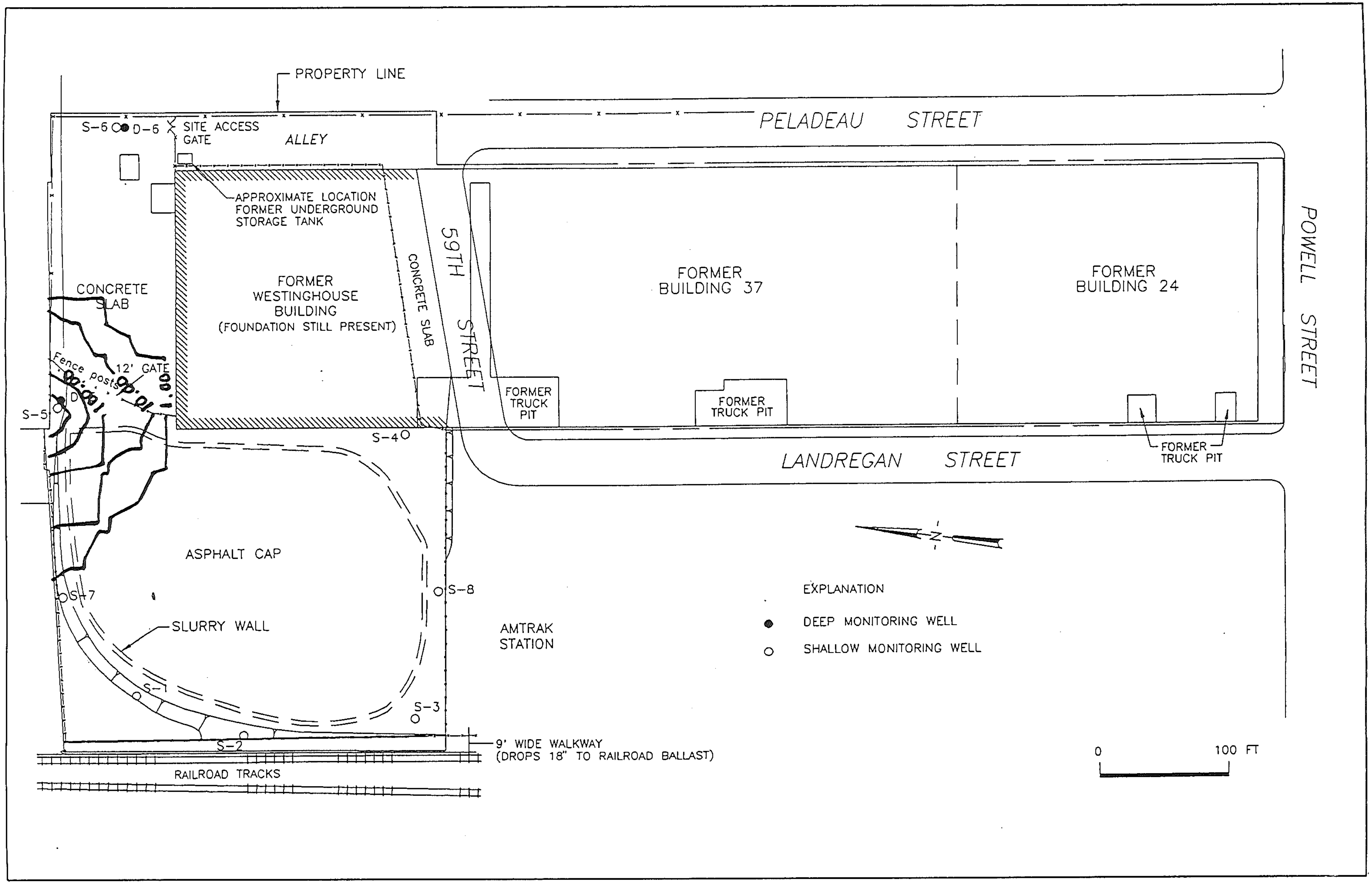


FIGURE A-6: Simulated concentration of Trichloroethene in groundwater after 30 years.

SOMA ENVIRONMENTAL ENGINEERING

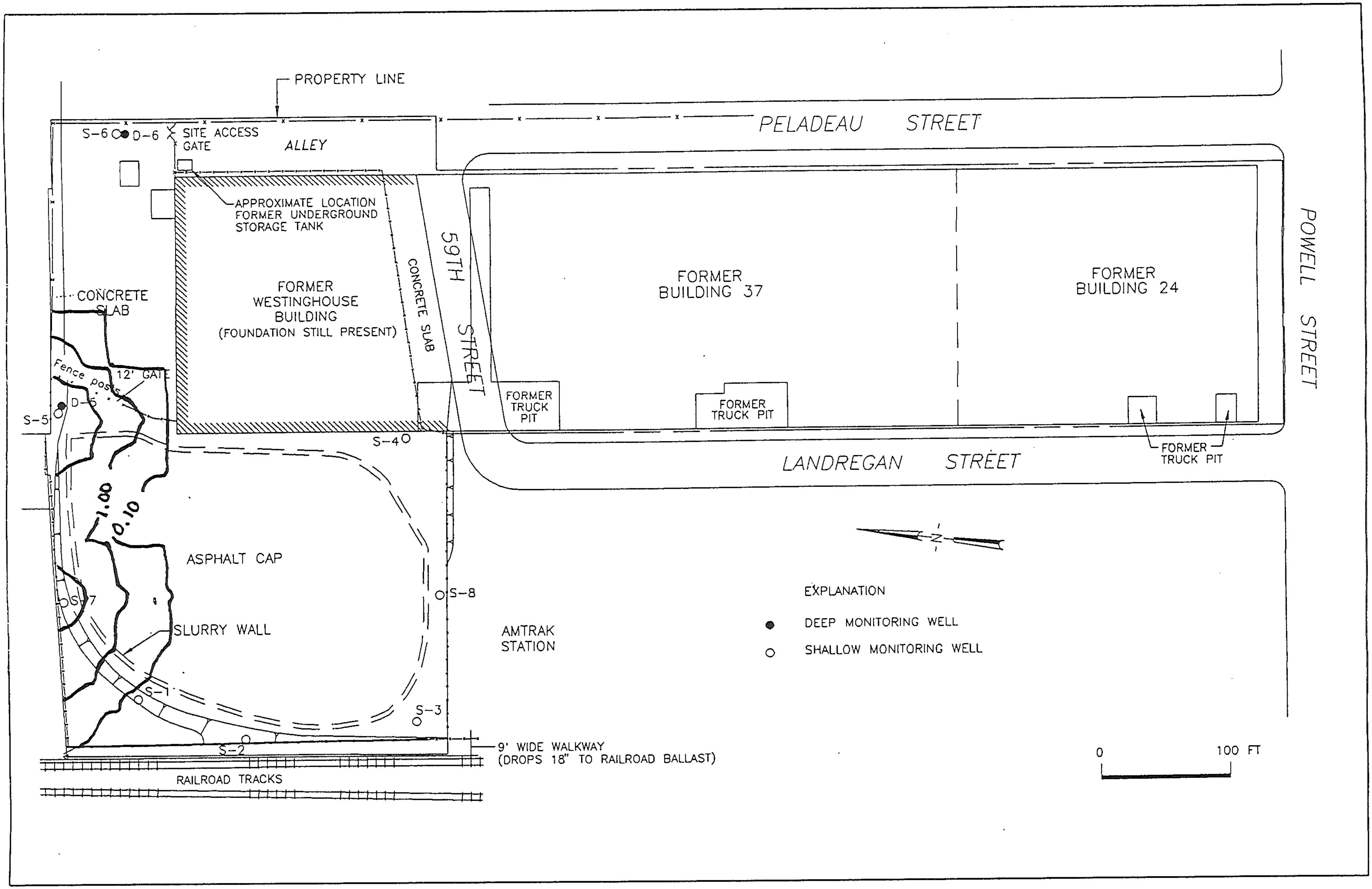


FIGURE A-7: Simulated concentration of trans-1,2-Dichloroethene in groundwater after 30 years.

ENVIRONMENTAL ENGINEERING

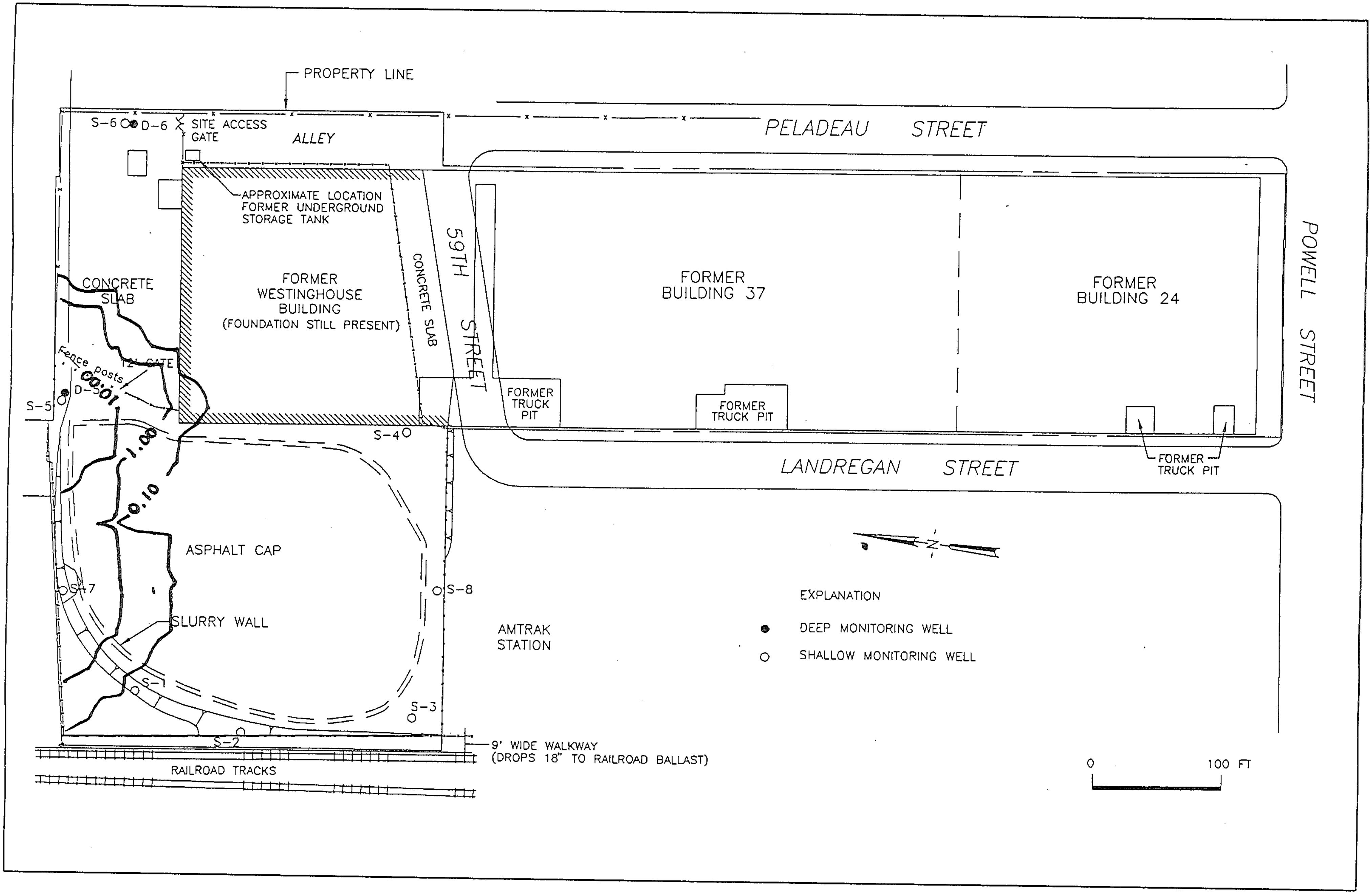


FIGURE A-8: Simulated concentration of cis-1,2-Dichloroethene in groundwater after 30 years.

ENVIRONMENTAL ENGINEERING

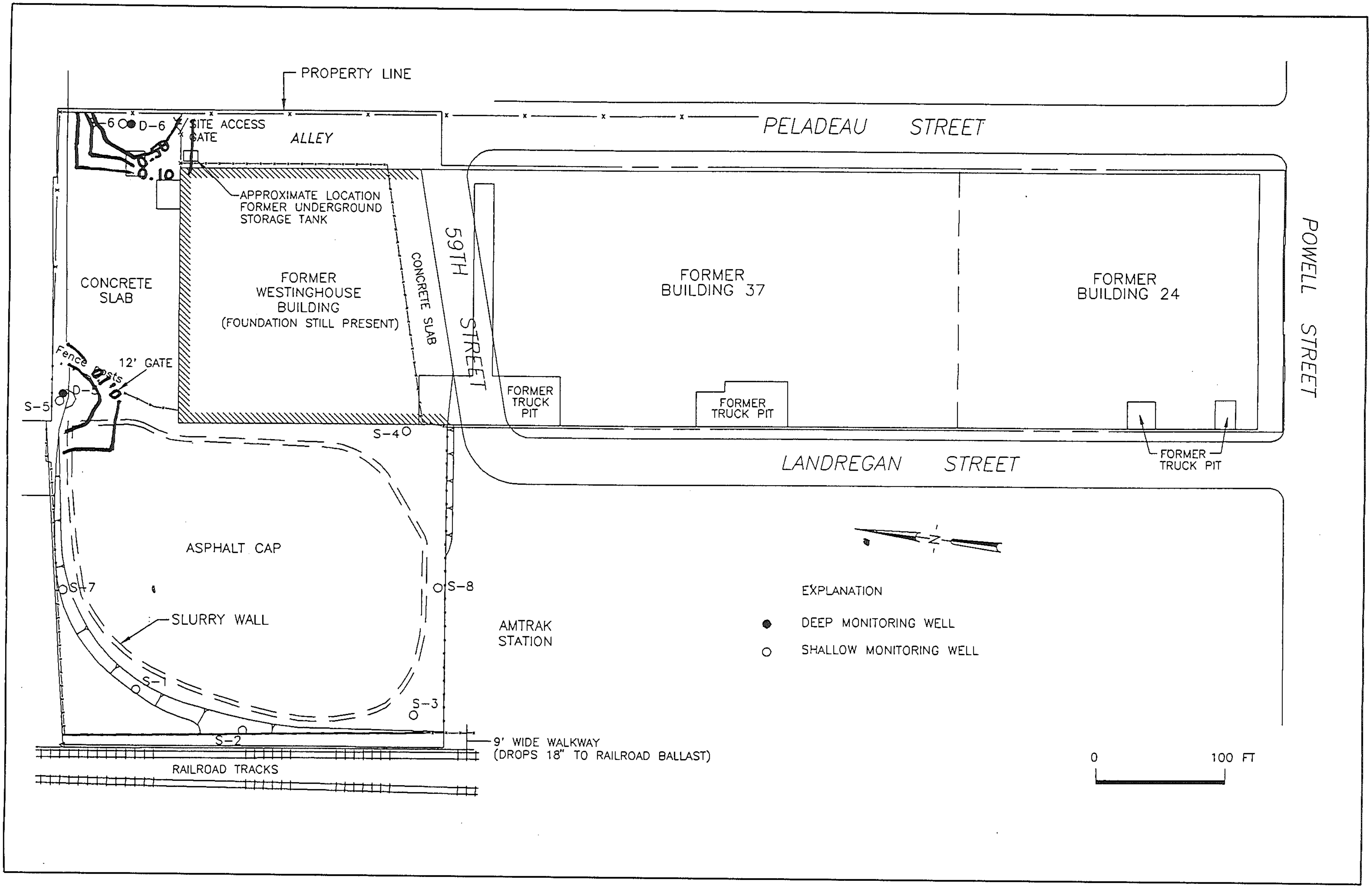


FIGURE A-9: Simulated concentration of Freon in groundwater after 30 years.

SOMA ENVIRONMENTAL ENGINEERING

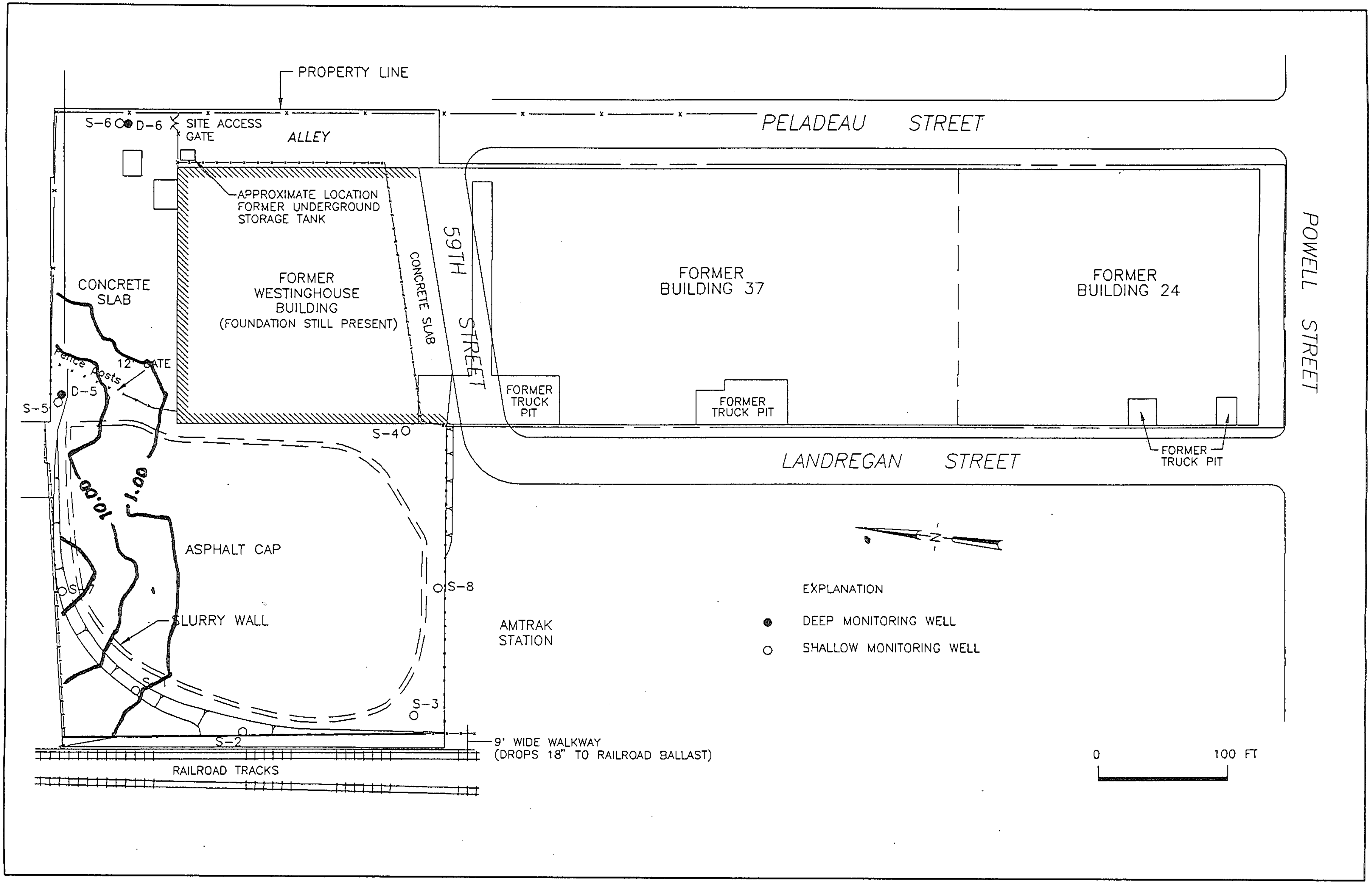


FIGURE A-10: Simulated concentration of Vinyl Chloride in groundwater after 30 years.

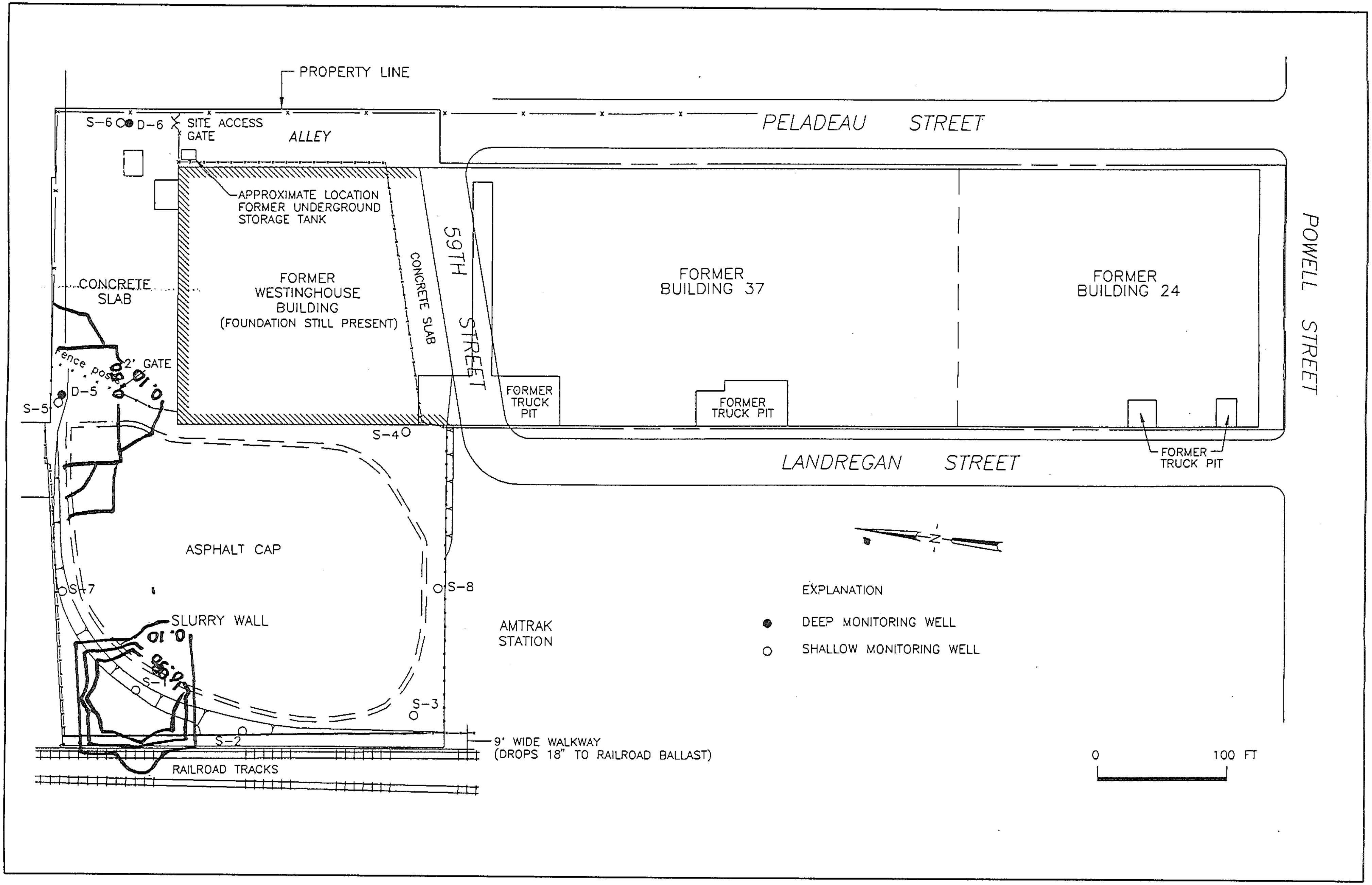


FIGURE A-11: Simulated concentration of Carbon Tetrachloride in groundwater after 30 years.

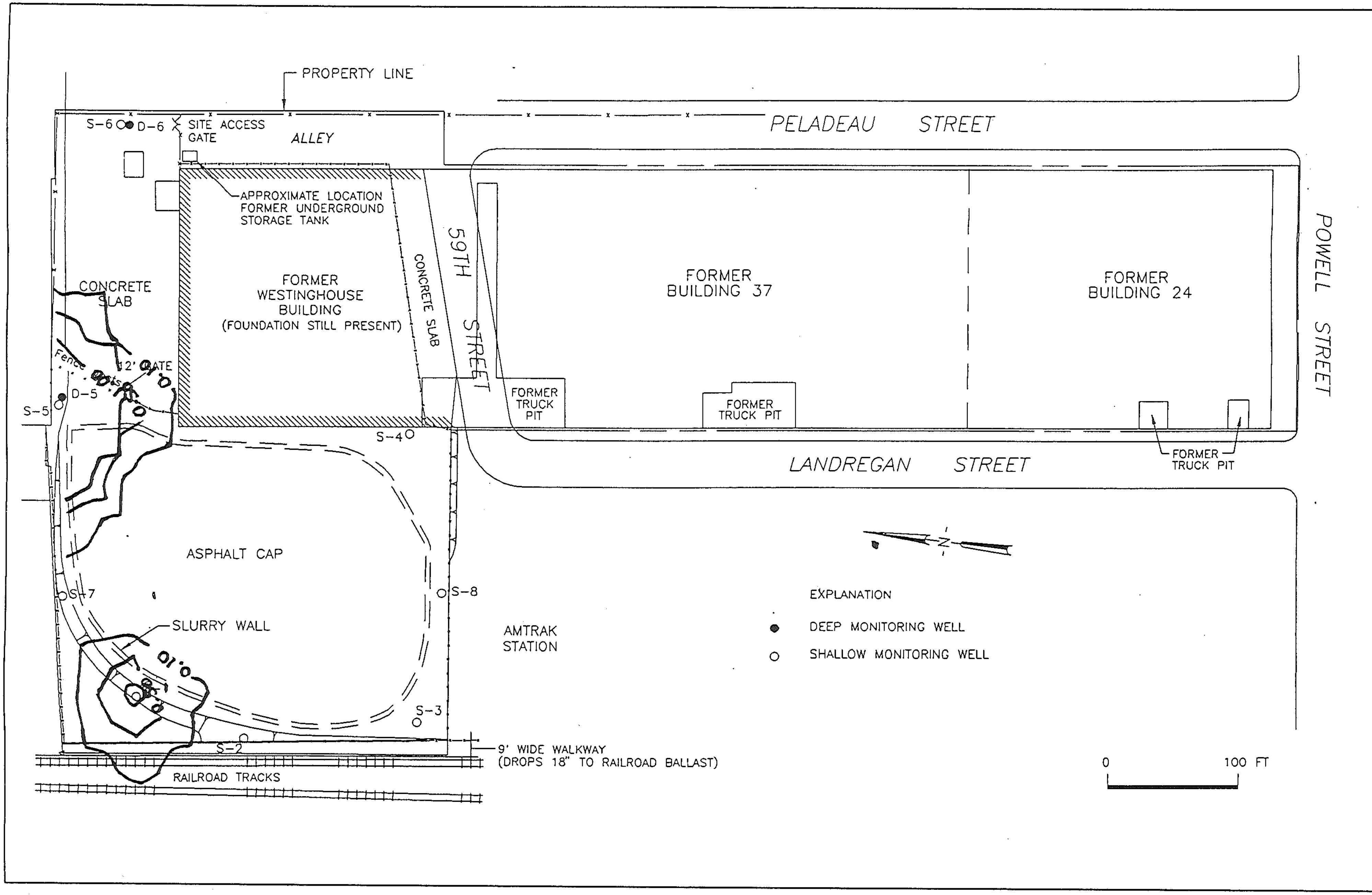


FIGURE A-12: Simulated concentration of Chloroform in groundwater after 30 years.

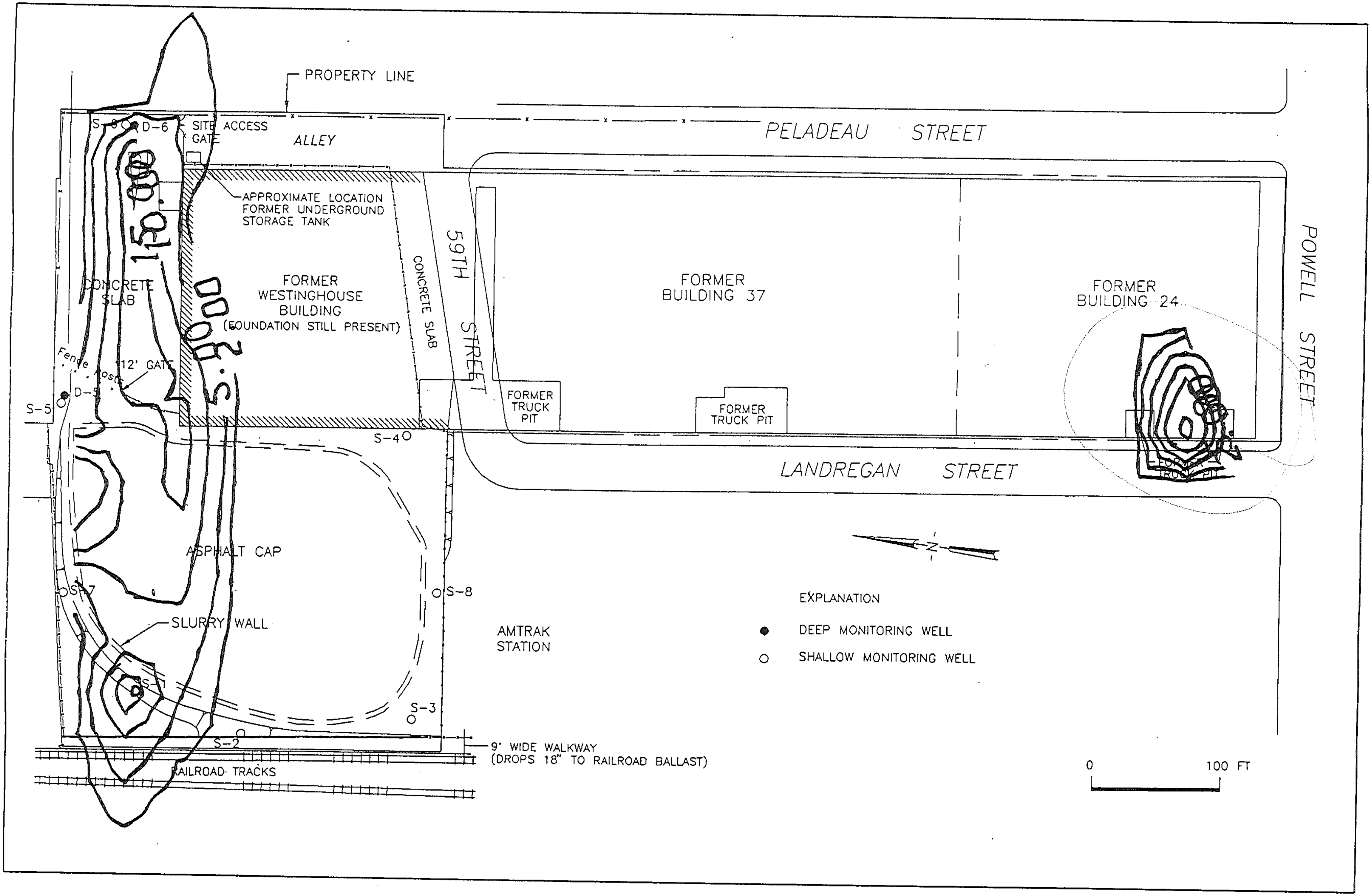


FIGURE A-13: Simulated concentration of PCB's in groundwater after 30 years.

0 5	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	2.000E-02	0.100	0.100	0.100	2.000E-02	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 6	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	2.000E-02	0.100	0.100	0.100	2.000E-02	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 7	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	2.000E-02	2.000E-02	2.000E-02	2.000E-02	2.000E-02	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 8	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 9	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 10	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 11	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 12	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 13	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 14	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 15	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 16	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 17	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 18	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 19	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 20	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 21	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 22	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 23	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 24	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100

	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 25	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 26	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 27	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 28	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 29	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 30	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 31	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 32	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 33	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 34	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 35	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								
0 36	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
	0.100	0.100	0.100								

0

BOTTOM FOR LAYER 1 WILL BE READ ON UNIT 11 USING FORMAT: (10F8.2)

0

SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE

0

MAXIMUM ITERATIONS ALLOWED FOR CLOSURE = 150
ACCELERATION PARAMETER = 1.4500
HEAD CHANGE CRITERION FOR CLOSURE = 0.10000E-01
SIP HEAD CHANGE PRINTOUT INTERVAL = 1

0
CALCULATE ITERATION PARAMETERS FROM MODEL CALCULATED WSEED
1
STRESS PERIOD NO. 1, LENGTH = 25550.00

NUMBER OF TIME STEPS = 7

MULTIPLIER FOR DELT = 1.000

INITIAL TIME STEP SIZE = 3650.000

0

140 HEAD-DEPENDENT BOUNDARY NODES

0

LAYER	ROW	COL	ELEVATION	CONDUCTANCE	BOUND NO.
1	1	1	8.560	0.1578	1
1	1	2	8.570	0.1578	2
1	1	3	8.570	0.1578	3
1	1	4	8.580	0.1579	4
1	1	5	8.580	0.1579	5
1	1	6	8.580	0.1579	6
1	1	7	8.580	0.1579	7
1	1	8	8.590	0.1579	8
1	1	9	8.600	0.1580	9
1	1	10	8.620	0.1581	10
1	1	11	8.640	0.1582	11
1	1	12	8.680	0.1584	12
1	1	13	8.720	0.1586	13
1	1	14	8.760	0.1588	14
1	1	15	8.820	0.1591	15
1	1	16	8.870	0.1593	16
1	1	17	8.940	0.1597	17
1	1	18	9.000	0.1600	18
1	1	19	9.070	0.1603	19
1	1	20	9.130	0.1607	20
1	1	21	9.200	0.1610	21
1	1	22	9.260	0.1613	22
1	1	23	9.320	0.1616	23
1	1	24	9.370	0.1618	24
1	1	25	9.420	0.1621	25
1	1	26	9.460	0.1623	26
1	1	27	9.490	0.1624	27
1	1	28	9.520	0.1626	28
1	1	29	9.540	0.1627	29
1	1	30	9.550	0.1628	30
1	1	31	9.560	0.1628	31
1	1	32	9.560	0.1628	32
1	1	33	9.570	0.1629	33
1	1	34	9.560	0.1628	34
1	1	35	9.560	0.1628	35
1	1	36	9.560	0.1628	36
1	2	1	6.570	0.1052	37
1	3	1	6.590	0.1053	38
1	4	1	6.590	0.1053	39
1	5	1	6.590	0.1053	40
1	6	1	6.580	0.1053	41
1	7	1	6.580	0.1053	42
1	8	1	6.580	0.1053	43
1	9	1	6.570	0.1052	44
1	10	1	6.570	0.1052	45
1	11	1	6.580	0.1053	46
1	12	1	6.580	0.1053	47
1	13	1	6.580	0.1053	48
1	14	1	6.590	0.1053	49
1	15	1	6.600	0.1053	50
1	16	1	6.610	0.1054	51
1	17	1	6.620	0.1054	52
1	18	1	6.630	0.1054	53
1	19	1	6.650	0.1055	54
1	20	1	6.660	0.1055	55
1	21	1	6.670	0.1056	56
1	22	1	6.690	0.1056	57
1	23	1	6.700	0.1057	58
1	24	1	6.710	0.1057	59
1	25	1	6.720	0.1057	60
1	26	1	6.730	0.1058	61
1	27	1	6.740	0.1058	62
1	28	1	6.750	0.1058	63
1	29	1	6.750	0.1058	64
1	30	1	6.760	0.1059	65
1	31	1	6.760	0.1059	66
1	32	1	6.760	0.1059	67
1	33	1	6.760	0.1059	68
1	34	1	6.760	0.1059	69
1	35	1	6.760	0.1059	70
1	36	1	6.750	0.1587	71
1	36	2	6.760	0.1588	72
1	36	3	6.760	0.1588	73
1	36	4	6.760	0.1588	74
1	36	5	6.770	0.1588	75

1	36	6	6.780	0.1589	76
1	36	7	6.790	0.1590	77
1	36	8	6.810	0.1591	78
1	36	9	6.820	0.1591	79
1	36	10	6.840	0.1592	80
1	36	11	6.850	0.1593	81
1	36	12	6.870	0.1593	82
1	36	13	6.890	0.1594	83
1	36	14	6.900	0.1595	84
1	36	15	6.920	0.1596	85
1	36	16	6.930	0.1596	86
1	36	17	6.950	0.1597	87
1	36	18	6.970	0.1599	88
1	36	19	6.990	0.1600	89
1	36	20	7.030	0.1601	90
1	36	21	7.080	0.1604	91
1	36	22	7.160	0.1608	92
1	36	23	7.270	0.1614	93
1	36	24	7.420	0.1621	94
1	36	25	7.570	0.1629	95
1	36	26	7.650	0.1633	96
1	36	27	7.610	0.1631	97
1	36	28	7.490	0.1624	98
1	36	29	7.620	0.1631	99
1	36	30	7.910	0.1646	100
1	36	31	8.280	0.1664	101
1	36	32	8.660	0.1683	102
1	36	33	8.980	0.1699	103
1	36	34	9.310	0.1716	104
1	36	35	9.690	0.1734	105
1	36	36	10.10	0.1755	106
1	2	36	9.560	0.2171	107
1	3	36	9.560	0.2171	108
1	4	36	9.560	0.2171	109
1	5	36	9.570	0.2171	110
1	6	36	9.580	0.2172	111
1	7	36	9.590	0.2173	112
1	8	36	9.600	0.2173	113
1	9	36	9.610	0.2174	114
1	10	36	9.630	0.2175	115
1	11	36	9.650	0.2177	116
1	12	36	9.680	0.2179	117
1	13	36	9.710	0.2181	118
1	14	36	9.740	0.2183	119
1	15	36	9.780	0.2185	120
1	16	36	9.830	0.2189	121
1	17	36	9.880	0.2192	122
1	18	36	9.940	0.2196	123
1	19	36	10.01	0.2201	124
1	20	36	10.09	0.2206	125
1	21	36	10.18	0.2212	126
1	22	36	10.28	0.2219	127
1	23	36	10.38	0.2225	128
1	24	36	10.49	0.2233	129
1	25	36	10.58	0.2239	130
1	26	36	10.67	0.2245	131
1	27	36	10.75	0.2250	132
1	28	36	10.82	0.2255	133
1	29	36	10.90	0.2260	134
1	30	36	11.00	0.2267	135
1	31	36	11.13	0.2275	136
1	32	36	11.29	0.2286	137
1	33	36	11.51	0.2301	138
1	34	36	11.77	0.2318	139
1	35	36	12.01	0.2334	140

```
OAVERAGE SEED = 0.00187574
 MINIMUM SEED = 0.00095101
0
    5 ITERATION PARAMETERS CALCULATED FROM AVERAGE SEED:

          0.0000000E+00  0.7918900E+00  0.9566902E+00  0.9909868E+00  0.9981242E+00
0
    11 ITERATIONS FOR TIME STEP    1 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL
```

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-------
     1.360     (  1, 30, 30) -0.5578     (  1, 35, 35) -0.4713     (  1, 36, 36)  0.2474     (  1,  2, 14)  0.4230     (  1, 15,
21)
   -0.2460E-01 (  1, 21, 26) -0.4292E-01 (  1, 23, 28) -0.4270E-01 (  1, 27, 34) -0.8498E-01 (  1, 21, 29) -0.3640E-01 (  1,  7,
31)
   -0.2690E-02 (  1,  5, 24)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   2 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

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-------
   -0.1413E-02 (  1,  7, 24)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   3 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

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-------
    0.8562E-03 (  1, 25, 32)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   4 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

--------------------------------------------------------------------------------------------------------------------------------
-------
    0.7686E-03 (  1, 25, 33)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   5 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

--------------------------------------------------------------------------------------------------------------------------------
-------
    0.6903E-03 (  1, 25, 33)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   6 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

--------------------------------------------------------------------------------------------------------------------------------
-------
    0.6254E-03 (  1, 25, 33)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
      1 ITERATIONS FOR TIME STEP   7 IN STRESS PERIOD  1
OMAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE  LAYER,ROW,COL  HEAD  CHANGE
LAYER,ROW,COL

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-------
    0.5644E-03 (  1, 25, 33)
0

 HEADS AND FLOW TERMS SAVED ON UNIT 22 FOR USE BY MT3D TRANSPORT MODEL
1                      HEAD IN LAYER  1 AT END OF TIME STEP  7 IN STRESS PERIOD  1
```

	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36				
0 1	-0.5383	-0.5497	-0.5782	-0.5994	-0.6316	-0.6643	-0.6974	-0.7213	-0.7458	-0.7611
	-0.7774	-0.7748	-0.7730	-0.7720	-0.7519	-0.7423	-0.7133	-0.6944	-0.6658	-0.6474
	-0.6198	-0.6034	-0.5895	-0.5897	-0.5999	-0.6129	-0.6293	-0.6335	-0.6391	-0.6513
	-0.6617	-0.6806	-0.6882	-0.7138	-0.7271	-0.7364				
0 2	-0.4842	-0.5105	-0.5348	-0.5789	-0.6130	-0.6474	-0.6820	-0.7070	-0.7325	-0.7486
	-0.7554	-0.7629	-0.7611	-0.7499	-0.7393	-0.7190	-0.6991	-0.6792	-0.6493	-0.6294
	-0.5999	-0.5813	-0.5750	-0.5594	-0.5723	-0.5856	-0.6212	-0.6341	-0.6347	-0.6460
	-0.6566	-0.6663	-0.6848	-0.7020	-0.7178	-0.7327				
0 3	-0.4324	-0.4735	-0.5215	-0.5582	-0.5944	-0.6303	-0.6662	-0.6923	-0.7187	-0.7255
	-0.7427	-0.7405	-0.7387	-0.7274	-0.7164	-0.6956	-0.6749	-0.6540	-0.6327	-0.6011
	-0.5789	-0.5571	-0.5498	-0.5587	-0.5556	-0.5508	-0.5847	-0.6282	-0.6296	-0.6312
	-0.6425	-0.6530	-0.6728	-0.6915	-0.7093	-0.7266				
0 4	-0.4068	-0.4494	-0.4996	-0.5382	-0.5760	-0.6132	-0.6503	-0.6773	-0.6945	-0.7119
	-0.7196	-0.7276	-0.7260	-0.7146	-0.7034	-0.6822	-0.6608	-0.6291	-0.6067	-0.5831
	-0.5576	-0.5285	-0.5435	-0.5601	-0.5504	-0.5363	-0.5756	-0.6121	-0.6143	-0.6266
	-0.6289	-0.6506	-0.6617	-0.6819	-0.7013	-0.7200				
0 5	-0.3847	-0.4379	-0.4793	-0.5191	-0.5681	-0.5964	-0.6344	-0.6622	-0.6801	-0.6980
	-0.7061	-0.7045	-0.7030	-0.6916	-0.6803	-0.6589	-0.6372	-0.6150	-0.5918	-0.5671
	-0.5399	-0.5089	-0.5301	-0.5524	-0.5394	-0.5247	-0.5608	-0.6059	-0.5987	-0.6122
	-0.6157	-0.6288	-0.6513	-0.6630	-0.6838	-0.7038				
0 6	-0.3749	-0.4184	-0.4603	-0.5110	-0.5508	-0.5899	-0.6187	-0.6472	-0.6656	-0.6840
	-0.6925	-0.6911	-0.6898	-0.6786	-0.6573	-0.6459	-0.6241	-0.5918	-0.5684	-0.5435
	-0.5160	-0.4946	-0.5146	-0.5419	-0.5299	-0.5161	-0.5475	-0.5886	-0.5824	-0.5875
	-0.6028	-0.6177	-0.6318	-0.6549	-0.6771	-0.6884				
0 7	-0.3570	-0.4004	-0.4526	-0.4938	-0.5341	-0.5738	-0.6031	-0.6322	-0.6511	-0.6600
	-0.6688	-0.6777	-0.6667	-0.6556	-0.6445	-0.6233	-0.6017	-0.5796	-0.5567	-0.5325
	-0.5061	-0.4854	-0.4770	-0.5035	-0.5066	-0.5078	-0.5347	-0.5578	-0.5645	-0.5726
	-0.5804	-0.5972	-0.6131	-0.6378	-0.6613	-0.6738				
0 8	-0.3404	-0.3936	-0.4359	-0.4773	-0.5180	-0.5581	-0.5879	-0.6173	-0.6366	-0.6459
	-0.6551	-0.6543	-0.6535	-0.6427	-0.6219	-0.6009	-0.5797	-0.5582	-0.5362	-0.5137
	-0.4906	-0.4782	-0.4721	-0.4690	-0.4744	-0.4800	-0.4979	-0.5180	-0.5351	-0.5480
	-0.5587	-0.5778	-0.5954	-0.6217	-0.6367	-0.6603				
0 9	-0.3346	-0.3777	-0.4200	-0.4615	-0.5023	-0.5427	-0.5728	-0.5926	-0.6122	-0.6318
	-0.6313	-0.6308	-0.6303	-0.6198	-0.5993	-0.5788	-0.5581	-0.5373	-0.5163	-0.4953
	-0.4845	-0.4647	-0.4575	-0.4621	-0.4568	-0.4716	-0.4768	-0.4909	-0.5100	-0.5255
	-0.5385	-0.5596	-0.5791	-0.5970	-0.6234	-0.6481				
0 10	-0.3198	-0.3626	-0.4047	-0.4462	-0.4871	-0.5177	-0.5479	-0.5779	-0.5978	-0.6076
	-0.6174	-0.6172	-0.6071	-0.5969	-0.5768	-0.5567	-0.5366	-0.5165	-0.4965	-0.4766
	-0.4672	-0.4486	-0.4412	-0.4449	-0.4389	-0.4429	-0.4565	-0.4689	-0.4785	-0.4955
	-0.5103	-0.5331	-0.5543	-0.5738	-0.6016	-0.6277				
0 11	-0.2957	-0.3481	-0.3899	-0.4313	-0.4622	-0.5028	-0.5331	-0.5533	-0.5734	-0.5834
	-0.5935	-0.5935	-0.5837	-0.5739	-0.5542	-0.5346	-0.5151	-0.4957	-0.4764	-0.4575
	-0.4390	-0.4311	-0.4239	-0.4174	-0.4210	-0.4245	-0.4375	-0.4494	-0.4595	-0.4776
	-0.4938	-0.5083	-0.5311	-0.5522	-0.5815	-0.6091				
0 12	-0.2820	-0.3240	-0.3655	-0.4066	-0.4474	-0.4780	-0.5084	-0.5387	-0.5489	-0.5591
	-0.5694	-0.5697	-0.5601	-0.5507	-0.5314	-0.5123	-0.4933	-0.4746	-0.4561	-0.4379
	-0.4201	-0.4128	-0.4060	-0.3995	-0.4032	-0.4066	-0.4096	-0.4216	-0.4323	-0.4515
	-0.4691	-0.4851	-0.5095	-0.5323	-0.5633	-0.5825				
0 13	-0.2686	-0.3102	-0.3513	-0.3922	-0.4228	-0.4633	-0.4836	-0.5139	-0.5242	-0.5346
	-0.5451	-0.5356	-0.5364	-0.5173	-0.5084	-0.4897	-0.4713	-0.4532	-0.4353	-0.4178
	-0.4007	-0.3940	-0.3876	-0.3815	-0.3854	-0.3892	-0.3925	-0.3951	-0.4167	-0.4270
	-0.4460	-0.4636	-0.4896	-0.5141	-0.5368	-0.5577				
0 14	-0.2455	-0.2865	-0.3272	-0.3678	-0.3982	-0.4385	-0.4587	-0.4890	-0.4994	-0.5099
	-0.5105	-0.5113	-0.5023	-0.4935	-0.4750	-0.4568	-0.4389	-0.4214	-0.4041	-0.3973
	-0.3808	-0.3747	-0.3689	-0.3634	-0.3578	-0.3622	-0.3662	-0.3796	-0.3922	-0.4038
	-0.4143	-0.4335	-0.4613	-0.4876	-0.5122	-0.5348				
0 15	-0.2225	-0.2629	-0.3032	-0.3433	-0.3734	-0.4135	-0.4336	-0.4539	-0.4742	-0.4848
	-0.4855	-0.4865	-0.4778	-0.4594	-0.4512	-0.4335	-0.4161	-0.3991	-0.3925	-0.3763
	-0.3605	-0.3551	-0.3500	-0.3451	-0.3403	-0.3455	-0.3504	-0.3549	-0.3587	-0.3718
	-0.3938	-0.4048	-0.4245	-0.4528	-0.4794	-0.5042				
0 16	-0.1995	-0.2393	-0.2790	-0.3187	-0.3484	-0.3783	-0.4082	-0.4284	-0.4487	-0.4493
	-0.4601	-0.4513	-0.4428	-0.4347	-0.4270	-0.4096	-0.3928	-0.3863	-0.3703	-0.3548
	-0.3497	-0.3351	-0.3308	-0.3267	-0.3228	-0.3290	-0.3250	-0.3307	-0.3360	-0.3507
	-0.3545	-0.3774	-0.3992	-0.4197	-0.4486	-0.4657				
0 17	-0.1764	-0.2155	-0.2546	-0.2938	-0.3232	-0.3527	-0.3824	-0.4024	-0.4127	-0.4233
	-0.4242	-0.4256	-0.4173	-0.4095	-0.4021	-0.3852	-0.3788	-0.3630	-0.3576	-0.3428
	-0.3385	-0.3246	-0.3212	-0.3181	-0.3053	-0.3025	-0.2999	-0.3070	-0.3039	-0.3103
	-0.3262	-0.3412	-0.3553	-0.3782	-0.3996	-0.4293				
0 18	-0.1530	-0.1914	-0.2199	-0.2586	-0.2975	-0.3267	-0.3462	-0.3660	-0.3862	-0.3867
	-0.3977	-0.3892	-0.3911	-0.3836	-0.3766	-0.3701	-0.3542	-0.3489	-0.3443	-0.3402
	-0.3266	-0.3237	-0.3112	-0.2992	-0.2975	-0.2861	-0.2848	-0.2736	-0.2723	-0.2807
	-0.2887	-0.2960	-0.3126	-0.3282	-0.3624	-0.3850				

0 19	-0.1194	-0.1569	-0.1948	-0.2329	-0.2614	-0.2902	-0.3194	-0.3390	-0.3490	-0.3595
	-0.3605	-0.3621	-0.3642	-0.3569	-0.3503	-0.3442	-0.3489	-0.3442	-0.3402	-0.3268
	-0.3242	-0.3121	-0.3107	-0.2998	-0.2795	-0.2695	-0.2598	-0.2503	-0.2409	-0.2415
	-0.2418	-0.2517	-0.2610	-0.2796	-0.3070	-0.3329				
0 20	-9.5175E-02	-0.1320	-0.1691	-0.2067	-0.2346	-0.2630	-0.2819	-0.3012	-0.3211	-0.3316
	-0.3326	-0.3342	-0.3365	-0.3395	-0.3331	-0.3375	-0.3327	-0.3386	-0.3352	-0.3327
	-0.3309	-0.3199	-0.3096	-0.2900	-0.2710	-0.2525	-0.2346	-0.2170	-0.1997	-0.1925
	-0.1854	-0.1880	-0.2004	-0.2221	-0.2430	-0.2727				
0 21	-7.0438E-02	-0.1065	-0.1429	-0.1698	-0.2073	-0.2352	-0.2537	-0.2728	-0.2825	-0.2928
	-0.3038	-0.3055	-0.3079	-0.3111	-0.3150	-0.3198	-0.3255	-0.3320	-0.3394	-0.3376
	-0.3368	-0.3268	-0.3177	-0.2994	-0.2719	-0.2451	-0.2090	-0.1835	-0.1584	-0.1337
	-0.1192	-0.1248	-0.1303	-0.1456	-0.1703	-0.2042				
0 22	-3.5163E-02	-7.0317E-02	-0.1060	-0.1423	-0.1691	-0.1966	-0.2247	-0.2435	-0.2529	-0.2631
	-0.2740	-0.2857	-0.2883	-0.2916	-0.3059	-0.3111	-0.3172	-0.3343	-0.3424	-0.3515
	-0.3516	-0.3428	-0.3349	-0.3080	-0.2721	-0.2370	-0.1929	-0.1395	-9.6760E-02	-6.4652E-02
	-4.3024E-02	-4.1745E-02	-4.0669E-02	-5.9640E-02	-8.8477E-02	-0.1270				
0 23	-9.0766E-03	-4.3410E-02	-7.8355E-02	-0.1140	-0.1402	-0.1672	-0.1848	-0.2132	-0.2224	-0.2324
	-0.2432	-0.2549	-0.2676	-0.2711	-0.2857	-0.3012	-0.3178	-0.3355	-0.3543	-0.3643
	-0.3754	-0.3776	-0.3610	-0.3356	-0.2913	-0.2381	-0.1759	-0.1048	-3.4591E-02	1.4783E-02
	4.3420E-02	6.1433E-02	5.8945E-02	3.6077E-02	-7.0496E-03	-5.0326E-02				
0 24	1.7811E-02	-1.5694E-02	-4.9872E-02	-7.4781E-02	-0.1104	-0.1368	-0.1540	-0.1821	-0.1909	-0.2107
	-0.2214	-0.2330	-0.2457	-0.2594	-0.2742	-0.2901	-0.3171	-0.3354	-0.3549	-0.3857
	-0.3978	-0.4112	-0.4059	-0.3820	-0.3394	-0.2681	-0.1780	-6.9259E-02	2.8360E-02	0.1049
	0.1604	0.1850	0.1689	0.1420	9.4457E-02	3.6254E-02				
0 25	4.5538E-02	1.2882E-02	-2.0512E-02	-4.4700E-02	-7.9694E-02	-0.1055	-0.1222	-0.1498	-0.1583	-0.1778
	-0.1883	-0.2099	-0.2225	-0.2363	-0.2613	-0.2775	-0.3050	-0.3339	-0.3641	-0.4057
	-0.4288	-0.4533	-0.4694	-0.4570	-0.4061	-0.3168	-0.1989	-5.2578E-02	9.2350E-02	0.2159
	0.2982	0.3193	0.3094	0.2584	0.1866	0.1038				
0 26	7.4155E-02	4.2364E-02	9.7785E-03	-1.3663E-02	-4.7972E-02	-7.3182E-02	-9.9326E-02	-0.1164	-0.1346	-0.1537
	-0.1640	-0.1854	-0.1980	-0.2219	-0.2470	-0.2735	-0.3014	-0.3307	-0.3716	-0.4141
	-0.4681	-0.5038	-0.5413	-0.5504	-0.5113	-0.4239	-0.2684	-7.4502E-02	0.1377	0.3282
	0.4471	0.4846	0.4508	0.3758	0.2696	0.1723				
0 27	0.1037	7.2793E-02	4.1042E-02	8.3804E-03	-1.5207E-02	-3.9758E-02	-6.5310E-02	-8.1904E-02	-9.9583E-02	-0.1184
	-0.1384	-0.1596	-0.1721	-0.1959	-0.2212	-0.2579	-0.2861	-0.3259	-0.3774	-0.4306
	-0.4857	-0.5525	-0.6113	-0.6620	-0.6547	-0.5794	-0.3960	-0.1548	9.4551E-02	0.3719
	0.5874	0.6412	0.5834	0.4642	0.3437	0.2322				
0 28	0.1342	0.1042	7.3319E-02	4.1471E-02	1.8646E-02	-1.5199E-02	-3.0108E-02	-5.6130E-02	-7.3308E-02	-9.1693E-02
	-0.1113	-0.1323	-0.1546	-0.1784	-0.2036	-0.2305	-0.2690	-0.3193	-0.3613	-0.4253
	-0.5012	-0.5892	-0.6793	-0.7716	-0.8260	-0.7727	-0.5617	-0.3130	-0.1366	0.1875
	0.6295	0.7394	0.6474	0.5139	0.3990	0.2831				
0 29	0.1558	0.1267	9.6641E-02	7.5644E-02	4.3632E-02	2.0545E-02	-3.6693E-03	-2.9062E-02	-4.5683E-02	-6.3583E-02
	-8.2817E-02	-0.1034	-0.1255	-0.1491	-0.1844	-0.2113	-0.2500	-0.3006	-0.3532	-0.4178
	-0.4947	-0.5937	-0.7151	-0.8488	-0.9550	-0.9738	-0.7651	-0.5990	-0.6756	-0.4448
	0.3235	0.5894	0.5831	0.5049	0.4252	0.3446				
0 30	0.1883	0.1601	0.1310	0.1009	6.9789E-02	4.7521E-02	2.4062E-02	9.3560E-03	-1.6647E-02	-3.4001E-02
	-5.2759E-02	-7.2985E-02	-9.4749E-02	-0.1281	-0.1532	-0.1901	-0.2290	-0.2698	-0.3228	-0.3881
	-0.4757	-0.5758	-0.6984	-0.8436	-0.9715	-1.032	-0.9858	-1.052	-1.362	-1.415
	-0.5601	8.1562E-02	0.3606	0.4474	0.4523	0.4260				
0 31	0.2118	0.1845	0.1564	0.1274	0.1072	7.5781E-02	6.3139E-02	3.9180E-02	1.3855E-02	-2.8872E-03
	-2.1100E-02	-4.0847E-02	-6.2204E-02	-9.5260E-02	-0.1201	-0.1569	-0.1957	-0.2367	-0.2900	-0.3558
	-0.4342	-0.5252	-0.6390	-0.7756	-0.9151	-1.018	-1.083	-1.233	-1.475	-1.491
	-0.9108	-0.2836	0.1406	0.3720	0.4808	0.5375				
0 32	0.2362	0.2099	0.1829	0.1549	0.1358	0.1154	9.3624E-02	7.0468E-02	5.5877E-02	2.9809E-02
	1.2214E-02	-6.9728E-03	-3.7827E-02	-6.0447E-02	-8.4948E-02	-0.1215	-0.1601	-0.2012	-0.2547	-0.3109
	-0.3699	-0.4518	-0.5466	-0.6546	-0.7856	-0.9099	-0.9877	-1.089	-1.195	-1.145
	-0.8183	-0.3657	5.3423E-02	0.3492	0.5514	0.6800				
0 33	0.2611	0.2361	0.2105	0.1838	0.1658	0.1464	0.1256	0.1033	8.9471E-02	6.4135E-02
	4.7227E-02	2.8686E-02	-1.5655E-03	-2.3628E-02	-4.7632E-02	-8.3735E-02	-0.1221	-0.1630	-0.2065	-0.2530
	-0.3025	-0.3652	-0.4212	-0.4904	-0.5628	-0.6186	-0.6780	-0.7517	-0.8103	-0.7538
	-0.5519	-0.2342	0.1098	0.4201	0.6760	0.8854				
0 34	0.2863	0.2630	0.2391	0.2139	0.1972	0.1790	0.1591	0.1377	0.1247	0.1101
	8.3974E-02	6.6162E-02	3.6621E-02	1.5251E-02	-8.0972E-03	-4.3601E-02	-8.1481E-02	-0.1120	-0.1554	-0.1919
	-0.2219	-0.2653	-0.2824	-0.3028	-0.2965	-0.2734	-0.2840	-0.3894	-0.4606	-0.4181
	-0.2612	-8.8673E-03	0.2700	0.5657	0.8571	1.139				
0 35	0.3107	0.2905	0.2691	0.2457	0.2303	0.2132	0.1943	0.1837	0.1615	0.1478
	0.1225	0.1055	8.6740E-02	5.6221E-02	3.3710E-02	-9.6703E-04	-2.8100E-02	-6.7965E-02	-0.1009	-0.1273
	-0.1475	-0.1518	-0.1500	-0.1119	-5.6898E-02	1.5532E-02	1.4865E-02	-0.1709	-0.2446	-0.1667
	1.4163E-02	0.2502	0.4936	0.7560	1.058	1.393				
0 36	0.3222	0.3194	0.3010	0.2794	0.2653	0.2491	0.2311	0.2214	0.2001	0.1872
	0.1627	0.1466	0.1288	9.9285E-02	7.7788E-02	4.4232E-02	1.8130E-02	-1.0750E-02	-4.2846E-02	-5.8851E-02
	-6.9077E-02	-5.4045E-02	-1.3769E-02	6.2189E-02	0.1354	0.1377	1.9031E-02	-0.1844	-0.1500	3.2025E-02
	0.2847	0.5421	0.7386	0.9471	1.214	1.540				

0

VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP 7 IN STRESS PERIOD 1

```
0                 CUMULATIVE VOLUMES      L**3
                  ------------------

                      IN:
                      ---
                         STORAGE =    0.00000
                   CONSTANT HEAD =    0.00000
                 HEAD DEP BOUNDS =    0.21857E+06
0                       TOTAL IN =    0.21857E+06
0                    OUT:
                     ----
                         STORAGE =    0.00000
                   CONSTANT HEAD =    0.00000
                 HEAD DEP BOUNDS =    0.21810E+06
0                      TOTAL OUT =    0.21810E+06
0                       IN - OUT =     464.31
0           PERCENT DISCREPANCY =                0.21
```

```
RATES FOR THIS TIME STEP       L**3/T
------------------------

            IN:
            ---
             STORAGE =    0.00000
       CONSTANT HEAD =    0.00000
     HEAD DEP BOUNDS =     8.5456
            TOTAL IN =     8.5456
           OUT:
           ----
             STORAGE =    0.00000
       CONSTANT HEAD =    0.00000
     HEAD DEP BOUNDS =     8.5374
           TOTAL OUT =     8.5374
            IN - OUT =    0.82150E-02
PERCENT DISCREPANCY =                0.10
```

0

TIME SUMMARY AT END OF TIME STEP 7 IN STRESS PERIOD 1

	SECONDS	MINUTES	HOURS	DAYS	YEARS
TIME STEP LENGTH	0.315360E+09	0.525600E+07	87600.0	3650.00	9.99316
STRESS PERIOD TIME	0.220752E+10	0.367920E+08	613200.	25550.0	69.9521
TOTAL SIMULATION TIME	0.220752E+10	0.367920E+08	613200.	25550.0	69.9521

1

```
                    +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    +                                                                     +
                    +                                M T 3 D                              +
                    +              A Modular Three-Dimensional Transport Model            +
                    +     For Simulation of Advection, Dispersion and Chemical Reactions  +
                    +               of Contaminants in Groundwater Systems                +
                    +                              (V. 1.80)                              +
                    +                                                                     +
                    +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 -----
 | M T | Water Quality Modeling for Westinghouse Electric, Emeryville, CA.
 | 3 D | SOMA Environmental Engineering August, 1995 (Tce run)
 -----
THE TRANSPORT MODEL CONSISTS OF     1 LAYER(S)   36 ROW(S)   36 COLUMN(S)
NUMBER OF STRESS PERIOD(S) IN SIMULATION =    1
UNIT FOR TIME IS  DAY;  UNIT FOR LENGTH IS   FT;  UNIT FOR MASS IS   LB
MAJOR TRANSPORT COMPONENTS TO BE SIMULATED:
 1  ADVECTION
 2  DISPERSION
 3  SINK AND SOURCE MIXING
 4  CHEMICAL REACTIONS (DECAY AND/OR SORPTION)

BTN1 -- BASIC TRANSPORT PACKAGE, VER 1.8, OCTOBER 1992, INPUT READ FROM UNIT  1
   14400 ELEMENTS OF THE  X ARRAY USED BY THE BTN PACKAGE
    1297 ELEMENTS OF THE IX ARRAY USED BY THE BTN PACKAGE

ADV1 -- ADVECTION PACKAGE, VER 1.8, OCTOBER 1992, INPUT READ FROM UNIT  2
ADVECTION IS SOLVED WITH THE UPSTREAM FINITE DIFFERENCE SCHEME
COURANT NUMBER ALLOWED IN SOLVING THE ADVECTION TERM = 0.700
MAXIMUM NUMBER OF MOVING PARTICLES ALLOWED =   10000
       0 ELEMENTS OF THE  X ARRAY USED BY THE ADV PACKAGE
       0 ELEMENTS OF THE IX ARRAY USED BY THE ADV PACKAGE

DSP1 -- DISPERSION PACKAGE, VER 1.8, OCTOBER 1992, INPUT READ FROM UNIT  3
    6483 ELEMENTS OF THE  X ARRAY USED BY THE DSP PACKAGE
       0 ELEMENTS OF THE IX ARRAY USED BY THE DSP PACKAGE

SSM1 -- SINK & SOURCE MIXING PACKAGE, VER 1.8, OCTOBER 1992, INPUT READ FROM UNIT  4
MAJOR STRESS COMPONENTS PRESENT IN THE FLOW MODEL:
 1  GENERAL-HEAD-DEPENDENT BOUNDARY
MAXIMUM NUMBER OF POINT SINKS/SOURCES =     140
     840 ELEMENTS OF THE  X ARRAY USED BY THE SSM PACKAGE
       0 ELEMENTS OF THE IX ARRAY BY THE SSM PACKAGE

RCT1 -- CHEMICAL REACTIONS PACKAGE, VER 1.8, OCTOBER 1992, INPUT READ FROM UNIT  9
TYPE OF SORPTION SELECTED IS [LINEAR]
NO FIRST-ORDER RATE REACTION IS SIMULATED
       3 ELEMENTS OF THE  X ARRAY USED BY THE RCT PACKAGE
       0 ELEMENTS OF THE IX ARRAY USED BY THE RCT PACKAGE

 ...........................................................
   21727 ELEMENTS OF THE  X ARRAY USED OUT OF  9999999
    1298 ELEMENTS OF THE IX ARRAY USED OUT OF  9999999
 ...........................................................

 LAYER NUMBER  AQUIFER TYPE
 ------------  ------------
      1             1
                                     WIDTH ALONG ROWS (DELR)  =   50.00000
                                     WIDTH ALONG COLS (DELC)  =   50.00000

                         TOP ELEV. OF 1ST LAYER   READ ON UNIT  1 USING FORMAT: "   (10F8.2)         "
                         ---------------------------------------------------------------------------

                   CELL THICKNESS (DZ)      FOR LAYER  1 READ ON UNIT  1 USING FORMAT: "  (10F8.2)          "
                   ------------------------------------------------------------------------------------------
                                     EFFECTIVE POROSITY        =  0.3500000     FOR LAYER  1

                   CONCN. BOUNDARY ARRAY    FOR LAYER  1 READ ON UNIT  1 USING FORMAT: " (36i2)             "
                   ------------------------------------------------------------------------------------------

                   INITIAL CONCENTRATION    FOR LAYER  1 READ ON UNIT  1 USING FORMAT: " (10F8.2)           "
                   ------------------------------------------------------------------------------------------
```

VALUE INDICATING INACTIVE CONCENTRATION CELLS = 0.0000000

OUTPUT CONTROL OPTIONS

PRINT CELL CONCENTRATION USING FORMAT CODE: 12
DO NOT PRINT PARTICLE NUMBER IN EACH CELL
DO NOT PRINT RETARDATION FACTOR
DO NOT PRINT DISPERSION COEFFICIENT
SAVE CONCENTRATION IN UNFORMATTED FILE [MT3D.UCN] ON UNIT 18

NUMBER OF TIMES AT WHICH SIMULATION RESULTS ARE SAVED = 1
TOTAL ELAPSED TIMES AT WHICH SIMULATION RESULTS ARE SAVED:
365.00

NUMBER OF OBSERVATION POINTS = 0

A ONE-LINE SUMMRY OF MASS BALANCE FOR EACH STEP SAVED IN FILE [MT3D.MAS] ON UNIT 19

MAXIMUM LENGTH ALONG THE X (J) AXIS = 1800.000
MAXIMUM LENGTH ALONG THE Y (I) AXIS = 1800.000
MAXIMUM LENGTH ALONG THE Z (K) AXIS = 31.89000

ADVECTION SOLUTION OPTIONS

DISPERSION PARAMETERS

LONG. DISPERSIVITY (AL) = 50.00000 FOR LAYER 1
H. TRANS./LONG. DISP. = 0.6500000
V. TRANS./LONG. DISP. = 0.0000000
DIFFUSION COEFFICIENT = 0.0000000

SORPTION AND 1ST ORDER RATE REACTION PARAMETERS

BULK DENSITY (RHOB) = 87.00000
SORPTION CONSTANT NO. 1 = 307.6300
SORPTION CONSTANT NO. 2 = 0.0000000

RETARD. FACTOR IN LAYER 1 FOR TIME STEP 1, STRESS PERIOD 1
----

	1 11 21 31	2 12 22 32	3 13 23 33	4 14 24 34	5 15 25 35	6 16 26 36	7 17 27	8 18 28	9 19 29	10 20 30
1	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
2	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
3	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
4	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
5	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
6	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04

	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
7	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
8	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
9	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04				
10	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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11	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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12	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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13	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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14	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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15	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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16	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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17	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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18	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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19	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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20	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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21	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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22	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04	7.6469E+04
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    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
36  7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
    7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04 7.6469E+04
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                            STRESS PERIOD NO.  001
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
LENGTH OF CURRENT STRESS PERIOD =   25550.00
NUMBER OF TIME STEPS FOR CURRENT STRESS PERIOD =     7
TIME STEP MULTIPLIER =    1.000000
USER-SPECIFIED TRANSPORT STEPSIZE =  -1.000000      DAY
MAXIMUM NUMBER OF TRANSPORT STEPS ALLOWED  IN ONE TIME STEP =       5000
```

NO	LAYER	ROW	COLUMN	CONCENTRATION	TYPE
1	1	1	1	0.0000000	HEAD DEP BOUND
2	1	1	2	0.0000000	HEAD DEP BOUND
3	1	1	3	0.0000000	HEAD DEP BOUND
4	1	1	4	0.0000000	HEAD DEP BOUND
5	1	1	5	0.0000000	HEAD DEP BOUND
6	1	1	6	0.0000000	HEAD DEP BOUND
7	1	1	7	0.0000000	HEAD DEP BOUND
8	1	1	8	0.0000000	HEAD DEP BOUND
9	1	1	9	0.0000000	HEAD DEP BOUND
10	1	1	10	0.0000000	HEAD DEP BOUND
11	1	1	11	0.0000000	HEAD DEP BOUND
12	1	1	12	0.0000000	HEAD DEP BOUND
13	1	1	13	0.0000000	HEAD DEP BOUND
14	1	1	14	0.0000000	HEAD DEP BOUND
15	1	1	15	0.0000000	HEAD DEP BOUND
16	1	1	16	0.0000000	HEAD DEP BOUND
17	1	1	17	0.0000000	HEAD DEP BOUND
18	1	1	18	0.0000000	HEAD DEP BOUND
19	1	1	19	0.0000000	HEAD DEP BOUND

20	1	1	20	0.0000000	HEAD DEP BOUND
21	1	1	21	0.0000000	HEAD DEP BOUND
22	1	1	22	0.0000000	HEAD DEP BOUND
23	1	1	23	0.0000000	HEAD DEP BOUND
24	1	1	24	0.0000000	HEAD DEP BOUND
25	1	1	25	0.0000000	HEAD DEP BOUND
26	1	1	26	0.0000000	HEAD DEP BOUND
27	1	1	27	0.0000000	HEAD DEP BOUND
28	1	1	28	0.0000000	HEAD DEP BOUND
29	1	1	29	0.0000000	HEAD DEP BOUND
30	1	1	30	0.0000000	HEAD DEP BOUND
31	1	1	31	0.0000000	HEAD DEP BOUND
32	1	1	32	0.0000000	HEAD DEP BOUND
33	1	1	33	0.0000000	HEAD DEP BOUND
34	1	1	34	0.0000000	HEAD DEP BOUND
35	1	1	35	0.0000000	HEAD DEP BOUND
36	1	1	36	0.0000000	HEAD DEP BOUND
37	1	2	1	0.0000000	HEAD DEP BOUND
38	1	3	1	0.0000000	HEAD DEP BOUND
39	1	4	1	0.0000000	HEAD DEP BOUND
40	1	5	1	0.0000000	HEAD DEP BOUND
41	1	6	1	0.0000000	HEAD DEP BOUND
42	1	7	1	0.0000000	HEAD DEP BOUND
43	1	8	1	0.0000000	HEAD DEP BOUND
44	1	9	1	0.0000000	HEAD DEP BOUND
45	1	10	1	0.0000000	HEAD DEP BOUND
46	1	11	1	0.0000000	HEAD DEP BOUND
47	1	12	1	0.0000000	HEAD DEP BOUND
48	1	13	1	0.0000000	HEAD DEP BOUND
49	1	14	1	0.0000000	HEAD DEP BOUND
50	1	15	1	0.0000000	HEAD DEP BOUND
51	1	16	1	0.0000000	HEAD DEP BOUND
52	1	17	1	0.0000000	HEAD DEP BOUND
53	1	18	1	0.0000000	HEAD DEP BOUND
54	1	19	1	0.0000000	HEAD DEP BOUND
55	1	20	1	0.0000000	HEAD DEP BOUND
56	1	21	1	0.0000000	HEAD DEP BOUND
57	1	22	1	0.0000000	HEAD DEP BOUND
58	1	23	1	0.0000000	HEAD DEP BOUND
59	1	24	1	0.0000000	HEAD DEP BOUND
60	1	25	1	0.0000000	HEAD DEP BOUND
61	1	26	1	0.0000000	HEAD DEP BOUND
62	1	27	1	0.0000000	HEAD DEP BOUND
63	1	28	1	0.0000000	HEAD DEP BOUND
64	1	29	1	0.0000000	HEAD DEP BOUND
65	1	30	1	0.0000000	HEAD DEP BOUND
66	1	31	1	0.0000000	HEAD DEP BOUND
67	1	32	1	0.0000000	HEAD DEP BOUND
68	1	33	1	0.0000000	HEAD DEP BOUND
69	1	34	1	0.0000000	HEAD DEP BOUND
70	1	35	1	0.0000000	HEAD DEP BOUND
71	1	36	1	0.0000000	HEAD DEP BOUND
72	1	36	2	0.0000000	HEAD DEP BOUND
73	1	36	3	0.0000000	HEAD DEP BOUND
74	1	36	4	0.0000000	HEAD DEP BOUND
75	1	36	5	0.0000000	HEAD DEP BOUND
76	1	36	6	0.0000000	HEAD DEP BOUND
77	1	36	7	0.0000000	HEAD DEP BOUND
78	1	36	8	0.0000000	HEAD DEP BOUND
79	1	36	9	0.0000000	HEAD DEP BOUND
80	1	36	10	0.0000000	HEAD DEP BOUND
81	1	36	11	0.0000000	HEAD DEP BOUND
82	1	36	12	0.0000000	HEAD DEP BOUND
83	1	36	13	0.0000000	HEAD DEP BOUND
84	1	36	14	0.0000000	HEAD DEP BOUND
85	1	36	15	0.0000000	HEAD DEP BOUND
86	1	36	16	0.0000000	HEAD DEP BOUND
87	1	36	17	0.0000000	HEAD DEP BOUND
88	1	36	18	0.0000000	HEAD DEP BOUND
89	1	36	19	0.0000000	HEAD DEP BOUND
90	1	36	20	0.0000000	HEAD DEP BOUND
91	1	36	21	0.0000000	HEAD DEP BOUND
92	1	36	22	0.0000000	HEAD DEP BOUND
93	1	36	23	0.0000000	HEAD DEP BOUND
94	1	36	24	0.0000000	HEAD DEP BOUND
95	1	36	25	0.0000000	HEAD DEP BOUND
96	1	36	26	0.0000000	HEAD DEP BOUND

97	1	36	27	0.0000000	HEAD DEP BOUND
98	1	36	28	0.0000000	HEAD DEP BOUND
99	1	36	29	0.0000000	HEAD DEP BOUND
100	1	36	30	0.0000000	HEAD DEP BOUND
101	1	36	31	0.0000000	HEAD DEP BOUND
102	1	36	32	0.0000000	HEAD DEP BOUND
103	1	36	33	0.0000000	HEAD DEP BOUND
104	1	36	34	0.0000000	HEAD DEP BOUND
105	1	36	35	0.0000000	HEAD DEP BOUND
106	1	36	36	0.0000000	HEAD DEP BOUND
107	1	2	36	0.0000000	HEAD DEP BOUND
108	1	3	36	0.0000000	HEAD DEP BOUND
109	1	4	36	0.0000000	HEAD DEP BOUND
110	1	5	36	0.0000000	HEAD DEP BOUND
111	1	6	36	0.0000000	HEAD DEP BOUND
112	1	7	36	0.0000000	HEAD DEP BOUND
113	1	8	36	0.0000000	HEAD DEP BOUND
114	1	9	36	0.0000000	HEAD DEP BOUND
115	1	10	36	0.0000000	HEAD DEP BOUND
116	1	11	36	0.0000000	HEAD DEP BOUND
117	1	12	36	0.0000000	HEAD DEP BOUND
118	1	13	36	0.0000000	HEAD DEP BOUND
119	1	14	36	0.0000000	HEAD DEP BOUND
120	1	15	36	0.0000000	HEAD DEP BOUND
121	1	16	36	0.0000000	HEAD DEP BOUND
122	1	17	36	0.0000000	HEAD DEP BOUND
123	1	18	36	0.0000000	HEAD DEP BOUND
124	1	19	36	0.0000000	HEAD DEP BOUND
125	1	20	36	0.0000000	HEAD DEP BOUND
126	1	21	36	0.0000000	HEAD DEP BOUND
127	1	22	36	0.0000000	HEAD DEP BOUND
128	1	23	36	0.0000000	HEAD DEP BOUND
129	1	24	36	0.0000000	HEAD DEP BOUND
130	1	25	36	0.0000000	HEAD DEP BOUND
131	1	26	36	0.0000000	HEAD DEP BOUND
132	1	27	36	0.0000000	HEAD DEP BOUND
133	1	28	36	0.0000000	HEAD DEP BOUND
134	1	29	36	0.0000000	HEAD DEP BOUND
135	1	30	36	0.0000000	HEAD DEP BOUND
136	1	31	36	0.0000000	HEAD DEP BOUND
137	1	32	36	0.0000000	HEAD DEP BOUND
138	1	33	36	0.0000000	HEAD DEP BOUND
139	1	34	36	0.0000000	HEAD DEP BOUND
140	1	35	36	0.0000000	HEAD DEP BOUND

==
TIME STEP NO. 001
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FROM TIME = 0.00000   TO   3650.0

"HEAD   " FLOW TERMS FOR TIME STEP 1, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QXX   " FLOW TERMS FOR TIME STEP 1, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QYY   " FLOW TERMS FOR TIME STEP 1, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
= 0.5868E+05(WHEN MIN. R.F.=1) AT K=   1, I= 34, J= 35

"CNH   " FLOW TERMS FOR TIME STEP 1, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"GHB   " FLOW TERMS FOR TIME STEP 1, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =   140

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
= 0.4348E+05(WHEN MIN. R.F.=1) AT K=   1, I= 35, J= 36

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
= 0.1740E+05(WHEN MIN. R.F.=1) AT K= 1, I= 34, J= 35

TRANSPORT STEP NO. 1

TOTAL ELAPSED TIME SINCE BEGINNING OF SIMULATION = 365.0000 DAY

CONCENTRATIONS IN LAYER 1 AT END OF TRANSPORT STEP 1, TIME STEP 1, STRESS PERIOD 1

	1 11 21 31	2 12 22 32	3 13 23 33	4 14 24 34	5 15 25 35	6 16 26 36	7 17 27	8 18 28	9 19 29	10 20 30
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	-4.3947E-08	4.6837E-07	5.6836E-07	6.500	2.2805E-07	2.5455E-07	5.700	9.9082E-08	0.0000
	-2.9418E-08	2.6224E-07	2.6795E-08	0.0000	0.0000	0.0000				
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	1.1155E-06	19.00	5.6221E-07	1.6143E-07	-7.0948E-09	4.4654E-09	1.0151E-07	-7.6126E-09	0.0000
	5.7600E-07	21.90	2.8321E-07	0.0000	0.0000	0.0000				
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	3.7771E-08	7.4435E-07	-1.0409E-08	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2.8513E-08	4.4521E-07	-2.5640E-08	0.0000	0.0000	0.0000				
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	5.3322E-08	1.800	2.7201E-08	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	6.7242E-10	3.6551E-08	3.9569E-13	0.0000	-1.0104E-09	1.0715E-08	1.5574E-09	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	4.6972E-08	1.500	2.3015E-08	2.0960E-08	3.3654E-08	1.200	1.6754E-08	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	1.0298E-09	1.9396E-08	2.6974E-08	2.300	1.4391E-08	1.1631E-08	-1.8513E-09	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	2.0995E-09	3.9933E-08	-1.7767E-09	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
27	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
29	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
31	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
33	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
34	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
35	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				

CUMMULATIVE MASS BUDGETS AT END OF TRANSPORT STEP 1, TIME STEP 1, STRESS PERIOD 1

	IN		OUT	
CONSTANT CONCENTRATION:	11518.16		0.0000000	
CONSTANT HEAD:	0.0000000		0.0000000	
HEAD-DEPENDENT BOUNDARY:	0.0000000		0.0000000	
DECAY OR BIODEGRADATION:	0.0000000		0.0000000	
MASS STORAGE (SOLUTE):	0.3113420E-02		-0.1537385	
MASS STORAGE (ADSORBED):	238.0771		-11756.09	
[TOTAL]:	11756.24	LB	-11756.24	LB

NET (IN - OUT): -0.2929688E-02
DISCREPANCY (PERCENT): -0.2492028E-04

TIME STEP NO. 002

FROM TIME = 3650.0 TO 7300.0

"HEAD " FLOW TERMS FOR TIME STEP 2, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QXX " FLOW TERMS FOR TIME STEP 2, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QYY " FLOW TERMS FOR TIME STEP 2, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
= 0.5868E+05(WHEN MIN. R.F.=1) AT K= 1, I= 34, J= 35

"CNH " FLOW TERMS FOR TIME STEP 2, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"GHB " FLOW TERMS FOR TIME STEP 2, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL = 140

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
= 0.4348E+05(WHEN MIN. R.F.=1) AT K= 1, I= 35, J= 36

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
= 0.1739E+05(WHEN MIN. R.F.=1) AT K= 1, I= 34, J= 35

TIME STEP NO. 003

FROM TIME = 7300.0 TO 10950.

"HEAD " FLOW TERMS FOR TIME STEP 3, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QXX " FLOW TERMS FOR TIME STEP 3, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

"QYY " FLOW TERMS FOR TIME STEP 3, STRESS PERIOD 1 READ UNFORMATTED ON UNIT 10

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 ------------------------------------------------------------------------------------------

 MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
 = 0.5870E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

                    "CNH             " FLOW TERMS FOR TIME STEP  3, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "GHB             " FLOW TERMS FOR TIME STEP  3, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------


 TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =    140

 MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
 = 0.4348E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  35, J=  36

 MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
 = 0.1740E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

                                                ===============================================
                                                                TIME STEP NO.  004
                                                ===============================================

 FROM TIME =    10950.     TO    14600.

                    "HEAD            " FLOW TERMS FOR TIME STEP  4, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "QXX             " FLOW TERMS FOR TIME STEP  4, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "QYY             " FLOW TERMS FOR TIME STEP  4, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

 MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
 = 0.5870E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

                    "CNH             " FLOW TERMS FOR TIME STEP  4, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "GHB             " FLOW TERMS FOR TIME STEP  4, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------


 TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =    140

 MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
 = 0.4349E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  35, J=  36

 MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
 = 0.1740E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

                                                ===============================================
                                                                TIME STEP NO.  005
                                                ===============================================

 FROM TIME =    14600.     TO    18250.

                    "HEAD            " FLOW TERMS FOR TIME STEP  5, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "QXX             " FLOW TERMS FOR TIME STEP  5, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

                    "QYY             " FLOW TERMS FOR TIME STEP  5, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------

     IUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
     '871E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

                    "CNH             " FLOW TERMS FOR TIME STEP  5, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
                    ------------------------------------------------------------------------------------------
```

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"GHB                " FLOW TERMS FOR TIME STEP  5, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------


TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =    140

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
= 0.4349E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  35, J=  36

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
= 0.1740E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35


                                            ===============================================
                                                          TIME STEP NO.  006
                                            ===============================================

FROM TIME =   18250.      TO     21900.


"HEAD               " FLOW TERMS FOR TIME STEP  6, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"QXX                " FLOW TERMS FOR TIME STEP  6, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"QYY                " FLOW TERMS FOR TIME STEP  6, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
= 0.5872E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

"CNH                " FLOW TERMS FOR TIME STEP  6, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"GHB                " FLOW TERMS FOR TIME STEP  6, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------


TOTAL NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =    140

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
= 0.4350E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  35, J=  36

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
= 0.1741E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35


                                            ===============================================
                                                          TIME STEP NO.  007
                                            ===============================================

FROM TIME =   21900.      TO     25550.


"HEAD               " FLOW TERMS FOR TIME STEP  7, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"QXX                " FLOW TERMS FOR TIME STEP  7, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"QYY                " FLOW TERMS FOR TIME STEP  7, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

MAXIMUM STEPSIZE DURING WHICH ANY PARTICLE CANNOT MOVE MORE THAN ONE CELL
= 0.5873E+05(WHEN MIN. R.F.=1)  AT K=   1, I=  34, J=  35

"CNH                " FLOW TERMS FOR TIME STEP  7, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------

"GHB                " FLOW TERMS FOR TIME STEP  7, STRESS PERIOD  1 READ UNFORMATTED ON UNIT 10
-------------------------------------------------------------------------------------------


NUMBER OF POINT SOURCES/SINKS PRESENT IN THE FLOW MODEL =    140

IM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE SINK & SOURCE TERM
```

= 0.4351E+05(WHEN MIN. R.F.=1) AT K= 1, I= 35, J= 36

MAXIMUM STEPSIZE WHICH MEETS STABILITY CRITERION OF THE DISPERSION TERM
= 0.1741E+05(WHEN MIN. R.F.=1) AT K= 1, I= 34, J= 35

TRANSPORT STEP NO. 1

TOTAL ELAPSED TIME SINCE BEGINNING OF SIMULATION = 25550.00 DAY

CONCENTRATIONS IN LAYER 1 AT END OF TRANSPORT STEP 1, TIME STEP 7, STRESS PERIOD 1

	1 11 21 31	2 12 22 32	3 13 23 33	4 14 24 34	5 15 25 35	6 16 26 36	7 17 27	8 18 28	9 19 29	10 20 30
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	-9.9492E-44	-9.0515E-37	-3.9921E-30	-9.8058E-24	-1.3753E-17
	-1.0185E-11	-3.0485E-06	3.2502E-05	3.9632E-05	6.500	1.5850E-05	1.7912E-05	5.700	6.9301E-06	-2.3749E-13
	-2.0733E-06	1.8484E-05	1.8863E-06	1.3095E-12	3.2385E-19	2.7861E-26				
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	3.7134E-43	3.8752E-36	2.0296E-29	6.1858E-23	1.1509E-16
	1.2816E-10	7.7348E-05	19.00	3.9075E-05	1.1292E-05	-4.9888E-07	3.1476E-07	7.1349E-06	-5.3483E-07	3.3883E-11
	4.0985E-05	21.90	2.0088E-05	7.2103E-12	1.3021E-18	1.3237E-25				
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	7.7071E-44	7.0736E-37	3.1765E-30	8.0180E-24	1.1639E-17
	8.9854E-12	2.6602E-06	5.2029E-05	-7.4461E-07	3.1590E-12	-7.5797E-13	3.4364E-13	4.9781E-12	-6.7326E-13	3.4485E-12
	2.0080E-06	3.1323E-05	-1.8044E-06	-1.3415E-12	-3.8465E-19	-5.4922E-26				
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.5414E-44	1.5636E-37	7.5548E-31	2.1833E-24	4.0351E-18
	4.8564E-12	3.7130E-06	1.800	1.8865E-06	1.1574E-12	-4.9882E-14	2.1211E-13	7.2917E-14	4.8079E-15	8.2747E-14
	2.5040E-12	1.8618E-11	-2.0605E-12	5.4898E-14	3.1869E-20	6.8170E-27				
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.7163E-39	3.1444E-32	7.4351E-26	1.0767E-19
	9.5262E-14	4.8234E-08	2.5513E-06	-7.7447E-10	4.0169E-13	-6.8375E-08	7.5120E-07	1.0837E-07	1.0692E-13	1.3384E-19
	1.2937E-18	6.0582E-18	-9.6172E-19	4.8138E-20	-7.5929E-22	-3.1694E-28				
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	5.6052E-45	6.8766E-38	3.8074E-31	1.2628E-24	2.6801E-18
	3.7110E-12	3.2541E-06	1.500	1.6069E-06	1.4623E-06	2.3613E-06	1.200	1.1721E-06	5.9088E-13	1.6847E-19
	3.8825E-25	1.1802E-24	-2.3718E-25	1.6560E-26	-4.7928E-28	4.6059E-30				
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0505E-38	4.7749E-32	1.2370E-25	1.8920E-19
	1.6417E-13	7.0989E-08	1.3501E-06	1.8989E-06	2.300	1.0038E-06	8.1225E-07	-1.2895E-07	-1.3984E-13	-6.1268E-20
	-1.4030E-26	1.3755E-31	-3.2888E-32	2.8069E-33	-1.0972E-34	1.7674E-36				
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0706E-40	2.0945E-33	3.7453E-27	3.2910E-21
	1.0304E-15	2.6383E-14	8.5848E-13	1.4151E-07	2.7653E-06	-1.2098E-07	3.5914E-13	-2.2086E-13	7.6417E-15	6.5212E-21
	2.1688E-27	3.5585E-34	-2.4524E-39	2.3827E-40	-1.0871E-41	2.0599E-43				
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.7188E-41	4.1057E-35	4.3275E-29	1.5392E-23
	6.5432E-22	1.8339E-20	2.6250E-15	1.7111E-13	2.0570E-12	-1.7167E-13	4.2537E-15	-1.2731E-19	9.3801E-21	-1.7259E-22
	-1.1334E-28	-2.7060E-35	-2.8685E-42	0.0000	0.0000	0.0000				
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5644E-43	3.6808E-37	1.6665E-31	9.9339E-30
	3.1998E-28	3.2420E-23	3.2008E-21	9.8101E-20	8.4839E-19	-1.0653E-19	5.0465E-21	-8.9069E-23	3.9819E-27	-1.4515E-28
	1.6292E-30	7.4689E-37	1.1070E-43	0.0000	0.0000	0.0000				
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4013E-45	1.2261E-39	9.3679E-38	3.6079E-36
	3.0521E-31	3.5875E-29	1.6230E-27	3.1642E-26	2.0989E-25	-3.4940E-26	2.3533E-27	-7.4930E-29	8.9412E-31	-4.1171E-35
	8.5745E-37	-5.6384E-39	-1.4013E-45	0.0000	0.0000	0.0000				
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3822E-44	2.0322E-39
	2.6952E-37	1.4949E-35	4.2460E-34	5.9653E-33	3.1545E-32	-6.4535E-33	5.4590E-34	-2.3597E-35	4.9665E-37	-3.8307E-39
	1.3873E-43	-1.4013E-45	0.0000	0.0000	0.0000	0.0000				
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4013E-45
	8.4078E-44	2.8937E-42	5.8700E-41	6.3576E-40	2.7541E-39	-6.5965E-40	6.5446E-41	-3.4150E-42	9.5288E-44	-1.4013E-45
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				

15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
27	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
29	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
31	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
33	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
34	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
35	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				

CUMMULATIVE MASS BUDGETS AT END OF TRANSPORT STEP 1, TIME STEP 7, STRESS PERIOD 1

	IN		OUT	
CONSTANT CONCENTRATION:	805514.5		0.0000000	
CONSTANT HEAD:	0.0000000		0.0000000	
HEAD-DEPENDENT BOUNDARY:	0.0000000		0.0000000	
DECAY OR BIODEGRADATION:	0.0000000		0.0000000	
MASS STORAGE (SOLUTE):	0.2181894		-10.75205	
MASS STORAGE (ADSORBED):	16684.51		-822188.4	
[TOTAL]:	822199.2	LB	-822199.1	LB

NET (IN - OUT): 0.6250000E-01
DISCREPANCY (PERCENT): 0.7601564E-05

| M T |
| 3 D | End of Model Output

10/05/95 4:46 pm
1

FUGITIVE DUST MODEL (FDM)
VERSION 91109
MAR, 1991

RUN TITLE:
Fugitive Dust Modeling for Westinghouse Electric Corp. August, 1995

INPUT FILE NAME: run1.in
OUTPUT FILE NAME: run1.out
PLOT OUTPUT WRITTEN TO FILE NAME: plot1

CONVERGENCE OPTION 1=OFF, 2=ON	2
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	3
PLOT FILE OUTPUT, 1=NO, 2=YES	2
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
BYPASS RAMMET CALMS RECOGNITION, 1=NO, 2=YES	1
[illegible] SOURCES PROCESSED	1
[illegible]	441
[illegible]S	5
[illegible] DATA PROCESSED	576
LENGTH IN [illegible] OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	60.00
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50
ANEMOMETER HEIGHT IN M	10.00

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	2.0000000	**	**	.5220
2	3.5000000	**	**	.2370
3	7.5000000	**	**	.1600
4	15.0000000	**	**	.0630
5	25.0000000	**	**	.0180

** COMPUTED BY FDM

1

RECEPTOR COORDINATES (X,Y,Z)

(0.,	0.,	2.)	(21.,	0.,	2.)	(42.,	0.,	2.)
(63.,	0.,	2.)	(84.,	0.,	2.)	(105.,	0.,	2.)
(126.,	0.,	2.)	(147.,	0.,	2.)	(168.,	0.,	2.)
(189.,	0.,	2.)	(210.,	0.,	2.)	(231.,	0.,	2.)
(252.,	0.,	2.)	(273.,	0.,	2.)	(294.,	0.,	2.)
(315.,	0.,	2.)	(336.,	0.,	2.)	(357.,	0.,	2.)
(378.,	0.,	2.)	(399.,	0.,	2.)	(420.,	0.,	2.)
(0.,	21.,	2.)	(21.,	21.,	2.)	(42.,	21.,	2.)
(63.,	21.,	2.)	(84.,	21.,	2.)	(105.,	21.,	2.)
(126.,	21.,	2.)	(147.,	21.,	2.)	(168.,	21.,	2.)
(189.,	21.,	2.)	(210.,	21.,	2.)	(231.,	21.,	2.)
(252.,	21.,	2.)	(273.,	21.,	2.)	(294.,	21.,	2.)
(315.,	21.,	2.)	(336.,	21.,	2.)	(357.,	21.,	2.)
(378.,	21.,	2.)	(399.,	21.,	2.)	(420.,	21.,	2.)
(0.,	42.,	2.)	(21.,	42.,	2.)	(42.,	42.,	2.)
(63.,	42.,	2.)	(84.,	42.,	2.)	(105.,	42.,	2.)
(126.,	42.,	2.)	(147.,	42.,	2.)	(168.,	42.,	2.)
(189.,	42.,	2.)	(210.,	42.,	2.)	(231.,	42.,	2.)
(252.,	42.,	2.)	(273.,	42.,	2.)	(294.,	42.,	2.)
(315.,	42.,	2.)	(336.,	42.,	2.)	(357.,	42.,	2.)
(378.,	42.,	2.)	(399.,	42.,	2.)	(420.,	42.,	2.)
(0.,	63.,	2.)	(21.,	63.,	2.)	(42.,	63.,	2.)
(63.,	63.,	2.)	(84.,	63.,	2.)	(105.,	63.,	2.)
(126.,	63.,	2.)	(147.,	63.,	2.)	(168.,	63.,	2.)

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(  189.,   63.,  2.)  (  210.,   63.,  2.)  (  231.,   63.,  2.)
(  252.,   63.,  2.)  (  273.,   63.,  2.)  (  294.,   63.,  2.)
(  315.,   63.,  2.)  (  336.,   63.,  2.)  (  357.,   63.,  2.)
(  378.,   63.,  2.)  (  399.,   63.,  2.)  (  420.,   63.,  2.)
(    0.,   84.,  2.)  (   21.,   84.,  2.)  (   42.,   84.,  2.)
(   63.,   84.,  2.)  (   84.,   84.,  2.)  (  105.,   84.,  2.)
(  126.,   84.,  2.)  (  147.,   84.,  2.)  (  168.,   84.,  2.)
(  189.,   84.,  2.)  (  210.,   84.,  2.)  (  231.,   84.,  2.)
(  252.,   84.,  2.)  (  273.,   84.,  2.)  (  294.,   84.,  2.)
(  315.,   84.,  2.)  (  336.,   84.,  2.)  (  357.,   84.,  2.)
(  378.,   84.,  2.)  (  399.,   84.,  2.)  (  420.,   84.,  2.)
(    0.,  105.,  2.)  (   21.,  105.,  2.)  (   42.,  105.,  2.)
(   63.,  105.,  2.)  (   84.,  105.,  2.)  (  105.,  105.,  2.)
(  126.,  105.,  2.)  (  147.,  105.,  2.)  (  168.,  105.,  2.)
(  189.,  105.,  2.)  (  210.,  105.,  2.)  (  231.,  105.,  2.)
(  252.,  105.,  2.)  (  273.,  105.,  2.)  (  294.,  105.,  2.)
(  315.,  105.,  2.)  (  336.,  105.,  2.)  (  357.,  105.,  2.)
(  378.,  105.,  2.)  (  399.,  105.,  2.)  (  420.,  105.,  2.)
(    0.,  126.,  2.)  (   21.,  126.,  2.)  (   42.,  126.,  2.)
(   63.,  126.,  2.)  (   84.,  126.,  2.)  (  105.,  126.,  2.)
(  126.,  126.,  2.)  (  147.,  126.,  2.)  (  168.,  126.,  2.)
(  189.,  126.,  2.)  (  210.,  126.,  2.)  (  231.,  126.,  2.)
(  252.,  126.,  2.)  (  273.,  126.,  2.)  (  294.,  126.,  2.)
(  315.,  126.,  2.)  (  336.,  126.,  2.)  (  357.,  126.,  2.)
(  378.,  126.,  2.)  (  399.,  126.,  2.)  (  420.,  126.,  2.)
(    0.,  147.,  2.)  (   21.,  147.,  2.)  (   42.,  147.,  2.)
(   63.,  147.,  2.)  (   84.,  147.,  2.)  (  105.,  147.,  2.)
(  126.,  147.,  2.)  (  147.,  147.,  2.)  (  168.,  147.,  2.)
(  189.,  147.,  2.)  (  210.,  147.,  2.)  (  231.,  147.,  2.)
(  252.,  147.,  2.)  (  273.,  147.,  2.)  (  294.,  147.,  2.)
(  315.,  147.,  2.)  (  336.,  147.,  2.)  (  357.,  147.,  2.)
(  378.,  147.,  2.)  (  399.,  147.,  2.)  (  420.,  147.,  2.)
(    0.,  168.,  2.)  (   21.,  168.,  2.)  (   42.,  168.,  2.)
(   63.,  168.,  2.)  (   84.,  168.,  2.)  (  105.,  168.,  2.)
(  126.,  168.,  2.)  (  147.,  168.,  2.)  (  168.,  168.,  2.)
(  189.,  168.,  2.)  (  210.,  168.,  2.)  (  231.,  168.,  2.)
(  252.,  168.,  2.)  (  273.,  168.,  2.)  (  294.,  168.,  2.)
(  315.,  168.,  2.)  (  336.,  168.,  2.)  (  357.,  168.,  2.)
(  378.,  168.,  2.)  (  399.,  168.,  2.)  (  420.,  168.,  2.)
(    0.,  189.,  2.)  (   21.,  189.,  2.)  (   42.,  189.,  2.)
(   63.,  189.,  2.)  (   84.,  189.,  2.)  (  105.,  189.,  2.)
(  126.,  189.,  2.)  (  147.,  189.,  2.)  (  168.,  189.,  2.)
(  189.,  189.,  2.)  (  210.,  189.,  2.)  (  231.,  189.,  2.)
(  252.,  189.,  2.)  (  273.,  189.,  2.)  (  294.,  189.,  2.)
(  315.,  189.,  2.)  (  336.,  189.,  2.)  (  357.,  189.,  2.)
(  378.,  189.,  2.)  (  399.,  189.,  2.)  (  420.,  189.,  2.)
(    0.,  210.,  2.)  (   21.,  210.,  2.)  (   42.,  210.,  2.)
(   63.,  210.,  2.)  (   84.,  210.,  2.)  (  105.,  210.,  2.)
(  126.,  210.,  2.)  (  147.,  210.,  2.)  (  168.,  210.,  2.)
(  189.,  210.,  2.)  (  210.,  210.,  2.)  (  231.,  210.,  2.)
(  252.,  210.,  2.)  (  273.,  210.,  2.)  (  294.,  210.,  2.)
(  315.,  210.,  2.)  (  336.,  210.,  2.)  (  357.,  210.,  2.)
(  378.,  210.,  2.)  (  399.,  210.,  2.)  (  420.,  210.,  2.)
(    0.,  231.,  2.)  (   21.,  231.,  2.)  (   42.,  231.,  2.)
(   63.,  231.,  2.)  (   84.,  231.,  2.)  (  105.,  231.,  2.)
(  126.,  231.,  2.)  (  147.,  231.,  2.)  (  168.,  231.,  2.)
(  189.,  231.,  2.)  (  210.,  231.,  2.)  (  231.,  231.,  2.)
(  252.,  231.,  2.)  (  273.,  231.,  2.)  (  294.,  231.,  2.)
(  315.,  231.,  2.)  (  336.,  231.,  2.)  (  357.,  231.,  2.)
(  378.,  231.,  2.)  (  399.,  231.,  2.)  (  420.,  231.,  2.)
(    0.,  252.,  2.)  (   21.,  252.,  2.)  (   42.,  252.,  2.)
(   63.,  252.,  2.)  (   84.,  252.,  2.)  (  105.,  252.,  2.)
(  126.,  252.,  2.)  (  147.,  252.,  2.)  (  168.,  252.,  2.)
(  189.,  252.,  2.)  (  210.,  252.,  2.)  (  231.,  252.,  2.)
(  252.,  252.,  2.)  (  273.,  252.,  2.)  (  294.,  252.,  2.)
(  315.,  252.,  2.)  (  336.,  252.,  2.)  (  357.,  252.,  2.)
(  378.,  252.,  2.)  (  399.,  252.,  2.)  (  420.,  252.,  2.)
(    0.,  273.,  2.)  (   21.,  273.,  2.)  (   42.,  273.,  2.)
(   63.,  273.,  2.)  (   84.,  273.,  2.)  (  105.,  273.,  2.)
(  126.,  273.,  2.)  (  147.,  273.,  2.)  (  168.,  273.,  2.)
(  189.,  273.,  2.)  (  210.,  273.,  2.)  (  231.,  273.,  2.)
(  252.,  273.,  2.)  (  273.,  273.,  2.)  (  294.,  273.,  2.)
(  315.,  273.,  2.)  (  336.,  273.,  2.)  (  357.,  273.,  2.)
(  378.,  273.,  2.)  (  399.,  273.,  2.)  (  420.,  273.,  2.)
(    0.,  294.,  2.)  (   21.,  294.,  2.)  (   42.,  294.,  2.)
(   63.,  294.,  2.)  (   84.,  294.,  2.)  (  105.,  294.,  2.)
(  126.,  294.,  2.)  (  147.,  294.,  2.)  (  168.,  294.,  2.)
(  189.,  294.,  2.)  (  210.,  294.,  2.)  (  231.,  294.,  2.)
(  252.,  294.,  2.)  (  273.,  294.,  2.)  (  294.,  294.,  2.)
(  315.,  294.,  2.)  (  336.,  294.,  2.)  (  357.,  294.,  2.)
(  378.,  294.,  2.)  (  399.,  294.,  2.)  (  420.,  294.,  2.)
```

(0.,	315.,	2.)	(21.,	315.,	2.)	(42.,	315.,	2.)
(63.,	315.,	2.)	(84.,	315.,	2.)	(105.,	315.,	2.)
(126.,	315.,	2.)	(147.,	315.,	2.)	(168.,	315.,	2.)
(189.,	315.,	2.)	(210.,	315.,	2.)	(231.,	315.,	2.)
(252.,	315.,	2.)	(273.,	315.,	2.)	(294.,	315.,	2.)
(315.,	315.,	2.)	(336.,	315.,	2.)	(357.,	315.,	2.)
(378.,	315.,	2.)	(399.,	315.,	2.)	(420.,	315.,	2.)
(0.,	336.,	2.)	(21.,	336.,	2.)	(42.,	336.,	2.)
(63.,	336.,	2.)	(84.,	336.,	2.)	(105.,	336.,	2.)
(126.,	336.,	2.)	(147.,	336.,	2.)	(168.,	336.,	2.)
(189.,	336.,	2.)	(210.,	336.,	2.)	(231.,	336.,	2.)
(252.,	336.,	2.)	(273.,	336.,	2.)	(294.,	336.,	2.)
(315.,	336.,	2.)	(336.,	336.,	2.)	(357.,	336.,	2.)
(378.,	336.,	2.)	(399.,	336.,	2.)	(420.,	336.,	2.)
(0.,	357.,	2.)	(21.,	357.,	2.)	(42.,	357.,	2.)
(63.,	357.,	2.)	(84.,	357.,	2.)	(105.,	357.,	2.)
(126.,	357.,	2.)	(147.,	357.,	2.)	(168.,	357.,	2.)
(189.,	357.,	2.)	(210.,	357.,	2.)	(231.,	357.,	2.)
(252.,	357.,	2.)	(273.,	357.,	2.)	(294.,	357.,	2.)
(315.,	357.,	2.)	(336.,	357.,	2.)	(357.,	357.,	2.)
(378.,	357.,	2.)	(399.,	357.,	2.)	(420.,	357.,	2.)
(0.,	378.,	2.)	(21.,	378.,	2.)	(42.,	378.,	2.)
(63.,	378.,	2.)	(84.,	378.,	2.)	(105.,	378.,	2.)
(126.,	378.,	2.)	(147.,	378.,	2.)	(168.,	378.,	2.)
(189.,	378.,	2.)	(210.,	378.,	2.)	(231.,	378.,	2.)
(252.,	378.,	2.)	(273.,	378.,	2.)	(294.,	378.,	2.)
(315.,	378.,	2.)	(336.,	378.,	2.)	(357.,	378.,	2.)
(378.,	378.,	2.)	(399.,	378.,	2.)	(420.,	378.,	2.)
(0.,	399.,	2.)	(21.,	399.,	2.)	(42.,	399.,	2.)
(63.,	399.,	2.)	(84.,	399.,	2.)	(105.,	399.,	2.)
(126.,	399.,	2.)	(147.,	399.,	2.)	(168.,	399.,	2.)
(189.,	399.,	2.)	(210.,	399.,	2.)	(231.,	399.,	2.)
(252.,	399.,	2.)	(273.,	399.,	2.)	(294.,	399.,	2.)
(315.,	399.,	2.)	(336.,	399.,	2.)	(357.,	399.,	2.)
(378.,	399.,	2.)	(399.,	399.,	2.)	(420.,	399.,	2.)
(0.,	420.,	2.)	(21.,	420.,	2.)	(42.,	420.,	2.)
(63.,	420.,	2.)	(84.,	420.,	2.)	(105.,	420.,	2.)
(126.,	420.,	2.)	(147.,	420.,	2.)	(168.,	420.,	2.)
(189.,	420.,	2.)	(210.,	420.,	2.)	(231.,	420.,	2.)
(252.,	420.,	2.)	(273.,	420.,	2.)	(294.,	420.,	2.)
(315.,	420.,	2.)	(336.,	420.,	2.)	(357.,	420.,	2.)
(378.,	420.,	2.)	(399.,	420.,	2.)	(420.,	420.,	2.)

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
3	.000000001	.00000	.000	198.	366.	73.	30.	.50	.00
		===========							
TOTAL EMISSIONS		.00000							

AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3
FOR STATISTICAL WIND ROSE

X (m)	Y (m)	Conventration ug/m3
.00000	.00000	.44891E-05
21.00000	.00000	.49267E-05
42.00000	.00000	.55663E-05
63.00000	.00000	.68346E-05
84.00000	.00000	.85702E-05
105.00000	.00000	.10446E-04
126.00000	.00000	.12385E-04
147.00000	.00000	.14426E-04
168.00000	.00000	.16149E-04
189.00000	.00000	.17942E-04
210.00000	.00000	.18369E-04
231.00000	.00000	.17750E-04
252.00000	.00000	.17176E-04
273.00000	.00000	.16326E-04
294.00000	.00000	.15221E-04
315.00000	.00000	.14199E-04
336.00000	.00000	.13202E-04
357.00000	.00000	.12408E-04
378.00000	.00000	.11833E-04
399.00000	.00000	.11274E-04
420.00000	.00000	.10863E-04
.00000	21.00000	.47135E-05

21.00000	21.00000	.52160E-05
42.00000	21.00000	.58166E-05
63.00000	21.00000	.69757E-05
84.00000	21.00000	.88554E-05
105.00000	21.00000	.11015E-04
126.00000	21.00000	.13314E-04
147.00000	21.00000	.15652E-04
168.00000	21.00000	.17733E-04
189.00000	21.00000	.19859E-04
210.00000	21.00000	.20363E-04
231.00000	21.00000	.19606E-04
252.00000	21.00000	.18826E-04
273.00000	21.00000	.17886E-04
294.00000	21.00000	.16548E-04
315.00000	21.00000	.15380E-04
336.00000	21.00000	.14278E-04
357.00000	21.00000	.13469E-04
378.00000	21.00000	.12852E-04
399.00000	21.00000	.12229E-04
420.00000	21.00000	.11673E-04
.00000	42.00000	.49500E-05
21.00000	42.00000	.55151E-05
42.00000	42.00000	.61489E-05
63.00000	42.00000	.71756E-05
84.00000	42.00000	.91119E-05
105.00000	42.00000	.11577E-04
126.00000	42.00000	.14383E-04
147.00000	42.00000	.17012E-04
168.00000	42.00000	.19551E-04
189.00000	42.00000	.22115E-04
210.00000	42.00000	.22716E-04
231.00000	42.00000	.21721E-04
252.00000	42.00000	.20815E-04
273.00000	42.00000	.19597E-04
294.00000	42.00000	.18094E-04
315.00000	42.00000	.16727E-04
336.00000	42.00000	.15546E-04
357.00000	42.00000	.14709E-04
378.00000	42.00000	.13945E-04
399.00000	42.00000	.13232E-04
420.00000	42.00000	.12575E-04
.00000	63.00000	.51872E-05
21.00000	63.00000	.58537E-05
42.00000	63.00000	.65454E-05
63.00000	63.00000	.74841E-05
84.00000	63.00000	.93558E-05
105.00000	63.00000	.12211E-04
126.00000	63.00000	.15386E-04
147.00000	63.00000	.18607E-04
168.00000	63.00000	.21635E-04
189.00000	63.00000	.24801E-04
210.00000	63.00000	.25526E-04
231.00000	63.00000	.24218E-04
252.00000	63.00000	.22998E-04
273.00000	63.00000	.21574E-04
294.00000	63.00000	.19861E-04
315.00000	63.00000	.18292E-04
336.00000	63.00000	.17055E-04
357.00000	63.00000	.16068E-04
378.00000	63.00000	.15335E-04
399.00000	63.00000	.14447E-04
420.00000	63.00000	.13499E-04
.00000	84.00000	.53310E-05
21.00000	84.00000	.61726E-05
42.00000	84.00000	.69196E-05
63.00000	84.00000	.79247E-05
84.00000	84.00000	.96362E-05
105.00000	84.00000	.12756E-04
126.00000	84.00000	.16477E-04
147.00000	84.00000	.20277E-04
168.00000	84.00000	.24217E-04
189.00000	84.00000	.28048E-04
210.00000	84.00000	.28936E-04
231.00000	84.00000	.27655E-04
252.00000	84.00000	.25960E-04
273.00000	84.00000	.24002E-04
294.00000	84.00000	.21987E-04
315.00000	84.00000	.20152E-04
336.00000	84.00000	.18851E-04
357.00000	84.00000	.17744E-04
378.00000	84.00000	.16746E-04
399.00000	84.00000	.15583E-04

420.00000	84.00000	.14324E-04
.00000	105.00000	.54915E-05
21.00000	105.00000	.63958E-05
42.00000	105.00000	.74158E-05
63.00000	105.00000	.84805E-05
84.00000	105.00000	.10045E-04
105.00000	105.00000	.13233E-04
126.00000	105.00000	.17688E-04
147.00000	105.00000	.22480E-04
168.00000	105.00000	.27537E-04
189.00000	105.00000	.32016E-04
210.00000	105.00000	.33120E-04
231.00000	105.00000	.31418E-04
252.00000	105.00000	.29467E-04
273.00000	105.00000	.26857E-04
294.00000	105.00000	.24420E-04
315.00000	105.00000	.22415E-04
336.00000	105.00000	.20892E-04
357.00000	105.00000	.19574E-04
378.00000	105.00000	.18351E-04
399.00000	105.00000	.16820E-04
420.00000	105.00000	.15490E-04
.00000	126.00000	.55489E-05
21.00000	126.00000	.66854E-05
42.00000	126.00000	.78716E-05
63.00000	126.00000	.91663E-05
84.00000	126.00000	.10677E-04
105.00000	126.00000	.13754E-04
126.00000	126.00000	.18901E-04
147.00000	126.00000	.24916E-04
168.00000	126.00000	.30981E-04
189.00000	126.00000	.36896E-04
210.00000	126.00000	.38272E-04
231.00000	126.00000	.36124E-04
252.00000	126.00000	.33573E-04
273.00000	126.00000	.30206E-04
294.00000	126.00000	.27361E-04
315.00000	126.00000	.25069E-04
336.00000	126.00000	.23541E-04
357.00000	126.00000	.21826E-04
378.00000	126.00000	.20050E-04
399.00000	126.00000	.18186E-04
420.00000	126.00000	.16670E-04
.00000	147.00000	.56323E-05
21.00000	147.00000	.67668E-05
42.00000	147.00000	.81827E-05
63.00000	147.00000	.97894E-05
84.00000	147.00000	.11458E-04
105.00000	147.00000	.14448E-04
126.00000	147.00000	.20072E-04
147.00000	147.00000	.27800E-04
168.00000	147.00000	.35428E-04
189.00000	147.00000	.43008E-04
210.00000	147.00000	.44658E-04
231.00000	147.00000	.41911E-04
252.00000	147.00000	.38425E-04
273.00000	147.00000	.34342E-04
294.00000	147.00000	.31011E-04
315.00000	147.00000	.28492E-04
336.00000	147.00000	.26398E-04
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378.00000	147.00000	.21675E-04
399.00000	147.00000	.19793E-04
420.00000	147.00000	.18270E-04
.00000	168.00000	.57508E-05
21.00000	168.00000	.68947E-05
42.00000	168.00000	.84824E-05
63.00000	168.00000	.10385E-04
84.00000	168.00000	.12552E-04
105.00000	168.00000	.15369E-04
126.00000	168.00000	.21425E-04
147.00000	168.00000	.30721E-04
168.00000	168.00000	.40853E-04
189.00000	168.00000	.50795E-04
210.00000	168.00000	.53567E-04
231.00000	168.00000	.48957E-04
252.00000	168.00000	.44434E-04
273.00000	168.00000	.39468E-04
294.00000	168.00000	.35473E-04
315.00000	168.00000	.32482E-04
336.00000	168.00000	.29760E-04
357.00000	168.00000	.26616E-04

378.00000	168.00000	.23954E-04
399.00000	168.00000	.21902E-04
420.00000	168.00000	.20444E-04
.00000	189.00000	.59850E-05
21.00000	189.00000	.70625E-05
42.00000	189.00000	.85688E-05
63.00000	189.00000	.11000E-04
84.00000	189.00000	.13635E-04
105.00000	189.00000	.16880E-04
126.00000	189.00000	.22684E-04
147.00000	189.00000	.34114E-04
168.00000	189.00000	.47287E-04
189.00000	189.00000	.61614E-04
210.00000	189.00000	.64911E-04
231.00000	189.00000	.58999E-04
252.00000	189.00000	.52402E-04
273.00000	189.00000	.46015E-04
294.00000	189.00000	.41556E-04
315.00000	189.00000	.37451E-04
336.00000	189.00000	.33491E-04
357.00000	189.00000	.29540E-04
378.00000	189.00000	.26814E-04
399.00000	189.00000	.24814E-04
420.00000	189.00000	.23061E-04
.00000	210.00000	.64002E-05
21.00000	210.00000	.73812E-05
42.00000	210.00000	.89134E-05
63.00000	210.00000	.11127E-04
84.00000	210.00000	.14526E-04
105.00000	210.00000	.18535E-04
126.00000	210.00000	.24557E-04
147.00000	210.00000	.37716E-04
168.00000	210.00000	.56073E-04
189.00000	210.00000	.75992E-04
210.00000	210.00000	.80371E-04
231.00000	210.00000	.72307E-04
252.00000	210.00000	.62819E-04
273.00000	210.00000	.54802E-04
294.00000	210.00000	.48732E-04
315.00000	210.00000	.43035E-04
336.00000	210.00000	.37422E-04
357.00000	210.00000	.33686E-04
378.00000	210.00000	.30644E-04
399.00000	210.00000	.28558E-04
420.00000	210.00000	.26911E-04
.00000	231.00000	.69939E-05
21.00000	231.00000	.80450E-05
42.00000	231.00000	.92774E-05
63.00000	231.00000	.11676E-04
84.00000	231.00000	.15195E-04
105.00000	231.00000	.20335E-04
126.00000	231.00000	.27267E-04
147.00000	231.00000	.42320E-04
168.00000	231.00000	.67090E-04
189.00000	231.00000	.95079E-04
210.00000	231.00000	.10259E-03
231.00000	231.00000	.90494E-04
252.00000	231.00000	.76669E-04
273.00000	231.00000	.66350E-04
294.00000	231.00000	.58066E-04
315.00000	231.00000	.49837E-04
336.00000	231.00000	.43787E-04
357.00000	231.00000	.38879E-04
378.00000	231.00000	.36502E-04
399.00000	231.00000	.33469E-04
420.00000	231.00000	.30374E-04
.00000	252.00000	.73981E-05
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84.00000	252.00000	.15857E-04
105.00000	252.00000	.22136E-04
126.00000	252.00000	.30770E-04
147.00000	252.00000	.48643E-04
168.00000	252.00000	.81099E-04
189.00000	252.00000	.12099E-03
210.00000	252.00000	.13299E-03
231.00000	252.00000	.11541E-03
252.00000	252.00000	.97714E-04
273.00000	252.00000	.82034E-04
294.00000	252.00000	.69518E-04
315.00000	252.00000	.59029E-04

336.00000	252.00000	.52013E-04
357.00000	252.00000	.47761E-04
378.00000	252.00000	.42899E-04
399.00000	252.00000	.38704E-04
420.00000	252.00000	.34315E-04
.00000	273.00000	.77565E-05
21.00000	273.00000	.92958E-05
42.00000	273.00000	.11308E-04
63.00000	273.00000	.13801E-04
84.00000	273.00000	.17130E-04
105.00000	273.00000	.23255E-04
126.00000	273.00000	.34420E-04
147.00000	273.00000	.56380E-04
168.00000	273.00000	.10302E-03
189.00000	273.00000	.15828E-03
210.00000	273.00000	.17737E-03
231.00000	273.00000	.15727E-03
252.00000	273.00000	.12707E-03
273.00000	273.00000	.10316E-03
294.00000	273.00000	.85185E-04
315.00000	273.00000	.73857E-04
336.00000	273.00000	.65238E-04
357.00000	273.00000	.56817E-04
378.00000	273.00000	.51021E-04
399.00000	273.00000	.43445E-04
420.00000	273.00000	.38552E-04
.00000	294.00000	.89956E-05
21.00000	294.00000	.10126E-04
42.00000	294.00000	.12157E-04
63.00000	294.00000	.15060E-04
84.00000	294.00000	.19472E-04
105.00000	294.00000	.25488E-04
126.00000	294.00000	.38535E-04
147.00000	294.00000	.64607E-04
168.00000	294.00000	.14034E-03
189.00000	294.00000	.21511E-03
210.00000	294.00000	.25331E-03
231.00000	294.00000	.22545E-03
252.00000	294.00000	.17201E-03
273.00000	294.00000	.13727E-03
294.00000	294.00000	.11184E-03
315.00000	294.00000	.94962E-04
336.00000	294.00000	.80738E-04
357.00000	294.00000	.67786E-04
378.00000	294.00000	.58170E-04
399.00000	294.00000	.51412E-04
420.00000	294.00000	.46059E-04
.00000	315.00000	.12117E-04
21.00000	315.00000	.13615E-04
42.00000	315.00000	.15279E-04
63.00000	315.00000	.17492E-04
84.00000	315.00000	.21954E-04
105.00000	315.00000	.29699E-04
126.00000	315.00000	.42849E-04
147.00000	315.00000	.79081E-04
168.00000	315.00000	.20383E-03
189.00000	315.00000	.32712E-03
210.00000	315.00000	.39110E-03
231.00000	315.00000	.35442E-03
252.00000	315.00000	.25677E-03
273.00000	315.00000	.19162E-03
294.00000	315.00000	.15129E-03
315.00000	315.00000	.12475E-03
336.00000	315.00000	.99873E-04
357.00000	315.00000	.85252E-04
378.00000	315.00000	.74064E-04
399.00000	315.00000	.64613E-04
420.00000	315.00000	.56348E-04
.00000	336.00000	.14476E-04
21.00000	336.00000	.17618E-04
42.00000	336.00000	.20972E-04
63.00000	336.00000	.25942E-04
84.00000	336.00000	.32166E-04
105.00000	336.00000	.39880E-04
126.00000	336.00000	.55439E-04
147.00000	336.00000	.94431E-04
168.00000	336.00000	.34828E-03
189.00000	336.00000	.56880E-03
210.00000	336.00000	.69305E-03
231.00000	336.00000	.66684E-03
252.00000	336.00000	.42536E-03
273.00000	336.00000	.30204E-03

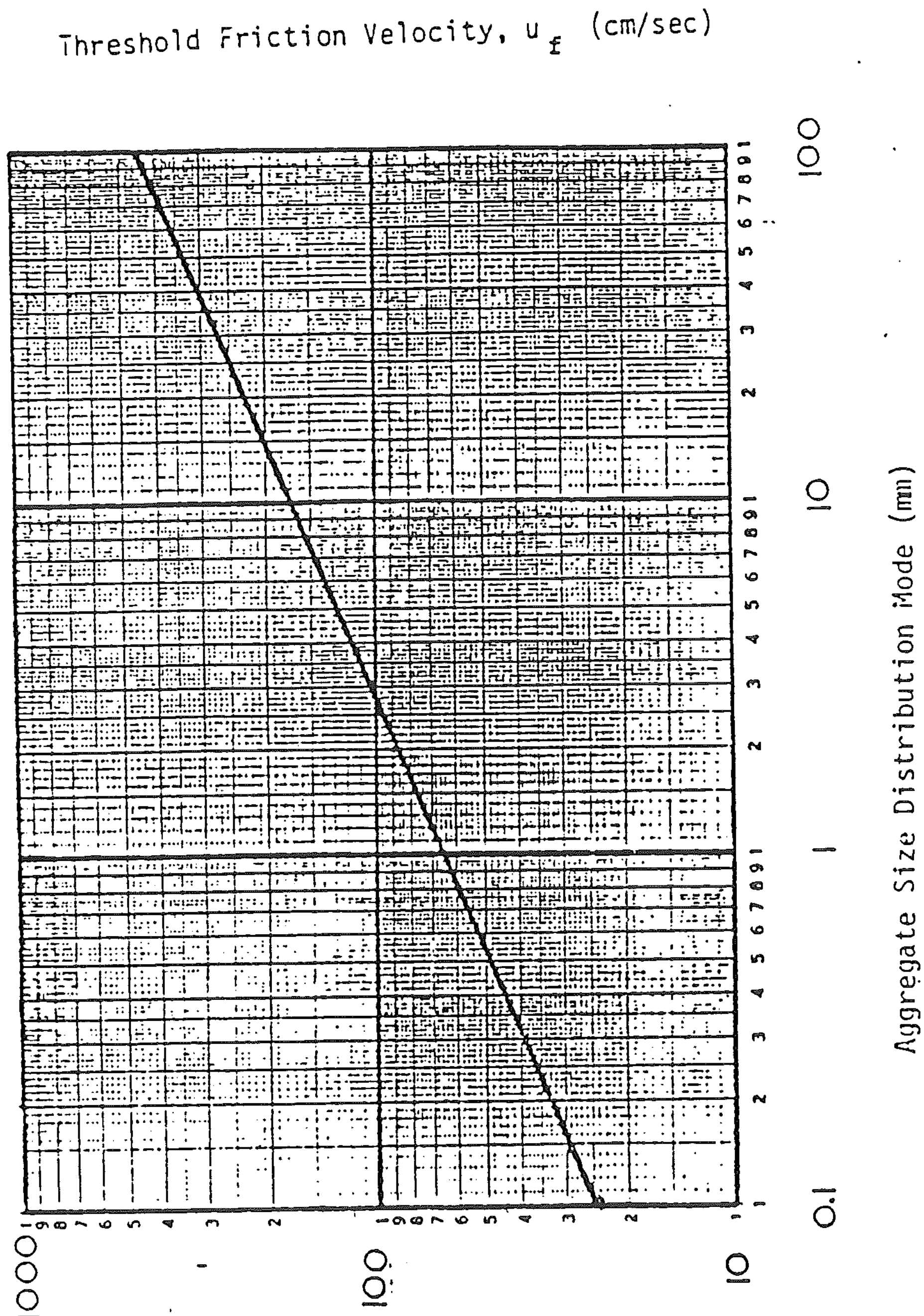
294.00000	336.00000	.22321E-03
315.00000	336.00000	.17262E-03
336.00000	336.00000	.13553E-03
357.00000	336.00000	.10808E-03
378.00000	336.00000	.89762E-04
399.00000	336.00000	.75101E-04
420.00000	336.00000	.63030E-04
.00000	357.00000	.17560E-04
21.00000	357.00000	.21356E-04
42.00000	357.00000	.26620E-04
63.00000	357.00000	.33992E-04
84.00000	357.00000	.45105E-04
105.00000	357.00000	.65050E-04
126.00000	357.00000	.98720E-04
147.00000	357.00000	.17830E-03
168.00000	357.00000	.61153E-03
189.00000	357.00000	.13384E-02
210.00000	357.00000	.15876E-02
231.00000	357.00000	.16118E-02
252.00000	357.00000	.93240E-03
273.00000	357.00000	.50064E-03
294.00000	357.00000	.32266E-03
315.00000	357.00000	.22484E-03
336.00000	357.00000	.16630E-03
357.00000	357.00000	.12944E-03
378.00000	357.00000	.10359E-03
399.00000	357.00000	.85002E-04
420.00000	357.00000	.71163E-04
.00000	378.00000	.20431E-04
21.00000	378.00000	.25324E-04
42.00000	378.00000	.32210E-04
63.00000	378.00000	.42076E-04
84.00000	378.00000	.60108E-04
105.00000	378.00000	.91448E-04
126.00000	378.00000	.15438E-03
147.00000	378.00000	.30739E-03
168.00000	378.00000	.61674E-03
189.00000	378.00000	.11702E-02
210.00000	378.00000	.13010E-02
231.00000	378.00000	.11758E-02
252.00000	378.00000	.69732E-03
273.00000	378.00000	.41636E-03
294.00000	378.00000	.28348E-03
315.00000	378.00000	.19943E-03
336.00000	378.00000	.15474E-03
357.00000	378.00000	.12114E-03
378.00000	378.00000	.98069E-04
399.00000	378.00000	.80993E-04
420.00000	378.00000	.68148E-04
.00000	399.00000	.23364E-04
21.00000	399.00000	.28973E-04
42.00000	399.00000	.37450E-04
63.00000	399.00000	.50331E-04
84.00000	399.00000	.70670E-04
105.00000	399.00000	.10218E-03
126.00000	399.00000	.15568E-03
147.00000	399.00000	.23643E-03
168.00000	399.00000	.33319E-03
189.00000	399.00000	.37655E-03
210.00000	399.00000	.37242E-03
231.00000	399.00000	.32214E-03
252.00000	399.00000	.24470E-03
273.00000	399.00000	.19664E-03
294.00000	399.00000	.15460E-03
315.00000	399.00000	.13468E-03
336.00000	399.00000	.11230E-03
357.00000	399.00000	.93282E-04
378.00000	399.00000	.77931E-04
399.00000	399.00000	.66990E-04
420.00000	399.00000	.56401E-04
.00000	420.00000	.25248E-04
21.00000	420.00000	.31097E-04
42.00000	420.00000	.39626E-04
63.00000	420.00000	.51176E-04
84.00000	420.00000	.66352E-04
105.00000	420.00000	.87162E-04
126.00000	420.00000	.11355E-03
147.00000	420.00000	.13808E-03
168.00000	420.00000	.16662E-03
189.00000	420.00000	.17711E-03
210.00000	420.00000	.17455E-03
231.00000	420.00000	.15110E-03

252.00000	420.00000	.12862E-03
273.00000	420.00000	.11126E-03
294.00000	420.00000	.97193E-04
315.00000	420.00000	.81520E-04
336.00000	420.00000	.70340E-04
357.00000	420.00000	.63021E-04
378.00000	420.00000	.57410E-04
399.00000	420.00000	.51123E-04
420.00000	420.00000	.47194E-04

APPENDIX B

FIGURES USED FROM

CALIFONIA SITE MITIGATION DECISION TREE (1986)



Threshold Friction Velocity, u_f (cm/sec)
1000
100
10
0.1
1
10
100
Aggregate Size Distribution Mode (mm)

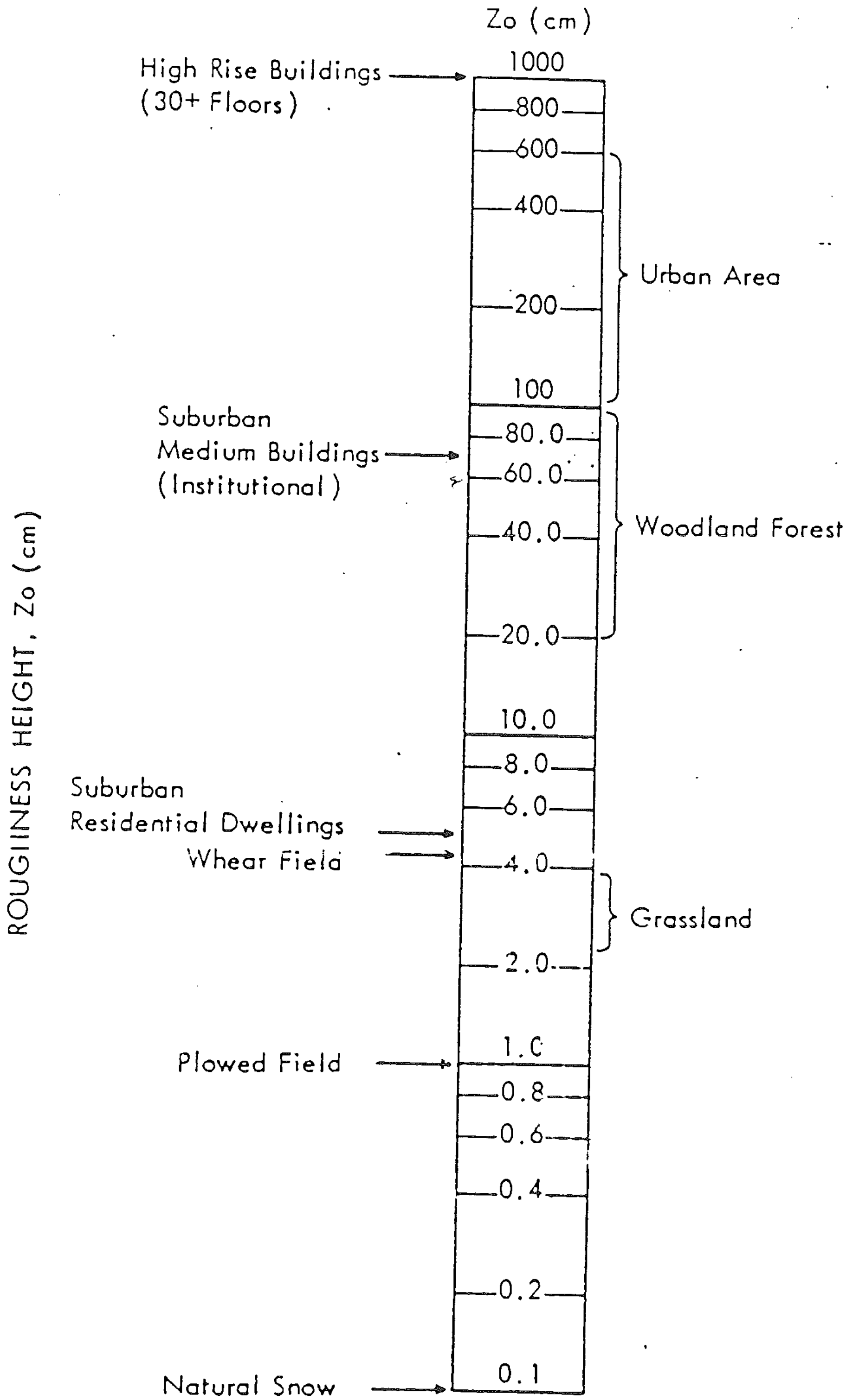
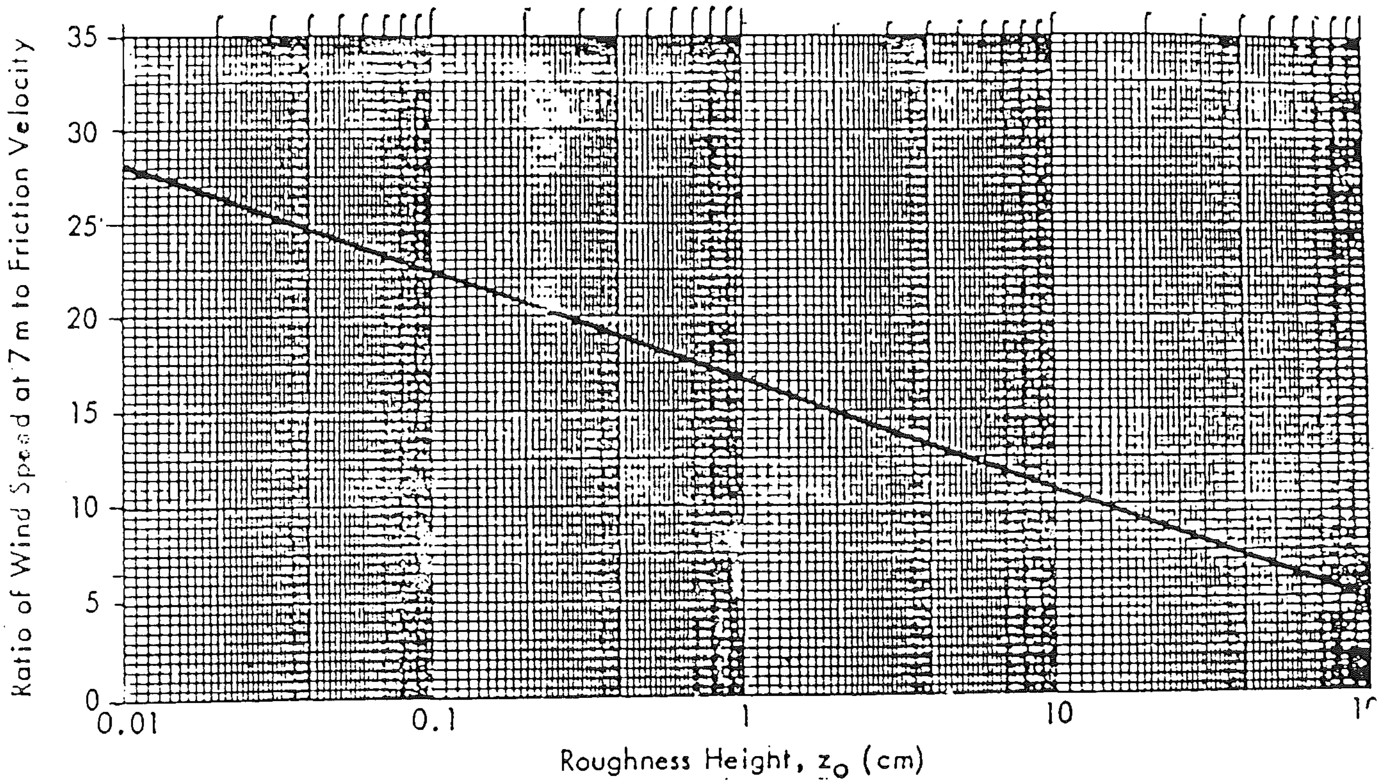


Figure 8.6 Roughness Heights for Various Surfaces (From Cowherd et al 1984)

Figure 8.7 Ratio of Wind Speed at 7 m to Friction Velocity As A Function of Roughness Height. (from (Cowherd et al 1984).



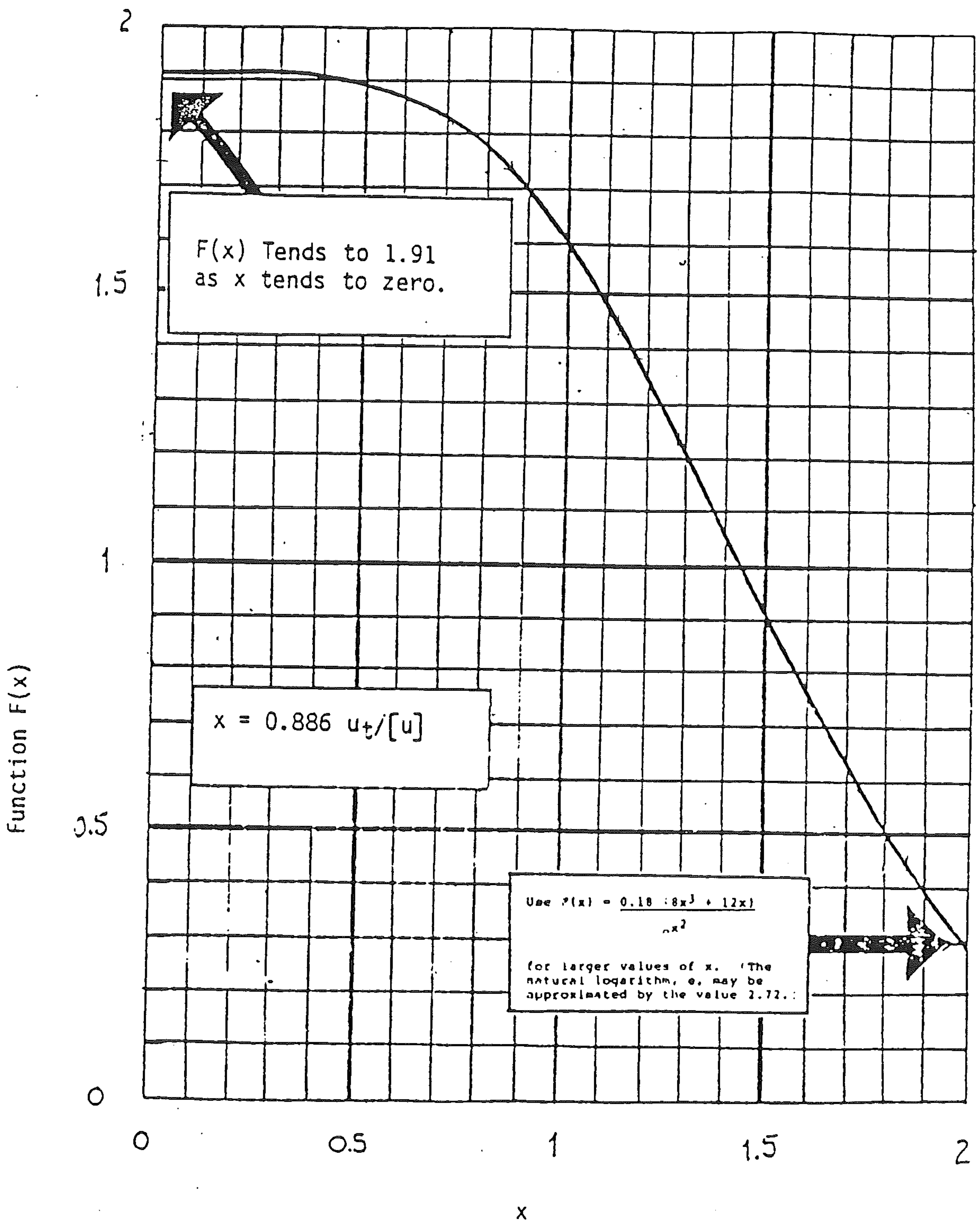


Figure 8.8. Graph of Function of Function F(X) Needed to Estimate Particulate Emissions from Hazardous Waste Sites

From: Cowherd, C. et al. 1984.

APPENDIX C

REFERENCE DOSE
AND RISK CALCULATIONS

Table C-1
On-Site Noncarcinogenic Health Hazards from Ingestion of Soil Contaminants for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	On-Site Child Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles				
Acetone	0.1	1.28E-06	1.00E-01	1.28E-05
2-Butanone	0.046	5.88E-07	6.00E-01	9.80E-07
Chlorobenzene	1.8	2.30E-05	2.00E-02	1.15E-03
1,2-Dichlorobenzene (1,2-DCB)	0.4	5.11E-06	9.00E-02	5.68E-05
1,3-Dichlorobenzene (1,3-DCB)	6.6	8.44E-05	9.00E-02	9.38E-04
1,4-Dichlorobenzene (1,4-DCB)	15	1.92E-04	2.30E-01	8.34E-04
Tetrachloroethylene (PCE)	0.007	8.95E-08	1.00E-02	8.95E-06
Toluene	0.006	7.67E-08	2.00E-01	3.84E-07
Semivolatiles				
Polychlorinated biphenyls (PCBs) [1]	188	2.40E-03	2.00E-05	1.20E+02
Benzo(g,h,i-)perylene	0.4	5.11E-06	na	
Bis(2-ethylhexyl)phthalate	1.3	1.66E-05	2.00E-02	8.31E-04
Fluoranthene	0.5	6.39E-06	4.00E-02	1.60E-04
Pyrene	0.5	6.39E-06	3.00E-02	2.13E-04
		Hazard Index		**1.20E+02**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-2
On-Site Carcinogenic Risks from Ingestion of Soil Contaminants for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	On-Site Adult Chemical Intake (mg/kg-day)	On-Site Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (LADI)	Oral Slope Factor (mg/kg-day)[-1]	Incremental Cancer Risk
Volatiles						
1,4-Dichlorobenzene (1,4-DCB)	15	7.05E-06	1.64E-05	2.35E-05	4.00E-02	9.39E-07
Tetrachloroethylene (PCE)	0.007	3.29E-09	7.67E-09	1.10E-08	5.10E-02	5.59E-10
Semivolatiles						
Polychlorinated biphenyls (PCBs)	188	8.83E-05	2.06E-04	2.94E-04	7.70E+00	2.27E-03
Bis(2-ethylhexyl)phthalate	1.3	6.11E-07	1.42E-06	2.04E-06	8.40E-03	1.71E-08
				Total Risk		**2.27E-03**

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Table C-3
On-Site Noncarcinogenic Health Hazards from Dermal Contact with Soil Contaminants for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	On-Site Child Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles					
Acetone	0.1	0.1	2.56E-07	1.00E-01	2.56E-06
2-Butanone	0.046	0.1	1.18E-07	6.00E-01	1.96E-07
Chlorobenzene	1.8	0.1	4.60E-06	2.00E-02	2.30E-04
1,2-Dichlorobenzene (1,2-DCB)	0.4	0.1	1.02E-06	9.00E-02	1.14E-05
1,3-Dichlorobenzene (1,3-DCB)	6.6	0.1	1.69E-05	9.00E-02	1.88E-04
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	3.84E-05	2.30E-01	1.67E-04
Tetrachloroethylene (PCE)	0.007	0.1	1.79E-08	1.00E-02	1.79E-06
Toluene	0.006	0.1	1.53E-08	2.00E-01	7.67E-08
Semivolatiles					
Polychlorinated biphenyls (PCBs) [1]	188	0.15	7.21E-04	2.00E-05	3.61E+01
Benzo(g,h,i-)perylene	0.4	0.15	1.53E-06	na	
Bis(2-ethylhexyl)phthalate	1.3	0.1	3.32E-06	2.00E-02	1.66E-04
Fluoranthene	0.5	0.15	1.92E-06	4.00E-02	4.79E-05
Pyrene	0.5	0.15	1.92E-06	3.00E-02	6.39E-05
			Hazard Index		**3.61E+01**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-4
On-Site Carcinogenic Risks from Dermal Contact with Soil Contaminants for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	On-Site Adult Chemical Intake (mg/kg-day)	On-Site Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (LADI)	Oral Slope Factor $(mg/kg-day)^{-1}$	Incremental Cancer Risk
Volatiles							
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	2.01E-06	3.29E-06	5.30E-06	4.00E-02	2.12E-07
Tetrachloroethylene (PCE)	0.007	0.1	9.39E-10	1.53E-09	2.47E-09	5.10E-02	1.26E-10
Semivolatiles							
Polychlorinated biphenyls (PCBs)	188	0.15	3.78E-05	6.18E-05	9.96E-05	7.70E+00	7.67E-04
Bis(2-ethylhexyl)phthalate	1.3	0.1	1.74E-07	2.85E-07	4.59E-07	8.40E-03	3.86E-09
					Total Risk		**7.68E-04**

Table C-5
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Air Concentration (mg/m^3)	Child Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.26E-07	1.44E-07	1.00E-01	1.44E-06
Benzene	6.10E-10	3.90E-10	na	
2-Butanone	5.45E-07	3.48E-07	2.90E-01	1.20E-06
Carbon tetrachloride	6.58E-08	4.21E-08	5.70E-04	7.38E-05
Chlorobenzene	4.20E-07	2.68E-07	5.70E-03	4.71E-05
Chloroform	9.51E-08	6.08E-08	1.00E-02	6.08E-06
1,2-Dichlorobenzene (1,2-DCB)	5.33E-08	3.41E-08	5.70E-02	5.98E-07
1,3-Dichlorobenzene (1,3-DCB)	2.78E-07	1.78E-07	5.70E-02	3.12E-06
1,4-Dichlorobenzene (1,4-DCB)	3.11E-07	1.99E-07	2.30E-01	8.64E-07
cis-1,2-Dichloroethylene (cis-1,2-DCE)	1.63E-07	1.04E-07	1.00E-02	1.04E-05
trans-1,2-Dichloroethylene (trans-1,2-DCE)	1.17E-07	7.48E-08	2.00E-02	3.74E-06
Freon [1]	2.99E-09	1.91E-09	5.70E-02	3.35E-08
Tetrachloroethylene (PCE)	2.47E-07	1.58E-07	1.00E-02	1.58E-05
Toluene	2.54E-07	1.62E-07	1.10E-01	1.48E-06
Trichloroethylene (TCE)	5.44E-06	3.48E-06	6.00E-03	5.80E-04
Vinyl chloride	2.39E-06	1.53E-06	na	
		Hazard Index		**7.45E-04**

Table C-6
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Air Concentration (mg/m^3)	Adult Chemical Intake (mg/kg-day)	Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (LADI) (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	6.10E-10	5.73E-11	3.34E-11	9.07E-11	1.00E-01	9.07E-12
Carbon tetrachloride	6.58E-08	6.18E-09	3.61E-09	9.79E-09	1.50E-01	1.47E-09
Chloroform	9.51E-08	8.93E-09	5.21E-09	1.41E-08	1.90E-02	2.69E-10
1,4-Dichlorobenzene	3.11E-07	2.92E-08	1.70E-08	4.63E-08	4.00E-02	1.85E-09
Tetrachloroethylene (PCE)	2.47E-07	2.32E-08	1.35E-08	3.67E-08	2.10E-02	7.71E-10
Trichloroethylene (TCE)	5.44E-06	5.11E-07	2.98E-07	8.09E-07	1.00E-02	8.09E-09
Vinyl Chloride	2.39E-06	2.25E-07	1.31E-07	3.55E-07	2.70E-01	9.60E-08
			Total Risk			**1.08E-07**

Table C-7
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	On-Site Indoor Air Concentration (mg/m^3)	Child Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	1.14E-04	4.78E-05	1.00E-01	4.78E-04
Benzene	8.04E-07	3.37E-07	na	
2-Butanone	1.10E-04	4.61E-05	2.90E-01	1.59E-04
Carbon tetrachloride	1.54E-04	6.46E-05	5.70E-04	1.13E-01
Chlorobenzene	2.76E-03	1.16E-03	5.70E-03	2.03E-01
Chloroform	7.75E-06	3.25E-06	1.00E-02	3.25E-04
1,2-Dichlorobenzene	2.19E-05	9.18E-06	5.70E-02	1.61E-04
1,3-Dichlorobenzene	2.68E-04	1.12E-04	5.70E-02	1.97E-03
1,4-Dichlorobenzene	1.78E-04	7.46E-05	2.30E-01	3.25E-04
cis-1,2-Dichloroethylene (cis-1,2-DCE)	3.37E-04	1.41E-04	1.00E-02	1.41E-02
trans-1,2-Dichloroethylene (trans-1,2-DCE)	2.62E-05	1.10E-05	2.00E-02	5.49E-04
Freon [1]	2.65E-05	1.11E-05	5.70E-02	1.95E-04
Tetrachloroethylene (PCE)	2.49E-04	1.04E-04	1.00E-02	1.04E-02
Toluene	2.56E-04	1.07E-04	1.10E-01	9.76E-04
Trichloroethylene (TCE)	2.12E-03	8.89E-04	6.00E-03	1.48E-01
Vinyl chloride	1.90E-04	7.97E-05	na	
		Hazard Index		**4.94E-01**

Table C-8
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Indoor Air Concentration (mg/m^3)	Adult Chemical Intake (mg/kg-day)	Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	8.04E-07	3.90E-08	2.89E-08	6.79E-08	1.00E-01	6.79E-09
Carbon tetrachloride	1.54E-04	7.47E-06	5.54E-06	1.30E-05	1.50E-01	1.95E-06
Chloroform	7.75E-06	3.76E-07	2.79E-07	6.55E-07	1.90E-02	1.24E-08
1,4-Dichlorobenzene	1.78E-04	8.64E-06	6.40E-06	1.50E-05	4.00E-02	6.01E-07
Tetrachloroethylene (PCE)	2.49E-04	1.21E-05	8.95E-06	2.10E-05	2.10E-02	4.42E-07
Trichloroethylene (TCE)	2.12E-03	1.03E-04	7.62E-05	1.79E-04	1.00E-02	1.79E-06
Vinyl Chloride	1.90E-04	9.22E-06	6.83E-06	1.60E-05	2.70E-01	4.33E-06
				Total Risk		**9.14E-06**

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Table C-9
On-Site Noncarcinogenic Health Hazards from Inhalation of Particulate Emissions in Outdoor Air for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	Off-Site Outdoor Particulate Air Concentration (mg/m^3)	On-Site Child Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Polychlorinated biphenyls (PCBs) [1]	3.05E-07	1.95E-07	2.00E-05	9.75E-03
Benzo(g,h,i-)perylene	4.00E-09	2.56E-09	na	
Bis(2-ethylhexyl)phthalate	4.00E-09	2.56E-09	2.20E-02	1.16E-07
Pyrene	1.12E-10	7.16E-11	3.00E-02	2.39E-09
		Hazard Index		**9.75E-03**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-10
On-Site Carcinogenic Risks from Inhalation of Particulate Emissions in Outdoor Air for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Indoor Air Concentration (mg/m^3)	On-Site Adult Chemical Intake (mg/kg-day)	On-Site Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (LADI)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Polychlorinated biphenyls (PCBs)	3.05E-07	2.86E-08	1.67E-08	4.54E-08	7.70E+00	2.21E-07
Bis(2-ethylhexyl)phthalate	4.00E-09	3.76E-10	2.19E-10	5.95E-10	8.40E-03	3.16E-12
		Total Risk				**2.21E-07**

na No published toxicity criteria were available.

Table C-23
Noncarcinogenic Health Hazards from Dermal Contact with Soil Contaminants for a Hypothetical Construction Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Construction Worker Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles					
Acetone	0.1	0.1	2.63E-07	1.00E-01	2.63E-06
2-Butanone	0.046	0.1	1.21E-07	6.00E-01	2.01E-07
Chlorobenzene	1.8	0.1	4.73E-06	2.00E-02	2.36E-04
1,2-Dichlorobenzene (1,2-DCB)	0.4	0.1	1.05E-06	9.00E-02	1.17E-05
1,3-Dichlorobenzene (1,3-DCB)	6.6	0.1	1.73E-05	9.00E-02	1.93E-04
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	3.94E-05	2.30E-01	1.71E-04
Tetrachloroethylene (PCE)	0.007	0.1	1.84E-08	1.00E-02	1.84E-06
Toluene	0.006	0.1	1.58E-08	2.00E-01	7.88E-08
Semivolatiles					
Polychlorinated biphenyls (PCBs) [1]	188	0.15	7.41E-04	2.00E-05	3.70E+01
Benzo(g,h,i-)perylene	0.4	0.15	1.58E-06	na	
Bis(2-ethylhexyl)phthalate	1.3	0.1	3.42E-06	2.00E-02	1.71E-04
Fluoranthene	0.5	0.15	1.97E-06	4.00E-02	4.93E-05
Pyrene	0.5	0.15	1.97E-06	3.00E-02	6.57E-05
			Hazard Index		**3.70E+01**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-24
Carcinogenic Risks from Dermal Contact with Soil Contaminants for a Hypothetical Construction Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Construction Worker Chemical Intake (mg/kg-day)	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Volatiles					
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	1.41E-07	4.00E-02	5.63E-09
Tetrachloroethylene (PCE)	0.007	0.1	6.57E-11	5.10E-02	3.35E-12
Semivolatiles					
Polychlorinated biphenyls (PCBs)	188	0.15	2.65E-06	7.70E+00	2.04E-05
Bis(2-ethylhexyl)phthalate	1.3	0.1	1.22E-08	8.40E-03	1.02E-10
			Total Risk		**2.04E-05**

Table C-25
Noncarcinogenic Health Hazards from Inhalation of On-Site Soil Contaminants for a Hypothetical Construction Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Estimated Air Concentration from Mechanical Suspension (mg/m^3)	Construction Worker Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles					
Acetone	0.1	1.00E-07	1.96E-08	1.00E-01	1.96E-07
2-Butanone	0.046	4.60E-08	9.00E-09	2.90E-01	3.10E-08
Chlorobenzene	1.8	1.80E-06	3.52E-07	5.70E-03	6.18E-05
1,2-Dichlorobenzene (1,2-DCB)	0.4	4.00E-07	7.83E-08	5.70E-02	1.37E-06
1,3-Dichlorobenzene (1,3-DCB)	6.6	6.60E-06	1.29E-06	5.70E-02	2.27E-05
1,4-Dichlorobenzene (1,4-DCB)	15	1.50E-05	2.94E-06	2.30E-01	1.28E-05
Tetrachloroethylene (PCE)	0.007	7.00E-09	1.37E-09	1.00E-02	1.37E-07
Toluene	0.006	6.00E-09	1.17E-09	1.10E-01	1.07E-08
Semivolatiles					
Polychlorinated biphenyls (PCBs) [1]	188	1.88E-04	3.68E-05	2.00E-05	1.84E+00
Benzo(g,h,i-)perylene	0.4	4.00E-07	7.83E-08	na	
Bis(2-ethylhexyl)phthalate	1.3	1.30E-06	2.54E-07	2.00E-02	1.27E-05
Fluoranthene	0.5	5.00E-07	9.78E-08	4.00E-02	2.45E-06
Pyrene	0.5	5.00E-07	9.78E-08	3.00E-02	3.26E-06
		Hazard Index			**1.84E+00**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-26
Carcinogenic Risks from Inhalation of On-Site Soil Contaminants for a Hypothetical Construction Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Estimated Air Concentration from Mechanical Suspension (mg/m^3)	Construction Worker Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Volatiles					
1,4-Dichlorobenzene (1,4-DCB)	15	1.50E-05	1.05E-08	4.00E-02	4.19E-10
Tetrachloroethylene (PCE)	0.007	7.00E-09	4.89E-12	2.10E-02	1.03E-13
Semivolatiles					
Polychlorinated biphenyls (PCBs)	188	1.88E-04	1.31E-07	7.70E+00	1.01E-06
Bis(2-ethylhexyl)phthalate	1.3	1.30E-06	9.09E-10	8.40E-03	7.63E-12
		Total Risk			**1.01E-06**

na No published toxicity criteria were available.

Table C-27
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Construction Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Air Concentration (mg/m^3)	Construction Worker Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.26E-07	4.42E-08	1.00E-01	4.42E-07
Benzene	6.10E-10	1.19E-10	na	
2-Butanone	5.45E-07	1.07E-07	2.90E-01	3.68E-07
Carbon tetrachloride	6.58E-08	1.29E-08	5.70E-04	2.26E-05
Chlorobenzene	4.20E-07	8.22E-08	5.70E-03	1.44E-05
Chloroform	9.51E-08	1.86E-08	1.00E-02	1.86E-06
1,2-Dichlorobenzene (1,2-DCB)	5.33E-08	1.04E-08	5.70E-02	1.83E-07
1,3-Dichlorobenzene (1,3-DCB)	2.78E-07	5.44E-08	5.70E-02	9.54E-07
1,4-Dichlorobenzene (1,4-DCB)	3.11E-07	6.09E-08	2.30E-01	2.65E-07
cis-1,2-Dichloroethylene (cis-1,2-DCE)	1.63E-07	3.19E-08	1.00E-02	3.19E-06
trans-1,2-Dichloroethylene (trans-1,2-DCE)	1.17E-07	2.29E-08	2.00E-02	1.14E-06
Freon [1]	2.99E-09	5.85E-10	5.70E-02	1.03E-08
Tetrachloroethylene (PCE)	2.47E-07	4.83E-08	1.00E-02	4.83E-06
Toluene	2.54E-07	4.97E-08	1.10E-01	4.52E-07
Trichloroethylene (TCE)	5.44E-06	1.06E-06	6.00E-03	1.77E-04
Vinyl chloride	2.39E-06	4.68E-07	na	
		Hazard Index		**2.28E-04**

Table C-28
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Construction Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Air Concentration (mg/m^3)	Construction Worker Chemical Intake (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Incremental Cancer Risk
Benzene	6.10E-10	4.26E-13	1.00E-01	4.26E-14
Carbon tetrachloride	6.58E-08	4.60E-11	1.50E-01	6.90E-12
Chloroform	9.51E-08	6.65E-11	1.90E-02	1.26E-12
1,4-Dichlorobenzene	3.11E-07	2.17E-10	4.00E-02	8.69E-12
Tetrachloroethylene (PCE)	2.47E-07	1.73E-10	2.10E-02	3.63E-12
Trichloroethylene (TCE)	5.44E-06	3.80E-09	1.00E-02	3.80E-11
Vinyl Chloride	2.39E-06	1.67E-09	2.70E-01	4.51E-10
		Total Risk		**5.10E-10**

Table C-29
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions Inside a Parking Garage for a Hypothetical Residential Scenario

Chemicals of Potential Concern (COPCs)	On-Site Indoor Air Concentration (mg/m[3])	Child Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.86E-05	1.24E-07	1.00E-01	1.24E-06
Benzene	2.01E-07	8.74E-10	na	
2-Butanone	2.74E-05	1.19E-07	2.90E-01	4.11E-07
Carbon tetrachloride	3.86E-05	1.68E-07	5.70E-04	2.94E-04
Chlorobenzene	6.89E-04	3.00E-06	5.70E-03	5.25E-04
Chloroform	1.94E-06	8.43E-09	1.00E-02	8.43E-07
1,2-Dichlorobenzene	5.48E-06	2.38E-08	5.70E-02	4.18E-07
1,3-Dichlorobenzene	6.69E-05	2.91E-07	5.70E-02	5.10E-06
1,4-Dichlorobenzene	4.44E-05	1.93E-07	2.30E-01	8.39E-07
cis-1,2-Dichloroethylene (cis-1,2-DCE)	8.42E-05	3.66E-07	1.00E-02	3.66E-05
trans-1,2-Dichloroethylene (trans-1,2-DCE)	6.55E-06	2.85E-08	2.00E-02	1.42E-06
Freon [1]	6.62E-06	2.88E-08	5.70E-02	5.05E-07
Tetrachloroethylene (PCE)	6.23E-05	2.71E-07	1.00E-02	2.71E-05
Toluene	6.40E-05	2.78E-07	1.10E-01	2.53E-06
Trichloroethylene (TCE)	5.31E-04	2.31E-06	6.00E-03	3.85E-04
Vinyl chloride	4.74E-05	2.06E-07	na	
		Hazard Index		**1.28E-03**

na No published toxicity data available

Table C-30
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions Inside a Parking Garage for a Hypothetical Residential Scenario

Chemical of Potential Concern (COPC)	On-Site Indoor Air Concentration (mg/m[3])	Adult Chemical Intake (mg/kg-day)	Child Chemical Intake (mg/kg-day)	Lifetime Average Daily Intake (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Incremental Cancer Risk
Benzene	2.01E-07	1.01E-10	7.49E-11	1.76E-10	1.00E-01	1.76E-11
Carbon tetrachloride	3.86E-05	1.94E-08	1.44E-08	3.38E-08	1.50E-01	5.07E-09
Chloroform	1.94E-06	9.76E-10	7.23E-10	1.70E-09	1.90E-02	3.23E-11
1,4-Dichlorobenzene	4.44E-05	2.23E-08	1.65E-08	3.89E-08	4.00E-02	1.56E-09
Tetrachloroethylene (PCE)	6.23E-05	3.13E-08	2.32E-08	5.46E-08	2.10E-02	1.15E-09
Trichloroethylene (TCE)	5.31E-04	2.67E-07	1.98E-07	4.65E-07	1.00E-02	4.65E-09
Vinyl Chloride	4.74E-05	2.38E-08	1.77E-08	4.15E-08	2.70E-01	1.12E-08
				Total Risk		**2.37E-08**

Table C-31
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions Inside a Parking Garage for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Indoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.86E-05	5.60E-06	1.00E-01	5.60E-05
Benzene	2.01E-07	3.93E-08	na	
2-Butanone	2.74E-05	5.36E-06	2.90E-01	1.85E-05
Carbon tetrachloride	3.86E-05	7.55E-06	5.70E-04	1.33E-02
Chlorobenzene	6.89E-04	1.35E-04	5.70E-03	2.37E-02
Chloroform	1.94E-06	3.80E-07	1.00E-02	3.80E-05
1,2-Dichlorobenzene	5.48E-06	1.07E-06	5.70E-02	1.88E-05
1,3-Dichlorobenzene	6.69E-05	1.31E-05	5.70E-02	2.30E-04
1,4-Dichlorobenzene	4.44E-05	8.69E-06	2.30E-01	3.78E-05
cis-1,2-Dichloroethylene (cis-1,2-DCE)	8.42E-05	1.65E-05	1.00E-02	1.65E-03
trans-1,2-Dichloroethylene (trans-1,2-DCE)	6.55E-05	1.28E-05	2.00E-02	6.41E-04
Freon [1]	6.62E-06	1.30E-06	5.70E-02	2.27E-05
Tetrachloroethylene (PCE)	6.23E-05	1.22E-05	1.00E-02	1.22E-03
Toluene	6.40E-05	1.25E-05	1.10E-01	1.14E-04
Trichloroethylene (TCE)	5.31E-04	1.04E-04	6.00E-03	1.73E-02
Vinyl chloride	4.74E-05	9.28E-06	na	
		Hazard Index		**5.83E-02**

na No published toxicity data available

Table C-32
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions Inside a Parking Garage for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Indoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Incremental Cancer Risk
Benzene	2.01E-07	1.40E-08	1.00E-01	1.40E-09
Carbon tetrachloride	3.86E-05	2.70E-06	1.50E-01	4.05E-07
Chloroform	1.94E-06	1.36E-07	1.90E-02	2.58E-09
1,4-Dichlorobenzene	4.44E-05	3.10E-06	4.00E-02	1.24E-07
Tetrachloroethylene (PCE)	6.23E-05	4.35E-06	2.10E-02	9.14E-08
Trichloroethylene (TCE)	5.31E-04	3.71E-05	1.00E-02	3.71E-07
Vinyl Chloride	4.74E-05	3.31E-06	2.70E-01	8.94E-07
		Total Risk		**1.89E-06**

Table C-33
Noncarcinogenic Health Hazards from Ingestion of On-Site Soil Contaminants for a Hypothetical Utility Worker Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Occupational Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles				
Acetone	0.1	5.87E-09	1.00E-01	5.87E-08
2-Butanone	0.046	2.70E-09	6.00E-01	4.50E-09
Chlorobenzene	1.8	1.06E-07	2.00E-02	5.28E-06
1,2-Dichlorobenzene (1,2-DCB)	0.4	2.35E-08	9.00E-02	2.61E-07
1,3-Dichlorobenzene (1,3-DCB)	6.6	3.87E-07	9.00E-02	4.31E-06
1,4-Dichlorobenzene (1,4-DCB)	15	8.81E-07	2.30E-01	3.83E-06
Tetrachloroethylene (PCE)	0.007	4.11E-10	1.00E-02	4.11E-08
Toluene	0.006	3.52E-10	2.00E-01	1.76E-09
Semivolatiles				
Polychlorinated biphenyls (PCBs) [1]	188	1.10E-05	2.00E-05	5.52E-01
Benzo(g,h,i-)perylene	0.4	2.35E-08	na	
Bis(2-ethylhexyl)phthalate	1.3	7.63E-08	2.00E-02	3.82E-06
Fluoranthene	0.5	2.94E-08	4.00E-02	7.34E-07
Pyrene	0.5	2.94E-08	3.00E-02	9.78E-07
		Hazard Index		**5.52E-01**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-34
Carcinogenic Risks from Ingestion of On-Site Soil Contaminants for a Hypothetical Utility Worker Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Occupational Chemical Intake (mg/kg-day)	Oral Slope Factor (mg/kg-day)⁻¹	Incremental Cancer Risk
Volatiles				
1,4-Dichlorobenzene (1,4-DCB)	15	1.26E-07	4.00E-02	5.03E-09
Tetrachloroethylene (PCE)	0.007	5.87E-11	5.10E-02	2.99E-12
Semivolatiles				
Polychlorinated biphenyls (PCBs)	188	1.58E-06	7.70E+00	1.21E-05
Bis(2-ethylhexyl)phthalate	1.3	1.09E-08	8.40E-03	9.16E-11
		Total Risk		**1.21E-05**

Table C-35
Noncarcinogenic Health Hazards from Dermal Contact with Soil Contaminants for a Hypothetical Utility Worker Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Occupational Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles					
Acetone	0.1	0.1	6.31E-09	1.00E-01	6.31E-08
2-Butanone	0.046	0.1	2.90E-09	6.00E-01	4.83E-09
Chlorobenzene	1.8	0.1	1.13E-07	2.00E-02	5.67E-06
1,2-Dichlorobenzene (1,2-DCB)	0.4	0.1	2.52E-08	9.00E-02	2.80E-07
1,3-Dichlorobenzene (1,3-DCB)	6.6	0.1	4.16E-07	9.00E-02	4.62E-06
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	9.46E-07	2.30E-01	4.11E-06
Tetrachloroethylene (PCE)	0.007	0.1	4.41E-10	1.00E-02	4.41E-08
Toluene	0.006	0.1	3.78E-10	2.00E-01	1.89E-09
Semivolatiles					
Polychlorinated biphenyls (PCBs) [1]	188	0.15	1.78E-05	2.00E-05	8.89E-01
Benzo(g,h,i-)perylene	0.4	0.15	3.78E-08	na	
Bis(2-ethylhexyl)phthalate	1.3	0.1	8.20E-08	2.00E-02	4.10E-06
Fluoranthene	0.5	0.15	4.73E-08	4.00E-02	1.18E-06
Pyrene	0.5	0.15	4.73E-08	3.00E-02	1.58E-06
			Hazard Index		**8.89E-01**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-36
Carcinogenic Risks from Dermal Contact with Soil Contaminants for a Hypothetical Utility Worker Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Occupational Chemical Intake (mg/kg-day)	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Volatiles					
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	1.35E-07	4.00E-02	5.40E-09
Tetrachloroethylene (PCE)	0.007	0.1	6.31E-11	5.10E-02	3.22E-12
Semivolatiles					
Polychlorinated biphenyls (PCBs)	188	0.15	2.54E-06	7.70E+00	1.96E-05
Bis(2-ethylhexyl)phthalate	1.3	0.1	1.17E-08	8.40E-03	9.84E-11
			Total Risk		**1.96E-05**

Table C-37
Noncarcinogenic Health Hazards from Inhalation of On-Site Particulate Emissions in Outdoor Air for a Hypothetical Utility Worker Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Particulate Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Polychlorinated biphenyls (PCBs) [1]	3.05E-07	7.16E-09	2.00E-05	3.58E-04
Benzo(g,h,i-)perylene	4.00E-09	9.39E-11	na	
Bis(2-ethylhexyl)phthalate	4.00E-09	9.39E-11	2.20E-02	4.27E-09
Pyrene	1.12E-10	2.63E-12	3.00E-02	8.77E-11
		Hazard Index		**3.58E-04**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-38
Carcinogenic Risks from Inhalation of On-Site Particulate Emissions in Outdoor Air for a Hypothetical Utility Worker Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Particulate Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Polychlorinated biphenyls (PCBs)	3.05E-07	1.02E-09	7.70E+00	7.88E-09
Bis(2-ethylhexyl)phthalate	4.00E-09	1.34E-11	8.40E-03	1.13E-13
		Total Risk		**7.88E-09**

Table C-39

Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Utility Worker Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.26E-07	5.31E-09	1.00E-01	5.31E-08
Benzene	6.10E-10	1.43E-11	na	
2-Butanone	5.45E-07	1.28E-08	2.90E-01	4.41E-08
Carbon tetrachloride	6.58E-08	1.55E-09	5.70E-04	2.71E-06
Chlorobenzene	4.20E-07	9.86E-09	5.70E-03	1.73E-06
Chloroform	9.51E-08	2.23E-09	1.00E-02	2.23E-07
1,2-Dichlorobenzene (1,2-DCB)	5.33E-08	1.25E-09	5.70E-02	2.20E-08
1,3-Dichlorobenzene (1,3-DCB)	2.78E-07	6.53E-09	5.70E-02	1.15E-07
1,4-Dichlorobenzene (1,4-DCB)	3.11E-07	7.30E-09	2.30E-01	3.18E-08
cis-1,2-Dichloroethylene (cis-1,2-DCE)	1.63E-07	3.83E-09	1.00E-02	3.83E-07
trans-1,2-Dichloroethylene (trans-1,2-DCE)	1.17E-07	2.75E-09	2.00E-02	1.37E-07
Freon [1]	2.99E-09	7.02E-11	5.70E-02	1.23E-09
Tetrachloroethylene (PCE)	2.47E-07	5.80E-09	1.00E-02	5.80E-07
Toluene	2.54E-07	5.96E-09	1.10E-01	5.42E-08
Trichloroethylene (TCE)	5.44E-06	1.28E-07	6.00E-03	2.13E-05
Vinyl chloride	2.39E-06	5.61E-08	na	
		Hazard Index		**2.74E-05**

na No published toxicity data available

Table C-40

Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Utility Worker Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	6.10E-10	2.05E-12	1.00E-01	2.05E-13
Carbon tetrachloride	6.58E-08	2.21E-10	1.50E-01	3.31E-11
Chloroform	9.51E-08	3.19E-10	1.90E-01	6.06E-11
1,4-Dichlorobenzene	3.11E-07	1.04E-09	4.00E-02	4.17E-11
Tetrachloroethylene (PCE)	2.47E-07	8.29E-10	2.10E-02	1.74E-11
Trichloroethylene (TCE)	5.44E-06	1.82E-08	1.00E-02	1.82E-10
Vinyl Chloride	2.39E-06	8.02E-09	2.70E-01	2.16E-09
		Total Risk		**2.50E-09**

Table C-41
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Utility Worker Scenario

Chemicals of Potential Concern (COPCs)	Residential On-Site Indoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	1.14E-04	2.68E-06	1.00E-01	2.68E-05
Benzene	8.04E-07	1.89E-08	na	
2-Butanone	1.10E-04	2.58E-06	2.90E-01	8.91E-06
Carbon tetrachloride	1.54E-04	3.62E-06	5.70E-04	6.34E-03
Chlorobenzene	2.76E-03	6.48E-05	5.70E-03	1.14E-02
Chloroform	7.75E-06	1.82E-07	1.00E-02	1.82E-05
1,2-Dichlorobenzene (1,2-DCB)	2.19E-05	5.14E-07	5.70E-02	9.02E-06
1,3-Dichlorobenzene (1,3-DCB)	2.68E-04	6.29E-06	5.70E-02	1.10E-04
1,4-Dichlorobenzene (1,4-DCB)	1.78E-04	4.18E-06	2.30E-01	1.82E-05
cis-1,2-Dichloroethylene (cis-1,2-DCE)	3.37E-04	7.91E-06	1.00E-02	7.91E-04
trans-1,2-Dichloroethylene (trans-1,2-DCE)	2.62E-05	6.15E-07	2.00E-02	3.08E-05
Freon [1]	2.65E-05	6.22E-07	5.70E-02	1.09E-05
Tetrachloroethylene (PCE)	2.49E-04	5.85E-06	1.00E-02	5.85E-04
Toluene	2.56E-04	6.01E-06	1.10E-01	5.47E-05
Trichloroethylene (TCE)	2.12E-03	4.98E-05	6.00E-03	8.30E-03
Vinyl chloride	1.90E-04	4.46E-06	na	
		Hazard Index		**2.77E-02**

na No published toxicity data available

Table C-42
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Utility Worker Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	8.04E-07	2.70E-09	1.00E-01	2.70E-10
Carbon tetrachloride	1.54E-04	5.17E-07	1.50E-01	7.75E-08
Chloroform	7.75E-06	2.60E-08	1.90E-02	4.94E-10
1,4-Dichlorobenzene	1.78E-04	5.97E-07	4.00E-02	2.39E-08
Tetrachloroethylene (PCE)	2.49E-04	8.35E-07	2.10E-02	1.75E-08
Trichloroethylene (TCE)	2.12E-03	7.11E-06	1.00E-02	7.11E-08
Vinyl Chloride	1.90E-04	6.37E-07	2.70E-03	1.72E-09
		Total Risk		**1.93E-07**

08/22/95 1:54 pm

INPUT PARAMETERS:

Rb,dry,Kg/M3	foc	TETA	PHI	Jw(M/Day)
1569.00000	.00942	.29200	.40800	.00000

DELTA t (Day)	DELTA z (M)	d (M)	L (M)	W (M)
365	1.00000	.01000	.45000	.61000

CHEMICAL	CONC(PPM)	Kh	Koc(m3/Kg)	DgAIR(m2/d)	DlWATER(m2/d)	Mu(1/d)
Chlorobenzene	1.00	.16100	.33100	.06219	.00000	.00000
1,4-DCB	1.00	.18200	.15800	.54890	.00001	.00000
1,2-DCB	1.00	.09820	1.70000	.54890	.00001	.00000
1,3-DCB	1.00	.19200	1.70000	.54890	.00001	.00000
Acetone	1.00	.00160	.00037	.89080	.00001	.00000
Toluene	1.00	.27600	.11550	.67690	.00001	.00000
PCE	1.00	1.06060	.36300	.63020	.00001	.00000
BIS(2-ethylhexyl)Phthalate	1.00	.00450	100.00000	.33670	.00000	.00000
MEK	1.00	.00190	.00191	.77340	.00001	.00000
Pyrene	1.00	.00040	45.70910	.43740	.00000	.00000
Flouranthene	1.00	.75340	41.69000	.57530	.00001	.00000
Benzo(g,h,i)Perylene	1.00	.00001	7762.47000	.37410	.00000	.00000

****

OUTPUT VALUES:

Emission Rate for Chlorobenzene:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.28E-13
730	-.44E-10
1095	-.50E-09
1460	-.16E-08
1825	-.31E-08
2190	-.48E-08
2555	-.65E-08
2920	-.81E-08
3285	-.95E-08
3650	-.11E-07
4015	-.12E-07
4380	-.13E-07
4745	-.13E-07
5110	-.14E-07
5475	-.15E-07
5840	-.15E-07
6205	-.15E-07
6570	-.16E-07
6935	-.16E-07
7300	-.16E-07
7665	-.16E-07
8030	-.16E-07
8395	-.16E-07
8760	-.16E-07
9125	-.16E-07
9490	-.16E-07
9855	-.16E-07
10220	-.16E-07
10585	-.16E-07
10950	-.16E-07

Emission Rate for 1,3-DCB:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.16E-09
730	-.44E-08
1095	-.12E-07
1460	-.19E-07
1825	-.25E-07
2190	-.29E-07
2555	-.32E-07
2920	-.33E-07
3285	-.35E-07
3650	-.35E-07
4015	-.35E-07
4380	-.35E-07
4745	-.35E-07
5110	-.34E-07
5475	-.34E-07
5840	-.33E-07
6205	-.32E-07
6570	-.32E-07
6935	-.31E-07
7300	-.30E-07
7665	-.29E-07
8030	-.29E-07
8395	-.28E-07
8760	-.27E-07
9125	-.26E-07
9490	-.26E-07
9855	-.25E-07
10220	-.24E-07
10585	-.24E-07
10950	-.23E-07

Emission Rate for Acetone:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.10E-08
730	-.12E-07
1095	-.25E-07
1460	-.34E-07
1825	-.40E-07
2190	-.44E-07
2555	-.45E-07
2920	-.46E-07
3285	-.46E-07
3650	-.46E-07
4015	-.45E-07
4380	-.44E-07
4745	-.42E-07
5110	-.41E-07
5475	-.40E-07
5840	-.38E-07
6205	-.37E-07
6570	-.36E-07
6935	-.35E-07
7300	-.33E-07
7665	-.32E-07
8030	-.31E-07
8395	-.30E-07
8760	-.29E-07
9125	-.28E-07
9490	-.27E-07
9855	-.26E-07
10220	-.25E-07
10585	-.24E-07
10950	-.24E-07

Emission Rate for Toluene:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.63E-06
730	-.36E-06
1095	-.23E-06
1460	-.16E-06
1825	-.12E-06
2190	-.96E-07
2555	-.78E-07
2920	-.65E-07
3285	-.56E-07
3650	-.48E-07
4015	-.42E-07
4380	-.37E-07
4745	-.33E-07
5110	-.30E-07
5475	-.27E-07
5840	-.25E-07
6205	-.23E-07
6570	-.21E-07
6935	-.19E-07
7300	-.18E-07
7665	-.17E-07
8030	-.16E-07
8395	-.15E-07
8760	-.14E-07
9125	-.13E-07
9490	-.12E-07
9855	-.12E-07
10220	-.11E-07
10585	-.10E-07
10950	-.99E-08

Emission Rate for PCE:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.68E-06
730	-.35E-06
1095	-.22E-06
1460	-.15E-06
1825	-.11E-06
2190	-.89E-07
2555	-.72E-07
2920	-.60E-07
3285	-.51E-07
3650	-.44E-07
4015	-.38E-07
4380	-.34E-07
4745	-.30E-07
5110	-.27E-07
5475	-.25E-07
5840	-.22E-07
6205	-.20E-07
6570	-.19E-07
6935	-.17E-07
7300	-.16E-07
7665	-.15E-07
8030	-.14E-07
8395	-.13E-07
8760	-.12E-07
9125	-.12E-07
9490	-.11E-07
9855	-.10E-07
10220	-.99E-08
10585	-.94E-08
10950	-.89E-08

Emission Rate for BIS(2-ethylhexyl)Phthalate:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	.00E+00
730	.00E+00
1095	.00E+00
1460	.00E+00
1825	.00E+00
2190	.00E+00
2555	.00E+00
2920	.00E+00
3285	.00E+00
3650	.00E+00
4015	.00E+00
4380	.00E+00
4745	.00E+00
5110	.00E+00
5475	.00E+00
5840	.00E+00
6205	.00E+00
6570	.00E+00
6935	.00E+00
7300	.00E+00
7665	.00E+00
8030	.00E+00
8395	.00E+00
8760	.00E+00
9125	.00E+00
9490	.00E+00
9855	.00E+00
10220	.00E+00
10585	.00E+00
10950	.00E+00

Emission Rate for MEK:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	-.70E-09
730	-.96E-08
1095	-.21E-07
1460	-.30E-07
1825	-.36E-07
2190	-.40E-07
2555	-.42E-07
2920	-.43E-07
3285	-.43E-07
3650	-.43E-07
4015	-.43E-07
4380	-.42E-07
4745	-.41E-07
5110	-.40E-07
5475	-.39E-07
5840	-.37E-07
6205	-.36E-07
6570	-.35E-07
6935	-.34E-07
7300	-.33E-07
7665	-.32E-07
8030	-.31E-07
8395	-.30E-07
8760	-.29E-07
9125	-.28E-07
9490	-.27E-07
9855	-.26E-07
10220	-.25E-07
10585	-.24E-07
10950	-.24E-07

Emission Rate for Pyrene:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	.00E+00
730	.00E+00
1095	.00E+00
1460	.00E+00
1825	.00E+00
2190	.00E+00
2555	.00E+00
2920	.00E+00
3285	.00E+00
3650	.00E+00
4015	.00E+00
4380	.00E+00
4745	.00E+00
5110	.00E+00
5475	.00E+00
5840	.00E+00
6205	.00E+00
6570	.00E+00
6935	.00E+00
7300	.00E+00
7665	.00E+00
8030	.00E+00
8395	.00E+00
8760	.00E+00
9125	.00E+00
9490	.00E+00
9855	.00E+00
10220	.00E+00
10585	.00E+00
10950	.00E+00

Emission Rate for Flouranthene:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	.00E+00
730	.00E+00
1095	-.32E-13
1460	-.10E-11
1825	-.79E-11
2190	-.30E-10
2555	-.78E-10
2920	-.16E-09
3285	-.27E-09
3650	-.42E-09
4015	-.59E-09
4380	-.78E-09
4745	-.99E-09
5110	-.12E-08
5475	-.14E-08
5840	-.17E-08
6205	-.19E-08
6570	-.21E-08
6935	-.23E-08
7300	-.25E-08
7665	-.28E-08
8030	-.30E-08
8395	-.31E-08
8760	-.33E-08
9125	-.35E-08
9490	-.37E-08
9855	-.38E-08
10220	-.40E-08
10585	-.41E-08
10950	-.43E-08

Emission Rate for Benzo(g,h,i)Perylene:

TIME IN DAYS	FLUX IN KG/M2.DAY
365	.00E+00
730	.00E+00
1095	.00E+00
1460	.00E+00
1825	.00E+00
2190	.00E+00
2555	.00E+00
2920	.00E+00
3285	.00E+00
3650	.00E+00
4015	.00E+00
4380	.00E+00
4745	.00E+00
5110	.00E+00
5475	.00E+00
5840	.00E+00
6205	.00E+00
6570	.00E+00
6935	.00E+00
7300	.00E+00
7665	.00E+00
8030	.00E+00
8395	.00E+00
8760	.00E+00
9125	.00E+00
9490	.00E+00
9855	.00E+00
10220	.00E+00
10585	.00E+00
10950	.00E+00

Table C-11
Noncarcinogenic Health Hazards from Ingestion of On-Site Soil Contaminants for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Occupational Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles				
Acetone	0.1	4.89E-08	1.00E-01	4.89E-07
2-Butanone	0.046	2.25E-08	6.00E-01	3.75E-08
Chlorobenzene	1.8	8.81E-07	2.00E-02	4.40E-05
1,2-Dichlorobenzene (1,2-DCB)	0.4	1.96E-07	9.00E-02	2.17E-06
1,3-Dichlorobenzene (1,3-DCB)	6.6	3.23E-06	9.00E-02	3.59E-05
1,4-Dichlorobenzene (1,4-DCB)	15	7.34E-06	2.30E-01	3.19E-05
Tetrachloroethylene (PCE)	0.007	3.42E-09	1.00E-02	3.42E-07
Toluene	0.006	2.94E-09	2.00E-01	1.47E-08
Semivolatiles				
Polychlorinated biphenyls (PCBs) [1]	188	9.20E-05	2.00E-05	4.60E+00
Benzo(g,h,i-)perylene	0.4	1.96E-07	na	
Bis(2-ethylhexyl)phthalate	1.3	6.36E-07	2.00E-02	3.18E-05
Fluoranthene	0.5	2.45E-07	4.00E-02	6.12E-06
Pyrene	0.5	2.45E-07	3.00E-02	8.15E-06
		Hazard Index		**4.60E+00**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-12
Carcinogenic Risks from Ingestion of On-Site Soil Contaminants for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Occupational Chemical Intake (mg/kg-day)	Oral Slope Factor (mg/kg-day)$^{-1}$	Incremental Cancer Risk
Volatiles				
1,4-Dichlorobenzene (1,4-DCB)	15	2.62E-06	4.00E-02	1.05E-07
Tetrachloroethylene (PCE)	0.007	1.22E-09	5.10E-02	6.24E-11
Semivolatiles				
Polychlorinated biphenyls (PCBs)	188	3.28E-05	7.70E+00	2.53E-04
Bis(2-ethylhexyl)phthalate	1.3	2.27E-07	8.40E-03	1.91E-09
		Total Risk		**2.53E-04**

na No published toxicity criteria were available.

Table C-13
Noncarcinogenic Health Hazards from Dermal Contact with Soil Contaminants for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Occupational Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles					
Acetone	0.1	0.1	5.25E-08	1.00E-01	5.25E-07
2-Butanone	0.046	0.1	2.42E-08	6.00E-01	4.03E-08
Chlorobenzene	1.8	0.1	9.46E-07	2.00E-02	4.73E-05
1,2-Dichlorobenzene (1,2-DCB)	0.4	0.1	2.10E-07	9.00E-02	2.34E-06
1,3-Dichlorobenzene (1,3-DCB)	6.6	0.1	3.47E-06	9.00E-02	3.85E-05
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	7.88E-06	2.30E-01	3.43E-05
Tetrachloroethylene (PCE)	0.007	0.1	3.68E-09	1.00E-02	3.68E-07
Toluene	0.006	0.1	3.15E-09	2.00E-01	1.58E-08
Semivolatiles					
Polychlorinated biphenyls (PCBs) [1]	188	0.15	1.48E-04	2.00E-05	7.41E+00
Benzo(g,h,i-)perylene	0.4	0.15	3.15E-07	na	
Bis(2-ethylhexyl)phthalate	1.3	0.1	6.83E-07	2.00E-02	3.42E-05
Fluoranthene	0.5	0.15	3.94E-07	4.00E-02	9.85E-06
Pyrene	0.5	0.15	3.94E-07	3.00E-02	1.31E-05
			Hazard Index		**7.41E+00**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-14
Carcinogenic Risks from Dermal Contact with Soil Contaminants for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Dermal Absorption Factor (unitless)	Occupational Chemical Intake (mg/kg-day)	Oral Slope Factor (mg/kg-day)$^{-1}$	Incremental Cancer Risk
Volatiles					
1,4-Dichlorobenzene (1,4-DCB)	15	0.1	2.81E-06	4.00E-02	1.13E-07
Tetrachloroethylene (PCE)	0.007	0.1	1.31E-09	5.10E-02	6.70E-11
Semivolatiles					
Polychlorinated biphenyls (PCBs)	188	0.15	5.29E-05	7.70E+00	4.07E-04
Bis(2-ethylhexyl)phthalate	1.3	0.1	2.44E-07	8.40E-03	2.05E-09
			Total Risk		**4.08E-04**

na No published toxicity criteria were available.

Table C-15
Noncarcinogenic Health Hazards from Inhalation of On-Site Particulate Emissions in Outdoor Air for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Particulate Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Polychlorinated biphenyls (PCBs) [1]	3.05E-07	5.97E-08	2.00E-05	2.98E-03
Benzo(g,h,i-)perylene	4.00E-09	7.83E-10	na	
Bis(2-ethylhexyl)phthalate	4.00E-09	7.83E-10	2.20E-02	3.56E-08
Pyrene	1.12E-10	2.19E-11	3.00E-02	7.31E-10
		Hazard Index		**2.98E-03**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-16
Carcinogenic Risks from Inhalation of On-Site Particulate Emissions in Outdoor Air for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Particulate Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Polychlorinated biphenyls (PCBs)	3.05E-07	2.13E-08	7.70E+00	1.64E-07
Bis(2-ethylhexyl)phthalate	4.00E-09	2.80E-10	8.40E-03	2.35E-12
		Total Risk		**1.64E-07**

Table C-17
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Outdoor Air Concentration (mg/m³)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	2.26E-07	4.42E-08	1.00E-01	4.42E-07
Benzene	6.10E-10	1.19E-10	na	
2-Butanone	5.45E-07	1.07E-07	2.90E-01	3.68E-07
Carbon tetrachloride	6.58E-08	1.29E-08	5.70E-04	2.26E-05
Chlorobenzene	4.20E-07	8.22E-08	5.70E-03	1.44E-05
Chloroform	9.51E-08	1.86E-08	1.00E-02	1.86E-06
1,2-Dichlorobenzene (1,2-DCB)	5.33E-08	1.04E-08	5.70E-02	1.83E-07
1,3-Dichlorobenzene (1,3-DCB)	2.78E-07	5.44E-08	5.70E-02	9.54E-07
1,4-Dichlorobenzene (1,4-DCB)	3.11E-07	6.09E-08	2.30E-01	2.65E-07
cis-1,2-Dichloroethylene (cis-1,2-DCE)	1.63E-07	3.19E-08	1.00E-02	3.19E-06
trans-1,2-Dichloroethylene (trans-1,2-DCE)	1.17E-07	2.29E-08	2.00E-02	1.14E-06
Freon [1]	2.99E-09	5.85E-10	5.70E-02	1.03E-08
Tetrachloroethylene (PCE)	2.47E-07	4.83E-08	1.00E-02	4.83E-06
Toluene	2.54E-07	4.97E-08	1.10E-01	4.52E-07
Trichloroethylene (TCE)	5.44E-06	1.06E-06	6.00E-03	1.77E-04
Vinyl chloride	2.39E-06	4.68E-07	na	
		Hazard Index		**2.28E-04**

Table C-18
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Outdoor Air for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Outdoor Air Concentration (mg/m³)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	6.10E-10	4.26E-11	1.00E-01	4.26E-12
Carbon tetrachloride	6.58E-08	4.60E-09	1.50E-01	6.90E-10
Chloroform	9.51E-08	6.65E-09	1.90E-02	1.26E-10
1,4-Dichlorobenzene	3.11E-07	2.17E-08	4.00E-02	8.69E-10
Tetrachloroethylene (PCE)	2.47E-07	1.73E-08	2.10E-02	3.63E-10
Trichloroethylene (TCE)	5.44E-06	3.80E-07	1.00E-02	3.80E-09
Vinyl Chloride	2.39E-06	1.67E-07	2.70E-01	4.51E-08
		Total Risk		**5.10E-08**

Table C-19
Noncarcinogenic Health Hazards from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Occupational Scenario

Chemicals of Potential Concern (COPCs)	On-Site Indoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Quotient (HQ)
Acetone	1.14E-04	2.23E-05	1.00E-01	2.23E-04
Benzene	8.04E-07	1.57E-07	na	
2-Butanone	1.10E-04	2.15E-05	2.90E-01	7.42E-05
Carbon tetrachloride	1.54E-04	3.01E-05	5.70E-04	5.29E-02
Chlorobenzene	2.76E-03	5.40E-04	5.70E-03	9.48E-02
Chloroform	7.75E-06	1.52E-06	1.00E-02	1.52E-04
1,2-Dichlorobenzene	2.19E-05	4.29E-06	5.70E-02	7.52E-05
1,3-Dichlorobenzene	2.68E-04	5.24E-05	5.70E-02	9.20E-04
1,4-Dichlorobenzene	1.78E-04	3.48E-05	2.30E-01	1.51E-04
cis-1,2-Dichloroethylene (cis-1,2-DCE)	3.37E-04	6.59E-05	1.00E-02	6.59E-03
trans-1,2-Dichloroethylene (trans-1,2-DCE)	2.62E-05	5.13E-06	2.00E-02	2.56E-04
Freon [1]	2.65E-05	5.19E-06	5.70E-02	9.10E-05
Tetrachloroethylene (PCE)	2.49E-04	4.87E-05	1.00E-02	4.87E-03
Toluene	2.56E-04	5.01E-05	1.10E-01	4.55E-04
Trichloroethylene (TCE)	2.12E-03	4.15E-04	6.00E-03	6.91E-02
Vinyl chloride	1.90E-04	3.72E-05	na	
		Hazard Index		**2.31E-01**

Table C-20
Carcinogenic Risks from Inhalation of On-Site Volatile Emissions in Indoor Air for a Hypothetical Occupational Scenario

Chemical of Potential Concern (COPC)	On-Site Indoor Air Concentration (mg/m^3)	Occupational Chemical Intake (mg/kg-day)	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Incremental Cancer Risk
Benzene	8.04E-07	5.62E-08	1.00E-01	5.62E-09
Carbon tetrachloride	1.54E-04	1.08E-05	1.50E-01	1.61E-06
Chloroform	7.75E-06	5.42E-07	1.90E-02	1.03E-08
1,4-Dichlorobenzene	1.78E-04	1.24E-05	4.00E-02	4.98E-07
Tetrachloroethylene (PCE)	2.49E-04	1.74E-05	2.10E-02	3.65E-07
Trichloroethylene (TCE)	2.12E-03	1.48E-04	1.00E-02	1.48E-06
Vinyl Chloride	1.90E-04	1.33E-05	2.70E-01	3.59E-06
		Total Risk		**7.56E-06**

Table C-21
Noncarcinogenic Health Hazards from Ingestion of On-Site Soil Contaminants for a Hypothetical Construction Scenario

Chemicals of Potential Concern (COPCs)	On-Site Soil Concentration (mg/kg)	Construction Worker Chemical Intake (mg/kg-day)	Oral RfD (mg/kg-day)	Hazard Quotient (HQ)
Volatiles				
Acetone	0.1	9.78E-08	1.00E-01	9.78E-07
2-Butanone	0.046	4.50E-08	6.00E-01	7.50E-08
Chlorobenzene	1.8	1.76E-06	2.00E-02	8.81E-05
1,2-Dichlorobenzene (1,2-DCB)	0.4	3.91E-07	9.00E-02	4.35E-06
1,3-Dichlorobenzene (1,3-DCB)	6.6	6.46E-06	9.00E-02	7.18E-05
1,4-Dichlorobenzene (1,4-DCB)	15	1.47E-05	2.30E-01	6.38E-05
Tetrachloroethylene (PCE)	0.007	6.85E-09	1.00E-02	6.85E-07
Toluene	0.006	5.87E-09	2.00E-01	2.94E-08
Semivolatiles				
Polychlorinated biphenyls (PCBs) [1]	188	1.84E-04	2.00E-05	9.20E+00
Benzo(g,h,i-)perylene	0.4	3.91E-07	na	
Bis(2-ethylhexyl)phthalate	1.3	1.27E-06	2.00E-02	6.36E-05
Fluoranthene	0.5	4.89E-07	4.00E-02	1.22E-05
Pyrene	0.5	4.89E-07	3.00E-02	1.63E-05
		Hazard Index		**9.20E+00**

[1] Noncarcinogenic toxicity data for AROCLOR 1254 were used as a surrogate for the PCB chemical class.

na No published toxicity criteria were available.

Table C-22
Carcinogenic Risks from Ingestion of On-Site Soil Contaminants for a Hypothetical Construction Scenario

Chemical of Potential Concern (COPC)	On-Site Soil Concentration (mg/kg)	Construction Worker Chemical Intake (mg/kg-day)	Oral Slope Factor (mg/kg-day)[-1]	Incremental Cancer Risk
Volatiles				
1,4-Dichlorobenzene (1,4-DCB)	15	5.24E-08	4.00E-02	2.10E-09
Tetrachloroethylene (PCE)	0.007	2.45E-11	5.10E-02	1.25E-12
Semivolatiles				
Polychlorinated biphenyls (PCBs)	188	6.57E-07	7.70E+00	5.06E-06
Bis(2-ethylhexyl)phthalate	1.3	4.54E-09	8.40E-03	3.82E-11
		Total Risk		**5.06E-06**