BASELINE

REPORT ON SOIL GAS SAMPLING AND HUMAN HEALTH RISK ASSESSMENT

JUNE 1999

670 98TH AVENUE
Oakland, California

For:

City of Oakland
Public Works Agency
Oakland, California

98383-05

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

1,2 ; low-RBCA

Oakland
All-America City
1993

CITY OF OAKLAND

DALZIEL BUILDING • 250 FRANK H. OGAWA PLAZA, SUITE 5301 • OAKLAND, CALIFORNIA 94612

Public Works Agency
Environmental Services

(510) 238-6688
FAX (510) 238-7286
TDD (510) 238-7644

June 18, 1999

Ms. eva chu
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

Dear Ms. chu:

Subject: **Report on Soil Gas Sampling and Human Health Risk Assessment - 670 98th Avenue, Oakland, California**

Enclosed for your review, please find a copy of the subject report prepared by the City of Oakland's consultant, Baseline Environmental, presenting the results of a soil gas survey and modified RBCA Tier 2 human health risk assessment. The results of the RBCA evaluation, which assumed conservative site conditions, indicate that both carcinogenic and non-carcinogenic risks are substantially below acceptable health risk criteria. On the basis of the conclusions presented, the City requests your office to issue a case closure notification for the site.

Please call me at 238-7695, or Andrew Clark-Clough at 238-6361, if you have any questions or require additional information.

Yours very truly,

Mark B Hersh

Mark B. Hersh
Environmental Program Specialist

cc: Andrew Clark-Clough
Kevin O'Dea, Baseline Environmental

Previously Tier 1 comparison done from soil + GW SV to indoor air did not pass
This RBCA Tier 2 addresses SV from surface (≤ 3' bgs) soil to indoor air
- Should do GW vapors to indoor air also.
in Tier 2 - ND · Representative conc are several magnitude of order less than SSTL

99 JUN 23 PM 2:35
ENVIRONMENTAL PROTECTION

Compare w/ 10⁻⁶ risk.

BASELINE

ENVIRONMENTAL CONSULTING

4 June 1999
98383-05

Mr. Mark Hirsch
City of Oakland
Environmental Services
1333 Broadway, Suite 330
Oakland, CA 94612

Subject: Report on Soil Gas Sampling and Health Risk Assessment, June 1999, 670 98th Avenue, Oakland, California

Dear Mark:

Enclosed please find three copies of the Report on Soil Gas Sampling and Health Risk Assessment at 670 98th Avenue, Oakland. The Report presents the results of soil gas sampling performed in March 1999 and analysis of potential human health risks associated with aromatic and halogented hydrocarbons detected in soil, soil gas, and groundwater at and in the vicinity of the project site. A copy of the Report should be submitted to Ms. eva chu of the Alameda County Department of Environmental Health. If you have any questions or comments, please contact us at your convenience.

Sincerely,

Yane Nordhav
Principal
Reg. Geologist No. 4009

Kevin O'Dea, CEG
Vice President (707) 762-5233

Julie Pettijohn, MPH
Staff Scientist

YN:KOD:JP:km
Enclosure

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

REPORT ON SOIL GAS SAMPLING AND HUMAN HEALTH RISK ASSESSMENT

JUNE 1999

670 98TH AVENUE
Oakland, California

For:

City of Oakland
Public Works Agency
Oakland, California

98383-05

BASELINE Environmental Consulting
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EXECUTIVE SUMMARY

The results of soil gas sampling and the human health risk assessment presented in this report complete an important stage in the investigation of releases of petroleum and chlorinated hydrocarbons at and surrounding the project site at 670 98th Avenue in Oakland, California. The site is owned by the City of Oakland and was formerly operated as a service station. Detection of petroleum hydrocarbons in soils at the site in 1989 led to a series of subsurface investigations performed by the City to determine the extent of soil and groundwater affected by the releases and the potential impacts of these releases. A network of monitoring wells and temporary well points has provided groundwater and soil quality data which form the basis for the determination of health risks at the project site and surrounding area. Interim remedial actions have included the removal of underground fuel and waste oil storage tanks and excavation and disposal of contaminated soil in the vicinity of the tanks.

Following an initial health risk assessment using the ASTM Risk-Based Corrective Action Tier 1 methodology, soil gas samples were collected in March 1999 from four locations at the site and in the surrounding area. The purpose of the sampling was to refine the health risk assessment by providing actual soil gas concentrations in the near-surface soils instead of relying on contaminant fate and transport modeling. Site-specific physical and chemical soil data were also collected to improve the determination of human health risks. The results of the sampling indicated the presence of low but detectable concentrations of 17 chemicals in the soil gas samples. These data provided input to a modified RBCA Tier 2 health risk model which considered all exposure pathways with the exception of groundwater ingestion. The results of the modeling indicate that none of the detected compounds exceed the Site-Specific Target Limits determined by the RBCA methodology. The calculated cumulative individual excess lifetime cancer risk was determined to be 5.3×10^{-7}, significantly lower than the range of typically acceptable increased health risk criteria (10^{-4} to 10^{-6}). Similarly, the site-specific cumulative hazard index for non-carcinogenic compounds (0.0012) was well below the acceptable criteria (1.0).

The data collected and the analysis performed at the site and surrounding areas over the period 1989 to present indicate that the source of petroleum and chlorinated hydrocarbons has been removed from the site; the extent of groundwater affected by the release of petroleum hydrocarbons have been determined; and the residual contaminants in soil, soil gas, and groundwater do not pose a significant human health risk. The assumptions used in the analysis of health risks/hazards, including consideration of residential use, potential use of the site by children, and the possibility of unpaved floors in buildings, reflect the conservative approach in assessing the potential health risks/hazards at the site. The assumption that groundwater in the vicinity of the site would not be used as a drinking water source is reasonable considering that there are no drinking water wells within 0.5 miles of the project site and that the area is served by a municipal water supply.

Given that calculated health risks/hazards related to exposure pathways of surface soil ingestion and dermal contact and inhalation of indoor and outdoor air are significantly below accepted health risks/hazards thresholds and the conclusion that ingestion of groundwater is unlikely, the project site should qualify for case closure by Alameda County Department of Environmental Health as a "low risk groundwater" site.

REPORT ON SOIL GAS SAMPLING AND HUMAN HEALTH RISK ASSESSMENT
670 98th Avenue
Oakland, California

INTRODUCTION

BASELINE Environmental Consulting was retained by the City of Oakland, Public Works Agency to evaluate groundwater quality at 670 98th Avenue, Oakland (site) (Figure 1). In 1989 and 1990, environmental investigations and interim remedial activities were conducted at the site. The result of these investigations indicated that petroleum and chlorinated hydrocarbons had been released to groundwater at and near the project site. Subsequent sampling confirmed the presence of these compounds in the monitoring well network. An initial (Tier 1) analysis of the potential human health risks associated with the presence and fate and transport of the compounds using the American Society for Testing and Materials (ASTM) Risk-Based Corrective Action (RBCA) methodology was performed. The results indicated that the highest concentrations of benzene and tetrachloroethene detected in groundwater exceeded the risk-based screening levels (RBSLs) for acceptable individual excess lifetime cancer risks in residential settings.

On the basis of these preliminary results, the decision was made to more accurately evaluate the near surface conditions at the project site and vicinity to determine if assumptions made in the preliminary health risk assessment were appropriate for determining the fate and transport of compounds in the subsurface and expected levels of human exposure at the surface. Specifically, additional investigation was proposed to characterize soil properties at the site and to obtain direct measurement of contaminant concentrations in soil gas. The purpose of the collection of these data was to refine the modeling of potential adverse human exposure in the areas of the most significant concentrations of contaminants in groundwater. A work plan, describing the proposed investigation and analysis, was submitted to the Alameda County Department of Environmental Health (ACDEH) 10 October 1998. Upon approval of the work plan, the proposed sampling was performed in March 1999. This report documents the results of the sampling and analysis of potential human health risks/hazards.

BACKGROUND

The City-owned project site (Figure 2) at 670 98th Avenue was occupied by a Union 76 service station from about 1947 through 1983. An old station building and an underground tank that occupied the site were removed in 1966. During that same year, a new station building, two 10,000-gallon underground gasoline tanks, and one 230-gallon waste oil tank were installed at the site. The station building was demolished and the underground storage tanks were removed in 1983.[1]

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[1]Subsurface Consultants, Inc., 1989, *Preliminary Contaminated Soil Assessment, 98th and Edes Avenues, Oakland, California*, 17 July.

In addition to the on-site source of subsurface petroleum contamination, an additional potential source of contamination at the site was identified at 692 98th Avenue, located northeast of the site. This property was occupied by a Richfield service station from about 1949 to 1963. In 1970, four 1,000-gallon underground fuel storage tanks were removed; the contents and former tank locations are not known.[2]

In 1989, during the widening of 98th Avenue, workers encountered contaminated soil while excavating a water line trench at the site. Soil samples collected from the trench were found to contain up to 350 mg/kg total petroleum hydrocarbons (TPH).

In response to the identification of contaminated soils during road widening, a preliminary soil investigation was conducted by Subsurface Consultants, Inc. Soil samples were collected from 14 soil borings. The highest concentrations of TPH were generally detected in soil samples collected at or immediately below the groundwater table.

Previous Investigations

In 1990, Subsurface Consultants, Inc. further evaluated subsurface conditions and groundwater quality at the site. Eleven soil borings were drilled, and six of the borings were completed as monitoring wells (MW-1 through MW-5, and Well 18; Figure 2). Subsurface Consultants, Inc. concluded that the former tank locations were the primary source of contamination at the site. Groundwater samples were found to contain TPH, benzene, toluene, ethylbenzene, and xylenes (BTEX), and chlorinated hydrocarbons. The chlorinated hydrocarbons were detected in monitoring wells located upgradient of the former tank locations, suggesting that those might originate from an off-site source. The analytical results of groundwater samples collected at the site are summarized in Tables 1 and 2.

Subsurface Consultants, Inc. performed groundwater monitoring during the second and third quarterly periods of 1990. The concentration of contaminants detected in groundwater samples from each well varied from one quarterly period to the next. In general, elevated concentrations of petroleum hydrocarbons were detected in groundwater samples collected from MW-1 and Well 18 (down- and/or crossgradient from the site), but none were detected in samples from MW-4 and MW-5 (up- and/or crossgradient from the site). Free petroleum product was detected in MW-1 at a thickness of 0.52 feet on 4 October 1990. The report for the investigation concluded that a plume of groundwater containing petroleum hydrocarbons was migrating downgradient (westward) of the site. Chlorinated hydrocarbons had been detected in samples from all wells. The source of chlorinated hydrocarbons was not identified.

Contaminated soil was excavated from the area along the roadway under the direction of Subsurface Consultants, Inc. Soil was excavated within five feet of the centerline of the trench and extended to groundwater, approximately ten feet below ground surface. The former tank excavation backfill

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[2]Subsurface Consultants, Inc., 1990, *Soil and Groundwater Contamination Assessment, Phase 2, 98th and Edes Avenues, Oakland, California*, 10 April.

find exact location of trench so 2 users can be granted when closure is recommended -
Oakland staff could not locate users

was removed until native soil was encountered, ten to 13 feet below ground surface. The soil was treated by aeration and transported off-site for disposal. About 1,200 cubic yards of materials were removed from the site. Soil samples were collected from the sidewalls and base of the excavation. The analytical results indicated that residual concentrations of TPH ranging from 50 to 2,100 mg/kg remained in the soil on-site.[3]

In 1990, Subsurface Consultants designed a groundwater extraction trench along the northwestern side of 98th Avenue, across the street from the project site. The trench and associated piping were installed as part of a proposed groundwater remediation system for collection and treatment of groundwater affected by petroleum and chlorinated hydrocarbons in the area of the site. The system, as designed, was to include a bioreactor system for treatment of groundwater extracted from the trench. The bioreactor system was not installed and extraction of groundwater was never initiated.

Hydrogeologic investigation of the site was resumed in 1993 by Applied Geotechnology, Inc. (AGI). Water level measurements were made monthly in April, May, and June 1993 from MW-1, 2, 3, and 4 and Well 18 (the location of well MW-5 had been paved over at this time, precluding sampling and water level measurements of that well). Prior to the water level measurements, the tops of casings of the wells had been surveyed relative to the City of Oakland Datum. During each water level monitoring event, free product was detected in MW-1, ranging in thickness from 0.005 to 0.02 feet. The water level measurements indicated a consistent gradient directed to the northwest.[4]

On 15 April 1993, AGI collected samples from wells MW-2, MW-3, and Well 18. In acknowledgment of contamination reflected by the observed presence of free product in monitoring well MW-1, samples were not collected in this well. In April 1993, MW-4 was buried by fill and was not accessible for sampling. The well was uncovered and subsequently sampled on 24 May 1993. The collected groundwater samples were submitted to CKY, Inc. laboratories for analysis of total petroleum, aromatic, and chlorinated hydrocarbons. The results of the analyses indicated the presence of total petroleum hydrocarbons and aromatic hydrocarbons in the sample from Well 18. One chlorinated hydrocarbon compound, trichloroethene (TCE), was detected in MW-2. No chlorinated hydrocarbon compounds were detected in any of the other samples (Tables 1 and 2).

In the report on the 1993 groundwater sampling event, AGI included an evaluation of potential on- and off-site sources of chemical compounds detected in the samples collected from the groundwater monitoring network for the project site. The report identified 39 sites within 2,000 feet of the project site as potential sources of the release of industrial solvents. On the basis of proximity to the site and position relative to groundwater flow direction, the report concluded that nine sites had a low to moderate potential for being associated with the chlorinated hydrocarbons detected in groundwater at and adjacent to the project site. The known waste oil tank at the project site and a

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[3]Subsurface Consultants, Inc., 1990, *Progress Report, Contaminated Soil Removal Utility Trench Alignment, 98th and Edes Avenues, Oakland, California,* 13 December.

[4]Applied Geotechnology, 1993, *Limited Phase I Environmental Assessment and Groundwater Monitoring, 670 and 692 98th Avenue, Oakland, California,* 11 August.

suspected waste oil tank at 692 98th Avenue (located adjacent to and northeast of the site) were included as two of the nine "low to moderate" potential sites.

In March 1995, BASELINE collected groundwater quality samples from monitoring wells MW-1, MW-2, MW-3, and Well 18. Monitoring wells MW-4 and MW-5 could not be located at that time. It was not known if the wells had been removed or covered by paving or fill. The groundwater samples were analyzed for total petroleum hydrocarbons (as gasoline and diesel), BTEX, and halogenated hydrocarbons. The results (Tables 1 and 2) of the analyses confirmed the presence of petroleum-related compounds and chlorinated hydrocarbons.

In December 1996, BASELINE collected groundwater quality samples from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, and Well 18. The groundwater samples were analyzed for TPH as gasoline and diesel, BTEX, and chlorinated hydrocarbons. Although groundwater samples from all of the wells contained low levels of chlorinated hydrocarbons, the samples from cross-gradient wells MW-2 and MW-5 were not found to contain detectable TPH and BTEX. A low level of TPH as gasoline (0.79 mg/L) was detected in the upgradient well MW-4. Free product previously observed in MW-1 in 1993 was not detected, and the downgradient wells (MW-1 and Well 18) were found to have detectable levels of BTEX (Tables 1 and 2).[5] In addition, the groundwater samples were analyzed for nitrate, sulfate, and total iron to assess the relative activity of intrinsic bioremediation processes. The intrinsic bioremediation indicator parameters collected during the December 1996 sampling event indicated that bioremediation processes within the aquifer beneath the site were active.

In September 1997, 13 temporary well points (Figure 3) were installed in the vicinity of the project site to determine the extent of groundwater affected by the release of petroleum and chlorinated hydrocarbons. Groundwater sampling at the well points and previously installed monitoring wells indicated the presence of petroleum hydrocarbons and/or BTEX (Tables 1 and 2) in groundwater at the three down- to crossgradient wells (MW-1, MW-3, and Well 18) and at well points WP-5, WP-7, WP-8, and WP-9. Detected levels of TPH as gasoline (TPHg) ranged from 0.076 mg/L at WP-5 to 8.6 mg/L at WP-8. TPHg was not detected at MW-2, MW-4, MW-5, WP-1, WP-2, WP-3, WP-6, WP-10, WP-11, WP-13, and WP-14. TPH as diesel was detected in WP-9 at 0.14 mg/L. Although the detected extractable hydrocarbon was quantified by the laboratory as diesel, the sample chromatogram did not match the laboratory standard for diesel.

Benzene, ethylbenzene and xylenes were detected in the September 1997 groundwater samples from wells MW-1 and Well 18; BTEX were detected in well points WP-7, WP-8, and WP-12 (Table 1). Detected levels of benzene ranged from 0.0085 mg/L at Well 18 to 3.6 mg/L at WP-8. Detected levels of toluene ranged from 0.0014 mg/L at WP-8 to 0.11 mg/L at WP-12; for ethylbenzene, from 0.0048 mg/L at Well 18 to 0.14 mg/L at MW-1; and for xylenes, from 0.001 mg/l at WP-9 to 0.56 mg/L at MW-1. Although TPHg, benzene, ethylbenzene, and xylenes were detected in the initial

[5]Benzene concentrations in MW-1 and Well 18, and the xylene concentration in MW-1 exceeded the California maximum contaminant levels (MCLs) for these constituents.

sample from MW-1, these compounds were not detected in the duplicate sample collected from this well (Table 1).

Several chlorinated hydrocarbons (Table 2) were detected in the September 1997 groundwater samples from each of the wells and well points. Trichloroethene (TCE) was detected in each of the wells and well points except MW-5, WP-1, and WP-8, ranging in concentration from 0.0006 mg/L at MW-4 to 0.029 mg/L at WP-2.

Notably, the September 1997 concentrations of TPHg and BTEX in groundwater at MW-1, MW-3, and Well 18 had decreased significantly relative to the concentrations measured during the December 1996 sampling event. For example, the reported TPHg and BTEX levels decreased by two orders of magnitude (100 times) at Well 18. The trend of decreasing petroleum and aromatic hydrocarbons at these downgradient positions was consistent with previous sampling results.

Initial Human Health Risk Assessment

Source Characterization and Potential Human Health Receptors

The site was the location of a former automobile service station from 1947 through 1983. This former land use included the storage and dispensing of fuel from underground storage tanks, and a waste oil tank. Operation of a vehicle maintenance area may also have occurred on the site. The past land uses were described in a Phase I Environmental Site Assessment, completed in 1993.[6] The distribution of petroleum, BTEX, and chlorinated hydrocarbons detected in soil, groundwater, and soil vapor at the site indicates that these compounds may have been released from the tanks due to leaks or spills, and/or during fueling or maintenance operations. Residual contamination, primarily chlorinated hydrocarbons, may also be present in groundwater underlying the site from off-site upgradient sources.

Portions of 670 98th Avenue are currently used for commercial purposes (equipment rental company) with paved areas for equipment storage and office space; the equipment rental company is fenced. The adjacent areas are used for commercial purposes, including a gas station, and parking (along 98th and Edes avenues). The majority of these adjacent land uses are paved. Residential land uses are also located along Edes Avenue and downgradient of the site. Minimal habitat with a lack of vegetation, surface water, and wildlife were observed at and near the site during field investigations. The site topography is relatively flat, while the regional topography slopes gently toward the west-northwest.

Although there are some current commercial sites users, potential current and future exposure to human receptors was assumed to be residential for purposes of the risk analysis to allow for unrestricted use/development of the site and for protection of downgradient off-site residential areas. The assumption of residential current and future land uses would also be protective of commercial land uses. Future site uses are unknown. The risk analysis was also conducted assuming there

[6]AGS, 1993, op. cit..

would be no additional active remediation activities at the site. However, water quality data from the site indicate that passive bioremediation is occurring at the site.

Site Characterization

Subsurface investigations, including previous soil and groundwater sampling, and soil vapor sampling and analysis, as described in this report, provide the basis of the identification of the extent of soil and groundwater affected by the release of petroleum and associated aromatic hydrocarbons, and chlorinated hydrocarbons at and near the site. Residual contamination was found to be associated with surface soils (less than 3.3 feet bgs) (based on a limited number of samples), subsurface soils (greater than 3.3 feet bgs), and groundwater. See Tables 1, 2, and 3 for summaries of analytical results.

Risk Based Corrective Actions (RBCA) Methodology

The American Society for Testing and Materials RBCA approach[7] is designed as a tiered approach for defining health risks/hazards at affected sites and development of appropriate remedial actions, as needed. Tier 1 of RBCA allows for the assessment of the potential human health risks/hazards posed by residual soil and groundwater contaminants through 1) identification of potential sources of contamination, 2) determination of potential exposure pathways, 3) comparison of site-specific contaminant concentrations to risk based screening levels (RBSLs), and 4), and evaluation of appropriate general corrective actions to ensure health protection, as needed.

The RBSLs established in the RBCA approach are based on assumed "typical" site conditions that include estimated conservative assumptions regarding soil, groundwater, and atmospheric conditions; conservative contaminant migration models; upper-bound estimates on exposure parameters; and available toxicological data. RBSL values are considered to be "evergreen" and are expected to change as new methodologies and parameters are developed. Site concentrations evaluated under RBCA that do not exceed the RBSLs for anticipated exposure pathways are generally considered not to pose a significant threat to human health and are not evaluated further in the assessment.

If site contaminants exceed Tier 1 RBSLs, a Tier 2 analysis may be conducted for those exposure pathways that exceeded the Tier 1 RBSLS. In the Tier 2 analysis, site-specific data on the physical properties of subsurface materials at the project site are used in the fate and transport modeling to develop Site Specific Target Limits (SSTLs). The same exposure parameters, risk/hazard levels, and calculations as used in the Tier 1 analysis are used in the Tier 2 analysis. Following the Tier 2 analysis, an evaluation is made of appropriate general corrective actions to ensure health protection, if site contaminants exceed Tier 2 SSTLs. Site concentrations that do not exceed Tier 2 SSTLs for anticipated exposure pathways are generally considered not to pose a significant threat to human health and are not evaluated further.

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[7] American Society for Testing and Materials (ASTM), 1995, *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, E 1739-95.

Preliminary Risk Analysis

Following the completion of the last quarterly groundwater monitoring event in September 1997,[8] the maximum groundwater concentrations of BTEX and chlorinated hydrocarbons from all groundwater samples collected at and near the site in 1996 and 1997 (Tables 1 and 2), and reported above laboratory reporting limits, were compared with modified ASTM Tier 1 Risk-Based Screening Levels (RBSLs) that would be protective of human health for potential residential site users at the one-in-one million excess lifetime cancer risk and hazard index of unity (1.0)[9] hazard levels for volatilization into indoor and outdoor air. The following chemicals were evaluated in the preliminary analysis: 1,1-dichloroethylene, benzene, 1,1-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, ethylbenzene, tetrachloroethene, toluene, 1,1,1-trichloroethane, trichloroethene, and xylenes (o,m,p-isomers combined).

Modified Tier 1 RBSLs

The Tier 1 RBSLs were initially only modified to account for shallower groundwater at the site than was included in the default ASTM Tier 1 RBSLs. The depth to groundwater was set at six feet below ground surface, the shallowest depth where groundwater was encountered at the site during groundwater monitoring (Table 4).[10] Modifying the RBSLs to account for shallower groundwater at the site would result in slightly lower (more conservative) RBSLs than the default Tier 1 RBSLs.

Soil leaching to groundwater and groundwater ingestion was not included in the preliminary (and subsequent) analysis as the quality of groundwater in the area of the project site is not suitable as a drinking water source. A well survey completed in 1996 identified no drinking water (municipal) wells within one-half mile of the 98th and Edes avenues. Industrial water supply wells were identified at five locations within one-half mile of the site and irrigation wells were identified at six locations within one-half mile of the site.[11] The depth of nearly all of the wells at these locations was at least 120 feet bgs, although the depth of two of the wells was not stated, and another well was indicated as only two feet bgs, which is assumed to be inaccurate. The municipal water supply for the urban area of the project site is provided by a public utility, which delivers water from outside the hydrogeologic area of the project site. Drinking water is expected to be provided from this source in the future.

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[8] BASELINE, 1997, op. cit.

[9] A one-in-one million excess lifetime cancer risk is often misconstrued as an expectation that one out of one million people exposed will be stricken with cancer. In actuality, the carcinogenic risk is not an actual risk, but rather a mathematical probability that an individual may develop cancer over a 70-year lifetime as a result of the exposure conditions evaluated. The non-cancer hazard index is expressed as a ratio of the estimated exposure over a specified time period to a modified toxicity value (called a reference dose) for a similar exposure period; if the exposure exceeds the reference dose, there may be concern for non cancer adverse health effects under the exposure conditions evaluated.

[10] The default is approximately ten feet below ground surface.

[11] Alameda County Public Works Agency, 1996, Well survey for 98th and Edes, Oakland, California, 12 April.

Tier 1 wl not conc in 1996-97. Did not avg. last 4 qtrs.

Results of Preliminary Risk Analysis

Based on this preliminary assessment, a comparison of the maximum concentration of benzene and tetrachloroethene from groundwater samples collected in 1996 and 1997 with the modified Tier 1 RBSLs, indicated that these levels may represent health risks exceeding the one-in-one million excess lifetime cancer risk level for the indoor air pathway (results not shown).[12]

Although the designated risk level appeared to have been exceeded for that pathway, the fate and transport modeling included in RBCA methodology is generally considered to be very conservative and may significantly overestimate the actual exposure to contaminants volatilized from soil and/or groundwater. Use of site-specific soil vapor data in lieu of estimating volatilization from soil and groundwater samples improves the reliability of the fate and transport modeling.

The results of this preliminary risk analysis prompted the preparation of a work plan for a soil vapor gas survey, collection of soil samples for analysis of soil parameters, and risk analysis update as well as an evaluation of other potential human health exposure pathways, in addition to groundwater. This work plan was submitted to and approved by the ACDEH on 21 October 1998.

HYDROGEOLOGY

The site is located on the East Bay Plain and is underlain by fluvial and alluvial fan deposits. The fluvial deposits consist primarily of fine-grained sands, silts, and clays. The alluvial deposits consist of a heterogeneous mixture of clay, silt, sand, and gravel. According to soil and well borings drilled at the site, the subsurface materials encountered at the site consist primarily of silty and sandy clays to depths of approximately 12 to 15 feet bgs. This is underlain by a gravelly sand that extends to a depth of approximately 24 feet. The gravelly sand is underlain by interbedded clay, sandy clay, and clayey sand layers.

The regional groundwater gradient is west-northwest to the Bay, the direction of the ground surface slope. Measurement of groundwater levels in wells at the site indicates that the localized gradient is directed northwestward.[13] The direction of groundwater flow indicates that wells MW-1, MW-3, and Well 18 are located downgradient to crossgradient of the former tank locations; MW-2, MW-4, and MW-5 are upgradient to crossgradient wells (Figure 3).

In the urban setting of the project site, surface water is conveyed by the municipal storm drain system. Sheetflow runoff is collected in gutters and conveyed to subsurface storm drains. There are no surface water channels or open water bodies at or in the vicinity of the project site.

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[12] Note that the preliminary risk evaluation did not include site classification and an assessment of initial response actions according to the ASTM guidelines (ASTM, 1995), since initial response actions, including groundwater monitoring activities, had been completed at the site for several years. Source removal activities took place with removal of the tanks in 1983.

[13] Subsurface Consultants, Inc., 1990, *Soil and Groundwater Contamination Assessment, Phase 2, 98th and Edes Avenues, Oakland, California*, 10 April.

FIELD ACTIVITIES

Soil/Soil Vapor Sampling Activities

On 10 March 1999, four soil and soil vapor borings (Figure 4) were drilled for the purpose of collecting soil and soil vapor samples by Veronix Inc. under the direction of a BASELINE field geologist. A drilling permit was obtained from Alameda County Public Works Agency prior to the commencement of drilling (Appendix A).

Soil Vapor Sampling

The soil vapor borings were made using direct-push technology. Under this technique a geoprobe was advanced using hydraulic ram attached to pick-up truck. The probe was advanced to a depth of 3.5 feet bgs. The probe was retreated a foot, exposing the soil from 2.5 to 3.5 feet bgs. One end of clean ¼-inch diameter polyethylene tubing was screwed into the base of the probe, through an air-tight fitting, exposing it to soil vapor. The other end was attached to a vacuum pump that was used to purge a minimum of three tube volumes prior to sampling. The tubing was then clamped off and attached to a laboratory-prepared six-liter Summa sampling cannister. The valve on the cannister was then opened to allow the cannister to fill slowly over a period of several minutes. The valve was then closed and the labeled cannister was packed for transport to laboratory. The soil vapor samples SG-1, SG-2, SG-3, and SG-4 were submitted under chain-of-custody to Air Toxics Ltd. in Folsom, California, a state-certified laboratory, for the analysis of aromatic hydrocarbons and chlorinated hydrocarbons (EPA Method T014).

Upon completion of sampling, the geoprobe was removed from each soil vapor location, the boring was sealed by backfilling with bentonite chips and hydrated with water. The soil vapor boring SG-1 was capped with an asphalt patch to match the surrounding asphalt surface. At the completion of each boring, the geoprobe was decontaminated by washing it in a Alcanox solution and rinsed with deionized water.

Soil Sampling

Soil borings were installed adjacent to soil vapor borings using direct-push technology using the same technique described above. A four-foot long butyrate liner was inserted inside the geoprobe. The probe with the liner was advanced to depth of three feet bgs. The liner was removed, and a portion of the liner representing 2.0 to 2.5 feet bgs was separated and capped. The soil samples SG-1, SG-2, SG-3, and SG-4 were submitted to Cooper Testing Laboratories in Mountain View, California for analysis of bulk density, total porosity, moisture content, grain size analysis, and organic carbon fraction.

Upon completion of sampling, the geoprobe was removed from each soil sample location, the boring was sealed by backfilling with bentonite chips and hydrated with water. The soil vapor boring SG-1 was capped with an asphalt patch to match the surrounding asphalt surface. The geoprobe was decontaminated after completion of each boring by washing it in a Alcanox solution and rinsing with deionized water.

RESULTS

Analytical Results - Soil Gas

The laboratory report on analysis of the soil gas samples is presented in Appendix B. The results of the analyses are summarized in Table 5. The analytical results indicated the presence of several volatile and semi-volatile organic compounds in each of the soil gas samples above laboratory reporting limits. Chloromethane [1.6 to 4.0 parts per billion vapor (ppbv)], methylene chloride (0.72 to 1.3 ppbv), benzene (0.96 to 1.7 ppbv), toluene (4.1 to 5.0 ppbv), ethylbenzene (0.83 to 1.6 ppbv), mp-xylene (3.0 to 6.1 ppbv), o-xylene (1.3 to 2.3 ppbv), 1,2,4-trimethylbenzene (1.2 to 3.4 ppbv), 1,3-dichlorobenzene (0.91 to 3.4 ppbv), acetone (14 to 21 ppbv), and ethanol (36 to 72 ppbv) were detected in all four of the soil gas samples. Freon 12 was detected in sample SG-2 (0.71 ppbv) and Freon 11 was detected in SG-1 (1.9 ppbv). Styrene (0.85 ppbv) and 1,3,5-trimethylbenzene (0.92 ppbv) were identified in SG-4; styrene and 1,3,5-trimethylbenzene were also detected in SG-2 at 0.78 ppbv and 0.71 ppbv, respectively. Samples SG-2, SG-3, and SG-4 also contained 2-propanol at concentrations ranging from 2.8 to 3.2 ppbv. Methyl ethyl ketone (also known as 2-butanone) was detected in SG-1 (3.7 ppbv), SG-2 (3.8 ppbv), and SG-3 (2.9 ppbv). 4-ethyltoluene was also reported in SG-4 (2.8 ppbv).

The highest concentrations of chloromethane (4.0 ppbv), methylene chloride (1.3 ppbv), toluene (5.0 ppbv), ethylbenzene (1.6 ppbv), mp-xylene (6.1 ppbv), o-xylene (2.3 ppbv), 1,2,4-trimethylbenzene (3.4 ppbv), 1,3,5-trimethylbenzene (0.92 ppbv), styrene (0.85 ppbv), 1,3-dichlorobenzene (3.4 ppbv), 4-ethyltoluene (2.8 ppbv), ethanol (72 ppbv), and toluene (5.0 ppbv) were detected in SG-4. The level of benzene was highest in SG-1 (1.7 ppbv); Freon 11 (1.9 ppbv) was also highest in SG-1. Freon 12 and 2-butanone were highest in SG-2. The sample from SG-3 contained the highest levels of acetone (21 ppbv) and 2-propanol (3.8 ppbv).

The highest reported levels of Freon 11, Freon 12, methylenechloride, benzene, ehtylbenzene, methylethyl ketone, styrene, 1,3,5 - trimethylbenzene, 2-propanol, and 4 ethyltoluene were reported as "estimated values" (J-values) by the laboratory. Thirty eight of the 56 positive results reported by the laboratory were identified as J-values. The J-values reported for this project represent results that indicate accurate identification of a compound that is present at concentrations below the detection limit specified for the analytical method of the compound. The identity of the compound is relatively certain but the concentration is uncertain. Therefore, the numerical value of the concentration is reported as an estimated value. In accordance with recommendations of USEPA on evaluation of qualified or coded laboratory results[14], the J-values were considered usable data for the health risk assessment presented in this report.

Analytical Results - Soil Properties

The soil samples collected at each of the soil gas sampling locations were submitted to Cooper Testing Laboratory for characterization of physical properties. The soil properties are summarized in Table 6; the laboratory report is presented in Appendix C. Grain size analysis (including

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[14] USEPA, 1989, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual*, December.

hydrometer analysis) indicates that all of the samples were predominantly fine-grained (containing 37.6 to 49.4 percent clay and 28.2 to 33.7 percent silt) and are classified as dark brown to black clay or sandy clay. The samples contained 17.9 to 33.4 percent sand with predominantly fine sand. The dry density of the samples ranged from 96.5 to 106.9 pounds per cubic foot (pcf), averaging with an average of 101.2 pcf. The average porosity of the samples was 39.7 percent, reflecting the fine-grained texture of the soil. The average moisture and organic content of the samples were 22.5 and 4.0 percent, respectively.

REVISED HUMAN HEALTH RISK ANALYSIS

With the additional work completed to characterize soil vapors and site-specific soil parameters, the modified Tier 1 assessment was expanded to include surface soil ingestion, dermal contact, and inhalation of vapors. The following chemicals were evaluated in surface soil (less than or equal to 3.3 feet bgs): benzene, toluene, ethylbenzene, and xylenes (Table 3). The revised human health risk analysis for soil vapors, to account for volatilization from subsurface soil and groundwater to indoor and outdoor air, was prepared separately, and is described below.

As in the preliminary risk analysis, potential current and future human receptors were assumed to be residential, and a conservative approach using the maximum concentration of all chemicals reported above the laboratory reporting limit in at least one soil sample (less than or equal to 3.3 feet bgs) was included in the assessment. Only three samples of surface soil were identified as having been collected at the site, since the subsurface investigations primarily focused on the source of the contamination from the former underground storage tanks, located in the subsurface soil. A conceptual site model showing the potential contaminant sources, transport mechanisms, exposure pathways and potential receptors considered under the Tier 2 analysis (including soil vapor) is shown in Figure 5.

Tier 2 Site Specific Target Limits

Modifications to account for site-specific conditions were made to the modified Tier 1 RBSLs resulting in Tier 2 Site Specific Target Limits (SSTLs) in the revised risk analysis. The Tier 2 results were calculated according to the ASTM procedure.[15] These modifications included:

- Assuming 10 percent dermal absorption for all aromatic hydrocarbons and chlorinated hydrocarbons[16, 17];

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[15] Groundwater Services Inc (GSI), 1995-1997, Tier 2 RBCA Guidance Manual for Risk-Based Corrective Actions, and Tier 2 RBCA Spreadsheet System and Modeling Guidelines, Version 1.01.

[16] U.S. EPA, 1998, Region 9 Preliminary Remediation Goals (PRGs) for 1998, 1998, Memorandum from Stanford Smucker, US EPA Region IX, to PRG Table Mailing List, not dated.

[17] Department of Toxic Substances Control (DTSC), 1994, *Preliminary Endangerment Assessment Guidance Manual, Cal/EPA*, January.

- Including the most conservative toxicological data information from the following sources: RBCA spreadsheet program,[18] IRIS,[19] Cal/EPA,[20] Cal/EPA Hot Spots Unit Risk and Cancer Potency Values,[21] and the U.S. EPA Preliminary Remediation Goals list.[22] The most conservative toxicological value that would contribute to the greatest calculated theoretical risk or hazard was used;

- Use of the mean of site-specific soil parameters from four soil samples collected at the site (porosity, soil density, moisture content, air content of soils, and organic carbon) (Table 6), otherwise conservative default assumptions regarding subsurface characteristics were used in the assessment; and

- SSTLs were calculated to be protective of both children and adults.

Results of the Tier 2 Analysis for Surface Soils

The maximum concentration of contaminants in surface soil (3.3 feet bgs or less) did not exceed Tier 2 surface soil SSTLs for any contaminant evaluated at the one-in-one-million excess lifetime cancer risk level or a hazard index of 1.0. The SSTL for benzene was 2.0 mg/kg, which was above the maximum shallow soil concentration of 0.94 mg/kg (Table 7). All parameters, calculations, and results are included in Appendix D.

Comparing RBCA Tier 2 w/ Oakland RBCA Tier 2

By comparison, the SSTL for benzene, developed by the City of Oakland for residential surficial soil exposure scenarios in areas underlain by clayey silts was 19 mg/kg. The City of Oakland benzene SSTL developed for ingestion, dermal contact and inhalation of surface soils, comprising of sandy silts, was 27 mg/kg.[23] The maximum site concentrations for benzene and all other reported compounds were all below the City of Oakland SSTLs.

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[18] GIS, 1997, op. cit.

[19] Integrated Risk Information System (IRIS), 1998, Reviewed via the Internet, U.S. Environmental Protection Agency, April.

[20] California Environmental Protection Agency (Cal/EPA), 1994, *California Cancer Potency Factors: Update, Memorandum from Standards and Criteria Work Group to all Cal/EPA Departments, Board, and Office*, 1 November.

[21] California Environmental Protection Agency (Cal/EPA), 1999, *Hot Spots Unit Risk and Cancer Potency Values, Reviewed via the Internet*, April.

[22] U.S. EPA, 1998, Region 9 Preliminary Remediation Goals (PRGs) for 1998, 1998, Memorandum from Stanford Smucker, US EPA Region IX, to PRG Table Mailing List, not dated.

[23] Spence, L.R. and Gomez, M.M., 1999, *Oakland Risk-Based Corrective Action: Technical Background Document*, prepared for the City of Oakland Public Works Agency, Environmental Services Division, May.

Soil Vapor Risk Analysis

Detected soil vapors are assumed to have been derived from a combination of vapors from residual contaminants in soil and groundwater underlying the site. All chemicals detected in at least one of the four soil vapor samples above the laboratory reporting limit were considered in the screening assessment. Estimated results (i.e., "J values") were also included (Appendix D). Based on the soil vapor results (Table 5), the following chemicals were included in the soil vapor risk analysis: benzene, toluene, ethylbenzene, xylenes (combined isomers), dichlorodifluoromethane (aka, Freon 12), methyl ethyl ketone (MEK) (aka, 2-butanone), acetone, 1,3-dichlorobenzene, methylene chloride, trichlorofluoromethane (aka, Freon 11), chloromethane, 1,2,4-trimethylbenzene, styrene, 1,3,5-trimethylbenzene, ethanol, 2-propanol, and 4-ethyl toluene.

The effective soil diffusivity, diffusive vapor flux, enclosed space air concentration, outdoor air concentrations, dose and risk calculations were obtained from ASTM RBCA guidance.[24] The maximum allowable vapor concentration for individual chemicals was then calculated by iteration to achieve the acceptable risk/hazard level in indoor air and outdoor air. This maximum allowable vapor concentration in indoor and outdoor air was then compared to the maximum soil vapor concentrations from the four samples detected at the site.

The same excess lifetime cancer risk levels/hazard levels, current toxicity data, site-specific soil characteristics considered in the preliminary risk evaluation were used in the calculation of soil vapor SSTLs, otherwise conservative default assumptions regarding subsurface characteristics were used in the assessment. Insufficient toxicity information was available for ethanol (aka ethyl alcohol), 2-propanol (aka, isopropyl alcohol), or 4-ethyltoluene reported in soil vapor; these compounds were further excluded from the assessment. Exclusion of these compounds should not significantly affect the results as detected levels in soil vapor were very low. Selected conservative assumptions included in the development of soil vapor SSTLs included the following:

- There is no building slab considered for the indoor air pathway (i.e., there is a dirt floor on a hypothetic building located on the site) so any soil vapors could be transported into the building. Capping the site, with maintenance of the cap, would act to attenuate volatilization;
- There is no capping on other portions of the site (outdoor air);
- There is no natural attenuation of contaminants over time;
- A building air exchange rate of 0.5 exchange per hour (indoor air) (actual building air exchange rates may be higher);
- Children (ages 1-16) were selected as the human receptor. Use of children as the human receptor is a conservative assumption, since it takes into account the lower body weight of children. The children were assumed to have a body weight of 35 kilograms (kg), and inhale

[24] ASTM, 1995, op. cit.

15 m^3 of air per day for 350 days per year for 16 years. As a comparison, SSTLs for adults weighing 70 kg, and living on the site for 30 years, breathing 20 m^3 per day for 350 days per year are also presented in Table 7.

Appendix D presents a list of all parameters used in the risk calculations. Cumulative risk/hazard calculations from exposure to all contaminants evaluated in soil vapors in indoor and outdoor air (children), plus dermal contact, ingestion, and inhalation of surface soils with residual contaminants (adults and children) were also calculated (Table 8).

Cumulative risk calculations are determined by summing risks from individual chemicals that are known or suspected to cause cancer for each exposure pathway (indoor air, outdoor air, and dermal contact, ingestion and inhalation of surface soils), and then summing the exposure pathways to calculate the cumulative risk for a human receptor. Cumulative hazard calculations were similarly made by summing hazard quotients from individual chemicals that are not known or suspected of causing cancer, but may cause other health effects (non-carcinogens), for each exposure pathway, and then summing the exposure pathways to calculate the cumulative hazard for a human receptor.

Results of the Tier 2 Analysis for Soil Vapors

The maximum concentration of individual chemicals in soil vapor did not exceed SSTLs developed to prevent exposures in indoor air for residential site uses (both children and adults) calculated at the one-in-one million (10^{-6}) excess lifetime cancer risk or hazard index of 1.0 level. In addition, the maximum concentration of chemicals in soil vapor did not exceed SSTLs developed to prevent exposure from soil vapors in outdoor air for residential site uses (Table 7). All parameters, calculations, and results are shown in Appendix D and are summarized in Table 8. **No soil vapor SSTLs have been developed by the City of Oakland.** The cumulative individual excess lifetime cancer risk calculated for the project site and surrounding area ($5.3x10^{-7}$) is below the applicable threshold limits (1×10^{-6}). The cumulative noncarcinogenic hazard index, 0.0012 is also well below the applicable threshold limit (1.0).

CONCLUSIONS

- The potential sources of releases of petroleum hydrocarbons, volatile organic compounds, and chlorinated hydrocarbons, including former underground fuel and waste oil tanks, associated piping, and 1,200 cubic yards of contaminated soil, have been removed from the project site.

- The groundwater monitoring network, including monitoring wells and temporary well points, have adequately characterized the extent of groundwater affected by releases of petroleum hydrocarbons and associated volatile organic compounds at and in the vicinity of the project site.

- The TPHg and aromatic hydrocarbons (BTEX) levels measured in the monitoring well network during the September 1997 sampling event indicate a continuing reduction in concentration of these compounds at each of the wells. Detectable levels of BTEX were only identified in MW-1 and Well 18. The decrease in concentrations at these locations over time

probably reflects a combination of passive bioremediation of the compounds, diffusion and dilution of the plume, and downgradient migration. Significantly, well points WP-11, WP-13, and WP-14, which are located downgradient of MW-1, did not contain detectable levels of TPHg or BTEX.

- The detection of relatively high TPHg and BTEX at well point location WP-8 in September 1997 may indicate the presence of an isolated area, or hot spot, of groundwater affected by the petroleum hydrocarbons. The hot spot may represent a detached plume that has migrated from an upgradient source, possibly the fuel tanks removed from the project site. Alternatively, the hot spot may indicate a potential separate release of these compounds at or near the well point location (which is currently a vacant lot); or it could be an aberrant data point.

- The detection of chlorinated hydrocarbons throughout the area of investigation does not indicate an identifiable source for these compounds at the project site. These compounds have been identified in groundwater samples collected upgradient, cross gradient, and downgradient of the location of the waste oil tank (a potential source of chlorinated hydrocarbons) removed from the project site. However, the widespread presence of these compounds in groundwater appears to indicate a remote off-site, upgradient source of chlorinated hydrocarbons. The highest levels of TCE (0.029 mg/L) and PCE (0.047 mg/L) were identified at upgradient locations WP-2 and MW-4 (Figure 3). The highest total chlorinated hydrocarbon concentrations were also detected in MW-4 (0.0497 mg/L) and WP-2 (0.0463 mg/L).

- The maximum concentration of detected chemicals of concern in surface soil and in soil vapor (from soil and groundwater sources) did not exceed their respective SSTLs for residential site users at the established risk/hazard levels (one-in-one million excess lifetime cancer risk for carcinogens and a hazard index of 1.0 for non-carcinogens). Cumulative risk/hazard for all pathways combined were also below the one-in-one million excess lifetime cancer risk and hazard index of 1.0 level.

- Although determination of acceptable risk/hazard is ultimately a risk management decision, action is generally warranted when cumulative health risks exceed a 1×10^{-4} (one-in-one ten thousand) to 1×10^{-6} (one-in-one million) individual excess lifetime cancer risk, or a hazard index of 1.0. The calculated cumulative individual excess lifetime cancer risk (5.3×10^{-7}) and noncarinogenic hazard index (0.0012) for the project are well below the most conservative acceptable risk criteria. Based on the data evaluated, the potential exposure of residential (and commercial) site users to contaminants in surface soil or soil gas (soil ingestion and dermal contact, and inhalation of indoor or outdoor air) would therefore not present an unacceptable health risk or hazard using U.S. EPA's guidelines. Additionally, the assumptions used in the analysis of health risks/hazards were very conservative, including consideration of residential use, potential use of the site by children, and the possibility of unpaved floors in building sites.

- No action to reduce potential human health risk/hazard is therefore warranted for the site to protect site users from risks/hazards associated with exposure to contaminants in surface soil

or soil vapor. However, for worker protection, any utility work or site construction activities should be conducted by appropriately trained workers under a Site Health and Safety Plan.

- Although the maximum levels of benzene and some of the chlorinated hydrocarbons in groundwater detected from sampling points within the monitoring network have exceeded the Maximum Contaminant Level for drinking water, there are no drinking water supply wells within 0.5 mile of the project site. The RWQCB Interim guidance on Required Cleanup at Low-Risk Fuel Sites (5 January 1996) establishes the absence of drinking water wells within 250 feet of a contaminant release as a criterion for "low risk groundwater sites." Given that the area of the site is served by a municipal water source, it is unlikely that any drinking water supply wells would be drilled at or in the vicinity of the site. Furthermore, any new drinking water supply wells would be required to be constructed with a minimum twenty-foot sanitary seal, further reducing the potential that a drinking water supply well would be screened within the uppermost water bearing zones. Therefore, the potential that groundwater affected by the release of volatile and semi-volatile organic compounds in the vicinity of the project site would be used as drinking water resource is low to negligible.

RECOMMENDATIONS

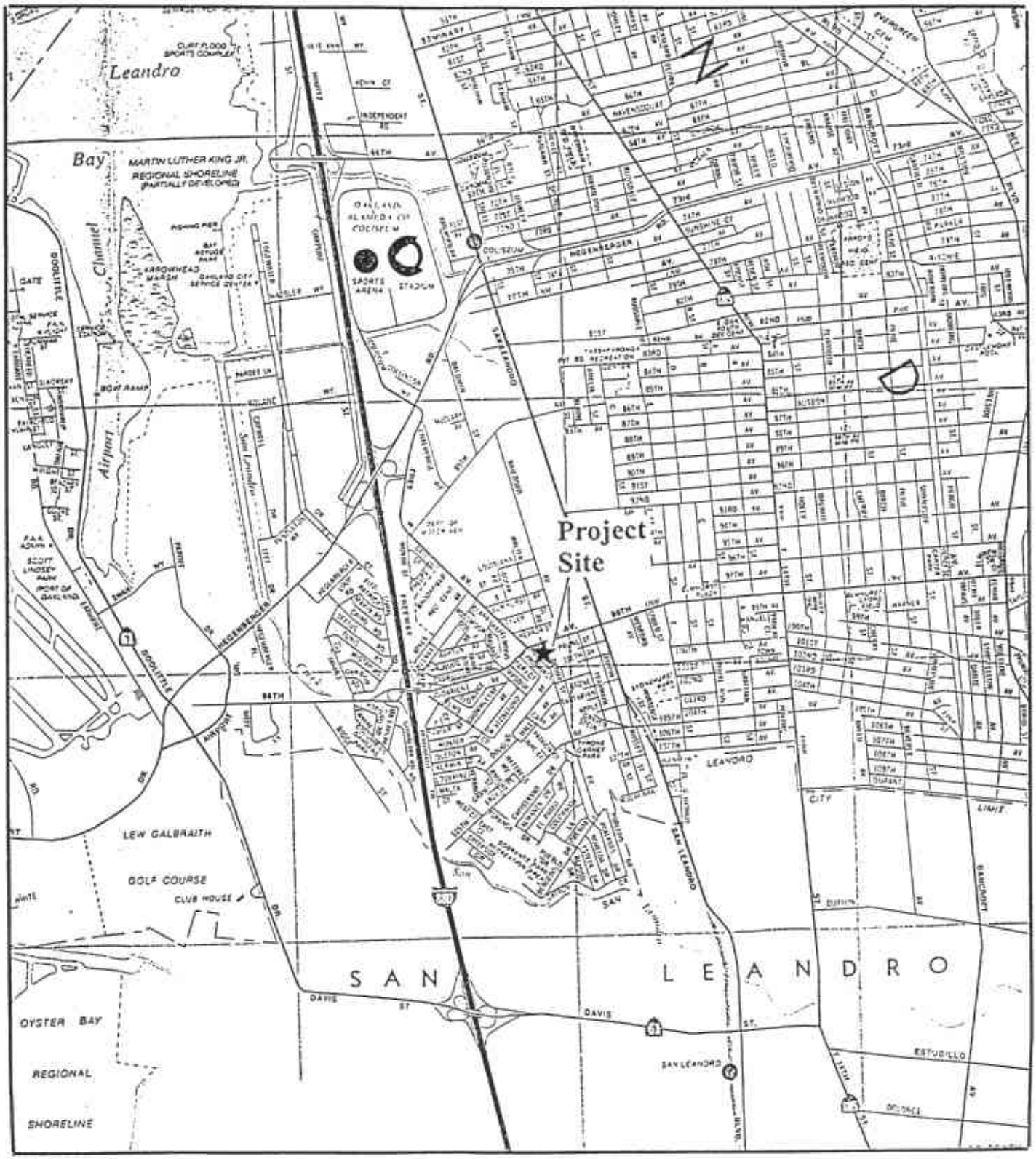
- Following review of this report, the Alameda County Department of Environmental Health should consider the closure of the 670 98th Avenue project site as a Leaking Underground Storage Tank investigation. Given that calculated health risks/hazards related to exposure pathways of surface soil ingestion and dermal contact and inhalation of indoor and outdoor air are significantly less than unacceptable health risks/hazards and the conclusion that ingestion of groundwater is unlikely, the project site should qualify for closure as a "low risk groundwater" site.

LIMITATIONS

The conclusions presented in this report are professional opinions based on the indicated data described in this report. They are intended only for the purpose, site, and project indicated. Opinions and recommendations presented herein apply to site conditions existing at the time of our study. Changes in the conditions of the subject property can occur with time, because of natural processes or the works of man, on the subject sites or on adjacent properties. Changes in applicable standards can also occur as the result of legislation or from the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes beyond our control.

REGIONAL LOCATION

Figure 1



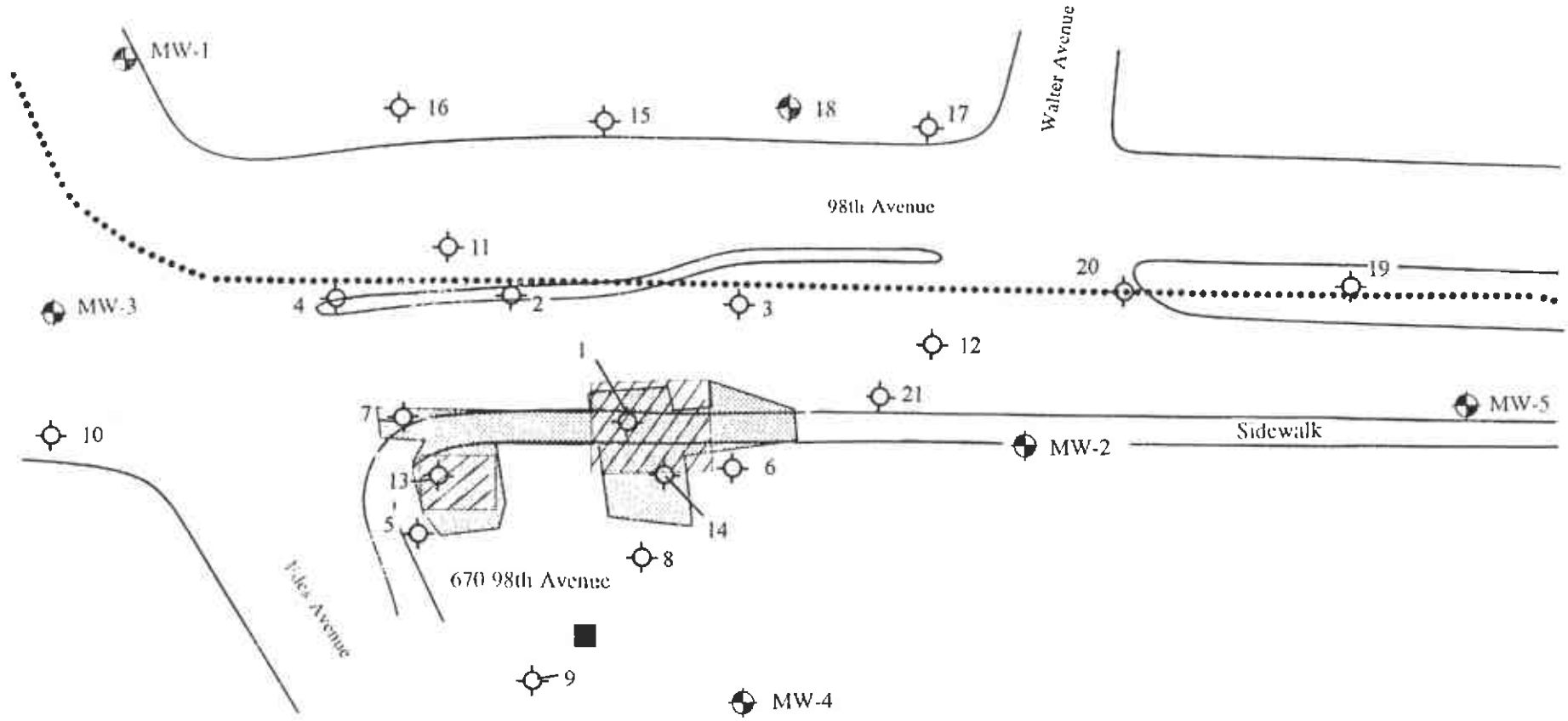
670 98th Avenue
Oakland, California

BASELINE

93343-F1 4/23/97

SITE PLAN

Figure 2



Legend

- Soil Boring
- MW-5 Groundwater Monitoring Well
- Former Waste Oil Tank Location
- Former Gasoline Tank Locations
- Areas of Previous Excavation
- 27-Inch Storm Drain

Approximate

0 50 Feet

670 98th Avenue
Oakland, California

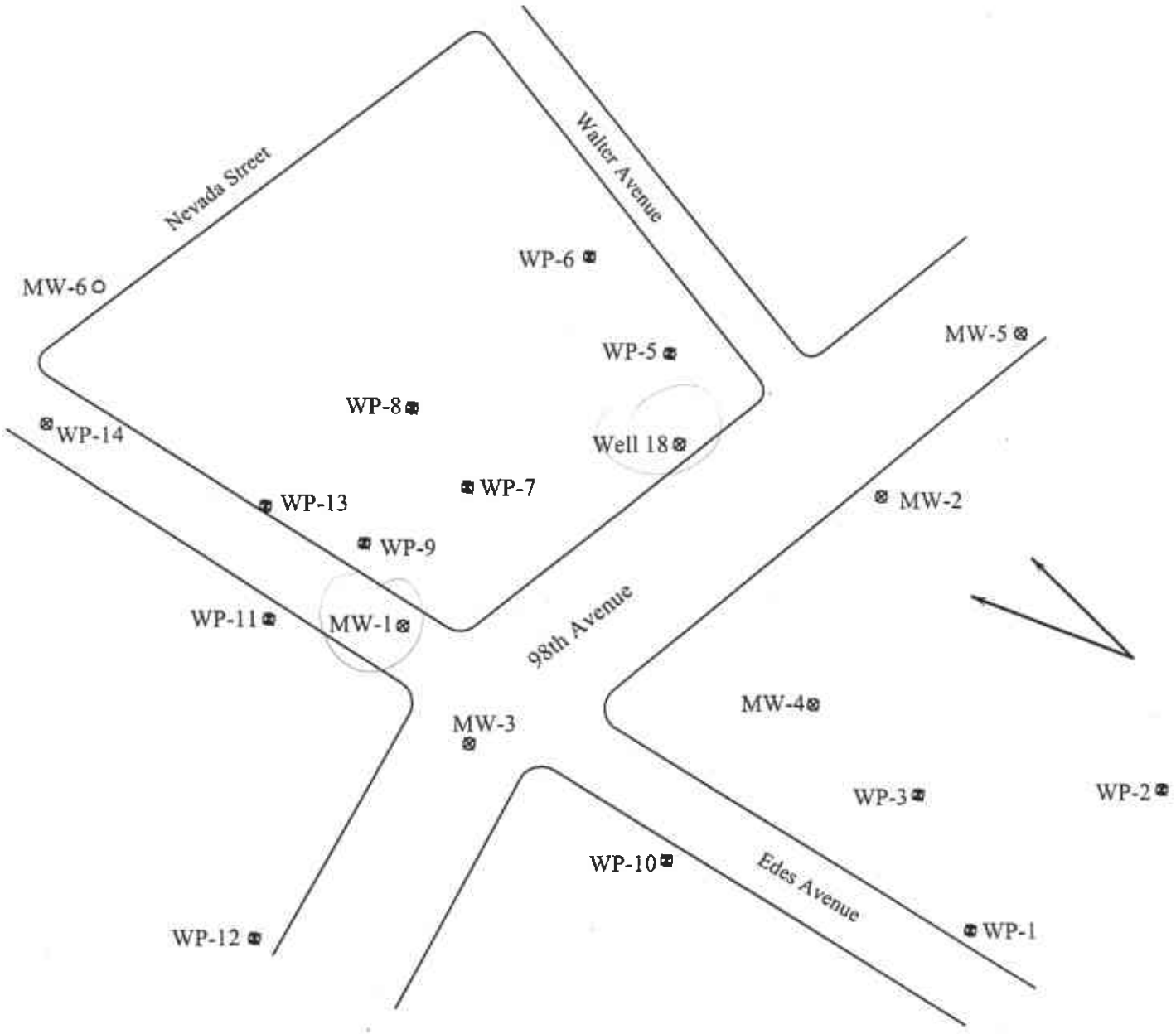
Source: Subsurface Consultants, Inc., 1990

BASELINE

98383-05 6/9/99

GROUNDWATER SAMPLE LOCATIONS

Figure 3



Legend

MW-1 ⊗ Monitoring Well

WP-1 ⊕ Well Point Location

Range of Groundwater Flow Direction (3/95 - 9/97)

MW-6 ● Proposed Monitoring Well

0 100 Feet

670 98th Avenue
Oakland, California

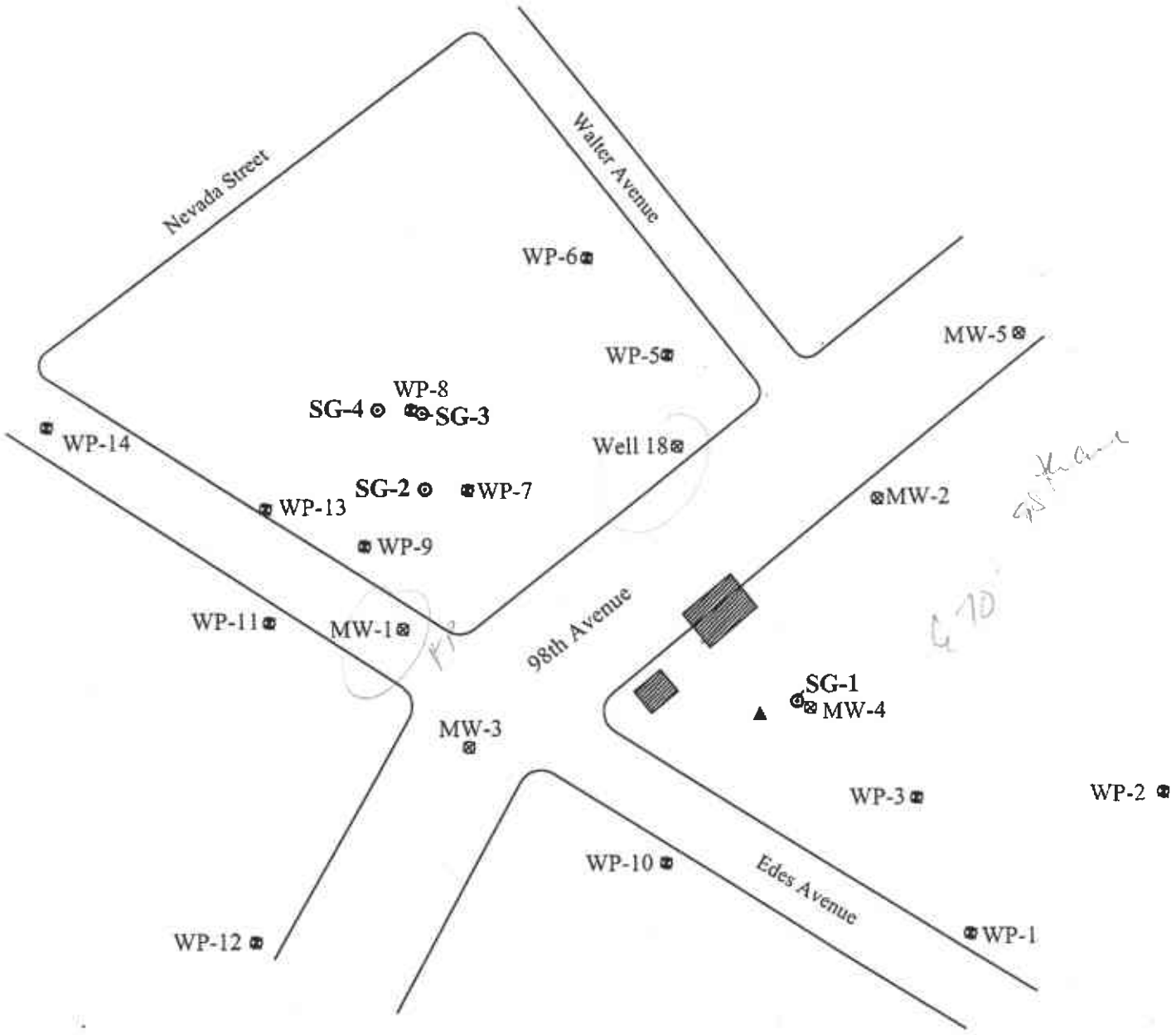
Base map source: Applied Geotechnology Inc., 7-93.

BASELINE

D:\Graphics\93343F1\Groundwater Sample Locaitons.vcd 6/2/99

SOIL VAPOR SAMPLING LOCATIONS

Figure 4



Legend

MW-1	⊗	Monitoring Well
WP-1	⊕	Well Point Location
SG-1	⊙	Soil Vapor Sampling Location
	▨	Former Gasoline Tank Location
	▲	Former Waste Oil Tank Location

0 100 Feet

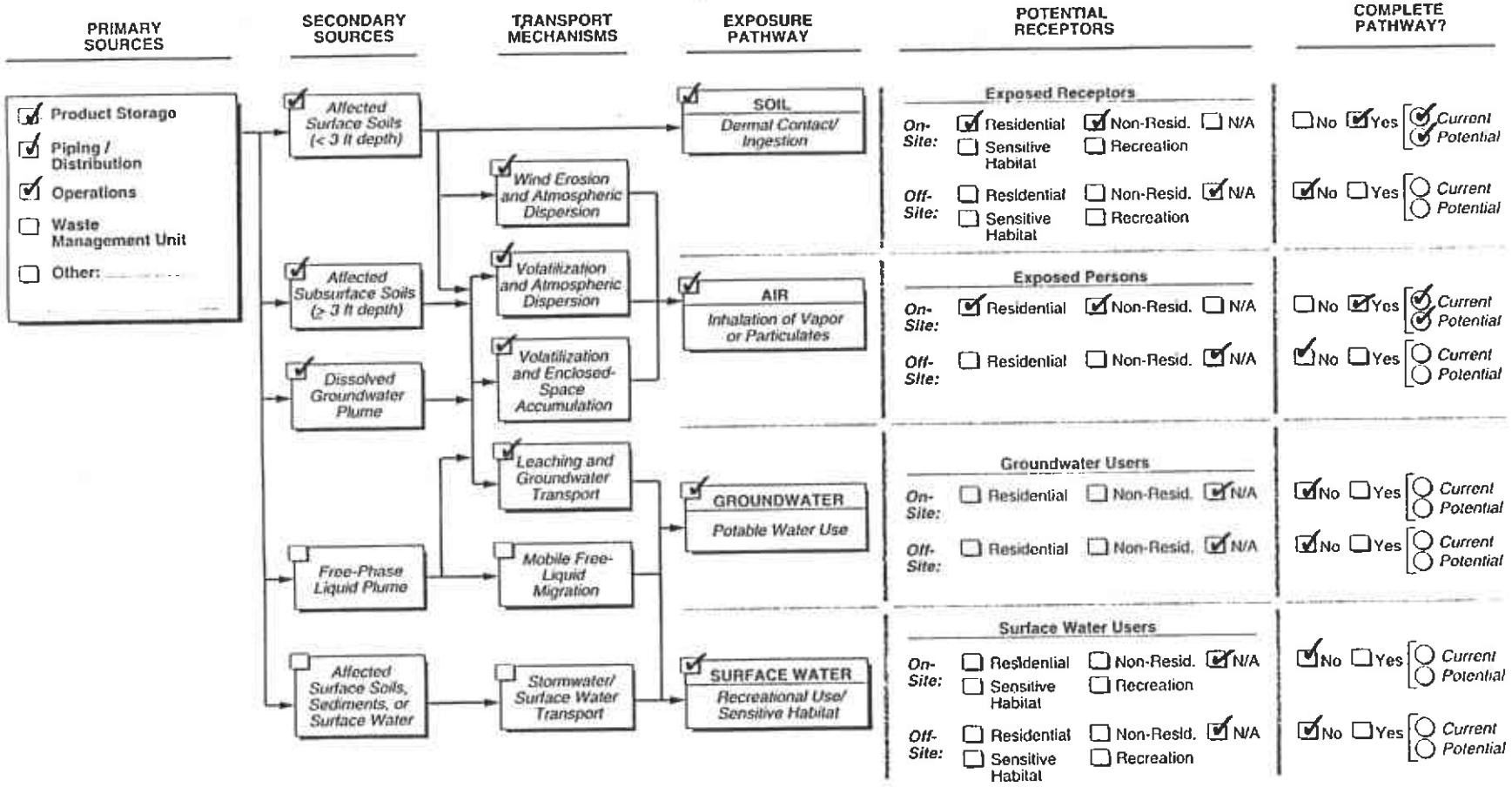
Base map source: Applied Geotechnology Inc., 7-93.

BASELINE

D:|Graphics\98383-05\svsl.vcd 5/3/99

CONCEPTUAL SITE MODEL

Figure 5



670 98th Avenue
Oakland, California

93343-F1

TABLE 1

SUMMARY OF ANALYTICAL RESULTS, GROUNDWATER
PETROLEUM AND AROMATIC HYDROCARBONS
670 98th Avenue, Oakland, California
(mg/L)

Sample ID	Date	Gasoline[1]	Diesel[1]	Kerosene[1]	Motor Oil[1]	Total Oil & Grease[1]	Benzene[2]	Toluene[2]	Ethyl-benzene[2]	Xylenes[2]	Total Lead
MW-1	2/12/90	**0.0551**	**0.100**	--	--	ND	**0.0608**	**0.0119**	ND	**0.0199**	--
	6/30/90	**0.95**/<0.05	<0.5	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	10/4/90	**2,940**	<0.2	--	--	--	**7.78**	**26.7**	**20**	**20.3**	--
	4/15/93	--	--	--	--	--	--	--	--	--	--
	3/31/95	**5.9**	--[3]	**2.3**[4]	--	--	**0.067**	**0.012**	**0.092**	**0.5**	**0.014**
	12/31/96	**14**	**10**[5,6]	--	--	--	**0.13**	<0.025	**0.47**	**2.0**	--
	9/22/97	**2**/	<0.051/	<0.051/	<0.51/	--	**0.035**/	<0.0025/	**0.14**/	**0.56**/	--
		<0.05	<0.054	<0.054	<0.54		<0.0005	<0.0005	<0.0005	<0.0005	
MW-2	2/13/90	**0.0351**	**0.100**	--	--	ND	ND	ND	**0.0013**	**0.004**	--
	6/30/90	<0.5/<0.05	<0.5	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	10/4/90	**0.0528**	<0.2	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	4/15/93	<1.0	<1.0	--	--	--	<0.001	<0.001	<0.001	<0.001	--
	3/31/95	<0.05	<0.05	<0.05	--	--	<0.0005	<0.0005	<0.0005	<0.0005	**0.0042**
	12/31/96	<0.05	**0.2**[5,7]	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	9/22/97	<0.05	<0.051	<0.051	<0.51	--	<0.0005	<0.0005	<0.0005	<0.0005	--
MW-3	2/13/90	ND	**0.100**	--	--	ND	ND	ND	ND	**0.0029**	--
	6/30/90	**2.6/0.85**	<0.5	--	--	--	<0.0005	<0.0005	<0.0005	**0.044**	--
	10/4/90	**0.0429**	<0.2	--	--	--	<0.0005	<0.0005	<0.0005	**0.0085**	--
	4/15/93	<1.0	<1.0	--	--	--	<0.001	<0.001	<0.001	<0.001	--
	3/31/95	**1.6**	--[1]	0.5[4]	--	--	<0.0005	<0.0005	<0.0005	**0.0041**	<0.003
	12/31/96	**0.38**	**0.62**[5,6,8]	--	--	--	<0.0005	<0.0005	<0.0005	**0.00065**	--
	9/22/97	**0.061**	<0.051	<0.051	<0.51	--	<0.0005	<0.0005	<0.0005	<0.0005	--
MW-4	2/13/90	ND	ND	--	--	ND	ND	ND	ND	ND	--
	6/30/90	<0.5/<0.05	<0.5	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	10/4/90	<0.020	<0.2	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	5/24/93	<1.0	<1.0	--	--	--	<0.001	<0.001	<0.001	<0.001	--
	12/31/96	**0.79**	<0.05	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	9/22/97	<0.05	<0.05	<0.05	<0.5	--	<0.0005	<0.0005	<0.0005	<0.0005	--
MW-5	2/13/90	ND	ND	--	--	ND	ND	ND	ND	ND	--
	6/30/90	<0.5/<0.05	<0.5	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	10/4/90	<0.020	<0.2	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	12/31/96	<0.05	<0.05	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--
	9/22/97	<0.05	<0.051	<0.051	<0.51	--	<0.0005	<0.0005	<0.0005	<0.0005	--

Table 1 - *continued*

Sample ID	Date	Gasoline[1]	Diesel[1]	Kerosene[1]	Motor Oil[1]	Total Oil & Grease[1]	Benzene[2]	Toluene[2]	Ethyl-benzene[2]	Xylenes[2]	Total Lead
Well 18	2/14/90	**134**	**17**	--		**120**	**3.73**	**8.92**	**5.43**	**22**	--
	6/30/90	**26/20**	**2.4**	--		--	**0.66**	**0.47**	**0.18**	**2.0**	--
	10/4/90	**4.9**	<0.2	--		--	**0.082**	**0.04**	**0.19**	**0.635**	--
	4/15/93	**7**	**10[4]**	--		--	**0.440**	**0.180**	**0.340**	**1.6**	--
	3/31/95	**11**	--[3]	**1.9[4]**		--	**0.19**	**0.01**	**0.35**	**1.3**	**0.016**
	12/31/96	**18**	<0.05	--		--	**0.110[9]**	**0.0023[9]**	**0.10[9]**	**0.23[9]**	--
	9/22/97	**0.19**	<0.051	<0.051	<0.51	--	**0.0085**	<0.0005	**0.0048**	**0.0074**	--
WP1-W	9/23/97	<0.05	<0.05	<0.05	<0.5	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP2-W	9/22/97	<0.05	<0.053	<0.053	<0.53	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP3-W	9/22/97	<0.05	<0.051	<0.051	<0.51	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP5-W	9/22/97	**0.076**	<0.054	<0.054	<0.54	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP6-W	9/22/97	<0.05	<0.054	<0.054	<0.54	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP7-W	9/24/97	**0.41**	<0.051	<0.051	<0.51	--	**0.013**	**0.058**	**0.013**	**0.081**	--
WP8-W	9/24/97	**8.6**	<0.051	<0.051	<0.51	--	**3.6**	**0.0014**	**0.016**	**0.0018**	--
WP9-W	9/23/97	<0.05	**0.14[10]**	<0.05	<0.5	--	<0.0005	<0.0005	<0.0005	**0.001**	--
WP10-W	9/23/97	<0.05	<0.05	<0.05	<0.5	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP11-W	9/23/97	<0.05	<0.053	<0.053	<0.53	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP12-W	9/23/97	**0.98**	<0.051	<0.051	<0.51	--	**0.097**	**0.11**	**0.11**	**0.32**	--
WP13-W	9/24/97	<0.05	<0.051	<0.051	<0.51	--	<0.0005	<0.0005	<0.0005	<0.0005	--
WP14-W	9/23/97	<0.05	<0.056	<0.056	<0.56	--	<0.0005	<0.0005	<0.0005	<0.0005	--
Trip Blank	3/31/95	<0.05	--	--		--	<0.0005	<0.0005	<0.0005	<0.0005	--
	9/22/97	<0.05	--	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--

Notes:
-- = Constituent not analyzed or data not available.
<x.x = Constituent not detected at stated reporting limit.
ND = Constituent not detected; reporting limit unknown.
xx/xx = Duplicate sample.
xx = Bolded numbers indicate compounds identified above the level of detection.
1990 groundwater samples collected by Subsurface Consultants.
Monitoring well locations are shown on Figure 2.

1 EPA Test Method 8015 M.
2 EPA Test Method 8020/602.
3 Diesel range not reported by laboratory due to overlap of hydrocarbon ranges.
4 Laboratory reports that sample chromatogram does not resemble hydrocarbon standards.
5 Laboratory reports that hydrocarbon reported does not resemble diesel standard.
6 Laboratory estimated concentration due to overlapping fuel patterns.
7 Laboratory reports hydrocarbon is in late diesel range.
8 Laboratory reports hydrocarbon is in early diesel range.
9 Surrogate recovery was outside laboratory QA/QC limits due to sample interference.
10 Laboratory reports that compound is in the diesel range but its chromatogram does not have a pattern characteristic of petroleum hydrocarbons.

TABLE 2

SUMMARY OF ANALYTICAL RESULTS, GROUNDWATER

CHLORINATED HYDROCARBONS

670 98th Avenue, Oakland, California

(mg/L)

Sample ID	Date	1,1 Dichloro-ethene[1]	1,1 Dichloro-ethane[1]	Total 1,2 dichloro-ethene[1]	1,1,1 Trichloro-ethane[1]	Trichloro-ethene[1]	Dibromo-chloro-methane[1]	Tetrachloro-ethene[1]	Chloroform[1]	Total Chlorinated Hydrocarbons
MW-1	2/12/90	ND	ND	ND	**0.0051**	**0.0118**	**0.009**	**0.0024**	ND	
	6/30/90	<0.001	**0.0041**	<0.001	**0.008**	**0.013**	<0.001	**0.0028**	<0.001	
	10/4/90	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
	3/31/95	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	
	12/31/96	<0.0005	**0.0015**	**0.001**	<0.0005	**0.0009**	<0.0005	<0.0005	<0.002	**0.0034**
	9/22/97	<0.0005/ <0.0005	**0.0015/** <0.0005	**0.0011/** <0.0005	**0.0019/ 0.001**	**0.0056/** <0.0005	<0.0005/ <0.0005	**0.0018/ 0.0091**	<0.003/ <0.003	**0.0119/ 0.0101**
MW-2	2/13/90	**0.0071**	**0.0049**	ND	**0.0116**	**0.0251**	**0.0079**	**0.0085**	ND	
	6/30/90	**0.0031**	**0.0051**	**0.0048**	**0.015**	**0.035**	<0.001	**0.016**	<0.001	
	10/4/90	<0.0005	**0.0024**	<0.0005	**0.0063**	**0.0187**	<0.0005	**0.0068**	<0.0005	
	4/15/93	<0.001	<0.001	<0.001	<0.001	**0.014**	<0.001	<0.001	<0.001	
	3/31/95	**0.0017**	**0.0011**	**0.0014**	**0.0051**	**0.046**	<0.001	**0.022**	<0.001	
	12/31/96	<0.0005	**0.0006**	<0.0005	**0.0006**	**0.0076**	<0.0005	**0.0035**	<0.002	**0.0123**
	9/22/97	<0.0005	<0.0005	<0.0005	**0.0017**	**0.012**	<0.0005	**0.0063**	<0.003	**0.02**
MW-3	2/13/90	**0.0057**	ND	ND	**0.0171**	**0.0217**	**0.0692**	**0.0016**	ND	
	6/30/90	**0.0013**	**0.0021**	**0.0035**	**0.021**	**0.026**	<0.001	**0.0062**	<0.001	
	10/4/90	<0.0005	<0.0005	<0.0005	**0.011**	**0.0245**	<0.0005	**0.0051**	<0.0005	
	4/15/93	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	3/31/95	**0.0022**	<0.001	<0.001	**0.018**	**0.018**	<0.002	**0.0041**	<0.001	
	12/31/96	<0.0005	<0.0005	<0.0005	**0.005**	**0.0088**	<0.0005	**0.0015**	<0.002	**0.0153**
	9/22/97	<0.0005	<0.0005	<0.0005	**0.0055**	**0.012**	<0.0005	**0.0028**	<0.003	**0.0203**
MW-4	2/13/90	ND	ND	ND	**0.0018**	**0.0024**	**0.0153**	**0.0674**	ND	
	6/30/90	<0.001	<0.001	<0.001	**0.0027**	**0.003**	<0.001	**0.26**	<0.001	
	10/4/90	<0.0005	<0.0005	<0.0005	**0.0011**	**0.0028**	<0.0005	**0.0955**	**0.0007**	
	5/24/93[2]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	12/31/96	<0.0005	<0.0005	<0.0005	**0.0017**	**0.0007**	<0.0005	**0.31**[3]	<0.002	**0.3124**
	9/22/97	<0.0005	<0.0005	<0.0005	**0.0021**	**0.0006**	<0.0005	**0.047**[3]	<0.003	**0.0497**
MW-5	2/13/90	ND	ND	ND	**0.0013**	**0.001**	ND	**0.0014**	ND	
	6/30/90	<0.001	<0.001	<0.001	**0.0013**	<0.001	<0.001	**0.0021**	<0.001	
	10/4/90	<0.0005	<0.0005	<0.0005	**0.0005**	<0.0005	<0.0005	**0.0007**	<0.0005	
	12/31/96	<0.0005	<0.0005	<0.0005	**0.0005**	<0.0005	<0.0005	**0.003**	<0.002	**0.0035**
	9/22/97	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	**0.0019**	<0.003	**0.0019**

Table 2 - *continued*

Sample ID	Date	1,1 Dichloro-ethene[1]	1,1 Dichloro-ethane[1]	Total 1,2 dichloro-ethene[1]	1,1,1 Trichloro-ethane[1]	Trichloro-ethene[1]	Dibromo-chloro-methane[1]	Tetrachloro-ethene[1]	Chloroform[1]	Total Chlorinated Hydrocarbons
Well 18	2/14/90	ND	ND	ND	ND	ND	ND	ND	ND	
	6/30/90	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
	10/4/90	<0.005	<0.005	<0.0005	**0.009**	**0.091**	<0.005	**0.006**	<0.0005	
	4/15/93	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	3/31/95	<0.01	<0.01	<0.01	<0.01	**0.029**	<0.01	**0.01**	<0.01	
	12/31/96	<0.0005	<0.0005	<0.0005	**0.0021**	**0.011**	<0.0005	**0.0056**	<0.002	**0.0187**
	9/22/97	**0.0007**	<0.0005	<0.0005	**0.0048**	**0.018**	<0.0005	**0.011**	<0.003	**0.0345**
WP1-W	9/23/97	<0.0005	<0.0005	<0.0005	**0.001**	<0.0005	<0.0005	**0.0081**	<0.003	**0.0091**
WP2-W	9/22/97	**0.001**	<0.0005	<0.0005	**0.0053**	**0.029**[3]	<0.0005	**0.011**	<0.003	**0.0463**
WP3-W	9/22/97	<0.0005	<0.0005	**0.0026**	**0.0043**	**0.0066**	<0.0005	**0.029**[3]	<0.003	**0.0425**
WP5-W	9/22/97	<0.0005	<0.0005	**0.0019**	<0.0005	**0.01**	<0.0005	**0.015**	<0.003	**0.0269**
WP6-W	9/22/97	<0.0005	<0.0005	**0.0031**	**0.0008**	**0.012**	<0.0005	**0.012**	<0.003	**0.0279**
WP7-W	9/24/97	<0.0005	**0.0007**	**0.0037**	<0.0005	**0.0033**	<0.0005	**0.0032**	<0.003	**0.0109**
WP8-W	9/24/97	<0.0005	**0.0014**	**0.0022**	<0.0005	<0.0005	<0.0005	<0.0005	<0.003	**0.0036**
WP9-W	9/23/97	<0.0005	**0.0007**	<0.0005	**0.0012**	**0.004**	<0.0005	<0.0005	<0.003	**0.0059**
WP10-W	9/23/97	<0.0005	<0.0005	<0.0005	**0.0033**	**0.0077**	<0.0005	**0.0025**	<0.003	**0.0135**
WP11-W	9/23/97	**0.0017**	<0.0005	<0.0005	**0.012**	**0.02**	<0.0005	**0.0039**	<0.003	**0.0376**
WP12-W	9/23/97	**0.005**	**0.001**	<0.0005	**0.02**[3]	**0.015**[3]	<0.0005	**0.0021**	<0.003	**0.0431**
WP13-W	9/24/97	<0.0005	<0.0005	<0.0005	**0.0026**	**0.0071**	<0.0005	**0.0017**	<0.003	**0.0114**
WP14-W	9/23/97	**0.0012**	**0.0013**	<0.0005	**0.0094**	**0.018**	<0.0005	**0.0026**	<0.003	**0.0325**
Trip Blank	3/31/95	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.0345**
	9/22/97[4]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	**0.0079**	**0.0079**

Notes:
-- = Constituent not analyzed or data not available.
xx = Bolded numbers indicate compounds identified above the level of detection.
<x.x = Constituent not detected at stated reporting limit.
xx/xx = Duplicate sample.
1990 groundwater samples collected by Subsurface Consultants.
ND = Constituent not detected; reporting limit unknown.
Monitoring well locations are shown on Figure 2.

[1] EPA Test Method 8010/601 except where noted.
[2] Surrogate recovery was outside of QA/QC limits due to matrix interference.
[3] Value taken from EPA Test Method 8240.
[4] Laboratory reported that trichlorofluoromethane (0.0008 mg/L) was detected above laboratory reporting limits.

TABLE 4

GROUNDWATER ELEVATIONS, FLOW DIRECTIONS AND GRADIENT MAGNITUDES

670 98th Avenue, Oakland, California

Date	MW-1[1]		MW-2[2]		MW-3[3]		MW-4[4]		MW-5[5]		Well 18[6]		Groundwater Flow Direction	Gradient Magnitude
	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)	Depth to Groundwater (feet from TOC)	Groundwater Elevation (feet)		
3/1/90[7]	8.95	7.24	8.85	7.67	9.17	7.39	9.98	7.73	9.61	--	8.53	7.44	--[8]	--[8]
3/6/90[7]	8.55	7.64	8.46	8.06	8.78	7.78	9.60	8.11	9.23	--	8.11	7.86	--[8]	--[8]
3/23/90[7]	9.17	7.02	9.02	7.50	9.35	7.21	10.20	7.51	9.80	--	8.73	7.24	--[8]	--[8]
6/30/90[7]	9.56	6.63	9.40	7.12	9.74	6.82	10.57	7.14	10.17	--	9.11	6.86	--[8]	--[8]
10/4/90[7]	10.23	5.96	9.80	6.72	10.17	6.39	10.98	6.73	10.59	--	9.50	6.47	--[8]	--[8]
4/15/93[9]	8.47	7.73[10]	8.31	8.21	8.65	7.91	--[11]	--	--[11]	--	8.06	7.91	--[8]	--[8]
5/24/93[9]	8.93	7.28[10]	8.73	7.79	9.10	7.46	9.88	7.83	--[11]	--	8.49	7.48	--[8]	--[8]
6/24/93[9]	8.86	7.33[10]	8.63	7.89	9.02	7.54	9.78	7.93	--[11]	--	8.40	7.57	--[8]	--[8]
3/31/95	7.47	8.75	7.35	9.17	7.67	8.89	--[11]	--	--[11]	--	7.09[12]	8.88	N55W	0.002
12/31/96	6.41	9.77	6.37	10.13	6.62	9.92	8.15	10.25	7.18	10.17	6.01	9.94	N55W	0.002
9/22/97	8.86	7.32	8.69	7.81	9.08	7.46	10.59	7.81	9.48	7.87	8.45	7.50	N68W	0.002

Notes: TOC = Top of well casing.
-- = Data not available.

1 Elevation of top of casing = 16.19 feet above City of Oakland datum (SCI), 16.18 feet (revised 12 July 1996, Bates & Bailey).

2 Elevation of top of casing = 16.52 feet above City of Oakland datum (SCI), 16.50 feet (revised 12 July 1996, Bates & Bailey).

3 Elevation of top of casing = 16.56 feet above City of Oakland datum (SCI), 16.54 feet (revised 12 July 1996, Bates & Bailey).

4 Elevation of top of casing = 17.71 feet above City of Oakland datum (SCI), 18.40 feet (revised 12 July 1996, Bates & Bailey).

5 Monitoring well not accessible during elevation survey (SCI), elevation of top of casing = 17.35 feet above City of Oakland datum (revised 12 July 1996, Bates & Bailey).

6 Elevation of top of casing = 15.97 feet above City of Oakland datum (SCI),15.95 feet (revised, determined by calculating from revised TOC for MW-1 through MW-5).

7 Groundwater data collected by Subsurface Consultants, Inc. (SCI).

8 Groundwater flow direction and gradient magnitude not reported.

9 Groundwater data collected by Applied Geotechnology, Inc. (AGI).

10 Free product detected. Reported groundwater elevation adjusted by AGI for presence of free product.

11 Monitoring wells were inaccessible.

12 Slight petroleum odor and sheen.

TABLE 3
SUMMARY OF ANALYTICAL RESULTS, SOIL
PETROLEUM AND AROMATIC HYDROCARBONS
670 98th Avenue, Oakland, California
(mg/kg)

Sample ID	Date	Depth (feet)	TPH as Gasoline	TPH as Diesel	Total Oil & Grease	Benzene	Toluene	Ethyl-benzene	Xylenes
Soil Borings									
1	5/25/89	7[1,2]	<10	<10	60	--	--	--	--
		10	1,100	--	--	8.1	2.6	31	120
		13.5	<10	--	--	0.025	0.015	0.052	0.23
2	5/25/89	5	280	--	--	3.1	17	12	72
		9	1,100	--	--	16	31	39	130
		11	13,000	--	--	--	--	--	--
3	5/25/89	4	20	--	--	0.39	0.90	0.33	1.7
		7	<10	--	--	--	--	--	--
		10	260	--	--	1.7	6.2	3.1	26
4	5/25/89	3	14	--	--	0.83	1.1	0.71	3.6
		9	150	--	--	4.7	5.9	6.8	49
5	5/25/89	7	130	--	--	4.7	17	13	58
		10	930	--	--	11	32	20	90
		12	2,600	--	--	--	--	--	--
6	5/25/89	6	<10	--	--	<0.005	<0.005	<0.005	<0.015
		9	45	--	<50	1.1	1.2	2.2	16
7	5/26/89	3[1]	45	--	--	3.7	6.0	2.6	14
		9[1]	200	--	--	5.2	8.3	2.9	16
8	5/26/89	7	<10	--	--	<0.010	0.018	<0.010	<0.020
		9	120	--	--	1.5	0.27	4.7	--
9	5/26/89	8	<10	--	--	0.017	<0.010	<0.010	<0.020
		11	--	--	--	--	--	--	--
10	5/26/89	2	<10	--	--	<0.010	0.048	0.012	0.047
		8	<10	--	--	<0.010	0.12	<0.010	<0.020
11	5/26/89	3	16	--	--	0.94	1.9	0.48	2.5
		8	150	--	--	3.3	6.3	3.4	15
12	5/26/89	4	<10	--	--	<0.010	0.046	<0.010	<0.020
		8	440	<10	--	--	--	--	--
		10	310	--	--	1.5	2.2	2.9	13
13	5/26/89	8[1,2]	9,600	67	<50	23	270	190	1,000
		11[1]	25,000	--	--	--	--	--	--
		13	28	--	--	--	--	--	--
14	5/26/89	12.5[1]	730	--	--	--	--	--	--
15	2/9/90	6	ND	--	--	ND	0.003	0.004	0.006
		9.5	0.737	16	--	0.75	8.32	9.25	49.0
		10.5	56.6	1,540	--	39.1	260	96.2	519
16	2/9/90	4	ND	--	--	ND	0.079	ND	0.005
		7	0.641	62	--	0.4	2.13	1.43	8.06
		11.5	10.2	5,650	--	13.1	81.9	25.3	146

Table 3 - *continued*

Sample ID	Date	Depth (feet)	TPH as Gasoline	TPH as Diesel	Total Oil & Grease	Benzene	Toluene	Ethyl-benzene	Xylenes
17	2/9/90	8	ND	--	--	ND	0.007	ND	ND
		10	ND	ND	--	ND	0.037	0.108	0.444
		11.5	ND	--	--	ND	0.007	0.038	0.135
19	2/9/90	10	ND	--	--	ND	0.007	ND	ND
20	2/9/90	9	ND	--	--	ND	0.007	0.003	0.011
21	2/9/90	7.5	ND	--	--	ND	0.005	0.007	0.016
		9.5	ND	16	ND	ND	0.072	0.280	0.970
		11.5	754	20	--	ND	0.860	0.73	2.73
		13	ND	--	--	ND	0.017	0.024	0.07
Monitoring Wells									
MW-1	2/7/90	8	ND	--	--	0.329	0.007	0.070	0.130
		10.5	ND	732	--	1.690	12.8	9.47	48.3
		12	ND	--	--	0.072	0.004	0.006	0.002
MW-2	2/7/90	6	ND	--	--	ND	ND	ND	ND
		9[2]	ND	293	278	ND	0.355	0.81	3.98
		12	ND	--	--	ND	ND	0.74	3.74
MW-3	2/8/90	6	ND	--	--	ND	ND	ND	ND
		9	14.4	352	840	ND	ND	1.99	10.2
MW-4	2/8/90	4.5	ND	--	--	ND	ND	ND	ND
		10.5	ND	ND	ND	ND	ND	ND	ND
		13.5	ND	--	--	ND	ND	ND	ND
MW-5	2/9/90	9	ND	ND	--	ND	ND	ND	ND
		11	ND	--	--	ND	0.003	ND	ND
18	2/9/90	8	ND	--	--	ND	0.008	0.003	0.012
		9.5	0.766	138	ND	0.333	1.39	2.63	11.5
		11.5	0.703	--	--	0.122	0.236	0.552	1.53
Excavation Sidewall Samples[3]									
SW-1	10/90	9	ND	--	--	--	--	--	--
SW-2	10/90	12	81	--	--	--	--	--	--
SW-3	10/90	10	430	--	--	--	--	--	--
SW-4	10/90	9	210	--	--	--	--	--	--
NW-1	10/90	9	ND	--	--	--	--	--	--
NW-2	10/90	10	260	--	--	--	--	--	--
NW-3	10/90	9	420	--	--	--	--	--	--
NW-4	10/90	9	50	--	--	--	--	--	--
NW-5	10/90	9	83	--	--	--	--	--	--
WW-1[1]	10/90	9	2,000	--	--	--	--	--	--
WW-2	10/90	9	140	--	--	--	--	--	--

Table 3 - *continued*

Sample ID	Date	Depth (feet)	TPH as Gasoline	TPH as Diesel	Total Oil & Grease	Benzene	Toluene	Ethyl-benzene	Xylenes
Excavation Base Samples[3]									
B-1	10/90	10	**790**	--	--	--	--	--	--
B-2	10/90	13.5	**1,700**	--	--	--	--	--	--
B-3	10/90	10	**1,400**	--	--	--	--	--	--
B-4	10/90	10.5	**2,100**	--	--	--	--	--	--

Notes
-- = Constituent not analyzed or data not available.
<x.x = Constituent not detected at stated reporting limit.
ND = Constituent not detected, reporting limit unknown.
xx = Bolded numbers indicate compounds identified above the level of detection 1989 and 1990 soil samples collected by Subsurface Consultants, Inc. Monitoring well and soil boring locations are shown on Figure 2.

1 Soil excavated from sample location.
2 Sample also analyzed for purgeable halocarbons (Method 8010); no compounds detected.
3 Collection date of excavation sidewall samples not reported.

TABLE 5
SUMMARY OF ANALYTICAL RESULTS, SOIL VAPOR
670 98th Avenue, Oakland, California
March 1999

Chemical	Soil Vapor Results[2]							
	SG-1		SG-2		SG-3		SG-4	
	ppbv	$\mu g/m^3$	ppbv	$\mu g/m^3$	ppbv	$\mu g/m^3$	ppbv	$\mu g/m^3$
Freon 12	<0.71	<3.5	**0.71**[1]	**3.6**[1]	<0.67	<3.4	<0.70	<3.5
Chloromethane	**1.7**[1]	**3.6**[1]	**1.8**[1]	**3.7**[1]	**1.6**[1]	**3.3**[1]	**4.0**	**8.4**
Freon 11	**1.9**[1]	**11**[1]	<0.68	<3.9	<0.67	<3.8	<0.70	<4.0
Methylene chloride	**1.0**[1]	**3.6**[1]	**0.95**[1]	**3.3**[1]	**0.72**[1]	**2.6**[1]	**1.3**[1]	**4.7**[1]
Benzene	**1.7**[1]	**5.5**[1]	**1.1**[1]	**3.6**[1]	**1.2**[1]	**4.1**[1]	**0.96**[1]	**3.1**[1]
Ethylbenzene	**0.83**[1]	**3.6**[1]	**1.3**[1]	**5.7**[1]	**1.4**[1]	**6.1**[1]	**1.6**[1]	**6.9**[1]
m,p-xylene	**3.0**	**13**	**5.3**	**23**	**5.0**	**22**	**6.1**	**27**
o-xylene	**1.3**[1]	**5.8**[1]	**2.1**[1]	**9.2**[1]	**1.9**[1]	**8.4**[1]	**2.3**[1]	**10**[1]
Styrene	<0.71	<3.1	**0.78**[1]	**3.4**[1]	<0.67	<2.9	**0.85**[1]	**3.7**[1]
1,3,5-trimethylbenzene	<0.71	<3.5	**0.71**[1]	3.6[1]	<0.67	<3.3	**0.92**[1]	**4.6**[1]
1,2,4-trimethylbenzene	**1.2**[1]	**6.1**[1]	**2.6**[1]	**13**[1]	**2.0**[1]	**10**[1]	**3.4**	**17**
1,3-dichlorobenzene	**0.91**[1]	**5.6**[1]	**2.2**[1]	**13**[1]	**1.8**[1]	**11**[1]	**3.4**	**21**
Acetone	**16**	**38**	**17**	**40**	**21**	**50**	**14**	**34**
2-propanol	<2.8	<7.0	**2.8**[1]	**7.1**[1]	**3.8**[1]	**9.5**[1]	**3.2**[1]	**8.0**[1]
2-butanone (methyl ethyl ketone)	**3.7**[1]	**11**[1]	**3.8**[1]	**11**[1]	**2.9**[1]	**8.8**[1]	<2.8	<8.3
4-ethyltoluene	<2.8	<14	<2.7	<14	<2.7	<13	**2.8**[1]	**14**[1]
Ethanol	**36**	**70**	**56**	**110**	**57**	**110**	**72**	**140**
Toluene	**4.1**	**16**	**4.8**	**18**	**4.9**	**19**	**5.0**	**19**

Notes: All samples were collected 10 March 1999 at 2.5 to 3.0 feet below ground surface with a 6-liter summa canister.
ppbv = parts per billion vapor
$\mu g/m^3$ = micrograms per cubic meter
Conversions: ppbv = $\mu g/m^3$ x 24.45/molecular weight (MW)
<x.x = Constituent not detected at stated reporting limit.
Bolded number indicate compounds identified above the detection limit.
All other chemicals were identified below their respective laboratory reporting limits or did not have concentrations. These chemicals included Freon 114, vinyl chloride, bromomethane, chloroethane, 1,1-dichloroethene, Freon 113, 1,1-dichloroethane, cis-1,2-dichloroethene, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, 1,2-dichloroethane, trichloroethene, 1,2-dichloropropane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 1,1,2-trichloroethane, tetrachloroethene, ethylene dibromide, chlorobenzene, 1,1,2,2-tetrachloroethane, 1,4-dichlorobenzene, chlorotoluene, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobutadiene, propylene, 1,3-butadiene, carbon disulfide, trans-1,2-dichloroethene, vinyl acetate, hexane tetrahydrofuran, cyclohexane, 1,4-dioxane, bromodichloromethane, 4-methyl-2-pentanone, 2-hexanone, dibromochloromethane, bromoform, methyl tert-butyl ether, and heptane. Detection limits ranged from 0.67 to 2.8 ppbv and 1.7 to 30 $\mu g/m^3$.
See Appendix B for laboratory report.
Soil vapor sampling locations are shown in Figure 4.

[1] Estimated value by laboratory.
[2] All samples analyzed by EPA method TO-14 GC/MS Full Scan.

TABLE 6
SUMMARY OF ANALYTICAL RESULTS, SOIL CHARACTERISTICS
670 98th Avenue, Oakland, California
March 1999

					Mean[1]
Sample ID	SG-1	SG-2	SG-3	SG-4	NA
Depth (feet bgs)	2.0-2.5	2.0-2.5	2.0-2.5	2.0-2.5	NA
Porosity (%)	36.6	40.6	39.5	42.1	39.7
Moisture (%)	20.7	24.0	21.0	24.5	22.5
Dry density (pcf)	106.9	99.3	102.3	96.5	101.2
Dry density (g/cm^3)	1.71	1.59	1.64	1.55	1.62
Air % (by calculation)[2]	15.9	16.6	18.5	17.6	17.2
Percent organics[3]	4.0	4.4	3.2	4.2	4.0

Notes: Analyses conducted by Cooper Testing Labs, Mountain View, California.
All samples were collected 10 March 1999 2.0 to 2.5 feet bgs
bgs = below ground surface
pcf = pounds per cubic foot
NA = Not applicable
Dry density (pcf) converted to dry density (g/cm^3) by the following conversion: 1 lb/ft^3 = 0.016018 g/cm^3
See Figure 4 for sampling location
See Appendix C for laboratory report.

[1] Used for risk analysis purposes.
[2] Air % = % porosity - % moisture = % air
[3] ASTM Method D2974

TABLE 7
SITE SPECIFIC TARGET LIMITS (SSTLS) FOR SURFACE SOIL AND SOIL VAPOR
670 98th Avenue, Oakland, California
March 1999

Source/Pathway/ Contaminant	SSTL-Child and Adult	SSTL-Child (1-16)	SSTL-Adult	Maximum Site Concentration	Does Maximum Site Concentration Exceed SSTL?
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Surface Soil/ Ingestion, Inhalation and Dermal Contact					
Benzene	2.0	NA	NA	0.94	No
Toluene	>RES	NA	NA	1.9	No
Ethylbenzene	>RES	NA	NA	0.71	No
Xylenes	>RES	NA	NA	3.6	No
	(ppbv)	(ppbv)	(ppbv)	(ppbv)	
Soil Vapors/ Inhalation of Indoor Air					
Benzene	NA	42.7	34.2	1.7	No
Toluene	NA	9.97E+4	1.5E+5	5	No
Ethylbenzene	NA	2.55E+5	3.83E+5	1.6	No
Xylenes	NA	1.86E+5	2.79E+5	8.4	No
Dichlorodifluoromethane (aka Freon 12)	NA	6.43E+4	9.65E+4	0.71	No
Methyl ethyl ketone (aka 2-butanone)	NA	3.34E+5	5.02E+5	3.8	No
Acetone	NA	8.06E+4	1.21E+5	21	No
1,3-dichlorobenzene	NA	1.4E+3	2.1E+3	3.4	No
Methylene chloride (aka dibromomethane)	NA	1.03E+3	8.24E+2	1.3	No
Trichlorofluoromethane (aka Freon 11)	NA	1.19E+5	1.78E+5	1.9	No
Chloromethane (aka methyl chloride)	NA	7.73E+2	6.18E+2	4	No
1,2,4-trimethylbenzene	NA	1.34E+3	2.01E+3	3.4	No
Styrene	NA	2.78E+5	4.17E+5	0.85	No
1,3,5-trimethylbenzene	NA	1.34E+3	2.01E+3	0.92	No

Table 7 - *continued*

Source/Pathway/ Contaminant	SSTL-Child and Adult	SSTL-Child (1-16)	SSTL-Adult	Maximum Site Concentration	Does Maximum Site Concentration Exceed SSTL?
	(ppbv)	(ppbv)	(ppbv)	(ppbv)	
Soil Vapors/Inhalation of Outdoor Air					
Benzene	NA	4.58E+4	3.66E+4	1.7	No
Toluene	NA	1.07E+8	1.6E+8	5	No
Ethylbenzene	NA	2.73E+8	4.1E+8	1.6	No
Xylenes	NA	1.99E+8	2.99E+8	8.4	No
Dichlorodifluoromethane (aka Freon 12)	NA	6.89E+7	1.03E+8	0.71	No
Methyl ethyl ketone (aka 2-butanone)	NA	3.58E+8	5.38E+8	3.8	No
Acetone	NA	8.64E+7	1.3E+8	21	No
1,3-dichlorobenzene	NA	1.5E+6	2.25E+6	3.4	No
Methylene chloride (aka dibromomethane)	NA	1.1E+6	8.83E+5	1.3	No
Trichlorofluoromethane (aka Freon 11)	NA	1.27E+8	1.91E+8	1.9	No
Chloromethane (aka methyl chloride)	NA	8.28E+5	6.62E+5	4	No
1,2,4-trimethylbenzene	NA	1.43E+6	2.15E+6	3.4	No
Styrene	NA	2.98E+8	4.47E+8	0.85	No
1,3,5-trimethylbenzene	NA	1.44E+6	2.15E+6	0.92	No

NOTES: >RES indicates risk-based target concentration greater than constituent residual saturation value.
NA = not applicable
The most conservative SSTL for constituents that cause both carcinogenic and non-carcinogenic health effects is included in this table.
See Appendix D for risk calculations.

TABLE 8
CUMULATIVE HUMAN HEALTH RISKS/HAZARDS
670 98th Avenue, Oakland, California
March 1999

Source/Pathway	Individual Excess Lifetime Cancer Risk	Hazard Index
Surface Soil/Ingestion and Dermal Contact[1]	4.2×10^{-7}	0.0034
Surface Soil/Inhalation[1]	6.3×10^{-8}	0.00092
Soil Vapor/Inhalation of Outdoor Air[2]	4.31×10^{-11}	0.00000716
Soil Vapor/Inhalation of Indoor Air[2]	4.62×10^{-8}	0.00767
Cumulative Risk/Hazard	5.29×10^{-7}	0.0012

Notes: See Appendix D for risk calculations.

[1] For adults and children
[2] For children only (1-16 years)

COOPER
TESTING LABORATORY

COOPER TESTING LABORATORY
1951 Colony Street, Unit X
Mountain View, California 94043
Tel: 650 968-9472 FAX: 650 968-4228
email: cooper@coopertestinglabs.com
Web Page: http://www.coopertestinglabs.com

LETTER OF TRANSMITTAL

TO: Baseline Environmental
101 H Street, #L
Petaluma, CA 94952
Attn: Bruce

DATE: March 24, 1999

PROJECT: 95357-19

CTL#: 351-002

ENCLOSED: Laboratory soil test data.

REMARKS:

David R. Cooper

COOPER TESTING LAB

CHAIN OF CUSTODY RECORD

BASELINE
5900 Hollis Street, Suite D
Emeryville, CA 94608
(510) 420-8686

FAX 707-762-5271

Bills to Eastshore

Turn-around Time
Lab Cooper
BASELINE Contact Person Kevin O'Dea

Project No.	Project Name and Location
95357-19	670 98th Ave Oakland CA

Samplers: (Signature) William K Scott

Sample ID No. Station	Date		Media	Depth	No. of Containers	Bulk Density w/ liner	Total Porosity SPG	Moisture Content	grain size w/ hydrometer	Total organic carbon Fraction	Remarks/ Composite	Detection Limits
SG-1 2.0-2.5	3-10-99		Soil	2.0-2.5	1	X	X	X	X	X		
SG-2 2.0-2.5	↓		↓	↓	1	X	X	X	X	X		
SG-3 2.0-2.5					1	X	X	X	X	X		
SG-4 2.0-2.5					1	X	X	X	X	X		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Conditions of Samples Upon Arrival at Laboratory:
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks:
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job #	351-002
Client	Baseline
Project/Location	95357-19
Date	3/15/99

Boring #	SG-1	SG-2	SG-3	SG-4	$\bar{X}$
Depth (ft)	2.0-2.5	2.0-2.5	2.0-2.5	2.0-2.5	
Soil Type	see sieve	see sieve	see sieve	see sieve	
Specific Gravity	2.70	2.68	2.71	2.67	2.69
Volume Total cc	49.831	49.731	77.303	67.379	
Volume of Solids	31.606	29.520	46.751	39.017	
Volume of Voids	18.225	20.211	30.552	28.362	
Void Ratio	0.577	0.685	0.654	0.727	
Porosity %	36.6%	40.6%	39.5%	42.1%	39.7
Saturation %	96.9%	93.9%	87.1%	90.0%	
Moisture %	20.7%	24.0%	21.0%	24.5%	22.55
Dry Density (pcf)	106.9	99.3	102.3	96.5	101.25

Remarks

The accuracy of the test results may be effected by the small diameter (1.5"+-). Diameter measurments varied quite a bit.

Specific Gravity
ASTM D-854

Cooper Testing Lab

Job#: 351-002a Client: Baseline Project: 95357-19			Date: 03/16/99 By: DC			
Boring: ' Sample: Depth, ft.:	SG-1 2.0-2.5	SG-2 2.0-2.5	SG-3 2.0-2.5	SG-4 2.-2.5		
Soil Classification: (visual)	see sieve					
Wt. of Pycnometer Soil & Water, gm:	343.56	298.3	332.33	700.5		
Temp. centigrade:	18	18	18	18		
Wt. of Pycnometer & Water, gm:	316.27	274.65	302.36	665.96		
Wt. Dry Soil, gm:	43.37	37.7	47.51	55.25		
Temp. Correction Factor:	1	1	1	1		
Specific Gravity:	2.70	2.68	2.71	2.67	ERR	ERR

Remarks: The temperature correction factor is shown as 1 if the weight of the pycnometer is taken from the lab temperature correction curve.

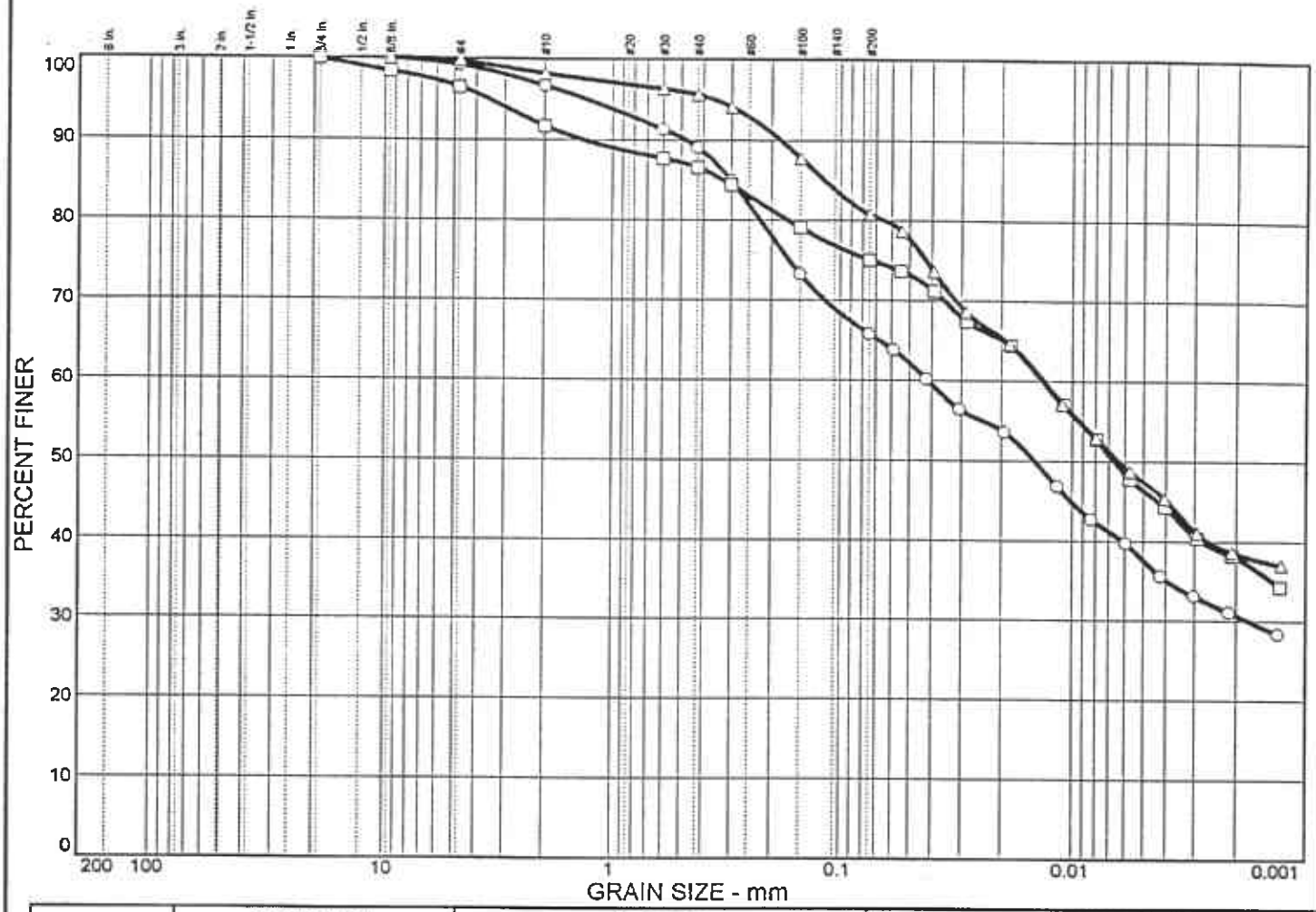
Organic Content
ASTM D2974

Cooper Testing Lab

JOB NO.: 351-002					
CLIENT: Baseline			DATE:	03/15/99	
PROJECT 95357.19			BY:	DC	
BORING:	SG-1	SG-2	SG-3	SG-4	
SAMPLE:					
DEPTH, ft.:	2.0-2.5	2.0-2.5	2.0-2.5	2.0-2.5	
SOIL CLASSIFICATION: (visual)	see sieve				
SOIL, ORGANICS & DISH, gm:	113.05	114.91	115.5	117.28	
SOIL & DISH, gm:	111.55	113.5	114.45	115.75	
DISH, gm:	75.57	82.76	83.14	80.93	
SOIL, gm:	35.98	30.74	31.31	34.82	0
SOIL & ORGANICS, gm:	37.48	32.15	32.36	36.35	0
% ORGANICS:	4.0	4.4	3.2	4.2	ERR

3.95

PARTICLE SIZE DISTRIBUTION CURVES



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.8	2.5	7.6	23.3	28.2	37.6
□	0.0	0.0	3.5	4.8	5.1	11.5	28.8	46.3
△	0.0	0.0	0.2	1.6	2.6	14.8	33.5	47.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.302	0.0417	0.0144	0.0018				
□			0.326	0.0132	0.0067					
△			0.118	0.0133	0.0064					

MATERIAL DESCRIPTION	USCS	AASHTO
○ black sandy CLAY		
□ black CLAY w/sand		
△ dark brown CLAY		

Project No. 351-002 **Client:** Baseline

Project: 95357-19

○ **Source:** SG-1 **Elev./Depth:** 2.0-2.5'

□ **Source:** SG-2 **Elev./Depth:** 2.0-2.5'

△ **Source:** SG-3 **Elev./Depth:** 2.0-2.5'

Remarks:

○

□

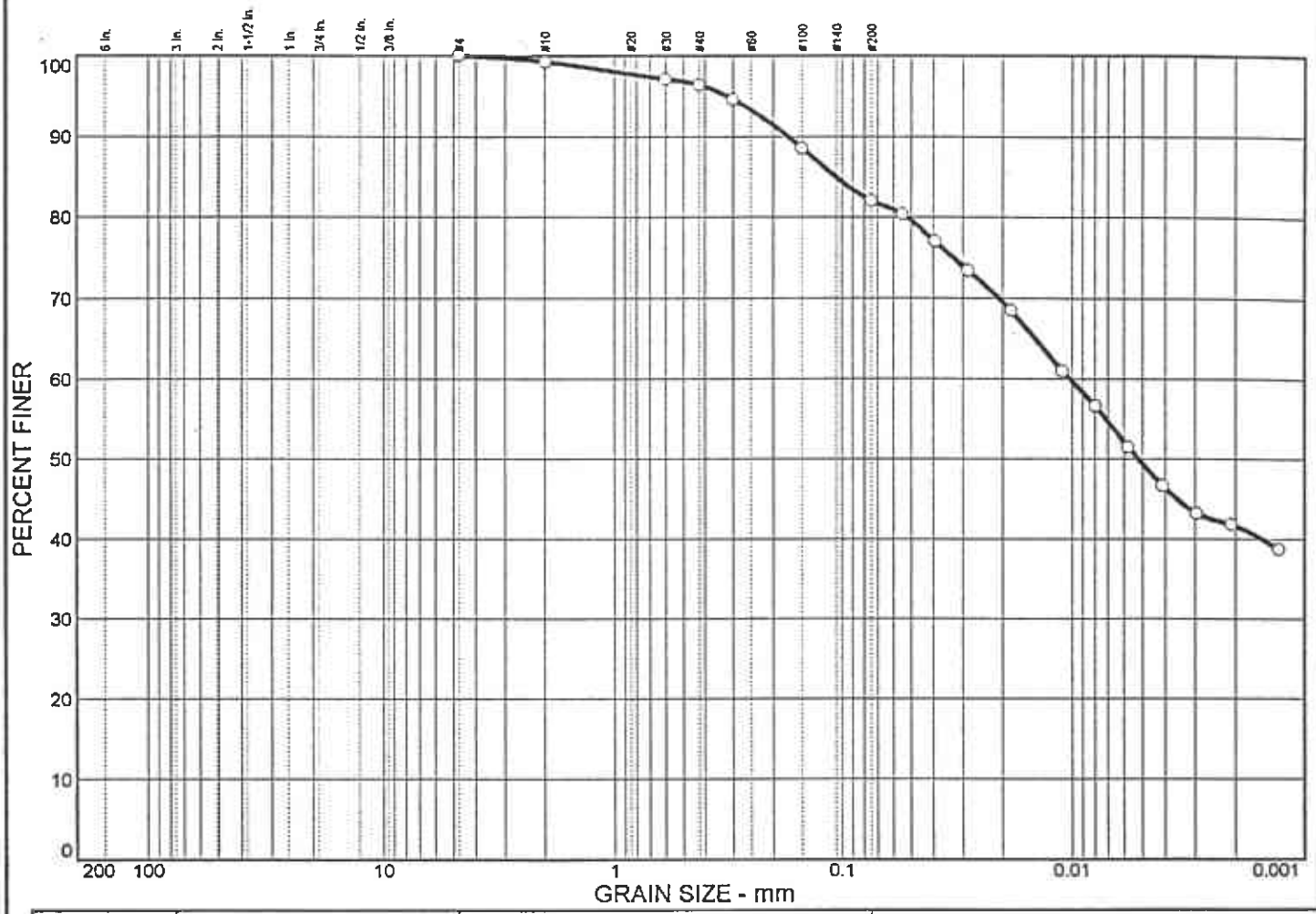
△

PARTICLE SIZE DISTRIBUTION CURVES

COOPER TESTING LABORATORY

Plate

PARTICLE SIZE DISTRIBUTION CURVES



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.7	2.9	14.3 17.1	32.7	49.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	.		0.107	0.0102	0.0052					

MATERIAL DESCRIPTION	USCS	AASHTO
○ black CLAY w/sand		

Project No. 351-002 **Client:** Baseline

Project: 95357-19

○ **Source:** SG-4

Remarks:

○

PARTICLE SIZE DISTRIBUTION CURVES

COOPER TESTING LABORATORY

Plate

GRAIN SIZE DISTRIBUTION TEST DATA

Client: Baseline
Project: 95357-19
Project Number: 351-002

Sample Data

Source: SG-1
Sample No.:
Elev. or Depth: 2.0-2.5'
Sample Length (in./cm.):
Location:
Description: black sandy CLAY
Liquid Limit:
Plastic Limit:
USCS Classification:
AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

	Initial
Dry sample and tare=	104.70
Tare =	0.00
Dry sample weight =	104.70

Sample split on number 10 sieve
Split sample data:
Sample and tare = 60.75 Tare = .00 Sample weight = 60.75
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3/8 inch	0.00	100.0
# 4	0.80	99.2
# 10	3.50	96.7
# 30	3.40	91.3
# 40	4.80	89.1
# 50	7.40	84.9
# 100	14.70	73.3
# 200	19.40	65.8

Hydrometer Analysis Data

Separation sieve is #10
Percent -#10 based upon complete sample= 96.7
Weight of hydrometer sample: 60.75
Hygroscopic moisture correction:
Moist weight & tare = 26.85
Dry weight & tare = 26.16
Tare = 11.90
Hygroscopic moisture= 4.8 %
Calculated biased weight= 59.92
Automatic temperature correction
Composite correction at 20 deg C = -4.9

Meniscus correction only=
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989
Hydrometer type: 152H
Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.50	18.0	44.0	38.6	0.0138	44.0	9.1	0.0587	63.8
1.00	18.0	41.8	36.4	0.0138	41.8	9.4	0.0424	60.2
2.00	18.0	39.5	34.1	0.0138	39.5	9.8	0.0305	56.4
5.00	18.5	37.7	32.4	0.0137	37.7	10.1	0.0195	53.6
15.00	19.0	33.5	28.4	0.0136	33.5	10.8	0.0116	46.8
30.00	19.0	31.0	25.9	0.0136	31.0	11.2	0.0083	42.7
60.00	19.0	29.2	24.1	0.0136	29.2	11.5	0.0060	39.7
120.00	20.0	26.5	21.6	0.0134	26.5	11.9	0.0042	35.6
240.00	20.0	25.0	20.1	0.0134	25.0	12.2	0.0030	33.1
480.00	20.0	23.8	18.9	0.0134	23.8	12.4	0.0022	31.1
1382.00	17.0	22.8	17.2	0.0140	22.8	12.6	0.0013	28.4

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
COBBLES = % GRAVEL = 0.8 (% coarse = % fine = 0.8)
% SAND = 33.4 (% coarse = 2.5 % medium = 7.6 % fine = 23.3)
% SILT = 28.2 % CLAY = 37.6

D_{85}= 0.30 D_{60}= 0.04 D_{50}= 0.01
D_{30}= 0.00

GRAIN SIZE DISTRIBUTION TEST DATA

Client: Baseline
Project: 95357-19
Project Number: 351-002

Sample Data

Source: SG-2
Sample No.:
Elev. or Depth: 2.0-2.5'
Sample Length (in./cm.):
Location:
Description: black CLAY w/sand
Liquid Limit:
Plastic Limit:
USCS Classification:
AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

Initial
Dry sample and tare= 105.70
Tare = 0.00
Dry sample weight = 105.70
Sample split on number 10 sieve
Split sample data:
Sample and tare = 57.60 Tare = .00 Sample weight = 57.60
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3/4 inch	0.00	100.0
3/8 inch	1.70	98.4
# 4	3.70	96.5
# 10	8.80	91.7
# 30	2.50	87.7
# 40	3.20	86.6
# 50	4.60	84.4
# 100	7.90	79.1
# 200	10.40	75.1

Hydrometer Analysis Data

Separation sieve is #10
Percent -#10 based upon complete sample= 91.7
Weight of hydrometer sample: 60.83
Hygroscopic moisture correction:
Moist weight & tare = 27.47
Dry weight & tare = 26.63
Tare = 11.51
Hygroscopic moisture= 5.6 %
Calculated biased weight= 62.84
Automatic temperature correction
Composite correction at 20 deg C = -4.9

Meniscus correction only=
Specific gravity of solids= 2.68
Specific gravity correction factor= 0.993
Hydrometer type: 152H

Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.50	18.0	52.0	46.6	0.0139	52.0	7.8	0.0547	73.7
1.00	18.0	50.4	45.0	0.0139	50.4	8.0	0.0393	71.2
2.00	18.0	48.0	42.6	0.0139	48.0	8.4	0.0285	67.4
5.00	18.5	46.0	40.7	0.0138	46.0	8.8	0.0182	64.4
15.00	19.0	41.3	36.2	0.0137	41.3	9.5	0.0109	57.1
30.00	19.0	38.5	33.4	0.0137	38.5	10.0	0.0079	52.7
60.00	19.0	35.4	30.3	0.0137	35.4	10.5	0.0057	47.8
120.00	20.0	33.0	28.1	0.0135	33.0	10.9	0.0041	44.3
240.00	20.0	30.5	25.6	0.0135	30.5	11.3	0.0029	40.4
480.00	20.0	29.1	24.2	0.0135	29.1	11.5	0.0021	38.2
1382.00	17.0	27.3	21.7	0.0140	27.3	11.8	0.0013	34.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 3.5 (% coarse = % fine = 3.5)
% SAND = 21.4 (% coarse = 4.8 % medium = 5.1 % fine = 11.5)
% SILT = 28.8 % CLAY = 46.3

D_{85}= 0.33 D_{60}= 0.01 D_{50}= 0.01

GRAIN SIZE DISTRIBUTION TEST DATA

Client: Baseline
Project: 95357-19
Project Number: 351-002

Sample Data

Source: SG-3
Sample No.:
Elev. or Depth: 2.0-2.5'
Sample Length (in./cm.):
Location:
Description: dark brown CLAY
Liquid Limit:
Plastic Limit:
USCS Classification:
AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

	Initial
Dry sample and tare=	136.50
Tare =	0.00
Dry sample weight =	136.50

Sample split on number 10 sieve
Split sample data:
Sample and tare = 57.43 Tare = .00 Sample weight = 57.43
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3/8 inch	0.00	100.0
# 4	0.30	99.8
# 10	2.50	98.2
# 30	1.10	96.3
# 40	1.50	95.6
# 50	2.40	94.1
# 100	6.10	87.8
# 200	10.20	80.8

Hydrometer Analysis Data

Separation sieve is #10
Percent -#10 based upon complete sample= 98.2
Weight of hydrometer sample: 60.3
Hygroscopic moisture correction:
Moist weight & tare = 28.94
Dry weight & tare = 28.11
Tare = 11.50
Hygroscopic moisture= 5.0 %
Calculated biased weight= 58.48
Automatic temperature correction
Composite correction at 20 deg C = -4.9

Meniscus correction only=
Specific gravity of solids= 2.71
Specific gravity correction factor= 0.987
Hydrometer type: 152H
Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.50	18.0	52.0	46.6	0.0137	52.0	7.8	0.0542	78.7
1.00	18.0	49.0	43.6	0.0137	49.0	8.3	0.0395	73.7
2.00	18.0	46.0	40.6	0.0137	46.0	8.8	0.0288	68.6
5.00	18.5	43.5	38.2	0.0137	43.5	9.2	0.0185	64.6
15.00	19.0	39.0	33.9	0.0136	39.0	9.9	0.0110	57.1
30.00	19.0	36.5	31.4	0.0136	36.5	10.3	0.0080	52.9
60.00	19.0	34.0	28.9	0.0136	34.0	10.7	0.0057	48.7
120.00	20.0	31.8	26.8	0.0134	31.8	11.1	0.0041	45.3
240.00	20.0	29.3	24.3	0.0134	29.3	11.5	0.0029	41.0
480.00	20.0	27.8	22.9	0.0134	27.8	11.7	0.0021	38.6
1382.00	17.0	27.5	21.9	0.0139	27.5	11.8	0.0013	37.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200

COBBLES = % GRAVEL = 0.2 (% coarse = % fine = 0.2)
% SAND = 19.0 (% coarse = 1.6 % medium = 2.6 % fine = 14.8)
% SILT = 33.5 % CLAY = 47.3

D_{85}= 0.12 D_{60}= 0.01 D_{50}= 0.01

GRAIN SIZE DISTRIBUTION TEST DATA

Client: Baseline
Project: 95357-19
Project Number: 351-002

Sample Data

Source: SG-4
Sample No.:
Elev. or Depth: Sample Length (in./cm.):
Location:
Description: black CLAY w/sand
Liquid Limit: Plastic Limit:
USCS Classification: AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

	Initial
Dry sample and tare=	151.90
Tare =	0.00
Dry sample weight =	151.90

Sample split on number 10 sieve
Split sample data:
Sample and tare = 57.28 Tare = .00 Sample weight = 57.28
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
# 4	0.00	100.0
# 10	1.10	99.3
# 30	1.30	97.1
# 40	1.70	96.4
# 50	2.70	94.6
# 100	6.20	88.6
# 200	9.90	82.1

Hydrometer Analysis Data

Separation sieve is #10
Percent -#10 based upon complete sample= 99.3
Weight of hydrometer sample: 60.32
Hygroscopic moisture correction:
Moist weight & tare = 29.61
Dry weight & tare = 28.72
Tare = 11.80
Hygroscopic moisture= 5.3 %
Calculated biased weight= 57.71
Automatic temperature correction
Composite correction at 20 deg C = -4.9

Meniscus correction only=
Specific gravity of solids= 2.67
Specific gravity correction factor= 0.995
Hydrometer type: 152H
Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.50	18.0	52.0	46.6	0.0139	52.0	7.8	0.0548	80.4
1.00	18.0	50.0	44.6	0.0139	50.0	8.1	0.0396	77.0
2.00	18.0	48.0	42.6	0.0139	48.0	8.4	0.0285	73.5
5.00	18.5	45.0	39.7	0.0138	45.0	8.9	0.0185	68.5
15.00	19.0	40.5	35.4	0.0137	40.5	9.7	0.0110	61.0
30.00	19.0	38.0	32.9	0.0137	38.0	10.1	0.0080	56.6
60.00	19.0	35.0	29.9	0.0137	35.0	10.6	0.0058	51.5
120.00	20.0	32.0	27.1	0.0136	32.0	11.0	0.0041	46.7
240.00	20.0	30.0	25.1	0.0136	30.0	11.4	0.0030	43.2
480.00	20.0	29.2	24.3	0.0136	29.2	11.5	0.0021	41.8
1382.00	17.0	28.0	22.4	0.0141	28.0	11.7	0.0013	38.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL =
% SAND = 17.9 (% coarse = 0.7 % medium = 2.9 % fine = 14.3)
% SILT = 32.7 % CLAY = 49.4

D_{85}= 0.11 D_{60}= 0.01 D_{50}= 0.01

APPENDIX A

DRILLING PERMIT

ALAMEDA COUNTY PUBLIC WORKS AGENCY

WATER RESOURCES SECTION
951 TURNER COURT, SUITE 300, HAYWARD, CA 94545-2651
PHONE (510) 670-5575 ANDREAS GODFREY FAX (510) 670-5262
(510) 670-5243 ALVIN KAN

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 670 98th Avenue
Oakland

California Coordinates Source _____ ft. Accuracy ± ___ ft.
CCN _____ ft. CCE _____ ft.
APN (please attached site Maps)

CLIENT
Name City of Oakland Environmental Services
Address 1333 Broadway Phone 510-238-7695
City Oakland CA Zip 94612

APPLICANT
Name BASELINE Environmental
Fax 510-420-1707
Address 5900 Hollis St. Phone 510-420-8686
City Emeryville Zip 94608

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	☐	General	☐
Water Supply	☐	Contamination	☑
Monitoring	☐	Well Destruction	☐

PROPOSED WATER SUPPLY WELL USE

New Domestic	☐	Replacement Domestic	☐
Municipal	☐	Irrigation	☐
Industrial	☐	Other ~~unknown~~	☐

DRILLING METHOD:

Mud Rotary	☐	Air Rotary	☐	Auger	☐
Cable	☐	Other	☑		

DRILLER'S LICENSE NO. 705927

WELL PROJECTS
Drill Hole Diameter _____ in. Maximum
Casing Diameter _____ in. Depth _____ ft.
Surface Seal Depth _____ ft. Number _____

GEOTECHNICAL PROJECTS
Number of Borings 4 Maximum
Hole Diameter 2 in. Depth 5.0 ft.

ESTIMATED STARTING DATE 3/10/99
ESTIMATED COMPLETION DATE 3/10/99

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 3/8/99

FOR OFFICE USE

PERMIT NUMBER 99WR 0 88
WELL NUMBER _____
APN _____

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A) GENERAL
1. A permit application should be submitted to as to arrive at the ACPWA office five days prior to proposed starting date.
2. Submit to ACPWA within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

C. GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie
2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

(D) GEOTECHNICAL
Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

E. CATHODIC
Fill hole above anode zone with concrete placed by tremie

F. WELL DESTRUCTION
See attached.

G. SPECIAL CONDITIONS

APPROVED [signature] DATE 3/9/99

APPENDIX B

SOIL VAPOR LABORATORY REPORT

@AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

RECEIVED
MAR 26 1999
BASELINE

WORK ORDER #: 9903147

Work Order Summary

CLIENT:	Mr. Kevin O'Dea Baseline Environmental Consultants 5900 Hollis Street, Suite D Emeryville, CA 94608	**BILL TO:** Same	
PHONE:	707-762-5233	**P.O. #** NR	
FAX:	707-762-5271	**PROJECT #** 95357-19 670 98th Ave, Oakland CA	
DATE RECEIVED:	3/11/99		
DATE COMPLETED:	3/24/99		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.
01A	SG-1	TO-14	1.5 "Hg
02A	SG-2	TO-14	0.5 "Hg
03A	SG-3	TO-14	0.0 "Hg
04A	SG-4	TO-14	1.0 "Hg
05A	Lab Blank	TO-14	NA

CERTIFIED BY: _____ DATE: 3/24/99

Laboratory Director

Certification numbers: CA ELAP - 1149, NY ELAP - 11291, UT ELAP - E-217

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA 95630
(916) 985-1000 • (800) 985-5955 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME : SG-1

ID#: 9903147-01A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031818	Date of Collection:	3/10/99
Dil. Factor:	1.41	Date of Analysis:	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Freon 12	0.71	3.5	Not Detected	Not Detected
Freon 114	0.71	5.0	Not Detected	Not Detected
Chloromethane	0.71	1.5	1.7 J	3.6 J
Vinyl Chloride	0.71	1.8	Not Detected	Not Detected
Bromomethane	0.71	2.8	Not Detected	Not Detected
Chloroethane	0.71	1.9	Not Detected	Not Detected
Freon 11	0.71	4.0	1.9 J	11 J
1,1-Dichloroethene	0.71	2.8	Not Detected	Not Detected
Freon 113	0.71	5.5	Not Detected	Not Detected
Methylene Chloride	0.71	2.5	1.0 J	3.6 J
1,1-Dichloroethane	0.71	2.9	Not Detected	Not Detected
cis-1,2-Dichloroethene	0.71	2.8	Not Detected	Not Detected
Chloroform	0.71	3.5	Not Detected	Not Detected
1,1,1-Trichloroethane	0.71	3.9	Not Detected	Not Detected
Carbon Tetrachloride	0.71	4.5	Not Detected	Not Detected
Benzene	0.71	2.3	1.7 J	5.5 J
1,2-Dichloroethane	0.71	2.9	Not Detected	Not Detected
Trichloroethene	0.71	3.9	Not Detected	Not Detected
1,2-Dichloropropane	0.71	3.3	Not Detected	Not Detected
cis-1,3-Dichloropropene	0.71	3.3	Not Detected	Not Detected
Toluene	0.71	2.7	4.1	16
trans-1,3-Dichloropropene	0.71	3.3	Not Detected	Not Detected
1,1,2-Trichloroethane	0.71	3.9	Not Detected	Not Detected
Tetrachloroethene	0.71	4.9	Not Detected	Not Detected
Ethylene Dibromide	0.71	5.5	Not Detected	Not Detected
Chlorobenzene	0.71	3.3	Not Detected	Not Detected
Ethyl Benzene	0.71	3.1	0.83 J	3.6 J
m,p-Xylene	0.71	3.1	3.0	13
o-Xylene	0.71	3.1	1.3 J	5.8 J
Styrene	0.71	3.1	Not Detected	Not Detected
1,1,2,2-Tetrachloroethane	0.71	4.9	Not Detected	Not Detected
1,3,5-Trimethylbenzene	0.71	3.5	Not Detected	Not Detected
1,2,4-Trimethylbenzene	0.71	3.5	1.2 J	6.1 J
1,3-Dichlorobenzene	0.71	4.3	0.91 J	5.6 J
1,4-Dichlorobenzene	0.71	4.3	Not Detected	Not Detected
Chlorotoluene	0.71	3.7	Not Detected	Not Detected
1,2-Dichlorobenzene	0.71	4.3	Not Detected	Not Detected
1,2,4-Trichlorobenzene	0.71	5.3	Not Detected	Not Detected
Hexachlorobutadiene	0.71	7.6	Not Detected	Not Detected
Propylene	2.8	4.9	Not Detected	Not Detected
1,3-Butadiene	2.8	6.3	Not Detected	Not Detected
Acetone	2.8	6.8	16	38

AIR TOXICS LTD.

SAMPLE NAME : SG-1

ID#: 9903147-01A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031818	**Date of Collection:**	3/10/99
Dil. Factor:	1.41	**Date of Analysis:**	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Carbon Disulfide	2.8	8.9	Not Detected	Not Detected
2-Propanol	2.8	7.0	Not Detected	Not Detected
trans-1,2-Dichloroethene	2.8	11	Not Detected	Not Detected
Vinyl Acetate	2.8	10	Not Detected	Not Detected
2-Butanone (Methyl Ethyl Ketone)	2.8	8.5	3.7 J	11 J
Hexane	2.8	10	Not Detected	Not Detected
Tetrahydrofuran	2.8	8.5	Not Detected	Not Detected
Cyclohexane	2.8	9.9	Not Detected	Not Detected
1,4-Dioxane	2.8	10	Not Detected	Not Detected
Bromodichloromethane	2.8	19	Not Detected	Not Detected
4-Methyl-2-pentanone	2.8	12	Not Detected	Not Detected
2-Hexanone	2.8	12	Not Detected	Not Detected
Dibromochloromethane	2.8	24	Not Detected	Not Detected
Bromoform	2.8	30	Not Detected	Not Detected
4-Ethyltoluene	2.8	14	Not Detected	Not Detected
Ethanol	2.8	5.4	36	70
Methyl tert-Butyl Ether	2.8	10	Not Detected	Not Detected
Heptane	2.8	12	Not Detected	Not Detected

J = Estimated value.

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
1,2-Dichloroethane-d4	107	70-130
Toluene-d8	87	70-130
4-Bromofluorobenzene	83	70-130

AIR TOXICS LTD.

SAMPLE NAME : SG-2

ID#: 9903147-02A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031819	Date of Collection:	3/10/99
Dil. Factor:	1.36	Date of Analysis:	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Freon 12	0.68	3.4	0.71 J	3.6 J
Freon 114	0.68	4.8	Not Detected	Not Detected
Chloromethane	0.68	1.4	1.8 J	3.7 J
Vinyl Chloride	0.68	1.8	Not Detected	Not Detected
Bromomethane	0.68	2.7	Not Detected	Not Detected
Chloroethane	0.68	1.8	Not Detected	Not Detected
Freon 11	0.68	3.9	Not Detected	Not Detected
1,1-Dichloroethene	0.68	2.7	Not Detected	Not Detected
Freon 113	0.68	5.3	Not Detected	Not Detected
Methylene Chloride	0.68	2.4	0.95 J	3.3 J
1,1-Dichloroethane	0.68	2.8	Not Detected	Not Detected
cis-1,2-Dichloroethene	0.68	2.7	Not Detected	Not Detected
Chloroform	0.68	3.4	Not Detected	Not Detected
1,1,1-Trichloroethane	0.68	3.8	Not Detected	Not Detected
Carbon Tetrachloride	0.68	4.3	Not Detected	Not Detected
Benzene	0.68	2.2	1.1 J	3.6 J
1,2-Dichloroethane	0.68	2.8	Not Detected	Not Detected
Trichloroethene	0.68	3.7	Not Detected	Not Detected
1,2-Dichloropropane	0.68	3.2	Not Detected	Not Detected
cis-1,3-Dichloropropene	0.68	3.1	Not Detected	Not Detected
Toluene	0.68	2.6	4.8	18
trans-1,3-Dichloropropene	0.68	3.1	Not Detected	Not Detected
1,1,2-Trichloroethane	0.68	3.8	Not Detected	Not Detected
Tetrachloroethene	0.68	4.7	Not Detected	Not Detected
Ethylene Dibromide	0.68	5.3	Not Detected	Not Detected
Chlorobenzene	0.68	3.2	Not Detected	Not Detected
Ethyl Benzene	0.68	3.0	1.3 J	5.7 J
m,p-Xylene	0.68	3.0	5.3	23
o-Xylene	0.68	3.0	2.1 J	9.2 J
Styrene	0.68	2.9	0.78 J	3.4 J
1,1,2,2-Tetrachloroethane	0.68	4.7	Not Detected	Not Detected
1,3,5-Trimethylbenzene	0.68	3.4	0.71 J	3.6 J
1,2,4-Trimethylbenzene	0.68	3.4	2.6 J	13 J
1,3-Dichlorobenzene	0.68	4.2	2.2 J	13 J
1,4-Dichlorobenzene	0.68	4.2	Not Detected	Not Detected
Chlorotoluene	0.68	3.6	Not Detected	Not Detected
1,2-Dichlorobenzene	0.68	4.2	Not Detected	Not Detected
1,2,4-Trichlorobenzene	0.68	5.1	Not Detected	Not Detected
Hexachlorobutadiene	0.68	7.4	Not Detected	Not Detected
Propylene	2.7	4.8	Not Detected	Not Detected
1,3-Butadiene	2.7	6.1	Not Detected	Not Detected
Acetone	2.7	6.6	17	40

AIR TOXICS LTD.

SAMPLE NAME : SG-2

ID#: 9903147-02A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031819	Date of Collection:	3/10/99
Dil. Factor:	1.36	Date of Analysis:	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Carbon Disulfide	2.7	8.6	Not Detected	Not Detected
2-Propanol	2.7	6.8	2.8 J	7.1 J
trans-1,2-Dichloroethene	2.7	11	Not Detected	Not Detected
Vinyl Acetate	2.7	9.7	Not Detected	Not Detected
2-Butanone (Methyl Ethyl Ketone)	2.7	8.2	3.8 J	11 J
Hexane	2.7	9.7	Not Detected	Not Detected
Tetrahydrofuran	2.7	8.2	Not Detected	Not Detected
Cyclohexane	2.7	9.5	Not Detected	Not Detected
1,4-Dioxane	2.7	10	Not Detected	Not Detected
Bromodichloromethane	2.7	19	Not Detected	Not Detected
4-Methyl-2-pentanone	2.7	11	Not Detected	Not Detected
2-Hexanone	2.7	11	Not Detected	Not Detected
Dibromochloromethane	2.7	24	Not Detected	Not Detected
Bromoform	2.7	29	Not Detected	Not Detected
4-Ethyltoluene	2.7	14	Not Detected	Not Detected
Ethanol	2.7	5.2	56	110
Methyl tert-Butyl Ether	2.7	10	Not Detected	Not Detected
Heptane	2.7	11	Not Detected	Not Detected

J = Estimated value.

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
1,2-Dichloroethane-d4	111	70-130
Toluene-d8	95	70-130
4-Bromofluorobenzene	98	70-130

AIR TOXICS LTD.

SAMPLE NAME : SG-3

ID#: 9903147-03A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031820	Date of Collection:	3/10/99
Dil. Factor:	1.34	Date of Analysis:	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Freon 12	0.67	3.4	Not Detected	Not Detected
Freon 114	0.67	4.8	Not Detected	Not Detected
Chloromethane	0.67	1.4	1.6 J	3.3 J
Vinyl Chloride	0.67	1.7	Not Detected	Not Detected
Bromomethane	0.67	2.6	Not Detected	Not Detected
Chloroethane	0.67	1.8	Not Detected	Not Detected
Freon 11	0.67	3.8	Not Detected	Not Detected
1,1-Dichloroethene	0.67	2.7	Not Detected	Not Detected
Freon 113	0.67	5.2	Not Detected	Not Detected
Methylene Chloride	0.67	2.4	0.72 J	2.6 J
1,1-Dichloroethane	0.67	2.8	Not Detected	Not Detected
cis-1,2-Dichloroethene	0.67	2.7	Not Detected	Not Detected
Chloroform	0.67	3.3	Not Detected	Not Detected
1,1,1-Trichloroethane	0.67	3.7	Not Detected	Not Detected
Carbon Tetrachloride	0.67	4.3	Not Detected	Not Detected
Benzene	0.67	2.2	1.2 J	4.1 J
1,2-Dichloroethane	0.67	2.8	Not Detected	Not Detected
Trichloroethene	0.67	3.7	Not Detected	Not Detected
1,2-Dichloropropane	0.67	3.1	Not Detected	Not Detected
cis-1,3-Dichloropropene	0.67	3.1	Not Detected	Not Detected
Toluene	0.67	2.6	4.9	19
trans-1,3-Dichloropropene	0.67	3.1	Not Detected	Not Detected
1,1,2-Trichloroethane	0.67	3.7	Not Detected	Not Detected
Tetrachloroethene	0.67	4.6	Not Detected	Not Detected
Ethylene Dibromide	0.67	5.2	Not Detected	Not Detected
Chlorobenzene	0.67	3.1	Not Detected	Not Detected
Ethyl Benzene	0.67	3.0	1.4 J	6.1 J
m,p-Xylene	0.67	3.0	5.0	22
o-Xylene	0.67	3.0	1.9 J	8.4 J
Styrene	0.67	2.9	Not Detected	Not Detected
1,1,2,2-Tetrachloroethane	0.67	4.7	Not Detected	Not Detected
1,3,5-Trimethylbenzene	0.67	3.3	Not Detected	Not Detected
1,2,4-Trimethylbenzene	0.67	3.3	2.0 J	10 J
1,3-Dichlorobenzene	0.67	4.1	1.8 J	11 J
1,4-Dichlorobenzene	0.67	4.1	Not Detected	Not Detected
Chlorotoluene	0.67	3.5	Not Detected	Not Detected
1,2-Dichlorobenzene	0.67	4.1	Not Detected	Not Detected
1,2,4-Trichlorobenzene	0.67	5.1	Not Detected	Not Detected
Hexachlorobutadiene	0.67	7.3	Not Detected	Not Detected
Propylene	2.7	4.7	Not Detected	Not Detected
1,3-Butadiene	2.7	6.0	Not Detected	Not Detected
Acetone	2.7	6.5	21	50

AIR TOXICS LTD.

SAMPLE NAME : SG-3

ID#: 9903147-03A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031820	**Date of Collection:**	3/10/99
Dil. Factor:	1.34	**Date of Analysis:**	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Carbon Disulfide	2.7	8.5	Not Detected	Not Detected
2-Propanol	2.7	6.7	3.8 J	9.5 J
trans-1,2-Dichloroethene	2.7	11	Not Detected	Not Detected
Vinyl Acetate	2.7	9.6	Not Detected	Not Detected
2-Butanone (Methyl Ethyl Ketone)	2.7	8.0	2.9 J	8.8 J
Hexane	2.7	9.6	Not Detected	Not Detected
Tetrahydrofuran	2.7	8.0	Not Detected	Not Detected
Cyclohexane	2.7	9.4	Not Detected	Not Detected
1,4-Dioxane	2.7	9.8	Not Detected	Not Detected
Bromodichloromethane	2.7	18	Not Detected	Not Detected
4-Methyl-2-pentanone	2.7	11	Not Detected	Not Detected
2-Hexanone	2.7	11	Not Detected	Not Detected
Dibromochloromethane	2.7	23	Not Detected	Not Detected
Bromoform	2.7	28	Not Detected	Not Detected
4-Ethyltoluene	2.7	13	Not Detected	Not Detected
Ethanol	2.7	5.1	57	110
Methyl tert-Butyl Ether	2.7	9.8	Not Detected	Not Detected
Heptane	2.7	11	Not Detected	Not Detected

J = Estimated value.

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
1,2-Dichloroethane-d4	111	70-130
Toluene-d8	95	70-130
4-Bromofluorobenzene	101	70-130

AIR TOXICS LTD.

SAMPLE NAME : SG-4

ID#: 9903147-04A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031821	Date of Collection:	3/10/99
Dil. Factor:	1.39	Date of Analysis:	3/16/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Freon 12	0.70	3.5	Not Detected	Not Detected
Freon 114	0.70	4.9	Not Detected	Not Detected
Chloromethane	0.70	1.5	4.0	8.4
Vinyl Chloride	0.70	1.8	Not Detected	Not Detected
Bromomethane	0.70	2.7	Not Detected	Not Detected
Chloroethane	0.70	1.9	Not Detected	Not Detected
Freon 11	0.70	4.0	Not Detected	Not Detected
1,1-Dichloroethene	0.70	2.8	Not Detected	Not Detected
Freon 113	0.70	5.4	Not Detected	Not Detected
Methylene Chloride	0.70	2.5	1.3 J	4.7 J
1,1-Dichloroethane	0.70	2.9	Not Detected	Not Detected
cis-1,2-Dichloroethene	0.70	2.8	Not Detected	Not Detected
Chloroform	0.70	3.4	Not Detected	Not Detected
1,1,1-Trichloroethane	0.70	3.9	Not Detected	Not Detected
Carbon Tetrachloride	0.70	4.4	Not Detected	Not Detected
Benzene	0.70	2.3	0.96 J	3.1 J
1,2-Dichloroethane	0.70	2.9	Not Detected	Not Detected
Trichloroethene	0.70	3.8	Not Detected	Not Detected
1,2-Dichloropropane	0.70	3.3	Not Detected	Not Detected
cis-1,3-Dichloropropene	0.70	3.2	Not Detected	Not Detected
Toluene	0.70	2.7	5.0	19
trans-1,3-Dichloropropene	0.70	3.2	Not Detected	Not Detected
1,1,2-Trichloroethane	0.70	3.9	Not Detected	Not Detected
Tetrachloroethene	0.70	4.8	Not Detected	Not Detected
Ethylene Dibromide	0.70	5.4	Not Detected	Not Detected
Chlorobenzene	0.70	3.3	Not Detected	Not Detected
Ethyl Benzene	0.70	3.1	1.6 J	6.9 J
m,p-Xylene	0.70	3.1	6.1	27
o-Xylene	0.70	3.1	2.3 J	10 J
Styrene	0.70	3.0	0.85 J	3.7 J
1,1,2,2-Tetrachloroethane	0.70	4.8	Not Detected	Not Detected
1,3,5-Trimethylbenzene	0.70	3.5	0.92 J	4.6 J
1,2,4-Trimethylbenzene	0.70	3.5	3.4	17
1,3-Dichlorobenzene	0.70	4.2	3.4	21
1,4-Dichlorobenzene	0.70	4.2	Not Detected	Not Detected
Chlorotoluene	0.70	3.7	Not Detected	Not Detected
1,2-Dichlorobenzene	0.70	4.2	Not Detected	Not Detected
1,2,4-Trichlorobenzene	0.70	5.2	Not Detected	Not Detected
Hexachlorobutadiene	0.70	7.5	Not Detected	Not Detected
Propylene	2.8	4.9	Not Detected	Not Detected
1,3-Butadiene	2.8	6.3	Not Detected	Not Detected
Acetone	2.8	6.7	14	34

AIR TOXICS LTD.

SAMPLE NAME : SG-4

ID#: 9903147-04A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031821	**Date of Collection:**	3/10/99
Dil. Factor:	1.39	**Date of Analysis:**	3/18/99

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Carbon Disulfide	2.8	8.8	Not Detected	Not Detected
2-Propanol	2.8	6.9	3.2 J	8.0 J
trans-1,2-Dichloroethene	2.8	11	Not Detected	Not Detected
Vinyl Acetate	2.8	9.9	Not Detected	Not Detected
2-Butanone (Methyl Ethyl Ketone)	2.8	8.3	Not Detected	Not Detected
Hexane	2.8	10	Not Detected	Not Detected
Tetrahydrofuran	2.8	8.3	Not Detected	Not Detected
Cyclohexane	2.8	9.7	Not Detected	Not Detected
1,4-Dioxane	2.8	10	Not Detected	Not Detected
Bromodichloromethane	2.8	19	Not Detected	Not Detected
4-Methyl-2-pentanone	2.8	12	Not Detected	Not Detected
2-Hexanone	2.8	12	Not Detected	Not Detected
Dibromochloromethane	2.8	24	Not Detected	Not Detected
Bromoform	2.8	29	Not Detected	Not Detected
4-Ethyltoluene	2.8	14	2.8 J	14 J
Ethanol	2.8	5.3	72	140
Methyl tert-Butyl Ether	2.8	10	Not Detected	Not Detected
Heptane	2.8	12	Not Detected	Not Detected

J = Estimated value.

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
1,2-Dichloroethane-d4	116	70-130
Toluene-d8	95	70-130
4-Bromofluorobenzene	104	70-130

AIR TOXICS LTD.

SAMPLE NAME : Lab Blank

ID#: 9903147-05A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031804	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 3/18/99	

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Freon 12	0.50	2.5	Not Detected	Not Detected
Freon 114	0.50	3.6	Not Detected	Not Detected
Chloromethane	0.50	1.0	Not Detected	Not Detected
Vinyl Chloride	0.50	1.3	Not Detected	Not Detected
Bromomethane	0.50	2.0	Not Detected	Not Detected
Chloroethane	0.50	1.3	Not Detected	Not Detected
Freon 11	0.50	2.9	Not Detected	Not Detected
1,1-Dichloroethene	0.50	2.0	Not Detected	Not Detected
Freon 113	0.50	3.9	Not Detected	Not Detected
Methylene Chloride	0.50	1.8	Not Detected	Not Detected
1,1-Dichloroethane	0.50	2.1	Not Detected	Not Detected
cis-1,2-Dichloroethene	0.50	2.0	Not Detected	Not Detected
Chloroform	0.50	2.5	Not Detected	Not Detected
1,1,1-Trichloroethane	0.50	2.8	Not Detected	Not Detected
Carbon Tetrachloride	0.50	3.2	Not Detected	Not Detected
Benzene	0.50	1.6	Not Detected	Not Detected
1,2-Dichloroethane	0.50	2.1	Not Detected	Not Detected
Trichloroethene	0.50	2.7	Not Detected	Not Detected
1,2-Dichloropropane	0.50	2.3	Not Detected	Not Detected
cis-1,3-Dichloropropene	0.50	2.3	Not Detected	Not Detected
Toluene	0.50	1.9	Not Detected	Not Detected
trans-1,3-Dichloropropene	0.50	2.3	Not Detected	Not Detected
1,1,2-Trichloroethane	0.50	2.8	Not Detected	Not Detected
Tetrachloroethene	0.50	3.4	Not Detected	Not Detected
Ethylene Dibromide	0.50	3.9	Not Detected	Not Detected
Chlorobenzene	0.50	2.3	Not Detected	Not Detected
Ethyl Benzene	0.50	2.2	Not Detected	Not Detected
m,p-Xylene	0.50	2.2	Not Detected	Not Detected
o-Xylene	0.50	2.2	Not Detected	Not Detected
Styrene	0.50	2.2	Not Detected	Not Detected
1,1,2,2-Tetrachloroethane	0.50	3.5	Not Detected	Not Detected
1,3,5-Trimethylbenzene	0.50	2.5	Not Detected	Not Detected
1,2,4-Trimethylbenzene	0.50	2.5	Not Detected	Not Detected
1,3-Dichlorobenzene	0.50	3.1	Not Detected	Not Detected
1,4-Dichlorobenzene	0.50	3.1	Not Detected	Not Detected
Chlorotoluene	0.50	2.6	Not Detected	Not Detected
1,2-Dichlorobenzene	0.50	3.1	Not Detected	Not Detected
1,2,4-Trichlorobenzene	0.50	3.8	Not Detected	Not Detected
Hexachlorobutadiene	0.50	5.4	Not Detected	Not Detected
Propylene	2.0	3.5	Not Detected	Not Detected
1,3-Butadiene	2.0	4.5	Not Detected	Not Detected
Acetone	2.0	4.8	Not Detected	Not Detected

AIR TOXICS LTD.

SAMPLE NAME : Lab Blank

ID#: 9903147-05A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	g031804	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 3/18/99	

Compound	Det. Limit (ppbv)	Det. Limit (uG/m3)	Amount (ppbv)	Amount (uG/m3)
Carbon Disulfide	2.0	6.3	Not Detected	Not Detected
2-Propanol	2.0	5.0	Not Detected	Not Detected
trans-1,2-Dichloroethene	2.0	8.1	Not Detected	Not Detected
Vinyl Acetate	2.0	7.2	Not Detected	Not Detected
2-Butanone (Methyl Ethyl Ketone)	2.0	6.0	Not Detected	Not Detected
Hexane	2.0	7.2	Not Detected	Not Detected
Tetrahydrofuran	2.0	6.0	Not Detected	Not Detected
Cyclohexane	2.0	7.0	Not Detected	Not Detected
1,4-Dioxane	2.0	7.3	Not Detected	Not Detected
Bromodichloromethane	2.0	14	Not Detected	Not Detected
4-Methyl-2-pentanone	2.0	8.3	Not Detected	Not Detected
2-Hexanone	2.0	8.3	Not Detected	Not Detected
Dibromochloromethane	2.0	17	Not Detected	Not Detected
Bromoform	2.0	21	Not Detected	Not Detected
4-Ethyltoluene	2.0	10	Not Detected	Not Detected
Ethanol	2.0	3.8	Not Detected	Not Detected
Methyl tert-Butyl Ether	2.0	7.3	Not Detected	Not Detected
Heptane	2.0	8.3	Not Detected	Not Detected

Container Type: NA

Surrogates	% Recovery	Method Limits
1,2-Dichloroethane-d4	100	70-130
Toluene-d8	87	70-130
4-Bromofluorobenzene	78	70-130

CHAIN OF CUSTODY RECORD

BASELINE
5900 Hollis Street, Suite D
Emeryville, CA 94608
(510) 420-8686

Turn-around Time: Normal 14 Day
Lab: AIR TOXICS LTD
BASELINE Contact Person: Kevin O'Dea

Project No.	Project Name and Location
95357-19	670 98th Ave, Oakland CA

Samplers: (Signature) William K Scott

	Sample ID No. Station	Date	Time	Media	Depth	No. of Containers	TEH	(TPH with BTX&E)	Oil & Grease	Motor Oil	PNAs	Title 22 Metals	Total Lead	Aromatic hydrocarbons Chlorinated hydrocarbons (EPA TO14)					Remarks/ Composite	Detection Limits
19A	SG-1	3-10-99	9:40	Vapor	2.5-3.0	1-6 liter								X					1.5 "Hg	
20A	SG-2	3-10-99	10:20			1-6 liter								X					0.5 "Hg	
21A	SG-3	3-10-99	10:46			1-6 liter								X					0 "Hg	
22A	SG-4	3-10-99	11:30			1-6 liter								X					1.0 "Hg	

EJ 3-11-99

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Conditions of Samples Upon Arrival at Laboratory:
William K Scott	3/10/99 / 13:40			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks:
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	
		Theresa Magtalas	3/11/99 945	

Cooler Seal Intact? Y N (None) Temp Ambient

COSTRCDEFM2

ADMIN/ADD-5/27/92

APPENDIX C

SOIL PROPERTIES LABORATORY REPORT

APPENDIX D

RISK ANALYSIS FOR HUMAN HEALTH

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: 670 98th Avenue | Job Identification: 93343-F1 | Software: GSI RBCA Spreadsheet
Site Location: Oakland | Date Completed: 4/29/99 | Version: 1.0.1
Completed By: Julie Pettijohn

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

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			20	
IRa.out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	***TRUE***			FALSE	
AAFd	Age adjustment on skin surface area	***TRUE***			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwate	FALSE				

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

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

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

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	2.2E+06	
W	Length of affect. soil parallel to wind (cm)	1.5E+03	
W.gw	Length of affect. soil parallel to groundwater (		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

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

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)			
hv	Vadose zone thickness (cm)			
rho	Soil density (g/cm^3)	***1.622***		
foc	Fraction of organic carbon in vadose zone	***0.0395***		
phi	Soil porosity in vadose zone	***0.397***		
Lgw	Depth to groundwater (cm)			
Ls	Depth to top of affected subsurface soil (cm)	1.0E+02		
Lsubs	Thickness of affected subsurface soils (cm)			
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	***0.2255***	0.2255	0.12
phi.a	Volumetric air content	***0.1715***	***0.1715***	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA

(Complete the following table)

CONSTITUENT	Representative COC Concentration in Groundwater value (mg/L)	note	in Surface Soil alue (mg/kg	note	in Subsurface Soil alue (mg/kg	note
Benzene			9.4E-1	max		
Ethylbenzene			7.1E-1	max		
Toluene			1.9E+0	max		
Xylene (mixed isomers)			3.6E+0	max		

Site Name: 670 98th Avenue
Site Location: Oakland

Completed By: Julie Pettijohn
Date Completed: 4/29/1999

RBCA CHEMICAL DATABASE

Physical Property Data

CAS Number	Constituent	type	Molecular Weight (g/mole) MW	Diffusion Coefficients in air (cm2/s) Dair	Diffusion Coefficients in water (cm2/s) Dwat	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	Henry's Law Constant (@ 20 - 25 C) (atm-m3/mol)	Henry's Law Constant (@ 20 - 25 C) (unitless)	Vapor Pressure (@ 20 - 25 C) (mm Hg)	Solubility (@ 20 - 25 C) (mg/L)	acid pKa	base pKb
71-43-2	Benzene	A	78.1	9.30E-02	1.10E-05	1.58	5.29E-03	2.20E-01	9.52E+01	1.75E+03		
100-41-4	Ethylbenzene	A	106.2	7.60E-02	8.50E-06	1.98	7.69E-03	3.20E-01	1.00E+01	1.52E+02		
108-88-3	Toluene	A	92.4	8.50E-02	9.40E-06	2.13	6.25E-03	2.60E-01	3.00E+01	5.15E+02		
1330-20-7	Xylene (mixed isomers)	A	106.2	7.20E-02	8.50E-06	2.38	6.97E-03	2.90E-01	7.00E+00	1.98E+02		

Site Name: 670 98th Avenue Site Location: Oakland Completed By: Julie Pettijohn Date Completed: 4/29/1999

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	Reference Dose (mg/kg/day) Inhalation RfD_inhal	Slope Factors 1/(mg/kg/day) Oral SF_oral	Slope Factors 1/(mg/kg/day) Inhalation SF_inhal	EPA Weight of Evidence	Is Constituent Carcinogenic ?
71-43-2	Benzene	3.00E-03	1.70E-03	1.00E-01	1.00E-01	A	TRUE
100-41-4	Ethylbenzene	1.00E-01	2.86E-01	-	-	D	FALSE
108-88-3	Toluene	2.00E-01	1.14E-01	-	-	D	FALSE
1330-20-7	Xylene (mixed isomers)	2.00E+00	2.00E-01	-	-	D	FALSE

Site Name: 670 98th Avenue Site Location: Oakland Completed By: Julie Pettijohn Date Completed: 4/29/1999

Software version: 1.0.1

RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level MCL (mg/L)	Maximum Contaminant Level reference	Permissible Exposure Limit PEL/TLV (mg/m3)	Relative Absorption Factors Oral	Relative Absorption Factors Dermal	Detection Limits Groundwater (mg/L)	Detection Limits Soil (mg/kg)	Half Life (First-Order Decay) (days) Saturated	Half Life (First-Order Decay) (days) Unsaturated
71-43-2	Benzene				1	0.1			720	720
100-41-4	Ethylbenzene				1	0.1			228	228
108-88-3	Toluene				1	0.1			28	28
1330-20-7	Xylene (mixed isomers)				1	0.1			360	360

Site Name: 670 98th Avenue Site Location: Oakland Completed By: Julie Pettijohn Date Completed: 4/29/1999

Software version: 1.0.1

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 9.1**

Site Name: 670 98th Avenue
Site Location: Oakland

Completed By: Julie Pettijohn
Date Completed: 4/29/1999

SURFACE SOIL SSTL VALUES (< 3.3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration		Soil Leaching to Groundwater			X Ingestion, Inhalation and Dermal Contact		Construction Worker	Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL) : (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	9.4E-1	NA	NA	NA	2.0E+0	NA	NA	2.0E+0	☐	<1
100-41-4	Ethylbenzene	7.1E-1	NA	NA	NA	>Res	NA	NA	>Res	☐	<1
108-88-3	Toluene	1.9E+0	NA	NA	NA	>Res	NA	NA	>Res	☐	<1
1330-20-7	Xylene (mixed isomers)	3.6E+0	NA	NA	NA	>Res	NA	NA	>Res	☐	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial: G-303-QJX-294

Site Name: 670 98th Avenue | Site Location: Oakland | Completed By: Julie Pettijohn | Date Completed: 4/29/1999 |

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

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

SURFACE SOILS: VAPOR AND DUST INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium: Surface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor: On-Site Residential		3) Exposure Medium: Outdoor Air: POE Conc. (mg/m^3) (1) / (2) — On-Site Residential		4) Exposure Multiplier: (IRxEFxED)/(BWxAT) (m^3/kg-day) — On-Site Residential		5) Average Daily Intake Rate: (mg/kg-day) (3) X (4) — On-Site Residential	
Benzene	9.4E-1	1.8E+5		5.4E-6		1.2E-1		6.3E-7	
Ethylbenzene	7.1E-1	1.8E+5		4.1E-6		2.7E-1		1.1E-6	
Toluene	1.9E+0	1.8E+5		1.1E-5		2.7E-1		3.0E-6	
Xylene (mixed isomers)	3.6E+0	1.8E+5		2.1E-5		2.7E-1		5.6E-6	

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

Site Name: 670 98th Avenue | Site Location: Oakland | Completed By: Julie Pettijohn | Date Completed: 4/29/1999 | 2 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

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

SUBSURFACE SOILS: VAPOR INHALATION

Constituents of Concern	Exposure Concentration: 1) Source Medium — Subsurface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium — Outdoor Air: POE Conc. (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
Benzene	0.0E+0								
Ethylbenzene	0.0E+0								
Toluene	0.0E+0								
Xylene (mixed isomers)	0.0E+0								

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

Site Name: 670 98th Avenue | Site Location: Oakland | Completed By: Julie Pettijohn | Date Completed: 4/29/1999 | 3 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

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

GROUNDWATER: VAPOR INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium: Groundwater Conc. (mg/L)	2) NAF Value (m^3/L) Receptor		3) Exposure Medium: Outdoor Air: POE Conc. (mg/m^3) (1) / (		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)		TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from surface, subsurface & groundwater routes.) On-Site Residential	
Benzene	0.0E+0									6.3E-7	
Ethylbenzene	0.0E+0									1.1E-6	
Toluene	0.0E+0									3.0E-6	
Xylene (mixed isomers)	0.0E+0									5.6E-6	

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

RBCA SITE ASSESSMENT	Tier 2 Worksheet 8.2

Site Name: 670 98th Avenue | Site Location: Oakland | Completed By: Julie Pettijohn | Date Completed: 4/29/1999 |

TIER 2 PATHWAY RISK CALCULATION

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

		CARCINOGENIC RISK					TOXIC EFFECTS			
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Residential		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Residential		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Residential		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Residential	
Benzene	A	6.3E-7		1.0E-1	6.3E-8		1.5E-6		1.7E-3	8.7E-4	
Ethylbenzene	D						1.1E-6		2.9E-1	3.9E-6	
Toluene	D						3.0E-6		1.1E-1	2.6E-5	
Xylene (mixed isomers)	D						5.6E-6		2.0E-1	2.8E-5	
Total Pathway Carcinogenic Risk =					6.3E-8	0.0E+0	***Total Pathway Hazard Index =***			9.2E-4	0.0E+0

Site Name: 670 98th Avenue Site Location: Oakland Completed By: Julie Petti Date Completed: 4/29/1999

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS: **Exposure Concentration**

DERMAL CONTACT

	1) Source Medium	2) Exposure Multiplier (SAxAFxABSxCFxEFxED)/(BWxAT) (kg/kg-day)		3) Average Daily Intake Rate (mg/kg-day) (1) x (2)	
Constituents of Concern	Surface Soil Conc. (mg/kg)	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial
Benzene	9.4E-1	2.9E-6		2.7E-6	
Ethylbenzene	7.1E-1	6.7E-6		4.7E-6	
Toluene	1.9E+0	6.7E-6		1.3E-5	
Xylene (mixed isomers)	3.6E+0	6.7E-6		2.4E-5	

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

Site Name: 670 98th Avenue . Site Location: Oakland Completed By: Julie Pettijohn Date Completed: 4/29/1999

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

INGESTION

	Exposure Concentration	1) Source Medium	2) Exposure Multiplier (IRxCFxEFxED)/(BWxAT) (kg/kg-day)		3) Average Daily Intake Rate (mg/kg-day) (1) x (2)		TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from dermal & ingestion routes.)	
Constituents of Concern		Surface Soil Conc. (mg/kg)	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial
Benzene		9.4E-1	1.6E-6		1.5E-6		4.2E-6	
Ethylbenzene		7.1E-1	3.7E-6		2.6E-6		7.3E-6	
Toluene		1.9E+0	3.7E-6		6.9E-6		2.0E-5	
Xylene (mixed isomers)		3.6E+0	3.7E-6		1.3E-5		3.7E-5	

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

Site Name: 670 98th Avenue | Site Location: Oakland | Completed By: Julie Pettijohn | Date Completed: 4/29/1999 | 3 OF 4

TIER 2 PATHWAY RISK CALCULATION

SOIL EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAYS ARE ACTIVE)

		CARCINOGENIC RISK					TOXIC EFFECTS				
	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
Constituents of Concern		On-Site Residential	On-Site Commercial	(mg/kg-day)^-1	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	(mg/kg-day)	On-Site Residential	On-Site Commercial
Benzene	A	4.2E-6		1.0E-1	4.2E-7		9.7E-6		3.0E-3	3.2E-3	
Ethylbenzene	D						7.3E-6		1.0E-1	7.3E-5	
Toluene	D						2.0E-5		2.0E-1	9.8E-5	
Xylene (mixed isomers)	D						3.7E-5		2.0E+0	1.9E-5	
Total Pathway Carcinogenic Risk =					**4.2E-7**	**0.0E+0**	***Total Pathway Hazard Index =***			**3.4E-3**	**0.0E+0**

Table D-1
Identification of Chemicals of Concern for Indoor Air Based on Soil Vapor Results
670 98th Avenue, Oakland, California
March 1999

Chemicals of Concern	Maximum Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	Sampling Location with Maximum Concentration
chloromethane	4	8.4	SG-4
freon 11	1.9 J	11 J	SG-1
methylene chloride	1.3 J	4.7 J	SG-4
benzene	1.7 J	5.5 J	SG-1
toluene	5	19	SG-4
ethylbenzene	1.6 J	6.9 J	SG-4
o,m,p-xylenes	8.4	37	SG-4
1,2,4-trimethylbenzene	3.4	17	SG-4
1,3-dichlorobenzene	3.4	21	SG-4
acetone	21	50	SG-3
2-butanone (MEK)	3.8 J	11 J	SG-2
ethanol	72	140	SG-4
freon 12	0.71 J	3.6 J	SG-2
styrene	0.85 J	3.7 J	SG-4
1,3,5-trimethylbenzene	0.92 J	4.6 J	SG-4
2-propanol	3.8 J	9.5 J	SG-3
4-ethyltoluene	2.8 J	14 J	SG-4

Notes: J = value estimated by laboratory
ppbv = parts per billion vapor
ppmv = parts per million vapor
ug/m^3 = micrograms per cubic meter
MEK = methyl ethyl ketone

Conversions:
ppbv = ug/m^{33} x 24.45/molecular weight (MW)
ppbv x 1000 = ppmv

All samples were collected 10 March 1999 at 2.5 to 3.0 feet below ground surface with a 6 Liter summa canister.

All other chemicals were identified below their respective laboratory reporting limits or did not have estimated concentrations. These chemicals were excluded from the analysis and included: freon 114, vinyl chloride, bromomethane, chloroethane, 1,1-dichloroethene, freon 113, 1,1-dichloroethane, cis-1,2-dichloroethene, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, 1,2-dichloroethane, trichloroethene, 1,2-dicholoropropane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 1,1,2-trichloroethane, tetrachloroethene, ethylene dibromide,chlorobenzene, 1,1,2,2-tetrachloroethane, 1,4-dichlorobenzene, chlorotoluene, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobutadiene, propylene, 1,3-butadiene, carbon disulfide, trans-1,2-dichloroethene, vinyl acetate, hexane, tetrahydrofuran, cyclohexane, 1,4-dioxane, bromodichloromethane, 4-methyl-2-pentanone, 2-hexanone, dibromochloromethane, bromoform, methyl tert-butyl ether, and heptane. Detection limits ranged from 0.67 to 2.8 ppbv and 1.7 to 30 ug/m^3.

See Appendix B for laboratory report
Soil vapor sampling locations are shown in Figure 4.
All samples analyzed by EPA Method TO-14 GC/MS Full Scan.

Soil Vapor Calculations
Indoor Air - Child (1-16 years)

Inputs	Symbol	Benzene (NC)	Benzene (C)	Toluene (NC)	Ethylbenzene (NC)	Xylene (NC)	Dichlorodifluoromethane (NC)(aka Freon 12)	MEK (NC)(aka 2-Butanone)	Acetone (NC)	1,3 Dichlorobenzene (NC)	Methylene Chloride (NC) (aka Dibromomethane)
Air diffusion coeficient (cm^2/s)	Dair	0.093	0.093	0.085	0.076	0.072	5.20E-02	8.08E-02	1.24E-01	6.88E-02	1.01E-01
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	0.000011	0.000011	0.0000094	0.0000085	0.0000085	1.05E-05	9.80E-06	1.14E-05	7.90E-06	1.17E-05
Henry's law (unitless)	H	0.22	0.22	0.26	0.32	0.29	1.65E+01	5.36E-03	1.03E-03	1.34E-01	9.03E-02
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Exchange rate indoor (sec^-1)	ER air-ind	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
Enclosed space volume/infiltration area ratio (cm)	Lb	200	200	200	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-child	BW	35	35	35	35	35	35	35	35	35	35
Averaging time (days)	AT	5840	25550	5840	5840	5840	5840	5840	5840	5840	5840
Slope factor Inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sli/RfDi	0.0017	0.1	0.11	0.29	0.2	0.057	0.29	0.1	0.002	0.86
Inhalation rate air-indoor (m^3/day)	Irair-in	15	15	15	15	15	15	15	15	15	15
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350	350	350	350
Exposure duration (years)	ED	16	16	16	16	16	16	16	16	16	16
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1	1.00E-06	1	1	1	1.00E+00	1	1	1	1
Molecular weight (g/mol)	MW	78	7.80E+01	92	106	106	120.92	72.1	58.08	147	85
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.67E-03	1.67E-03	1.52E-03	1.36E-03	1.29E-03	9.30E-04	1.53E-03	2.71E-03	1.23E-03	1.81E-03
	Dose (mg)=	3.47E+02	8.94E+00	2.25E+04	5.93E+04	4.09E+04	1.17E+04	5.93E+04	2.04E+04	4.09E+02	1.76E+05
	C indoor (enclosed space air concentration)(ug/cm^3)=	4.14E-06	1.06E-07	2.68E-04	7.06E-04	4.87E-04	1.39E-04	7.06E-04	2.43E-04	4.87E-06	2.09E-03
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	1.16E-07	2.98E-09	7.49E-06	1.98E-05	1.36E-05	3.88E-06	1.98E-05	6.81E-06	1.36E-07	5.86E-05
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	5.30E+00	1.36E-01	3.75E+02	1.11E+03	8.05E+02	3.18E+02	9.86E+02	1.92E+02	8.42E+00	2.46E+03
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	1.66E+00	4.27E-02	9.97E+01	2.55E+02	1.86E+02	6.43E+01	3.34E+02	8.06E+01	1.40E+00	7.09E+02
	Max allowable chemical concentration in vapor(ppbv)(unit conversion)	1.66E+03	4.27E+01	9.97E+04	2.55E+05	1.86E+05	6.43E+04	3.34E+05	8.06E+04	1.40E+03	7.09E+05
	Maximum site concentration (ppbv)	1.7	1.7	5	1.6	8.4	0.71	3.8	21	3.4	1.3
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No	No	No	No
	Cumulative Risk/Hazard										
	Maxium concentration/maximum allowable concentration by SSTL	1.02E-03	3.98E-02	5.01E-05	6.27E-06	4.52E-05	1.10E-05	1.14E-05	2.60E-04	2.43E-03	1.83E-06
	Cumulative Hazard-Non carcinogens	7.67E-03									
	Cumulative Risk- Carcinogens	4.62E-08									

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations. The maximum allowable vapor comcentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore excluded from the risk calculations.

Soil Vapor Calculations
Indoor Air - Child (1-16 years)

Inputs	Symbol	Methylene Chloride (C) (aka Dibromomethane)	Trichlorofluoromethane (NC) (aka Freon 11)	Chloromethane (NC) (aka Methyl Chloride)	Chloromethane (C) (aka Methyl Chloride)	1,2,4-Trimethylbenzene (NC)	Styrene (NC)	1,3,5-Trimethylbenzene (NC)
Air diffusion coeficient (cm^2/s)	Dair	1.01E-01	8.70E-02	1.28E-01	1.28E-01	7.50E-02	7.10E-02	7.50E-02
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	1.17E-05	9.70E-06	1.68E-04	1.68E-04	7.10E-06	8.00E-06	7.10E-06
Henry's law (unitless)	H	9.03E-02	2.40E+00	3.64E-01	3.64E-01	0.23	0.11	0.32
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Exchange rate indoor (sec^-1)	ER air-ind	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
Enclosed space volume/infiltration area ratio (cm)	Lb	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-child	BW	35	35	35	35	35	35	35
Averaging time (days)	AT	25550	5840	5840	25550	5840	5840	5840
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	3.50E-03	0.2	0.0063	6.10E-03	0.0017	0.29	0.0017
Inhalation rate air-indoor (m^3/day)	trair-in	15	15	15	15	15	15	15
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350
Exposure duration (years)	ED	16	16	16	16	16	16	16
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1.00E-06	1	1	1.00E-06	1	1	1
Molecular weight (g/mol)	MW	85	137.4	51	51	120	104	120
	Deffs (diffusion coeficient soil)(cm^2/sec)	1.81E-03	1.56E-03	2.31E-03	2.31E-03	1.34E-03	1.27E-03	1.34E-03
	Dose (mg)=	2.56E+02	4.09E+04	1.29E+03	1.47E+02	3.47E+02	5.93E+04	3.47E+02
	C indoor (enclosed space air concentration)(ug/cm^3)=	3.04E-06	4.87E-04	1.53E-05	1.75E-06	4.14E-06	7.06E-04	4.14E-06
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	8.52E-08	1.36E-05	4.29E-07	4.89E-08	1.16E-07	1.98E-05	1.16E-07
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	3.58E+00	6.67E+02	1.42E+01	1.61E+00	6.57E+00	1.18E+03	6.57E+00
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	1.03E+00	1.19E+02	6.79E+00	7.73E-01	1.34E+00	2.78E+02	1.34E+00
	Max allowable chemical concentration in vapor(ppbv)(unit conversion)	1.03E+03	1.19E+05	6.79E+03	7.73E+02	1.34E+03	2.78E+05	1.34E+03
	Maximum site concentration (ppbv)	1.3	1.9	4	4	3.4	0.85	0.92
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No
	Cumulative Risk/Hazard Maxium concentration/maximum allowable concentration by SSTL	1.26E-03	1.60E-05	5.89E-04	5.18E-03	2.54E-03	3.06E-06	6.87E-04

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore exctuded from the risk calculations.

Soil Vapor Calculations
Indoor Air - Adult

	Symbol	Benzene (NC)	Benzene (C)	Toluene (NC)	Ethylbenzene (NC)	Xylene (NC)	Dichlorodifluoromethane (NC) (aka Freon 12)	MEK (NC)(aka 2-Butanone)	Acetone (NC)	1,3 Dichlorobenzene (NC)	Methylene Chloride (NC) (aka Dibromomethane)
Inputs											
Air diffusion coeficient (cm^2/s)	Dair	0.093	0.093	0.085	0.076	0.072	5.20E-02	8.08E-02	1.24E-01	6.88E-02	1.01E-01
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	0.000011	0.000011	0.0000094	0.0000085	0.0000085	1.05E-05	9.80E-06	1.14E-05	7.90E-06	1.17E-05
Henry's law (unitless)	H	0.22	0.22	0.26	0.32	0.29	1.65E+01	5.36E-03	1.03E-03	1.34E-01	9.03E-02
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Exchange rate indoor (sec^-1)	ER air-ind	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
Enclosed space volume/infiltration area ratio (cm)	Lb	200	200	200	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-adult	BW	70	70	70	70	70	70	70	70	70	70
Averaging time (days)	AT	10950	25550	10950	10950	10950	10950	10950	10950	10950	10950
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	0.0017	0.1	0.11	0.29	0.2	0.057	0.29	0.1	0.002	0.86
Inhalation rate air-indoor (m^3/day)	Irair-In	20	20	20	20	20	20	20	20	20	20
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350	350	350	350
Exposure duration (years)	ED	30	30	30	30	30	30	30	30	30	30
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1	1.00E-06	1	1	1	1.00E+00	1	1	1	1
Molecular weight (g/mol)	MW	78	7.80E+01	92	106	106	120.92	72.1	58.08	147	85
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.67E-03	1.67E-03	1.52E-03	1.36E-03	1.29E-03	9.30E-04	1.53E-03	2.71E-03	1.23E-03	1.81E-03
	Dose (mg)=	1.30E+03	1.79E+01	8.43E+04	2.22E+05	1.53E+05	4.37E+04	2.22E+05	7.67E+04	1.53E+03	6.59E+05
	C Indoor (enclosed space air concentration)(ug/cm^3)=	6.21E-06	8.52E-08	4.02E-04	1.06E-03	7.30E-04	2.08E-04	1.06E-03	3.65E-04	7.30E-06	3.14E-03
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	1.74E-07	2.38E-09	1.12E-05	2.96E-05	2.04E-05	5.83E-06	2.96E-05	1.02E-05	2.04E-07	8.79E-05
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	7.95E+00	1.09E-01	5.63E+02	1.66E+03	1.21E+03	4.77E+02	1.48E+03	2.87E+02	1.26E+01	3.70E+03
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	2.49E+00	3.42E-02	1.50E+02	3.83E+02	2.79E+02	9.65E+01	5.02E+02	1.21E+02	2.10E+00	1.06E+03
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	2.49E+03	3.42E+01	1.50E+05	3.83E+05	2.79E+05	9.65E+04	5.02E+05	1.21E+05	2.10E+03	1.06E+06
	Maximum site concentration (ppbv)	1.7	1.7	5	1.6	8.4	0.71	3.8	21	3.4	1.3
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No	No	No	No
	Cumulative Risk/Hazard Maximum concentration/maximum allowable concentration by SSTL	6.82E-04	4.97E-02	3.34E-05	4.18E-06	3.01E-05	7.36E-06	7.57E-06	1.74E-04	1.62E-03	1.22E-06
	Cumulative Hazard - Non carcinogens	5.11E-03									
	Cumulative Risk- Carcinogens	5.78E-08									

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore excluded from the risk calculations.

Soil Vapor Calculations
Indoor Air - Adult

	Symbol	Methylene Chloride (C) (aka Dibromomethane)	Trichlorofluoromethane (NC)(aka Freon 11)	Chloromethane (NC) (aka Methyl Chloride)	Chloromethane (C) (aka Methyl Chloride)	1,2,4-Trimethylbenzene (NC)	Styrene (NC)	1,3,5-Trimethylbenzene (NC)
Inputs								
Air diffusion coeficient (cm^2/s)	Dair	1.01E-01	8.70E-02	1.28E-01	1.28E-01	7.50E-02	7.10E-02	7.50E-02
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	1.17E-05	9.70E-06	1.68E-04	1.68E-04	7.10E-06	8.00E-06	7.10E-06
Henry's law (unitless)	H	9.03E-02	2.40E+00	3.64E-01	3.64E-01	0.23	0.11	0.32
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Exchange rate indoor (sec^-1)	ER air-ind	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
Enclosed space volume/infiltration area ratio (cm)	Lb	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-adult	BW	70	70	70	70	70	70	70
Averaging time (days)	AT	25550	10950	10950	25550	10950	10950	10950
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	3.50E-03	0.2	0.0063	6.10E-03	0.0017	0.29	0.0017
Inhalation rate air-indoor (m^3/day)	Inair-in	20	20	20	20	20	20	20
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350
Exposure duration (years)	ED	30	30	30	30	30	30	30
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1.00E-06	1	1	1.00E-06	1	1	1
Molecular weight (g/mol)	MW	85	137.4	51	51	120	104	120
	Delfs (diffusion coefficient soil)(cm^2/sec)	1.81E-03	1.56E-03	2.31E-03	2.31E-03	1.34E-03	1.27E-03	1.34E-03
	Dose (mg)=	5.11E+02	1.53E+05	4.83E+03	2.93E+02	1.30E+03	2.22E+05	1.30E+03
	C Indoor (enclosed space air concentration)(ug/cm^3)=	2.43E-06	7.30E-04	2.30E-05	1.40E-06	6.21E-06	1.06E-03	6.21E-06
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	6.81E-08	2.04E-05	6.44E-07	3.91E-08	1.74E-07	2.96E-05	1.74E-07
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	2.86E+00	1.00E+03	2.12E+01	1.29E+00	9.86E+00	1.77E+03	9.86E+00
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	8.24E-01	1.78E+02	1.02E+01	6.18E-01	2.01E+00	4.17E+02	2.01E+00
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	8.24E+02	1.78E+05	1.02E+04	6.18E+02	2.01E+03	4.17E+05	2.01E+03
	Maximum site concentration (ppbv)	1.3	1.9	4	4	3.4	0.85	0.92
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No
	Cumulative Risk/Hazard Maximum concentration/maximum allowable concentration by SSTL	1.58E-03	1.07E-05	3.93E-04	6.47E-03	1.69E-03	2.04E-06	4.58E-04

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore excluded from the risk calculations.

Soil Vapor Calculations
Outdoor Air - Child (1-16 years)

Inputs	Symbol	Benzene (NC)	Benzene (C)	Toluene (NC)	Ethylbenzene (NC)	Xylene (NC)	Dichlorodifluoromethane (NC)(aka Freon 12)	MEK (NC)(aka 2-Butanone)	Acetone (NC)	1,3 Dichlorobenzene (NC)	Methylene Chloride (NC) (aka Dibromomethane)
Air diffusion coeficient (cm^2/s)	Dair	0.093	0.093	0.085	0.076	0.072	5.20E-02	8.08E-02	1.24E-01	6.88E-02	1.01E-01
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	0.000011	0.000011	0.0000094	0.0000085	0.0000085	1.05E-05	9.80E-06	1.14E-05	7.90E-06	1.17E-05
Henry's law (unitless)	H	0.22	0.22	0.26	0.32	0.29	1.65E+01	5.36E-03	1.03E-03	1.34E-01	9.03E-02
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Width of source area parallel to wind or groundwater flow direction (cm)	W	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Windspeed (cm/sec)	Uair	225	225	225	225	225	225	225	225	225	225
Ambient mixing zone height (cm)	dair	200	200	200	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-child	BW	35	35	35	35	35	35	35	35	35	35
Averaging time (days)	AT	5840	25550	5840	5840	5840	5840	5840	5840	5840	5840
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	0.0017	0.1	0.11	0.29	0.2	0.057	0.29	0.1	0.002	0.86
Inhalation rate (m^3/day)	Irair	15	15	15	15	15	15	15	15	15	15
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350	350	350	350
Exposure duration (years)	ED	16	16	16	16	16	16	16	16	16	16
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1	1.00E-06	1	1	1	1.00E+00	1	1	1	1
Molecular weight (g/mol)	MW	78	7.80E+01	92	106	106	120.92	72.1	58.08	147	85
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.67E-03	1.67E-03	1.52E-03	1.36E-03	1.29E-03	9.30E-04	1.53E-03	2.71E-03	1.23E-03	1.81E-03
	Dose (mg)=	3.47E+02	8.94E+00	2.25E+04	5.93E+04	4.09E+04	1.17E+04	5.93E+04	2.04E+04	4.09E+02	1.76E+05
	C outdoor (ug/cm^3)=	4.14E-06	1.06E-07	2.68E-04	7.06E-04	4.87E-04	1.39E-04	7.06E-04	2.43E-04	4.87E-06	2.09E-03
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	1.24E-04	3.19E-06	8.03E-03	2.12E-02	1.46E-02	4.16E-03	2.12E-02	7.30E-03	1.46E-04	6.28E-02
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	5.68E+03	1.46E+02	4.02E+05	1.19E+06	8.63E+05	3.41E+05	1.06E+06	2.05E+05	9.02E+03	2.64E+06
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	1.78E+03	4.58E+01	1.07E+05	2.73E+05	1.99E+05	6.89E+04	3.58E+05	8.64E+04	1.50E+03	7.59E+05
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	1.78E+06	4.58E+04	1.07E+08	2.73E+08	1.99E+08	6.89E+07	3.58E+08	8.64E+07	1.50E+06	7.59E+08
	Maximum site concentration (ppbv)	1.7	1.7	5	1.6	8.4	0.71	3.8	21	3.4	1.3
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No	No	No	No
	Cumulative Risk/Hazard										
	Maximum concentration/maximum allowable concentration by SSTL	9.55E-07	3.71E-05	4.68E-08	5.85E-09	4.22E-08	1.03E-08	1.06E-08	2.43E-07	2.27E-06	1.71E-09
	Cumulative Hazard- Non carcinogens	7.16E-06									
	Cumulative Risk - Carcinogens	4.31E-11									

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, outdoor air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore excluded from the risk calculations.

Soil Vapor Calculations
Outdoor Air - Child (1-16 years)

Inputs	Symbol	Methylene Chloride (C) (aka Dibromomethane)	Trichlorofluoromethane (NC) (aka Freon 11)	Chloromethane (NC) (aka Methyl Chloride)	Chloromethane (C) (aka Methyl Chloride)	1,2,4-Trimethylbenzene (NC)	Styrene (NC)	1,3,5-Trimethylbenzene (NC)
Air diffusion coeficient (cm^2/s)	Dair	1.01E-01	8.70E-02	1.28E-01	1.28E-01	7.50E-02	7.10E-02	7.50E-02
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	1.17E-05	9.70E-06	1.68E-04	1.68E-04	7.10E-06	8.00E-06	7.10E-06
Henry's law (unitless)	H	9.03E-02	2.40E+00	3.64E-01	3.64E-01	0.23	0.11	0.32
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Width of source area parallel to wind or groundwater flow direction (cm)	W	1500	1500	1500	1500	1500	1500	1500
Windspeed (cm/sec)	Uair	225	225	225	225	225	225	225
Ambient mixing zone height (cm)	dair	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-child	BW	35	35	35	35	35	35	35
Averaging time (days)	AT	25550	5840	5840	25550	5840	5840	5840
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	3.50E-03	0.2	0.0063	6.10E-03	0.0017	0.29	0.0017
Inhalation rate (m^3/day)	Irair	15	15	15	15	15	15	15
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350
Exposure duration (years)	ED	16	16	16	16	16	16	16
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1.00E-06	1	1	1.00E-06	1	1	1
Molecular weight (g/mol)	MW	85	137.4	51	51	120	104	120
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.81E-03	1.56E-03	2.31E-03	2.31E-03	1.34E-03	1.27E-03	1.34E-03
	Dose (mg)=	2.56E+02	4.09E+04	1.29E+03	1.47E+02	3.47E+02	5.93E+04	3.47E+02
	C outdoor (ug/cm^3)=	3.04E-06	4.87E-04	1.53E-05	1.75E-06	4.14E-06	7.06E-04	4.14E-06
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	9.13E-05	1.46E-02	4.60E-04	5.24E-05	1.24E-04	2.12E-02	1.24E-04
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	3.84E+03	7.15E+05	1.52E+04	1.73E+03	7.04E+03	1.27E+06	7.04E+03
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	1.10E+03	1.27E+05	7.27E+03	8.28E+02	1.43E+03	2.98E+05	1.44E+03
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	1.10E+06	1.27E+08	7.27E+06	8.28E+05	1.43E+06	2.98E+08	1.44E+06
	Maximum site concentration (ppbv)	1.3	1.9	4	4	3.4	0.85	0.92
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No
	Cumulative Risk/Hazard							
	Maximum concentration/maximum allowable concentration by SSTL	1.18E-06	1.49E-08	5.50E-07	4.83E-08	2.37E-06	2.85E-09	6.41E-07

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, outdoor air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore excluded from the risk calculations.

Soil Vapor Calculations
Outdoor Air - Adult

Inputs	Symbol	Benzene (NC)	Benzene (C)	Toluene (NC)	Ethylbenzene (NC)	Xylene (NC)	Dichlorodifluoromethane (NC)(aka Freon 12)	MEK (NC)(aka 2-Butanone)	Acetone (NC)	1,3 Dichlorobenzene (NC)	Methylene Chloride (NC) (aka Dibromomethane)
Air diffusion coeficient (cm^2/s)	Dair	0.093	0.093	0.085	0.076	0.072	5.20E-02	8.08E-02	1.24E-01	6.88E-02	1.01E-01
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	0.000011	0.000011	0.0000094	0.0000085	0.0000085	1.05E-05	9.80E-06	1.14E-05	7.90E-06	1.17E-05
Henry's law (unitless)	H	0.22	0.22	0.26	0.32	0.29	1.65E+01	5.36E-03	1.03E-03	1.34E-01	9.03E-02
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Width of source area parallel to wind or groundwater flow direction (cm)	W	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Windspeed (cm/sec)	Uair	225	225	225	225	225	225	225	225	225	225
Ambient mixing zone height (cm)	dair	200	200	200	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-adult	BW	70	70	70	70	70	70	70	70	70	70
Averaging time (days)	AT	10950	25550	10950	10950	10950	10950	10950	10950	10950	10950
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	0.0017	0.1	0.11	0.29	0.2	0.057	0.29	0.1	0.002	0.86
Inhalation rate (m^3/day)	Irair	20	20	20	20	20	20	20	20	20	20
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350	350	350	350
Exposure duration (years)	ED	30	30	30	30	30	30	30	30	30	30
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1	1.00E-06	1	1	1	1.00E+00	1	1	1	1
Molecular weight (g/mol)	MW	78	7.80E+01	92	106	106	120.92	72.1	58.08	147	85
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.67E-03	1.67E-03	1.52E-03	1.36E-03	1.29E-03	9.30E-04	1.53E-03	2.71E-03	1.23E-03	1.81E-03
	Dose (mg)=	1.30E+03	1.79E+01	8.43E+04	2.22E+05	1.53E+05	4.37E+04	2.22E+05	7.67E+04	1.53E+03	6.59E+05
	C outdoor (ug/cm^3)=	6.21E-06	8.52E-08	4.02E-04	1.06E-03	7.30E-04	2.08E-04	1.06E-03	3.65E-04	7.30E-06	3.14E-03
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	1.86E-04	2.56E-06	1.20E-02	3.18E-02	2.19E-02	6.24E-03	3.18E-02	1.10E-02	2.19E-04	9.42E-02
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	8.52E+03	1.17E+02	6.03E+05	1.78E+06	1.29E+06	5.11E+05	1.59E+06	3.08E+05	1.35E+04	3.96E+06
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	2.67E+03	3.66E+01	1.60E+05	4.10E+05	2.99E+05	1.03E+05	5.38E+05	1.30E+05	2.25E+03	1.14E+06
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	2.67E+06	3.66E+04	1.60E+08	4.10E+08	2.99E+08	1.03E+08	5.38E+08	1.30E+08	2.25E+06	1.14E+09
	Maximum site concentration (ppbv)	1.7	1.7	5	1.6	8.4	0.71	3.8	21	3.4	1.3
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No	No	No	No
	Cumulative Risk/Hazard										
	Maximum concentration/maximum allowable concentration by SSTL	6.37E-07	4.64E-05	3.12E-08	3.90E-09	2.81E-08	6.87E-09	7.07E-09	1.62E-07	1.51E-06	1.14E-09
	Cumulative Hazard-Non carcinogens	4.77E-06									
	Cumulative Risk-Carcinogens	5.39E-11									

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not appticable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, outdoor air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore exluded from the risk calculations.

Soil Vapor Calculations
Outdoor Air - Adult

Inputs	Symbol	Methylene Chloride (C) (aka Dibromomethane)	Trichlorofluoromethane (NC)(aka Freon 11)	Chloromethane (NC) (aka Methyl Chloride)	Chloromethane (C) (aka Methyl Chloride)	1,2,4-Trimethylbenzene (NC)	Styrene (NC)	1,3,5-Trimethylbenzene (NC)
Air diffusion coeficient (cm^2/s)	Dair	1.01E-01	8.70E-02	1.28E-01	1.28E-01	7.50E-02	7.10E-02	7.50E-02
Air content (v/v)	theta as	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715	0.1715
Porosity (v/v)	theta t	0.397	0.397	0.397	0.397	0.397	0.397	0.397
Water diffusion coefficient(cm^2/s)	Dwat	1.17E-05	9.70E-06	1.68E-04	1.68E-04	7.10E-06	8.00E-06	7.10E-06
Henry's law (unitless)	H	9.03E-02	2.40E+00	3.64E-01	3.64E-01	0.23	0.11	0.32
Depth to vapor sample (cm)	d	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Water content (v/v)	theta ws	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255	0.2255
Width of source area parallel to wind or groundwater flow direction (cm)	W	1500	1500	1500	1500	1500	1500	1500
Windspeed (cm/sec)	Uair	225	225	225	225	225	225	225
Ambient mixing zone height (cm)	dair	200	200	200	200	200	200	200
Bulk density (g/cm^3)	ps	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Body weight-adult	BW	70	70	70	70	70	70	70
Averaging time (days)	AT	25550	10950	10950	25550	10950	10950	10950
Slope factor inhalation (mg/kg- day)^-1 or RfDi (mg/kg-day)	Sfi/RfDi	3.50E-03	0.2	0.0063	6.10E-03	0.0017	0.29	0.0017
Inhalation rate (m^3/day)	Irair	20	20	20	20	20	20	20
Exposure frequency (days/year)	EF	350	350	350	350	350	350	350
Exposure duration (years)	ED	30	30	30	30	30	30	30
Risk level (carcinogen)/hazard level (noncarcinogens)	NA	1.00E-06	1	1	1.00E-06	1	1	1
Molecular weight (g/mol)	MW	85	137.4	51	51	120	104	120
	Deffs (diffusion coefficient soil)(cm^2/sec)	1.81E-03	1.56E-03	2.31E-03	2.31E-03	1.34E-03	1.27E-03	1.34E-03
	Dose (mg)=	5.11E+02	1.53E+05	4.83E+03	2.93E+02	1.30E+03	2.22E+05	1.30E+03
	C outdoor (ug/cm^3)=	2.43E-06	7.30E-04	2.30E-05	1.40E-06	6.21E-06	1.06E-03	6.21E-06
	Fmax (max vapor flux predicted by chemical concentration in soil vapor (ug/cm^2-sec) =	7.30E-05	2.19E-02	6.90E-04	4.19E-05	1.86E-04	3.18E-02	1.86E-04
	Cv,max (iter.)(max allowable chemical concentration in vapor) (ug/L)=	3.07E+03	1.07E+06	2.28E+04	1.38E+03	1.06E+04	1.90E+06	1.06E+04
	Max allowable chemical concentration in vapor (ppmv)(unit conv.)	8.83E+02	1.91E+05	1.09E+04	6.62E+02	2.15E+03	4.47E+05	2.15E+03
	Max allowable chemical concentration in vapor(ppbv)(unit conv.)	8.83E+05	1.91E+08	1.09E+07	6.62E+05	2.15E+06	4.47E+08	2.15E+06
	Maximum site concentration (ppbv)	1.3	1.9	4	4	3.4	0.85	0.92
	Does max site concentration exceed max allowable chemical concentration in vapor (ppbv)?	No	No	No	No	No	No	No
	Cumulative Risk/Hazard							
	Maximum concentration/maximum allowable concentration by SSTL	1.47E-06	9.96E-09	3.67E-07	8.04E-06	1.58E-06	1.90E-09	4.27E-07

Notes:
NC = evaluated as a non carcinogen
C = evaluated as a carcinogen
NA = Not applicable
See ASTM, 1995, for calculations for effective diffusivity, diffusive vapor flux, outdoor air concentration, dose and risk calculations. The maximum allowable vapor concentration was calculated by iteration to achieve the acceptable risk level.
No toxicological information was identified for ethanol (aka ethyl alcohol), 2-propanol (aka isopropyl alcohol), or 4-ethyltoluene; these compounds were therefore exluded from the risk calculations.