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8:43 am, Aug 11, 2010

Alameda County
Environmental Health

August 9, 2010

Jerry Wickham, PG
Alameda County Health Care Services Agency
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Draft Risk Management Plan and Draft Fact Sheet
Carnation Dairy, 1310 14th Street, Oakland, CA
Fuel Leak Case No. RO0000018 and Geotracker Global ID T0600100262

Dear Mr. Wickham:

On behalf of Nestlé USA, Inc. (Nestlé), Environmental Cost Management, Inc. (ECM) has prepared the enclosed draft Risk Management Plan and draft Fact Sheet for the northwestern portion of the property located at 1310 14th Street in Oakland, California (i.e., "the Site").

These submittals are made in response to requests in a letter from the Alameda County Health Care Services (ACEH), dated June 9, 2010. The June 9, 2010 letter acknowledged ECM's submittal of the April 2010 *Corrective Action Plan* (CAP) Report. This letter requests that Nestlé and Hall Equities submit the above referenced documents, along with a draft Deed Restriction, for review by ACEH in support of the proposed institutional controls to be instituted as the final CAP for the Site.

The draft Deed Restriction is currently being jointly developed by Nestlé and Hall Equities, and per an August 9, 2010 email from Jerry Wickham, the deadline for submission of this document has been extended until September 9, 2010. Nestlé and Hall Equities will submit a jointly developed draft Deed Restriction in advance of this revised deadline.

Upon ACEH approval of these documents and the forthcoming Deed Restriction, Nestlé and Hall Equities will submit final, signed copies of the Deed Restriction and Risk Management Plan. In addition, upon your approval of the Fact Sheet, ECM will distribute a finalized copy of the Fact Sheet to the designated neighbors surrounding the Site.

Should you have any questions regarding the enclosed documents, please contact Brent Searcy at (415) 282-1979.

Perjury Statement

I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge.

Brent Searcy, P.E.
Senior Engineer

Enclosure: Draft Risk Management Plan, Draft Fact Sheet

Cc: Ken Cheitlin, Hall Equities Group
Jennifer Costanza, Nestlé USA
Michael Desso, Nestlé USA
Binayak Acharya, ECM
Nestlé USA, File

Report to:

Nestlé USA, Inc.
800 North Brand Boulevard
Glendale, California 91203

DRAFT
Revised Risk Management Plan
1310 14th Street, Oakland, CA

August 9, 2010

Prepared By:

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Binayak Acharya
Program Manager

August 9, 2010
Date

Brent Searcy, P.E.
Senior Engineer

August 9, 2010
Date

CONTENTS

FIGURES

APPENDICES

ACRONYMS and ABBREVIATIONS

AB	Assembly Bill
ACEH	Alameda County Environmental Health
BTEX	benzene, toluene, ethylbenzene, total xylenes
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CAP	*Corrective Action Plan*
CCR	California Code of Regulations
CFR	Code of Federal Regulations
COFS	City of Oakland Fire Services
COPCs	chemicals of potential concern
1,2-DCA	1,2-dichloroethane
HASP	health and safety plan
HVOCs	halogenated volatile organic compounds
IIPP	Injury and Illness Prevention Program
LPH	liquid-phase hydrocarbons
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
ND	non-detect
PCBs	polychlorinated biphenyls
RBCA	risk-based corrective action
RMP	*Risk Management Plan*
RWQCB	California Regional Water Quality Control Board, San Francisco Region
SCM	*Site Conceptual Model*
TPH-d	Total petroleum hydrocarbons in the diesel range
TPH-g	Total petroleum hydrocarbons in the gasoline range
TPH-mo	Total petroleum hydrocarbons in the motor oil range
USEPA	United States Environmental Protection Agency
USTs	underground storage tanks
VOCs	volatile organic compounds

1. INTRODUCTION

On behalf of Nestlé USA, Inc. (Nestlé), Environmental Cost Management, Inc. (ECM) has prepared this *Revised Risk Management Plan* (RMP) for the Site located at 1310 14th Street, Oakland, California (**Figure 1**). **Figure 2** outlines the area for which the restrictions and risk management protocols discussed in this document apply. This RMP responds to requests made in a June 9, 2010 letter from the Alameda County Environmental Health Care Services (ACEH). The June 9, 2010 letter acknowledged ECM's submittal of the April 2010 *Corrective Action Plan* (CAP) *Report*[1] and requested the RMP as part of the recommended final corrective action and institutional controls for the Site. The RMP includes the Deed Restriction filed for the portion of the property formerly operated by Nestlé (**Appendix A**). In addition, potential health risks associated with commercial/industrial occupants at the Site have been documented in the May 18, 2009 *Screening Health Risk Evaluation* and the March 22, 2010 *Sub-slab Soil Gas Sampling and Analysis Report,* included as **Appendix B1** and **B2**, respectively.

This RMP describes the specific risk management measures that will be implemented prior to, during, and after any future development of the Site. It was prepared solely for use within the Site and is not intended for management of risks outside of this area. Although this RMP sets forth the requirements to appropriately manage the chemicals in soil and groundwater, the RMP is not intended to catalog all other legal requirements that may apply to the project or to activities conducted within the Site area.

Current and future owners and lessees, occupants and managers, or contractors delegated or authorized to perform property maintenance or construction are required to comply with the measures identified in the RMP when engaging in the relevant activities discussed. A Deed Restriction for the portion of the property formerly operated by Nestlé (Site) has been recorded on <day> <month> 2010 with the ACEH (**Appendix A**). **Figure 2** shows the deed-restricted portion of the property, referred to as the Site in this RMP report. The Deed Restriction requires Owner and/or Lessee compliance with the RMP measures. Specifically, the Deed Restriction places responsibility for compliance with the Owner and/or Lessee of the Site at the time the activity is conducted, even when such Owner or Lessee has contracted with another party to perform those measures. The term "Owner" or "Owners", as used in this RMP, shall mean those persons (whether individuals, corporations, or other legal entities) who, at such time when activities regulated by this RMP are conducted, hold title to the Site. The term "Lessee" or 'Lessees", as used in this RMP, shall mean those persons who are entitled by ownership, leasehold, license, permit, or other legal relationship with the Owner, to enter and exclusively occupy the Site and to engage in activities that are regulated by this RMP. A former Owner or former Lessee, licensee, permittee, or other former holder of a property or contract right who, at such time when activities regulated by this RMP are conducted, no longer holds an interest in title to a parcel or no longer has a property or contract interest in a parcel, will not be considered an Owner or Lessee for the purposes of this RMP.

The California Environmental Protection Agency (Cal/EPA) has designated ACEH as the "Administering Agency" under Assembly Bill (AB) 2061, in December 1998. As the Administering Agency, ACEH is responsible for overseeing implementation of the CAP recommendations, approval of the necessary institutional control documents (i.e., this RMP and the associated Deed Restriction (**Appendix A**)), and closure requirements of the Site.

The *Screening Health Risk Evaluation* and 2010 *Sub-slab Soil Gas Sampling and Analysis Report* concluded that the chemicals of potential concern (COPCs) observed at the Site do not pose a significant risk to daily site occupants following proposed redevelopment and commercial/industrial land use at the site. Accordingly, additional remediation at the site is not warranted, provided that future development will maintain a surface cap of the soil, exclusive of minor landscape areas, by buildings or paved surfaces. In addition, implementation of risk management practices, as described in this RMP, is recommended to address potential health risks associated with direct exposure of construction workers to chemicals beneath the site during redevelopment. To aid in development and implementation of risk management practices, the risk to construction workers was quantitatively evaluated and is summarized in **Appendix B1** and **B2**.

2. SITE BACKGROUND

2.1. SITE LOCATION

The property is located at 1310 14th Street, Oakland, California. The deed-restricted area is located in the northwest portion of the property (**Figure 1**). The deed-restricted portion of the property is bounded by 16th Street to the north and Mandela Parkway to the west. As of the date of this RMP, an "L" shaped building is present on the Site. The "L" shaped building once housed warehouse and service bay facilities.

The topography slopes gently to the west, toward San Francisco Bay. Land use in the immediate area is primarily light industrial, with some commercial property and residences located east and west of the property.

2.1.1. CLIMATE

Climatic conditions in the region are moderate, with mild, wet winters and warm, dry summers. Representative mean high/low temperatures and wind conditions are presented below:

	January	April	July	October	Annual
Average temperature (degrees F)	52.3	61.5	66.0	65.5	60.9
Average wind speed (mph, long term average)	7.4	9.7	9.7	7.3	8.6
Average wind direction (long term average)	SE	W	NW	W	W
Rainfall (inches)	4.41	0.24	0.00	0.35	14.27

Temperature, rainfall from National Oceanic and Atmospheric Administration for Oakland Museum Station.
Wind data from California Air Resources Board for Oakland International Airport

2.2. SITE HISTORY

Ice cream and packaged milk were once manufactured on the Site. The Site was also used for

the distribution of ice cream and packaged fresh milk by trucks. A maintenance yard for vehicles used in the distribution of dairy products operated at the facility and included underground fuel and waste oil storage tanks.

The original facilities were constructed by American Creamery in 1915. The Carnation Company purchased the property in 1929 and made additions and improvements to the buildings between 1946 and 1973 for dairy product processing and distribution. Nestlé (as Nestlé USA, Inc.) assumed operation of the property following the purchase of Carnation in approximately 1985. Nestlé ceased operations at the property in 1991, and the property, including the Site (northwestern portion of property) was sold to Encinal 14th Street, LLC in July 2000.

2.2.1. ADJACENT LAND USE

Land use surrounding the property/Site is light industrial and residential. Facilities to the north and south of the Site are primarily light industrial. Immediately east of the site are light industrial facilities, with residential land use extending from approximately one block east of the Site to Interstate 980 (I-980). West of the Site is a mixed light industrial and residential area.

ETIC Engineering conducted database searches and door-to-door well surveys for areas surrounding the site in November 1999[2]. No active water supply wells were identified during these efforts. The January 2001 *Comprehensive Site Characterization Report*[3] documents the aforementioned well surveys and database searches.

2.3. SUMMARY OF SITE INVESTIGATIONS AND CURRENT ENVIRONMENTAL CONDITIONS

Following the discovery of hydrocarbons in the subsurface during the December 1988 and January 1989 excavation of underground storage tanks (USTs) at the Site, multiple phases of site characterization and remediation have taken place. The following sections provide an overview of the delineation of COPCs, as well as the various remediation activities undertaken to address impacts at the Site.

2.3.1. SOIL GAS CHARACTERIZATION

Soil gas samples were collected across the Site during three separate studies (August 1999, May 2008, and January 2010) to evaluate the magnitude and extent of volatile organic compounds (VOCs) in shallow soil gas. All soil gas investigations addressed soil vapor conditions following active remediation activities. As directed by ACEH, a focused sub-slab vapor sampling event was conducted in January 2010.

Following the May 2009 submittal of a Draft CAP Report and the *Screening Health Risk Evaluation* (**Appendix B1**), ACEH requested additional subslab sampling to verify the site-specific calculation of exposure risks to on-site commercial workers. Sub-slab soil gas sampling was performed on January 6, 2010 at six locations beneath the existing, unoccupied onsite commercial/industrial building. The results of the subslab sampling were reported in the March 2010 *Sub-slab Soil Gas Sampling and Analysis Report* (**Appendix B2**).

The findings of the sub-slab soil gas data evaluation included:

- No chemical was detected in any sample at a concentration exceeding its cancer-based or noncancer-based screening level.
- The estimated cumulative cancer risk at every sampling location is below the accepted exposure level of 1×10^{-6}, as defined, and endorsed by, relevant state and federal agencies[4].
- The estimated cumulative noncancer hazard index ranges from 0.0094 to 0.12 across the six primary sub-slab soil gas samples, and thus is below the threshold noncancer level of 1.0 at all locations.

These results are consistent with the previous screening-level vapor intrusion evaluation of the building (**Appendix B1**), and confirm the lack of exposure risks to on-site commercial workers posed by residual hydrocarbon impacts currently beneath the Site.

2.3.2. SOIL CHARACTERIZATION

Three separate historical field investigations in 1991, 1999, and 2008 involved subsurface soil sampling and analysis. Soil data gathered after active remediation activities were integrated into the three dimensional model of hydrocarbon impacts presented in the November 2008 *Revised Site Conceptual Model Report* (Revised SCM Report)[5].

The 1991 soil boring investigation data indicated that impacts from total petroleum hydrocarbons in the gasoline range (TPH-g) were mainly limited to the 5 to 15-foot interval below ground surface (bgs). The maximum TPH-g concentration at 5 feet bgs was 2,500 milligrams per kilogram (mg/kg). At 10 feet bgs, the maximum TPH-g concentration was 10,000 mg/kg. By 15 feet bgs, the maximum TPH-g concentration dropped to 1,900 mg/kg, and at 20 feet bgs, the maximum TPH-g level decreased to 260 mg/kg.

The distribution of total petroleum hydrocarbons in the diesel range (TPH-d) followed a pattern similar to that of TPH-g. The maximum TPH-d impact at 5 feet bgs was 470 mg/kg. At 10 feet bgs, the maximum TPH-d concentration increased to 940 mg/kg. By 20 feet bgs, the maximum TPH-d concentration dropped to 23 mg/kg.

Thirteen soil borings were advanced and sampled during the August 1999 soil investigation. The locations of the borings represented subsurface conditions in the area downgradient (NNW) of the UST source areas and assessed impacts beneath the footprint of the L-shaped building on the northwest edge of the property. Low levels (at or below 2.7 micrograms per kilogram [μg/kg]) of 1,2-dichloroethane (1,2-DCA), toluene, ethylbenzene and total xylenes were observed in the 3.5 to 4-foot bgs interval. The maximum TPH-d was 1,200 mg/kg in this interval.

Sporadic concentrations of hydrocarbons and halogenated-VOCs (HVOCs) characterized the soil at the water table (6.5 to 7 feet bgs). Concentrations of 1,2-DCA ranged from below laboratory reporting limits at multiple locations, to 430 µg/kg of 1,2-DCA. Concentrations of TPH-g ranged from 2.25 to 10,100 mg/kg, and TPH-d ranged from 60 to 2,900 mg/kg. Benzene concentrations ranged from 0.07 to 76 mg/kg.

For the May 2008 soil sampling investigation, 15 soil borings were advanced using a 2-inch diameter direct-push Geoprobe® coring method and logged[6]. Soil samples were analyzed for TPH-g, TPH-d, and TPH as motor oil (TPH-mo). Soil samples were also analyzed for 1,2-DCA. Elevated levels of hydrocarbons were detected at borings located to the north and northwest of the former UST locations. TPH-g ranged from non-detect (ND) up to 12,000 mg/kg. TPH-d ranged from ND up to 17,000 mg/kg. TPH-mo ranged from ND up to 13,000 mg/kg. Concentrations of 1,2-DCA were not detected above detection limits at any of the soil boring sampling locations.

2.3.3. GROUNDWATER CHARACTERIZATION

As many as 65 monitoring wells were sampled quarterly and semi-annually to characterize dissolved hydrocarbons and VOCs in groundwater between 1994 and 2004. The number of wells monitored was reduced in 2004, consistent with ACEH approval in November 2002. Between December 2002 and late 2004, 11 monitoring wells were sampled. Grab groundwater samples were collected during the May 2008 soil boring investigation. Cumulative groundwater monitoring results (1993 through 2008) are provided in the November 2008 Revised SCM Report[7]

Historical groundwater results indicate that TPH-g and benzene detections above reportable limits are generally limited to the area immediately downgradient (NNW) of the former USTs. Groundwater monitoring data do not indicate any predominant or persistent source of HVOCs.

ACEH had also requested delineation of the potential presence of polychlorinated biphenyls (PCBs) in the subsurface at the Site[8], which was completed as part of the May 2008 soil investigation discussed in Section 2.3.2. Groundwater samples were collected during this investigation and analyzed for PCBs at eight boring locations. No PCBs were detected[9]. The absence of PCB detections in groundwater confirms that PCBs are not present at the Site.

Liquid phase hydrocarbons (LPH) were first observed at the Site in the area of the USTs and maintenance bays during UST removal in 1988. Following the cessation of regular LPH monitoring in August 2001, semi-annual groundwater sampling was continued at 11 on- and off-site wells from November 2002 through November 2004. LPH was not observed in any of the 11 monitoring wells monitored as part of the semi-annual sampling events.

2.4. FUTURE SITE DEVELOPMENT

As of July 2010, specific future development and/or construction plans for this site are unknown. This document outlines the risk management procedures which must be followed during any future development of the Site. This RMP provides the specific protocols to be followed in order to mitigate risks to human health and the environment that were identified and documented in the May 18, 2009 *Screening Health Risk Evaluation* and the March 22, 2010 *Sub-slab Soil Gas Sampling and Analysis Report* (**Appendix B1** and **B2**, respectively).

Sections 5 and 6 of this report provide the risk management protocols which must be followed during and after any future site development activities. **Appendices B1** and **B2** present the results of risk analysis efforts performed specifically for the purposes of developing a health and safety plan for protection of construction workers who may be involved in any future development activities at the site.

2.5. EXISTING DEED RESTRICTION

The entire property was sold by Nestlé to Encinal 14th Street, LLC in July 2000. Prior to the sale of the property, Covenants and Environmental Restrictions were developed for the Site area (northwest portion) of the property. The restrictions were reviewed by ACEH and the RWQCB, and were signed by the City of Oakland Fire Services (COFS) in June 2000. These restrictions were recorded against the deed for the former Nestlé property on June 12, 2000. Subsequent to the submittal of the April 2010 Revised CAP Report for the site, the ACEH requested that, as part of implementation of the Revised CAP, a new Deed Restriction, signed by the current property owner (to Encinal 14th Street, LLC) and ACEH, should be filed in order to adhere to current ACEH requirements[10]. A complete copy of the Deed Restriction is included as **Appendix A**.

3. SUMMARY OF HEALTH RISKS

Risk assessments were performed in support of the April 2010 Revised CAP Report for the site in order to document any human health risks associated with residual comprehensive site characterization and the low risk designation requirement for the Site (**Appendix B1** and **B2**). These risk analyses focus on potential health risks to construction workers and future daily occupants at and in the vicinity of the Site.

The Revised SCM Report provides a basis for the characterization of residual COCs used in the assessment of the fate and transport, and potential exposure scenarios, considered in the *Screening Health Risk Evaluation* and the *Sub-slab Soil Gas Sampling and Analysis Report* (**Appendix B1** and **B2**, respectively). As indicated in these risk assessment documents, complete exposure pathways associated with daily onsite and offsite occupants include:

- Ingestion, inhalation, and dermal contact with surface soils (onsite industrial/commercial workers);
- Inhalation of volatile emissions and/or particulates from subsurface soils and groundwater to indoor air (onsite industrial/commercial workers);
- Inhalation of volatile emissions and/or particulates from subsurface soils and groundwater to outdoor air (onsite industrial/commercial workers);
- Inhalation of volatile emissions and/or particulates from groundwater to indoor air (offsite residents); and
- Inhalation of volatile emissions and/or particulates from groundwater to outdoor air (offsite residents).

The risk assessment documents do not include an evaluation of health risks to potential intermittent receptors such as site visitors and/or trespassers; however, the risks to daily site occupants may be used as a conservative estimate of risks to intermittent receptors.

Details of the risk assessment analyses are documented in **Appendices B1** and **B2**. Conclusions of the risk-based corrective action (RBCA) analyses for onsite and offsite receptors include:

- Risks/hazards associated with direct exposure of daily site (commercial/industrial) occupants to observed levels of chemicals in surface soils are protective of United States Environmental Protection Agency (USEPA)-defined target risk/hazard levels;
- Risks/hazards associated with onsite (commercial/industrial) indoor and outdoor air inhalation of volatiles detected in shallow soil vapor samples are protective of USEPA-defined target risk/hazard levels;
- Risks/hazards associated with offsite (residential) indoor and outdoor air inhalation of volatiles detected in groundwater at offsite locations are protective of USEPA-defined target risk/hazard levels; and
- Risks/hazards associated with onsite outdoor intrusive construction workers are above the accepted exposure levels as defined, and endorsed by, relevant state and federal agencies[11]. However, this cancer risk and noncancer hazard were attributable entirely to assumed dermal contact with COPCs in groundwater at the bottom of a construction trench, and do not account for personal protective equipment that intrusive construction workers would be required to use. Therefore, to protect construction workers from potentially hazardous exposure levels at the Site, the recommendations in this RMP document should be implemented.

4. RISK MANAGEMENT MEASURES PRIOR TO SITE DEVELOPMENT

Potential exposure prior to development of the Site is limited to intermittent visitors or trespassers. As indicated in Section 3, the risk to intermittent receptors is considered insignificant. Moreover, due to the presence of a fence around the property and a paved surface throughout much of the property, additional risk management measures prior to development of the Site are not warranted.

5. RISK MANAGEMENT MEASURES DURING SITE DEVELOPMENT

The Deed Restriction for the Site indicates that no owners or occupants of the Site or any portion thereof shall conduct any excavation work on the Site, unless expressly permitted in writing by the ACEH. Should excavation be permitted as part of redevelopment, the primary exposure to chemicals at the Site will be limited to that associated with construction workers. As indicated in Section 3, risk management measures are recommended for protection of construction workers. To this end, risk management measures were developed to provide adequate protection to human health for onsite construction workers during development of the Site.

Development activities at the facilities may include various site preparation activities such as, but not limited to, excavation, stockpiling, trenching, site grading, backfilling, and dewatering that may disturb the native soils and/or groundwater beneath the Site. Specifically, potential events or activities associated with development of the Site that may result in potential health impacts to onsite construction workers during development include:

- Dust generation associated with soil excavation and trenching, grading, loading activities, backfilling, movement of construction and transportation equipment, and fugitive dust generation from winds traversing an exposed soil stockpile; and
- Potential contact with subsurface chemicals during trenching and excavation.

The risk management measures that will control potential impacts associated with each of these activities are described below. Management measures that are recommended to control potential impacts on construction workers, contractors, and short-term intrusive workers who may be engaged in limited excavation activities, such as utility repair, are also described below.

5.1. SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS AND SAFETY PLAN

The construction contractor shall assume full responsibility and liability for the compliance with provisions of the Work Hours and Safety Standard Act (40 U.S.C. 327 et seq.). The construction contractor shall comply with all applicable safety regulations and other requirements, including, but not limited to, the following:

- Code of Federal Regulations (CFR), Title 29-Labor
- State of California, California Code of Regulations (CCR), Industrial Relations
- Medical Surveillance Programs (e.g., OSHA, 29 CFR 1200)
- Injury and Illness Prevention Programs (e.g., SB 198, 8 CCR, CAL/OSHA, GISO 3203 Section 5192, and CSO 1509/GISO 3203)
- Implementation of mitigation measures under California Environmental Quality Act (CEQA), if any
- The Construction Standard (29 CFR 1926)
- Workers' Right to Know (29 CFR 1910.120)
- Section 6360-99 of the California Labor Code (Hazard Communication)

During construction and site development activities, workers that may directly contact contaminated soil or groundwater at the Site must perform their activities in accordance with a hazardous operations site-specific health and safety plan (HASP). The construction contractor will be responsible for development and implementation of the HASP in compliance with all applicable federal, state, and local regulations and requirements. The HASP shall be prepared by a Certified Industrial Hygienist. If construction activities involve the possibility of direct worker contact with contaminated soil or groundwater at the Site, the construction contractor will submit the HASP to the RWQCB or ACEH for review. Preparation of a HASP will be required for, but not limited to, site preparation work including grading, utility installation, foundation construction, service pit construction, and other activities where workers might directly contact impacted soil or groundwater beneath the Site.

5.2. CONSTRUCTION IMPACT MITIGATION MEASURES

Measures must also be implemented to mitigate potential health impacts on construction workers, should they be exposed directly to chemicals in soil and groundwater underlying the

Site. Potential exposure pathways associated with onsite construction workers include inhalation, incidental ingestion, and dermal contact with chemicals in soils and groundwater.

Specifically, measures that must be implemented to mitigate potential impacts during construction include the following:

- Each contractor will prepare and implement a site-specific HASP to address the potential exposure to contaminated soils and groundwater during construction;
- Dust control through spraying of water and other techniques to minimize mobility of impacted soils toward offsite locations; and
- Minimize soil and groundwater contact by onsite construction worker.

Details of these mitigation measures, except the site-specific HASP, are described below.

5.2.1. DUST CONTROL

Dust controls must be implemented to prevent offsite dispersion and accumulation of impacted soils and to comply with applicable regulations pertaining to air quality and nuisance control. Potential construction activities that could generate dust and warrant risk management measures include: (1) excavation and stockpile control; (2) onsite construction vehicle traffic, and (3) windblown soil.

Alameda County may require monitoring of dust generation during site construction at the Site. Results of the monitoring will be used by the construction contractor for determining the needs and appropriate dust control practices in accordance with the regulations for excavating and restoring streets in Alameda County.

Dust generation will be minimized by all appropriate measures, which may include, but not be limited to, the following:

- Wetting of surface soils and spoil piles during excavation, trenching, compaction, and site grading and paving;
- Control of excavation techniques to minimize dust generation such as minimizing drop distances; and
- Covering of stockpiles, if present, with visqueen or other suitable membrane covers.

Additional measures, if required, may be utilized at the discretion of the construction contractor.

5.2.2. MINIMIZING SOIL AND GROUNDWATER CONTACT BY CONSTRUCTION WORKER

Existing data indicate the subsurface presence of chemicals in unsaturated soils, saturated soils, and groundwater beneath the Site. Shallow groundwater beneath the Site occurs at depths ranging from 5 to 10 feet bgs. Details of the hydrogeological characterization are presented in the Revised SCM Report[12].

Future construction work at the site may involve excavation and/or direct contact with chemicals above and below the water table. To mitigate risks associated with this exposure, the construction contractor shall develop and implement a site-specific HASP. Examples of health and safety measures are the use of protective clothing, protective gloves and boots, and

suitable respirators with cartridges during construction activities.

6. RISK MANAGEMENT MEASURES AFTER SITE DEVELOPMENT

The post-construction portion of this RMP addresses the precautions that must be undertaken to mitigate the long-term health risks associated with the Site after all redevelopment activities are complete. Any future reuse of the Site involving disturbance of soil, pavements, or building foundations must be accomplished in a manner consistent with the objectives of this RMP.

Components of the post-construction portion of this RMP include the following:

- Prevention of the exposure of daily site occupants or visitors to impacted soil by maintaining cover materials in appropriate conditions;
- Establishment of protocols to protect onsite workers engaged in subsurface excavation activities such as buried utility repair, work on buried foundations, or pavement requiring exposure to soil and/or groundwater;
- Prevention of use of groundwater beneath the facility;
- Agency (ACEH and RWQCB) notification on change in property use.

6.1. COVERING OF THE SITE

As indicated in the Deed Restriction (**Appendix A**) for the former Nestlé property, all uses and development of the Site shall maintain a surface cap of the soil, exclusive of minor landscape areas, by buildings or paved surfaces. The Maintenance and Operations Facility Manager or their designated representative must annually conduct a visual inspection of the cover to ensure that the cover materials remain in adequate shape. Damage to the integrity of the cover materials, such as major cracks, must be promptly repaired.

Upon completion of the inspection and any necessary repairs, the Maintenance and Operations Facility Manager or their designated representative will prepare a report documenting the inspection and repairs. The report will contain, at a minimum, the following information:

- Date of inspection
- Personnel conducting the inspection
- Results of the inspection
- Repairs completed to maintain the integrity of the cover

Reports must be signed by the Maintenance and Operations Facility Manager or their designated representative. Reports must be filed by the site occupant at the Maintenance and Operations Facility or similar location at the Site. The reports will be available for review by the ACEH, and RWQCB.

6.2. PROTOCOLS FOR FUTURE SUBSURFACE DEVELOPMENT

If excavation is permitted by the ACEH, health and safety procedures must be followed, as previously described, for all individuals engaged in subsurface excavation activities in which

covered soil and groundwater may be exposed. The likely scenarios are buried utility repairs, work on buried foundations, or repairs and alterations to pavements. At a minimum, a site-specific HASP must be prepared and employed in concert with any such work.

If minor soil disturbance is undertaken in the future, the work must follow the guidelines presented herein. Any impacted soil subject to excavation and brought to the surface by grading, excavation, trenching, or backfilling shall be managed in accordance with all applicable provisions of local, state, and federal laws. Excavated soil may be reused as backfill in the excavation area, provided that the excavation will be properly covered with asphalt, concrete, or clean material. Excess material must be disposed of offsite at an appropriate waste facility.

If future activities at the Site are planned involving a significant reduction in the extent or effectiveness of the cap over the soil, then an addendum to this RMP must be prepared and submitted to the ACEH and RWQCB.

6.3. USE OF GROUNDWATER

As indicated in the Deed Restriction (**Appendix A**) for the former Nestlé property, no owner or occupants of the Site shall drill, bore, otherwise construct, or use a well for the purpose of extracting groundwater for any use, including, but not limited to, domestic, potable, or industrial uses, unless expressly permitted in writing by the ACEH and RWQCB.

6.4. AGENCY NOTIFICATION ON CHANGE OF PROPERTY USE

As indicated in the Deed Restriction (**Appendix A**) for the former Nestlé property, land use at the Site will be restricted to industrial, commercial, or office space. Use of the Site as a residence for human habitation, hospital, school for persons under 21 years of age, and/or day care center is also prohibited by the Deed Restriction (**Appendix A**).

7. ENDNOTES

[1] Environmental Cost Management (ECM, Inc.). 2008 Corrective Action Plan (CAP) Report Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California. ECM, Costa Mesa, California. April.

[2] ETIC (ETIC Engineering, Inc.). 2001. Comprehensive Site Characterization Report, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California. ETIC, Pleasant Hill, California. January.

[3] ETIC (ETIC Engineering, Inc.). 2001. Comprehensive Site Characterization Report, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California. ETIC, Pleasant Hill, California. January

[4] United States Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Interim Final. Office of Emergency and Remedial Response. December.

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[9] Environmental Cost Management (ECM, Inc.). 2008. Revised Site Conceptual Model Report, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California. ECM, Costa Mesa, California. November.

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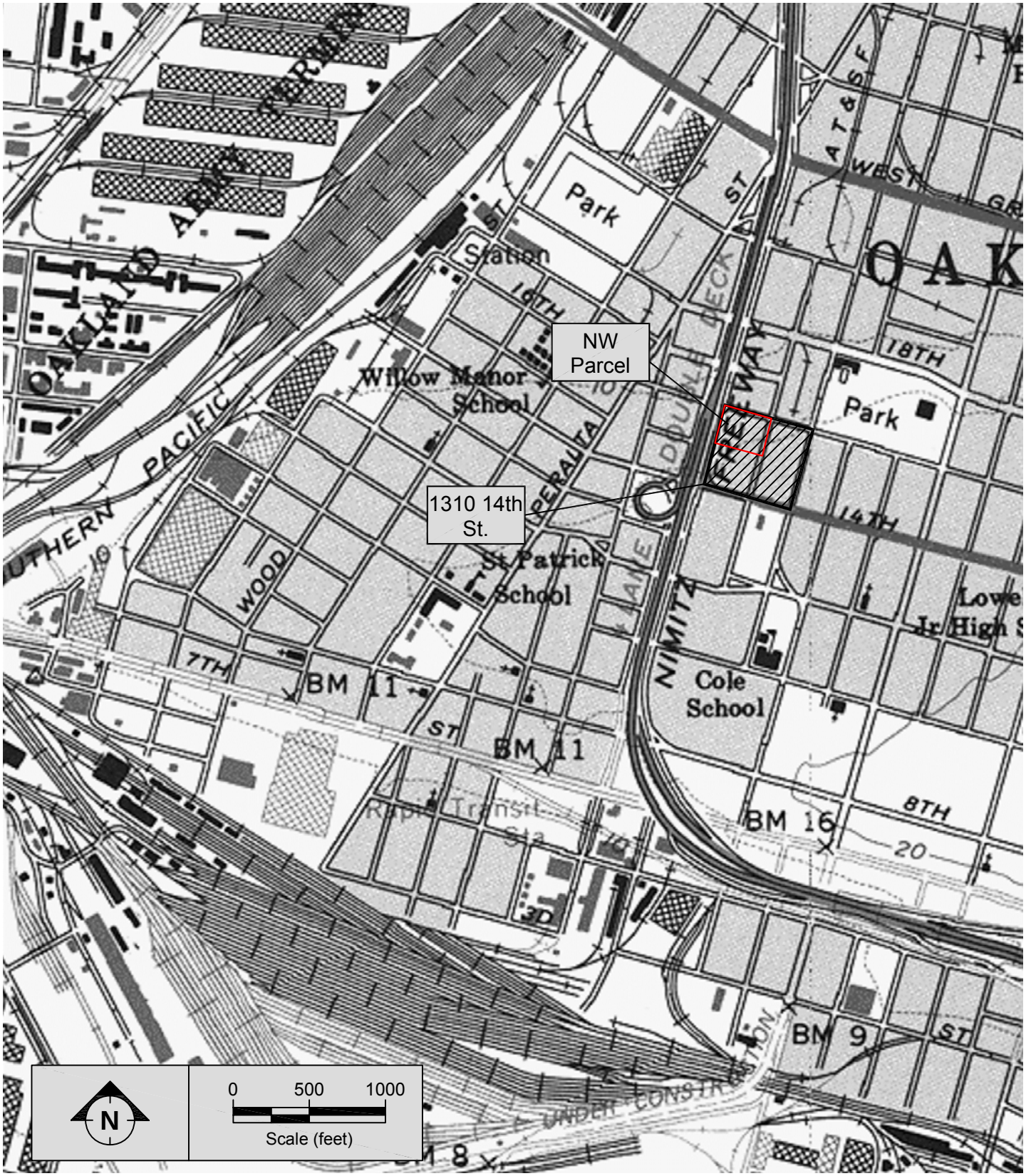
FIGURES



Project: Nestle-Oakland
Proj. Manager: B. Acharya
Date drafted: 3/22/10
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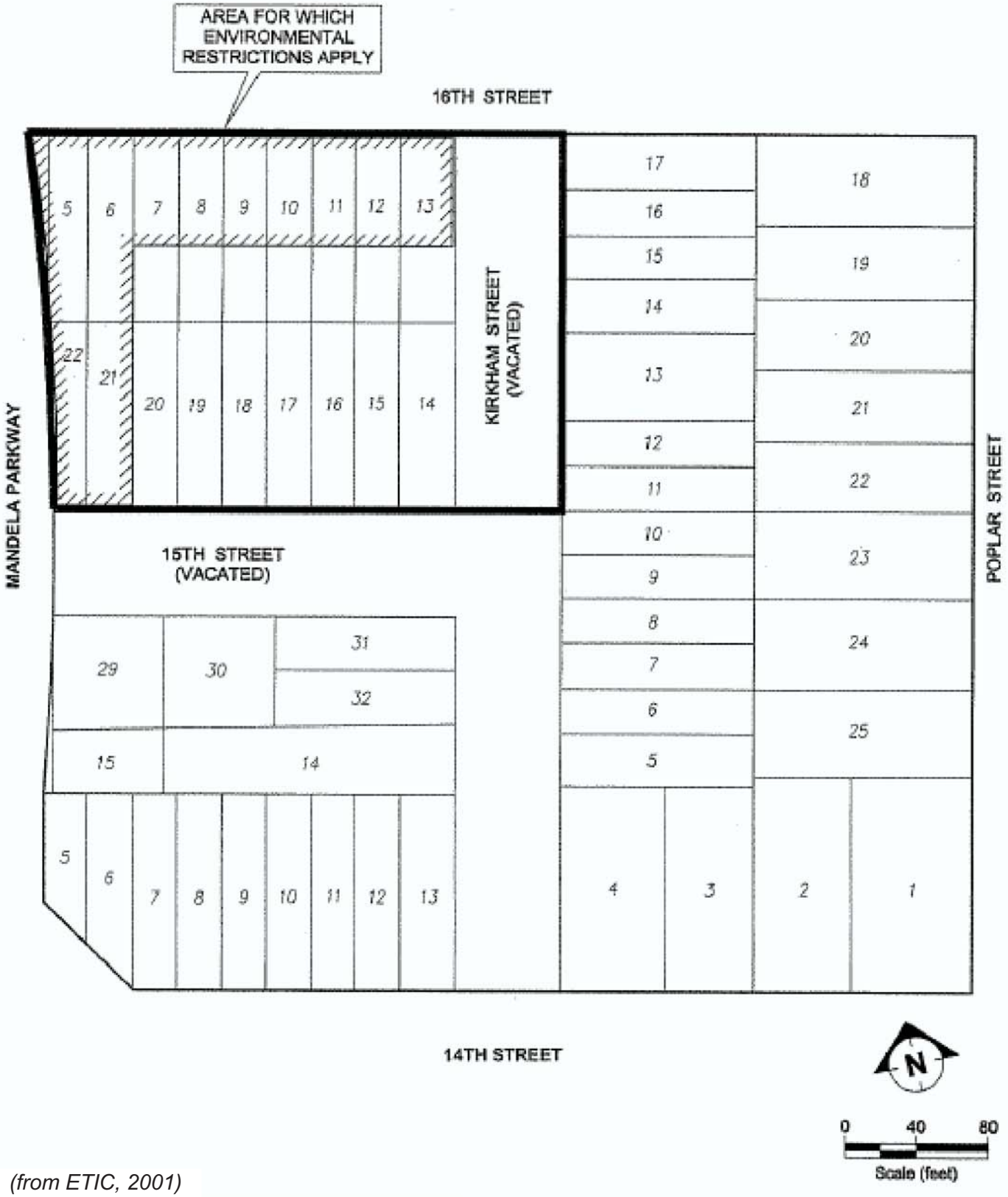
Site Location
Former Nestle Oakland Facility
1310 14th Street, Oakland, CA-94607

Figure
1



(from ETIC, 2001)

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Deed Restricted Area

Risk Management Plan
August 2010

Figure

2

APPENDICES

Appendix A: Covenant and Environmental Restriction (Deed Restriction)
Appendix B1: Screening Health Risk Evaluation
Appendix B2:Sub-slab Soil Gas Sampling and Analysis Report

Appendix A: Covenant and Environmental Restriction (Deed Restriction)

(in development)

Appendix B1: Screening Health Risk Evaluation

IRIS ENVIRONMENTAL

Via Email and FTP

May 18, 2009

Jerry Wickham
Senior Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: Screening Health Risk Evaluation
Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Dear Mr. Wickham:

On behalf of Nestlé USA, Inc., Iris Environmental is pleased to submit this Screening Health Risk Evaluation for the former Nestlé USA, Inc. facility located at 1310 14th Street in Oakland, California (the former Carnation Dairy).

We declare, under penalty of perjury, that the information and recommendations contained in the attached report are true and correct to the best of our knowledge.

Please don't hesitate to call us at (510) 834-4747 if you have any questions regarding this report.

Sincerely,

IRIS ENVIRONMENTAL

Robert Balas
Principal, Air Sciences

Gregory S. Noblet, P.E.
Senior Manager

Attachments: Screening Health Risk Evaluation, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California

SCREENING HEALTH RISK EVALUATION

Former Nestlé USA, Inc. Facility

1310 14th Street, Oakland, California

May 18, 2009

Prepared for:

Nestlé USA, Inc.
800 North Brand Boulevard
Glendale, California 91203

Prepared by:

IRIS ENVIRONMENTAL
1438 Webster Street, Suite 302
Oakland, California 94612
(510) 834-4747

EXECUTIVE SUMMARY

This report describes the methodology and results of a screening level human health risk evaluation for the northwestern portion of the commercial property located at 1310 14th Street in Oakland, California. The potential health impacts to onsite and offsite populations, associated with exposures to site-related chemicals, have been quantified. Potentially exposed populations which have been considered in this evaluation are onsite indoor commercial/industrial workers who are assumed to work full-time in the onsite commercial building for 25 years, onsite outdoor intrusive construction workers who are assumed to work onsite for 4 weeks, and offsite residents who are assumed to live near the site for 30 years. Estimated potential cancer risks for residential and commercial receptor populations are compared to the typical points of departure, with respect to risk management, of one in a million (1×10^{-6}) and 10 in a million (1×10^{-5}), respectively. Estimated potential noncancer hazard indices for all receptor populations are compared to the threshold noncancer hazard index of 1.

The main conclusions of the screening health risk evaluation are as follows.

- The estimated potential cancer risk for onsite indoor commercial/industrial workers is 8.0×10^{-6}. The estimated potential noncancer hazard index for onsite indoor commercial/industrial workers is 0.051. Both the estimated cancer risk and the noncancer hazard index are below levels of concern.
- The estimated potential cancer risk for onsite outdoor intrusive construction workers is 9.8×10^{-5}. The estimated potential noncancer hazard index for onsite outdoor intrusive construction workers is 21. Both the estimated cancer risk and the noncancer hazard index are above levels of concern. However, this cancer risk and noncancer hazard are attributable entirely to assumed dermal contact with COPCs in groundwater at the bottom of a construction trench, and do not account for personal protective equipment that intrusive construction workers would be required to use. Actual exposures after implementation of a site-specific Environmental Health and Safety Plan are highly likely to much lower than estimated here, and the actual cancer risk and hazard are likely to be below levels of concern.
- The estimated potential cancer risk for offsite residents is 4.1×10^{-7}. The estimated noncancer hazard index for offsite residents is 0.0040. Both the estimated cancer risk and the noncancer hazard index are below levels of concern.

The human health risk evaluation presented in this report is a screening-level evaluation that is based on a combination of conservative assumptions – regarding exposure point concentrations (including vapor intrusion modeling assumptions), exposure assumptions, toxicological data, and summation of health effects across chemicals and exposure routes – and therefore it is likely that actual health risks to exposed populations would be lower, or significantly lower, than those estimated in this analysis.

TABLE OF CONTENTS

Tables

Figures

1.0 INTRODUCTION

This report describes the methodology and results of a screening level human health risk evaluation for the northwestern portion of the commercial property located at 1310 14th Street in Oakland, California (the site). The site is the former location of the Carnation Dairy. Historical operations at the site are known to have resulted in release of petroleum hydrocarbons to soil and groundwater. Remedial activities have resulted in the removal of hydrocarbon product and a reduction in hydrocarbon concentrations in site soil, soil gas, and groundwater, however residual concentrations of hydrocarbons remain in these site media, as documented by a recent May 2008 site investigation. The purpose of this screening level human health risk evaluation is to conservatively estimate the potential health impacts to onsite and offsite populations, associated with exposures to site-related chemicals.

2.0 SITE DESCRIPTION

2.1 Site History

The 1310 14th Street site (see Figure 1) was formerly occupied by the Carnation Dairy. The primary activities conducted at the site were the manufacturing and distribution of ice cream and packaged milk. Delivery trucks were fueled and maintained onsite; the fuel storage and dispensing system was located in the northwest portion of the site, and consisted of underground storage tanks and associated underground piping. These activities were conducted at the site until 1988. The underground storage tanks and associated piping are now known to have leaked petroleum products into site soils, resulting in petroleum contamination of subsurface soils, a layer of petroleum product floating on the groundwater table, and dissolved petroleum hydrocarbons in site groundwater (ETIC, 2001a). These impacts have been partially addressed by various remedial activities, as described below.

2.2 Remedial Activities

Five underground storage tanks and associated underground piping were removed from the site between December 1988 and January 1989, including: two 12,000-gallon diesel tanks, two 10,000-gallon gasoline tanks, and one 1,000-gallon used oil tank. At that time, 1,200 cubic yards of petroleum hydrocarbon-impacted soil were excavated, treated onsite, and replaced into the excavation. Noted at the time of this removal action was the presence of petroleum hydrocarbons in the soil and floating on the groundwater table outside of the excavation area (ETIC, 2001a).

Various site investigations and remedial activities have been conducted at the site since the initial underground storage tank excavations. Remedial activities have included the following (COFS, 2000; ETIC, 2001a).

- Approximately 1.5 million gallons of groundwater were extracted from the subsurface following removal of the underground storage tanks.

- Product skimming was conducted between January and March 1989. Approximately 1,800 gallons of liquid phase hydrocarbons were removed from the subsurface.
- A soil vapor extraction system was operated from January 1994 to February 1995. An estimated 5,200 gallons of hydrocarbon equivalent were removed from the subsurface.
- A multi-phase extraction system was operated from August 1997 through June 2000. A total of 10,875 pounds of hydrocarbons were removed during this period.

Current site conditions have been characterized through soil, soil gas, and groundwater sampling conducted in May of 2008, as described below.

2.3 Site Investigations

Impacts to site soil, groundwater, and soil gas, associated with leaks of petroleum hydrocarbons from underground storage tanks and piping, have been documented in several site investigations performed since 1991. Soil gas investigations were performed in 1999 and in May of 2008. Soil investigations were performed at the time of underground storage tank excavation in 1991, in 1999, and most recently in May of 2008. Groundwater monitoring was performed on a regular basis from 1993 to 2004 and in May of 2008.

As noted in the *Supplemental Soil, Soil Gas, and Groundwater Investigation Report* (ECM, 2008a), components of the May 2008 site investigation consisted of

- soil sampling for total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) at five locations (SB-16 through SB-20), at various depths, to provide current characterization of residual hydrocarbon impacts in the area downgradient from the former underground storage tanks;
- soil sampling for TPH and VOCs at seven locations (SB-21 through SB-27), at various depths, to provide delineation of hydrocarbon impacts in areas of the site which had not been thoroughly characterized;
- soil sampling for polychlorinated biphenyls (PCBs) at seven locations (PCB-1 through PCB-7), at various depths, to document the presence or absence of PCBs at the site;
- soil gas sampling for TPH and VOCs at 12 locations (SB-16 through SB-27), including seven locations in the area downgradient from the former underground storage tanks (SB-20 through SB-27), at a depth of 5 feet, to provide a complete set of soil gas data for use in evaluating vapor intrusion; and
- grab groundwater sampling for TPH and VOCs at 11 locations (SB-16 through SB-27 exclusive of SB-23).

The results of all previous site investigations, as summarized in Table 1a (1999 soil gas data), Table 1b (2008 soil gas data), Table 2 (soil TPH and VOC data), Table 3 (soil PCB

data), and Table 4 (groundwater data) of the *Revised Site Conceptual Model Report* (ECM, 2008b), are provided in Appendix A.

In addition to the investigations performed to characterize impacts to site soil, soil gas, and groundwater, noted above, a site investigation was conducted in January 2009 to characterize site-specific soil properties, specifically to support transport modeling (see Sections 4.5.1 and 4.5.2). The number and location of soil properties samples were determined by the project geologist, in order to ensure that the soil at the site is well characterized. The soil properties data collected during this investigation are documented in Figure 2.

3.0 CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPCs) for the screening-level human health risk evaluation are defined for each of three impacted site media: soil gas, soil, and groundwater. In general, any chemical that has been detected above the laboratory reporting limit in any sample from any site investigation is designated as a COPC in that medium. The COPCs in soil gas, soil, and groundwater are identified below.

3.1 Soil Gas

As discussed above, site soil gas has been characterized by investigations conducted in 1999 and 2008. The soil gas data from the 2008 investigation are considered to be generally more appropriate for evaluation of future vapor transport into the onsite commercial building, for one primary reason: the data collected in 2008 are likely more representative of current and future conditions than the data collected in 1999, particularly since remedial activities were conducted after 1999 to remove product from the subsurface. As shown in the historical soil gas data summaries presented in Appendix A, VOCs were generally detected at higher concentrations in 1999 (ECM Table 1a) than in 2008 (ECM Table 1b). Also of note, the 2008 soil gas data were collected at a depth of 5 feet below ground surface (bgs), whereas the 1999 soil gas data were collected at 3 feet bgs.

Current DTSC soil gas sampling guidance (Cal/EPA, 2005b) states that, "soil gas samples should not be collected depths shallower than 5 feet in order to minimize barometric pumping effects." That the 1999 soil gas samples were collected at depths shallower than 5 feet provides a secondary rationale for favoring the 2008 data. However, the 1999 dataset includes detections of 1,3-butadiene, a potentially significant carcinogen which was not sampled for in 2008. Therefore, to be comprehensive, both the 1999 and the 2008 soil gas data are used to characterize COPCs in soil gas for this screening level health risk evaluation. The COPCs in soil gas are defined as those 38 VOCs which were detected above their respective laboratory reporting limit in at least one soil gas sample from either the 1999 or 2008 soil gas investigation:

- acetone;
- benzene;
- 1,3-butadiene;

- 2-butanone (methyl ethyl ketone);
- carbon disulfide;
- chlorobenzene;
- chloroform;
- chloromethane (methyl chloride);
- cyclohexane;
- 1,2-dichlorobenzene;
- 1,3-dichlorobenzene;
- 1,4-dichlorobenzene;
- dichlorodifluoromethane (Freon 12);
- 1,1-dichloroethane;
- 1,2-dichloroethane;
- 1,1-dichloroethene (1,1-DCE);
- *cis*-1,2-dichloroethene (*cis*-1,2-DCE);
- 1,4-dioxane;
- ethanol;
- ethylbenzene;
- 4-ethyltoluene;
- heptane;
- hexane;
- methyl tertiary butyl ether (MTBE);
- methylene chloride;
- 4-methyl-2-pentanone (methyl isobutyl ketone);
- 2-propanol;
- styrene;
- tetrachloroethene (PCE);
- tetrahydrofuran;
- toluene;
- 1,1,1-trichloroethane;
- trichloroethene (TCE);
- trichlorofluoromethane (Freon 11);
- 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113);
- 1,2,4-trimethylbenzene;

- 1,3,5-trimethylbenzene; and
- xylenes.

The derivation of representative concentrations of these COPCs in soil gas is described in Section 4.5 below.

3.2 Soil

As discussed above, site soils have been characterized by several investigations conducted since 1991. Results of these soil investigations are included in Appendix A. The COPCs in soil for this screening risk evaluation are defined as those ten VOCs which have been detected above their respective laboratory reporting limit in at least one site soil sample from any investigation:

- benzene;
- chlorobenzene;
- 1,2-dichlorobenzene;
- 1,3-dichlorobenzene;
- 1,4-dichlorobenzene;
- 1,2-dichloroethane;
- ethylbenzene;
- methyl tertiary butyl ether (MTBE);
- toluene; and,
- xylenes.

The derivation of representative concentrations of these COPCs in soil is described in Section 4.5 below.

3.3 Groundwater

Groundwater monitoring has been performed at the site since 1993. Results of these groundwater investigations are included in Appendix A. The COPCs in groundwater for this screening risk evaluation are defined as those 20 VOCs which have been detected above their respective laboratory reporting limit in at least one site groundwater sample from any investigation or sampling event:

- benzene;
- bromodichloromethane;
- chlorobenzene;
- chloroethane (ethyl chloride);
- chloroform;
- chloromethane (methyl chloride);

- 1,2-dichlorobenzene;
- dichlorodifluoromethane (Freon 12);
- 1,1-dichloroethane;
- 1,2-dichloroethane;
- 1,1-dichloroethene (1,1-DCE);
- *cis*-1,2-dichloroethene (*cis*-1,2-DCE);
- ethylbenzene;
- methyl tertiary butyl ether (MTBE);
- methylene chloride;
- 1,1,2,2-tetrachloroethane;
- toluene;
- 1,1,1-trichloroethane;
- trichloroethene (TCE); and,
- xylenes.

The derivation of representative exposure point concentrations of these COPCs in groundwater is described in Section 4.5 below.

4.0 EXPOSURE ASSESSMENT

The purpose of exposure assessment is to estimate the type and magnitude of exposures to the chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information (see Section 5) to characterize potential risks (see Section 6).

4.1 Physical Setting

The 1310 14th Street property is located in West Oakland, approximately 2 miles from San Francisco Bay. The deed-restricted portion of the 1310 14th Street property (the site) is approximately 1.3 acres in size. The site contains one existing unoccupied L-shaped building of approximately 29,000 square feet which was formerly used for maintenance of delivery trucks. The site is relatively flat, and is covered with concrete and asphalt pavement in addition to the large building. There are no onsite surface water bodies. Groundwater has been historically detected at the site at depths ranging from 5 to 12 feet. The site is surrounded by a mix of light industrial, commercial, and residential land uses.

4.2 Sources of Contamination

As noted above, the underground storage tanks and associated piping which comprised the fuel storage and distribution system are known to have leaked gasoline, diesel fuel, and waste oil into the subsurface, resulting in hydrocarbon impacts to soil and groundwater and a layer of hydrocarbon product floating on the groundwater table. The

various remedial activities performed at the site have apparently been successful in extracting the free-phase hydrocarbons, and in reducing hydrocarbon concentrations in soil and groundwater.

4.3 Potential Transport Mechanisms

As noted above, the primary impacted media at the site are soil and groundwater. Direct exposures to impacted site soil and groundwater are evaluated for intrusive onsite construction workers, as described below in Section 4.4. Described in this section are the transport pathways by which COPCs in site soil and groundwater may migrate to other media, where exposures may also occur.

Volatilization of chemicals from soil and groundwater has resulted in impacts to soil gas in the vadose (unsaturated) soil zone above the groundwater table. Given the presence of volatile COPCs in site soil, groundwater, and soil gas, there are several transport mechanisms whereby COPCs could potentially migrate to another medium. These potential transport mechanisms are evaluated below. Transport pathways which are determined to be complete and are included in the screening health risk evaluation are shown in the conceptual site model depicted in Figure 3.

4.3.1 Particulate Emission into Outdoor Air

This transport pathway comprises the release of particulate matter (*i.e.*, dust) from the ground surface to ambient air, either by wind erosion or by mechanical disturbance. The dust-inhalation pathway is evaluated when there are non-volatile chemicals present in site soils; the non-volatile chemicals may be adhered to the dust which is emitted from soil into ambient air. Based on the site characterization, however, it appears that COPCs in site media are primarily volatile, and thus would generally be emitted into ambient air in the vapor phase, not the particulate phase. Further, the site is essentially capped with pavement and the existing commercial building, and the site deed restriction (COFS, 2000) and Risk Management Plan (ETIC, 2001b) require that future site development maintains a surface cap of site soil, exclusive of minor landscaped areas, by buildings or pavement. Because site soils are capped, the potential for dust emissions is very low. Therefore, based on the volatile nature of identified site-related COPCs and the presence of the cap, the inhalation of respirable particulate matter (*i.e.*, dust) is not included in this screening level health risk evaluation.

4.3.2 Vapor Intrusion from Soil Gas into Indoor Air

The conceptual site model (see Figure 3) assumes that volatile COPCs which are present in the subsurface may migrate upwards via diffusion through the vadose (unsaturated) soil zone, and be transported by advection through cracks, conduits, or seams in the building foundation and into the indoor air space of the onsite building (a transport phenomenon known as “vapor intrusion”), where building occupants may be exposed to the COPCs via the inhalation route.

4.3.3 Volatilization from Soil Gas to Outdoor Air

The conceptual site model (see Figure 3) assumes that volatile COPCs which are present in the subsurface may migrate upwards via diffusion through the vadose soil zone and be emitted from the ground surface into ambient air, where outdoor workers may be exposed to the COPCs via the inhalation route.

4.3.4 Advective Transport to Offsite Locations

The conceptual site model (see Figure 3) assumes that, once volatile COPCs have been emitted from the ground surface into onsite outdoor air (see Section 4.3.2 above), they may be transported downwind to offsite locations. As described below, the offsite populations which are evaluated in this screening risk evaluation are child and adult residents. Thus, the conceptual site model assumes the advective transport of volatile COPCs from the site to downwind offsite residential land uses.

4.3.5 Groundwater and Soil Gas Transport to Offsite Locations

The SCM Report (ECM, 2008b) concludes that the plume of dissolved hydrocarbons in site groundwater is not migrating offsite. The SCM Report notes that chemical concentrations measured in groundwater wells located downgradient of the primary area of impact have stabilized at low or non-detect levels. The SCM Report further notes that a review of subsurface utilities indicates that subsurface utilities do not act as conduits for migration of chemicals in the subsurface. Based on these findings, it appears that significant offsite transport of COPCs is not occurring, via either groundwater transport or diffusive transport of soil gas. Accordingly, these subsurface transport pathways are considered to be incomplete based on the information provided in the SCM Report.

4.3.6 Surface Water Transport

The potential for COPCs to migrate offsite via storm water runoff has been considered. The 1310 14th Street site is essentially capped with pavement and the existing commercial building. The Covenant and Environmental Restriction on Property ("deed restriction") between Nestlé USA, Inc. and City of Oakland Fire Services (COFS, 2000) and the site Risk Management Plan (ETIC, 2001b) require that future site development maintains a surface cap of site soil, exclusive of minor landscaped areas, by buildings or pavement. Because site soils are capped, the potential for storm water runoff to become impacted by site-related COPCs is likely to be low. Accordingly, the offsite transport of COPCs via storm water runoff is considered to be incomplete.

4.3.7 Onsite Extraction of Groundwater

While not a considered a "transport" pathway in the formal sense, the extraction and onsite use of impacted site groundwater as a potable water supply could lead to exposures for onsite indoor commercial/industrial workers to COPCs present in the groundwater via ingestion and dermal contact. However, because use of site groundwater (via an extraction well) is prohibited by the deed restriction (COFS, 2000), this transport

pathway is considered to be incomplete, and no ingestion or dermal contact exposures to groundwater (*i.e.*, tap water) are possible.

4.3.8 Summary of Complete Transport Pathways and Exposure Media

In summary, the primary impacted media at the site are soil, groundwater, and soil gas. The site deed restriction (COFS, 2000) effectively breaks certain transport pathways, including transport from site soil to other media via surface water runoff or dust emissions, and extraction of groundwater for use as potable water supply. Other potential transport pathways are considered to be incomplete for the reasons described above. The transport pathways which are considered to be potentially complete are:

- vapor intrusion from soil gas to indoor air of the onsite commercial building;
- volatilization from soil gas to onsite outdoor; and
- advective transport from onsite outdoor air to the outdoor or indoor air of offsite residential land uses.

Thus, the exposure media which are included in the quantitative screening risk evaluation are:

- onsite soil;
- onsite groundwater;
- onsite soil gas;
- indoor air of the existing onsite commercial building;
- onsite outdoor air; and
- outdoor or indoor air at offsite residential land uses.

Potentially exposed human populations and routes of exposure (ingestion, etc.) are discussed below in Section 4.4.

4.4 Potentially Exposed Populations and Exposure Routes

This section describes the potentially exposed populations and associated exposure routes that are included in the screening health risk evaluation of the 1310 14th Street site. These populations and routes are summarized in the conceptual site model depicted in Figure 3.

4.4.1 Onsite Commercial/Industrial Worker

The intended future land use for the 1310 14th Street site is commercial/industrial, consistent with the site deed restriction (COFS; 2000). Thus, the primary population of potential concern is future commercial/industrial workers, who are assumed to work full-time in the onsite building. Because the site is effectively capped by the existing building and by pavement as required by the deed restriction, no direct contact between the commercial/industrial worker and site soil or groundwater is possible, and therefore these exposure routes are considered to be incomplete. Because use of site groundwater (via an

extraction well) is prohibited by the deed restriction, no ingestion or dermal contact exposures to groundwater are possible, and therefore these exposure routes are also considered to be incomplete. Therefore, as indicated in the conceptual site model depicted in Figure 3, the only complete exposure pathway/route for the onsite indoor commercial/industrial is inhalation of volatile COPCs that are present in indoor air as a result of transport from soil gas to indoor air (*i.e.*, vapor intrusion).

4.4.2 Onsite Intrusive Construction Worker

Also included in this screening level health risk evaluation are onsite, outdoor intrusive construction workers who are assumed to engage in excavation of site soils (*e.g.*, trenching for utility installation) over a relatively short period of time. These intrusive construction workers are assumed to contact impacted soils via dermal contact and incidental ingestion, and are assumed to contact impacted groundwater via dermal contact with groundwater that could be present at the floor of a utility trench. Intrusive construction workers are also assumed to be exposed via inhalation to volatile COPCs present in onsite outdoor air as a result of volatilization from soil gas to outdoor air. For the purpose of quantifying exposures, it is assumed that intrusive construction workers are onsite and in a utility trench for 8 hours per day, for a total of 20 working days (*i.e.*, four weeks). It should be noted that intrusive construction work would necessarily puncture the site cap and likely lead to dust emissions; because the identified site-related COPCs are volatile in nature, however, exposure of intrusive construction workers to fugitive dust is not evaluated (USEPA, 2002).

4.4.3 Offsite Resident

The current land uses in the vicinity of the 1310 14th Street site include commercial, industrial, and residential uses. In this screening analysis, no distinction is made with respect to the actual locations of these various land uses, relative to the site. As explained above (see Section 4.3), the only potentially complete offsite transport pathway is advective transport (*i.e.*, by wind) of volatile COPCs, and the only complete exposure route for offsite populations is inhalation of volatile COPCs in air. Due to the greater exposure frequency and exposure duration associated with residential exposures compared with commercial and industrial exposures, the offsite receptor that is included in the analysis is the offsite resident. As discussed below, it is conservatively assumed that the concentrations of volatile COPCs that an offsite residential building occupant may be exposed to are equal to the concentrations of those volatile COPCs in onsite outdoor air.

4.5 Exposure Point Concentrations

An exposure point is defined as a location of potential contact between an organism (*e.g.*, human receptor) and a physical or chemical agent. The exposure point concentration is defined as the average concentration of the physical or chemical agent in the exposure medium over the period of exposure. The exposure point concentration does not represent the maximum concentration that could be contacted at any one time, but rather represents a reasonable estimate of the concentration likely to be contacted over time

(USEPA, 1989). In this screening level health risk evaluation, however, exposure point concentrations are conservatively based on historical maximum detected concentrations in site media. Exposure point concentrations in each of the relevant exposure media – indoor air of the onsite commercial building, onsite outdoor air, indoor or outdoor air inhaled by an offsite resident, onsite soil, and onsite groundwater – are discussed below.

4.5.1 Indoor Air of Onsite Commercial Building

The conceptual site model (see Figure 3) assumes that volatile COPCs present in the subsurface may migrate upwards through the vadose soil zone and into the indoor air space of the overlying onsite commercial building, where workers may be exposed to the volatile COPCS via inhalation; this transport phenomenon is referred to as vapor intrusion. The transport of COPCs from soil gas to the indoor air of the onsite building is modeled using the United States Environmental Protection Agency (USEPA)-recommended Johnson & Ettinger Model for soil gas (SG-SCREEN Version 2.0), as modified by the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) Human and Ecological Risk Division (HERD) (Johnson and Ettinger, 1991; USEPA, 2004a; Cal/EPA, 2005a), and as modified by Iris Environmental to allow for the input of multiple chemicals and site-specific building parameters. As recommended by DTSC (Cal/EPA, 2005c), soil gas data, rather than soil or groundwater data, are used to evaluate the vapor intrusion pathway, because soil gas data represent a direct measurement of the volatile chemicals that may potentially migrate into indoor air.

The Johnson and Ettinger model is a conservative, screening-level model that incorporates both convective and diffusive mechanisms for estimating the transport of vapor-phase chemicals from soil gas to an indoor air space located directly above the source of contamination. The Johnson and Ettinger model is described in detail in the *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (USEPA, 2004a). Inputs to the Johnson and Ettinger model include depth and concentration of contamination, physicochemical properties of the chemicals being transported, lithology and building parameters, and soil properties. Model input data are documented in Tables 1 through 3 and are discussed below.

Source Characterization

The soil gas data collected during both the 1999 and 2008 site soil gas investigations are used to characterize the contaminant source in soil gas. The maximum detected concentration of each COPC in soil gas, from the combined 1999 and 2008 datasets, is conservatively assumed to be representative of the contaminant source strength. This assumption is consistent with current DTSC vapor intrusion guidance (Cal/EPA, 2005b), which recommends the use of maximum detected soil gas concentrations in vapor intrusion screening risk evaluations.

As noted above, the 1999 soil gas samples were collected at 3 feet bgs, while the 2008 soil gas samples were collected at 5 feet bgs. For the purpose of modeling vapor intrusion transport, all COPCs are conservatively assumed to be present at the shallower

3 feet bgs sampling depth. The concentration in soil gas and depth to contamination of each COPC, used as Johnson and Ettinger model inputs, are documented in Table 1.

Physicochemical Properties

Physicochemical properties that are used by the Johnson and Ettinger model to simulate the transport of volatile chemicals through the subsurface include: diffusivity in water, diffusivity in air, Henry's Law constant, molecular weight, and other properties. These data are used by the model to calculate the effective diffusivity of the volatile chemical through the vadose zone, which varies slightly from chemical-to-chemical. These input data are documented in Table 2.

Lithology and Building Parameters

The screening-level Johnson and Ettinger model for soil gas used in this analysis (SG-SCREEN Version 2.0) is a one-soil-layer model; assumed soil properties are documented below. The existing on-site commercial building is assumed to be of slab-on-grade construction. Building-parameter inputs to the screening-level Johnson and Ettinger model are the area of the building footprint, the depth below grade of the bottom of the foundation slab, the building air exchange rate, and the flow rate of soil gas into the building. The values assigned to these building parameters include site-specific values of building area and height, and Cal/EPA default values of depth below grade of the bottom of the foundation slab, building air exchange rate, and flow rate of soil gas into the building. The modeled site lithology and building geometry are depicted in Figures 4 and 5. These input data are documented in Table 3.

Soil Properties

Soil-property inputs to the screening-level Johnson and Ettinger model are total porosity, water-filled porosity, bulk density, and temperature. Soil properties were measured in eight soil samples collected from four soil borings (Appendix A, Figure 3) on January 22, 2009; as noted above, that investigation was performed specifically to obtain soil properties data to support transport modeling, and the number and location of soil samples were determined by the project geologist to adequately characterize site soil conditions. Results of that investigation are presented in Figure 2. The site average bulk density, total porosity, and water-filled porosity from these eight soil samples are assigned to the soil property inputs in the model. The assumed soil temperature of the soil layer is the USEPA-recommended default value for the San Francisco Bay area (USEPA, 2004a). These input data are documented in Table 3.

Modeling Results

The modeled concentrations of volatile COPCs in the indoor air space of the onsite commercial building, predicted by the Johnson and Ettinger model, are presented in Table 4. These modeling results represent the exposure point concentrations of volatile COPCs in indoor air that onsite commercial/industrial workers are assumed to be exposed to via the inhalation route.

4.5.2 Onsite Outdoor Air

The conceptual site model (see Figure 3) assumes that volatile COPCs present in soil gas may migrate upwards through the vadose soil zone and into ambient (outdoor) air, where onsite intrusive construction workers may be exposed to the volatile COPCS via inhalation. This transport process is similar to vapor intrusion, except that the volatile COPCs are emitted from the ground surface into outdoor air rather than into the indoor air space of an overlying building. The transport of volatile COPCs from soil gas to outdoor air is modeled using the USEPA methodology presented in *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002). In this methodology, the transport of volatile COPCs from soil gas to outdoor air is comprised of two components: the diffusive transport of volatile chemicals from soil gas to the ground surface; and the dispersion of volatile chemicals from the ground surface into the ambient air (USEPA, 2002; ASTM, 1995):

$$C_{OA} = \left[\frac{D_{eff} \times C_{SG}}{d} \times CF1 \times CF2 \right] \times \left[\frac{1}{(Q/C)_{vol}} \right] \qquad \text{(Eq. 1)}$$

where:

C_{OA} = concentration of volatile COPC in outdoor air (mg/m^3);

D_{eff} = effective diffusivity of COPC through vadose soil zone (cm^2/s) (see Equation 2, below);

C_{SG} = concentration of COPC in soil gas (mg/m^3);

d = depth of COPC contamination in soil gas (m);

CF1 = units conversion factor (m^2/cm^2);

CF2 = units conversion factor (g/kg);

$(Q/C)_{vol}$ = dispersion factor ($g/m^2/s$ per kg/m^3).

The first bracketed term of Equation 1 represents the steady-state flux of the volatile COPC from the ground surface into ambient air. This flux is a function of the concentration of the COPC in soil gas (C_{SG}), the effective diffusivity of the COPC through the vadose soil zone (D_{eff}), and the length (*i.e.*, height of soil column) over which the COPC must diffuse to reach the ground surface (d). The concentration of the COPC in soil gas and the depth to contamination are as-assumed in the evaluation of vapor intrusion transport, discussed above in Section 2.4.1 and documented in Table 1. The effective diffusivity of the COPC through the vadose soil zone (D_{eff}) is calculated as follows (USEPA, 2002; ASTM, 1995):

$$D_{eff} = \frac{(D_a \times q_a^{10/3})}{\eta^2} + \frac{(D_w \times q_w^{10/3})}{\eta^2 \times H'} \qquad \text{(Eq. 2)}$$

where:

D_a = diffusivity of COPC in air (cm^2/s);

q_a = air-filled soil porosity (cm^3/cm^3);

η = total soil porosity (cm^3/cm^3);

D_w = diffusivity of COPC in water (cm^2/s);

q_w = water-filled soil porosity (cm^3/cm^3); and

H' = Henry's law constant (cm^3/cm^3).

Values of the physicochemical properties appearing in Equation 2 – diffusivity in air (D_a), diffusivity in water (D_w), and Henry's law constant – are taken from the DTSC/HERD Johnson and Ettinger model (Cal/EPA, 2005a); these physicochemical data are documented in Table 2. Values of the soil properties appearing in Equation 2 – air filled soil porosity, water-filled soil porosity, and total soil porosity – are the average site-specific values measured during the January 2009 site investigation, and are the same values used as inputs to the Johnson and Ettinger modeling analysis of vapor intrusion transport to indoor air (see Section 4.5.1). As noted above, that investigation was performed specifically to obtain soil properties data to support transport modeling, and the number and location of soil samples were determined by the project geologist to adequately characterize site soil conditions. These soil properties data are documented in Table 3.

The second bracketed term of Equation 1 represents the dispersion of the volatile COPC, from the point of release at the ground surface into the larger body of onsite ambient air. The dispersion of volatile chemicals from the ground surface to ambient air is estimated as recommended in the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002). The USEPA soil-screening guidance document defines an annual-average dispersion factor, $(Q/C)_{vol}$, which represents the reciprocal of the ratio of the geometric mean air concentration at the center of a square source area to the emission flux from the square source area; *i.e.*, the $(Q/C)_{vol}$ dispersion factor is specifically designed to estimate the annual-average concentration of a volatile COPC in ambient air at the center of an area source from which it is emitted. The dispersion factor is a function of the source size and of empirical coefficients which are based on air dispersion modeling for specific climate zones (USEPA, 2002):

$$(Q/C)_{vol} = A \times \exp\left[\frac{(\ln A_{site} - B)^2}{C}\right] \qquad \text{(Eq. 3)}$$

where:

A = empirical dispersion coefficient (unitless);

A_{site} = area of source (acres);

B = empirical dispersion coefficient (unitless); and

C = empirical dispersion coefficient (unitless).

The site area from which volatilization of COPCs is modeled to occur (A_{site}) is conservatively assumed to be the size of the deed-restricted portion of the property.

Values assigned to the empirical dispersion coefficients (A, B, and C) are USEPA-recommended conservative default values specific for the San Francisco Bay region (USEPA, 2002). The values assigned to the variables in Equation 3 and the resulting dispersion factor are documented in Table 5.

In summary, the effective diffusivity (D_{eff}) of each volatile COPC is calculated by Equation 2, based on soil properties (porosity, etc.) and the physicochemical properties of the COPC (diffusivity in air, etc.). A site-specific dispersion factor [$(Q/C)_{vol}$] is calculated by Equation 3, based on the site area (A_{site}) and based on default regional dispersion coefficients (A, B, and C). These two derived parameters, and the depth and concentration of the COPC in soil gas(d and C_{SG}), are plugged into Equation 1 to calculate the concentration of the COPC in ambient air at the center of the site, resulting from volatilization from soil gas to ambient air. These exposure point concentrations of COPCs in onsite outdoor air, used to quantify potential health impacts associated with inhalation by intrusive construction workers, are documented in Table 6.

4.5.3 Indoor and Outdoor Air of Offsite Residences

The conceptual site model (see Figure 3) assumes that volatile COPCs present in the subsurface may migrate upwards through the vadose soil zone and into ambient (outdoor) air at the site (as described in the previous section). The volatile COPCs are then assumed be transported downwind to offsite residential land uses, where residents may be exposed to the VOCs via the inhalation route. In this screening level health risk evaluation, it is conservatively assumed that the concentrations of volatile COPCs that offsite residents are exposed to in outdoor or indoor air are equal to those in onsite ambient air. In other words, the exposure point concentrations of COPCs that offsite residents are potentially exposed to are assumed equal to the exposure point concentrations of COPCs in onsite outdoor air, as documented in Table 6. This is a highly conservative assumption, as the concentrations of COPCs in air would be diluted during downwind transport from the site to offsite residential land uses.

4.5.4 Onsite Soil

The conceptual site model (see Figure 3) assumes that onsite outdoor intrusive construction workers are exposed to COPCs in site soils via ingestion and dermal contact. (Direct soil exposures for the indoor commercial/industrial worker are assumed to be incomplete, due to the cap provided by the building and pavement.) For this screening level risk evaluation, it is assumed that intrusive construction workers are exposed to the maximum detected concentrations of COPCs in site soils, from any site soil investigation, at any sampling location, at any depth below ground surface. The exposure point concentrations of COPCs in site soils, used to quantify potential health impacts associated with ingestion and direct contact exposures, are documented in Table 7.

4.5.5 Onsite Groundwater

The conceptual site model (see Figure 3) assumes that onsite outdoor intrusive construction workers are exposed to COPCs in site groundwater via dermal contact with

the groundwater, such as at the bottom of a utility trench. For this screening level risk evaluation, it is assumed that the intrusive construction workers are exposed to the maximum detected concentrations of COPCs in site groundwater, from any site groundwater investigation or sampling event, at any sampling location. The exposure point concentrations of COPCs in site groundwater, used to quantify potential health impacts associated with direct contact exposures, are documented in Table 8.

4.6 Quantification of Potential Chemical Intakes

Exposure is defined as contact between an organism (*e.g.*, human body) and a chemical or physical agent. In accordance with USEPA risk assessment methodology (USEPA, 1989), exposures are averaged over time and to the body weight of the receptor, and are referred to as intakes. In this formulation, chemical intake is a function of: the concentration of the chemical in the exposure medium (*e.g.*, soil), the contact rate between the receptor and the exposure medium, the frequency and duration of the exposure, the body weight of the receptor, and the time period over which the exposure is normalized. Intakes are averaged over long periods of time are referred to as chronic daily intakes.

The generic equation for estimating the chronic daily intake of a chemical in air, soil, or water is as follows (USEPA, 1989):

$$CDI = \frac{C \times CR \times EF \times ED}{BW} \times \frac{1}{AT} \qquad \text{(Eq. 4)}$$

where:

CDI = chronic daily intake (mg/kg/d);

C = exposure point concentration of chemical in soil (mg/kg), groundwater (mg/L), or air (mg/m^3);

CR = contact rate with soil (kg/d), groundwater (L/d), or air (m^3/d);

EF = exposure frequency (d/yr);

ED = exposure duration (yr);

BW = body weight (kg); and

AT = averaging time (d).

Chronic daily intakes are specific to the exposure pathway, the receptor, and the type of health effect being evaluated (*i.e.*, cancer or noncancer). The pathway-specific equations used to quantify chronic daily intakes are documented in Table 9. The values assigned to the intake parameters are documented in Table 10, with the exception of dermal permeability coefficients which are documented in Table 2, and exposure point concentrations which are documented in Table 4 (onsite indoor air), Table 6 (onsite outdoor air and offsite indoor or outdoor air), Table 7 (onsite soil), and Table 8 (onsite groundwater). As documented in Table 10, the values assigned to the intake parameters are standard, conservative default values recommended by USEPA and/or Cal/EPA.

In evaluating the potential health impacts to residential populations, both child and adult receptors are considered. For noncancer health hazard, the child receptor experiences the largest intakes (due to lower body weight), and thus the noncancer hazard assessment for the offsite resident is based on the child receptor. Per DTSC guidance (Cal/EPA, 1994), cancer risks for residential populations are calculated using an age-adjusted approach, to account for the higher per-body weight exposures that occur during the childhood years; accordingly, the cancer risk assessment for the offsite resident is based on an "age adjusted" receptor who is assumed to be a child for the first 6 years of exposure and an adult for the remaining 24 years of an assumed 30-year residential exposure duration.

Chronic daily intakes calculated for all exposure pathways and exposed populations are presented in Table 11. In conjunction with toxicity data (see Section 5.0), these chronic daily intakes are used to characterize potential cancer risks and noncancer hazards, as discussed in Section 6.0.

5.0 TOXICITY ASSESSMENT

Toxicity assessment characterizes the relationship between the magnitude of exposure to a chemical and the potential for adverse effects. More specifically, toxicity assessment identifies or derives toxicity values that can be used to estimate the likelihood of adverse effects occurring in humans at different exposure levels. Consistent with regulatory risk assessment policy, adverse health effects resulting from chemical exposures are evaluated in two categories: carcinogenic effects and noncarcinogenic effects. The hierarchy of sources for the toxicity criteria used for this health risk evaluation generally corresponds to DTSC guidelines (Cal/EPA, 1994); all carcinogenic and noncarcinogenic toxicity values used to evaluate the potential health effects associated with exposure to COPCs in groundwater are presented and documented in Table 13.

5.1 Toxicity Assessment for Carcinogenic Effects

Current health risk assessment practice for carcinogens is based on the assumption that, for most substances, there is no threshold dose below which carcinogenic effects do not occur. This no-threshold assumption for carcinogenic effects is based on an assumption that the carcinogenic processes are the same at high and low doses. This approach has generally been adopted by regulatory agencies as a conservative practice to protect public health. The no-threshold assumption is used in this risk assessment for evaluating carcinogenic effects. Although the magnitude of the risk declines with decreasing exposure, the risk is believed to be zero only at zero exposure.

The response potency of a potential carcinogen is quantified by the cancer slope factor (SF). The slope factor represents the excess lifetime cancer risk due to a continuous, constant exposure to a specified level (*i.e.*, unit dose) of a carcinogen. Slope factors are generally reported as excess incremental cancer risk per milligram of chemical per kilogram body weight per day (per mg/kg/day). Separate slope factors are generally reported for inhalation and oral exposures; these slope factors are referred to as the inhalation slope factor (SF_i) and the oral slope factor (SF_o), respectively. Both dermal and oral exposures are generally evaluated using the oral slope factor.

The inhalation and oral slope factors (SF_i and SF_o values) used in this risk evaluation are taken from the following hierarchy of sources:

1) Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) on-line *Toxicity Criteria Database* (Cal/EPA, 2008); and
2) USEPA on-line *Integrated Risk Information System* (IRIS) (USEPA, 2008).

The slope factors, and their sources, used to evaluate the potential carcinogenic toxicity of COPCs are documented in Table 12.

5.2 Toxicity Assessment for Noncarcinogenic Effects

The toxicity assessment for noncarcinogenic effects is based on the assumption that there exists a threshold level of exposure below which no adverse health effects occur. This threshold level varies from individual to individual. In developing a toxicity parameter for noncarcinogenic effects, the approach is to identify a threshold value that is protective of sensitive individuals in the population. For most chemicals, this level can only be estimated, and the developed toxicity value incorporates uncertainty factors indicating the degree of extrapolation used to derive the estimated value. The developed toxicity level is generally considered to have uncertainty spanning an order of magnitude or more, and should not be viewed as a strict scientific demarcation between what level is toxic and nontoxic (USEPA, 1989).

The toxicity parameter that is typically used to evaluate noncarcinogenic effects is the reference dose (RfD). The reference dose represents an intake level, expressed in milligrams of chemical per kilogram of body weight per day (mg/kg/day), that would not be expected to cause adverse noncancer health effects in potentially exposed populations, including sensitive subpopulations (USEPA, 1989). Thus, the reference dose is often referred to as the "acceptable dose." The chronic reference dose specifically represents the daily exposure level that is unlikely to produce adverse noncancer health effects in potentially exposed populations, including sensitive subpopulations, over a lifetime. Analogous to slope factors, chronic reference doses are generally reported for inhalation and oral exposures; these chronic reference doses are referred to as the inhalation chronic reference dose (RfD_i) and the oral chronic reference dose (RfD_o), respectively. Both dermal and oral exposures are generally evaluated using the oral chronic reference dose.

The inhalation and oral chronic reference doses (RfD_i and RfD_o values) used in this risk assessment are taken directly from the following hierarchy of sources:

1) Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) on-line *Toxicity Criteria Database* (Cal/EPA, 2008);
2) USEPA on-line Integrated Risk Information System (IRIS) (USEPA, 2008); and
3) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (USEPA, 2008).

The chronic reference doses, and their sources, used to evaluate the potential noncarcinogenic toxicity of COPCs are documented in Table 13.

6.0 RISK CHARACTERIZATION

6.1 Cancer Risk

For carcinogens, risk is estimated as the incremental probability of an individual developing cancer over a lifetime as a result of daily exposure to the potential carcinogen. The cancer slope factor (SF) (see Section 5.1) converts the estimated daily intake averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. Because relatively low intakes are likely to result from exposure to chemicals at contaminated sites (compared to those experienced by laboratory test animals), it is assumed the dose-response relationship is linear. Under this assumption, the slope factor is constant and risk is directly related to intake (USEPA, 1989):

$$RISK = SF \times CDI \qquad \text{(Eq. 5)}$$

where:

RISK = cancer risk, *i.e.*, the probability of an individual developing cancer over a lifetime as a result of daily exposure to a particular carcinogen (unitless);

SF = cancer slope factor, *i.e.*, the lifetime incremental cancer risk per unit dose of the carcinogen (per mg/kg/d); and

CDI = chronic daily intake of the carcinogen (mg/kg/d).

Cancer risks are estimated by Equation 5 for each relevant exposure pathway and receptor and each carcinogenic chemical. As a matter of policy, USEPA (1989b) considers the cancer risk for contact with multiple carcinogens to be additive, regardless of the carcinogens' mechanisms of toxicity or sites (organs of the body) of action. Therefore, within each exposure pathway (*e.g.*, inhalation of indoor air), the chemical-specific cancer risks are summed to produce an estimate of the cumulative (multi-chemical) risk associated with the exposure pathway. In addition, cancer risk for a given receptor across multiple exposure routes is also considered to be additive (USEPA, 1989b). Therefore, the pathway-specific risks are summed to produce an estimate of the cumulative (multi-chemical and multi-pathway) risk to each specific receptor. This cumulative risk estimate represents the incremental probability of an individual within that receptor population (*e.g.*, onsite indoor commercial/industrial workers) developing cancer over a lifetime as a result of exposure to site-related carcinogenic COPCs. Estimated cancer risks are presented in Table 14.

The estimated incremental cancer risks presented in Table 14 are compared to the "acceptable" cancer risk level, as defined and endorsed by relevant state and federal agencies. The National Contingency Plan (NCP) is cited by USEPA (1989) as the basis for defining acceptable incremental risk levels. According to the NCP, lifetime incremental cancer risk levels posed by a site should be within the risk range of one in a million (1×10^{-6}) to 100 in a million (1×10^{-4}). Thus, USEPA and Cal/EPA agencies typically consider the 1×10^{-6} risk level to be an insignificant risk, and consider a calculated excess cancer risk between 1×10^{-6} and 1×10^{-4} to be within the acceptable risk

range. For commercial exposure scenarios, a typical point of departure is a risk level of 1×10^{-5}; *i.e.*, if risks are at or below 1×10^{-5}, the agency of record will generally accept no further action.

6.2 Noncancer Hazard

The reference-dose approach (see Section 5.2) is based on the theory that there exists a threshold level of exposure below which it is unlikely for even sensitive subpopulations to experience adverse noncancer health effects. If the actual exposure level (*i.e.*, the chronic daily intake) exceeds this threshold value (*i.e.*, the chronic reference dose), there may be concern for potential noncancer health effects. Generally, the larger ratio of chronic daily intake to chronic reference dose, the greater the level of concern. This ratio is not to be interpreted as a probability of developing noncancer health effects, however, and the level of concern does not increase linearly with this ratio USEPA (1989).

The ratio of the chronic daily intake of a chemical to the chronic reference dose for that chemical is referred to as the noncancer hazard quotient:

$$HQ = \frac{CDI}{RfD} \qquad \text{(Eq. 6)}$$

where:

HQ = noncancer hazard quotient, *i.e.*, the potential (not probability) for an individual to develop adverse noncancer health effects over a lifetime as a result of daily exposure to a particular chemical (unitless);

CDI = chronic daily intake of the chemical (mg/kg/d); and

RfD = chronic reference dose, *i.e.*, the threshold level of exposure that would not be expected to cause adverse noncancer health effects in potentially exposed populations, including sensitive subpopulations (unitless).

Noncancer hazard quotients are estimated by Equation 6 for each relevant exposure pathway and receptor and each chemical. Within each exposure pathway (*e.g.*, inhalation of indoor air), the chemical-specific noncancer hazard quotients are summed to produce an estimate of the cumulative (multi-chemical) "hazard index" associated with the exposure pathway. It should be noted here that the summation of hazard quotients across chemicals, independent of the target organ which is affected by each chemical, is conservative, as chemicals that impact different target organs (*e.g.*, liver, kidney) are not truly additive in their potential to cause the adverse impact. The pathway-specific hazard indices are then summed to produce an estimate of the cumulative (multi-chemical and multi-pathway) noncancer hazard index for the specific receptor. This cumulative hazard index estimate represents the incremental potential (not probability) of an individual within that receptor population (*e.g.*, onsite indoor commercial/industrial workers) developing adverse noncancer health effects as a result of exposure to site-related COPCs. Estimated noncancer hazards are presented in Table 15.

The estimated incremental noncancer hazards presented in Table 15 are compared to the threshold level of 1. Chemical exposures that yield hazard indices of less than 1 are not expected to result in adverse noncancer health effects (USEPA, 1989).

7.0 DISCUSSION OF RESULTS

7.1 Cancer Risk

A summary of estimated cancer risks, for all potentially exposed populations and associated routes of exposure, is presented in Table 14. These results are discussed in this section by receptor population.

As indicated in Table 14, the total (summed across all COPCs) estimated cancer risk for onsite indoor commercial/industrial workers, associated with inhalation of volatile COPCs that are present in indoor air as a result of vapor intrusion (the only complete exposure pathway for this receptor), is 8.0×10^{-6}. This estimated risk is below the 1×10^{-5} risk level that is the typical point of departure for commercial exposure scenarios. Nearly all of this risk may be attributed to inhalation of benzene (85 percent of total risk) and 1,3-butadiene (10 percent).

As indicated in Table 14, the total (summed across all COPCs and four exposure pathways) estimated cancer risk for onsite outdoor intrusive construction workers is 9.8×10^{-5}, which is approximately 10 times greater than the 1×10^{-5} risk level that is the typical point of departure for commercial/industrial exposure scenarios. This risk level is attributable to assumed dermal contact with COPCs in groundwater at the bottom of a construction trench – the estimated risks associated with inhalation of volatile COPCs in outdoor air, ingestion of COPCs in soil, and dermal contact with COPCs in soil are all well below levels of concern. The groundwater-dermal contact risk may be attributed to dermal contact with benzene (77 percent of total risk) and ethylbenzene (23 percent) in groundwater.

It should be noted that dermal exposures to soil and groundwater for the intrusive construction worker conservatively assume that the hands and forearms are exposed, *i.e.*, that the worker is wearing a short-sleeved shirt and no gloves. The site Risk Management Plan (ETIC, 2001b), however, requires that constructor contractors develop a site-specific Environmental Health and Safety Plan that specifies appropriate safety equipment to minimize contact between the construction worker and site soil and groundwater. Therefore, actual exposures after implementation of a site-specific Environmental Health and Safety Plan are highly likely to much lower than estimated here, and actual cancer risks are likely to be below levels of concern.

As indicated in Table 14, the total (summed across all COPCs) estimated cancer risk for offsite residents, associated with inhalation of volatile COPCs in indoor or outdoor air that have migrated downwind from the site (the only complete exposure pathway for this receptor), is 4.1×10^{-7}. This estimated risk is below the 1×10^{-6} risk level that is typically considered to be the point of departure for residential exposure scenarios.

7.2 Noncancer Hazard

A summary of estimated noncancer hazard indices, for all potentially exposed populations and associated routes of exposure, are presented in Table 15. These results are discussed in this section by receptor population.

As indicated in Table 15, the total (summed across all COPCs) estimated noncancer hazard index for onsite indoor commercial/industrial workers, associated with inhalation of volatile COPCs that are present in indoor air as a result of vapor intrusion (the only complete exposure pathway for this receptor), is 0.051. This estimated hazard is well below the threshold hazard index of 1, and thus may be considered negligible.

As indicated in Table 15, the total (summed across all COPCs and four exposure pathways) estimated noncancer hazard index for onsite outdoor intrusive construction workers is 21, which is 21 times greater than the threshold hazard index of 1. This hazard level is attributable to assumed dermal contact with COPCs in groundwater at the bottom of a construction trench – the estimated hazards associated with inhalation of volatile COPCs in outdoor air, ingestion of COPCs in soil, and dermal contact with COPCs in soil are all well below levels of concern. The groundwater-dermal contact hazard may be attributed primarily to dermal contact with benzene (63 percent of total hazard) and xylenes (23 percent) in groundwater.

As noted above, dermal exposures to soil and groundwater for the intrusive construction worker conservatively assume that the hands and forearms are exposed, *i.e.*, that the worker is wearing a short-sleeved shirt and no gloves. The site Risk Management Plan (ETIC, 2001b), however, requires that constructor contractors develop a site-specific Environmental Health and Safety Plan that specifies appropriate safety equipment to minimize contact between the construction worker and site soil and groundwater. Therefore, actual exposures after implementation of a site-specific Environmental Health and Safety Plan are highly likely to much lower than estimated here, and actual noncancer hazards are likely to be below levels of concern.

As indicated in Table 15, the total (summed across all COPCs) estimated noncancer hazard index for offsite residents, associated with inhalation of volatile COPCs in indoor or outdoor air that have migrated downwind from the site (the only complete exposure pathway for this receptor), is 0.0040. This estimated hazard is well below the threshold hazard index of 1, and may be considered negligible.

8.0 DEVELOPMENT OF RISK-BASED SOIL GAS CLEANUP GOALS

Risk-based soil gas cleanup goals are calculated in anticipation of potential site cleanup. Following the risk evaluation methodologies of Sections 5.0 and 6.0, risk-based indoor air concentrations protective of commercial workers are calculated for both carcinogenic and noncarcinogenic endpoints. These indoor air concentrations are presented in Table 16.

Transport of soil gas from 5.0 feet below ground surface into indoor air of the onsite commercial building is modeled with the Johnson and Ettinger Model as described in

Section 4.5.1. Site-specific soil and building parameters are used. The output parameter of the Johnson and Ettinger model is the attenuation factor (α). By definition, the attenuation factor is the ratio of the COPC concentration in indoor air (resulting from vapor intrusion) to the COPC concentration in soil gas beneath the building:

$$\alpha \equiv \frac{C_{IA}}{C_{SG}} \qquad \text{(Eq. 7)}$$

where:

α	=	attenuation factor (unitless);
C_{IA}	=	concentration of COPC in indoor air ($\mu g/m^3$); and
C_{SG}	=	concentration of COPC in soil gas ($\mu g/m^3$).

An attenuation factor is calculated with the Johnson and Ettinger model for each COPC in soil gas (38 total), at a depth of 5.0 feet bgs. These attenuation factors are presented in Table 16.

Chemical-specific risk-based soil gas cleanup goals at 5.0 feet bgs are calculated from the attenuation factors developed using the Johnson and Ettinger model and from the target indoor air concentrations estimated using standard USEPA and Cal/EPA inhalation risk-assessment methodology. For each chemical, the risk-based soil gas cleanup goal is calculated from:

$$RBCG = \frac{CA}{\alpha} \qquad \text{(Eq. 8)}$$

where:

RBCG	=	chemical- and depth-specific risk-based soil gas cleanup goal ($\mu g/m^3$);
CA	=	risk-based target concentration of COPC in indoor air ($\mu g/m^3$); and
α	=	chemical- and depth-specific attenuation factor (unitless).

Risk-based cleanup goals are presented in Table 16. By definition, each soil gas cleanup goal represents the concentration of that COPC in soil gas at 5.0 feet bgs that would be considered safe and acceptable for commercial use of the existing onsite building. It is important to note that exceedances of these soil gas screening levels should not be interpreted to mean that conditions in the building are unsafe. Rather, the soil gas screening levels are set sufficiently low, and incorporate many levels of conservatism, in order to allow for prudent and proactive additional analyses and actions. The soil gas screening levels developed in this assessment can be used to assess the effectiveness of the cleanup activities.

9.0 UNCERTAINTIES

Many of the assumptions used in the human health screening evaluation – regarding the representativeness of the sampling data, human exposures, fate and transport modeling, and chemical toxicity – are conservative, follow agency guidance, and reflect a 90th or

95th percentile value rather than a typical or average value. The use of several conservative exposure and toxicity assumptions can introduce considerable uncertainty into the human health screening evaluation. By using conservative exposure or toxicity estimates, the evaluation can develop a significant conservative bias that may result in the calculation of significantly higher cancer risks or noncancer hazards than are actually posed by the chemicals present in soil, soil gas, and groundwater. The key uncertainties in the human health screening evaluation are discussed in Appendix B. The uncertainty analysis focuses on the site-specific assumptions contributing most to uncertainty in the risk and hazard calculations, and does not assess the validity of default assumptions used in the health screening evaluation. Assumptions/data evaluated in the uncertainty analysis are: representative concentrations in soil gas, soil properties, and building height.

As noted above and discussed in Appendix B, uncertainties exist in the human health risk evaluation regarding representative concentrations of COPCs in soil gas, soil properties, and building air exchange rate. The baseline evaluation, the results of which are summarized above in Section 7, is based on a combination of assumptions regarding these three parameters, based primarily on DTSC vapor intrusion guidance (Cal/EPA, 2005b), and represents a relatively conservative estimate of potential risk and hazard. Discussed in Appendix B and documented in Appendices C and D are two sensitivity analyses which bound the range of potential risks and hazards associated with the uncertainties in these three input parameters. The first sensitivity analysis combines the most conservative, but likely least representative, options of the three parameters, to produce a high-end estimate of potential risk and hazard. The second sensitivity analysis combines the least conservative, but likely most representative, options of the three parameters, to produce a low-end estimate of potential risks and hazards. The conceptual differences between the three evaluations are summarized in the following table.

Summary of Health Risk Evaluations

Evaluation	Where Documented	Soil Gas Concentrations	Soil Properties	Building Ventilation Rate
High-end estimate	Appendix C	Maxima	Default	Default
Baseline estimate	Main report	Maxima	Site-specific	Default
Low-end estimate	Appendix D	Averages	Site-specific	Site-specific

Based on the results of these analyses, the following conclusions may be drawn regarding the sensitivity of the results of the health risk evaluation to the uncertainties regarding representative concentrations of COPCs in soil gas, soil properties, and building air exchange rate.

- Estimated potential risk and hazard for onsite indoor commercial/industrial workers range over approximately 2-1/2 orders of magnitude. The high-end estimates are approximately 8 times greater than the baseline estimates presented above in Section 7. The low-end estimates are less than the baseline estimates by a factor of approximately 47.

- Estimated potential risk and hazard for onsite outdoor intrusive construction workers are not sensitive to these uncertainties, as the estimated potential health effects for this receptor are driven by dermal contact with groundwater.
- Estimated potential risk and hazard for offsite residents range over approximately 2 orders of magnitude. The high-end estimates are approximately 17 times greater than the baseline estimates presented above in Section 7. The low-end estimates are less than the baseline estimates by a factor of approximately 11.
- The high-end estimates of potential risk are the within the 1×10^{-6} to 1×10^{-4} risk management range for all three receptors (onsite indoor commercial/industrial workers, onsite outdoor intrusive construction workers, and offsite residents). The high-end estimates of potential hazard are below the threshold hazard level of 1 for onsite indoor commercial/industrial workers and offsite residents. The high-end estimate of potential hazard exceeds the threshold hazard level of 1 for onsite outdoor intrusive construction workers; as noted above, this hazard is driven by dermal contact with groundwater.
- The low-end estimates of potential risk are below the 1×10^{-6} to 1×10^{-4} risk management range for onsite indoor commercial/industrial workers and offsite residents, and within the risk management range for onsite outdoor intrusive construction workers. The low-end estimates of potential hazard are below the threshold hazard level of 1 for onsite indoor commercial/industrial workers and offsite residents. The low-end estimate of potential hazard exceeds the threshold hazard level of 1 for onsite outdoor intrusive construction workers; as noted above, this hazard is driven by dermal contact with groundwater.

10.0 CONCLUSIONS

This report describes the methodology and results of a screening level human health risk evaluation for the northwestern portion of the commercial property located at 1310 14th Street in Oakland, California. The potential health impacts to onsite and offsite populations, associated with exposures to site-related chemicals, have been quantified. Of note, the site deed restriction (COFS, 2000) effectively breaks certain transport pathways, including transport from site soil to other media via surface water runoff or dust emissions, and extraction of groundwater for use as potable water supply; and physically prevents direct contact between onsite commercial workers and impacted site soils.

Potentially exposed populations which have been considered in this evaluation are onsite indoor commercial/industrial workers who are assumed to work full-time in the onsite commercial building for 25 years, onsite outdoor intrusive construction workers who are assumed to work onsite for 4 weeks, and offsite residents who are assumed to live near the site for 30 years. Estimated potential cancer risks for residential and commercial receptor populations are compared to the typical points of departure, with respect to risk management, of 1×10^{-6} and 1×10^{-5}, respectively. Estimated potential noncancer hazard indices for all receptor populations are compared to the threshold noncancer hazard index of 1.

The main conclusions of the screening health risk evaluation are as follows.

- The estimated potential cancer risk for onsite indoor commercial workers is 8.0×10^{-6}. The estimated potential noncancer hazard index for onsite indoor commercial workers is 0.051. Both the estimated cancer risk and the noncancer hazard index are below levels of concern.
- The estimated potential cancer risk for onsite outdoor intrusive construction workers is 9.8×10^{-5}. The estimated potential noncancer hazard index for onsite outdoor intrusive construction workers is 21. Both the estimated cancer risk and the noncancer hazard index are above levels of concern. However, this cancer risk and noncancer hazard are attributable entirely to assumed dermal contact with COPCs in groundwater at the bottom of a construction trench, and do not account for personal protective equipment that intrusive construction workers would be required to use. Actual exposures after implementation of a site-specific Environmental Health and Safety Plan are highly likely to much lower than estimated here, and the actual cancer risk and hazard are likely to be below levels of concern.
- The estimated potential cancer risk for offsite residents is 4.1×10^{-7}. The estimated noncancer hazard index for offsite residents is 0.0040. Both the estimated cancer risk and the noncancer hazard index are below levels of concern.

The human health risk evaluation presented in this report is a screening-level evaluation that is based on a combination of conservative assumptions – regarding vapor intrusion modeling assumptions, exposure assumptions, toxicological data, summation of health effects across chemicals and exposure routes – and therefore it is likely that actual health risks to exposed populations could be lower, or significantly lower, than those estimated in this analysis.

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Table 1. Representative Concentrations of Chemicals of Potential Concern in Soil Gas

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Acetone	620
Benzene	40,000
1,3-Butadiene	310
2-Butanone (methyl ethyl ketone)	420
Carbon disulfide	440
Chlorobenzene	160
Chloroform	170
Chloromethane (methyl chloride)	75
Cyclohexane	480
1,2-Dichlorobenzene	2,900
1,3-Dichlorobenzene	210
1,4-Dichlorobenzene	460
Dichlorodifluoromethane (Freon 12)	10,000
1,1-Dichloroethane	140
1,2-Dichloroethane	140
1,1-Dichloroethene (1,1-DCE)	140
cis-1,2-Dichloroethene (cis-1,2-DCE)	140
1,4-Dioxane	500
Ethanol	2,600
Ethylbenzene	7,700
4-Ethyltoluene	3,700
Heptane	550
Hexane	63,000
Methyl tertiary butyl ether (MTBE)	500
Methylene chloride	1,200
4-Methyl-2-pentanone (methyl isobutyl ketone)	550
2-Propanol	350
Styrene	150
Tetrachloroethene (PCE)	1,100
Tetrahydrofuran	420
Toluene	32,000
1,1,1-Trichloroethane	190

Table 1. Representative Concentrations of Chemicals of Potential Concern in Soil Gas

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Trichloroethene (TCE)	190
Trichlorofluoromethane (Freon 11)	200
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	270
1,2,4-Trimethylbenzene	2,900
1,3,5-Trimethylbenzene	3,600
Xylenes	19,000

Notes:

(1) Soil gas samples were collected at depths of 3 and 5 feet below ground surface (bgs) in 1999 and 2008, respectively.

(2) Concentration units are micrograms per cubic meter ($\mu g/m^3$).

(3) Representative concentration is the maximum of all samples collected in 1999 and 2008.

Table 2. Physicochemical Properties of Chemicals of Potential Concern

Chemical of Potential Concern	Diffusivity in Air (D_a)		Diffusivity In Water (D_w)		Henry's Law Constant at Reference Temperature (H)		Henry's Law Constant Reference Temperature (T_R)		Henry's Law Constant Unitless (H')		Enthalpy of Vaporization at The Normal Boiling Point ($DH_{v,b}$)		Normal Boiling Point (T_B)		Critical Temperature (T_C)		Organic Carbon Partition Coefficient, (K_{oc})		Pure Component Water Solubility, (S)		Vapor Pressure, (VP)		Dermal Permeability Constant, (K_p)		Soil Absorption Factor (ABS)	
	Value (cm^2/s)	Source	Value (cm^2/s)	Source	Value ($atm\text{-}m^3/mol$)	Source	Value (^oC)	Source	Value (unitless)	Source	Value (cal/mol)	Source	Value (^oK)	Source	Value (^oK)	Source	Value (cm^3/g)	Source	Value (mg/L)	Source	Value (mmHg)	Source	Value (cm/hr)	Source	Value (unitless)	Source
Acetone	1.24E-01	1	1.14E-05	1	3.87E-05	1	2.50E+01	1	1.59E-03	1	6.96E+03	1	3.29E+02	1	5.08E+02	1	5.75E-01	1	1.00E+06	1	5.06E+02	1	NA	NA	0.1	7
Benzene	8.80E-02	1	9.80E-06	1	5.54E-03	1	2.50E+01	1	2.27E-01	1	7.34E+03	1	3.53E+02	1	5.62E+02	1	5.89E+01	1	1.79E+03	1	9.64E+01	1	1.49E-02	3	0.1	7
Bromodichloromethane	2.98E-02	1	1.06E-05	1	1.60E-03	1	2.50E+01	1	6.54E-02	1	7.80E+03	1	3.63E+02	1	5.86E+02	1	5.50E+01	1	6.74E+03	1	4.99E+01	1	4.62E-03	3	0.1	7
1,3-Butadiene	2.49E-01	1	1.08E-05	1	7.34E-02	1	2.50E+01	1	3.01E+00	1	5.37E+03	1	2.69E+02	1	4.25E+02	1	1.91E+01	1	7.35E+02	1	7.58E+02	1	1.64E-02	3	0.1	7
2-Butanone (methyl ethyl ketone)	8.08E-02	1	9.80E-06	1	5.58E-05	1	2.50E+01	1	2.29E-03	1	7.48E+03	1	3.53E+02	1	5.37E+02	1	2.30E+00	1	2.23E+05	1	1.31E+02	1	9.63E-04	3	0.1	7
Carbon disulfide	1.04E-01	1	1.00E-05	1	3.02E-02	1	2.50E+01	1	1.24E+00	1	6.39E+03	1	3.19E+02	1	5.52E+02	1	4.57E+01	1	1.19E+03	1	3.58E+02	1	1.72E-02	3	0.1	7
Chlorobenzene	7.30E-02	1	8.70E-06	1	3.69E-03	1	2.50E+01	1	1.51E-01	1	8.41E+03	1	4.05E+02	1	6.32E+02	1	2.19E+02	1	4.72E+02	1	1.18E+01	1	2.82E-02	3	0.1	7
Chloroethane (ethyl chloride)	2.71E-01	1	1.15E-05	1	8.80E-03	1	2.50E+01	1	3.61E-01	1	5.88E+03	1	2.85E+02	1	4.60E+02	1	4.40E+00	1	5.68E+03	1	5.89E+02	1	6.07E-03	3	0.1	7
Chloroform	1.04E-01	1	1.00E-05	1	3.66E-03	1	2.50E+01	1	1.50E-01	1	6.99E+03	1	3.34E+02	1	5.36E+02	1	3.98E+01	1	7.92E+03	1	1.85E+02	1	6.83E-03	3	0.1	7
Chloromethane (methyl chloride)	1.26E-01	1	6.50E-06	1	8.80E-03	1	2.50E+01	1	3.61E-01	1	5.11E+03	1	2.49E+02	1	4.16E+02	1	2.12E+00	1	5.33E+03	1	7.05E+02	1	3.28E-03	3	0.1	7
Cyclohexane	8.00E-02	2	9.10E-06	2	1.50E-01	4	2.50E+01	4	6.10E+00	2	NA	NA	3.54E+02	4	NA	NA	1.66E+02	2	5.50E+01	2	9.69E+01	4	NA	NA	0.1	7
1,2-Dichlorobenzene	6.90E-02	1	7.90E-06	1	1.90E-03	1	2.50E+01	1	7.77E-02	1	9.70E+03	1	4.54E+02	1	7.05E+02	1	6.17E+02	1	1.56E+02	1	1.53E+00	1	4.13E-02	3	0.1	7
1,3-Dichlorobenzene	6.92E-02	1	7.86E-06	1	3.09E-03	1	2.50E+01	1	1.27E-01	1	9.23E+03	1	4.46E+02	1	6.84E+02	1	1.98E+03	1	1.34E+02	1	2.14E+00	1	5.79E-02	3	0.1	7
1,4-Dichlorobenzene	6.90E-02	1	7.90E-06	1	2.39E-03	1	2.50E+01	1	9.82E-02	1	9.27E+03	1	4.47E+02	1	6.85E+02	1	6.17E+02	1	7.90E+01	1	9.78E-01	1	4.20E-02	3	0.1	7
Dichlorodifluoromethane (Freon 12)	6.65E-02	1	9.92E-06	1	3.42E-01	1	2.50E+01	1	1.40E+01	1	9.42E+03	1	2.43E+02	1	3.85E+02	1	4.57E+02	1	2.80E+02	1	6.02E+02	1	8.95E-03	3	0.1	7
1,1-Dichloroethane	7.42E-02	1	1.05E-05	1	5.61E-03	1	2.50E+01	1	2.30E-01	1	6.90E+03	1	3.31E+02	1	5.23E+02	1	3.16E+01	1	5.06E+03	1	2.18E+02	1	6.74E-03	3	0.1	7
1,2-Dichloroethane	1.04E-01	1	9.90E-06	1	9.77E-04	1	2.50E+01	1	4.00E-02	1	7.64E+03	1	3.57E+02	1	5.61E+02	1	1.74E+01	1	8.52E+03	1	6.39E+01	1	4.20E-03	3	0.1	7
1,1-Dichloroethene (1,1-DCE)	9.00E-02	1	1.04E-05	1	2.60E-02	1	2.50E+01	1	1.07E+00	1	6.25E+03	1	3.05E+02	1	5.76E+02	1	5.89E+01	1	2.25E+03	1	4.59E+02	1	1.17E-02	3	0.1	7
cis-1,2-Dichloroethene (cis-1,2-DCE)	7.36E-02	1	1.13E-05	1	4.07E-03	1	2.50E+01	1	1.67E-01	1	7.19E+03	1	3.34E+02	1	5.44E+02	1	3.55E+01	1	3.50E+03	1	1.12E+02	1	NA	NA	0.1	7
1,4-Dioxane	8.70E-02	2	1.10E-05	2	4.80E-06	4	2.50E+01	4	2.00E-04	2	NA	NA	3.75E+02	4	NA	NA	1.00E+00	2	1.00E+06	2	3.81E+01	4	3.32E-04	3	0.1	7
Ethanol	1.23E-01	4	1.30E-05	6	5.00E-06	4	2.50E+01	4	2.05E-04	4	NA	NA	3.51E+02	4	NA	NA	1.85E-01	4	1.00E+06	4	5.93E+01	4	5.38E-04	3	0.1	7
Ethylbenzene	7.50E-02	1	7.80E-06	1	7.86E-03	1	2.50E+01	1	3.22E-01	1	8.50E+03	1	4.09E+02	1	6.17E+02	1	3.63E+02	1	1.69E+02	1	9.51E+00	1	4.93E-02	3	0.1	7
4-Ethyltoluene	6.81E-02	4	7.84E-06	6	5.01E-03	4	2.50E+01	4	2.05E-01	4	NA	NA	4.33E+02	4	NA	NA	1.77E+03	4	9.49E+01	4	3.01E+00	4	NA	NA	0.1	7
Heptane	7.04E-02	4	7.59E-06	6	2.00E+00	4	2.50E+01	4	8.20E+01	4	NA	NA	3.72E+02	4	NA	NA	1.94E+04	4	3.40E+00	4	5.16E+01	4	NA	NA	0.1	7
Hexane	2.00E-01	1	7.77E-06	1	1.66E+00	1	2.50E+01	1	6.82E+01	1	6.90E+03	1	3.42E+02	1	5.08E+02	1	4.34E+01	1	1.24E+01	1	1.82E+02	1	NA	NA	0.1	7
Methyl tertiary butyl ether (MTBE)	1.02E-01	1	1.05E-05	1	6.23E-04	1	2.50E+01	1	2.56E-02	1	6.68E+03	1	3.28E+02	1	4.97E+02	1	7.26E+00	1	5.10E+04	1	2.74E+02	1	NA	NA	0.1	7
Methylene chloride	1.01E-01	1	1.17E-05	1	2.18E-03	1	2.50E+01	1	8.96E-02	1	6.71E+03	1	3.13E+02	1	5.10E+02	1	1.17E+01	1	1.30E+04	1	2.55E+02	1	3.54E-03	3	0.1	7
4-Methyl-2-pentanone (methyl isobutyl ketone)	7.50E-02	1	7.80E-06	1	1.38E-04	1	2.50E+01	1	5.64E-03	1	8.24E+03	1	3.90E+02	1	5.71E+02	1	9.06E+00	1	1.90E+04	1	1.98E+01	1	2.66E-03	3	0.1	7
2-Propanol	1.02E-01	4	1.04E-05	6	8.10E-06	4	2.50E+01	4	3.32E-04	4	NA	NA	3.55E+02	4	NA	NA	4.28E-01	4	1.00E+06	4	4.54E+01	4	NA	NA	0.1	7
Styrene	7.10E-02	1	8.00E-06	1	2.74E-03	1	2.50E+01	1	1.12E-01	1	8.74E+03	1	4.18E+02	1	6.36E+02	1	7.76E+02	1	3.10E+02	1	6.21E+00	1	3.73E-02	3	0.1	7
1,1,2,2-Tetrachloroethane	7.10E-02	1	7.90E-06	1	3.44E-04	1	2.50E+01	1	1.41E-02	1	9.00E+03	1	4.20E+02	1	6.61E+02	1	9.33E+01	1	2.96E+03	1	4.62E+00	1	6.94E-03	3	0.1	7
Tetrachloroethene (PCE)	7.20E-02	1	8.20E-06	1	1.84E-02	1	2.50E+01	1	7.53E-01	1	8.29E+03	1	3.94E+02	1	6.20E+02	1	1.55E+02	1	2.00E+02	1	1.68E+01	1	3.34E-02	3	0.1	7
Tetrahydrofuran	1.02E-01	4	1.05E-05	6	7.05E-05	4	2.50E+01	4	2.89E-03	4	NA	NA	3.38E+02	4	NA	NA	1.11E+00	4	1.00E+06	4	7.43E+02	4	NA	NA	0.1	7
Toluene	8.70E-02	1	8.60E-06	1	6.62E-03	1	2.50E+01	1	2.72E-01	1	7.93E+03	1	3.84E+02	1	5.92E+02	1	1.82E+02	1	5.26E+02	1	2.87E+01	1	3.11E-02	3	0.1	7
1,1,1-Trichloroethane	7.80E-02	1	8.80E-06	1	1.72E-02	1	2.50E+01	1	7.03E-01	1	7.14E+03	1	3.47E+02	1	5.45E+02	1	1.10E+02	1	1.33E+03	1	1.30E+02	1	1.26E-02	3	0.1	7
Trichloroethene (TCE)	7.90E-02	1	9.10E-06	1	1.03E-02	1	2.50E+01	1	4.21E-01	1	7.51E+03	1	3.60E+02	1	5.44E+02	1	1.66E+02	1	1.47E+03	1	8.75E+01	1	1.16E-02	3	0.1	7
Trichlorofluoromethane (Freon 11)	8.70E-02	1	9.70E-06	1	9.68E-02	1	2.50E+01	1	3.97E+00	1	6.00E+03	1	2.97E+02	1	4.71E+02	1	4.97E+02	1	1.10E+03	1	5.89E+02	1	1.27E-02	3	0.1	7
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	7.80E-02	1	8.20E-06	1	4.80E-01	1	2.50E+01	1	1.97E+01	1	6.46E+03	1	3.21E+02	1	4.87E+02	1	1.11E+04	1	1.70E+02	1	3.31E+02	1	NA	NA	0.1	7
1,2,4-Trimethylbenzene	6.06E-02	1	7.92E-06	1	6.14E-03	1	2.50E+01	1	2.52E-01	1	9.37E+03	1	4.42E+02	1	6.49E+02	1	1.35E+03	1	5.70E+01	1	2.21E+00	1	NA	NA	0.1	7
1,3,5-Trimethylbenzene	6.02E-02	1	8.67E-06	1	5.87E-03	1	2.50E+01	1	2.41E-01	1	9.32E+03	1	4.38E+02	1	6.37E+02	1	1.35E+03	1	2.00E+00	1	7.42E-02	1	NA	NA	0.1	7
Xylenes	8.50E-02	2	9.90E-06	2	7.30E-03	5	2.50E+01	1,8	2.70E-01	2	8.66E+03	1,8	4.18E+02	1,8	6.30E+02	1,8	4.43E+02	2	1.06E+02	2	6.60E+00	1,8	NA	NA	0.1	7

Table 2. Physicochemical Properties of Chemicals of Potential Concern

Notes:

(a) Sources of chemical properties are as follows:

1 – USEPA. 2003. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Office of Emergency and Remedial Response. June 19.

2 – USEPA. 2008. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. URL: http://www.epa.gov/region09/waste/sfund/prg/. September 12.

3 – USEPA. 2004. Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. July.

4 – SRC PhysProp Database. 2003. Found at http://esc.syrres.com/interkow/physdemo.htm. And methods from Schwarzenback R. P. et al. 1993. Environmental Organic Chemistry. John Wiley and Sons, Inc., New York, NY.

5 – Regional Water Quality Control Board (RWQCB). 2000. Risked Based Screening Levels. Table J. Physio-chemical and Toxicity Constants used in Models. August.

6 – USEPA. 2006. *Water9, Version 3*. June 29. URL: http://www.epa.gov/ttn/chief/software/water/water9_3

7 – Cal/EPA. 2004. Preliminary Endangerment Assessment Guidance Manual. Department of Toxic Substances Control. January.

8 – For xylenes, o-xylene physicochemical properties are used.

(b) "NA" indicates not available.

Table 3. Johnson and Ettinger Model Inputs

Parameter	Symbol	Value	Units	Reference
Building Properties				
Depth below grade to bottom of enclosed space floor	L_F	15	cm	DTSC/HERD default (Cal/EPA, 2005a; 2005b)
Area of enclosed space below grade	$A_{b,sg}$	2.05E+07	cm^2	Site-specific
Building air exchange rate	AXR_b	1	hr^{-1}	DTSC default (Cal/EPA, 2005b)
Building height	Bh	503	cm	Site-specific
Building ventilation rate	Q_b	2.86E+06	cm^3/s	Calculated: $A_{b,sg}$ x AXR_b x B_h
Vapor flow rate into building	Q_{soil}	102	L/min	Calculated (Cal/EPA, 2005b)
Vapor flow rate into building	Q_{soil}	1707	cm^3/s	Calculated via units conversion
Soil Properties				
Average soil temperature	T_s	17	^oC	Region-specific (USEPA, 2004)
SCS soil type	Site-specific	Site-specific	–	Site-specific
Dry bulk density	ρ_b	1.79	g/cm^3	Site-specific average
Total porosity	n	0.339	cm^3/cm^3	Site-specific average
Water-filled porosity	θ_w	0.236	cm^3/cm^3	Site-specific average
Air-filled porosity	θ_a	0.103	cm^3/cm^3	Site-specific average

Table 4. Exposure Point Concentrations of Chemicals of Potential Concern in Indoor Air of the Onsite Building

Analyte	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Acetone	620	91	9.9E-05	6.1E-02
Benzene	40,000	91	3.5E-05	1.4E+00
1,3-Butadiene	310	91	8.8E-05	2.7E-02
2-Butanone (methyl ethyl ketone)	420	91	6.7E-05	2.8E-02
Carbon disulfide	440	91	4.0E-05	1.8E-02
Chlorobenzene	160	91	2.9E-05	4.7E-03
Chloroform	170	91	4.1E-05	7.0E-03
Chloromethane (methyl chloride)	75	91	4.8E-05	3.6E-03
Cyclohexane	480	91	3.2E-05	1.5E-02
1,2-Dichlorobenzene	2,900	91	2.8E-05	8.3E-02
1,3-Dichlorobenzene	210	91	2.8E-05	5.9E-03
1,4-Dichlorobenzene	460	91	2.8E-05	1.3E-02
Dichlorodifluoromethane (Freon 12)	10,000	91	2.7E-05	2.7E-01
1,1-Dichloroethane	140	91	3.0E-05	4.2E-03
1,2-Dichloroethane	140	91	4.3E-05	6.0E-03
1,1-Dichloroethene (1,1-DCE)	140	91	3.5E-05	5.0E-03
cis-1,2-Dichloroethene (cis-1,2-DCE)	140	91	3.0E-05	4.2E-03
1,4-Dioxane	500	91	2.4E-04	1.2E-01
Ethanol	2,600	91	2.6E-04	6.8E-01
Ethylbenzene	7,700	91	3.0E-05	2.3E-01
4-Ethyltoluene	3,700	91	2.7E-05	1.0E-01
Heptane	550	91	2.8E-05	1.5E-02
Hexane	63,000	91	7.3E-05	4.6E+00
Methyl tertiary butyl ether (MTBE)	500	91	4.3E-05	2.2E-02
Methylene chloride	1,200	91	4.0E-05	4.8E-02
4-Methyl-2-pentanone (methyl isobutyl ketone)	550	91	4.2E-05	2.3E-02
2-Propanol	350	91	1.7E-04	6.1E-02
Styrene	150	91	2.9E-05	4.3E-03
Tetrachloroethene (PCE)	1,100	91	2.9E-05	3.2E-02
Tetrahydrofuran	420	91	6.0E-05	2.5E-02

Table 4. Exposure Point Concentrations of Chemicals of Potential Concern in Indoor Air of the Onsite Building

Analyte	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Toluene	32,000	91	3.4E-05	1.1E+00
1,1,1-Trichloroethane	190	91	3.1E-05	5.9E-03
Trichloroethene (TCE)	190	91	3.1E-05	6.0E-03
Trichlorofluoromethane (Freon 11)	200	91	3.4E-05	6.8E-03
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	270	91	3.1E-05	8.3E-03
1,2,4-Trimethylbenzene	2,900	91	2.5E-05	7.1E-02
1,3,5-Trimethylbenzene	3,600	91	2.4E-05	8.8E-02
Xylenes	19,000	91	3.4E-05	6.4E-01

Notes:

(1) This vapor intrusion transport analysis is based on maximum concentrations of volatile organic compounds (VOCs) in soil gas from the August 1999 and May 2008 site investigations (see Table 1). Chemicals of potential concern (COPCs) with respect to vapor intrusion are those VOCs detected above reporting limits in at least one soil gas sample.

(2) The shallower sampling depth between the 1999 and 2008 sampling events, 3 feet below ground surface, is used in the model because it is a more conservative assumption, i.e., it produces higher indoor air concentrations.

(3) Non source-related inputs to the Johnson and Ettinger Model are documented in Table 3. Shown here are the results of the Johnson and Ettinger Model, consisting of, for each chemical of potential concern, the predicted attenuation factor (α) and the predicted concentration of the chemical in indoor air (CIA).

Table 5. Dispersion Factor Calculation

Parameter	Name	Value	Units	Reference
A_{site}	Area of site	1.3	acre	Area of deed-restricted portion of the site
A	Dispersion coefficient	13.81	–	Zone 2 / San Francisco (USEPA, 2002)
B	Dispersion coefficient	20.16	–	Zone 2 / San Francisco (USEPA, 2002)
C	Dispersion coefficient	234.29	–	Zone 2 / San Francisco (USEPA, 2002)
Q/C_{vol}	Dispersion factor	74.89	$g/m^2/s$ per kg/m^3	Equation D-1 (USEPA, 2002)

Table 6. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Acetone	9.6E-04
Benzene	2.3E-02
1,3-Butadiene	5.0E-04
2-Butanone (methyl ethyl ketone)	4.0E-04
Carbon disulfide	2.9E-04
Chlorobenzene	7.6E-05
Chloroform	1.1E-04
Chloromethane (methyl chloride)	6.1E-05
Cyclohexane	2.5E-04
1,2-Dichlorobenzene	1.3E-03
1,3-Dichlorobenzene	9.5E-05
1,4-Dichlorobenzene	2.1E-04
Dichlorodifluoromethane (Freon 12)	4.3E-03
1,1-Dichloroethane	6.7E-05
1,2-Dichloroethane	9.7E-05
1,1-Dichloroethene (1,1-DCE)	8.1E-05
cis-1,2-Dichloroethene (cis-1,2-DCE)	6.7E-05
1,4-Dioxane	3.1E-03
Ethanol	1.9E-02
Ethylbenzene	3.7E-03
4-Ethyltoluene	1.6E-03
Heptane	2.5E-04
Hexane	8.1E-02
Methyl tertiary butyl ether (MTBE)	3.5E-04
Methylene chloride	8.0E-04
4-Methyl-2-pentanone (methyl isobutyl ketone)	3.4E-04
2-Propanol	1.4E-03
Styrene	7.0E-05
Tetrachloroethene (PCE)	5.1E-04
Tetrahydrofuran	4.3E-04
Toluene	1.8E-02
1,1,1-Trichloroethane	9.6E-05

Table 6. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Trichloroethene (TCE)	9.7E-05
Trichlorofluoromethane (Freon 11)	1.1E-04
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1.4E-04
1,2,4-Trimethylbenzene	1.1E-03
1,3,5-Trimethylbenzene	1.4E-03
Xylenes	1.0E-02

Table 7. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Soil

Chemical of Potential Concern	Concentration (mg/kg)
Benzene	140
Chlorobenzene	0.0017
1,2-Dichlorobenzene	3.1
1,3-Dichlorobenzene	0.038
1,4-Dichlorobenzene	0.33
1,2-Dichloroethane	0.43
Ethylbenzene	170
Methyl tertiary butyl ether (MTBE)	0.084
Toluene	580
Xylenes	990

Notes:

(1) Concentration units are milligrams per kilograms (mg/kg).

(2) Exposure point concentrations (EPCs) in soil are historical maximum detected concentrations.

Table 8. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Groundwater

Chemical of Potential Concern	Concentration (µg/L)
Benzene	99,000
Bromodichloromethane	0.84
Chlorobenzene	0.90
Chloroethane (ethyl chloride)	46
Chloroform	4.7
Chloromethane (methyl chloride)	13
1,2-Dichlorobenzene	0.50
Dichlorodifluoromethane (Freon 12)	3.8
1,1-Dichloroethane	240
1,2-Dichloroethane	2,200
1,1-Dichloroethene (1,1-DCE)	31
cis-1,2-Dichloroethene (cis-1,2-DCE)	8.9
Ethylbenzene	80,000
Methyl tertiary butyl ether (MTBE)	2,800
Methylene chloride	7.9
1,1,2,2-Tetrachloroethane	0.50
Toluene	110,000
1,1,1-Trichloroethane	1.0
Trichloroethene (TCE)	3.8
Xylenes	640,000

Notes:

(1) Concentration units are micrograms per liter (µg/L).

(2) Exposure point concentrations (EPCs) in groundwater are historical maximum detected concentrations.

Table 9. Chronic Daily Intake (CDI) Equations

Inhalation of Vapors

Noncancer

$$CDI_{inhv,worker} = \frac{C_a \times BR_{worker} \times EF_{worker} \times ED_{worker}}{BW_{worker} \times AT_{nc,worker}}$$

$$CDI_{inhv,child} = \frac{C_a \times BR_{child} \times EF_{child} \times ED_{child}}{BW_{child} \times AT_{nc,child}}$$

Cancer

$$CDI_{inhv,worker} = \frac{C_a \times BR_{worker} \times EF_{worker} \times ED_{worker}}{BW_{worker} \times AT_{c}}$$

$$CDI_{inhv,age\text{-}adjusted} = \frac{C_a \times BR_{child} \times EF_{child} \times ED_{child}}{BW_{child} \times AT_{c}} + \frac{C_a \times BR_{adult} \times EF_{adult} \times ED_{adult,age\text{-}adjusted}}{BW_{adult} \times AT_{c}}$$

Soil Ingestion

Noncancer

$$CDI_{ing,worker} = \frac{C_s \times IR_{worker} \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{nc,worker}}$$

Cancer

$$CDI_{ing,worker} = \frac{C_s \times IR_{worker} \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{c}}$$

Soil Dermal Contact

Noncancer

$$CDI_{derm\_s,worker} = \frac{C_s \times SA_{worker} \times AF_{worker} \times ABS \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{nc,worker}}$$

Cancer

$$CDI_{derm\_s,worker} = \frac{C_s \times SA_{worker} \times AF_{worker} \times ABS \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{c}}$$

Groundwater Dermal Contact

Noncancer

$$CDI_{derm\_gw,worker} = \frac{C_w \times SA_{worker} \times K_p \times ET_{worker} \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{nc,worker}}$$

Cancer

$$CDI_{derm\_gw,worker} = \frac{C_w \times SA_{worker} \times K_p \times ET_{worker} \times EF_{worker} \times ED_{worker} \times CF}{BW_{worker} \times AT_{c}}$$

Notes:

(1) Definitions and values of symbols used are given in Tables 2 and 10.

(2) Worker indicates commercial and construction worker scenario; adult and child indicate residential scenario.

Table 10. Exposure Assumptions

Parameter	Symbol	Units	Offsite Resident Adult	Offsite Resident Age-Adjusted	Offsite Resident Child	Indoor Commercial Worker	Onsite Outdoor Intrusive Construction Worker
Dermal Contact with Soil and Groundwater							
Surface area	SA	cm^2/d	NA	NA	NA	NA	5,700
Adherence factor (soil only)	AF	mg/cm^2	NA	NA	NA	NA	0.8
Conversion Factor	CF	kg/mg	NA	NA	NA	NA	1.0E-06
Ingestion of Soil							
Ingestion Rate	IR	mg/d	NA	NA	NA	NA	330
Conversion Factor	CF	kg/mg	NA	NA	NA	NA	0.000001
Inhalation of Volatiles							
Breathing Rate	BR	m^3/d	20	20	10	14	20
General Intake Parameters							
Exposure Time		hrs/d	NA	NA	NA	8	8
Exposure Frequency	EF	d/y	350	350	350	250	20
Exposure Duration	ED	y	30	24	6	25	1
Body Weight	BW	kg	70	70	15	70	70
Averaging Time-Carcinogens	AT_c	d	25,550	25,550	25,550	25,550	25,550
Averaging Time-Noncarcinogens	AT_{nc}	d	10,950	NA	2,190	9,125	365

Notes:

(1) Exposure assumptions are derived from default values for the commercial scenario established in Cal/EPA's*Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities* (Cal/EPA, 2005).

(2) For the outdoor instrusive construction worker, it is assumed that the duration of instrusive construction work is 4 weeks (20 work days).

Table 11. Chronic Daily Intakes – Cancer

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact	Inhalation
Acetone	3.0E-06	2.1E-10	–	–	–	1.4E-07
Benzene	6.8E-05	5.1E-09	5.2E-07	7.1E-07	7.5E-04	3.4E-06
Bromodichloromethane	–	–	–	–	2.0E-09	–
1,3-Butadiene	1.3E-06	1.1E-10	–	–	–	7.4E-08
2-Butanone (methyl ethyl ketone)	1.4E-06	9.1E-11	–	–	–	6.0E-08
Carbon disulfide	8.7E-07	6.6E-11	–	–	–	4.4E-08
Chlorobenzene	2.3E-07	1.7E-11	6.3E-12	8.7E-12	1.3E-08	1.1E-08
Chloroethane (ethyl chloride)	–	–	–	–	1.4E-07	–
Chloroform	3.4E-07	2.6E-11	–	–	1.6E-08	1.7E-08
Chloromethane (methyl chloride)	1.8E-07	1.4E-11	–	–	2.2E-08	9.1E-09
Cyclohexane	7.4E-07	5.5E-11	–	–	–	3.7E-08
1,2-Dichlorobenzene	4.0E-06	2.9E-10	1.1E-08	1.6E-08	1.1E-08	2.0E-07
1,3-Dichlorobenzene	2.9E-07	2.1E-11	1.4E-10	1.9E-10	–	1.4E-08
1,4-Dichlorobenzene	6.4E-07	4.7E-11	1.2E-09	1.7E-09	–	3.1E-08
Dichlorodifluoromethane (Freon 12)	1.3E-05	9.6E-10	–	–	1.7E-08	6.4E-07
1,1-Dichloroethane	2.0E-07	1.5E-11	–	–	8.3E-07	1.0E-08
1,2-Dichloroethane	2.9E-07	2.2E-11	1.6E-09	2.2E-09	4.7E-06	1.4E-08
1,1-Dichloroethene (1,1-DCE)	2.4E-07	1.8E-11	–	–	1.8E-07	1.2E-08
cis-1,2-Dichloroethene (cis-1,2-DCE)	2.0E-07	1.5E-11	–	–	2.9E-08	1.0E-08
1,4-Dioxane	5.9E-06	7.0E-10	–	–	–	4.7E-07
Ethanol	3.3E-05	4.3E-09	–	–	–	2.8E-06
Ethylbenzene	1.1E-05	8.4E-10	6.3E-07	8.7E-07	2.0E-03	5.6E-07
4-Ethyltoluene	4.9E-06	3.7E-10	–	–	–	2.4E-07
Heptane	7.5E-07	5.6E-11	–	–	–	3.7E-08
Hexane	2.3E-04	1.8E-08	–	–	–	1.2E-05

Table 11. Chronic Daily Intakes – Cancer

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact	Inhalation
Methyl tertiary butyl ether (MTBE)	1.1E-06	7.8E-11	3.1E-10	4.3E-10	5.0E-06	5.2E-08
Methylene chloride	2.4E-06	1.8E-10	–	–	1.4E-08	1.2E-07
4-Methyl-2-pentanone (methyl isobutyl ketone)	1.1E-06	7.7E-11	–	–	–	5.1E-08
2-Propanol	3.0E-06	3.1E-10	–	–	–	2.0E-07
Styrene	2.1E-07	1.6E-11	–	–	–	1.0E-08
1,1,2,2-Tetrachloroethane	–	–	–	–	1.8E-09	–
Tetrachloroethene (PCE)	1.5E-06	1.1E-10	–	–	–	7.6E-08
Tetrahydrofuran	1.2E-06	9.7E-11	–	–	–	6.5E-08
Toluene	5.4E-05	4.0E-09	2.1E-06	3.0E-06	1.7E-03	2.7E-06
1,1,1-Trichloroethane	2.9E-07	2.1E-11	–	–	6.4E-09	1.4E-08
Trichloroethene (TCE)	2.9E-07	2.2E-11	–	–	2.3E-08	1.4E-08
Trichlorofluoromethane (Freon 11)	3.3E-07	2.5E-11	–	–	–	1.7E-08
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	4.1E-07	3.0E-11	–	–	–	2.0E-08
1,2,4-Trimethylbenzene	3.5E-06	2.5E-10	–	–	–	1.7E-07
1,3,5-Trimethylbenzene	4.3E-06	3.1E-10	–	–	–	2.1E-07
Xylenes	3.1E-05	2.3E-09	3.7E-06	5.0E-06	1.3E-02	1.6E-06

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

Table 12. Chronic Daily Intakes – Noncancer

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact	Inhalation
Acetone	8.4E-06	1.7E-09	–	–	–	6.9E-08
Benzene	1.9E-04	4.2E-05	9.0E-03	1.2E-02	1.3E+01	1.7E-03
Bromodichloromethane	–	–	–	–	6.9E-06	–
1,3-Butadiene	3.8E-06	1.4E-05	–	–	–	5.6E-04
2-Butanone (methyl ethyl ketone)	3.8E-06	4.4E-09	–	–	–	1.8E-07
Carbon disulfide	2.4E-06	2.3E-08	–	–	–	9.4E-07
Chlorobenzene	6.5E-07	4.2E-09	2.2E-08	3.0E-08	4.5E-05	1.7E-07
Chloroethane (ethyl chloride)	–	–	–	–	2.5E-05	–
Chloroform	9.5E-07	2.1E-08	–	–	1.1E-04	8.6E-07
Chloromethane (methyl chloride)	5.0E-07	3.7E-08	–	–	5.9E-05	1.5E-06
Cyclohexane	2.1E-06	2.3E-09	–	–	–	9.2E-08
1,2-Dichlorobenzene	1.1E-05	3.6E-07	8.9E-06	1.2E-05	8.2E-06	1.5E-05
1,3-Dichlorobenzene	8.1E-07	4.9E-08	3.3E-07	4.5E-07	–	2.0E-06
1,4-Dichlorobenzene	1.8E-06	1.4E-08	2.8E-06	3.9E-06	–	5.8E-07
Dichlorodifluoromethane (Freon 12)	3.6E-05	1.2E-06	–	–	6.1E-06	4.8E-05
1,1-Dichloroethane	5.7E-07	7.5E-09	–	–	2.9E-04	3.1E-07
1,2-Dichloroethane	8.2E-07	1.3E-08	5.6E-06	7.7E-06	1.6E-02	5.4E-07
1,1-Dichloroethene (1,1-DCE)	6.8E-07	6.4E-08	–	–	2.6E-04	2.6E-06
cis-1,2-Dichloroethene (cis-1,2-DCE)	5.7E-07	1.1E-07	–	–	2.0E-04	4.3E-06
1,4-Dioxane	1.6E-05	5.7E-08	–	–	–	2.3E-06
Ethanol	9.3E-05	1.0E-06	–	–	–	4.1E-05
Ethylbenzene	3.2E-05	2.0E-07	4.4E-04	6.1E-04	1.4E+00	8.4E-06
4-Ethyltoluene	1.4E-05	9.0E-07	–	–	–	3.7E-05
Heptane	2.1E-06	1.9E-08	–	–	–	8.0E-07

Table 12. Chronic Daily Intakes – Noncancer

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact	Inhalation
Hexane	6.3E-04	6.3E-06	–	–	–	2.6E-04
Methyl tertiary butyl ether (MTBE)	3.0E-06	6.4E-09	2.5E-08	3.5E-08	4.1E-04	2.6E-07
Methylene chloride	6.6E-06	1.1E-07	–	–	1.7E-05	4.5E-06
4-Methyl-2-pentanone (methyl isobutyl ketone)	3.2E-06	6.3E-09	–	–	–	2.6E-07
2-Propanol	8.4E-06	1.1E-08	–	–	–	4.4E-07
Styrene	5.9E-07	4.2E-09	–	–	–	1.7E-07
1,1,2,2-Tetrachloroethane	–	–	–	–	3.1E-05	–
Tetrachloroethene (PCE)	4.3E-06	8.0E-07	–	–	–	3.3E-05
Tetrahydrofuran	3.4E-06	7.9E-09	–	–	–	3.2E-07
Toluene	1.5E-04	3.3E-06	1.9E-03	2.6E-03	1.5E+00	1.3E-04
1,1,1-Trichloroethane	8.1E-07	5.2E-09	–	–	2.3E-07	2.1E-07
Trichloroethene (TCE)	8.2E-07	8.9E-09	–	–	5.3E-03	3.6E-07
Trichlorofluoromethane (Freon 11)	9.4E-07	8.8E-09	–	–	–	3.6E-07
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1.1E-06	2.5E-10	–	–	–	1.0E-08
1,2,4-Trimethylbenzene	9.8E-06	8.9E-06	–	–	–	3.6E-04
1,3,5-Trimethylbenzene	1.2E-05	1.3E-05	–	–	–	5.2E-04
Xylenes	8.8E-05	5.7E-06	1.3E-03	1.8E-03	4.7E+00	2.3E-04

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

Table 13. Carcinogenic and Noncarcinogenic Toxicity Values

Chemical of Potential Concern	Cancer Slope Factor (CSF)				Chronic Noncancer Reference Dose (RfD)			
	Inhalation (per mg/kg/d)	Source	Oral (per mg/kg/d)	Source	Inhalation (mg/kg/d)	Source	Oral (mg/kg/d)	Source
Acetone	NC	NA	NC	NA	8.9E+00	3A	9.0E-01	2
Benzene	1.0E-01	1	1.0E-01	1	8.6E-03	2	4.0E-03	2
Bromodichloromethane	1.3E-01	1	1.3E-01	1	2.0E-02	R	2.0E-02	2
1,3-Butadiene	6.0E-01	1	3.4E+00	1	5.7E-04	2	5.7E-04	R
2-Butanone (methyl ethyl ketone)	NC	NA	NC	NA	1.4E+00	2	6.0E-01	2
Carbon disulfide	NC	NA	NC	NA	2.0E-01	2	1.0E-01	2
Chlorobenzene	NC	NA	NC	NA	2.9E-01	1	2.0E-02	2
Chloroethane (ethyl chloride)	NC	NA	NC	NA	2.9E+00	2	4.0E-01	4N
Chloroform	1.9E-02	1	3.1E-02	1	8.6E-02	1	1.0E-02	2
Chloromethane (methyl chloride)	6.3E-03	3H	1.3E-02	3H	2.6E-02	2	2.6E-02	R
Cyclohexane	NC	NA	NC	NA	1.7E+00	2	1.7E+00	R
1,2-Dichlorobenzene	NC	NA	NC	NA	5.7E-02	3H	9.0E-02	2
1,3-Dichlorobenzene	NC	NA	NC	NA	3.0E-02	R	3.0E-02	4N
1,4-Dichlorobenzene	4.0E-02	1	5.4E-03	1	2.3E-01	1	3.0E-02	4N
Dichlorodifluoromethane (Freon 12)	NC	NA	NC	NA	5.7E-02	3H	2.0E-01	2
1,1-Dichloroethane	5.7E-03	1	5.7E-03	1	1.4E-01	4H	2.0E-01	3P
1,2-Dichloroethane	7.2E-02	1	4.7E-02	1	1.1E-01	1	2.0E-02	3P
1,1-Dichloroethene (1,1-DCE)	NC	NA	NC	NA	2.0E-02	1	5.0E-02	2
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	NA	NC	NA	1.0E-02	R	1.0E-02	3P
1,4-Dioxane	2.7E-02	1	2.7E-02	1	8.6E-01	1	8.6E-01	R
Ethanol	NC	NA	NC	NA	3.0E-01	R	3.0E-01	2
Ethylbenzene	8.7E-03	1	1.1E-02	1	2.9E-01	2	1.0E-01	2
4-Ethyltoluene	NC	NA	NC	NA	2.9E-02	2	2.0E-01	2
Heptane	NC	NA	NC	NA	2.0E-01	2	6.0E-02	3H
Hexane	NC	NA	NC	NA	2.0E-01	2	6.0E-02	3H
Methyl tertiary butyl ether (MTBE)	9.1E-04	1	1.8E-03	1	8.6E-01	2	8.6E-01	R
Methylene chloride	3.5E-03	1	1.4E-02	1	1.1E-01	1	6.0E-02	2
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	NA	NC	NA	8.6E-01	2	8.0E-02	3H
2-Propanol	NC	NA	NC	NA	2.0E+00	1	2.0E+00	R
Styrene	NC	NA	NC	NA	2.6E-01	1	2.0E-01	2
1,1,2,2-Tetrachloroethane	2.0E-01	1	2.7E-01	1	4.0E-03	R	4.0E-03	3P
Tetrachloroethene (PCE)	2.1E-02	1	5.4E-01	1	1.0E-02	1	1.0E-02	2
Tetrahydrofuran	7.0E-03	N	7.6E-03	4N	8.6E-01	N	3.0E-01	N
Toluene	NC	NA	NC	NA	8.6E-02	1	8.0E-02	2
1,1,1-Trichloroethane	NC	NA	NC	NA	2.9E-01	1	2.0E+00	2
Trichloroethene (TCE)	7.0E-03	1	1.3E-02	1	1.7E-01	1	3.0E-04	4N
Trichlorofluoromethane (Freon 11)	NC	NA	NC	NA	2.0E-01	3H	3.0E-01	2
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	NA	NC	NA	8.6E+00	3H	3.0E+00	2
1,2,4-Trimethylbenzene	NC	NA	NC	NA	2.0E-03	3P	5.0E-02	4P
1,3,5-Trimethylbenzene	NC	NA	NC	NA	1.7E-03	3P	5.0E-02	3P
Xylenes	NC	NA	NC	NA	2.9E-02	2	2.0E-01	2

Table 13. Carcinogenic and Noncarcinogenic Toxicity Values

Notes:

(a) Sources of toxicity data are as follows.

- 1 – OEHHA *Toxicity Criteria Database*
- 2 – USEPA *Integrated Risk Information System* (IRIS)
- 3 – USEPA *Region 9 Regional Screening Levels Table (2008)*
- 4 – USEPA *Region 9 PRG Table (2004)*
- A – Agency for Toxic Substances & Disease Registry (ATSDR)
- P – USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs) Database
- N – USEPA National Center for Environmental Assessment
- H – USEPA HEAST
- R – Route-to-route extrapolation

(b) Isobutanol was used as the surrogate for ethanol's oral and inhalation noncancer reference dose.

(c) Xylene was used as the surrogate for 4-ethyltoluene's oral and inhalation noncancer reference dose.

(d) Hexane was used as the surrogate for this heptane's oral and inhalation noncancer reference dose.

(e) Tetrahydrofuran toxicological values were derived from *Draft Toxicological Review of Tetrahydrofuran (USEPA, 2007).*

(f) "NC" indicates that the chemical is classified as a noncarcinogen for the inhalation pathway.

(g) "NA" means not-applicable (see note [e]).

Table 14. Summary of Estimated Cancer Risks – Baseline

	Onsite Commercial Worker	Onsite Intrusive Construction Worker					Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	NC	NC	–	–	–	–	NC
Benzene	6.8E-06	5.1E-10	5.2E-08	7.1E-08	7.5E-05	7.5E-05	3.4E-07
Bromodichloromethane	–	–	–	–	2.6E-10	2.6E-10	–
1,3-Butadiene	8.0E-07	6.7E-11	–	–	–	6.7E-11	4.4E-08
2-Butanone (methyl ethyl ketone)	NC	NC	–	–	–	–	NC
Carbon disulfide	NC	NC	–	–	–	–	NC
Chlorobenzene	NC	NC	NC	NC	NC	–	NC
Chloroethane (ethyl chloride)	–	–	–	–	NC	–	–
Chloroform	6.5E-09	4.9E-13	–	–	5.1E-10	5.1E-10	3.2E-10
Chloromethane (methyl chloride)	1.1E-09	8.6E-14	–	–	2.8E-10	2.8E-10	5.7E-11
Cyclohexane	NC	NC	–	–	–	–	NC
1,2-Dichlorobenzene	NC	NC	NC	NC	NC	–	NC
1,3-Dichlorobenzene	NC	NC	NC	NC	–	–	NC
1,4-Dichlorobenzene	2.5E-08	1.9E-12	6.6E-12	9.1E-12	–	1.8E-11	1.2E-09
Dichlorodifluoromethane (Freon 12)	NC	NC	–	–	NC	–	NC
1,1-Dichloroethane	1.2E-09	8.6E-14	–	–	4.7E-09	4.7E-09	5.7E-11
1,2-Dichloroethane	2.1E-08	1.6E-12	7.5E-11	1.0E-10	2.2E-07	2.2E-07	1.0E-09
1,1-Dichloroethene (1,1-DCE)	NC	NC	–	–	NC	–	NC
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	NC	–	–	NC	–	NC
1,4-Dioxane	1.6E-07	1.9E-11	–	–	–	1.9E-11	1.3E-08
Ethanol	NC	NC	–	–	–	–	NC
Ethylbenzene	9.8E-08	7.3E-12	6.9E-09	9.5E-09	2.2E-05	2.2E-05	4.8E-09
4-Ethyltoluene	NC	NC	–	–	–	–	NC
Heptane	NC	NC	–	–	–	–	NC
Hexane	NC	NC	–	–	–	–	NC
Methyl tertiary butyl ether (MTBE)	9.6E-10	7.1E-14	5.6E-13	7.7E-13	9.0E-09	9.0E-09	4.7E-11
Methylene chloride	8.3E-09	6.2E-13	–	–	2.0E-10	2.0E-10	4.1E-10
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	NC	–	–	–	–	NC

Table 14. Summary of Estimated Cancer Risks – Baseline

	Onsite Commercial Worker	Onsite Intrusive Construction Worker					Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
2-Propanol	NC	NC	–	–	–	–	NC
Styrene	NC	NC	–	–	–	–	NC
1,1,2,2-Tetrachloroethane	–	–	–	–	4.8E-10	4.8E-10	–
Tetrachloroethene (PCE)	3.2E-08	2.4E-12	–	–	–	2.4E-12	1.6E-09
Tetrahydrofuran	8.6E-09	6.8E-13	–	–	–	6.8E-13	4.5E-10
Toluene	NC	NC	NC	NC	NC	–	NC
1,1,1-Trichloroethane	NC	NC	–	–	NC	–	NC
Trichloroethene (TCE)	2.0E-09	1.5E-13	–	–	2.9E-10	2.9E-10	1.0E-10
Trichlorofluoromethane (Freon 11)	NC	NC	–	–	–	–	NC
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	NC	–	–	–	–	NC
1,2,4-Trimethylbenzene	NC	NC	–	–	–	–	NC
1,3,5-Trimethylbenzene	NC	NC	–	–	–	–	NC
Xylenes	NC	NC	NC	NC	NC	–	NC
Cumulative Risk	8.0E-06	6.1E-10	5.9E-08	8.1E-08	9.7E-05	9.8E-05	4.1E-07

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

(2) "NC" indicates chemical was determined to be a noncarcinogen.

Table 15. Summary of Estimated Noncancer Hazard Indices – Baseline

	Onsite Commercial Worker	Onsite Intrusive Construction Worker					Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	9.5E-07	1.7E-09	–	–	–	1.7E-09	6.9E-08
Benzene	2.2E-02	4.2E-05	9.0E-03	1.2E-02	1.3E+01	1.3E+01	1.7E-03
Bromodichloromethane	–	–	–	–	6.9E-06	6.9E-06	–
1,3-Butadiene	6.6E-03	1.4E-05	–	–	–	1.4E-05	5.6E-04
2-Butanone (methyl ethyl ketone)	2.7E-06	4.4E-09	–	–	–	4.4E-09	1.8E-07
Carbon disulfide	1.2E-05	2.3E-08	–	–	–	2.3E-08	9.4E-07
Chlorobenzene	2.3E-06	4.2E-09	2.2E-08	3.0E-08	4.5E-05	4.5E-05	1.7E-07
Chloroethane (ethyl chloride)	–	–	–	–	2.5E-05	2.5E-05	–
Chloroform	1.1E-05	2.1E-08	–	–	1.1E-04	1.1E-04	8.6E-07
Chloromethane (methyl chloride)	1.9E-05	3.7E-08	–	–	5.9E-05	5.9E-05	1.5E-06
Cyclohexane	1.2E-06	2.3E-09	–	–	–	2.3E-09	9.2E-08
1,2-Dichlorobenzene	2.0E-04	3.6E-07	8.9E-06	1.2E-05	8.2E-06	3.0E-05	1.5E-05
1,3-Dichlorobenzene	2.7E-05	4.9E-08	3.3E-07	4.5E-07	–	8.3E-07	2.0E-06
1,4-Dichlorobenzene	7.8E-06	1.4E-08	2.8E-06	3.9E-06	–	6.8E-06	5.8E-07
Dichlorodifluoromethane (Freon 12)	6.4E-04	1.2E-06	–	–	6.1E-06	7.2E-06	4.8E-05
1,1-Dichloroethane	4.1E-06	7.5E-09	–	–	2.9E-04	2.9E-04	3.1E-07
1,2-Dichloroethane	7.1E-06	1.3E-08	5.6E-06	7.7E-06	1.6E-02	1.6E-02	5.4E-07
1,1-Dichloroethene (1,1-DCE)	3.4E-05	6.4E-08	–	–	2.6E-04	2.6E-04	2.6E-06
cis-1,2-Dichloroethene (cis-1,2-DCE)	5.7E-05	1.1E-07	–	–	2.0E-04	2.0E-04	4.3E-06
1,4-Dioxane	1.9E-05	5.7E-08	–	–	–	5.7E-08	2.3E-06
Ethanol	3.1E-04	1.0E-06	–	–	–	1.0E-06	4.1E-05
Ethylbenzene	1.1E-04	2.0E-07	4.4E-04	6.1E-04	1.4E+00	1.4E+00	8.4E-06
4-Ethyltoluene	4.8E-04	9.0E-07	–	–	–	9.0E-07	3.7E-05
Heptane	1.1E-05	1.9E-08	–	–	–	1.9E-08	8.0E-07
Hexane	3.2E-03	6.3E-06	–	–	–	6.3E-06	2.6E-04
Methyl tertiary butyl ether (MTBE)	3.4E-06	6.4E-09	2.5E-08	3.5E-08	4.1E-04	4.1E-04	2.6E-07
Methylene chloride	5.8E-05	1.1E-07	–	–	1.7E-05	1.7E-05	4.5E-06
4-Methyl-2-pentanone (methyl isobutyl ketone)	3.7E-06	6.3E-09	–	–	–	6.3E-09	2.6E-07
2-Propanol	4.2E-06	1.1E-08	–	–	–	1.1E-08	4.4E-07

Table 15. Summary of Estimated Noncancer Hazard Indices – Baseline

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Styrene	2.3E-06	4.2E-09	–	–	–	4.2E-09	1.7E-07
1,1,2,2-Tetrachloroethane	–	–	–	–	3.1E-05	3.1E-05	–
Tetrachloroethene (PCE)	4.3E-04	8.0E-07	–	–	–	8.0E-07	3.3E-05
Tetrahydrofuran	4.0E-06	7.9E-09	–	–	–	7.9E-09	3.2E-07
Toluene	1.8E-03	3.3E-06	1.9E-03	2.6E-03	1.5E+00	1.5E+00	1.3E-04
1,1,1-Trichloroethane	2.8E-06	5.2E-09	–	–	2.3E-07	2.3E-07	2.1E-07
Trichloroethene (TCE)	4.8E-06	8.9E-09	–	–	5.3E-03	5.3E-03	3.6E-07
Trichlorofluoromethane (Freon 11)	4.7E-06	8.8E-09	–	–	–	8.8E-09	3.6E-07
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1.3E-07	2.5E-10	–	–	–	2.5E-10	1.0E-08
1,2,4-Trimethylbenzene	4.9E-03	8.9E-06	–	–	–	8.9E-06	3.6E-04
1,3,5-Trimethylbenzene	7.0E-03	1.3E-05	–	–	–	1.3E-05	5.2E-04
Xylenes	3.1E-03	5.7E-06	1.3E-03	1.8E-03	4.7E+00	4.7E+00	2.3E-04
Cumulative Hazard	5.1E-02	9.7E-05	1.3E-02	1.7E-02	2.1E+01	2.1E+01	4.0E-03

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

Table 16. Risk-based Soil Gas Cleanup Goals

Chemical of Potential Concern	Cancer-based Indoor Air Target Concentration (CA_c) ($\mu g/m^3$)	Noncancer-based Indoor Air Target Concentration (CA_{nc}) ($\mu g/m^3$)	Controlling Indoor Air Target Concentration (CA) ($\mu g/m^3$)	Attenuation Factor at 5.0 feet bgs	Risk-based Cleanup Goal at 5.0 ft bgs ($\mu g/m^3$)
Acetone	NC	6.5E+04	6.5E+04	5.9E-05	1.1E+09
Benzene	2.0E+00	6.3E+01	2.0E+00	2.0E-05	1.0E+05
1,3-Butadiene	3.4E-01	4.2E+00	3.4E-01	5.3E-05	6.5E+03
2-Butanone (methyl ethyl ketone)	NC	1.0E+04	1.0E+04	3.9E-05	2.7E+08
Carbon disulfide	NC	1.5E+03	1.5E+03	2.3E-05	6.3E+07
Chlorobenzene	NC	2.1E+03	2.1E+03	1.7E-05	1.2E+08
Chloroform	1.1E+01	6.3E+02	1.1E+01	2.3E-05	4.6E+05
Chloromethane (methyl chloride)	3.2E+01	1.9E+02	3.2E+01	2.8E-05	1.2E+06
Cyclohexane	NC	1.3E+04	1.3E+04	1.8E-05	7.0E+08
1,2-Dichlorobenzene	NC	4.2E+02	4.2E+02	1.6E-05	2.6E+07
1,3-Dichlorobenzene	NC	2.2E+02	2.2E+02	1.6E-05	1.4E+07
1,4-Dichlorobenzene	5.1E+00	1.7E+03	5.1E+00	1.6E-05	3.2E+05
Dichlorodifluoromethane (Freon 12)	NC	4.2E+02	4.2E+02	1.5E-05	2.8E+07
1,1-Dichloroethane	3.6E+01	1.0E+03	3.6E+01	1.7E-05	2.1E+06
1,2-Dichloroethane	2.8E+00	8.3E+02	2.8E+00	2.4E-05	1.2E+05
1,1-Dichloroethene (1,1-DCE)	NC	1.5E+02	1.5E+02	2.0E-05	7.2E+06
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	7.3E+01	7.3E+01	1.7E-05	4.3E+06
1,4-Dioxane	7.6E+00	6.3E+03	7.6E+00	1.6E-04	4.7E+04
Ethanol	NC	2.2E+03	2.2E+03	1.8E-04	1.2E+07

Table 16. Risk-based Soil Gas Cleanup Goals

Chemical of Potential Concern	Cancer-based Indoor Air Target Concentration (CA_c) ($\mu g/m^3$)	Noncancer-based Indoor Air Target Concentration (CA_{nc}) ($\mu g/m^3$)	Controlling Indoor Air Target Concentration (CA) ($\mu g/m^3$)	Attenuation Factor at 5.0 feet bgs	Risk-based Cleanup Goal at 5.0 ft bgs ($\mu g/m^3$)
Ethylbenzene	2.3E+01	2.1E+03	2.3E+01	1.7E-05	1.4E+06
4-Ethyltoluene	NC	2.1E+02	2.1E+02	1.5E-05	1.3E+07
Heptane	NC	1.5E+03	1.5E+03	1.6E-05	9.2E+07
Hexane	NC	1.5E+03	1.5E+03	4.3E-05	3.4E+07
Methyl tertiary butyl ether (MTBE)	2.2E+02	6.3E+03	2.2E+02	2.5E-05	9.1E+06
Methylene chloride	5.8E+01	8.3E+02	5.8E+01	2.3E-05	2.5E+06
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	6.3E+03	6.3E+03	2.4E-05	2.6E+08
2-Propanol	NC	1.5E+04	1.5E+04	1.1E-04	1.3E+08
Styrene	NC	1.9E+03	1.9E+03	1.6E-05	1.1E+08
Tetrachloroethene (PCE)	9.7E+00	7.3E+01	9.7E+00	1.6E-05	6.0E+05
Tetrahydrofuran	2.9E+01	6.3E+03	2.9E+01	3.5E-05	8.4E+05
Toluene	NC	6.3E+02	6.3E+02	2.0E-05	3.2E+07
1,1,1-Trichloroethane	NC	2.1E+03	2.1E+03	1.8E-05	1.2E+08
Trichloroethene (TCE)	2.9E+01	1.3E+03	2.9E+01	1.8E-05	1.6E+06
Trichlorofluoromethane (Freon 11)	NC	1.5E+03	1.5E+03	2.0E-05	7.5E+07
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	6.3E+04	6.3E+04	1.8E-05	3.6E+09
1,2,4-Trimethylbenzene	NC	1.5E+01	1.5E+01	1.4E-05	1.1E+06
1,3,5-Trimethylbenzene	NC	1.3E+01	1.3E+01	1.4E-05	9.0E+05
Xylenes	NC	2.1E+02	2.1E+02	1.9E-05	1.1E+07

Table 16. Risk-based Soil Gas Cleanup Goals

Chemical of Potential Concern	Cancer-based Indoor Air Target Concentration (CA_c) ($\mu g/m^3$)	Noncancer-based Indoor Air Target Concentration (CA_{nc}) ($\mu g/m^3$)	Controlling Indoor Air Target Concentration (CA) ($\mu g/m^3$)	Attenuation Factor at 5.0 feet bgs	Risk-based Cleanup Goal at 5.0 ft bgs ($\mu g/m^3$)

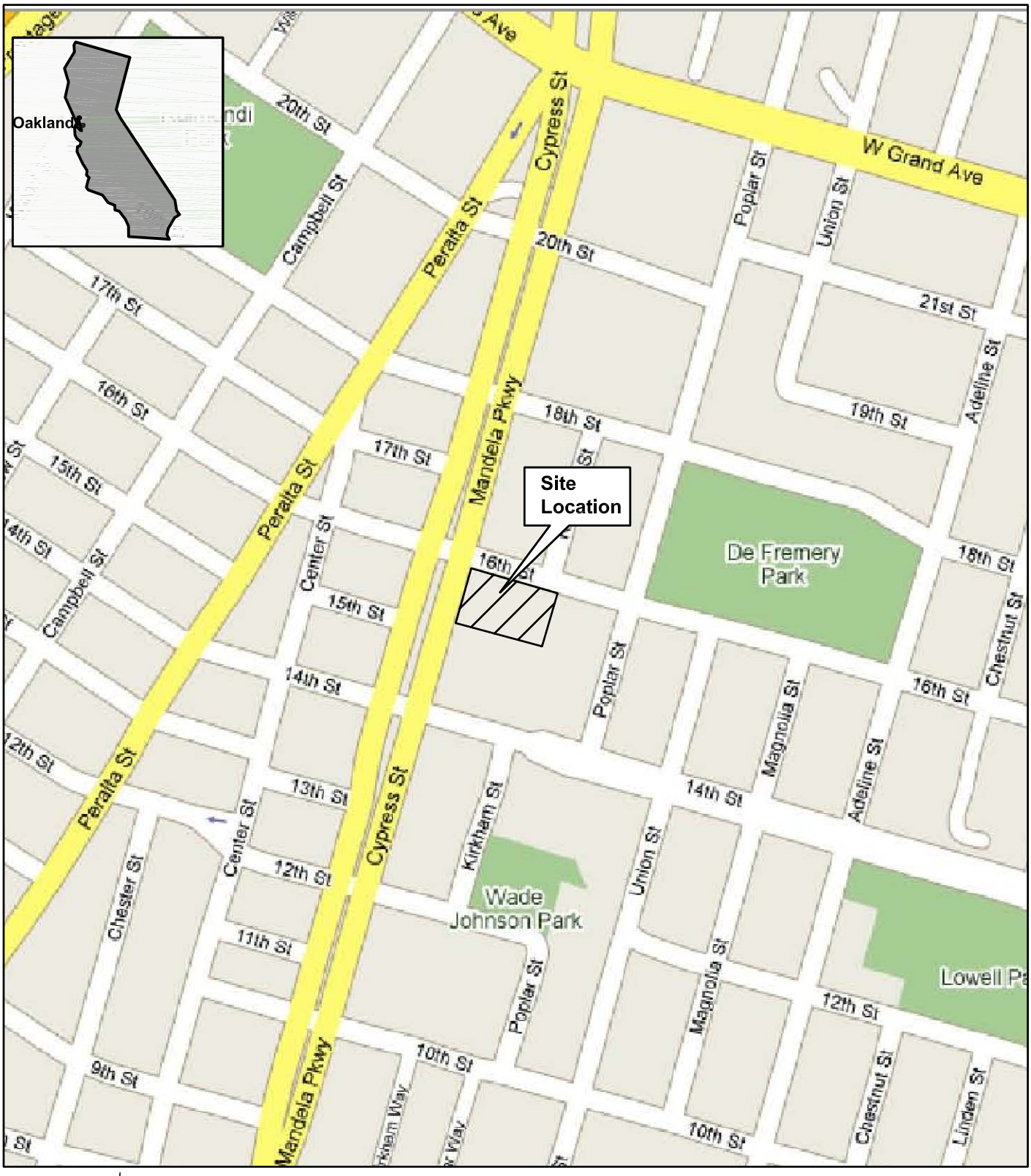
Notes:

(1) Cancer-based indoor air target concentrations assume a target risk of $1x10^{-5}$. Noncancer-based indoor air target concentrations assume a target hazard quotient of 1.

(2) Soil gas screening levels are calculated from the chemical-specific risk-based indoor air target concentration and attenuation factor:

$C_{SG} = C_{IA} / \alpha$

(3) NC = Noncarcinogenic



IRIS ENVIRONMENTAL
1438 Webster Street, Suite 302
Oakland, California 94612
Ph. (510) 834-4747 Fax: (510) 834-4199

Site Location Map
Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Figure
1

Drafter: EC | Date: 11/12/08 | Contract Number: 07-557-A

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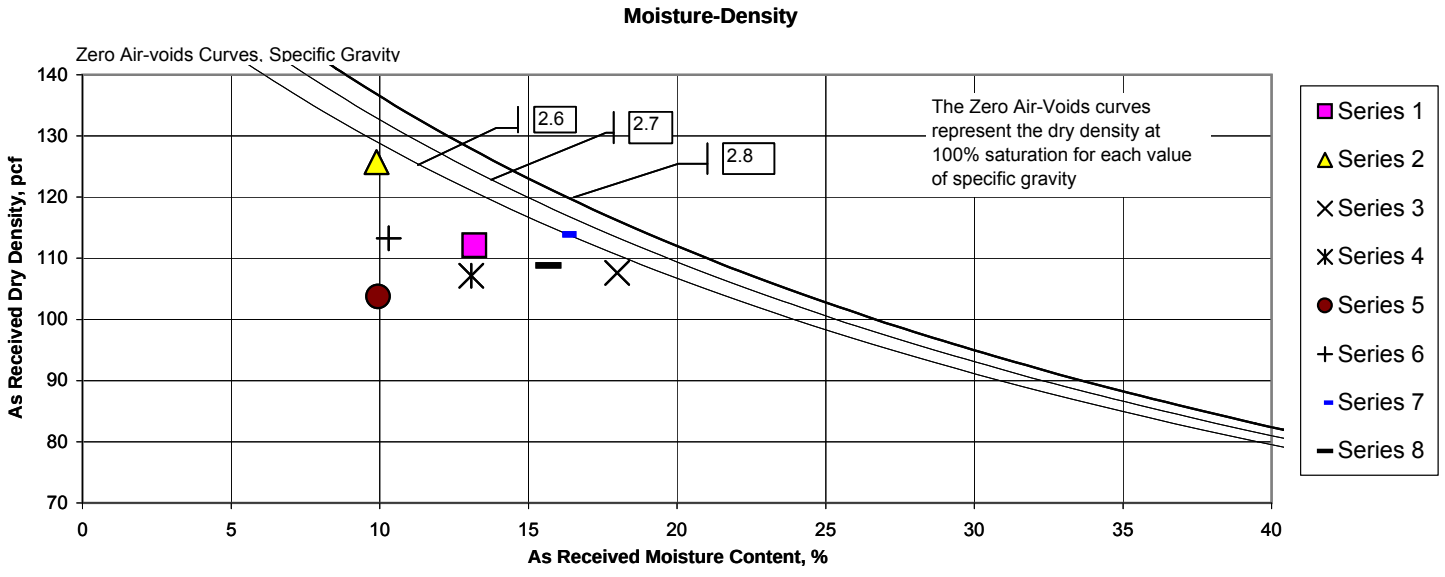
Total and Effective Porosity Report
(API RP40 and ASTM D6836m)

Job No: 634-013 **Project No.:** 720-17784-1
Client: TestAmerica **Date:** 2/17/09
Project Name: Nestle-Oakland **By:** PJ

Boring: / Sample: / Depth, ft:	GT-A-4.5 720-17784-1	GT-A-5.0 720-17784-2	GT-B-4.5 720-17784-3	GT-B-5.0 720-17784-4	GT-C-4.5 720-17784-5	GT-C-5.0 720-17784-6	GT-D-4.5 720-17784-7	GT-D-5.0 720-17784-8
Visual Description:	Grayish Brown Clayey SAND w/ Gravel	Grayish Brown Clayey GRAVEL w/ Sand	Mottled Reddish Brown Clayey SAND	Mottled Reddish Brown SAND w/ Clay*	Grayish Brown SAND w/ Clay*	Grayish Brown Clayey SAND	Mottled Brown Clayey SAND	Brown SAND w/ Clay*
Total Porosity, %	33.5	25.7	36.4	36.5	38.3	32.4	32.5	35.7
Effective Porosity, %	12.9	7.0	7.3	16.1	23.7	4.2	4.9	10.3
Air-filled Porosity, %	9.9	5.8	5.5	14.1	21.8	13.7	3.0	8.4
Water-filled Porosity, %	23.7	19.9	31.0	22.4	16.5	18.7	29.5	27.3
Saturation, %	70.6	77.3	85.0	61.5	43.1	57.7	90.9	76.4
Moisture, %	13.2	9.9	18.0	13.1	9.9	10.3	16.2	15.7
Wet Unit wt, pcf	126.9	138.2	127.0	121.1	114.1	124.9	132.3	125.9
Dry Unit wt, pcf	112.1	125.7	107.6	107.1	103.7	113.2	113.9	108.8
Series	1	2	3	4	5	6	7	8

Note: All reported values above are for the "as received" condition except for the effective porosity which is measured at a tension of 1/3 Bar. Both GT-A samples required significant patching due to gravel. This could have a significant impact on the reported values. * The material tested for effective porosity was slightly more coarsely grained than the portion tested for sieve analysis.



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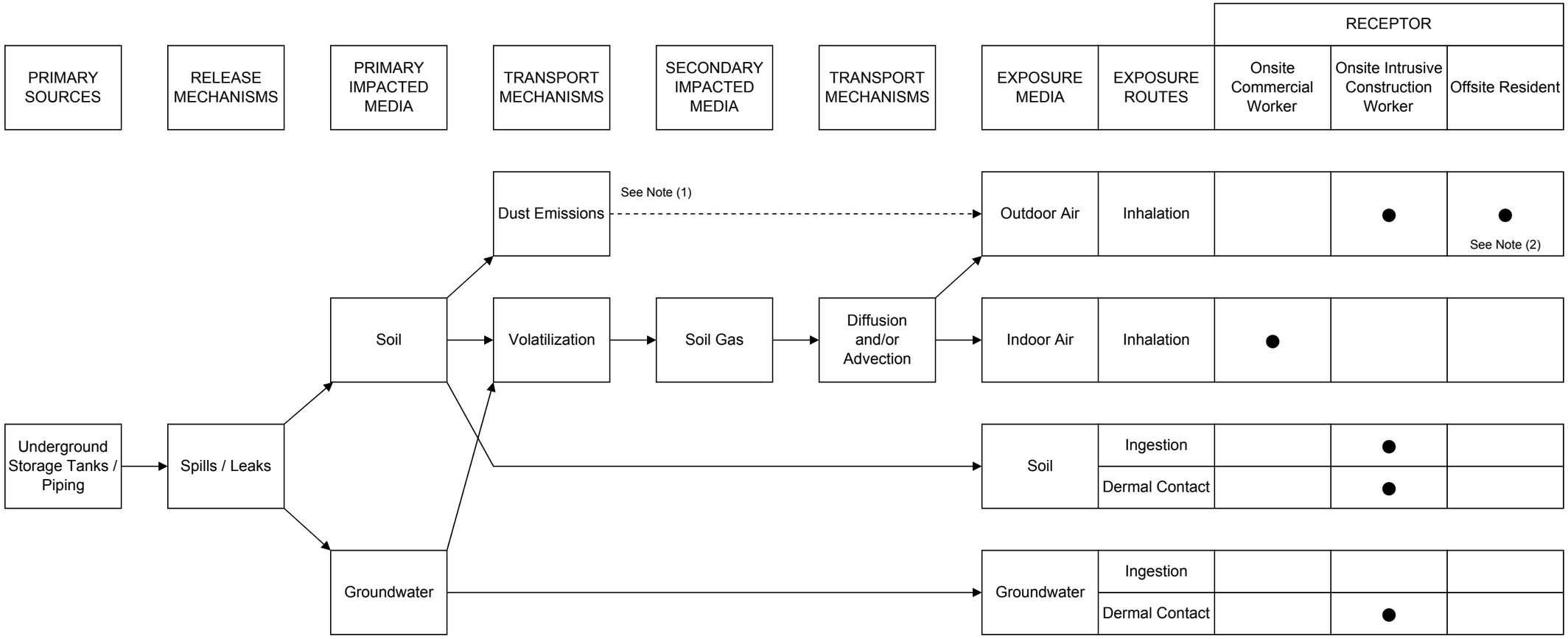
Total and Effective Porosity Report (Cooper, 2009)
Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Figure 2

Drafted by: DT Date: 2009-03-18



KEY:

Complete transport pathway

Incomplete transport pathway for reason(s) noted below

● Complete exposure pathway for receptor

NOTES:

(1) There are no non-volatile COPCs that could be adhered to emitted dust

(2) Offsite residents are potentially exposed via inhalation to COPCs in outdoor or indoor air that have been transported by advection (*i.e.* , wind) from the site to offsite residential land uses

IRIS ENVIRONMENTAL
1438 Webster Street, Suite 302
Oakland, California

Conceptual Site Model

Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Figure
3

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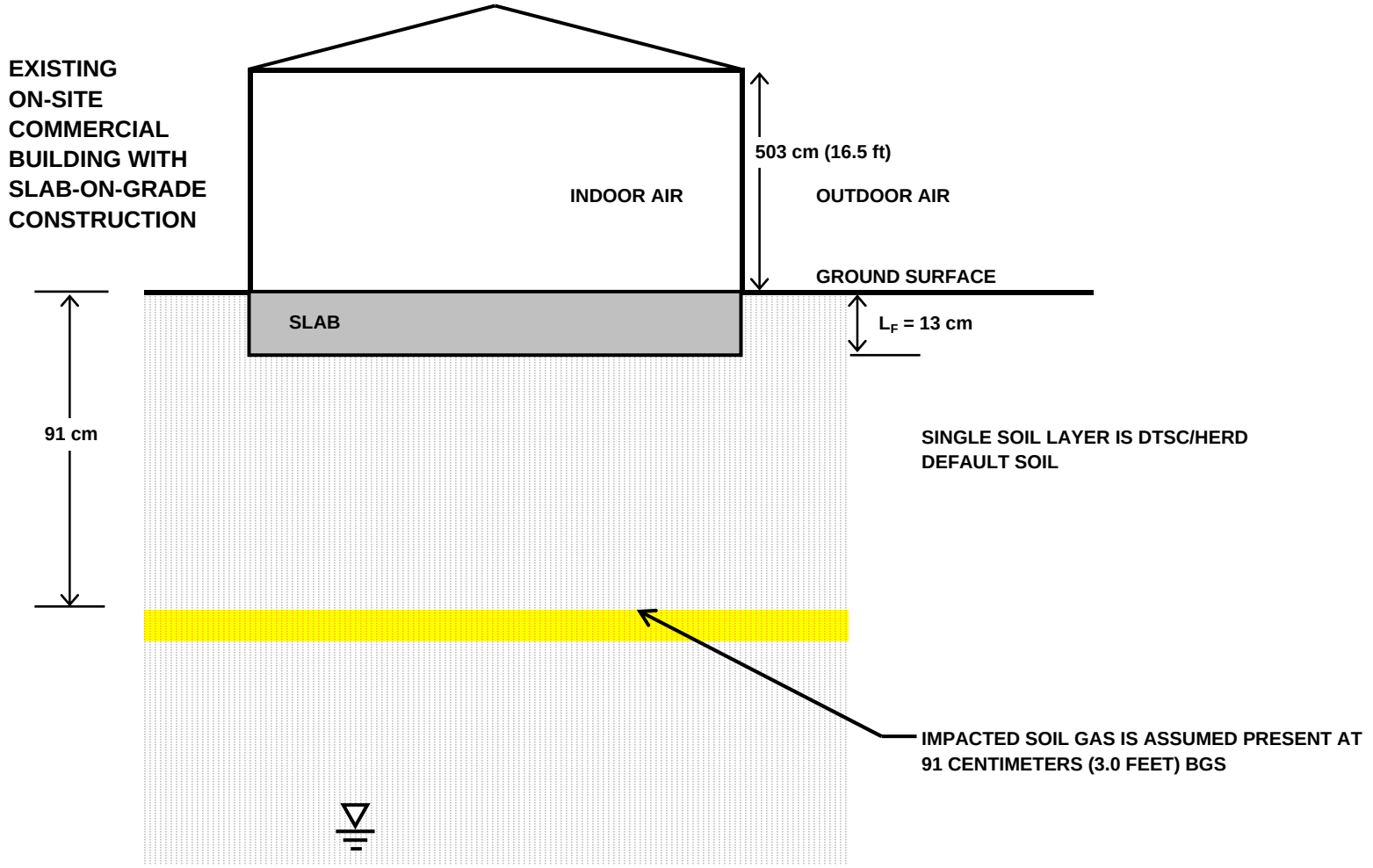

NOT TO SCALE

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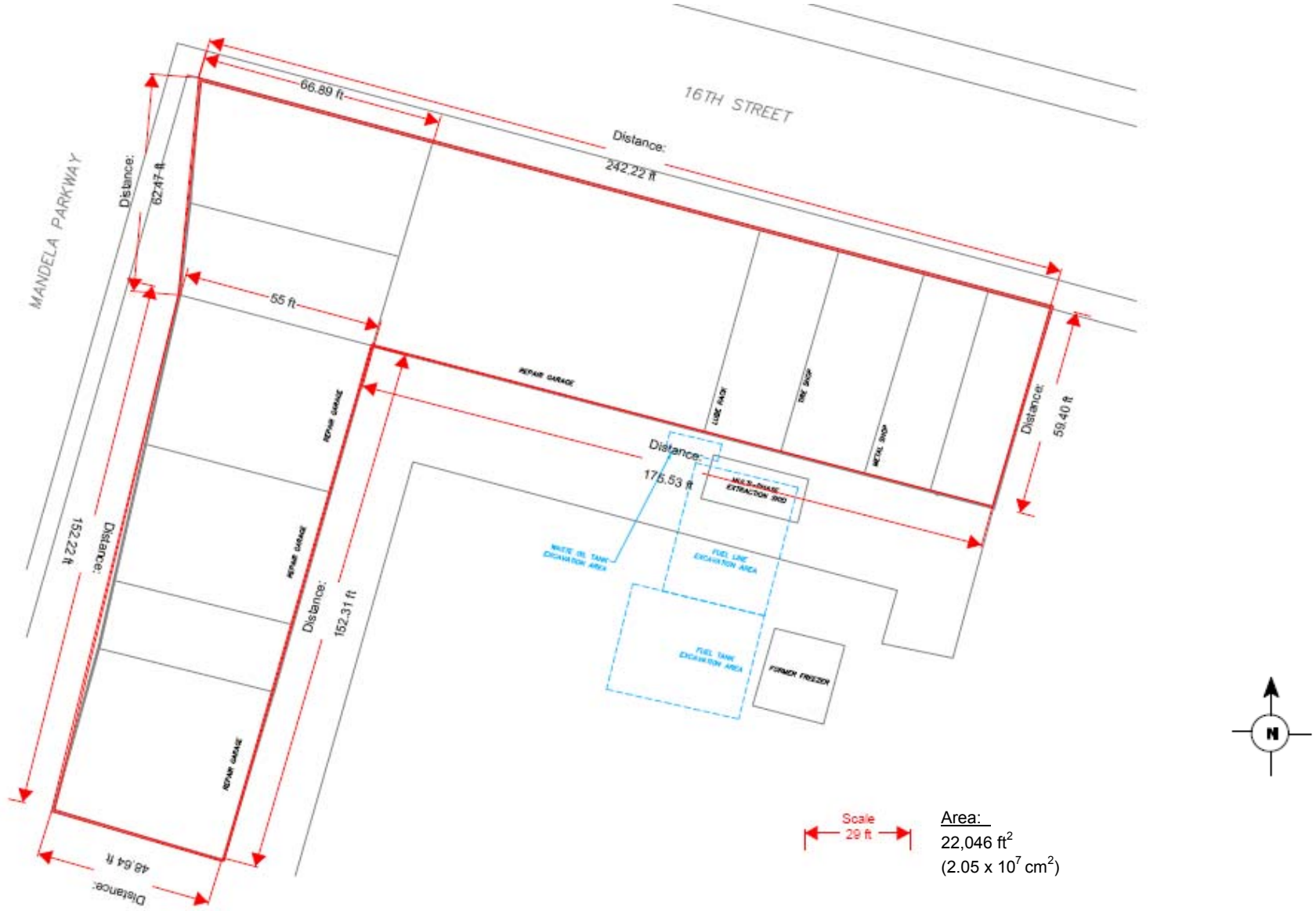
Modeled Soil Lithology and Building Geometry

Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Figure 4

File: I:\Carnation_Dairy\Figures\[Fig - lithology & building.xls]Fig_4 Drafted by: GSN Date: 2008-12-05 Contract No.: 07-557-A



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Building Dimensions and Area

Former Nestlé USA, Inc. Facility
1310 14th Street, Oakland, California

Figure
5

File: I:\Carnation_Dairy\Figures\[Fig - lithology & building.xls]Fig_5 Drafted by: GSN Date: 2008-12-05 Contract No.: 07-557-A

APPENDIX A

SUMMARY OF PREVIOUS SITE INVESTIGATIONS

Revised Site Conceptual Model
Former Nestlé USA, Inc. Facility-Oakland, CA
1310 14th Street, Oakland, CA

Table 1a: Soil Gas Sampling Results
Vapors in Soil - August 99

Concentration (ppbv)

Sample ID	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	Acetone	1,3-Bu-tadiene	2-Bu-tanone	Carbon Disulfide	Chloro-benzene	Chloro-form	Chloro-methane	Cyclo-hexane	1,2-Di-chloro-benzene	1,3-Di-chloro-benzene	1,4-Di-chloro-benzene	1,1-Di-chloro-ethane	1,2-Di-chloro-ethane	1,1-Di-chloro-ethene	cis-1,2-Dichloro-ethene	1,4-Di-oxane	Ethanol	4-Ethyl-toluene	Freon 11	Freon 12	Freon 113	Hep-tane	Hex-ane	4-Methyl-2-penta-none	Methylene Chloride	Methyl t-butyl ether	2-Pro-panol	Sty-rene	Tetra-chloro-ethene	Tetra-hydro-furan	1,1,1-Tri-chloro-ethane	Tri-chloro-ethene	1,2,4-Tri-methyl-benzene	1,3,5-Tri-methyl-benzene
SB1, 3'	**4.3**	**3.1**	<0.65	**2.74**	**800**	NA	**77 a**	**2.8**	**13**	**6.2**	<0.65	<0.65	<0.65	<2.6	<0.65	<0.65	**0.77**	<0.65	<0.65	<0.65	<0.65	<2.6	**63**	<2.6	**0.74**	**0.93**	**27**	<2.6	**4.4**	**3.8**	**3.7**	<2.6	**5.6**	<0.65	**1.2**	<2.6	<0.65	<0.65	**1.1**	<0.65
SB2, 3'	**7.5**	**12**	**3.6**	**17.6**	**1,100**	NA	**260 a**	<2.7	**24**	**9.0**	<0.67	**3.9**	<0.67	**12**	<0.67	<0.67	**1.8**	<0.67	<0.67	<0.67	<0.67	<2.7	**110**	<2.7	**1.2**	**200**	<0.67	**3.3**	**5.3**	**8.1**	**2.2**	<2.7	<2.7	**3.0**	<0.67	<2.7	<0.67	<0.67	**2.0**	**0.77**
SB3, 3'	**9,900**	**230**	**68**	**67**	**36,000**	NA	<190	<190	<190	<190	<48	<48	<48	<190	<48	<48	<48	<48	<48	<48	<48	<190	<190	<190	<48	**180**	<48	<190	**590**	<190	<48	<190	<190	<48	<48	<190	<48	<48	<48	<48
SB3, 3' dup	**9,500**	**240**	<140	<140	**40,000**	NA	<580	<580	<580	<580	<140	<140	<140	<580	<140	<140	<140	<140	<140	<140	<140	<580	<580	<580	<140	**160**	<140	<580	**580**	<580	<140	<580	<580	<140	<140	<580	<140	<140	<140	<140
SB4, 3'	**1,200**	**76**	**8.1**	**18.7**	**4,600**	NA	**200 a**	**19**	<14	<14	<3.5	<3.5	<3.5	**32**	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<14	**1,400**	<14	<3.5	**100**	<3.5	<14	**19**	**15**	**340**	<14	**22**	<3.5	**160**	<14	**21**	<3.5	<3.5	<3.5
SB5, 3'	**7.6**	**5.6**	**0.80**	**1.9**	**1,900**	NA	**45 a**	**61**	**12**	**18**	<0.71	<0.71	**0.77**	**8.2**	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71	**3.3**	**55**	<2.8	**4.4**	**1.2**	**3.4**	<2.8	<2.8	<2.8	<0.71	<2.8	<2.8	<0.71	<0.71	<2.8	<0.71	<0.71	<0.71	<0.71
SB6, 3'	**3.0**	**4.2**	<0.68	**2.52**	**560**	NA	**11 a**	<2.7	**4.0**	<2.7	<0.68	<0.68	<0.68	<2.7	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<2.7	**35**	<2.7	<0.68	<0.68	<0.68	<2.7	<2.7	<2.7	<0.68	<2.7	<2.7	<0.68	<0.68	<2.7	<0.68	<0.68	**1.1**	<0.68
SB7, 3'	**5.9**	**6.2**	**0.87**	**4.3**	**780**	NA	**43 a**	**3.4**	**7.9**	**3.3**	<0.73	<0.73	<0.73	**5.1**	<0.73	<0.73	**2.0**	<0.73	<0.73	<0.73	<0.73	**8.2**	**94**	<2.9	**0.74**	**1.1**	<0.73	<2.9	**6.8**	**4.4**	<0.73	<2.9	**3.8**	**1.0**	**2.0**	<2.9	<0.73	<0.73	**1.8**	<0.73
SB8, 3'	**10**	**12**	**3.8**	**15.7**	**1,300**	NA	**42 a**	<11	<11	<11	<2.8	<2.8	<2.8	<11	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<11	**62**	<11	**6.5**	**630**	<2.8	<11	<11	<11	<2.8	<11	<11	<2.8	<2.8	<11	<2.8	<2.8	**5.3**	<2.8
SB9, 3'	**12**	**18**	**1.7**	**9.9**	**690**	NA	**19 a**	<2.7	**6.0**	<2.7	<0.68	**1.1**	<0.68	**4.9**	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<2.7	**47**	<2.7	**1.5**	**20**	<0.68	<2.7	**4.3**	<2.7	<0.68	<2.7	<2.7	<0.68	<0.68	<2.7	<0.68	<0.68	**2.3**	**0.77**
SB10, 3'	**3.5**	**2.8**	<0.80	**1.7**	**610**	NA	**39 a**	<3.2	**9.7**	<3.2	<0.80	**1.6**	<0.80	<3.2	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<3.2	**40**	<3.2	<0.80	**1.4**	<0.80	<3.2	**3.9**	<3.2	<0.80	<3.2	<3.2	<0.80	<0.80	<3.2	<0.80	<0.80	**1.2**	<0.80
SB11, 3'	**2.7**	**1.9**	<0.82	**0.91**	**520**	NA	**38 a**	<3.3	**9.9**	<3.3	<0.82	<0.82	**3.7**	<3.3	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	**22**	**23**	<3.3	**4.6**	<0.82	<0.82	<3.3	<3.3	<3.3	**1.2**	<3.3	<3.3	<0.82	<0.82	<3.3	<0.82	<0.82	**0.85**	<0.82
SB12, 3'	**250**	<70	<70	**610**	**750,000**	NA	<280	<280	<280	<280	<70	<70	<70	<280	**480**	<70	**76**	<70	<70	<70	<70	<280	<280	**760**	<70	<70	<70	<280	**18,000**	<280	<70	<280	<280	<70	<70	<280	<70	<70	**580**	**740**
SB13, 3'	**0.91**	**8.5**	<0.67	**1.3**	**550**	NA	**49 a**	<2.7	**5.5**	**6.4**	<0.67	<0.67	<0.67	<2.7	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	**4.3**	**410 b**	<2.7	<0.67	<0.67	<0.67	**3.4**	<2.7	<2.7	**5.6**	<2.7	**26**	<0.67	<0.67	**58**	<0.67	<0.67	**1.1**	<0.67
SB14, 3'	**2.7**	**5.3**	**0.87**	**4.7**	**620**	NA	**10 a**	<2.8	**3.5**	<2.8	<0.70	<0.70	<0.70	<2.8	<0.70	<0.70	**1.6**	<0.70	<0.70	<0.70	<0.70	<2.8	**67**	<2.8	<0.70	<0.70	<0.70	<2.8	<2.8	**2.8**	**1.3**	**2.9**	<2.8	**0.82**	<0.70	<2.8	<0.70	<0.70	**2.0**	**0.81**
SB15, 3'	**42**	**12**	**1.6**	**6.7**	**2,100**	NA	**51 a**	**13**	**13**	<5.8	<1.4	<1.4	<1.4	<5.8	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<5.8	**190**	<5.8	<1.4	**46**	<1.4	<5.8	**50**	<5.8	**4.8**	<5.8	<5.8	<1.4	**2.1**	<5.8	<1.4	<1.4	**1.8**	<1.4

Notes:

ppbv	Parts per billion volumetric.
a	Compound present in laboratory blank greater than reporting limit (background subtraction not performed).
b	Exceeds instrument calibration range.
NA	Not analyzed.
TPH-g	Total Petroleum Hydrocarbons as gasoline.
TPH-d	Total Petroleum Hydrocarbons as diesel.

Revised Site Conceptual Model
Former Nestlé USA, Inc. Facility-Oakland, CA
1310 14th Street, Oakland, CA

Table 1b: Soil Gas Sampling Results
Vapors in Soil - May 08

Boring Location	Sample Depth (feet bgs)	Date of Sample Collection	Analytical results (ug/L) of Vapor							
			TPH g	TPH d	Benzene	Ethylbenzene	Toluene	Xylenes, Tot	1,2-DCA	Others
SB-16	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-17	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-18	5	19-May-08	630	<50	2.2	<0.10	0.44	<0.30	<0.10	
SB-19	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-20/ PCB-7	5	19-May-08	19	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-21/ PCB-8	5	19-May-08	25	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-22	5	19-May-08	2,600	<50	40	7.7	32	19.1	<0.10	Dichlorodifluoromethane: 0.39
SB-23	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-24/ PCB-1	5	19-May-08	<10	<50	<0.10	<0.10	0.22	<0.30	<0.10	
SB-25/ PCB-2	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-26	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	Dichlorodifluoromethane: 10
SB-27/ PCB-3	5	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	
SB-22 dup	5	19-May-08	2,600	<50	40	7.5	32	18.0	<0.10	Dichlorodifluoromethane: 0.38
Probe Blank	NA	19-May-08	<10	<50	<0.10	<0.10	<0.20	<0.30	<0.10	

Notes:

EPA Method 8260B for VOC Analyses of soil vapor
EPA Mentod 8015m for TPH-g and TPH-d analyses of soil vapor

Revised Site Conceptual Model
Former Nestlé USA, Inc. Facility-Oakland, CA
1310 14th Street, Oakland, CA

Table 2: Historical Soil Sample Results (1999 - 2008)

Boring Location	Sample Depth (feet bgs)	Date of Sample Collection	Analytical results (mg/Kg)								
			TPH g	TPH d	TPH mo	Benzene	Toluene	Ethylbenzene	Xylenes, Tot	1,2-DCA	Others
SB-1	3.5-4.0	08/12/99	<0.13	**1,200**	NA	<0.0013	<0.0013	<0.0013	<0.0013	<0.0011	
SB-1	6.5-7.0	08/12/99	<0.10	<5.9	NA	<0.001	<0.001	<0.001	<0.001	<0.0008	
SB-2	3.5-4.0	08/12/99	<0.09	<5.6	NA	<0.0009	<0.0009	<0.0009	<0.0009	<0.001	
SB-2	6.5-7.0	08/12/99	<0.10	<5.9	NA	<0.001	<0.001	<0.001	<0.001	**0.001**	
SB-3	3.5-4.0	08/12/99	<0.10	<5.6	NA	<0.001	<0.001	<0.001	<0.001	**0.0007**	
SB-3	6.5-7.0	08/12/99	**6,160**	<5.7	NA	**11**	**190**	**100**	**460**	**0.0018**	MTBE: 0.073
SB-4	3.5-4.0	08/12/99	<0.10	<5.5	NA	<0.001	<0.001	<0.001	<0.001	<0.0007	
SB-4	6.5-7.0	08/12/99	**1**	**94**	NA	**0.082**	**0.0085**	**0.0073**	**0.013**	**0.001**	
SB-5	3.5-4.0	08/12/99	<0.09	<5.5	NA	<0.0009	<0.0009	<0.0009	<0.0009	**0.0006**	
SB-5	6.5-7.0	08/12/99	<0.08	<5.9	NA	<0.0008	<0.0008	<0.0008	<0.0008	**0.0009**	
SB-6	3.5-4.0	08/13/99	<0.10	<5.5	NA	<0.001	<0.001	<0.001	<0.001	<0.0008	
SB-6	6.5-7.0	08/13/99	10,100	**1,100**	NA	**76**	**490**	**170**	**990**	**0.43**	
SB-7	3.5-4.0	08/12/99	<0.10	<5.4	NA	<0.001	<0.001	<0.001	<0.001	<0.0008	
SB-7	6.5-7.0	08/12/99	<0.11	<5.8	NA	<0.0011	<0.0011	<0.0011	<0.0011	<0.0009	
SB-8	3.5-4.0	08/12/99	<0.10	<5.6	NA	<0.001	<0.001	<0.001	<0.001	<0.0007	
SB-8	6.5-7.0	08/12/99	**13**	<5.8	NA	**0.43**	**0.36**	**0.12**	**0.83**	**0.0012**	MTBE: 0.022
SB-9	3.5-4.0	08/13/99	<0.09	<5.6	NA	<0.0009	<0.0009	<0.0009	<0.0009	<0.001	
SB-9	6.5-7.0	08/13/99	<0.61	<5.8	NA	**0.024**	<0.0061	<0.0061	<0.0061	<0.0011	
SB-10	3.5-4.0	08/13/99	<0.09	<5.6	NA	<0.0009	<0.0009	<0.0009	<0.0009	<0.0008	
SB-10	6.5-7.0	08/13/99	<0.13	<6.4	NA	<0.0013	<0.0013	<0.0013	<0.0013	<0.001	
SB-11	3.5-4.0	08/13/99	<0.20	<5.5	NA	<0.002	<0.002	<0.002	<0.002	<0.0011	
SB-11	6.5-7.0	08/13/99	<0.11	<5.7	NA	<0.0011	<0.0011	<0.0011	<0.0011	<0.001	
SB-12	3.5-4.0	08/12/99	<0.10	<5.5	NA	<0.001	<0.001	<0.001	<0.001	<0.0006	
SB-12	4.5-5.0	08/12/99	**496**	**2,900**	NA	**0.07**	**0.032**	**4**	**6.7**	<0.0009	Chlorobenzene: 0.0017 1,2-DCB: 3.1 1,3-DCB: 0.038 1,4-DCB: 0.33 MTBE:
SB-12	6.5-7.0	08/12/99	**2**	**60**		<0.001	<0.001	**0.023**	**0.0098**	<0.0011	MTBE: 0.001
SB-13	3.5-4.0	08/13/99	**1**	**390**	NA	<0.0012	**0.002**	**0.0027**	**0.0027**	**0.0025**	
SB-13	6.5-7.0	08/13/99	**12**	**65**	NA	**0.25**	**0.048**	**0.15**	**0.49**	**0.0014**	
SB-14	3.5-4.0	08/12/99	<0.08	<5.5	NA	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	MTBE: 0.084
SB-14	6.5-7.0	08/12/99	**29**	**450**	NA	**0.56**	**0.29**	**0.33**	**1.7**	**0.0097**	
SB-15	3.5-4.0	08/12/99	<0.51	**140**	NA	<0.0054	<0.0054	<0.0054	<0.0054	<0.0091	
SB-15	6.5-7.0	08/12/99	<0.57	**81**	NA	<0.0061	**0.012**	<0.0061	**0.0085**	<0.0098	
SB-16	6-6.5	05/19/08	<0.22	**30**	<50	<0.0043	<0.0043	<0.0043	<0.0087	<0.0043	
SB-17	8-8.5	05/22/08	**2,500**	**3,600**	**2,900**	**30**	**130**	**27**	**120**	ND	
SB-17	10-10.5	05/22/08	12,000	17,000	13,000	**140**	**580**	**120**	**620**	<8.3	
SB-17	15-15.5	05/22/08	**64**	**1,400**	**1,300**	<0.89	<0.89	<0.89	<1.8	<0.89	
SB-17	20-20.5	05/22/08	<0.21	<0.99	<49	<0.0042	<0.0042	<0.0042	<0.0084	<0.0042	
SB-18	8-8.5	05/21/08	**1,900**	**67**	<49	**41**	**110**	**28**	**130**	<19	
SB-19	8-8.5	05/21/08	<0.25	<0.99	<49	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	
SB-20/ PCB-7	8-8.5	05/22/08	**5,600**	**390**	**51**	**86**	**280**	**54**	**280**	<8.3	
SB-21/ PCB-8	8-8.5	05/21/08	**3,800**	**2,500**	<49	**40**	**210**	**69**	**360**	<19	
SB-22	8-8.5	05/21/08	**3,200**	**1,100**	<500	<47	**140**	<47	**190**	<47	
SB-23	11.5-12	05/22/08	<0.21	**1.2**	<49	<0.0041	<0.0041	<0.0041	<0.0082	<0.0041	
SB-24/ PCB-1	9-9.5	05/20/08	<0.19	**1.6**	<50	<0.0039	<0.0039	<0.0039	<0.0078	<0.0039	
SB-25/ PCB-2	8-8.5	05/20/08	<0.19	**1.1**	<50	<0.0037	<0.0037	<0.0037	<0.0075	<0.0037	
SB-26	8.5-9	05/21/08	<0.23	**10**	<50	<0.0047	<0.0047	<0.0047	<0.0093	<0.0047	
SB-27/ PCB-3	8.5-9	05/20/08	<0.27	<0.99	<49	<0.0054	<0.0054	<0.0054	<0.011	<0.0054	
SB-20/ PCB-7 Dup	8-8.5	05/22/08	**4,900**	**610**	<250	**99**	**300**	**64**	**340**	<21	
SB-25/ PCB-2 Dup	8-8.5	05/20/08	NA	<1.0	<50	NA	NA	NA	NA	NA	

Notes:

NA = Not Analyzed
EPA Method 8260 for BTEX and 1,2-DCA analyses of soil
EPA Mentod 8015m for TPH-g, TPH-d, and TPM-mo analyses of soil

Revised Site Conceptual Model
Former Nestlé USA, Inc. Facility-Oakland, CA
1310 14th Street, Oakland, CA

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-2	03/23/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	--	--	--	--	--	--	--	--	--	--	--	
	02/25/94	<1	<1	<1	<1	<100	<1,000	--	--	--	--	--	
	06/03/94	<0.5	<0.5	<0.5	<0.5	<50	<20,000	--	--	--	--	--	
	08/31/94	<0.3	<0.3	<0.3	<0.6	<500	<500	--	--	--	--	--	
	12/22/94	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	0.8	<0.5	<0.5	<0.5	<50	<400	--	--	--	--	--	
	06/09/95	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	09/21/95	0.7	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	--	
	01/16/97	<0.5	<0.5	<0.5	<0.5	<50	<150	0.7	<0.5	<0.5	<0.5	--	
	07/07/97	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
	01/27/98	<0.5	<0.5	<0.5	<0.5	100	<150	--	--	--	--	<0.5	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	--	--	--	--	--	<0.5	
	07/22/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
MW-3	03/23/93	35	2.9	2	3.2	300	ND	--	--	--	--	--	
	07/27/93	97	1	4	1.1	220	ND	--	--	--	--	--	
	11/05/93	4.9	ND	ND	1.2	170	ND	--	--	--	--	--	
	02/25/94	42	<1	<1	<1	100	<1,000	--	--	--	--	--	
	06/03/94	120	8.2	8.4	4.5	320	<20,000	--	--	--	--	--	
	08/31/94	83	1.1	5.3	2.9	<500	<500	--	--	--	--	--	
	12/22/94	1,460	18	100	50	3,800	270	--	--	--	--	--	
	03/13/95	3,600	260	270	280	14,000	1,700	--	--	--	--	--	
	06/09/95	4,700	58	140	71	3,700	120	--	--	--	--	--	
	09/21/95	9,800	58	600	95	14,000	300	--	--	--	--	--	
	12/12/95	330	2.1	47	5.3	700	<50	--	--	--	--	--	
	03/12/96	350	4.6	23	8.7	600	<50	--	--	--	--	--	
	06/21/96	940	76	98	57	1,900	<50	--	--	--	--	--	
	08/29/96	420	29	44	28	900	<150	--	--	--	--	--	
	01/16/97	1,600	270	120	194	3,600	700	<0.5	9.2	<0.5	<0.5	--	
	04/15/97	1,300	300	180	160	4,300	800	<0.5	16	<0.5	1.1	6.9	
	07/07/97	100	84	100	67	1,900	350	--	--	--	--	3.8	
	10/27/97	1,030	60	54	40	2,200	--	<0.5	2.4	<0.5	<0.5	3.1	
	01/27/98	1,070	98	73	69	3,200	--	--	--	--	--	3.9	
	04/22/98	610	56	49	54	1,800	--	<0.5	3.0	<0.5	<0.5	1.1	
	07/22/98	1,800	230	160	180	3,600	370	--	--	--	--	5.0	
	10/21/98	78	1.0	3.8	0.6	110	<250	<0.5	0.6	<0.5	<0.5	<0.5	
	07/23/99	1,500	140	76.0	260	4,000	790	<0.5	1.0	<0.5	<0.5	5.60	
	10/28/99	1,100	43	58	102	3,000	600	<0.5	0.9	--	<0.5	--	
	02/10/00	690	22	36	49	1,400	520	<0.5	<0.5	<0.5	<0.5	2.20	
	04/27/00	1,100	140	73	163	2,400	250	<0.5	0.6	<0.5	<0.5	<0.5	
	08/03/00	520	7.7	21	27	1,100	750	<0.5	0.6	<0.5	<0.5	<0.5	
	10/23/00	2,000	16	22	46	3,800	760	<0.5	0.7	<0.5	<0.5	<0.5	
	01/31/01	360	8.6	14	28	860	300	<0.5	0.6	<0.5	<0.5	<0.5	
	04/26/01	808	60.6	46.8	115	1,530	280	<0.5	0.8	<0.5	<0.5	<0.5	
	07/30/01	788	23.3	44.6	80.7	1,400	350	<0.5	0.6	<0.5	<0.5	<0.5	
	10/29/01	852	14.3	24.5	38.6	1,730	500	<0.5	0.5	<0.5	<0.5	<0.5	
	01/29/02	1,250	85.3	64.7	95.7	4,240	490	<0.5	1.4	<0.5	<0.5	<0.5	
	04/29/02	1,120	51.5	84.4	117	5,710	700	<0.5	1.1	<0.5	<0.5	<0.5	
MW-5	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	<0.5	<0.5	<0.5	<0.5	<0.5	
MW-6	03/23/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	02/25/94	<1	<1	<1	3.5	<100	<1,000	--	--	--	--	--	
	06/03/94	2.7	<0.5	<0.5	<0.5	69	<20,000	--	--	--	--	--	
	08/31/94	<0.3	8.7	1.6	3.5	<500	<500	--	--	--	--	--	
	12/22/94	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	1.2	<0.5	<0.5	<0.5	<50	<400	--	--	--	--	--	
	06/09/95	0.6	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	09/21/95	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	--	
	01/16/97	5.5	16	2.9	16	140	220	<0.5	6.3	<0.5	<0.5	--	
	07/07/97	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	<250	--	--	--	--	<0.5	
	10/24/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	7.7	<0.5	<0.5	<0.5	
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	6.9	<0.5	<0.5	<0.5	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-6	04/27/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	6.6	<0.5	<0.5	<0.5	
(cont.)	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	9.2	<0.5	<0.5	<0.5	
	10/30/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	10	<0.5	<0.5	<0.5	
	01/29/02	0.54	<0.5	<0.5	<1.0	<200	<250	<0.5	10	<0.5	<0.5	<0.5	
	04/30/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	14	<0.5	<0.5	<0.5	
MW-11	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
MW-12	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
MW-13	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
MW-15	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	430	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/22/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
MW-25	03/23/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	4.2	4.4	2.5	20	170	ND	--	--	--	--	--	
	02/25/94	2.1	<1	<1	<1	<100	<1,000	--	--	--	--	--	
	06/03/94	2.4	14	<0.5	3.4	97	<20,000	--	--	--	--	--	
	08/31/94	0.5	<0.3	<0.3	<0.6	<500	<500	--	--	--	--	--	
	12/22/94	0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	0.58	<0.5	<0.5	<0.5	150	950	--	--	--	--	--	
	06/09/95	0.8	<0.5	<0.5	<0.5	<100	60	--	--	--	--	--	
	09/21/95	<0.5	<0.5	<0.5	<0.5	50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<0.5	120	<50	--	--	--	--	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	90	<150	--	--	--	--	--	
	01/16/97	0.6	<0.5	<0.5	<0.5	80	<150	25	41	<0.5	<0.5	--	
	07/07/97	<0.5	<0.5	<0.5	<0.5	140	<150	--	--	--	--	11	
	01/27/98	<0.5	<0.5	<0.5	<0.5	<100	--	--	--	--	--	10	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	<250	--	--	--	--	24	
	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	340	28	59	<0.5	<0.5	28	1,1-DCE detected, 0.9 µg/L.
	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	27	72	<0.5	<0.5	27	1,1-DCE detected, 1.6 µg/L.
	07/23/99	1.80	<0.5	<0.5	<0.5	<50	<200	30	58	<0.5	<0.5	23.0	
	10/27/99	<0.5	1.4	<0.5	1.0	<100	<200	35	47	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	100	<250	39	41	<0.5	<0.5	29.0	1,1-Dichloroethene detected at 3.1 µg/L.
	04/26/00	<0.5	<0.5	<0.5	<0.5	<100	<250	51	38	<0.5	<0.5	18	1,1-Dichloroethene detected at 4.2 µg/L.
	08/03/00	<0.5	<0.5	<0.5	<0.5	<50	<250	40	57	<0.5	<0.5	27	1,1-Dichloroethene detected at 2.6 µg/L.
	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	<250	54	68	<0.5	<0.5	38	1,1-Dichloroethene detected at 3.5 µg/L.
	01/31/01	<0.5	<0.5	<0.5	<0.5	90	<250	52	46	<0.5	<0.5	22	1,1-Dichloroethene detected at 6.5 µg/L.
	04/26/01	<0.5	0.62	<0.5	<0.5	<200	<250	49	37	<0.5	<0.5	15.8	1,1-Dichloroethene detected at 6.0 µg/L.
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	33	36	<0.5	<0.5	10.9	Chloromethane detected at 0.8 µg/L; 1,1-Dichloroethene detected at 4.6 µg/L.
	10/29/01	<0.5	<0.5	<0.5	<1.0	<200	<500	22	38	<0.5	<0.5	10.5	Chloromethane detected at 0.5 µg/L; 1,1-Dichloroethene detected at 1.8 µg/L.
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	25	56	<0.5	<0.5	8.90	1,1-Dichloroethene detected at 2.8 µg/L.
	04/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	14	44	<0.5	<0.5	6.92	1,1-Dichloroethene detected at 1.7 µg/L; 1,1,2,2-Tetrachloroethane detected at 0.5 µg/L.
	10/22/02	7.64	248	133	843	4,790	1,240	9.6	34	<0.5	<0.5	1,410	1,1-Dichloroethene detected at 0.9 µg/L.
	11/15/02	<0.5	<0.5	<0.5	<1.0	<200	<250	11	35	<0.5	<0.5	7.3	Chloroethane detected at 22 µg/L.
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	8.5	34	<0.5	<0.5	5.7	1,1-Dichloroethene detected at 0.8 µg/L.
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	7.6	27	<0.5	<0.5	6.3	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	5.1	18	<0.5	<0.5	5.2	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**190**	**6.7**	**25**	**<0.50**	**<0.50**	**6.1**	1,1-Dichloroethene detected at 0.51 µg/L.
MW-26	03/23/93	180	190	55	330	7,000	1,300	ND	ND	ND	ND	--	
	07/27/93	470	96	30	80	1,800	ND	ND	140	ND	ND	--	
	11/05/93	4,700	1,300	9	1,400	19,000	ND	ND	120	ND	ND	--	
	02/25/94	4,800	570	200	860	14,000	<1,000	<1	28	<1	<1	--	
	06/03/94	4,100	300	120	230	12,000	<20,000	1.7	140	<0.5	<0.5	--	Bromodichloromethane detected, 0.84 µg/L.
	08/31/94	4,100	360	170	450	93,000	1,400	<4.0	<4.0	<4.0	<4.0	--	
	12/22/94	1,030	170	85	290	5,000	560	<2.0	<2.0	<2.0	<2.0	--	8 other volatiles detected by 8260.
	03/13/95	320	19	23	66	3,000	810	53	5.8	<0.5	<0.5	--	
	06/09/95	14,000	64	31	230	10,800	310	240	3.1	1	<0.5	--	
	09/21/95	1,900	160	160	330	8,000	200	1.3	120	<0.5	<0.5	--	
	12/12/95	13,000	38	36	120	25,000	0.6	1.4	180	<0.5	<0.5	--	No diesel pattern detected; result due to high gasoline concentration.
	03/12/96	9,000	33	30	65	4,400	<50	<0.5	180	<0.5	<0.5	--	
	06/21/96	14,000	27	16	66	5,400	<50	3.2	170	<0.5	<0.5	--	
	08/29/96	8,500	26	28	74	19,000	<150	<0.5	160	<0.5	<0.5	--	
	01/16/97	6,500	21	31	47	4,600	--	4.3	>50	<0.5	<0.5	26	
	04/15/97	16,000	33	40	160	26,000	2,200	3.5	97	<0.5	2.4	40	cis-1,2-DCE detected, 0.7 µg/L.
	07/07/97	22,000	44	170	200	28,000	1,100	<5.0	<5.0	<5.0	<5.0	95	
	10/27/97	16,000	26	100	37	30,000	--	3.6	92	<0.5	<0.5	38	
	01/27/98	23,600	<5.0	<5.0	<5.0	26,000	420	8.3	100	<0.5	<0.5	100	
	04/22/98	5,000	4.3	9.2	16	14,000	--	13	130	<0.5	<0.5	27	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-26	07/22/98	3,800	5.7	6.9	11	5,200	750	10	110	--	<1.0	33	
(cont.)	10/21/98	420	<0.5	2.1	2.7	820	<250	24	82	<0.5	<0.5	31	
	02/05/99	20	<0.5	0.60	0.80	230	230	10	51	<0.5	<0.5	29	
	04/07/99	<0.5	<0.5	<0.5	<0.5	80	<250	15	54	<0.5	<0.5	25	
	07/23/99	7.10	<0.5	<0.5	0.80	180	<200	12	32	<0.5	<0.5	12.0	
	10/27/99	14	1.4	2.9	7.8	400	<200	13	30	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	80	<250	13	32	<0.5	<0.5	28.0	
	04/26/00	0.7	<0.5	0.6	<0.5	200	340	7.5	39	<0.5	<0.5	22	
	08/03/00	6.8	<0.5	0.6	1.4	<50	<250	7.4	19	<0.5	<0.5	19	
	10/23/00	10	0.8	1.7	1.7	80	<250	5.1	37	<0.5	<0.5	26	
	01/31/01	26	0.70	2.4	2.2	390	320	5.7	51	<0.5	<0.5	33	
	04/26/01	10.6	<0.5	0.70	1.04	400	350	16	39	<0.5	<0.5	28.5	
	07/30/01	107	<0.5	1.42	1.06	1,920	380	22	44	<0.5	<0.5	31.4	
	10/29/01	31.6	<0.5	<0.5	<1.0	2,020	500	26	25	<0.5	<0.5	27	
	01/28/02	30.0	<0.5	0.70	<1.0	450	380	43	<0.5	<0.5	<0.5	14.5	1,1-Dichloroethene detected at 1.8 µg/L.
	04/29/02	394	<0.5	<0.5	<1.0	1,870	550	50	23	<0.5	<0.5	8.62	1,1-Dichloroethene detected at 2.5 µg/L.
	10/22/02	1,440	25.7	6.60	20.4	4,440	890	53	26	<0.5	<0.5	168	1,1-Dichloroethene detected at 3.7 µg/L.
	11/15/02	1,630	0.56	3.22	3.86	5,590	780	18	33	<0.5	<0.5	49.2	1,1-dichloroethene detected at 1.0 µg/L.
	05/06/03	1,250	<0.5	2.42	<1.0	3,730	380	46	24	<0.5	<0.5	13.1	1,1-Dichloroethene detected at 3.1 µg/L.
	10/14/03	51	<0.5	1.38	<1.0	3,100	<250	83	28	<0.5	<0.5	23.8	1,1-Dichloroethene detected at 3.3 µg/L.
	04/27/04	467	<0.5	1.24	<1.0	1,380	<250	82	33	<0.5	<0.5	<0.5	1,1-Dichloroethene detected at 5.2 µg/L.
	11/17/04	**120**	**<1.0**	**2.50**	**1.3**	**740**	**820**	**31**	**44**	**<0.50**	**<0.50**	**120**	1,1-Dichloroethene detected at 1.1 µg/L.
MW-27	06/21/96	<0.5	<0.5	<0.5	<0.5	<50	<50	<0.5	6.8	<0.5	<0.5	--	
	08/29/96	--	--	--	--	--	--	--	--	--	--	--	
	01/16/97	12	5.0	<0.5	2.6	70	<150	<0.5	5.7	<0.5	<0.5	--	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	<250	<1.0	1.4	--	<1.0	<0.5	
	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	<0.5	0.7	<0.5	<0.5	<0.5	
	07/23/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	0.7	<0.5	<0.5	<0.5	
	10/27/99	<0.5	<0.5	<0.5	<0.5	<100	<200	<0.5	<0.5	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/00	<0.5	<0.5	<0.5	<0.5	<100	250	<0.5	<0.5	<0.5	<0.5	<0.5	
	08/16/00	<0.5	<0.5	<0.5	<0.5	<50	--	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/29/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	0.5	<0.5	<0.5	<0.5	
	04/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/22/02	8.56	56.2	9.37	59.3	650	600	<0.5	<0.5	<0.5	<0.5	331	
	11/15/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**64**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<5.0**	
MW-28	03/23/93	ND	ND	ND	ND	110	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	ND	ND	ND	2.1	ND	ND	--	--	--	--	--	
	02/25/94	<1	<1	<1	<1	<100	<1	--	--	--	--	--	
	06/03/94	3.1	<0.5	<0.5	<0.5	<50	<20,000	--	--	--	--	--	
	08/31/94	1.4	<0.3	<0.3	<0.6	<500	<500	--	--	--	--	--	
	12/22/94	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	0.91	<0.5	<0.5	<0.5	<50	<400	--	--	--	--	--	
	06/09/95	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	09/21/95	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	06/21/96	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	--	
	01/16/97	18	20	2.2	13	220	<150	5.1	85	<0.5	<0.5	8.2	
	04/15/97	<0.5	<0.5	<0.5	<0.5	120	<150	1.1	150	<0.5	<0.5	7.1	
	07/07/97	<0.5	<0.5	<0.5	<0.5	110	<150	<5.0	170	<5.0	<5.0	7.2	
	10/27/97	3.6	<0.5	<0.5	<0.5	300	--	6.2	120	<0.5	<0.5	36	
	01/27/98	7.6	<0.5	<0.5	<0.5	500	<150	--	--	--	--	56	
	04/22/98	<0.5	<0.5	<0.5	<0.5	<50	--	1.0	89	<0.5	<0.5	8.6	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	--	<1.0	85	--	<1.0	18	
	10/21/98	<0.5	<0.5	<0.5	<0.5	<50	<250	0.5	80	<0.5	<0.5	12	
	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	32	29	<0.5	<0.5	5.0	1,1-DCE detected, 0.9 µg/L.
	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	62	<0.5	<0.5	4.5	
	07/23/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	50	<0.5	<0.5	1.80	
	10/27/99	--	--	--	--	--	<200	--	--	--	--	--	
	11/02/99	0.7	<0.5	<0.5	<0.5	<100	--	<0.5	32	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	39	<0.5	<0.5	4.30	
	04/26/00	<0.5	<0.5	<0.5	<0.5	<100	<250	<0.5	50	<0.5	<0.5	1.5	
	08/03/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	47	<0.5	<0.5	3.7	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-28	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	57	<0.5	<0.5	4.7	
(cont.)	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	46	<0.5	<0.5	4.4	
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	26	<0.5	<0.5	1.98	
	07/30/01	0.5	<0.5	0.64	2.58	<200	<250	<0.5	38	<0.5	<0.5	3.0	Chloromethane detected at 3.3 µg/L.
	10/29/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	29	<0.5	<0.5	3.74	
	01/28/02	6.20	<0.5	<0.5	<1.0	<200	<250	2.8	50	<0.5	<0.5	6.00	
	04/29/02	1.64	<0.5	<0.5	<1.0	<200	<250	3.7	44	<0.5	<0.5	4.81	
	10/22/02	25.0	<0.5	<0.5	<1.0	750	<250	2.0	59	<0.5	<0.5	<0.5	
	11/15/02	13.4	<0.5	1.29	<1.0	610	<250	1.3	54	<0.5	<0.5	<0.5	Chloromethane detected at 1.0 µg/L.
	05/06/03	3.1	<0.5	<0.5	<1.0	390	<250	0.8	70	<0.5	<0.5	9.29	Chloroethane detected at 0.8 µg/L.
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	38	<0.5	<0.5	6.44	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	9.29	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**<50**	**<0.50**	**4.7**	**<0.50**	**<0.50**	**<5.0**	
MW-29	03/23/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	ND	ND	2.1	11	ND	ND	--	--	--	--	--	
	02/25/94	<1	<1	<1	<1	<100	<1,000	--	--	--	--	--	
	06/03/94	<0.5	<0.5	<0.5	<0.5	<50	<20,000	--	--	--	--	--	
	08/31/94	<0.3	<0.3	<0.3	<0.6	<500	<500	--	--	--	--	--	
	12/22/94	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	0.59	<0.5	<0.5	<0.5	<50	<400	--	--	--	--	--	
	06/09/95	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	09/21/95	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	--	
	01/16/97	6.6	8.9	0.6	9.3	120	<150	47	24	<0.5	<0.5	1.8	
	07/07/97	<0.5	<0.5	<0.5	<0.5	<50	<150	52	21	<5.0	<5.0	1.2	
	01/27/98	<0.5	<0.5	<0.5	<0.5	100	<150	--	--	--	--	8.0	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	<250	12	29	--	<1.0	7.8	
	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	<0.5	68	<0.5	<0.5	8.5	
	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	30	38	<0.5	<0.5	4.9	1,1-DCE detected, 1.4 µg/L.
	07/23/99	<0.5	<0.5	<0.5	<0.5	<50	<200	44	33	<0.5	1.9	4.70	1,1-Dichloroethene detected at 2.3 µg/L; cis-1,2-Dichloroethene detected at 2.3 µg/L.
	10/27/99	<0.5	<0.5	<0.5	<0.5	<100	<200	36	23	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	87	25	<0.5	<0.5	18.0	1,1-Dichloroethene detected at 9.6 µg/L.
	04/26/00	<0.5	<0.5	<0.5	<0.5	<100	<250	61	38	<0.5	<0.5	12	1,1-Dichloroethene detected at 5.2 µg/L.
	08/16/00	<0.5	<0.5	<0.5	<0.5	<50	--	49	21	<0.5	<0.5	17	1,1-Dichloroethene detected at 6.0 µg/L.
	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	<250	94	40	<0.5	<0.5	34	1,1-Dichloroethene detected at 14 µg/L.
	01/31/01	<0.5	<0.5	<0.5	<0.5	60	<250	100	35	<0.5	<0.5	26	1,1-Dichloroethene detected at 13 µg/L.
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	270	87	38	<0.5	<0.5	39.1	1,1-Dichloroethene detected at 12 µg/L.
	07/30/01	1.25	1.28	1.1	5.99	220	<250	120	42	<0.5	<0.5	42.3	1,1-Dichloroethene detected at 13 µg/L.
	10/29/01	<0.5	<0.5	<0.5	<1.0	<200	<500	120	34	<0.5	<0.5	28.0	1,1-Dichloroethene detected at 14 µg/L.
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	120	44	<0.5	<0.5	28.9	1,1-Dichloroethene detected at 26 µg/L.
	04/29/02	4.95	<0.5	<0.5	<1.0	<200	<250	130	29	<0.5	<0.5	20.9	1,1-Dichloroethene detected at 23 µg/L.
	10/22/02	<0.5	<0.5	<0.5	<1.0	<200	<250	140	26	<0.5	<0.5	18.1	1,1-Dichloroethene detected at 19 µg/L.
	11/15/02	<0.5	<0.5	<0.5	<1.0	<200	<250	120	26	<0.5	<0.5	13.9	1,1-dichloroethene detected at 15 µg/L.
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	140	31	<0.5	<0.5	13.1	1,1-Dichloroethene detected at 24 µg/L.
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	110	22	<0.5	<0.5	11.9	Chloromethane detected at 0.9 µg/L.
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	160	28	<0.5	<0.5	15.3	1,1-Dichloroethene detected at 31 µg/L.
	11/17/04	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**120**	**<50**	**33**	**6.5**	**<0.50**	**<0.50**	**120**	1,1-Dichloroethene detected at 5.5 µg/L.
MW-30	03/23/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	07/27/93	ND	ND	ND	ND	ND	ND	--	--	--	--	--	
	11/05/93	ND	ND	ND	2.8	ND	ND	--	--	--	--	--	
	02/25/94	1.3	<1	<1	<1	<100	<1,000	--	--	--	--	--	
	06/03/94	1.1	<0.5	<0.5	<0.5	<50	<20,000	--	--	--	--	--	
	08/31/94	0.8	<0.3	<0.3	<0.6	<500	<500	--	--	--	--	--	
	12/22/94	0.6	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	Non-diesel peak reported.
	03/13/95	0.98	<0.5	<0.5	<0.5	<50	<400	--	--	--	--	--	
	06/09/95	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	09/21/95	<0.5	<0.5	<0.5	<0.5	<50	<50	--	--	--	--	--	
	12/12/95	<0.5	<0.5	<0.5	<1.0	<100	<50	--	--	--	--	--	
	03/12/96	<0.5	<0.5	<0.5	<0.5	<100	<50	--	--	--	--	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	--	
	01/16/97	<0.5	<0.5	<0.5	0.6	80	<150	<0.5	<0.5	<0.5	0.9	--	
	07/07/97	<0.5	<0.5	<0.5	<0.5	<50	<150	--	--	--	--	<0.5	
	01/27/98	5.4	<0.5	<0.5	<0.5	100	--	--	--	--	--	<0.5	
	07/22/98	<0.5	<0.5	<0.5	<0.5	<50	--	--	--	--	--	<0.5	
	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	--	--	--	--	<0.5	
	07/22/99	<0.5	<0.5	<0.5	<0.5	<50	--	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/28/99	<0.5	<0.5	<0.5	<0.5	<100	<200	<0.5	<0.5	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/00	<0.5	<0.5	<0.5	<0.5	<100	250	<0.5	<0.5	<0.5	<0.5	<0.5	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-30	08/04/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
(cont.)	10/24/00	5.4	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/29/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroethane detected at 1.3 µg/L.
	01/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/30/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/22/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**140**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<5.0**	
MW-32	03/23/93	391	6.2	3.1	9	440	ND	ND	60	ND	ND	--	
	07/27/93	ND	ND	ND	ND	ND	ND	ND	14	ND	ND	--	
	11/05/93	20	ND	1.8	2.1	170	ND	ND	7.9	ND	ND	--	
	02/25/94	5.6	<1	<1	<1	<100	<1,000	<1	<1	<1	<1	--	
	06/03/94	120	1.3	<0.5	1.4	350	<20,000	<0.5	11	<0.5	<0.5	--	
	08/31/94	39	0.5	2.2	1.2	<500	<500	<4.0	10	<4.0	<4.0	--	
	12/22/94	4.8	<0.5	<0.5	<0.5	<50	<50	<2.0	4.6	<2.0	<2.0	--	Non-diesel peak reported.
	03/13/95	220	3.6	6.5	5.8	1,100	<400	<0.5	16	<0.5	<0.5	--	
	06/09/95	1,500	7.9	43	14	2,200	180	0.7	<0.5	0.5	<0.5	--	
	09/21/95	1,200	2.4	72	4.5	2,300	60	<0.5	6.7	<0.5	1.4	--	
	12/12/95	230	<0.5	8.9	<1.0	500	<50	<0.5	28	<0.5	<0.5	--	
	03/12/96	40	<0.5	1.7	<0.5	110	<50	<0.5	6.8	<0.5	<0.5	--	
	06/21/96	--	--	--	--	--	--	--	--	--	--	--	
	08/29/96	150	<0.5	49	<0.5	700	<150	<0.5	27	<0.5	<0.5	--	
	01/16/97	14	<0.5	1.9	<0.5	150	<150	<0.5	10	<0.5	0.7	--	cis-1,2-DCE detected, 0.8 µg/L.
	07/07/97	370	11	110	21	1,600	190	--	--	--	--	11	
	01/27/98	13	<0.5	1.0	<0.5	300	--	<0.5	7.5	<0.5	<0.5	2.5	
	07/22/98	700	55	88	66	2,300	--	--	--	--	--	14	
	07/22/99	59.0	0.80	1.80	<0.5	900	220	<0.5	5.9	<0.5	<0.5	8.70	
	10/28/99	95	2.5	2.1	1.6	500	<200	<0.5	12	--	<0.5	--	
	02/10/00	7.0	<0.5	<0.5	<0.5	120	<250	<0.5	4.3	<0.5	<0.5	1.10	
	04/27/00	240	7.0	12	18.8	800	250	<0.5	9.8	<0.5	<0.5	<0.5	
	08/03/00	620	3.0	14	4.1	1,300	<250	<0.5	3.0	<0.5	<0.5	<0.5	
	10/23/00	430	4.30	5.50	8.80	1,200	260	<0.5	7.8	<0.5	<0.5	<0.5	
	01/31/01	42	1.5	0.90	2.8	280	<250	<0.5	5.7	<0.5	<0.5	3.6	
	04/26/01	268	13.0	22.1	22.0	780	<250	<0.5	6.3	<0.5	<0.5	<0.5	
	07/30/01	29.4	<0.5	0.52	0.51	320	<250	<0.5	6.6	<0.5	<0.5	<0.5	
	10/29/01	16.1	2.01	1.14	3.96	<200	<500	<0.5	5.4	<0.5	<0.5	<0.5	
	01/29/02	12.0	<0.5	0.70	<1.0	<200	<250	<0.5	4.9	<0.5	2.0	<0.5	cis 1,2-Dichloroethene detected at 1.3 µg/L.
	04/29/02	188	5.52	9.70	13.0	680	<250	<0.5	6.0	<0.5	<0.5	<0.5	
	10/22/02	4.84	<0.5	<0.5	<1.0	<200	<250	<0.5	4.8	<0.5	<0.5	<0.5	
	05/06/03	20.72	0.76	0.86	2.08	<200	<250	<0.5	5.8	<0.5	<0.5	<0.5	
	10/14/03	6.02	<0.5	<0.5	<1.0	<200	<250	<0.5	3.2	<0.5	<0.5	<0.5	
	04/27/04	23.60	1.68	0.67	3.91	<200	<250	<0.5	3.0	<0.5	<0.5	<0.5	
	11/17/04	**2.0**	**<0.50**	**<0.50**	**<0.50**	**<50**	**<50**	**<0.50**	**2.1**	**<0.50**	**<0.50**	**<5.0**	
MW-33	04/07/99	0.60	<0.5	0.90	<0.5	<50	<250	--	--	--	--	<0.5	
	07/22/99	8.90	<0.5	1.00	<0.5	<50	<200	0.6	0.7	<0.5	<0.5	<0.5	
	10/28/99	40	0.9	21	3.8	200	<200	0.8	1.3	--	<0.5	--	
	02/10/00	20	0.7	12	10.0	380	<250	0.9	0.6	<0.5	<0.5	1.30	
	04/27/00	6.9	<0.5	6.4	<0.5	<100	250	4.3	0.9	<0.5	<0.5	<0.5	
	08/03/00	31	0.5	20	1.0	150	550	<0.5	0.6	<0.5	<0.5	<0.5	
	10/23/00	89	1.5	36	3.9	350	<250	<0.5	2.1	<0.5	<0.5	<0.5	
	01/31/01	6.8	<0.5	2.0	<0.5	<50	<250	1.9	0.6	<0.5	<0.5	0.7	
	04/26/01	6.61	0.56	1.63	0.61	<200	<250	2.6	<0.5	<0.5	<0.5	<0.5	
	07/30/01	4.43	2.61	1.34	6.6	<200	<250	2.2	0.5	<0.5	<0.5	<0.5	Dichlorodifluoromethane detected at 0.6 µg/L.
	10/29/01	14.2	<0.5	0.63	<1.0	<200	<500	1.3	0.7	<0.5	<0.5	<0.5	
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	1.1	0.5	<0.5	3.8	<0.5	Dichlorodiflouromethane detected at 1.9 µg/L.; cis 1,2-Dichloroethene detected at 8.9 µg/L.
	04/29/02	14.6	<0.5	1.41	<1.0	<200	<250	0.8	0.9	<0.5	<0.5	<0.5	Dichlorodiflouromethane detected at 1.9 µg/L.
MW-100	07/06/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chloromethane detected at 1.8 µg/L.
	10/30/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/22/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<5.0**	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
MW-?	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	430	--	--	--	--	<0.5	
PR-26	07/26/99	20,000	15,000	1,100	7,250	82,500	11,000	--	--	--	--	33.0	
	10/26/99	28,000	25,000	2,300	8,400	110,000	60,000	<0.5	24	--	<0.5	--	
PR-45	07/26/99	13,200	8,200	2,600	15,600	82,500	39,000	--	--	--	--	35.0	
	10/28/99	12,000	8,200	1,700	8,500	45,000	25,000	<0.5	<0.5	--	<0.5	--	
	02/09/00	24,000	25,000	10,000	53,000	360,000	82,000	<0.5	4.0	<0.5	<0.5	1,000	
	04/27/00	17,000	9,500	16,000	92,000	1,300,000	20,300	<5.0	<5.0	<5.0	<5.0	<5.0	
	08/04/00	20,000	8,800	2,600	16,000	73,000	54,500	<0.5	1.0	<0.5	<0.5	<0.5	
	10/23/00	26,000	12,000	4,000	20,000	96,000	36,000	<0.5	1.2	<0.5	<0.5	<5.0	Chloroethane detected at 6.0 µg/L.
	04/27/01	16,200	8,600	3,220	19,000	178,000	22,700	<0.5	14	<0.5	<0.5	<25	Chloroethane detected at 4.6 µg/L.
	07/30/01	14,500	8,900	4,400	24,700	132,000	29,700	<0.5	11	<0.5	<0.5	<50	Chloromethane detected at 0.6 µg/L; Chloroethane detected at 11 µg/L; Methylene chloride detected at 0.5 µg/L.
	10/29/01	12,600	6,650	2,260	12,400	86,100	50,000	<0.5	7.8	<0.5	<0.5	<25	Chloroethane detected at 6.0 µg/L.
	01/29/02	8,930	4,860	2,640	12,700	114,000	19,400	<0.5	30	<0.5	<0.5	<0.5	Chloroethane detected at 7.5 µg/L.
	05/16/02	14,300	2,630	1,580	7,780	125,000	15,600	<0.5	1.0	<0.5	<0.5	<0.5	Chloroethane detected at 7.3 µg/L.
PR-52	07/26/99	12,000	1,720	750	12,400	172,000	40,000	<0.5	1.8	<0.5	<0.5	217	Methylene chloride detected at 7.9 µg/L.
	10/28/99	19,000	530	1,800	5,800	40,000	450,000	<0.5	<0.5	--	<0.5	--	
	02/09/00	22,000	1,600	4,100	15,800	200,000	140,000	<0.5	1.3	<0.5	<0.5	430	
	04/28/00	20,000	2,200	4,700	18,600	270,000	88,000	<1.0	<1.0	<1.0	<1.0	<5.0	
	08/04/00	26,000	1,600	2,900	15,000	150,000	110,000	<0.5	2.3	<0.5	<0.5	<0.5	
	10/24/00	52,000	13,000	41,000	180,000	650,000	280,000	<5.0	<5.0	<5.0	<5.0	<5.0	
	01/31/01	81,000	840	57,000	210,000	5,300,000	276,000	<0.5	1.0	<0.5	<0.5	500	Chloroethane detected at 2.4 µg/L; Methylene chloride detected at 0.6 µg/L.
	04/27/01	25,000	16,300	14,700	55,000	886,000	134,000	<0.5	<0.5	<0.5	<0.5	1,040	Chloroethane detected at 1.5 µg/L.
	07/30/01	31,100	2,480	13,500	51,700	340,000	185,000	<0.5	1.3	<0.5	<0.5	2,510	Chloromethane detected at 13 µg/L; Chloroethane detected at 46 µg/L; Methylene chloride detected at 0.6 µg/L.
	10/29/01	22,700	1,630	3,070	11,500	126,000	140,000	<0.5	0.9	<0.5	<0.5	<50	Chloromethane detected at 0.6 µg/L; Chloroethane detected at 4.0 µg/L; Methylene chloride detected at 0.7 µg/L.
	01/29/02	21,500	1,840	4,540	16,800	517,000	272,000	<0.5	<0.5	<0.5	<0.5	44.1	Chloroethane detected at 1.5 µg/L.
	05/16/02	31,600	53,600	43,800	216,000	2,020,000	75,000	<5.0	<5.0	<5.0	<5.0	63.5	Chloroethane detected at 8.3 µg/L.
PR-53	07/26/99	31,000	12,000	1,900	8,800	110,000	98,000	<0.5	43	<0.5	<0.5	43.0	Methylene chloride detected at 6.2 µg/L.
	10/27/99	17,000	3,900	890	3,320	54,000	16,000	<0.5	18	--	<0.5	--	
	02/09/00	21,000	5,000	1,200	5,300	65,000	9,400	0.6	20	<0.5	<0.5	67.0	Methylene chloride detected at 0.8 µg/L.
	04/28/00	34,000	30,000	9,300	51,000	730,000	104,000	<1.0	<1.0	<1.0	<1.0	340	
	08/04/00	35,000	17,000	3,800	24,000	180,000	69,500	<0.5	1.7	<0.5	<0.5	110	
	10/24/00	99,000	110,000	80,000	640,000	580,000	380,000	<5.0	5.0	<5.0	<5.0	380	
	01/31/01	66,000	15,000	28,000	140,000	2,400,000	960,000	<0.5	1.5	<0.5	<0.5	660	Chloroethane detected at 1.7 µg/L; Methylene chloride detected at 0.9 µg/L.
	04/27/01	55,500	10,000	23,700	137,000	4,240,000	806,000	<0.5	<0.5	<0.5	<0.5	<5,000	Chloroethane detected at 1.7 µg/L; Methylene chloride detected at 1.1 µg/L.
	10/29/01	46,500	9,520	12,900	74,000	1,630,000	130,000	<0.5	0.8	<0.5	<0.5	<500	Chloroethane detected at 3.0 µg/L; Methylene chloride detected at 0.9 µg/L.
	01/29/02	33,000	7,340	10,300	41,800	495,000	462,000	<0.5	1.8	<0.5	<0.5	122	Chloroethane detected at 3.2 µg/L.
	05/16/02	35,800	10,500	18,700	130,000	3,280,000	113,000	<5.0	<5.0	<5.0	<5.0	242	
PR-54	07/26/99	32,000	22,000	1,500	21,800	170,000	28,000	<0.5	3.0	<0.5	<0.5	56.0	Methylene chloride detected at 2.5 µg/L.
	10/26/99	27,000	10,000	3,700	19,500	190,000	350,000	<0.5	<0.5	--	<0.5	--	
	02/09/00	27,000	23,000	9,900	50,000	960,000	110,000	<0.5	3.9	<0.5	<0.5	1,000	
	04/28/00	24,000	14,000	1,200	9,000	76,000	80,000	<1.0	1.6	<1.0	<1.0	300	
	08/04/00	27,000	7,600	1,400	11,000	120,000	54,500	<0.5	2.0	<0.5	<0.5	200	
	10/24/00	23,000	4,400	2,000	13,000	140,000	96,000	<0.5	2.3	<0.5	<0.5	<100	Chloroethane detected at 5.3 µg/L; Methylene chloride detected at 2.3 µg/L.
	01/31/01	30,000	8,300	3,300	21,000	220,000	236,000	<0.5	2.6	<0.5	<0.5	480	Chloroethane detected at 2.8 µg/L; Methylene chloride detected at 1.7 µg/L.
	04/27/01	26,100	8,650	2,120	15,900	51,300	108,000	<0.5	<0.5	<0.5	<0.5	<500	Chloroethane detected at 3.0 µg/L.
	07/30/01	31,700	18,000	9,880	58,400	320,000	71,200	<0.5	3.9	<0.5	<0.5	2,750	Chloromethane detected at 2.2 µg/L; Chloroethane detected at 22 µg/L; Methylene chloride detected at 2.6 µg/L.
	10/30/01	25,400	11,300	3,500	18,800	222,000	530,000	<0.5	1.2	<0.5	<0.5	276	Chloroethane detected at 7.4 µg/L; Methylene chloride detected at 2.0 µg/L.
	01/29/02	13,300	9,850	4,240	33,100	108,000	48,000	<0.5	7.5	<0.5	<0.5	51.3	Chloroethane detected at 6.2 µg/L.
	05/16/02	27,900	34,500	5,630	36,400	324,000	172,000	<5.0	43	<5.0	<5.0	251	Chloroethane detected at 9.8 µg/L.
PR-64	07/26/99	22,000	18,000	1,700	10,300	110,000	--	<0.5	130	<0.5	<0.5	35.0	Methylene chloride detected at 1.4 µg/L.
	10/27/99	11,000	7,400	1,200	3,900	66,000	50,000	<0.5	110	--	<0.5	--	
	02/09/00	22,000	20,000	6,000	17,000	120,000	40,000	<0.5	>50	<0.5	<0.5	110	
	04/28/00	19,000	16,000	1,800	13,900	130,000	78,000	<1.0	67	<1.0	<1.0	300	
	05/16/02	18,300	40,100	10,400	104,000	30,600,000	419,000	<5.0	<5.0	<5.0	<5.0	<500	
PR-65	07/26/99	12,000	1,400	1,300	13,000	68,000	16,500	<0.5	2.6	<0.5	<0.5	20.0	
	10/26/99	14,000	2,300	1,800	11,000	65,000	50,000	<0.5	<0.5	--	<0.5	--	
PR-68	07/26/99	1,900	24.0	27.0	62.0	4,900	11,000	<0.5	1.2	<0.5	<0.5	4.40	
	10/26/99	2,800	36	86	62	8,000	2,800	<0.5	<0.5	--	<0.5	--	

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
PR-76	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	--	--	--	--	<0.5	
	10/22/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/14/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/04	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**85**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<5.0**	
V-24	04/07/99	<0.5	<0.5	<0.5	<0.5	120	<250	--	--	--	--	0.5	
V-31	07/26/99	7,000	600	550	1,370	17,500	5,350	--	--	--	--	19.0	
	10/26/99	7,000	120	850	950	18,000	3,000	<0.5	<0.5	--	<0.5	--	
V-46	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	270	<0.5	<0.5	<0.5	<0.5	<0.5	
V-55	07/22/99	8,000	480	740	2,880	30,000	2,100	<0.5	<0.5	<0.5	<0.5	13.0	
	10/28/99	11,000	59	1,200	317	28,000	38,000	<0.5	<0.5	--	<0.5	--	
	02/09/00	2,200	59	760	350	7,900	10,000	<0.5	<0.5	<0.5	<0.5	9.70	
	04/28/00	2,900	510	440	2,340	14,000	26,500	<5.0	<5.0	<5.0	<5.0	<5.0	
	08/03/00	9,400	380	720	2,200	28,000	70,000	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/23/00	11,000	140	900	1,300	30,000	51,000	<0.5	<0.5	<0.5	<0.5	<12	
	01/31/01	4,600	57	550	1,200	34,000	88,500	<0.5	<0.5	<0.5	<0.5	44	
	04/26/01	6,400	61.5	250	336	34,200	227,000	<0.5	<0.5	<0.5	<0.5	<25	
	10/30/01	5,360	70.0	1,090	1,450	32,700	78,000	<0.5	<0.5	<0.5	<0.5	<25	
	01/29/02	1,660	140	492	818	12,000	4,100	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/29/02	5,170	95.1	572	523	30,600	35,100	<0.5	<0.5	<0.5	<0.5	1.06	
V-72	07/26/99	13,500	6.80	1.10	3.90	3,900	12,900	<0.5	11	<0.5	<0.5	<0.5	
	10/28/99	2,900	58	21	47.7	6,000	48,000	<0.5	3.4	--	<0.5	--	
	02/09/00	670	8.2	<0.5	17.8	890	6,100	<0.5	3.0	<0.5	<0.5	<0.5	
	04/28/00	130	<0.5	<0.5	<0.5	200	5,950	<0.5	0.7	<0.5	<0.5	<0.5	
	08/04/00	460	0.8	<0.5	0.6	440	4,120	<0.5	2.8	<0.5	<0.5	<0.5	
	10/24/00	2,700	3.2	0.5	2.3	3,500	17,000	<0.5	4.0	<0.5	<0.5	<0.5	
	04/27/01	1,240	2.05	<0.5	2.78	1,310	6,290	<0.5	5.1	<0.5	<0.5	<0.5	Dichlorodifluoromethane detected at 0.8 µg/L.
	07/30/01	1,790	69.8	1.22	2.50	1,490	4,290	<0.5	6.2	<0.5	<0.5	<0.5	Chloromethane detected at 1.5 µg/L.
	10/29/01	1,330	4.38	0.55	3.32	1,960	--	<0.5	5.6	<0.5	<0.5	<0.5	Chloromethane detected at 1.1 µg/L.
	01/29/02	655	6.40	<0.5	8.00	1,840	2,250	<0.5	3.9	<0.5	<0.5	<0.5	Chloromethane detected at 1.8 µg/L.
	05/16/02	43.8	1.09	<0.5	4.36	230	5,120	<0.5	<0.5	<0.5	<0.5	<0.5	Chloromethane detected at 1.8 µg/L.
V-84	07/26/99	2,400	440	80.0	340	8,700	2,350	<0.5	2.4	<0.5	<0.5	6.40	
	10/26/99	1,100	130	46	108	4,000	700	<0.5	<0.5	--	<0.5	--	
	02/09/00	300	30	8.9	53	2,300	1,100	<0.5	1.2	<0.5	<0.5	<0.5	
	04/28/00	30	1.9	<0.5	<0.5	100	550	<5.0	<5.0	<5.0	<5.0	<0.5	
	08/04/00	900	110	34	120	2,700	1,380	<0.5	1.0	<0.5	<0.5	<0.5	
	10/24/00	2,000	480	24	110	48,000	1,900	<0.5	1.0	<0.5	<0.5	<0.5	
	01/31/01	68	1.3	5.3	8.2	970	1,820	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/01	925	97.0	45.4	59.7	2,360	1,180	<0.5	0.8	<0.5	<0.5	<0.5	
	07/30/01	1,720	282	50	359	8,100	7,040	<0.5	1.5	<0.5	<0.5	<0.5	
	10/30/01	870	250	27.6	167	8,960	--	<0.5	1.0	<0.5	<0.5	<0.5	
	01/29/02	197	4.90	1.70	3.60	640	500	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/29/02	318	34.4	15.4	18.4	1,070	400	<0.5	<0.5	<0.5	<0.5	<0.5	
29 (CC-1)	07/23/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/28/99	<0.5	<0.5	<0.5	<0.5	<100	<200	<0.5	<0.5	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/00	<0.5	<0.5	<0.5	<0.5	<100	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	08/03/00	1.4	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/30/01	1.12	0.56	<0.5	<0.5	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	
	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/29/02	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/22/02	1.38	14.6	2.44	16.4	220	<250	<0.5	<0.5	<0.5	<0.5	92.0	Chloromethane detected at 1.3 µg/L, Chloroform detected at 4.7 µg/L.
	11/15/02	<0.50	<0.50	<0.50	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroform detected at 2.6 µg/L.
	05/06/03	<0.50	<0.50	<0.50	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/14/03	<0.50	<0.50	<0.50	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroform detected at 0.7 µg/L.
	04/27/04	<0.50	<0.50	<0.50	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	11/17/04	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<50**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<5.0**	
30 (CC-2)	07/22/99	0.90	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/28/99	<0.5	<0.5	<0.5	<0.5	<100	<200	<0.5	<0.5	--	<0.5	--	
	02/08/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/00	<0.5	<0.5	<0.5	<0.5	<100	<250	<0.5	0.7	<0.5	<0.5	<0.5	
	08/03/00	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/23/00	<0.5	<0.5	<0.5	<0.5	<50	340	<0.5	0.9	<0.5	<0.5	<2.5	
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/30/01	<0.5	1.43	<0.5	1.63	<200	<250	<0.5	1.6	<0.5	<0.5	<0.5	Dichlorodifluoromethane detected at 2.8 µg/L.

Table 3: Historical Groundwater Sample Results (1993 - 2008)

Well Number	Date Sampled	Benzene µg/L	Toluene µg/L	Ethyl-Benzene µg/L	Xylenes µg/L	TPH-G µg/L	TPH-D µg/L	1,1-DCA µg/L	1,2-DCA µg/L	1,1,1-TCA µg/L	TCE µg/L	MTBE µg/L	Notes
30 (CC-2)	10/29/01	<0.5	<0.5	<1.0	<0.5	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	
(cont.)	01/28/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	1.9	<0.5	<0.5	<0.5	Dichlorodifluoromethane detected at 3.8 µg/L.
	04/29/02	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	2.5	<0.5	<0.5	0.86	Dichlorodifluoromethane detected at 3.6 µg/L.
	10/10/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroform detected at 0.6 µg/L.
	11/15/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroform detected at 0.5 µg/L.
	05/06/03	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
81	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	<150	<0.5	<0.5	<0.5	<0.5	<0.5	
	07/22/99	0.70	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
94	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	170	--	--	--	--	<0.5	
	07/22/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
210	02/05/99	<0.5	<0.5	<0.5	<0.5	<50	960	--	--	--	--	<0.5	
223	10/26/99	<0.5	<0.5	<0.5	<0.5	<100	<200	<0.5	<0.5	--	<0.5	--	
	02/10/00	<0.5	<0.5	<0.5	<0.5	<50	640	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/27/00	<0.5	<0.5	<0.5	<0.5	<100	250	<0.5	<0.5	<0.5	<0.5	<0.5	
	08/03/00	<0.5	<0.5	<0.5	<0.5	<50	680	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/23/00	1.30	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Chlorobenzene detected at 0.9 µg/L.
	01/31/01	<0.5	<0.5	<0.5	<0.5	<50	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/26/01	<0.5	<0.5	<0.5	<0.5	<200	390	<0.5	<0.5	<0.5	<0.5	<0.5	1,2-Dichlorobenzene detected at 0.5 µg/L.
	07/30/01	<0.5	<0.5	<0.5	<0.5	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	Dichlorodifluoromethane detected at 0.5 µg/L.
	10/30/01	<0.5	<0.5	<0.5	<1.0	<200	<500	<0.5	<0.5	<0.5	<0.5	<0.5	Chloromethane detected at 0.8 µg/L.
	01/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
	04/29/02	<0.5	<0.5	<0.5	<1.0	<200	<250	<0.5	<0.5	<0.5	<0.5	<0.5	
224	07/26/99	<0.5	<0.5	<0.5	<0.5	<50	640	<0.5	<0.5	<0.5	<0.5	<0.5	
239	07/26/99	55,000	85.0	1,500	190	30,000	--	<0.5	<0.5	<0.5	<0.5	5.30	
	10/26/99	23,000	53	1,500	103.2	28,000	10,000	<0.5	<0.5	--	<0.5	--	
	02/10/00	40,000	48	1,900	52	44,000	21,000	<0.5	1.0	<0.5	<0.5	14.0	
	04/28/00	25,000	540	2,000	710	36,000	12,500	<5.0	<5.0	<5.0	<5.0	<5.0	
	08/04/00	25,000	220	1,900	920	45,000	32,500	<0.5	0.6	<0.5	<0.5	<0.5	
	10/24/00	24,000	100	1,500	390	50,000	50,000	<0.5	<0.5	<0.5	<0.5	<5.0	
	01/31/01	23,000	84	1,900	200	52,000	112,000	<0.5	0.9	<0.5	<0.5	<0.5	
	04/26/01	23,900	113	1,990	590	298,000	143,000	<0.5	<0.5	<0.5	<0.5	<25	
	07/30/01	30,200	384	2,000	966	66,500	19,100	<0.5	<0.5	<0.5	<0.5	<0.5	
	10/30/01	41,200	273	1,470	215	54,300	120,000	<0.5	<0.5	<0.5	<0.5	<50	
	01/28/02	24,500	228	1,670	352	112,000	6,900	<0.5	<0.5	<0.5	<0.5	<0.5	Chloroethane detected at 0.6 µg/L.
	04/29/02	25,900	280	1,380	491	71,600	9,400	<0.5	<0.5	<0.5	<0.5	<0.5	
241	04/07/99	<0.5	<0.5	<0.5	<0.5	<50	<250	--	--	--	--	<0.5	
249	07/22/99	<0.5	<0.5	<0.5	<0.5	<50	<200	<0.5	<0.5	<0.5	<0.5	<0.5	
SB-16	05/20/08	<0.50	<0.50	<0.50	530	<50	530	NA	<0.50	NA	NA	NA	
SB-17	05/22/08	12,000	3,200	17,000	560,000	120,000	560,000	NA	<0.50	NA	NA	NA	
SB-18	05/22/08	50,000	2,300	46,000	23,000	190,000	23,000	NA	2,200	NA	NA	NA	
SB-19	05/22/08	<12	220	<12	1,600	8,200	1,600	NA	<12	NA	NA	NA	
SB-20/ PCB-7	05/22/08	41,000	3,000	30,000	47,000	170,000	47,000	NA	930	NA	NA	NA	
SB-21/ PCB-8	05/23/08	12,000	2,600	20,000	3,500	110,000	3,500	NA	<250	NA	NA	NA	
SB-22	05/22/08	27,000	13,000	39,000	73,000	870,000	73,000	NA	<2,500	NA	NA	NA	
SB-24/ PCB-1	05/21/08	1.1	<0.50	<0.50	360	<50	360	NA	<0.50	NA	NA	NA	
SB-25/ PCB-2	05/21/08	<0.50	<0.50	<0.50	140	<50	140	NA	<0.50	NA	NA	NA	
SB-26	05/22/08	<0.50	<0.50	<0.50	270	<50	270	NA	<0.50	NA	NA	NA	
SB-27/ PCB-3	05/20/08	<0.50	<0.50	<0.50	NA	NA	NA	NA	<0.50	NA	NA	NA	

Notes:

ND	Not detected.
NA	Not analyzed or not sampled.
µg/L	Micrograms per liter.
TPH-G	Total Petroleum Hydrocarbons as gasoline.
TPH-D	Total Petroleum Hydrocarbons as diesel.
1,1-DCA	1,1-Dichloroethane.
1,1-DCA	1,2-Dichloroethane.
cis-1,1-DCE	1,1-Dichloroethene.
1,1,1-TCA	1,1,1-Trichloroethane.
1,2-DCE	cis 1,2-Dichloroethylene.
TCE	Trichloroethene.
MTBE	Methyl tertiary butyl ether.

10/22/02 Data was confirmed anomalous by resampling on 11/15/02.

Project: Former Nestle Oakland Facility

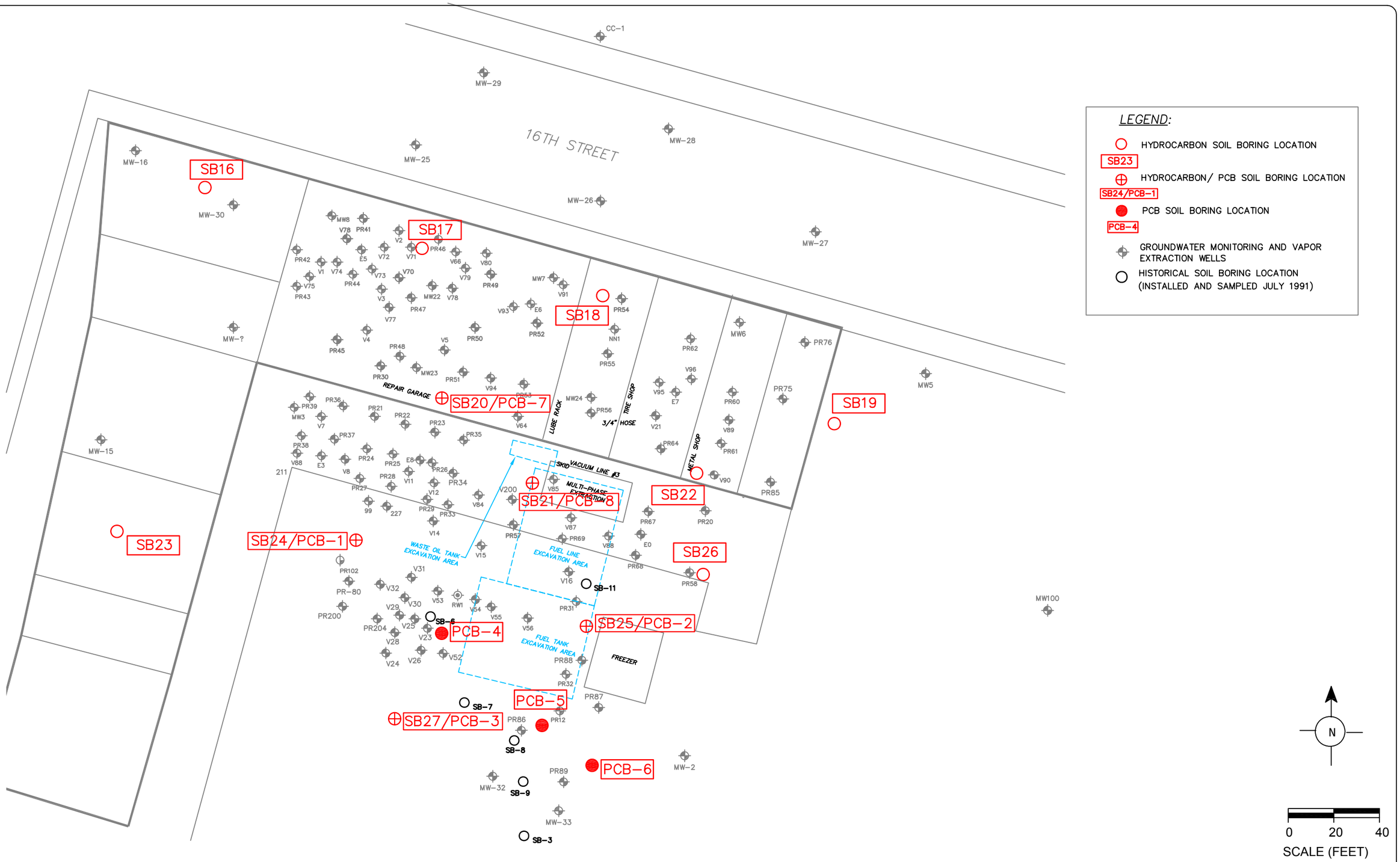
Proj. Manager: B. Acharya

Date drafted: 7/2/08

Chkd by: T. Loof

Drafter: J. Plummer

File Path:



LEGEND:

- HYDROCARBON SOIL BORING LOCATION (SB23)
- HYDROCARBON/ PCB SOIL BORING LOCATION (SB24/PCB-1)
- PCB SOIL BORING LOCATION (PCB-4)
- GROUNDWATER MONITORING AND VAPOR EXTRACTION WELLS
- HISTORICAL SOIL BORING LOCATION (INSTALLED AND SAMPLED JULY 1991)

Former Nestle Oakland Facility
1310 14th Street
Oakland, California - 94607

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
660 Baker Street, Suite 253 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

SUPPLEMENTAL SOIL, SOIL GAS AND GROUNDWATER INVESTIGATION
Soil Boring Locations
May 2008

Figure 2

Project: Nestle-Oakland

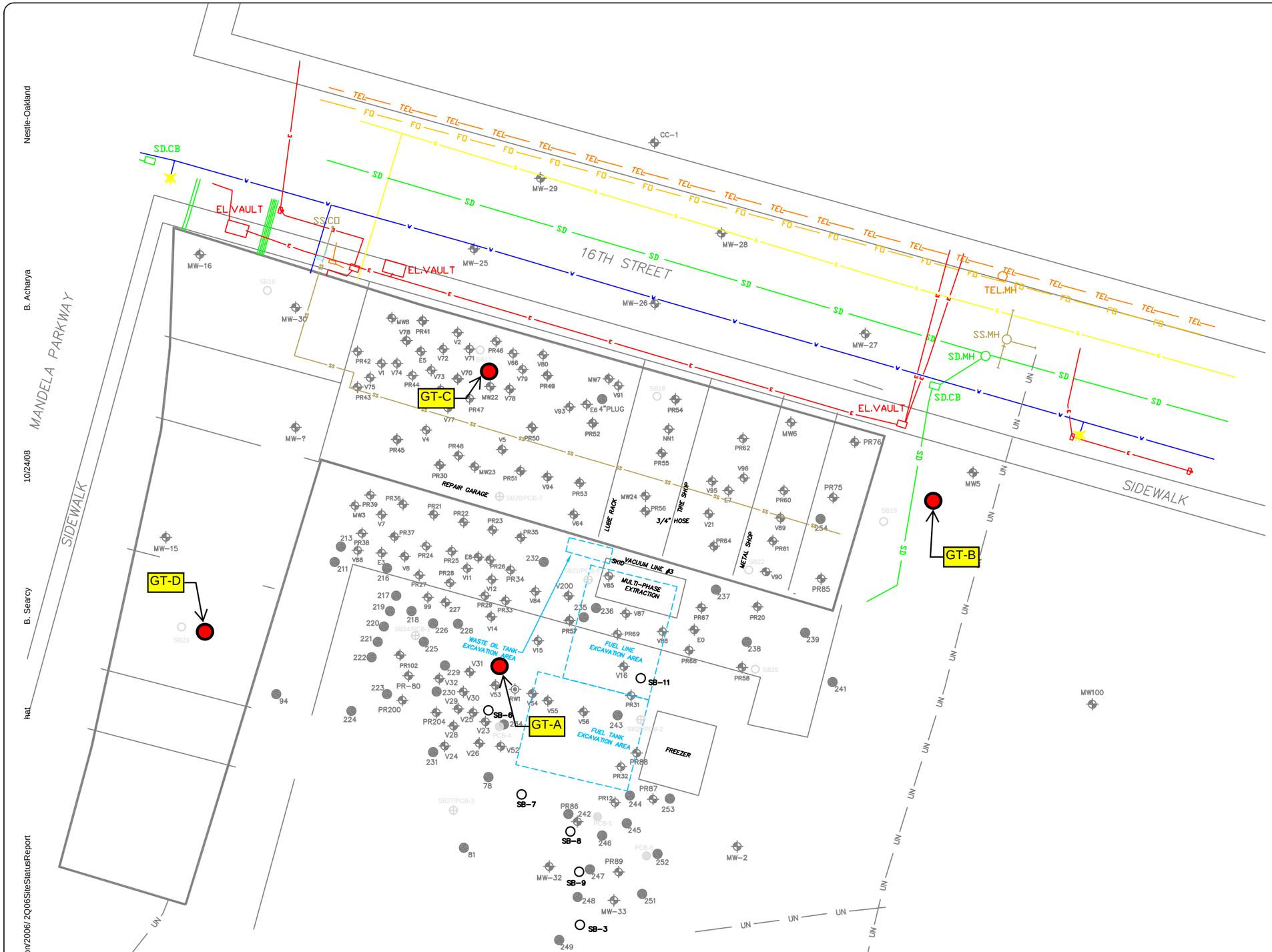
Proj. Manager: B. Achaya

Date drafted: 10/24/08

Chkd by: B. Searcy

Drafter: hat

File Path: Nestle/Ripon/2006/ 2Q06SiteStatusReport



LEGEND:

- HYDROCARBON SOIL BORING LOCATION (SB23)
- HYDROCARBON/ PCB SOIL BORING LOCATION
- PCB SOIL BORING LOCATION (SB24/PCB-1)
- GROUNDWATER MONITORING AND VAPOR EXTRACTION WELLS (PCB-4)
- HISTORICAL SOIL BORING LOCATION (INSTALLED AND SAMPLED JULY 1991)
- WELL OF UNKNOWN CONSTRUCTION (239)

UTILITIES

- TEL — TELEPHONE
- FO — FIBER OPTICS
- G — GAS LINE
- SD — STORM DRAIN MAIN
- V — WATER MAIN
- E — ELECTRICAL
- UN — UNKNOWN

NOTES:

1. SURVEY CONDUCTED BY SUBTRONIC CORPORATION IN NOVEMBER 2007.
2. NOT ALL UTILITIES MAY BE SHOWN. SOME LATERALS WERE NOT ACCESSIBLE AND WERE NOT LOCATED DURING SURVEY.
3. MOST UTILITIES ON THE PROPERTY ARE ABANDONED.

N

0 20 40

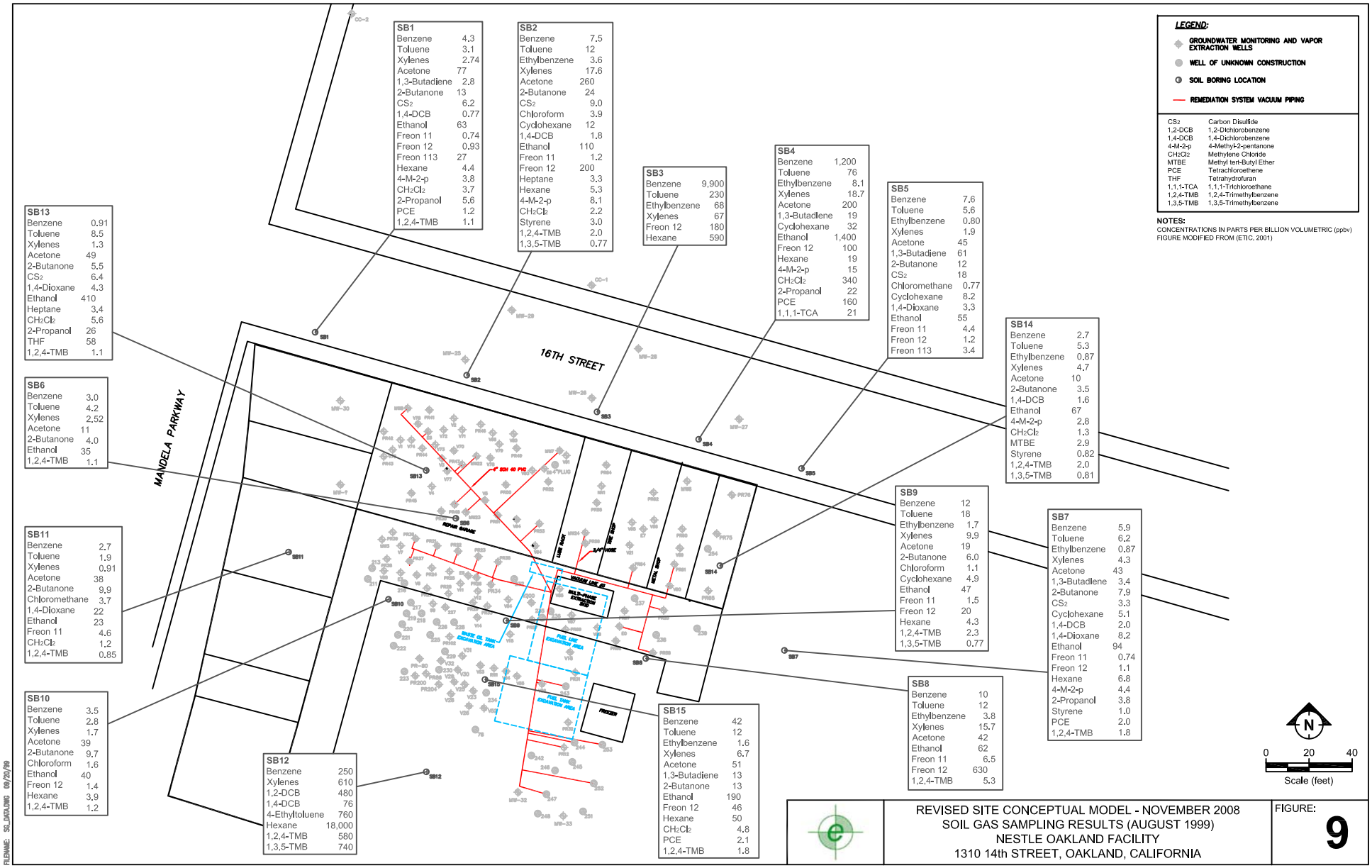
SCALE (FEET)

Former Nestlé Oakland Facility
1310 14th Street
Oakland, California - 94607

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
660 Baker Street, Suite 253 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

Soil Parameters Sampling Locations

Figure 3


16TH STREET
MANDELA PARKWAY
SB1
Benzene 4.3
Toluene 3.1
Xylenes 2.74
Acetone 77
1,3-Butadiene 2.8
2-Butanone 13
CS2 6.2
1,4-DCB 0.77
Ethanol 63
Freon 11 0.74
Freon 12 0.93
Freon 113 27
Hexane 4.4
4-M-2-p 3.8
CH2Cl2 3.7
2-Propanol 5.6
PCE 1.2
1,2,4-TMB 1.1
SB2
Benzene 7.5
Toluene 12
Ethylbenzene 3.6
Xylenes 17.6
Acetone 260
2-Butanone 24
CS2 9.0
Chloroform 3.9
Cyclohexane 12
1,4-DCB 1.8
Ethanol 110
Freon 11 1.2
Freon 12 200
Heptane 3.3
Hexane 5.3
4-M-2-p 8.1
CH2Cl2 2.2
Styrene 3.0
1,2,4-TMB 2.0
1,3,5-TMB 0.77
SB3
Benzene 9,900
Toluene 230
Ethylbenzene 68
Xylenes 67
Freon 12 180
Hexane 590
SB4
Benzene 1,200
Toluene 76
Ethylbenzene 8.1
Xylenes 18.7
Acetone 200
1,3-Butadiene 19
Cyclohexane 32
Ethanol 1,400
Freon 12 100
Hexane 19
4-M-2-p 15
CH2Cl2 340
2-Propanol 22
PCE 160
1,1,1-TCA 21
SB5
Benzene 7.6
Toluene 5.6
Ethylbenzene 0.80
Xylenes 1.9
Acetone 45
1,3-Butadiene 61
2-Butanone 12
CS2 18
Chloromethane 0.77
Cyclohexane 8.2
1,4-Dioxane 3.3
Ethanol 55
Freon 11 4.4
Freon 12 1.2
Freon 113 3.4
SB6
Benzene 3.0
Toluene 4.2
Xylenes 2.52
Acetone 11
2-Butanone 4.0
Ethanol 35
1,2,4-TMB 1.1
SB7
Benzene 5.9
Toluene 6.2
Ethylbenzene 0.87
Xylenes 4.3
Acetone 43
1,3-Butadiene 3.4
2-Butanone 7.9
CS2 3.3
Cyclohexane 5.1
1,4-DCB 2.0
1,4-Dioxane 8.2
Ethanol 94
Freon 11 0.74
Freon 12 1.1
Hexane 6.8
4-M-2-p 4.4
2-Propanol 3.8
Styrene 1.0
PCE 2.0
1,2,4-TMB 1.8
SB8
Benzene 10
Toluene 12
Ethylbenzene 3.8
Xylenes 15.7
Acetone 42
Ethanol 62
Freon 11 6.5
Freon 12 630
1,2,4-TMB 5.3
SB9
Benzene 12
Toluene 18
Ethylbenzene 1.7
Xylenes 9.9
Acetone 19
2-Butanone 6.0
Chloroform 1.1
Cyclohexane 4.9
Ethanol 47
Freon 11 1.5
Freon 12 20
Hexane 4.3
1,2,4-TMB 2.3
1,3,5-TMB 0.77
SB10
Benzene 3.5
Toluene 2.8
Xylenes 1.7
Acetone 39
2-Butanone 9.7
Chloroform 1.6
Ethanol 40
Freon 12 1.4
Hexane 3.9
1,2,4-TMB 1.2
SB11
Benzene 2.7
Toluene 1.9
Xylenes 0.91
Acetone 38
2-Butanone 9.9
Chloromethane 3.7
1,4-Dioxane 22
Ethanol 23
Freon 11 4.6
CH2Cl2 1.2
1,2,4-TMB 0.85
SB12
Benzene 250
Xylenes 610
1,2-DCB 480
1,4-DCB 76
4-Ethyltoluene 760
Hexane 18,000
1,2,4-TMB 580
1,3,5-TMB 740
SB13
Benzene 0.91
Toluene 8.5
Xylenes 1.3
Acetone 49
2-Butanone 5.5
CS2 6.4
1,4-Dioxane 4.3
Ethanol 410
Heptane 3.4
CH2Cl2 5.6
2-Propanol 26
THF 58
1,2,4-TMB 1.1
SB14
Benzene 2.7
Toluene 5.3
Ethylbenzene 0.87
Xylenes 4.7
Acetone 10
2-Butanone 3.5
1,4-DCB 1.6
Ethanol 67
4-M-2-p 2.8
CH2Cl2 1.3
MTBE 2.9
Styrene 0.82
1,2,4-TMB 2.0
1,3,5-TMB 0.81
SB15
Benzene 42
Toluene 12
Ethylbenzene 1.6
Xylenes 6.7
Acetone 51
1,3-Butadiene 13
2-Butanone 13
Ethanol 190
Freon 12 46
Hexane 50
CH2Cl2 4.8
PCE 2.1
1,2,4-TMB 1.8
LEGEND:
GROUNDWATER MONITORING AND VAPOR EXTRACTION WELLS
WELL OF UNKNOWN CONSTRUCTION
SOIL BORING LOCATION
REMEDIATION SYSTEM VACUUM PIPING
CS2 Carbon Disulfide
1,2-DCB 1,2-Dichlorobenzene
1,4-DCB 1,4-Dichlorobenzene
4-M-2-p 4-Methyl-2-pentanone
CH2Cl2 Methylene Chloride
MTBE Methyl tert-Butyl Ether
PCE Tetrachloroethene
THF Tetrahydrofuran
1,1,1-TCA 1,1,1-Trichloroethane
1,2,4-TMB 1,2,4-Trimethylbenzene
1,3,5-TMB 1,3,5-Trimethylbenzene
NOTES:
CONCENTRATIONS IN PARTS PER BILLION VOLUMETRIC (ppbv)
FIGURE MODIFIED FROM (ETIC, 2001)
N
0 20 40
Scale (feet)
REVISED SITE CONCEPTUAL MODEL - NOVEMBER 2008
SOIL GAS SAMPLING RESULTS (AUGUST 1999)
NESTLE OAKLAND FACILITY
1310 14th STREET, OAKLAND, CALIFORNIA
FIGURE: 9
FILENAME: SG_DATA.DWG 09/20/99

APPENDIX B

UNCERTAINTIES ANALYSIS

1.0 INTRODUCTION

Many of the assumptions used in the screening level human health risk evaluation – regarding the representativeness of the sampling data, human exposures, fate and transport modeling, and chemical toxicity – are conservative, follow agency guidance, and reflect a 90th or 95th percentile value rather than a typical or average value. The use of several conservative exposure and toxicity assumptions can introduce considerable uncertainty into the human health screening evaluation. By using conservative exposure or toxicity estimates, the evaluation can develop a significant conservative bias that may result in the calculation of significantly higher cancer risks or noncancer hazards than are actually posed by the chemicals present in soil, soil gas, and groundwater. The key uncertainties in the human health screening evaluation are discussed below. This uncertainty analysis focuses on the site-specific assumptions contributing most to uncertainty in the risk and hazard calculations, and does not assess the validity of default assumptions used in the health screening evaluation. The parameters evaluated in the uncertainty analysis are: representative concentrations in soil gas, soil properties, and building air exchange rate.

The uncertainties associated with representative concentrations in soil gas, soil properties, and building air exchange rate are discussed below. Two sensitivity analyses have been performed, to bound the range of potential risks and hazards associated with the uncertainties in these three input parameters. The first sensitivity analysis combines the most conservative options of the three parameters, to produce a high-end estimate of potential risk and hazard. The second sensitivity analysis combines the least conservative options of the three parameters, to produce a low-end estimate of potential risks and hazards. The baseline health risk evaluation, the results of which are presented in Section 7 of the main report, is based on a combination of assumptions regarding these three parameters, based primarily on DTSC vapor intrusion guidance (Cal/EPA, 2005b), and represents a relatively conservative estimate of potential risk and hazard. The conceptual differences between the three evaluations are summarized in the following table.

Summary of Health Risk Evaluations

Evaluation	Where Documented	Soil Gas Concentrations	Soil Properties	Building Ventilation Rate
High-end estimate	Appendix C	Maxima	Default	Default
Baseline estimate	Main report	Maxima	Site-specific	Default
Low-end estimate	Appendix D	Averages	Site-specific	Site-specific

2.0 Uncertainty in Representative Concentrations in Soil Gas

As discussed in Sections 4.5.1, and 4.5.2 of the main report, the baseline analyses of vapor transport from soil gas to indoor air and outdoor air are based on the historical maximum detected concentration of each COPC in soil gas, from the combined 1999 and 2008 datasets. This assumption is consistent with current DTSC vapor intrusion guidance (Cal/EPA, 2005b), which recommends the use of maximum detected soil gas concentrations in vapor intrusion screening risk evaluations. It should be noted that this recommendation is based on an assumed scenario of residential development on quarter-acre lots, with soil gas data collected at this same density (quarter-acre density is equivalent to 100-foot spacing between sampling locations), so that the worst-case residence is evaluated. At this site, however, soil gas sampling has been performed at a much greater density, including numerous samples collected beneath the one on-site commercial building (see ECM Figures 2 and 9 in Appendix A). Furthermore, the 1999 results are generally higher than the 2008 results and so provide most of the maximum concentrations, but are likely to be less representative of current site conditions than the 2008 data. Therefore, the use of average, rather than historical maximum, soil gas concentrations is arguably more appropriate for estimating the long-term average indoor air concentrations associated with vapor intrusion into the onsite commercial building. The sensitivity of the results of the health risk evaluation to the use of maximum versus average concentrations of COPCs in soil gas is discussed below in Section 5.0.

3.0 Uncertainty in Soil Properties

As discussed in Sections 4.5.1, and 4.5.2 of the main report, the baseline analyses of vapor transport from soil gas to indoor air and outdoor air are based on site-specific soil properties (total porosity, water-filled porosity, and bulk density) as recommended in the DTSC vapor intrusion guidance (Cal/EPA, 2005b). These properties were measured during the January 2009 site investigation. While measured site-specific soil properties are likely to be most representative of actual site soil conditions, these site-specific properties are less conservative than the DTSC/HERD default soil properties (Cal/EPA, 2005a). The sensitivity of the results of the health risk evaluation to the use of default versus site-specific soil properties is discussed below in Section 5.0.

4.0 Uncertainty in Building Air Exchange Rate

The predicted vapor intrusion transport of COPCs from soil gas into the onsite building is dependent upon the building air exchange rate; specifically, predicted concentrations of COPCs in indoor air are inversely proportional to the air exchange rate. As noted in Section 4.5.1 of the main report, the baseline vapor intrusion transport analysis assumes the DTSC/HERD default air exchange rate of 1 building volume per hour (Cal/EPA, 2005a). This default air exchange rate is conservative and very likely underestimates the actual air exchange rate of the existing onsite commercial building. The existing onsite building is an old, warehouse-type structure with several rollup doors; a reasonable estimate of the actual air exchange rate of this structure, based on engineering judgment, is 4 building volumes per hour. The sensitivity of the results of the health risk evaluation

to the use of a default versus site-specific building air exchange rate is discussed below in Section 5.0.

5.0 High-end and Low-end Estimates of Potential Risk and Hazard

As discussed above, uncertainties exist in the human health risk evaluation regarding representative concentrations of COPCs in soil gas, soil properties, and building air exchange rate. The baseline health risk evaluation, the results of which are summarized in Section 7 of the main report, is based on a combination of assumptions regarding these three parameters; these assumptions are consistent with DTSC vapor intrusion guidance (Cal/EPA, 2005b) and produce a reasonably conservative estimate of potential risk and hazard.

Discussed here are two sensitivity analyses which bound the range of potential risks and hazards associated with the uncertainties in these three input parameters. The first sensitivity analysis combines the most conservative, but likely least representative, options of the three parameters, to produce a high-end estimate of potential risk and hazard. The second sensitivity analysis combines the least conservative, but likely most representative, options of the three parameters, to produce a low-end estimate of potential risks and hazards.

The high-end estimate of potential risk and hazard is based on a combination of historical maximum concentrations of COPCs in soil gas, DTSC/HERD default soil properties, and the DTSC/HERD default building air exchange rate. This worst-case estimate is likely the least representative of actual exposures and associated health effects, of the three evaluations. This analysis is documented in Tables C-1 through C-5 of Appendix C. The results of this high-end estimate may be summarized as follows.

- Using default soil properties, the estimated cancer risk for onsite indoor commercial/industrial workers, associated with vapor intrusion (the only complete exposure pathway for this receptor), is 6.7×10^{-5}, which is within the 1×10^{-6} to 1×10^{-4} risk management range (see Table C-4). The estimated noncancer hazard index is 0.44, which is below the threshold hazard index of 1 (see Table C-5).
- Using default soil properties, the estimated cancer risk for onsite outdoor intrusive construction workers, summed across the four complete exposure pathways, is 9.8×10^{-5}, which is within the 1×10^{-6} to 1×10^{-4} risk management range (see Table C-4). The estimated noncancer hazard index is 21, which is above the threshold hazard index of 1 (see Table C-5).
- Using default soil properties, the estimated cancer risk for offsite residents, associated with inhalation of volatile COPCs in indoor or outdoor air that have migrated downwind from the site (the only complete exposure pathway for this receptor), is 6.9×10^{-6}, which is within the 1×10^{-6} to 1×10^{-4} risk management range (see Table C-4). The estimated noncancer hazard index is 0.069, which is below the threshold hazard index of 1 (see Table C-5).

The low-end estimate of potential risk and hazard is based on a combination of average concentrations of COPCs in soil gas, site-specific soil properties, and site-specific building air exchange rate. This estimate is likely the most representative of actual exposures and associated health effects, of the three evaluations. This analysis is documented in Tables D-1 through D-6 of Appendix C. The results of this low-end estimate may be summarized as follows.

- Using average concentrations of COPCs in soil gas and a site-specific building air exchange rate, the estimated cancer risk for onsite indoor commercial/industrial workers, associated with vapor intrusion (the only complete exposure pathway for this receptor), is 1.7×10^{-7}, which is below the 1×10^{-6} to 1×10^{-4} risk management range (see Table D-5). The estimated noncancer hazard index is 0.0011, which is below the threshold hazard index of 1 (see Table D-6).
- Using average concentrations of COPCs in soil gas and a site-specific building air exchange rate, the estimated cancer risk for onsite outdoor intrusive construction workers, summed across the four complete exposure pathways, is 9.8×10^{-5}, which is within the 1×10^{-6} to 1×10^{-4} risk management range (see Table D-5). The estimated noncancer hazard index is 21, which is above the threshold hazard index of 1 (see Table D-6).
- Using average concentrations of COPCs in soil gas and a site-specific building air exchange rate, the estimated cancer risk for offsite residents, associated with inhalation of volatile COPCs in indoor or outdoor air that have migrated downwind from the site (the only complete exposure pathway for this receptor), is 3.5×10^{-8}, which is below the 1×10^{-6} to 1×10^{-4} risk management range (see Table D-5). The estimated noncancer hazard index is 0.00033, which is below the threshold hazard index of 1 (see Table D-6).

The following conclusions may be drawn regarding the sensitivity of the results of the human health risk evaluation to the uncertainties regarding representative concentrations of COPCs in soil gas, soil properties, and building air exchange rate.

- Estimated potential risk and hazard for onsite indoor commercial/industrial workers range over approximately 2-1/2 orders of magnitude. The high-end estimates are approximately 8 times greater than the baseline estimates presented in Section 7 of the main report. The low-end estimates are less than the baseline estimates by a factor of approximately 47.
- Estimated potential risk and hazard for onsite outdoor intrusive construction workers are not sensitive to these uncertainties, as the estimated potential health effects for this receptor are driven by dermal contact with groundwater.
- Estimated potential risk and hazard for offsite residents range over approximately 2 orders of magnitude. The high-end estimates are approximately 17 times greater than the baseline estimates presented above in Section 7 of the main report. The low-end estimates are less than the baseline estimates by a factor of approximately 11.

APPENDIX C

HIGH-END ESTIMATE OF RISK AND HAZARD

Table C-1. Johnson and Ettinger Model Inputs – High-end Estimate

Parameter	Symbol	Value	Units	Reference
Building Properties				
Depth below grade to bottom of enclosed space floor	L_F	15	cm	DTSC/HERD default (Cal/EPA, 2005a; 2005b)
Area of enclosed space below grade	$A_{b,sg}$	2.05E+07	cm^2	Site-specific
Building air exchange rate	AXR_b	1	hr^{-1}	DTSC default (Cal/EPA, 2005b)
Building height	Bh	503	cm	Site-specific
Building ventilation rate	Q_b	2.86E+06	cm^3/s	Calculated: $A_{b,sg}$ x AXR_b x B_h
Vapor flow rate into building	Q_{soil}	102	L/min	Calculated (Cal/EPA, 2005b)
Vapor flow rate into building	Q_{soil}	1707	cm^3/s	Calculated via units conversion
Soil Properties				
Average soil temperature	T_s	17	^oC	Site-specific (USEPA, 2004)
SCS soil type	–	Herd Default	–	Site-specific
Dry bulk density	ρ_b	1.50	g/cm^3	DTSC default (Cal/EPA, 2005b)
Total porosity	n	0.430	cm^3/cm^3	DTSC default (Cal/EPA, 2005b)
Water-filled porosity	θ_w	0.150	cm^3/cm^3	DTSC default (Cal/EPA, 2005b)
Air-filled porosity	θ_a	0.280	cm^3/cm^3	DTSC default (Cal/EPA, 2005b)

Table C-2. Exposure Point Concentrations of Chemicals of Potential Concern in the Indoor Air of the Onsite Building – High-end Estimate

Chemical of Potential Concern	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Acetone	620	91	3.6E-04	2.2E-01
Benzene	40,000	91	3.1E-04	1.2E+01
1,3-Butadiene	310	91	4.5E-04	1.4E-01
2-Butanone (methyl ethyl ketone)	420	91	3.0E-04	1.3E-01
Carbon disulfide	440	91	3.3E-04	1.5E-01
Chlorobenzene	160	91	2.8E-04	4.5E-02
Chloroform	170	91	3.3E-04	5.7E-02
Chloromethane (methyl chloride)	75	91	3.6E-04	2.7E-02
Cyclohexane	480	91	3.0E-04	1.4E-01
1,2-Dichlorobenzene	2,900	91	2.7E-04	7.9E-01
1,3-Dichlorobenzene	210	91	2.7E-04	5.8E-02
1,4-Dichlorobenzene	460	91	2.7E-04	1.3E-01
Dichlorodifluoromethane (Freon 12)	10,000	91	2.7E-04	2.7E+00
1,1-Dichloroethane	140	91	2.8E-04	4.0E-02
1,2-Dichloroethane	140	91	3.3E-04	4.7E-02
1,1-Dichloroethene (1,1-DCE)	140	91	3.1E-04	4.4E-02
cis-1,2-Dichloroethene (cis-1,2-DCE)	140	91	2.8E-04	4.0E-02
1,4-Dioxane	500	91	3.2E-04	1.6E-01
Ethanol	2,600	91	3.7E-04	9.6E-01
Ethylbenzene	7,700	91	2.9E-04	2.2E+00
4-Ethyltoluene	3,700	91	2.7E-04	1.0E+00
Heptane	550	91	2.8E-04	1.5E-01
Hexane	63,000	91	4.2E-04	2.7E+01
Methyl tertiary butyl ether (MTBE)	500	91	3.3E-04	1.7E-01
Methylene chloride	1,200	91	3.3E-04	4.0E-01
4-Methyl-2-pentanone (methyl isobutyl ketone)	550	91	2.9E-04	1.6E-01
2-Propanol	350	91	3.4E-04	1.2E-01
Styrene	150	91	2.8E-04	4.2E-02
Tetrachloroethene (PCE)	1,100	91	2.8E-04	3.1E-01
Tetrahydrofuran	420	91	3.3E-04	1.4E-01

Table C-2. Exposure Point Concentrations of Chemicals of Potential Concern in the Indoor Air of the Onsite Building – High-end Estimate

Chemical of Potential Concern	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Toluene	32,000	91	3.1E-04	9.9E+00
1,1,1-Trichloroethane	190	91	2.9E-04	5.5E-02
Trichloroethene (TCE)	190	91	2.9E-04	5.6E-02
Trichlorofluoromethane (Freon 11)	200	91	3.1E-04	6.2E-02
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	270	91	2.9E-04	7.9E-02
1,2,4-Trimethylbenzene	2,900	91	2.5E-04	7.4E-01
1,3,5-Trimethylbenzene	3,600	91	2.5E-04	9.1E-01
Xylenes	19,000	91	3.0E-04	5.8E+00

Notes:

(1) This vapor intrusion transport analysis is based on maximum concentrations of volatile organic compounds (VOCs) in soil gas from the August 1999 and May 2008 site investigations (see Table 1). Chemicals of potential concern (COPCs) with respect to vapor intrusion are those VOCs detected above reporting limits in at least one soil gas sample.

(2) The shallower sampling depth between the 1999 and 2008 sampling events, 3 feet below ground surface, is used in the model because it is a more conservative assumption, *i.e.* , it produces higher indoor air concentrations.

(3) Non source-related inputs to the Johnson and Ettinger Model are documented in Table C-1. Shown here are the results of the Johnson and Ettinger Model, consisting of, for each chemical of potential concern, the predicted attenuation factor (α) and the predicted concentration of the chemical in indoor air (C_{IA}).

Table C-3. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air – High-end Estimate

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Acetone	8.8E-03
Benzene	4.0E-01
1,3-Butadiene	8.8E-03
2-Butanone (methyl ethyl ketone)	3.9E-03
Carbon disulfide	5.2E-03
Chlorobenzene	1.3E-03
Chloroform	2.0E-03
Chloromethane (methyl chloride)	1.1E-03
Cyclohexane	4.4E-03
1,2-Dichlorobenzene	2.3E-02
1,3-Dichlorobenzene	1.6E-03
1,4-Dichlorobenzene	3.6E-03
Dichlorodifluoromethane (Freon 12)	7.5E-02
1,1-Dichloroethane	1.2E-03
1,2-Dichloroethane	1.7E-03
1,1-Dichloroethene (1,1-DCE)	1.4E-03
cis-1,2-Dichloroethene (cis-1,2-DCE)	1.2E-03
1,4-Dioxane	5.3E-03
Ethanol	3.9E-02
Ethylbenzene	6.6E-02
4-Ethyltoluene	2.9E-02
Heptane	4.4E-03
Hexane	1.4E+00
Methyl tertiary butyl ether (MTBE)	5.8E-03
Methylene chloride	1.4E-02
4-Methyl-2-pentanone (methyl isobutyl ketone)	4.7E-03
2-Propanol	4.2E-03
Styrene	1.2E-03
Tetrachloroethene (PCE)	9.0E-03
Tetrahydrofuran	4.9E-03
Toluene	3.2E-01
1,1,1-Trichloroethane	1.7E-03

Table C-3. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air – High-end Estimate

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Trichloroethene (TCE)	1.7E-03
Trichlorofluoromethane (Freon 11)	2.0E-03
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	2.4E-03
1,2,4-Trimethylbenzene	2.0E-02
1,3,5-Trimethylbenzene	2.5E-02
Xylenes	1.8E-01

Table C-4. Summary of Estimated Cancer Risks – High-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	NC	NC	–	–	–	–	NC
Benzene	6.1E-05	8.9E-09	5.2E-08	7.1E-08	7.5E-05	7.5E-05	5.9E-06
Bromodichloromethane	–	–	–	–	2.6E-10	2.6E-10	–
1,3-Butadiene	4.1E-06	1.2E-09	–	–	–	1.2E-09	7.8E-07
2-Butanone (methyl ethyl ketone)	NC	NC	–	–	–	–	NC
Carbon disulfide	NC	NC	–	–	–	–	NC
Chlorobenzene	NC	NC	NC	NC	NC	–	NC
Chloroethane (ethyl chloride)	–	–	–	–	NC	–	–
Chloroform	5.3E-08	8.5E-12	–	–	5.1E-10	5.2E-10	5.7E-09
Chloromethane (methyl chloride)	8.4E-09	1.5E-12	–	–	2.8E-10	2.8E-10	1.0E-09
Cyclohexane	NC	NC	–	–	–	–	NC
1,2-Dichlorobenzene	NC	NC	NC	NC	NC	–	NC
1,3-Dichlorobenzene	NC	NC	NC	NC	–	–	NC
1,4-Dichlorobenzene	2.5E-07	3.2E-11	6.6E-12	9.1E-12	–	4.8E-11	2.1E-08
Dichlorodifluoromethane (Freon 12)	NC	NC	–	–	NC	–	NC
1,1-Dichloroethane	1.1E-08	1.5E-12	–	–	4.7E-09	4.7E-09	1.0E-09
1,2-Dichloroethane	1.7E-07	2.7E-11	7.5E-11	1.0E-10	2.2E-07	2.2E-07	1.8E-08
1,1-Dichloroethene (1,1-DCE)	NC	NC	–	–	NC	–	NC
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	NC	–	–	NC	–	NC
1,4-Dioxane	2.1E-07	3.2E-11	–	–	–	3.2E-11	2.1E-08
Ethanol	NC	NC	–	–	–	–	NC
Ethylbenzene	9.4E-07	1.3E-10	6.9E-09	9.5E-09	2.2E-05	2.2E-05	8.5E-08
4-Ethyltoluene	NC	NC	–	–	–	–	NC
Heptane	NC	NC	–	–	–	–	NC
Hexane	NC	NC	–	–	–	–	NC
Methyl tertiary butyl ether (MTBE)	7.4E-09	1.2E-12	5.6E-13	7.7E-13	9.0E-09	9.0E-09	7.9E-10
Methylene chloride	6.8E-08	1.1E-11	–	–	2.0E-10	2.1E-10	7.2E-09
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	NC	–	–	–	–	NC

Table C-4. Summary of Estimated Cancer Risks – High-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
2-Propanol	NC	NC	–	–	–	–	NC
Styrene	NC	NC	–	–	–	–	NC
1,1,2,2-Tetrachloroethane	–	–	–	–	4.8E-10	4.8E-10	–
Tetrachloroethene (PCE)	3.2E-07	4.2E-11	–	–	–	4.2E-11	2.8E-08
Tetrahydrofuran	4.8E-08	7.6E-12	–	–	–	7.6E-12	5.1E-09
Toluene	NC	NC	NC	NC	NC	–	NC
1,1,1-Trichloroethane	NC	NC	–	–	NC	–	NC
Trichloroethene (TCE)	1.9E-08	2.7E-12	–	–	2.9E-10	3.0E-10	1.8E-09
Trichlorofluoromethane (Freon 11)	NC	NC	–	–	–	–	NC
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	NC	–	–	–	–	NC
1,2,4-Trimethylbenzene	NC	NC	–	–	–	–	NC
1,3,5-Trimethylbenzene	NC	NC	–	–	–	–	NC
Xylenes	NC	NC	NC	NC	NC	–	NC
Cumulative Risk	6.7E-05	1.0E-08	5.9E-08	8.1E-08	9.7E-05	9.8E-05	6.9E-06

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

(2) "NC" indicates chemical is classified as a noncarcinogen.

Table C-5. Summary of Estimated Noncancer Hazard Indices – High-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	3.5E-06	1.6E-08	–	–	–	1.6E-08	6.3E-07
Benzene	2.0E-01	7.3E-04	9.0E-03	1.2E-02	1.3E+01	1.3E+01	3.0E-02
Bromodichloromethane	–	–	–	–	6.9E-06	6.9E-06	–
1,3-Butadiene	3.3E-02	2.4E-04	–	–	–	2.4E-04	9.8E-03
2-Butanone (methyl ethyl ketone)	1.2E-05	4.2E-08	–	–	–	4.2E-08	1.7E-06
Carbon disulfide	1.0E-04	4.1E-07	–	–	–	4.1E-07	1.7E-05
Chlorobenzene	2.2E-05	7.3E-08	2.2E-08	3.0E-08	4.5E-05	4.5E-05	3.0E-06
Chloroethane (ethyl chloride)	–	–	–	–	2.5E-05	2.5E-05	–
Chloroform	9.1E-05	3.7E-07	–	–	1.1E-04	1.1E-04	1.5E-05
Chloromethane (methyl chloride)	1.4E-04	6.5E-07	–	–	5.9E-05	6.0E-05	2.7E-05
Cyclohexane	1.1E-05	4.0E-08	–	–	–	4.0E-08	1.6E-06
1,2-Dichlorobenzene	1.9E-03	6.2E-06	8.9E-06	1.2E-05	8.2E-06	3.6E-05	2.5E-04
1,3-Dichlorobenzene	2.6E-04	8.6E-07	3.3E-07	4.5E-07	–	1.6E-06	3.5E-05
1,4-Dichlorobenzene	7.5E-05	2.5E-07	2.8E-06	3.9E-06	–	7.0E-06	1.0E-05
Dichlorodifluoromethane (Freon 12)	6.4E-03	2.1E-05	–	–	6.1E-06	2.7E-05	8.4E-04
1,1-Dichloroethane	3.9E-05	1.3E-07	–	–	2.9E-04	2.9E-04	5.4E-06
1,2-Dichloroethane	5.6E-05	2.3E-07	5.6E-06	7.7E-06	1.6E-02	1.6E-02	9.2E-06
1,1-Dichloroethene (1,1-DCE)	3.0E-04	1.1E-06	–	–	2.6E-04	2.6E-04	4.6E-05
cis-1,2-Dichloroethene (cis-1,2-DCE)	5.4E-04	1.8E-06	–	–	2.0E-04	2.0E-04	7.5E-05
1,4-Dioxane	2.6E-05	9.7E-08	–	–	–	9.7E-08	4.0E-06
Ethanol	4.4E-04	2.0E-06	–	–	–	2.0E-06	8.2E-05
Ethylbenzene	1.1E-03	3.6E-06	4.4E-04	6.1E-04	1.4E+00	1.4E+00	1.5E-04
4-Ethyltoluene	4.8E-03	1.6E-05	–	–	–	1.6E-05	6.4E-04
Heptane	1.0E-04	3.4E-07	–	–	–	3.4E-07	1.4E-05
Hexane	1.8E-02	1.1E-04	–	–	–	1.1E-04	4.6E-03
Methyl tertiary butyl ether (MTBE)	2.7E-05	1.1E-07	2.5E-08	3.5E-08	4.1E-04	4.1E-04	4.3E-06
Methylene chloride	4.8E-04	1.9E-06	–	–	1.7E-05	1.9E-05	7.7E-05

Table C-5. Summary of Estimated Noncancer Hazard Indices – High-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
4-Methyl-2-pentanone (methyl isobutyl ketone)	2.5E-05	8.6E-08	–	–	–	8.6E-08	3.5E-06
2-Propanol	8.1E-06	3.3E-08	–	–	–	3.3E-08	1.4E-06
Styrene	2.2E-05	7.4E-08	–	–	–	7.4E-08	3.0E-06
1,1,2,2-Tetrachloroethane	–	–	–	–	3.1E-05	3.1E-05	–
Tetrachloroethene (PCE)	4.2E-03	1.4E-05	–	–	–	1.4E-05	5.7E-04
Tetrahydrofuran	2.2E-05	8.9E-08	–	–	–	8.9E-08	3.6E-06
Toluene	1.6E-02	5.8E-05	1.9E-03	2.6E-03	1.5E+00	1.5E+00	2.4E-03
1,1,1-Trichloroethane	2.7E-05	9.2E-08	–	–	2.3E-07	3.2E-07	3.8E-06
Trichloroethene (TCE)	4.5E-05	1.6E-07	–	–	5.3E-03	5.3E-03	6.3E-06
Trichlorofluoromethane (Freon 11)	4.2E-05	1.5E-07	–	–	–	1.5E-07	6.3E-06
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1.3E-06	4.4E-09	–	–	–	4.4E-09	1.8E-07
1,2,4-Trimethylbenzene	5.1E-02	1.6E-04	–	–	–	1.6E-04	6.4E-03
1,3,5-Trimethylbenzene	7.3E-02	2.2E-04	–	–	–	2.2E-04	9.2E-03
Xylenes	2.8E-02	1.0E-04	1.3E-03	1.8E-03	4.7E+00	4.7E+00	4.1E-03
Cumulative Hazard	4.4E-01	1.7E-03	1.3E-02	1.7E-02	2.1E+01	2.1E+01	6.9E-02

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

APPENDIX D

LOW-END ESTIMATE OF RISK AND HAZARD

Table D-1. Average Concentrations of Chemicals of Potential Concern in Soil Gas

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Acetone	180
Benzene	2,900
1,3-Butadiene	51
2-Butanone (methyl ethyl ketone)	70
Carbon disulfide	62
Chlorobenzene	20
Chloroform	35
Chloromethane (methyl chloride)	9.9
Cyclohexane	72
1,2-Dichlorobenzene	210
1,3-Dichlorobenzene	27
1,4-Dichlorobenzene	45
Dichlorodifluoromethane (Freon 12)	940
1,1-Dichloroethane	32
1,2-Dichloroethane	32
1,1-Dichloroethene (1,1-DCE)	32
cis-1,2-Dichloroethene (cis-1,2-DCE)	32
1,4-Dioxane	71
Ethanol	350
Ethylbenzene	330
4-Ethyltoluene	290
Heptane	72
Hexane	4,400
Methyl tertiary butyl ether (MTBE)	64
Methylene chloride	77
4-Methyl-2-pentanone (methyl isobutyl ketone)	77
2-Propanol	52
Styrene	20
Tetrachloroethene (PCE)	80
Tetrahydrofuran	63
Toluene	1,300
1,1,1-Trichloroethane	39
Trichloroethene (TCE)	36

Table D-1. Average Concentrations of Chemicals of Potential Concern in Soil Gas

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Trichlorofluoromethane (Freon 11)	39
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	50
1,2,4-Trimethylbenzene	210
1,3,5-Trimethylbenzene	250
Xylenes	890

Notes:

(1) Soil gas samples were collected at depths of 3 and 5 feet below ground surface (bgs) in 1999 and 2008, respectively.

(2) Concentration units are micrograms per cubic meter ($\mu g/m^3$).

(3) Representative concentration is the mean of all samples collected in 1999 and 2008. For purposes of this averaging, non-detect results are assumed equal to one-half the reporting limit.

Table D-2. Johnson and Ettinger Model Inputs – Low-end Estimate

Parameter	Symbol	Value	Units	Reference
Building Properties				
Depth below grade to bottom of enclosed space floor	L_F	15	cm	DTSC/HERD default (Cal/EPA, 2005a; 2005b)
Area of enclosed space below grade	$A_{b,sg}$	1.00E+06	cm^2	DTSC default (Cal/EPA, 2005b)
Building air exchange rate	AXR_b	4	hr^{-1}	DTSC default (Cal/EPA, 2005b)
Building height	Bh	503	cm	DTSC default (Cal/EPA, 2005b)
Building ventilation rate	Q_b	5.59E+05	cm^3/s	Calculated: $A_{b,sg}$ x AXR_b x B_h
Vapor flow rate into building	Q_{soil}	5	L/min	Calculated (Cal/EPA, 2005b)
Vapor flow rate into building	Q_{soil}	83	cm^3/s	Calculated via units conversion
Soil Properties				
Average soil temperature	T_s	17	^oC	Site-specific (USEPA, 2004)
SCS soil type	–	Site-specific	–	Site-specific
Dry bulk density	ρ_b	1.79	g/cm^3	Site-specific average
Total porosity	n	0.339	cm^3/cm^3	Site-specific average
Water-filled porosity	θ_w	0.236	cm^3/cm^3	Site-specific average
Air-filled porosity	θ_a	0.103	cm^3/cm^3	Site-specific average

Table D-3. Exposure Point Concentrations of Chemicals of Potential Concern in the Indoor Air of the Onsite Building – Low-end Estimate

Chemical of Potential Concern	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Acetone	180	91	2.5E-05	4.4E-03
Benzene	2,900	91	8.7E-06	2.5E-02
1,3-Butadiene	51	91	2.2E-05	1.1E-03
2-Butanone (methyl ethyl ketone)	70	91	1.7E-05	1.2E-03
Carbon disulfide	62	91	1.0E-05	6.3E-04
Chlorobenzene	20	91	7.4E-06	1.5E-04
Chloroform	35	91	1.0E-05	3.6E-04
Chloromethane (methyl chloride)	9.9	91	1.2E-05	1.2E-04
Cyclohexane	72	91	7.9E-06	5.7E-04
1,2-Dichlorobenzene	210	91	7.1E-06	1.5E-03
1,3-Dichlorobenzene	27	91	7.0E-06	1.9E-04
1,4-Dichlorobenzene	45	91	7.1E-06	3.2E-04
Dichlorodifluoromethane (Freon 12)	940	91	6.6E-06	6.2E-03
1,1-Dichloroethane	32	91	7.4E-06	2.4E-04
1,2-Dichloroethane	32	91	1.1E-05	3.4E-04
1,1-Dichloroethene (1,1-DCE)	32	91	8.8E-06	2.8E-04
cis-1,2-Dichloroethene (cis-1,2-DCE)	32	91	7.4E-06	2.4E-04
1,4-Dioxane	71	91	6.0E-05	4.3E-03
Ethanol	350	91	6.5E-05	2.3E-02
Ethylbenzene	330	91	7.5E-06	2.5E-03
4-Ethyltoluene	290	91	6.8E-06	2.0E-03
Heptane	72	91	7.0E-06	5.0E-04
Hexane	4,400	91	1.8E-05	8.0E-02
Methyl tertiary butyl ether (MTBE)	64	91	1.1E-05	6.9E-04
Methylene chloride	77	91	1.0E-05	7.8E-04
4-Methyl-2-pentanone (methyl isobutyl ketone)	77	91	1.1E-05	8.1E-04
2-Propanol	52	91	4.4E-05	2.3E-03
Styrene	20	91	7.2E-06	1.4E-04
Tetrachloroethene (PCE)	80	91	7.2E-06	5.7E-04
Tetrahydrofuran	63	91	1.5E-05	9.4E-04

Table D-3. Exposure Point Concentrations of Chemicals of Potential Concern in the Indoor Air of the Onsite Building – Low-end Estimate

Chemical of Potential Concern	Modeled Soil Gas Source		Results of Vapor Intrusion Modeling	
	C_{SG} ($\mu g/m^3$)	Depth (cm)	α	C_{IA} ($\mu g/m^3$)
Toluene	1,300	91	8.6E-06	1.1E-02
1,1,1-Trichloroethane	39	91	7.7E-06	3.0E-04
Trichloroethene (TCE)	36	91	7.9E-06	2.8E-04
Trichlorofluoromethane (Freon 11)	39	91	8.6E-06	3.3E-04
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	50	91	7.7E-06	3.9E-04
1,2,4-Trimethylbenzene	210	91	6.1E-06	1.3E-03
1,3,5-Trimethylbenzene	250	91	6.1E-06	1.5E-03
Xylenes	890	91	8.4E-06	7.5E-03

Notes:

(1) This vapor intrusion transport analysis is based on average concentrations of volatile organic compounds (VOCs) in soil gas from the August 1999 and May 2008 site investigations (see Table 1). Chemicals of potential concern (COPCs) with respect to vapor intrusion are those VOCs detected above reporting limits in at least one soil gas sample. For the purpose of calculating average concentrations, non-detect results are assumed equal to one-half the laboratory reporting limit.

(2) The shallower sampling depth between the 1999 and 2008 sampling events, 3 feet below ground surface, is used in the model because it is a more conservative assumption, *i.e.* , it produces higher indoor air concentrations.

(3) Non source-related inputs to the Johnson and Ettinger Model are documented in Table D-1. Shown here are the results of the Johnson and Ettinger Model, consisting of, for each chemical of potential concern, the predicted attenuation factor (α) and the predicted concentration of the chemical in indoor air (C_{IA}).

Table D-4. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air – Low-end Estimate

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Acetone	2.8E-04
Benzene	1.7E-03
1,3-Butadiene	8.2E-05
2-Butanone (methyl ethyl ketone)	6.7E-05
Carbon disulfide	4.2E-05
Chlorobenzene	9.5E-06
Chloroform	2.4E-05
Chloromethane (methyl chloride)	8.0E-06
Cyclohexane	3.7E-05
1,2-Dichlorobenzene	9.5E-05
1,3-Dichlorobenzene	1.2E-05
1,4-Dichlorobenzene	2.0E-05
Dichlorodifluoromethane (Freon 12)	4.0E-04
1,1-Dichloroethane	1.5E-05
1,2-Dichloroethane	2.2E-05
1,1-Dichloroethene (1,1-DCE)	1.9E-05
cis-1,2-Dichloroethene (cis-1,2-DCE)	1.5E-05
1,4-Dioxane	4.4E-04
Ethanol	2.6E-03
Ethylbenzene	1.6E-04
4-Ethyltoluene	1.3E-04
Heptane	3.3E-05
Hexane	5.7E-03
Methyl tertiary butyl ether (MTBE)	4.5E-05
Methylene chloride	5.1E-05
4-Methyl-2-pentanone (methyl isobutyl ketone)	4.8E-05
2-Propanol	2.0E-04
Styrene	9.3E-06
Tetrachloroethene (PCE)	3.7E-05
Tetrahydrofuran	6.5E-05
Toluene	7.3E-04
1,1,1-Trichloroethane	2.0E-05

Table D-4. Exposure Point Concentrations of Chemicals of Potential Concern in Onsite Outdoor Air and in Offsite Air – Low-end Estimate

Chemical of Potential Concern	Concentration ($\mu g/m^3$)
Trichloroethene (TCE)	1.8E-05
Trichlorofluoromethane (Freon 11)	2.2E-05
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	2.5E-05
1,2,4-Trimethylbenzene	8.3E-05
1,3,5-Trimethylbenzene	9.8E-05
Xylenes	4.9E-04

Table D-5. Summary of Estimated Cancer Risks – Low-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	NC	NC	–	–	–	–	NC
Benzene	1.2E-07	3.7E-11	5.2E-08	7.1E-08	7.5E-05	7.5E-05	2.5E-08
Bromodichloromethane	–	–	–	–	2.6E-10	2.6E-10	–
1,3-Butadiene	3.3E-08	1.1E-11	–	–	–	1.1E-11	7.3E-09
2-Butanone (methyl ethyl ketone)	NC	NC	–	–	–	–	NC
Carbon disulfide	NC	NC	–	–	–	–	NC
Chlorobenzene	NC	NC	NC	NC	NC	–	NC
Chloroethane (ethyl chloride)	–	–	–	–	NC	–	–
Chloroform	3.3E-10	1.0E-13	–	–	5.1E-10	5.1E-10	6.7E-11
Chloromethane (methyl chloride)	3.7E-11	1.1E-14	–	–	2.8E-10	2.8E-10	7.5E-12
Cyclohexane	NC	NC	–	–	–	–	NC
1,2-Dichlorobenzene	NC	NC	NC	NC	NC	–	NC
1,3-Dichlorobenzene	NC	NC	NC	NC	–	–	NC
1,4-Dichlorobenzene	6.2E-10	1.8E-13	6.6E-12	9.1E-12	–	1.6E-11	1.2E-10
Dichlorodifluoromethane (Freon 12)	NC	NC	–	–	NC	–	NC
1,1-Dichloroethane	6.6E-11	2.0E-14	–	–	4.7E-09	4.7E-09	1.3E-11
1,2-Dichloroethane	1.2E-09	3.6E-13	7.5E-11	1.0E-10	2.2E-07	2.2E-07	2.4E-10
1,1-Dichloroethene (1,1-DCE)	NC	NC	–	–	NC	–	NC
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	NC	–	–	NC	–	NC
1,4-Dioxane	5.6E-09	2.7E-12	–	–	–	2.7E-12	1.8E-09
Ethanol	NC	NC	–	–	–	–	NC
Ethylbenzene	1.1E-09	3.1E-13	6.9E-09	9.5E-09	2.2E-05	2.2E-05	2.1E-10
4-Ethyltoluene	NC	NC	–	–	–	–	NC
Heptane	NC	NC	–	–	–	–	NC
Hexane	NC	NC	–	–	–	–	NC
Methyl tertiary butyl ether (MTBE)	3.1E-11	9.1E-15	5.6E-13	7.7E-13	9.0E-09	9.0E-09	6.1E-12
Methylene chloride	1.3E-10	4.0E-14	–	–	2.0E-10	2.0E-10	2.7E-11
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	NC	–	–	–	–	NC

Table D-5. Summary of Estimated Cancer Risks – Low-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker					Age-adjusted Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
2-Propanol	NC	NC	–	–	–	–	NC
Styrene	NC	NC	–	–	–	–	NC
1,1,2,2-Tetrachloroethane	–	–	–	–	4.8E-10	4.8E-10	–
Tetrachloroethene (PCE)	5.9E-10	1.7E-13	–	–	–	1.7E-13	1.2E-10
Tetrahydrofuran	3.2E-10	1.0E-13	–	–	–	1.0E-13	6.8E-11
Toluene	NC	NC	NC	NC	NC	–	NC
1,1,1-Trichloroethane	NC	NC	–	–	NC	–	NC
Trichloroethene (TCE)	9.7E-11	2.9E-14	–	–	2.9E-10	2.9E-10	1.9E-11
Trichlorofluoromethane (Freon 11)	NC	NC	–	–	–	–	NC
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	NC	–	–	–	–	NC
1,2,4-Trimethylbenzene	NC	NC	–	–	–	–	NC
1,3,5-Trimethylbenzene	NC	NC	–	–	–	–	NC
Xylenes	NC	NC	NC	NC	NC	–	NC
Cumulative Risk	1.7E-07	5.2E-11	5.9E-08	8.1E-08	9.7E-05	9.8E-05	3.5E-08

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

(2) "NC" indicates chemical is classified as a noncarcinogen.

Table D-6. Summary of Estimated Noncancer Hazard Indices – Low-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
Acetone	6.9E-08	4.9E-10	–	–	–	4.9E-10	2.0E-08
Benzene	4.0E-04	3.0E-06	9.0E-03	1.2E-02	1.3E+01	1.3E+01	1.2E-04
Bromodichloromethane	–	–	–	–	6.9E-06	6.9E-06	–
1,3-Butadiene	2.7E-04	2.2E-06	–	–	–	2.2E-06	9.1E-05
2-Butanone (methyl ethyl ketone)	1.1E-07	7.4E-10	–	–	–	7.4E-10	3.0E-08
Carbon disulfide	4.3E-07	3.3E-09	–	–	–	3.3E-09	1.3E-07
Chlorobenzene	7.1E-08	5.2E-10	2.2E-08	3.0E-08	4.5E-05	4.5E-05	2.1E-08
Chloroethane (ethyl chloride)	–	–	–	–	2.5E-05	2.5E-05	–
Chloroform	5.7E-07	4.3E-09	–	–	1.1E-04	1.1E-04	1.8E-07
Chloromethane (methyl chloride)	6.4E-07	4.9E-09	–	–	5.9E-05	5.9E-05	2.0E-07
Cyclohexane	4.5E-08	3.4E-10	–	–	–	3.4E-10	1.4E-08
1,2-Dichlorobenzene	3.6E-06	2.6E-08	8.9E-06	1.2E-05	8.2E-06	2.9E-05	1.1E-06
1,3-Dichlorobenzene	8.7E-07	6.4E-09	3.3E-07	4.5E-07	–	7.9E-07	2.6E-07
1,4-Dichlorobenzene	1.9E-07	1.4E-09	2.8E-06	3.9E-06	–	6.8E-06	5.7E-08
Dichlorodifluoromethane (Freon 12)	1.5E-05	1.1E-07	–	–	6.1E-06	6.2E-06	4.5E-06
1,1-Dichloroethane	2.3E-07	1.7E-09	–	–	2.9E-04	2.9E-04	7.0E-08
1,2-Dichloroethane	4.1E-07	3.0E-09	5.6E-06	7.7E-06	1.6E-02	1.6E-02	1.2E-07
1,1-Dichloroethene (1,1-DCE)	1.9E-06	1.5E-08	–	–	2.6E-04	2.6E-04	5.9E-07
cis-1,2-Dichloroethene (cis-1,2-DCE)	3.3E-06	2.4E-08	–	–	2.0E-04	2.0E-04	9.8E-07
1,4-Dioxane	6.8E-07	8.1E-09	–	–	–	8.1E-09	3.3E-07
Ethanol	1.0E-05	1.3E-07	–	–	–	1.3E-07	5.5E-06
Ethylbenzene	1.2E-06	8.8E-09	4.4E-04	6.1E-04	1.4E+00	1.4E+00	3.6E-07
4-Ethyltoluene	9.5E-06	7.0E-08	–	–	–	7.0E-08	2.9E-06
Heptane	3.4E-07	2.6E-09	–	–	–	2.6E-09	1.0E-07
Hexane	5.5E-05	4.4E-07	–	–	–	4.4E-07	1.8E-05
Methyl tertiary butyl ether (MTBE)	1.1E-07	8.2E-10	2.5E-08	3.5E-08	4.1E-04	4.1E-04	3.3E-08
Methylene chloride	9.3E-07	7.0E-09	–	–	1.7E-05	1.7E-05	2.9E-07

Table D-6. Summary of Estimated Noncancer Hazard Indices – Low-end Estimate

	Onsite Commercial Worker	Onsite Intrusive Construction Worker				Child Offsite Resident
	Indoor Air	Outdoor Air	Soil		Groundwater	Total	Indoor/Outdoor Air
Chemical of Potential Concern	Inhalation	Inhalation	Ingestion	Dermal Contact	Dermal Contact		Inhalation
4-Methyl-2-pentanone (methyl isobutyl ketone)	1.3E-07	8.8E-10	–	–	–	8.8E-10	3.6E-08
2-Propanol	1.6E-07	1.6E-09	–	–	–	1.6E-09	6.5E-08
Styrene	7.7E-08	5.7E-10	–	–	–	5.7E-10	2.3E-08
1,1,2,2-Tetrachloroethane	–	–	–	–	3.1E-05	3.1E-05	–
Tetrachloroethene (PCE)	7.9E-06	5.8E-08	–	–	–	5.8E-08	2.4E-06
Tetrahydrofuran	1.5E-07	1.2E-09	–	–	–	1.2E-09	4.9E-08
Toluene	1.8E-05	1.3E-07	1.9E-03	2.6E-03	1.5E+00	1.5E+00	5.5E-06
1,1,1-Trichloroethane	1.4E-07	1.1E-09	–	–	2.3E-07	2.3E-07	4.4E-08
Trichloroethene (TCE)	2.3E-07	1.7E-09	–	–	5.3E-03	5.3E-03	6.9E-08
Trichlorofluoromethane (Freon 11)	2.3E-07	1.7E-09	–	–	–	1.7E-09	7.0E-08
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	6.2E-09	4.6E-11	–	–	–	4.6E-11	1.9E-09
1,2,4-Trimethylbenzene	8.8E-05	6.5E-07	–	–	–	6.5E-07	2.6E-05
1,3,5-Trimethylbenzene	1.2E-04	8.9E-07	–	–	–	8.9E-07	3.6E-05
Xylenes	3.6E-05	2.7E-07	1.3E-03	1.8E-03	4.7E+00	4.7E+00	1.1E-05
Cumulative Hazard	1.1E-03	8.1E-06	1.3E-02	1.7E-02	2.1E+01	2.1E+01	3.3E-04

Notes:

(1) "–" indicates chemical was not determined to be a COPC for the respective pathway.

Appendix B2: Sub-slab Soil Gas Sampling and Analysis Report

SUB-SLAB SOIL GAS SAMPLING AND ANALYSIS REPORT

Former Nestlé USA, Inc. Facility

1310 14th Street, Oakland, California

March 22, 2010

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EXECUTIVE SUMMARY

This sub-slab soil gas sampling and analysis report (SAR) documents the methodology and results of a sub-slab soil gas investigation of the northwest portion of the former Nestlé USA, Inc. facility ("Carnation Dairy") located at 1310 14th Street in Oakland, California (the "site"). The investigation was performed by Iris Environmental on behalf of Nestlé USA, Inc. and Encinal 14th Street LLC, at the request of Alameda County Environmental Health (ACEH, 2009a), in accordance with the ACEH-approved *Draft Sub-slab Soil Gas Sampling and Analysis Plan, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California* (SAP; Iris Environmental, 2009b) and Technical Comment 1 of ACEH's conditional approval of the SAP (ACEH, 2009b).

A draft corrective action plan (CAP) for the site was previously prepared by Environmental Cost Management Inc. and submitted to ACEH on May 19, 2009 (ECM, 2009). The draft CAP summarized site characterization and remediation activities, and developed and evaluated remedial alternatives. The draft CAP included a screening level human health evaluation that evaluated potential health impacts to various receptor populations associated with the presence of VOCs at the site (Iris Environmental, 2009a). The human health evaluation presented site-specific vapor intrusion modeling with the Johnson and Ettinger Model which concluded that site soil gas conditions are such that vapor intrusion into the existing, unoccupied onsite commercial/industrial building is occurring below levels of concern for hypothetical future onsite commercial/industrial workers. The ACEH requested that a sub-slab soil gas investigation be performed to measure VOC concentrations beneath the building and thereby confirm the results of the vapor intrusion modeling evaluation (ACEH, 2009a). Based on the data collected during the sub-slab soil gas investigation, the CAP would be modified as appropriate.

Sub-slab soil gas sampling was performed on January 6, 2009 at six locations beneath the existing, unoccupied onsite commercial/industrial building. The potential vapor intrusion inhalation cancer risk and noncancer hazard to future building occupants, associated with measured concentrations of volatile chemicals in sub-slab soil gas, are estimated here in accordance with United States Environmental Protection Agency (USEPA) inhalation risk assessment guidance (USEPA, 2009a), California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) vapor intrusion guidance (Cal/EPA, 2005b), and Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) and DTSC inhalation risk assessment methodology (Cal/EPA, 2005a; 2009a). Cancer- and noncancer-based screening levels are developed based on a target risk level of 1×10^{-6} and target noncancer quotient of 1.0, respectively. These risk-based screening levels are used to evaluate the results of sub-slab soil gas sampling conducted beneath the building.

The findings of the sub-slab soil gas data evaluation may be summarized as follows.

- No chemical was detected in any sample at a concentration exceeding its cancer-based or noncancer-based screening level.
- The estimated cumulative (multi-chemical) cancer risk ranges across the six primary sub-slab soil gas samples from a minimum of 2.1×10^{-7} at SSG-2 to a maximum of 9.0×10^{-7} at SSG-3. This narrow range (less than an order of magnitude) of estimated risk across the

six samples can be generally attributed to the consistent detection of benzene in all samples. The estimated cumulative cancer risk is below the negligible risk level of 1×10^{-6} at every sampling location.

- The primary risk drivers at the site are benzene and naphthalene (note that naphthalene was detected in only one of six samples). Other chemicals which contribute significantly to cumulative risk in one or more samples are: 1,3-butadiene and tetrachloroethene.
- The estimated cumulative noncancer hazard index ranges from 0.0094 to 0.12 across the six primary sub-slab soil gas samples, and thus is below the threshold noncancer level of 1.0 at all locations.

In conclusion, the concentrations of volatile chemicals detected in sub-slab soil gas beneath the existing unoccupied commercial/industrial building during the January 2010 site investigation are below levels of concern with respect to potential vapor intrusion into the building. These results are consistent with the previous screening-level vapor intrusion evaluation of the building (Iris Environmental, 2009a), which was based on soil gas data previously collected at the site in 1999 and 2008.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

This sub-slab soil gas sampling and analysis report (SAR) documents the methodology and results of a sub-slab soil gas investigation of the northwest portion of the former Nestlé USA, Inc. facility ("Carnation Dairy") located at 1310 14th Street in Oakland, California (the "site"). The investigation was performed by Iris Environmental on behalf of Nestlé USA, Inc. and Encinal 14th Street LLC, at the request of Alameda County Environmental Health (ACEH, 2009a), in accordance with the ACEH-approved *Draft Sub-slab Soil Gas Sampling and Analysis Plan, Former Nestlé USA, Inc. Facility, 1310 14th Street, Oakland, California* (SAP; Iris Environmental, 2009b) and Technical Comment 1 of ACEH's conditional approval of the SAP (ACEH, 2009b). The purpose of the investigation is to evaluate the potential for volatile chemicals known to be present in the subsurface to migrate upwards through the soil column, through cracks or conduits in the building slab, and into the indoor air space of the existing onsite commercial/industrial building – a transport process known as vapor intrusion – where hypothetical future building occupants (the building is currently vacant) may be exposed to the volatile chemicals via the inhalation route. The potential vapor intrusion inhalation cancer risk and noncancer hazard to future building occupants, associated with measured concentrations of volatile chemicals in sub-slab soil gas, are estimated in accordance with United States Environmental Protection Agency (USEPA) inhalation risk assessment guidance (USEPA, 2009a), California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) vapor intrusion guidance (Cal/EPA, 2005b), and Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) and DTSC inhalation risk assessment methodology (Cal/EPA, 2005a; 2009a).

2.0 BACKGROUND

2.1 Site History

The 1310 14th Street property, which was formerly occupied by the Carnation Dairy facility, is bounded by 16th Street to the north, 14th Street to the south, Poplar Street to the east, and Nelson Mandela Parkway (formerly Cypress Street) to the west (see Figure 1). The primary activities conducted at the Carnation Dairy facility were the manufacture and distribution of ice cream and packaged milk. Delivery trucks were fueled and maintained at the northwest portion of the Carnation Dairy facility; the fuel storage and dispensing system consisted of underground storage tanks and associated underground piping. The subject "site" of this report is the northwest portion of the former Carnation Dairy facility, situated at the southeast corner of 16th Street and Nelson Mandela Parkway, where the fuel storage and dispensing operations were located. These operations were conducted at the site until 1988. The underground storage tanks and associated piping are now known to have leaked petroleum products into site soils, resulting in petroleum contamination of subsurface soils, a layer of petroleum product floating on the groundwater table, and dissolved petroleum hydrocarbons in site groundwater (ETIC, 2001). These impacts have been partially addressed by various remedial activities, as described below.

2.2 Remedial Activities

Five underground storage tanks and associated underground piping were removed from the site between December 1988 and January 1989, including: two 12,000-gallon diesel tanks, two 10,000-gallon gasoline tanks, and one 1,000-gallon used oil tank. At that time, 1,200 cubic yards of petroleum hydrocarbon-impacted soil were excavated, treated onsite, and replaced into the excavation (ETIC, 2001).

Various site investigations and remedial activities have been conducted at the site since the initial underground storage tank excavations. Remedial activities have included the following (COFS, 2000; ETIC, 2001):

- Approximately 1.5 million gallons of groundwater were extracted from the subsurface following removal of the underground storage tanks.
- Product skimming was conducted between January and March 1989. Approximately 1,800 gallons of liquid phase hydrocarbons were removed from the subsurface.
- A soil vapor extraction system was operated from January 1994 to February 1995. An estimated 5,200 gallons of hydrocarbon equivalent were removed from the subsurface.
- A multi-phase extraction system was operated from August 1997 through June 2000. A total of 10,875 pounds of hydrocarbons were removed during this period.

Current site conditions have been previously characterized through soil, soil gas, and groundwater sampling conducted in May of 2008, as described below.

2.3 Previous Site Investigations

Impacts to site soil, groundwater, and soil gas, associated with leaks of petroleum hydrocarbons from underground storage tanks and piping, have been documented in several site investigations performed since 1991. Soil gas investigations were performed in 1999 and in May of 2008. Soil investigations were performed at the time of underground storage tank excavation in 1991, in 1999, and most recently in May of 2008. Groundwater monitoring was performed on a regular basis from 1993 to 2004 and in May of 2008.

As noted in the *Supplemental Soil, Soil Gas, and Groundwater Investigation Report* (ECM, 2008), components of the May 2008 site investigation consisted of:

- soil sampling for total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) at five locations (SB-16 through SB-20), at various depths, to provide current characterization of residual hydrocarbon impacts in the area downgradient from the former underground storage tanks;
- soil sampling for TPH and VOCs at seven locations (SB-21 through SB-27), at various depths, to provide delineation of hydrocarbon impacts in areas of the site which had not been thoroughly characterized;
- soil sampling for polychlorinated biphenyls (PCBs) at seven locations (PCB-1 through PCB-7), at various depths, to document the presence or absence of PCBs at the site;

- soil gas sampling for TPH and VOCs at 12 locations (SB-16 through SB-27), including seven locations in the area downgradient from the former underground storage tanks (SB-20 through SB-27), at a depth of 5 feet, to provide a complete set of soil gas data for use in evaluating vapor intrusion; and
- grab groundwater sampling for TPH and VOCs at 11 locations (SB-16 through SB-27 exclusive of SB-23).

The results of all previous site investigations are provided in Appendix A of the SAP (Iris Environmental, 2009b).

2.4 Corrective Action Plan

A draft corrective action plan (CAP) for the site was prepared by Environmental Cost Management Inc. and submitted to ACEH on May 19, 2009 (ECM, 2009). The draft CAP summarized site characterization and remediation activities, and developed and evaluated remedial alternatives. The draft CAP included a screening level human health evaluation that evaluated potential health impacts to various receptor populations associated with the presence of VOCs at the site (Iris Environmental, 2009a). The human health evaluation presented site-specific vapor intrusion modeling with the Johnson and Ettinger Model which concluded that site conditions are such that any potential indoor air concentrations are below levels of concern for hypothetical future onsite commercial/industrial workers. The ACEH requested that a sub-slab soil gas investigation be performed to measure VOC concentrations beneath the building and thereby confirm the results of the vapor intrusion modeling evaluation (ACEH, 2009a). Based on the data collected during the sub-slab soil gas investigation, the CAP would be modified as appropriate.

3.0 CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPCs) (*i.e.*, target analytes) for this sub-slab soil gas investigation are the 38 VOCs proposed as COPCs in the SAP (Iris Environmental, 2009b) plus two additional analytes requested by ACEH (2009b): TPH in the gasoline range (TPH-g) and naphthalene. Previously, laboratory analytical protocols resulted in xylenes being reported as total xylenes. For this investigation, the laboratory protocol resulted in xylenes being reported as two separate analytes: m,p-xylene and o-xylene. Accordingly, there are a total of 41 target analytes included in this investigation. This list of 41 target analytes for the sub-slab soil gas investigation includes all analytes which have been previously detected in site soil gas, in either the 1999 or 2008 soil gas investigations.

4.0 SAMPLE COLLECTION AND ANALYSIS

Sub-slab soil gas sampling was performed in accordance with the ACEH-approved SAP (Iris Environmental, 2009b; ACEH, 2009b), except for minor deviations as noted below. Sub-slab soil gas sampling was performed on January 6, 2009 at the six locations identified in Figure 2. The emplacement of sub-slab probes and the collection and laboratory analysis of sub-slab soil gas samples are described below.

4.1 Utility Survey

Prior to beginning sub-slab work, each sampling location was cleared for potential underground utilities by an independent utility survey subcontractor, ForeSite, under the oversight of Iris Environmental. All sub-slab utilities were clearly marked prior to drilling. Underground Service Alert (USA) was also notified of planned investigation activities more than 48 hours prior to the start of drilling activities.

4.2 Probe Emplacement

A hand-held rotary hammer drill with core bit was used to drill a 2-inch diameter, 2-inch deep hole into the top surface of the slab. A concentric, smaller, 1.25-inch diameter inner hole was then drilled through the remainder of the slab and approximately 1 to 3 inches into the sub-slab material, which was observed to consist of fine silt/sand at each probe location. The larger outer hole was drilled to enable the top probe fitting to be recessed below the top of the concrete slab but still be accessible by hand (see Figure 4). The thickness of the building slab encountered at each probe location varied from approximately 6 to 8-1/2 inches. The inner and outer holes were cleaned with a brush to improve the potential for a good seal during cement application. The sampling probe assembly (see details below) was emplaced in the hole such that the vapor inlet was positioned beneath the bottom of the slab and above the bottom of the boring.

The sampling probe was constructed with the following specifications, in accordance with the ACEH-approved SAP, except where noted.

1) Each vapor probe was constructed of 1/4-inch diameter Teflon-lined polyethylene tubing, with a filter tip at the down-hole end and a quick-disconnect tube coupling at the top end. The SAP specified that brass tubing would be used for this component; Teflon-lined tubing was selected over brass tubing because the thickness of the slab at each location was unknown prior to drilling, and the Teflon-lined tubing could be cut to the correct length in the field more quickly than brass tubing, thereby minimizing the amount of time that the hole was open. The space beneath the probe tip and the annular space between the probe and sub-slab material were filled with sand to cover the filter tip.
2) Bentonite chips were emplaced immediately above the sand pack, followed by a mixture of hydrated bentonite chips and bentonite powder to fill the borehole annular space to approximately 2 inches below the quick-disconnect socket. Sufficient distilled water was added to the bentonite to form a seal. The probe was affixed to the foundation slab up to the base of the quick-disconnect socket with quick-setting contaminant-free cement patch.
3) Upon completion of sampling, the tubing and coupling were replaced with a brass cap and coupling plug to seal the probe. The recessed probe was covered with a plastic cap to be nearly flush with the foundation slab to reduce the tripping hazard and to protect the probe.

A schematic diagram of the sub-slab soil gas probe is presented in Figure 3. A photograph of the probe assembly, prior to emplacement, is provided in Figure 4. A photograph of an emplaced sub-slab soil gas sampling probe is provided in Figure 5.

Following probe emplacement, soil gas sampling was not conducted for at least 30 minutes to allow the cement to cure and to allow for subsurface conditions to equilibrate. The probe installation time and the estimated purge volume of each probe were recorded in the field notes (see Appendix B). The purge volume of each soil gas probe installation was estimated as the summation of the volumes of the sample pipe, the sample line, and the sand pack around the probe tip.

4.3 Sample Collection

Each sub-slab soil gas sample was collected into a batch-certified, 6-liter, silicon-lined, stainless steel Summa canister equipped with a mass flow controller device that regulated the flow of air into the canister at a rate between 100 and 200 milliliters per minute (mL/min) to limit stripping of chemical compounds, to prevent ambient air from diluting the soil gas samples, and to reduce the variability of purging and sampling rates. Teflon-lined polyethylene tubing was used to connect the probe to the Summa canister. Given the volume of soil gas collected, the zone of influence about the probe tip was approximately equal to a half-sphere with radius of 1 foot. After waiting for at least 30 minutes following probe installation, the sampling assembly was purged of three purge volumes in accordance with the ACEH-approved SAP. The sampling assembly was purged with a disposable syringe. Once the sampling assembly was appropriately purged, the Summa canister valve was opened to draw a soil gas sample from the sample line into the canister. As discussed below in Section 4.4, a leak detection test was conducted immediately before and after the soil gas sample was collected.

4.4 Leak Test

A leak test was performed in conjunction with each collected sub-slab soil gas sample to verify that indoor air was not diluting the soil gas sample or contaminating the sample with contaminants. The leak test was conducted using a helium shroud apparatus, as shown in Figure 5 (NYSDOH, 2006). The shroud was placed over the sub-slab probe and the 6-liter Summa canister, so that the probe surface seal and all sampling train components were within the shroud. Helium was injected into the shroud and maintained within the shroud at a stable concentration of between approximately 40 and 50 percent during sample collection. A handheld helium detector was used to measure the helium concentration within the shroud and within the sampling line by use of a tee connection just upstream from the Summa canister. The helium concentration within the sampling line was measured immediately before and after the soil gas sample was collected. These results were recorded in the field notes and are presented in Appendix B. Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sampling line is not a cause for alarm. New York State vapor intrusion guidance (NYSDOH, 2006) suggests that the helium concentration detected in the sampling line should be 10 percent or less of the helium concentration within the shroud, and emerging DTSC guidance (Cal/EPA, 2009c) appears to be consistent with this threshold. The helium concentration measured in the sampling line was less than 10 percent of the shroud concentration at each sub-slab probe location, as documented in Appendix B.

4.5 Procedure for Low-flow Conditions

Low- or no-flow conditions (sample flow rates of less than 10 mL/min) were not encountered during sampling.

4.6 Sample Handling and Documentation

A unique and descriptive sample identification (ID) number was assigned to each sub-slab soil gas sample by combining the sample type, location, and date. For example, sample ID number "SSG-1-20100106" is associated with the sub-slab soil gas sample collected at location 1 on January 6, 2010. The duplicate sample was identified by adding "Dup" to the end of the sample ID and the trip blank was labeled "Trip Blank." Sample ID numbers are documented in the Canister Sampling Log included in Appendix B and in the laboratory reports and chain of custody form included in Appendix A. For concision, the full sample ID numbers are not shown in the data summary presented in Table 5.

For each sub-slab soil gas sample, the following information was recorded in the field notes:

- Summa canister serial number;
- flow regulator serial number;
- sample location (marked on building floor plan figure);
- sample ID number;
- start time and canister vacuum;
- end time and canister vacuum; and
- sampler's name and affiliation.

This information is documented for each sample in the Canister Sampling Log included in Appendix B.

Following sample collection, the Summa canisters were packed into their shipping containers and were delivered via overnight courier under chain of custody protocol to Air Toxics Limited of Folsom, California. The samples were received at Air Toxics at approximately 3 p.m. on January 8, 2010.

4.7 Field QA/QC Procedures

In accordance with joint DTSC and Los Angeles RWQCB soil gas sampling guidance (Cal/EPA, 2003), one trip blank and one field-duplicate sample were included in the sub-slab soil gas investigation.

One trip blank sample was included in the sub-slab soil gas investigation to assess potential cross-contamination of the sample canisters. The trip blank sample consisted of a Summa canister that was prepared identically to the others (*i.e.*, was cleaned, individually certified, and evacuated by the laboratory), accompanied the others from the laboratory to the site and back to the laboratory, and was analyzed at the laboratory with the others; no sample was drawn into the Summa canister at the site, however, and the trip blank "sample" that was analyzed was

comprised of laboratory-certified "clean" air that is injected into every canister when it arrives back at the laboratory. The rationale for transporting an empty trip blank canister, rather than a canister already filled with laboratory-certified clean air, was to provide the greatest opportunity for cross-contamination to occur by maintaining the maximum pressure differential between the evacuated canister and ambient air.

One field duplicate sample was included in the sub-slab soil gas investigation to assess the overall variability in field sampling and laboratory analysis procedures. The field duplicate sample consisted of a second sub-slab soil gas sample collected into a separate Summa canister, collected at the same time and location as the associated primary sample using a duplicate sampling tee. The field duplicate sample was collected at location SSG-2, where concentrations of target analytes were expected to be relatively high, based upon a review of existing site data.

4.8 Post-sampling Activities

All sampling locations were recorded on a building floorplan drawing after measuring distances relative to nearby site features (*i.e.*, building walls). The sub-slab probes were left in-place for potential future use; each probe will be properly decommissioned after all sampling has been completed. The probe tip, probe piping, bentonite, and grout will be removed by redrilling. The borehole will be filled with grout and concrete patch material. Surface restoration will include a follow-up visit for final sanding and finish work to restore the floor slab to its original condition, if necessary.

4.9 Laboratory Analysis

Sub-slab soil gas samples were analyzed offsite by USEPA Method TO-15 by Air Toxics Ltd. of Folsom, California, a State-certified analytical laboratory. It is noted that the ACEH (2009b) requested that TPH-g be quantified by Method TO-3; to achieve a significantly lower laboratory reporting limit, TPH-g was instead quantified by TO-15. Samples were analyzed on a standard laboratory TAT of 10 working days from the date the canisters were received at the laboratory. Preliminary laboratory results were reported to Iris Environmental on January 25, 2010. Final laboratory results were reported to Iris Environmental on February 5, 2010. These results are discussed in Section 5.0 below.

5.0 RISK-BASED SUB-SLAB SOIL GAS SCREENING LEVELS

Risk-based screening levels of COPCs in sub-slab soil gas are established here to provide numerical criteria for evaluation of the sub-slab soil gas sampling results. These sub-slab soil gas screening levels are consistent with those developed prior to field work for the purpose of selecting appropriate sample collection and analysis methods, as presented in the SAP (Iris Environmental, 2009b), with two enhancements.

- As requested by ACEH in their conditional-approval letter (ACEH, 2009b), the following modifications have been made to the screening levels:
    - the cancer-based sub-slab soil gas screening levels developed here are based on a target risk level of 1×10^{-6} rather than 1×10^{-5};

  - cancer- and noncancer-based sub-slab soil gas screening levels are developed here for naphthalene; and
  - a noncancer-based sub-slab soil gas screening level is developed here for TPH-g.
- Target concentrations in indoor air are estimated here in accordance with newly promulgated USEPA inhalation risk assessment methodology (USEPA, 2009a).

The risk-based sub-slab soil gas screening levels are developed by combining risk-based target indoor air concentrations as calculated in Section 5.1 with a default sub-slab attenuation factor as discussed in Section 5.2.

5.1 Risk-based Target Indoor Air Concentrations

Risk-based target indoor air concentrations are developed here in accordance with USEPA (2009a), OEHHA (Cal/EPA, 2005a), and DTSC (Cal/EPA, 2009a) inhalation risk assessment methodology and guidance. The methodology and assumptions are consistent with those used by OEHHA in developing California Human Health Screening Levels (CHHSLs) for indoor air under a commercial exposure scenario (Cal/EPA, 2005a), and with those used by DTSC Human and Ecological Risk Division (HERD) in the inhalation-risk module of their Johnson and Ettinger Model (Cal/EPA, 2009a), with respect to: target risk and hazard levels, commercial/industrial worker exposure assumptions, and sources of toxicity values. The target concentrations developed here differ from indoor air CHHSLs in the following ways only.

- Target concentrations in indoor air are developed here for all COPCs of the investigation, including chemicals which were not included in the CHHSLs document.
- The hierarchy of sources for selecting noncancer toxicity values used here is the more conservative hierarchy recommended by DTSC/HERD (Cal/EPA, 2009a); under the DTSC/HERD hierarchy, the lower (more conservative) noncancer value from either Cal/EPA or USEPA is used to develop each noncancer-based target concentration. The less conservative OEHHA hierarchy prioritizes Cal/EPA over USEPA values, regardless of which value is lower.
- A noncancer-based target concentration of TPH-g is derived here from published noncancer toxicity values for specific TPH-g subgroups (*e.g.*, short-chain aliphatics), in accordance with DTSC guidance for evaluation of TPH mixtures (Cal/EPA, 2009b).
- The cancer- and noncancer-based target concentrations developed here incorporate an additional term, exposure time (ET; in hours per day), for consistency with newly promulgated USEPA inhalation risk assessment guidance (USEPA, 2009a).

The development of cancer- and noncancer-based target indoor air concentrations is presented below in Sections 5.1.1 and 5.1.2, respectively.

5.1.1 Cancer Effects

The target indoor air concentration, based on potential cancer effects, of each carcinogenic COPC that could be present in the indoor air of the onsite commercial/industrial building is estimated in accordance with USEPA (2009a), OEHHA (Cal/EPA, 2005a), and DTSC (Cal/EPA, 2009a) inhalation risk assessment methodology and guidance:

$$CA_c = \frac{TR \times AT_c}{URF \times ET \times EF \times ED} \quad (1)$$

where:

CA_c = concentration of chemical in indoor air ($\mu g/m^3$) that produces the target inhalation cancer risk under a commercial/industrial exposure scenario;

TR = target inhalation cancer risk (unitless);

URF = unit risk factor (per $\mu g/m^3$);

AT_c = averaging time for carcinogenic effects (hr);

ET = exposure time (hr/d);

EF = exposure frequency (d/yr); and

ED = exposure duration (yr).

The target risk level (TR) is based on an "acceptable" cancer risk level, as defined and endorsed by relevant state and federal agencies. The National Contingency Plan (NCP) is cited by USEPA (1989) as the basis for defining acceptable incremental (from a particular site, *i.e.*, above background) risk levels. According to the NCP, lifetime incremental cancer risk levels posed by a site should not exceed the risk range of one in a million (1×10^{-6}) to 100 in a million (1×10^{-4}). Thus, USEPA and Cal/EPA agencies typically consider the 1×10^{-6} risk level to be an insignificant risk, and consider a calculated excess cancer risk between 1×10^{-6} and 1×10^{-4} to be within the "risk-management" range. For commercial-industrial exposure scenarios, a typical point of departure with respect to risk-management decisions is a risk level of 1×10^{-5}; *i.e.*, if risks are at or below 1×10^{-5}, the agency of record will generally require no further action. Relatedly, California Proposition 65 cites the 1×10^{-5} risk level as the threshold of concern under commercial-industrial exposure scenarios. Notwithstanding typical risk-management thresholds, the target risk level used to develop risk-based target concentrations in indoor air and, by extension, risk-based sub-slab soil gas screening levels, ultimately has no impact on the calculation of inhalation cancer risk associated with a measured chemical concentration in sub-slab soil gas, as the target-risk variable "cancels out" of the calculation (see Section 6.2). As consistent with the target risk level used by OEHHA in developing the CHHSLs, the target risk level used here to develop target concentrations in indoor air is 1×10^{-6}.

The inhalation carcinogenic potency of each COPC is defined by its unit risk factor (URF). The unit risk factor represents the estimated probability of the receptor getting cancer as a result of a continuous exposure to an ambient concentration of 1 microgram per cubic meter ($\mu g/m^3$) of the chemical over a 70-year lifetime (USEPA, 1989). Consistent with OEHHA (CHHSLs) guidance (2005a) and current DTSC/HERD recommendation (Cal/EPA, 2009a), URF values are obtained from the OEHHA *Toxicity Criteria Database* (Cal/EPA, 2010). Toxicity values are presented in Table 1.

The values assigned to the exposure frequency (EF), exposure duration (ED), and averaging time for carcinogenic effects (AT_c) are consistent with standard DTSC/HERD exposure assumptions for commercial/industrial workers (Cal/EPA, 2005c; 2009a) and are consistent with the exposure assumptions made by OEHHA in developing the CHHSLs (Cal/EPA, 2005a). The value

assigned to the exposure time (ET) is consistent with current USEPA inhalation risk assessment guidance (USEPA, 2009a). Exposure assumptions are documented in Table 2.

Target indoor air concentrations, based on potential cancer effects, of carcinogenic COPCs are presented in Table 3.

5.1.2 Noncancer Effects

The target indoor air concentration, based on potential noncancer effects, of each COPC is estimated in accordance with USEPA (2009a), OEHHA (Cal/EPA, 2005a), and DTSC (Cal/EPA, 2009a) inhalation risk assessment methodology and guidance:

$$CA_{nc} = \frac{THQ \times AT_{nc} \times REL}{ET \times EF \times ED} \quad (2)$$

where:

CA_{nc} = concentration of chemical in indoor air ($\mu g/m^3$) that produces the target inhalation noncancer hazard quotient under a commercial/industrial exposure scenario;

THQ = target inhalation noncancer hazard quotient (unitless);

REL = reference exposure level (also known as chronic reference concentration [RfC]) ($\mu g/m^3$); and

AT_{nc} = averaging time for noncarcinogenic effects (d).

The target or acceptable noncancer hazard quotient (THQ) is 1.0. A hazard quotient equal to or less than 1.0 indicates that the exposure is not likely to result in adverse noncancer health effects, even for sensitive populations (USEPA, 1989). A target risk level of 1.0 is consistent with that used by OEHHA in developing the CHHSLs (Cal/EPA, 2005a).

The values assigned to the exposure frequency (EF), exposure duration (ED), body weight (BW), and averaging time for noncarcinogenic effects (AT_{nc}) are consistent with standard DTSC/HERD exposure assumptions for commercial/industrial workers (Cal/EPA, 2005c; 2009a) and are consistent with the exposure assumptions made by OEHHA in developing the CHHSLs (Cal/EPA, 2005a). The value assigned to the exposure time (ET) is consistent with current USEPA inhalation risk assessment guidance (USEPA, 2009a). Exposure assumptions are documented in Table 2.

The noncarcinogenic inhalation toxicity of each COPC is defined by its reference exposure level (REL), also known as chronic reference concentration (RfC). The REL represents the constant ambient air exposure concentration, expressed in micrograms per cubic meter ($\mu g/m^3$), that would not be expected to cause adverse noncancer health effects in potentially exposed populations, including sensitive subpopulations (USEPA, 1989). Consistent with current DTSC/HERD recommendation (Cal/EPA, 2009a), the RELs used in this analysis (except that for TPH-g, which is discussed separately below) are obtained from the following hierarchy of sources.

1) The lower (more conservative) of noncancer toxicity values from either

a) OEHHA *Toxicity Criteria Database* (Cal/EPA, 2010) or

b) *Integrated Risk Information System* (IRIS) (USEPA, 2010); and

2) *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (USEPA, 2009b).

It is noted that this DTSC/HERD-recommended noncancer toxicity value hierarchy is more conservative than that used by OEHHA in developing the CHHSLs (Cal/EPA, 2005a). The noncancer CHHSLs are based on toxicity values taken first from the OEHHA *Toxicity Criteria Database* and then from USEPA IRIS, regardless of which value is more conservative.

A noncancer-based target indoor air concentration for TPH-g mixture is developed here in accordance with recently promulgated DTSC guidance (Cal/EPA, 2009b). The new DTSC TPH guidance provides noncancer toxicity values (*i.e.*, REL values) for three subgroups of TPH within the gasoline range, based on chemical structure and carbon number:

- C_5 to C_8 aliphatics;
- C_9 to C_{18} aliphatics; and
- C_9 to C_{16} aromatics.

DTSC still recommends evaluating the noncancer health effects of C_6 to C_8 aromatics on an individual chemical basis (Cal/EPA, 2009b); the noncancer health effects of the other three TPH-g subgroups, listed above, are evaluated here in accordance with the DTSC interim guidance. A noncancer-based indoor air target concentration is calculated by Equation 2 for each of these three TPH-g subgroups, using the DTSC-published REL values. As discussed in the next paragraph, an assumption is made regarding the composition of the TPH-g mixture measured in site sub-slab soil gas. These assumed fractions are combined with the target indoor air concentrations for the TPH subgroups to calculate a weighted-average noncancer-based target indoor air concentration for the TPH-g mixture.

As recommended in the DTSC TPH guidance (Cal/EPA, 2009b), it is conservatively assumed that the TPH-g mixture measured in site sub-slab soil gas is comprised of 50 percent aliphatics and 50 percent aromatics. With respect to carbon number, it is assumed that the TPH-g measured in site sub-slab soil gas is comprised of 75 percent short-chain hydrocarbons and 25 percent long-chain hydrocarbons within each of the aromatic and aliphatic groups, based upon fractionation data for fresh gasoline product published by Metcalf and Eddy (1993). The TPH-g measured in site sub-slab soil gas is therefore assumed to be comprised of 37.5 percent C_5 to C_8 aliphatics; 37.5 percent C_6 to C_8 aromatics; 12.5 percent C_9 to C_{18} aliphatics; and 12.5 percent C_9 to C_{16} aromatics. These assumed fractions are applied to the noncancer-based target indoor air concentrations for the TPH subgroups calculate a weighted-average noncancer-based target indoor air concentration for TPH-g mixture:

$$CA_{nc,TPH\text{-}g} = \frac{1}{\sum \frac{x_i}{CA_{nc,i}}} \quad (3)$$

where:

$CA_{nc,TPH\text{-}g}$ = noncancer-based target indoor air concentration for TPH-g ($\mu g/m^3$);

x_i = mass fraction of TPH-g within subgroup *i* (unitless); and

$CA_{nc,i}$ = noncancer-based target indoor air concentration for subgroup *i* ($\mu g/m^3$).

It should be noted here that TPH-g is a catch-all measurement that represents the summation of the concentrations of all detected hydrocarbon compounds in the gasoline range, *i.e.*, from C_3 to C_{12}. It should not be assumed, however, that the concentrations of TPH-g measured in site sub-slab soil gas are necessarily associated with gasoline fuel, as there are many hydrocarbons within this range that would be included in the quantitation of TPH-g that are not gasoline constituents. The TPH noncancer toxicity values published by DTSC *do* assume that TPH-g is gasoline-related; *e.g.,* the noncancer toxicity of the C_5 to C_8 aliphatic fraction is (by DTSC) conservatively based upon the most toxic gasoline constituent within that fraction, hexane. Furthermore, it is conservatively assumed here that the fractionation by carbon number of the TPH-g measured at the site is consistent with that of fresh gasoline product. This evaluation of site TPH-g measurements is therefore highly conservative, as the noncancer-based target concentration assumes the TPH-g resembles fresh gasoline product, whereas the TPH-g measured at the site may not be related to gasoline at all, or may be related to highly weathered gasoline which would exhibit a different, and likely less toxic, speciation.

Noncancer-based target concentrations of COPCs, including the three TPH subgroups and the total TPH-g mixture, in indoor air under a commercial/industrial exposure scenario are presented in Table 3.

5.2 Risk-based Sub-slab Soil Gas Screening Levels

Risk-based sub-slab soil gas screening levels are developed here from: 1) the risk-based target concentrations of volatile chemicals in indoor air, calculated above in Section 5.1; and 2) a DTSC-recommended slab attenuation factor of 0.01 (Cal/EPA, 2005b). By definition, the attenuation factor represents the chemical concentration in indoor air (resulting from vapor intrusion) to the chemical concentration in soil gas beneath the building:

$$\alpha \equiv \frac{C_{IA}}{C_{SG}} \tag{4}$$

where:

α = attenuation factor (unitless);

C_{IA} = concentration of volatile chemical in indoor air resulting from vapor intrusion ($\mu g/m^3$); and

C_{SG} = concentration of volatile chemical in soil gas beneath building ($\mu g/m^3$).

It is noted that an attenuation factor (α) may, in general, be defined for soil gas contamination at any specific depth below the building slab. When defined for greater depths than sub-slab, the attenuation factor incorporates diffusive transport through the vadose soil zone as well as advective transport through the building slab, and therefore is a function of soil properties and physicochemical properties. Here, the attenuation factor is defined relative to soil gas

contamination present immediately beneath the building slab, and therefore is independent of soil and physicochemical properties.

In accordance with DTSC vapor intrusion guidance (Cal/EPA, 2005b), it is assumed that attenuation of chemical concentrations across the building slab is occurring at an attenuation factor of 0.01. In other words, it is assumed that the concentrations of all volatile chemicals decrease by a factor of 100 as the chemicals are transported from sub-slab soil gas into the indoor air space of the overlying building. Thus, sub-slab soil gas screening levels are 100 times higher than indoor air target concentrations.

For each carcinogenic COPC, the cancer-based sub-slab soil gas screening level is calculated from:

$$SL_c = \frac{CA_c}{\alpha} \quad (5)$$

where:

SL_c = cancer-based sub-slab soil gas screening level ($\mu g/m^3$);
CA_c = cancer-based target concentration in indoor air ($\mu g/m^3$); and
α = slab attenuation factor (unitless).

For each COPC, the noncancer-based sub-slab soil gas screening level is calculated from:

$$SL_{nc} = \frac{CA_{nc}}{\alpha} \quad (6)$$

where:

SL_{nc} = noncancer-based sub-slab soil gas screening level ($\mu g/m^3$);
CA_{nc} = noncancer-based target concentration in indoor air ($\mu g/m^3$); and
α = slab attenuation factor (unitless).

Cancer- and noncancer-based sub-slab soil gas screening levels are presented in Table 4. These screening levels are used to evaluate the sub-slab soil gas data collected at the site, as described in Section 6.0.

6.0 DATA EVALUATION

The risk-based sub-slab soil gas screening levels developed above in Section 5.0 are used here to evaluate the results of sub-slab soil gas sampling performed at the site in January 2010. The sampling results are presented and discussed, generally, in Section 6.1. Individual results are evaluated in Section 6.2 through comparison to the risk-based sub-slab soil gas screening levels. The potential cumulative (multi-chemical) inhalation cancer risk and noncancer hazard associated with each individual sub-slab soil gas sample are estimated in Section 6.3, in order to determine worst-case potential impacts associated with vapor intrusion. The two field QA/QC samples (*i.e.*, field duplicate and trip blank) are evaluated in Section 6.4.

6.1 Data Summary

As discussed above in Section 4.0, seven sub-slab soil gas samples (including one field duplicate sample) were collected at six locations beneath the existing onsite building (see Figure 2). One trip blank sample was also included in the investigation. The eight samples were analyzed for TPH-g and 40 individual volatile chemicals by modified Method TO-15 full scan. Sub-slab soil gas sampling results are presented in Table 5. The complete laboratory report is provided in Appendix A.

Of the 41 target analytes of the investigation, 29 were detected in at least one of the six primary sub-slab soil gas samples, and 12 were not detected in any of the six samples. Of the 29 detected analytes, 14 (including TPH-g) were detected in each of the six primary samples. Considering detection frequencies on an individual-sample basis, analytes were detected at the greatest frequency in the sample from SG-3 (24 of 41 analytes detected), and were detected at the lowest frequency in the sample from SG-2 (17 of 41). The significance of these chemical detections in sub slab soil gas, with respect to potential vapor intrusion inhalation risk and hazard, is evaluated in the two sections below.

6.2 Comparison of Results to Risk-based Sub-Slab Soil Gas Screening Levels

A comparison of sub-slab soil gas sampling results to risk-based sub-slab soil gas screening levels is presented in Table 5. As discussed above in Section 5.0, the cancer- and noncancer-based screening levels are based on a target risk level of 1×10^{-6} and target noncancer hazard quotient of 1.0, respectively. No chemical was detected in any sub-slab soil gas sample at a concentration exceeding its cancer-based or noncancer-based screening level.

As defined above in Section 5.1.1, each cancer-based sub-slab soil gas screening level represents the concentration of the associated carcinogenic COPC in sub-slab soil gas that results – via vapor intrusion transport to indoor air, and subsequent inhalation by building occupants – in the target cancer risk level of 1×10^{-6}, under a commercial/industrial land use scenario. Thus, the cancer risk associated with a measured concentration of a carcinogenic COPC in sub-slab soil gas may be calculated by taking the ratio of the measured concentration in sub-slab soil gas to the associated cancer-based sub-slab soil gas screening level, and multiplying this ratio by the target risk level:

$$\text{RISK} = \frac{C_{SG}}{SL_c} \times \text{TR} \qquad (7)$$

where:

RISK = cancer risk (unitless);

C_{SG} = measured concentration of carcinogenic COPC in sub-slab soil gas ($\mu g/m^3$);

SL_c = cancer-based sub-slab soil gas screening level ($\mu g/m^3$); and

TR = target inhalation cancer risk (unitless).

As noted above (see Section 5.1.1), the selected target risk level (TR) has no impact on the calculated inhalation cancer risk; the target risk "cancels out" of the calculation here in Equation 7.

Analogous to calculation of cancer risk, the noncancer hazard associated with a measured concentration of a COPC in sub-slab soil gas may be calculated by taking the ratio of the measured concentration in sub-slab soil gas to the associated noncancer-based sub-slab soil gas screening level, and multiplying this ratio by the target hazard quotient:

$$HQ = \frac{C_{SG}}{SL_{nc}} \times THQ \qquad (8)$$

where:

HQ = noncancer hazard quotient (unitless);

C_{SG} = concentration of COPC in soil gas ($\mu g/m^3$);

SL_{nc} = noncancer-based sub-slab soil gas screening level ($\mu g/m^3$); and

THQ = target noncancer hazard quotient (unitless).

Analogous to target risk level (TR), the selected target noncancer hazard quotient (THQ) has no impact on the calculated inhalation noncancer hazard; the target hazard "cancels out" of the calculation here in Equation 8.

To calculate the cancer risk and noncancer hazard associated with a non-detect result, the chemical concentration in sub-slab soil gas is assumed equal to one-half the laboratory reporting limit if the chemical was detected at least once in any of the six primary sub-slab soil gas samples, or is otherwise assumed to be zero.

The estimated cancer risk and noncancer hazard for each individual sub-slab soil gas sampling result, as calculated from Equations 7 and 8, are presented in Table 5.

6.3 Evaluation of Cumulative (Multi-chemical) Impacts

6.3.1 Cancer Risk

As a matter of policy, USEPA (1989) considers the potential cancer risks from exposure to multiple carcinogens to be additive, regardless of the carcinogens' mechanisms of toxicity or sites (organs of the body) of action. Therefore, the chemical-specific cancer risks calculated by Equation 7 may be summed across all carcinogenic COPCs to produce an estimate of the cumulative (multi-chemical) inhalation cancer risk associated with each sub-slab soil gas sample. This summation is presented in Table 5

The estimated cumulative (multi-chemical) cancer risk associated with each sub-slab soil gas sample may be compared to an acceptable cancer risk level, as defined and endorsed by relevant state and federal agencies. As noted above, the National Contingency Plan (NCP) is cited by USEPA (1989) as the basis for defining acceptable incremental (from a particular site) risk

levels. According to the NCP, lifetime incremental (above background) cancer risk levels posed by a site should not exceed the risk range of 1×10^{-6} to 1×10^{-4}. Thus, USEPA and Cal/EPA agencies typically consider the 1×10^{-6} risk level to be an insignificant risk, and consider a calculated incremental cancer risk between 1×10^{-6} and 1×10^{-4} to be within the risk-management range. For commercial/industrial exposure scenarios, a typical point of departure with respect to risk-management decisions is a risk level of 1×10^{-5}; *i.e.*, if risks are at or below 1×10^{-5}, the agency of record will typically accept no further action. Additionally, California Proposition 65 identifies a cancer risk level of 1×10^{-5} as an acceptable risk level for a commercial/industrial exposure scenario.

The estimated cumulative (multi-chemical) inhalation cancer risk associated with each sub-slab soil gas sample is presented in Table 5. The estimated cumulative cancer risk ranges from a minimum of 2.1×10^{-7} at SSG-2 to a maximum of 9.0×10^{-7} at SSG-3. This narrow range (less than an order of magnitude) of estimated risk across the six samples can be attributed to the consistent detection of benzene in all samples. The estimated cumulative cancer risk is below the negligible risk level of 1×10^{-6} at every sampling location.

Benzene is the primary risk driver in five of the six samples, and is the secondary risk driver in the other. Benzene contributes between 39 and 61 percent of the total risk associated with the six samples. Naphthalene is the primary risk driver at SSG-4 (43 percent of total), which is the only location where it was detected. Given that non-detect results are assumed equal to one-half the laboratory reporting limit for those chemicals detected in at least one of the six primary samples, naphthalene is the secondary risk driver at four of the other five locations, even though it was not detected at any of them. Naphthalene contributes between 22 and 29 percent of the total risk in the four samples where it is the secondary risk driver. Based on an arbitrary risk threshold of 1.0×10^{-7}, *i.e.*, 10 percent of the negligible risk level of 1.0×10^{-6}, other chemicals which contribute significantly to cumulative risk in one or more samples are: 1,3-butadiene (at SSG-3, and SSG-4) and tetrachloroethene (SSG-3).

6.3.2 Noncancer Hazard

The chemical-specific noncancer hazard quotients calculated by Equation 8 may be summed across all COPCs to produce an estimate of the cumulative (multi-chemical) inhalation "hazard index" associated with each sub-slab soil gas sample. It should be noted here that the summation of hazard quotients across chemicals, independent of the target organ which is affected by each chemical, is conservative, as chemicals that impact different target organs (*e.g.*, liver, kidney) are not truly additive in their potential to cause the adverse impact. USEPA risk assessment guidance (USEPA, 1989) states, "application of the hazard index equation to a number of compounds that are not expected to induce the same type of effects or that do not act by the same mechanism could overestimate the potential for effects, although such an approach is appropriate at a screening level."

The estimated cumulative noncancer hazard index associated with each sub-slab soil gas sample is compared to the threshold noncancer hazard index of 1.0. A hazard index less than or equal to 1.0 indicates that the exposure is not likely to result in adverse noncancer health effects, even for sensitive populations (USEPA, 1989).

The estimated cumulative (multi-chemical) inhalation noncancer hazard index associated with each sub-slab soil gas sample is presented in Table 5. The estimated cumulative noncancer hazard index ranges from a minimum of 0.0094 at SSG-2 to a maximum of 0.12 at SSG-4, and thus is well below the threshold noncancer level of 1.0 at all locations.

6.4 Comparison to Results of Previous Vapor Intrusion Evaluation

The previous screening-level health risk evaluation of the site (Iris Environmental, 2009a) included an evaluation of potential vapor intrusion into the existing onsite building. That evaluation was based on maximum detected concentrations of VOCs in soil gas, considering the combined dataset from the 1999 and 2008 site soil gas investigations. Soil gas samples were collected at depths of 3 feet bgs and 5 feet bgs in the 1999 and 2008 investigations, respectively. That screening-level vapor intrusion health risk evaluation presented an estimated cancer risk and noncancer hazard index of 8.0×10^{-6} and 0.051, respectively, based on the soil gas data. Of note, the estimated hazard index of 0.051 did not include noncancer hazard effects associated with TPH-g mixture.

The range of cancer risk estimated here of 2.1×10^{-7} to 9.0×10^{-7}, based on the sub-slab soil gas data, is slightly lower than the previous risk estimate of 8.0×10^{-6} based on historical maximum soil gas concentrations. The range of noncancer hazard estimated here of 0.0094 to 0.12, based on the sub-slab soil gas data, is comparable to the previous hazard estimate of 0.051 based on historical maximum soil gas concentrations. Of note, TPH-g is the largest contributor to cumulative noncancer hazard associated with the sub-slab soil gas data, and was not included in the previous noncancer hazard estimate based on the soil gas data.

6.5 Field QA/QC Samples

6.5.1 Trip Blank

Trip blank results are presented in Table 5. All results are non-detect. These trip blank results do not indicate any issue with cross-contamination of the sample canisters.

6.5.2 Field Duplicate

Field duplicate results are presented in Table 5, and are compared to the associated primary sample results in Table 6. The relative percent difference (RPD) ranges from 0 to 75 percent across the 41 pairs of results. The 25-percent rule-of-thumb is exceeded for only four of the 41 analytes, none of which is a risk driver: hexane (RPD of 75 percent), 2-butanone (60 percent), ethanol (57 percent), and acetone (36 percent). The associated primary and duplicate results are in excellent agreement for the risk drivers indentified above: benzene (RPD of 0 percent), naphthalene (0 percent [both results are non-detect]), 1,3-butadiene (0 percent [both results are non-detect]), and tetrachloroethene (11 percent). In sum, these field duplicate results indicate that the overall variability in field sampling and laboratory analysis procedures is low.

7.0 UNCERTAINTIES

7.1 Inhalation Health Risk Evaluation

The development of risk-based target concentrations of volatile chemicals in indoor air, presented in Section 5.1, is based on conservative agency-recommended default assumptions regarding cancer and noncancer toxicity values and regarding commercial/industrial worker exposure assumptions. Per USEPA risk assessment methodology (1989), each parameter represents either a central or upper tendency, such that the combination of parameters results in estimation of a reasonable maximum exposure (RME) for the exposed population. Accordingly, actual inhalation exposures to volatile chemicals are likely to be lower than estimated here.

As noted in Section 6.3.2, chemical-specific noncancer hazard quotients are summed across chemicals to estimate the cumulative noncancer hazard index associated with a particular sub-slab soil gas sample, regardless of the target organ that is affected by each chemical. This approach is conservative, as chemicals that impact different target organs (*e.g.*, liver, kidney) are not truly additive in their potential to cause the adverse impact. USEPA risk assessment guidance (USEPA, 1989) states, "application of the hazard index equation to a number of compounds that are not expected to induce the same type of effects or that do not act by the same mechanism could overestimate the potential for effects, although such an approach is appropriate at a screening level." Accordingly, the actual potential for building occupants to develop noncancer health effects is likely to be lower than estimated here.

7.2 TPH-g Composition

As discussed in Section 5.1.2, TPH-g is a catch-all measurement that represents the summation of the concentrations of all detected hydrocarbon compounds in the gasoline range, *i.e.*, from C3 to C12. The concentrations of TPH-g measured in site sub-slab soil gas are not necessarily associated with gasoline fuel, however, as there are many hydrocarbons within this range that would be included in the quantitation of TPH-g that are not gasoline constituents. The evaluation of the noncancer health effects of TPH-g mixture is based on the conservative assumption that the mixture resembles fresh gasoline product, with respect to fractionation of the TPH-g mixture by compound structure (aliphatic vs. aromatic) and carbon number and with respect to toxicity; whereas the TPH-g measured at the site may not be related to gasoline at all, or may be related to highly weathered gasoline which would exhibit a different, and likely less toxic, speciation. The actual noncancer health hazard associated with inhalation of TPH-g is therefore likely to be lower than estimated here.

7.3 Attenuation Factor

As discussed in Section 5.2, it is assumed that the transport of volatile chemicals from sub-slab soil gas to the indoor air of the overlying building is occurring at an attenuation factor of 0.01, in accordance with DTSC vapor intrusion guidance (Cal/EPA, 2005b). The DTSC guidance notes that USEPA recommends a more conservative slab attenuation factor of 0.1, but that more recent empirical evidence suggests that slab attenuation factors may be closer to 0.01. Vapor intrusion transport modeling with the Johnson and Ettinger Model produces a slab attenuation factor of approximately 0.001 under default commercial/industrial modeling assumptions (Cal/EPA,

2009a). Thus, the DTSC-recommended value of 0.01 used here falls at the midpoint of the 0.1 value recommended by USEPA and the 0.001 value produced by the Johnson and Ettinger Model. While there is uncertainty regarding the degree of attenuation that is occurring across the building slab, it should be noted that there is less uncertainty than if soil gas data were collected at greater depths than sub-slab (*e.g.*, 3 or 5 feet below ground surface) or at locations not directly beneath the building. By collecting soil gas data from directly beneath the building slab, uncertainty associated with chemical transport through the soil zone is eliminated.

8.0 SUMMARY AND CONCLUSIONS

This report documents the methodology and results of a sub-slab soil gas investigation of the northwest portion of the former Carnation Dairy facility located at 1310 14th Street in Oakland, California (the "site"). Sub-slab soil gas sampling was performed at six locations beneath the building on January 6, 2009, in accordance with the ACEH-approved SAP (Iris Environmental, 2009b; ACEH, 2009b). Risk-based sub-slab soil gas screening levels are developed here in accordance with USEPA (2009a), OEHHA (Cal/EPA, 2005a), and DTSC (Cal/EPA, 2009a) inhalation risk assessment methodology and a DTSC-recommended slab attenuation factor (Cal/EPA, 2005b). Cancer- and noncancer-based screening levels are based on a target risk level of 1×10^{-6} and target noncancer quotient of 1.0, respectively. These risk-based screening levels are used to evaluate the results of sub-slab soil gas sampling conducted beneath the building.

The findings of the sub-slab soil gas data evaluation may be summarized as follows.

- No chemical was detected in any sample at a concentration exceeding its cancer-based or noncancer-based screening level.
- The estimated cumulative (multi-chemical) cancer risk ranges across the six primary sub-slab soil gas samples from a minimum of 2.1×10^{-7} at SSG-2 to a maximum of 9.0×10^{-7} at SSG-3. This narrow range (less than an order of magnitude) of estimated risk across the six samples can be generally attributed to the consistent detection of benzene in all samples. The estimated cumulative cancer risk is below the negligible risk level of 1×10^{-6} at every sampling location.
- The primary risk drivers at the site are benzene and naphthalene (note that naphthalene was detected in only one of six samples). Other chemicals which contribute significantly to cumulative risk in one or more samples are: 1,3-butadiene and tetrachloroethene.
- The estimated cumulative noncancer hazard index ranges from 0.0094 to 0.12 across the six primary sub-slab soil gas samples, and thus is below the threshold noncancer level of 1.0 at all locations.

In conclusion, the concentrations of volatile chemicals detected in sub-slab soil gas beneath the existing unoccupied commercial/industrial building during the January 2010 site investigation are below levels of concern with respect to potential vapor intrusion into the building. These results are consistent with the previous screening-level vapor intrusion evaluation of the building (Iris Environmental, 2009a), which was based on soil gas data previously collected at the site in 1999 and 2008.

9.0 REFERENCES

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Table 1. Cancer and Noncancer Toxicity Values

Chemical of Potential Concern	Unit Risk Factor (URF)		Reference Concentration (RfC)	
	Value (per µg/m^3)	Source	Value (µg/m^3)	Source
Total Petroleum Hydrocarbons (TPH)				
Aliphatic C5-C8	NC	NC	7.0E+02	5
Aliphatic C9-C18	NC	NC	3.0E+02	5
Aromatic C9-C16	NC	NC	5.0E+01	5
Volatile Organic Compounds (VOCs)				
Acetone	NC	NC	3.1E+04	3
Benzene	2.9E-05	1	3.0E+01	2
1,3-Butadiene	1.7E-04	1	2.0E+00	2
2-Butanone (methyl ethyl ketone)	NC	NC	5.0E+03	2
Carbon disulfide	NC	NC	7.0E+02	2
Chlorobenzene	NC	NC	1.0E+03	1
Chloroform	5.3E-06	1	3.0E+02	1
Chloromethane (methyl chloride)	NC	NC	9.0E+01	2
Cyclohexane	NC	NC	6.0E+03	2
1,2-Dichlorobenzene	NC	NC	2.0E+02	3
1,3-Dichlorobenzene	NC	NC	1.1E+02	4R
1,4-Dichlorobenzene	1.1E-05	1	8.0E+02	1
Dichlorodifluoromethane (Freon 12)	NC	NC	2.0E+02	3
1,1-Dichloroethane (1,1-DCA)	1.6E-06	1	7.0E+02	3R
1,2-Dichloroethane (1,2-DCA)	2.1E-05	1	4.0E+02	1
1,1-Dichloroethene (1,1-DCE)	NC	NC	7.0E+01	1
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	NC	3.5E+01	2R
1,4-Dioxane	7.7E-06	1	3.0E+03	1
Ethanol	NC	NC	1.1E+03	2b R
Ethylbenzene	2.5E-06	1	1.0E+03	2
4-Ethyltoluene	NC	NC	1.0E+02	2c
Heptane	NC	NC	7.0E+02	2d
Hexane	NC	NC	7.0E+02	2
Methyl tertiary butyl ether (MTBE)	2.6E-07	1	3.0E+03	2

Table 1. Cancer and Noncancer Toxicity Values

Chemical of Potential Concern	Unit Risk Factor (URF)		Reference Concentration (RfC)	
	Value (per µg/m^3)	Source	Value (µg/m^3)	Source
Methylene chloride	1.0E-06	1	4.0E+02	1
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	NC	3.0E+03	2
Naphthalene	3.4E-05	1	3.0E+00	2
2-Propanol (isopropanol)	NC	NC	7.0E+03	1
Styrene	NC	NC	9.0E+02	1
Tetrachloroethene (PCE)	5.9E-06	1	3.5E+01	1
Tetrahydrofuran	2.0E-06	6	3.0E+03	6
Toluene	NC	NC	3.0E+02	1
1,1,1-Trichloroethane (1,1,1-TCA)	NC	NC	1.0E+03	1
Trichloroethene (TCE)	2.0E-06	1	6.0E+02	1
Trichlorofluoromethane (Freon 11)	NC	NC	7.0E+02	3
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 11	NC	NC	3.0E+04	3
1,2,4-Trimethylbenzene	NC	NC	7.0E+00	3
1,3,5-Trimethylbenzene	NC	NC	3.5E+01	3R
m-,p-Xylene	NC	NC	1.0E+02	2
o-Xylene	NC	NC	1.0E+02	2

Notes:

(a) Sources of toxicity data are as follows.

- 1 – *OEHHA Toxicity Criteria Database* (Cal/EPA, 2010)
- 2 – *Integrated Risk Information System* (IRIS) (USEPA, 2010)
- 3 – *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (USEPA, 2009b)
- 4 – *USEPA Region 9 PRG Table* (USEPA, 2004)
- 5 – *Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH)* (Cal/EPA, 2009b)
- 6 – Tetrahydrofuran toxicological values were derived from *Draft Toxicological Review of Tetrahydrofuran (USEPA, 2007).*
- R – Route-to-route extrapolation

(b) Isobutanol was used as the surrogate for ethanol's inhalation noncancer reference dose.

(c) Xylene was used as the surrogate for 4-ethyltoluene's inhalation noncancer reference dose.

(d) Hexane was used as the surrogate for heptane's inhalation noncancer reference dose.

(e) "NC" indicates that the chemical is classified as a noncarcinogen for the inhalation pathway.

Table 2. Commercial/Industrial Worker Exposure Assumptions

Parameter	Symbol	Value	Units
Exposure frequency	EF	250	d/yr
Exposure duration	ED	25	yr
Exposure time	ET	8	hr/d
Averaging time for carcinogenic effects	AT_c	613,200	hr
Averaging time for noncarcinogenic effects	AT_{nc}	219,000	hr
Target cancer risk	TR	1.0E-06	none
Target noncancer hazard quotient	THQ	1.0	none

Notes:

(1) Exposure assumptions are default values for the commercial/industrial scenario recommended by OEHHA (Cal/EPA, 2005a), DTSC/HERD (Cal/EPA, 2005c; 2009a), and USEPA (2009a).

Table 3. Risk-based Target Indoor Air Concentrations

Chemical of Potential Concern	Cancer-based Target Concentration (CA_c) ($\mu g/m^3$)	Noncancer-based Target Concentration (CA_{nc}) ($\mu g/m^3$)	Controlling Target Concentration (CA) ($\mu g/m^3$)
Total Petroleum Hydrocarbons (TPH)			
Aliphatic C5-C8	NC	2.5E+04	2.5E+04
Aliphatic C9-C18	NC	1.1E+04	1.1E+04
Aromatic C9-C16	NC	1.8E+03	1.8E+03
TPH-g	NC	1.0E+04	1.0E+04
Volatile Organic Compounds (VOCs)			
Acetone	NC	1.1E+06	1.1E+06
Benzene	3.4E+00	1.1E+03	3.4E+00
1,3-Butadiene	5.8E-01	7.0E+01	5.8E-01
2-Butanone (methyl ethyl ketone)	NC	1.8E+05	1.8E+05
Carbon disulfide	NC	2.5E+04	2.5E+04
Chlorobenzene	NC	3.5E+04	3.5E+04
Chloroform	1.9E+01	1.1E+04	1.9E+01
Chloromethane (methyl chloride)	NC	3.2E+03	3.2E+03
Cyclohexane	NC	2.1E+05	2.1E+05
1,2-Dichlorobenzene	NC	7.0E+03	7.0E+03
1,3-Dichlorobenzene	NC	3.7E+03	3.7E+03
1,4-Dichlorobenzene	8.9E+00	2.8E+04	8.9E+00
Dichlorodifluoromethane (Freon 12)	NC	7.0E+03	7.0E+03
1,1-Dichloroethane (1,1-DCA)	6.1E+01	2.5E+04	6.1E+01
1,2-Dichloroethane (1,2-DCA)	4.7E+00	1.4E+04	4.7E+00
1,1-Dichloroethene (1,1-DCE)	NC	2.5E+03	2.5E+03
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	1.2E+03	1.2E+03
1,4-Dioxane	1.3E+01	1.1E+05	1.3E+01
Ethanol	NC	3.7E+04	3.7E+04
Ethylbenzene	3.9E+01	3.5E+04	3.9E+01
4-Ethyltoluene	NC	3.5E+03	3.5E+03
Heptane	NC	2.5E+04	2.5E+04
Hexane	NC	2.5E+04	2.5E+04

Table 3. Risk-based Target Indoor Air Concentrations

Chemical of Potential Concern	Cancer-based Target Concentration (CA_c) ($\mu g/m^3$)	Noncancer-based Target Concentration (CA_{nc}) ($\mu g/m^3$)	Controlling Target Concentration (CA) ($\mu g/m^3$)
Methyl tertiary butyl ether (MTBE)	3.8E+02	1.1E+05	3.8E+02
Methylene chloride	9.8E+01	1.4E+04	9.8E+01
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	1.1E+05	1.1E+05
Naphthalene	2.9E+00	1.1E+02	2.9E+00
2-Propanol (isopropanol)	NC	2.5E+05	2.5E+05
Styrene	NC	3.2E+04	3.2E+04
Tetrachloroethene (PCE)	1.7E+01	1.2E+03	1.7E+01
Tetrahydrofuran	4.9E+01	1.1E+05	4.9E+01
Toluene	NC	1.1E+04	1.1E+04
1,1,1-Trichloroethane (1,1,1-TCA)	NC	3.5E+04	3.5E+04
Trichloroethene (TCE)	4.9E+01	2.1E+04	4.9E+01
Trichlorofluoromethane (Freon 11)	NC	2.5E+04	2.5E+04
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	1.1E+06	1.1E+06
1,2,4-Trimethylbenzene	NC	2.5E+02	2.5E+02
1,3,5-Trimethylbenzene	NC	1.2E+03	1.2E+03
m-,p-Xylene	NC	3.5E+03	3.5E+03
o-Xylene	NC	3.5E+03	3.5E+03

Notes:

(1) Risk-based target indoor air concentrations are developed here in accordance with USEPA (2009a), OEHHA (Cal/EPA, 2005a), and DTSC (Cal/EPA, 2009a) inhalation risk assessment methodology and guidance.

(2) Cancer-based and noncancer-based target concentrations are based on a target risk of $1.0x10^{-6}$ and target hazard quotient of 1.0, respectively; and commercial/industrial land use.

(3) "NC" indicates that the chemical is classified as a noncarcinogen for the inhalation pathway.

(4) The noncancer-based target concentration for TPH-g is calculated as a weighted average of the noncancer-based target concentrations for the TPH-g subgroups (C5-C8 aliphatics, etc.). See Section 5.1.2 of the text for details.

Table 4. Risk-based Sub-slab Soil Gas Screening Levels

Chemical of Potential Concern	Cancer-based Sub-slab Soil Gas Screening Level ($SL_{SSSG,c}$) ($\mu g/m^3$)	Noncancer-based Sub-slab Soil Gas Screening Level ($SL_{SSSG,nc}$) ($\mu g/m^3$)	Controlling Sub-slab Soil Gas Screening Level (SL_{SSSG}) ($\mu g/m^3$)
Total Petroleum Hydrocarbons (TPH)			
TPH-g	NC	1.3E+05	1.3E+05
Volatile Organic Compounds (VOCs)			
Acetone	NC	1.4E+07	1.4E+07
Benzene	4.2E+01	1.3E+04	4.2E+01
1,3-Butadiene	7.2E+00	8.8E+02	7.2E+00
2-Butanone (methyl ethyl ketone)	NC	2.2E+06	2.2E+06
Carbon disulfide	NC	3.1E+05	3.1E+05
Chlorobenzene	NC	4.4E+05	4.4E+05
Chloroform	2.3E+02	1.3E+05	2.3E+02
Chloromethane (methyl chloride)	NC	3.9E+04	3.9E+04
Cyclohexane	NC	2.6E+06	2.6E+06
1,2-Dichlorobenzene	NC	8.8E+04	8.8E+04
1,3-Dichlorobenzene	NC	4.6E+04	4.6E+04
1,4-Dichlorobenzene	1.1E+02	3.5E+05	1.1E+02
Dichlorodifluoromethane (Freon 12)	NC	8.8E+04	8.8E+04
1,1-Dichloroethane (1,1-DCA)	7.7E+02	3.1E+05	7.7E+02
1,2-Dichloroethane (1,2-DCA)	5.8E+01	1.8E+05	5.8E+01
1,1-Dichloroethene (1,1-DCE)	NC	3.1E+04	3.1E+04
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	1.5E+04	1.5E+04
1,4-Dioxane	1.6E+02	1.3E+06	1.6E+02
Ethanol	NC	4.6E+05	4.6E+05
Ethylbenzene	4.9E+02	4.4E+05	4.9E+02
4-Ethyltoluene	NC	4.4E+04	4.4E+04
Heptane	NC	3.1E+05	3.1E+05
Hexane	NC	3.1E+05	3.1E+05
Methyl tertiary butyl ether (MTBE)	4.7E+03	1.3E+06	4.7E+03
Methylene chloride	1.2E+03	1.8E+05	1.2E+03
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	1.3E+06	1.3E+06

Table 4. Risk-based Sub-slab Soil Gas Screening Levels

Chemical of Potential Concern	Cancer-based Sub-slab Soil Gas Screening Level ($SL_{SSSG,c}$) ($\mu g/m^3$)	Noncancer-based Sub-slab Soil Gas Screening Level ($SL_{SSSG,nc}$) ($\mu g/m^3$)	Controlling Sub-slab Soil Gas Screening Level (SL_{SSSG}) ($\mu g/m^3$)
Naphthalene	3.6E+01	1.3E+03	3.6E+01
2-Propanol (isopropanol)	NC	3.1E+06	3.1E+06
Styrene	NC	3.9E+05	3.9E+05
Tetrachloroethene (PCE)	2.1E+02	1.5E+04	2.1E+02
Tetrahydrofuran	6.1E+02	1.3E+06	6.1E+02
Toluene	NC	1.3E+05	1.3E+05
1,1,1-Trichloroethane (1,1,1-TCA)	NC	4.4E+05	4.4E+05
Trichloroethene (TCE)	6.1E+02	2.6E+05	6.1E+02
Trichlorofluoromethane (Freon 11)	NC	3.1E+05	3.1E+05
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	1.3E+07	1.3E+07
1,2,4-Trimethylbenzene	NC	3.1E+03	3.1E+03
1,3,5-Trimethylbenzene	NC	1.5E+04	1.5E+04
m-,p-Xylene	NC	4.4E+04	4.4E+04
o-Xylene	NC	4.4E+04	4.4E+04

Notes:

(1) Each risk-based sub-slab soil gas screening level is calculated from 1) the risk-based target concentration of the chemical in indoor air (see Table 3) and 2) the DTSC-recommended (Cal/EPA, 2005b) default slab attenuation factor of 0.01:

$SL_{SSSG,c} = CA_c / \alpha$

$SL_{SSSG,nc} = CA_{nc} / \alpha$

(2) Cancer-based and noncancer-based screening levels are based on a target risk of $1.0x10^{-6}$ and target hazard quotient of 1.0, respectively; and commercial/industrial land use.

(3) "NC" = noncarcinogenic.

Table 5. Results of Sub-slab Soil Gas Investigation

Chemical of Potential Concern	Risk-based Sub-slab Soil Gas Screening Level		Primary Sample Results																	QA/QC Sample Results	
			SSG-1			SSG-2			SSG-3			SSG-4			SSG-5			SSG-6			Trip Blank	SSG-2-DUP
	Cancer ($\mu g/m^3$)	Noncancer ($\mu g/m^3$)	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Result ($\mu g/m^3$)
TPH-g	NC	1.3E+05	1,200	NC	9.5E-03	600	NC	4.7E-03	3,600	NC	2.8E-02	12,000	NC	9.5E-02	1,500	NC	1.2E-02	1,900	NC	1.5E-02	< 8.2	580
Acetone	NC	1.4E+07	43	NC	3.2E-06	30	NC	2.2E-06	340 E	NC	2.5E-05	40	NC	2.9E-06	210	NC	1.5E-05	48	NC	3.5E-06	< 1.2	43
Benzene	4.2E+01	1.3E+04	6.5	1.5E-07	4.9E-04	4.3	1.0E-07	3.3E-04	20	4.7E-07	1.5E-03	14	3.3E-07	1.1E-03	13	3.1E-07	9.9E-04	5.1	1.2E-07	3.9E-04	< 0.32	4.3
1,3-Butadiene	7.2E+00	8.8E+02	< 0.34	2.4E-08	1.9E-04	< 0.36	2.5E-08	2.1E-04	0.92	1.3E-07	1.1E-03	0.78	1.1E-07	8.9E-04	< 0.72	5.0E-08	4.1E-04	< 0.34	2.4E-08	1.9E-04	< 0.22	< 0.36
2-Butanone (methyl ethyl ketone)	NC	2.2E+06	7.5	NC	3.4E-06	2.8	NC	1.3E-06	14	NC	6.4E-06	4.9	NC	2.2E-06	6.4	NC	2.9E-06	6.2	NC	2.8E-06	< 0.29	5.2
Carbon disulfide	NC	3.1E+05	< 2.4	NC	3.9E-06	< 2.5	NC	4.1E-06	2.6	NC	8.5E-06	< 2.5	NC	4.1E-06	< 5.1	NC	8.3E-06	< 2.4	NC	3.9E-06	< 1.6	< 2.6
Chlorobenzene	NC	4.4E+05	< 0.70	NC/ND	ND	< 0.75	NC/ND	ND	< 0.71	NC/ND	ND	< 0.74	NC/ND	ND	< 1.5	NC/ND	ND	< 0.70	NC/ND	ND	< 0.46	< 0.76
Chloroform	2.3E+02	1.3E+05	< 0.74	ND	ND	< 0.80	ND	ND	< 0.76	ND	ND	< 0.79	ND	ND	< 1.6	ND	ND	< 0.75	ND	ND	< 0.49	< 0.80
Chloromethane (methyl chloride)	NC	3.9E+04	< 0.31	NC	3.9E-06	< 0.34	NC	4.3E-06	0.38	NC	9.6E-06	< 0.33	NC	4.2E-06	< 0.67	NC	8.5E-06	< 0.32	NC	4.1E-06	< 0.21	< 0.34
Cyclohexane	NC	2.6E+06	2.8	NC	1.1E-06	< 0.56	NC	1.1E-07	2.8	NC	1.1E-06	160	NC	6.1E-05	2.9	NC	1.1E-06	1.4	NC	5.3E-07	< 0.34	< 0.57
1,2-Dichlorobenzene	NC	8.8E+04	< 0.91	NC/ND	ND	< 0.98	NC/ND	ND	< 0.93	NC/ND	ND	< 0.97	NC/ND	ND	< 2.0	NC/ND	ND	< 0.92	NC/ND	ND	< 0.60	< 0.99
1,3-Dichlorobenzene	NC	4.6E+04	< 0.91	NC/ND	ND	< 0.98	NC/ND	ND	< 0.93	NC/ND	ND	< 0.97	NC/ND	ND	< 2.0	NC/ND	ND	< 0.92	NC/ND	ND	< 0.60	< 0.99
1,4-Dichlorobenzene	1.1E+02	3.5E+05	< 0.91	ND	ND	< 0.98	ND	ND	< 0.93	ND	ND	< 0.97	ND	ND	< 2.0	ND	ND	< 0.92	ND	ND	< 0.60	< 0.99
Dichlorodifluoromethane (Freon 12)	NC	8.8E+04	8.1	NC	9.2E-05	2.6	NC	3.0E-05	3.0	NC	3.4E-05	2.4	NC	2.7E-05	2.6	NC	3.0E-05	2.2	NC	2.5E-05	< 0.49	2.5
1,1-Dichloroethane (1,1-DCA)	7.7E+02	3.1E+05	< 0.62	ND	ND	< 0.66	ND	ND	< 0.63	ND	ND	< 0.65	ND	ND	< 1.3	ND	ND	< 0.62	ND	ND	< 0.40	< 0.67
1,2-Dichloroethane (1,2-DCA)	5.8E+01	1.8E+05	< 0.62	ND	ND	< 0.66	ND	ND	< 0.63	ND	ND	< 0.65	ND	ND	< 1.3	ND	ND	< 0.62	ND	ND	< 0.40	< 0.67
1,1-Dichloroethene (1,1-DCE)	NC	3.1E+04	< 0.60	NC/ND	ND	< 0.65	NC/ND	ND	< 0.61	NC/ND	ND	< 0.64	NC/ND	ND	< 1.3	NC/ND	ND	< 0.61	NC/ND	ND	< 0.40	< 0.65
cis-1,2-Dichloroethene (cis-1,2-DCE)	NC	1.5E+04	< 0.60	NC/ND	ND	< 0.65	NC/ND	ND	< 0.61	NC/ND	ND	< 0.64	NC/ND	ND	< 1.3	NC/ND	ND	< 0.61	NC/ND	ND	< 0.40	< 0.65
1,4-Dioxane	1.6E+02	1.3E+06	< 0.55	1.7E-09	2.1E-07	< 0.59	1.9E-09	2.2E-07	< 0.56	1.8E-09	2.1E-07	< 0.58	1.8E-09	2.2E-07	1.7	1.1E-08	1.3E-06	< 0.55	1.7E-09	2.1E-07	< 0.36	< 0.59
Ethanol	NC	4.6E+05	3.6	NC	7.8E-06	1.9	NC	4.1E-06	6.1	NC	1.3E-05	2.9	NC	6.3E-06	13	NC	2.8E-05	2.0	NC	4.3E-06	< 0.94	3.4
Ethylbenzene	4.9E+02	4.4E+05	7.2	1.5E-08	1.6E-05	2.2	4.5E-09	5.0E-06	14	2.9E-08	3.2E-05	18	3.7E-08	4.1E-05	5.5	1.1E-08	1.3E-05	6.3	1.3E-08	1.4E-05	< 0.43	2.2
4-Ethyltoluene	NC	4.4E+04	22	NC	5.0E-04	3.5	NC	8.0E-05	32	NC	7.3E-04	34	NC	7.8E-04	4.8	NC	1.1E-04	7.3	NC	1.7E-04	< 0.49	3.0
Heptane	NC	3.1E+05	2.5	NC	8.2E-06	< 0.67	NC	1.1E-06	2.4	NC	7.8E-06	420 E	NC	1.4E-03	2.7	NC	8.8E-06	1.6	NC	5.2E-06	< 0.41	< 0.68
Hexane	NC	3.1E+05	2.2	NC	7.2E-06	0.64	NC	2.1E-06	2.9	NC	9.5E-06	390 E	NC	1.3E-03	2.7	NC	8.8E-06	1.9	NC	6.2E-06	< 0.35	< 0.58
Methyl tertiary butyl ether (MTBE)	4.7E+03	1.3E+06	< 0.55	ND	ND	< 0.59	ND	ND	< 0.56	ND	ND	< 0.58	ND	ND	< 1.2	ND	ND	< 0.55	ND	ND	< 0.36	< 0.59
Methylene chloride	1.2E+03	1.8E+05	1.2	9.8E-10	6.8E-06	< 1.1	4.5E-10	3.1E-06	1.9	1.5E-09	1.1E-05	< 1.1	4.5E-10	3.1E-06	< 2.3	9.4E-10	6.6E-06	1.4	1.1E-09	8.0E-06	< 0.69	< 1.1
4-Methyl-2-pentanone (methyl isobutyl ketone)	NC	1.3E+06	2.2	NC	1.7E-06	0.79	NC	6.0E-07	4.6	NC	3.5E-06	< 0.66	NC	2.5E-07	2.3	NC	1.8E-06	< 0.63	NC	2.4E-07	< 0.41	1.0
Naphthalene	3.6E+01	1.3E+03	< 4.0	5.5E-08	1.5E-03	< 4.3	6.0E-08	1.6E-03	< 4.1	5.7E-08	1.6E-03	13	3.6E-07	9.9E-03	< 8.5	1.2E-07	3.2E-03	< 4.0	5.5E-08	1.5E-03	< 2.6	< 4.3
2-Propanol (isopropanol)	NC	3.1E+06	< 1.9	NC	3.1E-07	< 2.0	NC	3.3E-07	2.9	NC	9.5E-07	< 2.0	NC	3.3E-07	4.7	NC	1.5E-06	< 1.9	NC	3.1E-07	< 1.2	< 2.0
Styrene	NC	3.9E+05	< 0.65	NC	8.2E-07	< 0.69	NC	8.8E-07	1.9	NC	4.8E-06	< 0.68	NC	8.6E-07	< 1.4	NC	1.8E-06	< 0.65	NC	8.2E-07	< 0.42	< 0.70
Tetrachloroethene (PCE)	2.1E+02	1.5E+04	< 1.0	2.4E-09	3.3E-05	2.7	1.3E-08	1.8E-04	44	2.1E-07	2.9E-03	< 1.1	2.6E-09	3.6E-05	< 2.2	5.3E-09	7.2E-05	5.4	2.6E-08	3.5E-04	< 0.68	3.0
Tetrahydrofuran	6.1E+02	1.3E+06	< 2.2	ND	ND	< 2.4	ND	ND	< 2.3	ND	ND	< 2.4	ND	ND	< 4.8	ND	ND	< 2.2	ND	ND	< 1.5	< 2.4
Toluene	NC	1.3E+05	54	NC	4.1E-04	9.0	NC	6.8E-05	69	NC	5.3E-04	42	NC	3.2E-04	28	NC	2.1E-04	69	NC	5.3E-04	< 0.38	8.9
1,1,1-Trichloroethane (1,1,1-TCA)	NC	4.4E+05	< 0.83	NC/ND	ND	< 0.89	NC/ND	ND	< 0.84	NC/ND	ND	< 0.88	NC/ND	ND	< 1.8	NC/ND	ND	< 0.83	NC/ND	ND	< 0.54	< 0.90
Trichloroethene (TCE)	6.1E+02	2.6E+05	< 0.82	6.7E-10	1.6E-06	< 0.88	7.2E-10	1.7E-06	< 0.83	6.8E-10	1.6E-06	< 0.86	7.0E-10	1.6E-06	< 1.8	1.5E-09	3.4E-06	7.8	1.3E-08	3.0E-05	< 0.54	< 0.89
Trichlorofluoromethane (Freon 11)	NC	3.1E+05	2.1	NC	6.8E-06	1.2	NC	3.9E-06	< 0.87	NC	1.4E-06	18	NC	5.9E-05	2.0	NC	6.5E-06	41	NC	1.3E-04	< 0.56	1.2
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NC	1.3E+07	< 1.2	NC	4.6E-08	< 1.2	NC	4.6E-08	< 1.2	NC	4.6E-08	< 1.2	NC	4.6E-08	< 2.5	NC	9.5E-08	2.1	NC	1.6E-07	< 0.77	< 1.3
1,2,4-Trimethylbenzene	NC	3.1E+03	26	NC	8.5E-03	4.7	NC	1.5E-03	35	NC	1.1E-02	29	NC	9.5E-03	5.9	NC	1.9E-03	5.7	NC	1.9E-03	< 0.49	4.6
1,3,5-Trimethylbenzene	NC	1.5E+04	8.0	NC	5.2E-04	2.0	NC	1.3E-04	13	NC	8.5E-04	10	NC	6.5E-04	2.4	NC	1.6E-04	2.7	NC	1.8E-04	< 0.49	1.9
m-,p-Xylene	NC	4.4E+04	33	NC	7.5E-04	12	NC	2.7E-04	65	NC	1.5E-03	83	NC	1.9E-03	21	NC	4.8E-04	21	NC	4.8E-04	< 0.43	12
o-Xylene	NC	4.4E+04	13	NC	3.0E-04	6.0	NC	1.4E-04	25	NC	5.7E-04	29	NC	6.6E-04	7.0	NC	1.6E-04	6.1	NC	1.4E-04	< 0.43	5.3
Cumulative (multi-chemical)				**2.5E-07**	**2.3E-02**		**2.1E-07**	**9.4E-03**		**9.0E-07**	**5.1E-02**		**8.4E-07**	**1.2E-01**		**5.0E-07**	**2.0E-02**		**2.5E-07**	**2.1E-02**		

Table 5. Results of Sub-slab Soil Gas Investigation

Chemical of Potential Concern	Risk-based Sub-slab Soil Gas Screening Level		Primary Sample Results																	QA/QC Sample Results	
			SSG-1			SSG-2			SSG-3			SSG-4			SSG-5			SSG-6			Trip Blank	SSG-2-DUP
	Cancer ($\mu g/m^3$)	Noncancer ($\mu g/m^3$)	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Risk	Hazard	Result ($\mu g/m^3$)	Result ($\mu g/m^3$)

Notes:

(1) Laboratory data qualifying flags are as follows:

E = Exceeds instrument calibration range.

(2) "NC" indicates that the chemical is classified as a noncarcinogen for the inhalation pathway. "ND" indicates the chemical was not detected in any primary sub-slab soil gas sample.

Table 6. Evaluation of Field Duplicate Results

	SSG-2		
Chemical	Primary ($\mu g/m^3$)	Duplicate ($\mu g/m^3$)	RPD (%)
TPH-g	600	580	3.4%
Acetone	30	43	35.6%
Benzene	4.3	4.3	0.0%
1,3-Butadiene	< 0.36	< 0.36	ND
2-Butanone (methyl ethyl ketone)	2.8	5.2	60.0%
Carbon disulfide	< 2.5	< 2.6	ND
Chlorobenzene	< 0.75	< 0.76	ND
Chloroform	< 0.80	< 0.80	ND
Chloromethane (methyl chloride)	< 0.34	< 0.34	ND
Cyclohexane	< 0.56	< 0.57	ND
1,2-Dichlorobenzene	< 0.98	< 0.99	ND
1,3-Dichlorobenzene	< 0.98	< 0.99	ND
1,4-Dichlorobenzene	< 0.98	< 0.99	ND
Dichlorodifluoromethane (Freon 12)	2.6	2.5	3.9%
1,1-Dichloroethane (1,1-DCA)	< 0.66	< 0.67	ND
1,2-Dichloroethane (1,2-DCA)	< 0.66	< 0.67	ND
1,1-Dichloroethene (1,1-DCE)	< 0.65	< 0.65	ND
cis-1,2-Dichloroethene (cis-1,2-DCE)	< 0.65	< 0.65	ND
1,4-Dioxane	< 0.59	< 0.59	ND
Ethanol	1.9	3.4	56.6%
Ethylbenzene	2.2	2.2	0.0%
4-Ethyltoluene	3.5	3.0	15.4%
Heptane	< 0.67	< 0.68	ND
Hexane	0.64	< 0.58	75.3%
Methyl tertiary butyl ether (MTBE)	< 0.59	< 0.59	ND
Methylene chloride	< 1.1	< 1.1	ND
4-Methyl-2-pentanone (methyl isobutyl ketone)	0.79	1.0	23.5%
Naphthalene	< 4.3	< 4.3	ND
2-Propanol (isopropanol)	< 2.0	< 2.0	ND
Styrene	< 0.69	< 0.70	ND
Tetrachloroethene (PCE)	2.7	3.0	10.5%

Table 6. Evaluation of Field Duplicate Results

Chemical	SSG-2 Primary ($\mu g/m^3$)	SSG-2 Duplicate ($\mu g/m^3$)	RPD (%)
Tetrahydrofuran	< 2.4	< 2.4	ND
Toluene	9.0	8.9	1.1%
1,1,1-Trichloroethane (1,1,1-TCA)	< 0.89	< 0.90	ND
Trichloroethene (TCE)	< 0.88	< 0.89	ND
Trichlorofluoromethane (Freon 11)	1.2	1.2	0.0%
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	< 1.2	< 1.3	ND
1,2,4-Trimethylbenzene	4.7	4.6	2.2%
1,3,5-Trimethylbenzene	2.0	1.9	5.1%
m-,p-Xylene	12	12	0.0%
o-Xylene	6.0	5.3	12.4%

Notes:

(1) Shown is the relative percent different (RPD) between primary and field duplicate sample results, where RPD is calculated as follows.

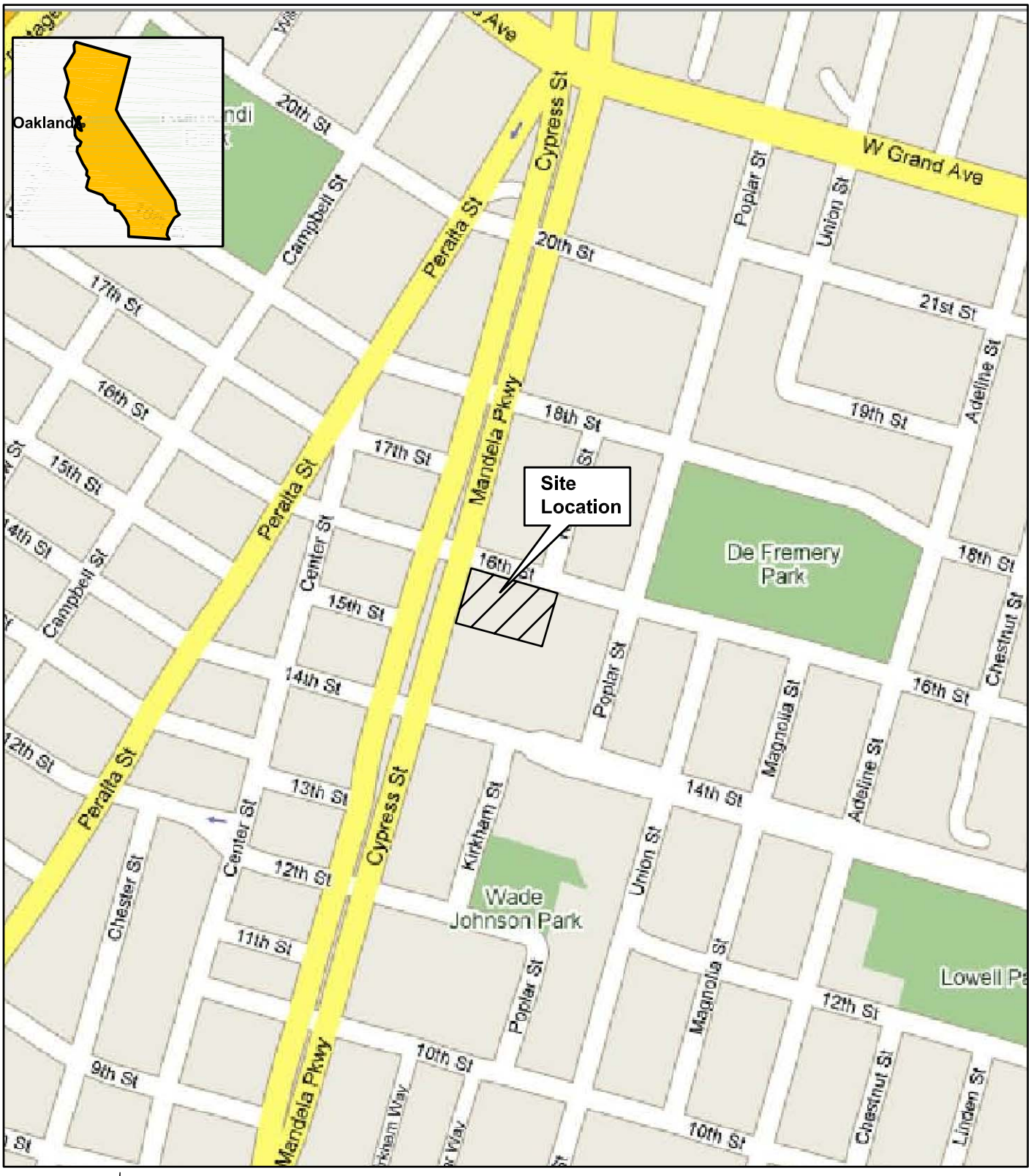
$$RPD = 100\% \times ABS [2 \times (D1 - D2) / (D1 + D2)]$$

where:

RPD = relative percent difference (%);

D1 = primary sample result ($\mu g/m^3$); and

D2 = field duplicate sample result ($\mu g/m^3$).



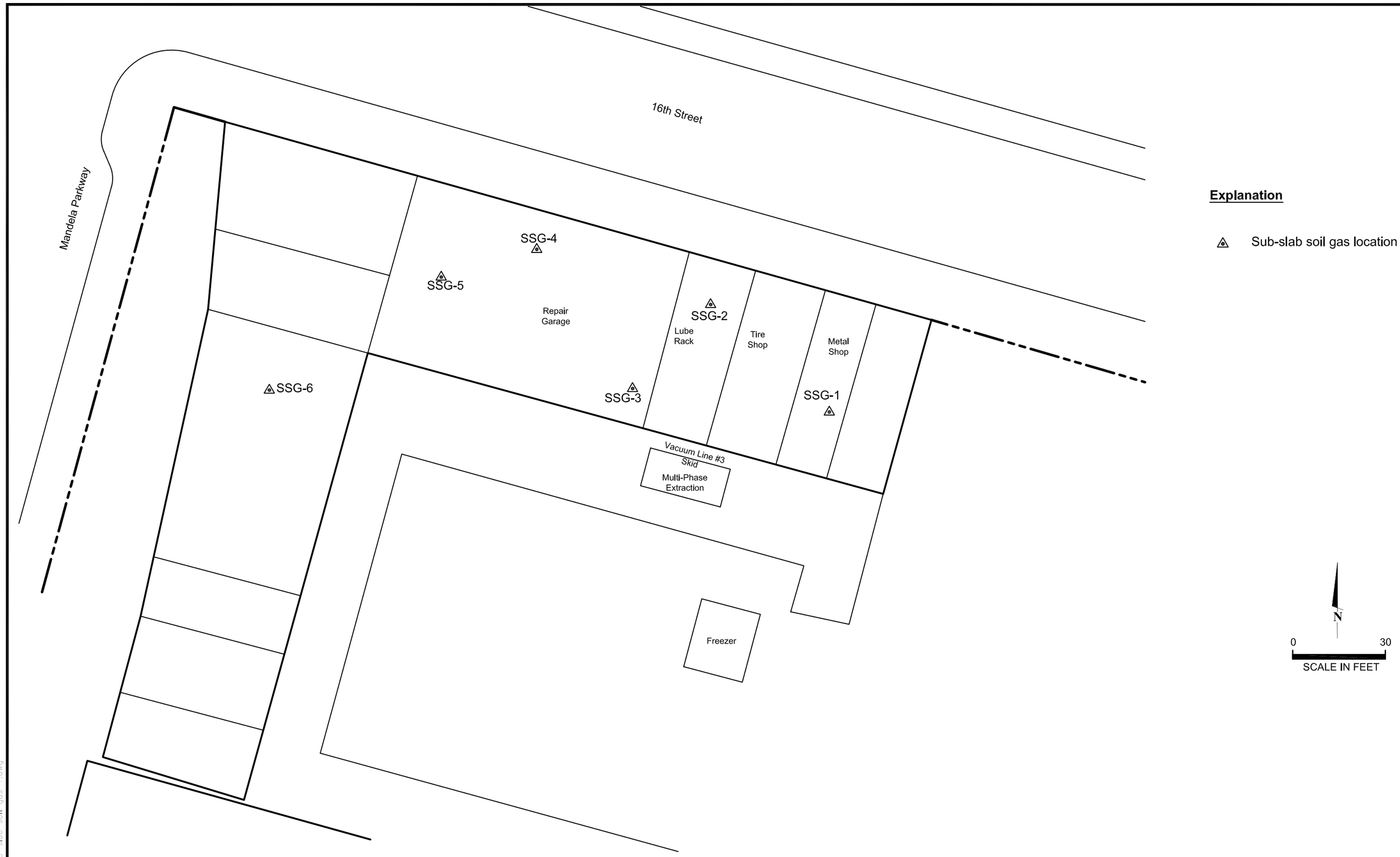
IRIS ENVIRONMENTAL
1438 Webster Street, Suite 302
Oakland, California 94612
Ph. (510) 834-4747 Fax: (510) 834-4199

Site Location Map
Sub-slab Soil Gas Sampling and Analysis Report
1310 14th Street, Oakland, California

Figure
1

Drafter: EC | Date: 11/12/08 | Contract Number: 07-557-A

I:\CAD\07\07-557-A\Site location map.dwg



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Sub-slab Soil Gas Sampling Locations
Sub-slab Soil Gas Sampling and Analysis Report
1310 14th Street, Oakland, California

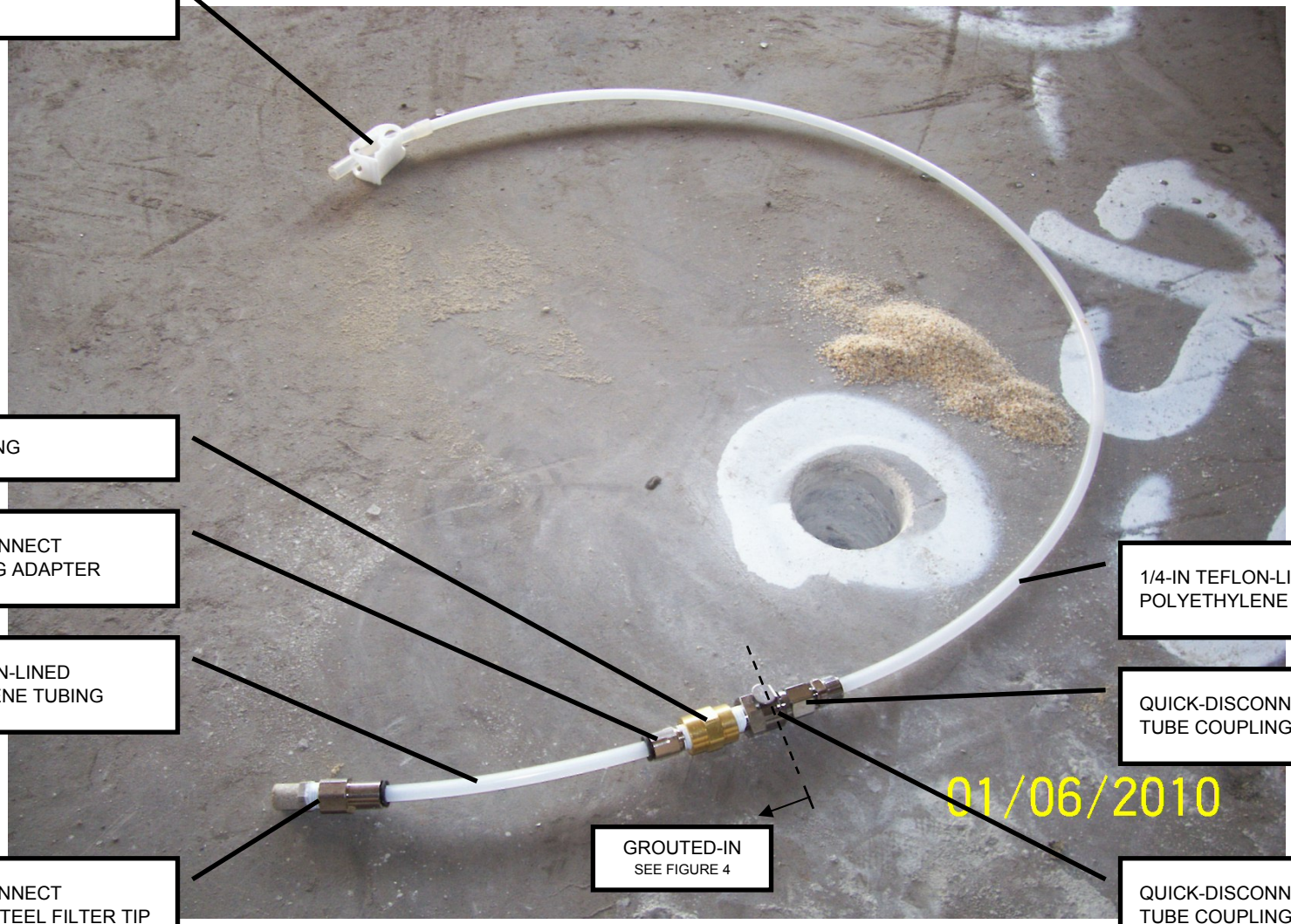
Figure
2

Drafter: EC

Date: 01/25/10

Contract Number: 07-557B

I:\CAD\07-557B\Sub-slab soil gas 1.dwg



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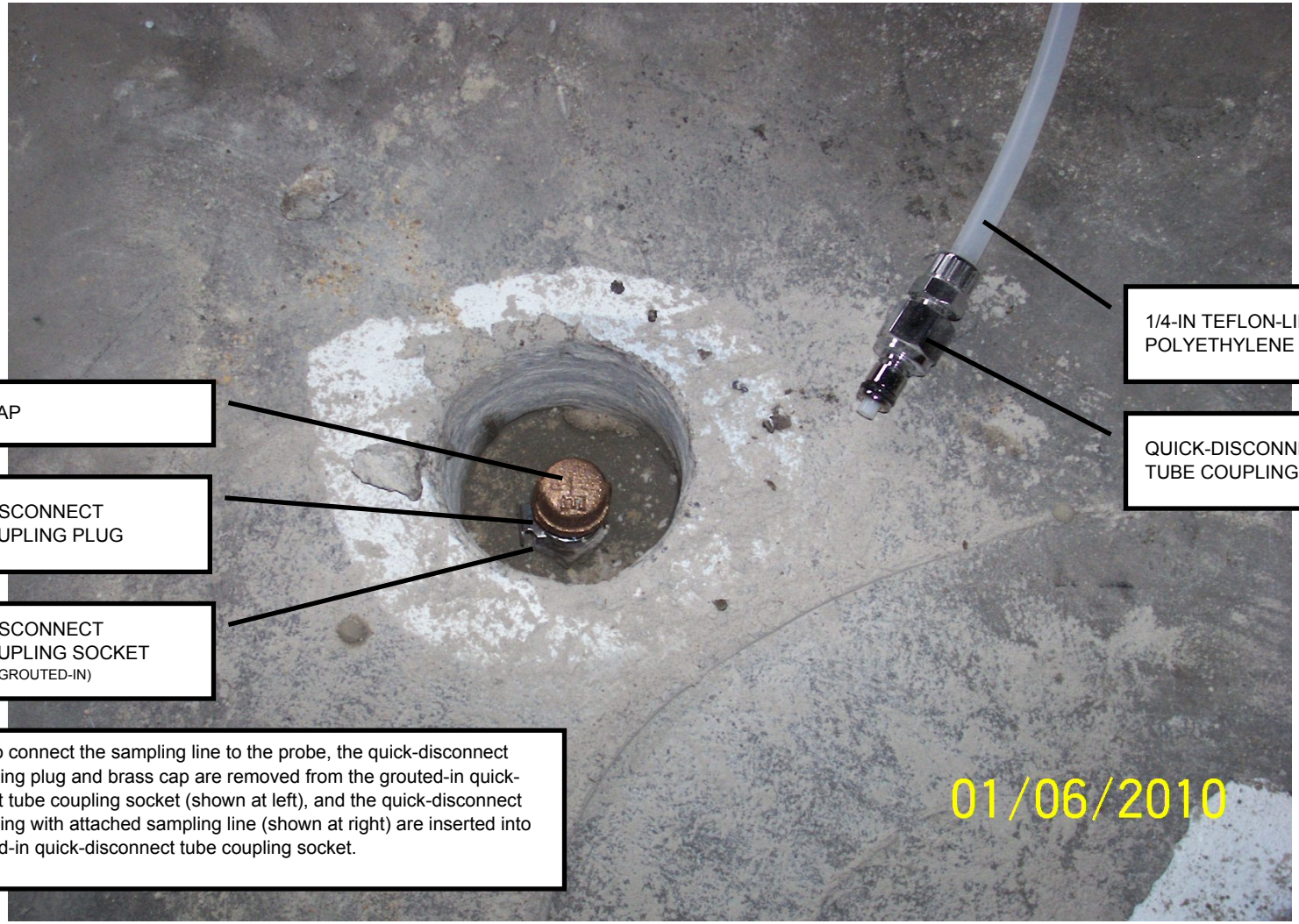
Photograph of Sub-slab Soil Gas Probe Assembly prior to Emplacement
Sub-slab Soil Gas Sampling and Analysis Report
1310 14th Street, Oakland, California

Figure
3

File: Drafted by: Date: 2010-02-12 Contract No.: 07-557B



NOTE: To connect the sampling line to the probe, the quick-disconnect tube coupling plug and brass cap are removed from the grouted-in quick-disconnect tube coupling socket (shown at left), and the quick-disconnect tube coupling with attached sampling line (shown at right) are inserted into the grouted-in quick-disconnect tube coupling socket.

IRIS ENVIRONMENTAL
1438 Webster Street, Suite 302
Oakland, California 94612
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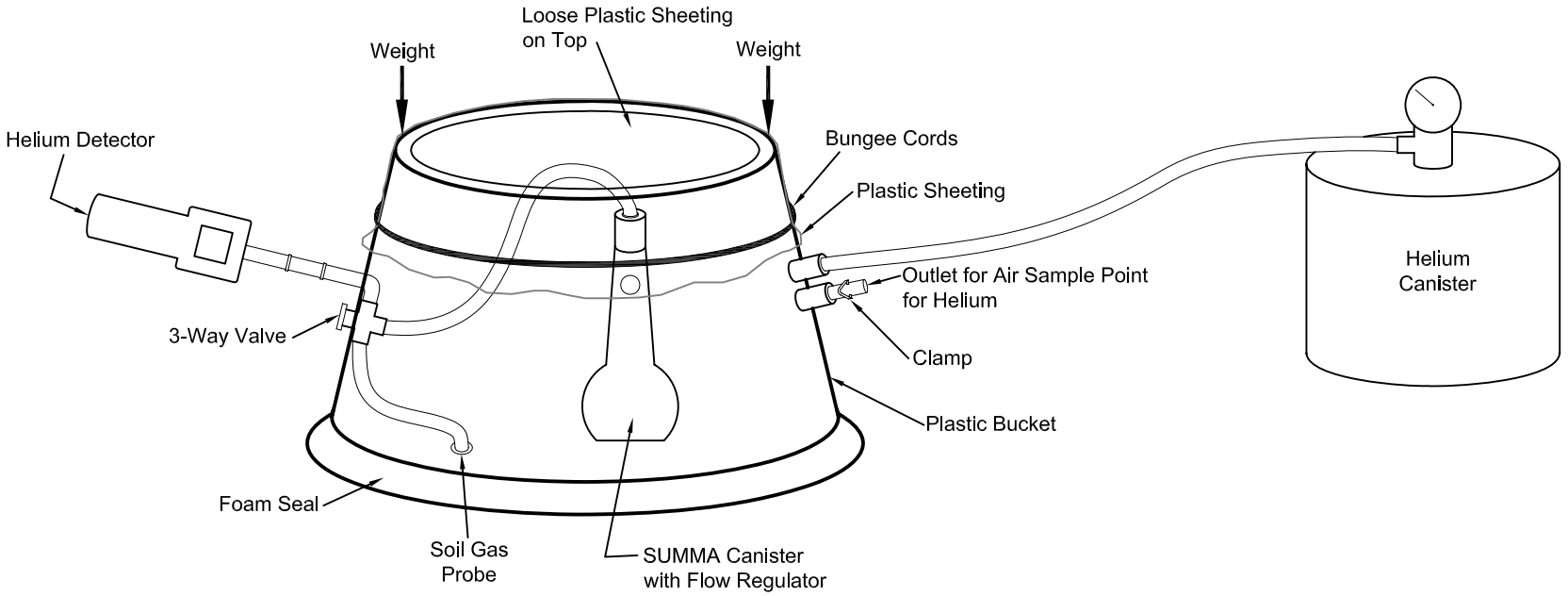
Photograph of Sub-slab Soil Gas Probe Assembly after Emplacement
Sub-slab Soil Gas Sampling and Analysis Report
1310 14th Street, Oakland, California

Figure
4

File: Drafted by: Date: 2010-02-12 Contract No.: 07-557B

Helium Shroud Schematic



IRIS ENVIRONMENTAL
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Helium Shroud Leak-Detection Apparatus
Sub-slab Soil Gas Sampling and Analysis Report
1310 14th Street, Oakland, California

Figure
5

Drafter: EC | Date: 02/11/10 | Contract Number: 07-557B

Appendix A

Air Toxics Ltd. Work Order No. 1001109R2

Air Toxics LTD.
Laboratory Services Since 1989

2/18/2010

Ms. Rebecca Lawrence
Iris Environmental
1438 Webster Street
Suite 302
Oakland CA 94612

Project Name: Carnation Dairy
Project #: 07-557B
Workorder #: 1001109R2

Dear Ms. Rebecca Lawrence

The following report includes the data for the above referenced project for sample(s) received on 1/8/2010 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Kelly Buettner at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Kelly Buettner

Project Manager

Air Toxics LTD.
Laboratory Services Since 1989

WORK ORDER #: 1001109R2

Work Order Summary

CLIENT:	Ms. Rebecca Lawrence Iris Environmental 1438 Webster Street Suite 302 Oakland, CA 94612	**BILL TO:**	Ms. Rebecca Lawrence Iris Environmental 1438 Webster Street Suite 302 Oakland, CA 94612
PHONE:	510-834-4747x40	**P.O. #**	
FAX:	510-834-4199	**PROJECT #**	07-557B Carnation Dairy
DATE RECEIVED:	01/08/2010	**CONTACT:**	Kelly Buettner
DATE COMPLETED:	01/25/2010		
DATE REISSUED:	02/17/2010		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
01A	SSG-1-20100106	Modified TO-15	3.6 "Hg	5 psi
02A	SSG-2-20100106	Modified TO-15	5.4 "Hg	5 psi
03A	SSG-2-20100106-DUP	Modified TO-15	5.6 "Hg	5 psi
04A	SSG-3-20100106	Modified TO-15	4.0 "Hg	5 psi
05A	SSG-4-20100106	Modified TO-15	5.0 "Hg	5 psi
05AA	SSG-4-20100106 Lab Duplicate	Modified TO-15	5.0 "Hg	5 psi
06A	SSG-5-20100106	Modified TO-15	5.4 "Hg	5 psi
07A	SSG-6-20100106	Modified TO-15	3.8 "Hg	5 psi
08A	Trip Blank	Modified TO-15	28.6 "Hg	5 psi
09A	Lab Blank	Modified TO-15	NA	NA
09B	Lab Blank	Modified TO-15	NA	NA
10A	CCV	Modified TO-15	NA	NA
10B	CCV	Modified TO-15	NA	NA
11A	LCS	Modified TO-15	NA	NA
11B	LCS	Modified TO-15	NA	NA

CERTIFIED BY: Linda D. Fruman DATE: 02/18/10

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/09, Expiration date: 06/30/10
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

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LABORATORY NARRATIVE
Modified TO-15
Iris Environmental
Workorder# 1001109R2

Eight 6 Liter Summa Canister (100% Certified) samples were received on January 08, 2010. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	***TO-15***	***ATL Modifications***
ICAL %RSD acceptance criteria	+- 30% RSD with 2 compounds allowed out to < 40% RSD	30% RSD with 4 compounds allowed out to < 40% RSD
Daily Calibration	+- 30% Difference	</= 30% Difference with four allowed out up to </=40%.; flag and narrate outliers
Blank and standards	Zero air	Nitrogen
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request

Receiving Notes

The Chain of Custody (COC) information for sample SSG-3-20100106 did not match the entry on the sample tag with regard to sample identification. The information on the COC was used to process and report the sample.

Sample identification for sample SSG-1-20100106 was not provided on the sample tag. Therefore the information on the Chain of Custody was used to process and report the sample.

Analytical Notes

The reported CCV for each daily batch may be derived from more than one analytical file due to the client's request for non-standard compounds.

Non-standard compounds may have different acceptance criteria than the standard TO-14A/TO-15 compound list as per contract or verbal agreement.

All Quality Control Limit exceedences and affected sample results are noted by flags. Each flag is defined at the bottom of this Case Narrative and on each Sample Result Summary page.

PER CLIENT REQUEST THE WORK ORDER WAS REISSUED ON FEBRUARY 5, 2010 TO AMEND THE TARGET COMPOUND LIST.

PER CLIENT REQUEST THE WORK ORDER WAS REISSUED ON FEBRUARY 17, 2010 TO AMEND THE PREVIOUSLY REPORTED NARRATIVE.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction not performed).

J - Estimated value.

E - Exceeds instrument calibration range.

S - Saturated peak.

Q - Exceeds quality control limits.

U - Compound analyzed for but not detected above the reporting limit.

UJ- Non-detected compound associated with low bias in the CCV

N - The identification is based on presumptive evidence.

File extensions may have been used on the data analysis sheets and indicates as follows:

a-File was requantified

b-File was quantified by a second column and detector

r1-File was requantified for the purpose of reissue

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-1-20100106

Lab ID#: 1001109R2-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.15	1.6	0.75	8.1
Freon 11	0.15	0.37	0.85	2.1
Ethanol	0.76	1.9	1.4	3.6
Acetone	0.76	18	1.8	43
Methylene Chloride	0.30	0.34	1.0	1.2
Hexane	0.15	0.63	0.54	2.2
2-Butanone (Methyl Ethyl Ketone)	0.15	2.5	0.45	7.5
Cyclohexane	0.15	0.81	0.52	2.8
Benzene	0.15	2.0	0.48	6.5
Heptane	0.15	0.61	0.62	2.5
4-Methyl-2-pentanone	0.15	0.52	0.62	2.2
Toluene	0.15	14	0.57	54
Ethyl Benzene	0.15	1.7	0.66	7.2
m,p-Xylene	0.15	7.7	0.66	33
o-Xylene	0.15	3.0	0.66	13
4-Ethyltoluene	0.15	4.4	0.75	22
1,3,5-Trimethylbenzene	0.15	1.6	0.75	8.0
1,2,4-Trimethylbenzene	0.15	5.4	0.75	26
TPH ref. to Gasoline (MW=100)	3.0	280	12	1200

Client Sample ID: SSG-2-20100106

Lab ID#: 1001109R2-02A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.52	0.81	2.6
Freon 11	0.16	0.21	0.92	1.2
Ethanol	0.82	1.0	1.5	1.9
Acetone	0.82	13	1.9	30
Hexane	0.16	0.18	0.57	0.64
2-Butanone (Methyl Ethyl Ketone)	0.16	0.95	0.48	2.8
Benzene	0.16	1.3	0.52	4.3
4-Methyl-2-pentanone	0.16	0.19	0.67	0.79
Toluene	0.16	2.4	0.61	9.0
Tetrachloroethene	0.16	0.39	1.1	2.7
Ethyl Benzene	0.16	0.50	0.71	2.2
m,p-Xylene	0.16	2.8	0.71	12

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-2-20100106

Lab ID#: 1001109R2-02A

o-Xylene	0.16	1.4	0.71	6.0
4-Ethyltoluene	0.16	0.71	0.80	3.5
1,3,5-Trimethylbenzene	0.16	0.40	0.80	2.0
1,2,4-Trimethylbenzene	0.16	0.96	0.80	4.7
TPH ref. to Gasoline (MW=100)	3.3	150	13	600

Client Sample ID: SSG-2-20100106-DUP

Lab ID#: 1001109R2-03A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.50	0.82	2.5
Freon 11	0.16	0.20	0.93	1.2
Ethanol	0.82	1.8	1.6	3.4
Acetone	0.82	18	2.0	43
2-Butanone (Methyl Ethyl Ketone)	0.16	1.8	0.49	5.2
Benzene	0.16	1.3	0.53	4.3
4-Methyl-2-pentanone	0.16	0.24	0.68	1.0
Toluene	0.16	2.4	0.62	8.9
Tetrachloroethene	0.16	0.44	1.1	3.0
Ethyl Benzene	0.16	0.50	0.72	2.2
m,p-Xylene	0.16	2.7	0.72	12
o-Xylene	0.16	1.2	0.72	5.3
4-Ethyltoluene	0.16	0.60	0.81	3.0
1,3,5-Trimethylbenzene	0.16	0.38	0.81	1.9
1,2,4-Trimethylbenzene	0.16	0.93	0.81	4.6
TPH ref. to Gasoline (MW=100)	3.3	140	13	580

Client Sample ID: SSG-3-20100106

Lab ID#: 1001109R2-04A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.61	0.77	3.0
Chloromethane	0.16	0.18	0.32	0.38
1,3-Butadiene	0.16	0.42	0.34	0.92
Ethanol	0.78	3.2	1.5	6.1
Acetone	0.78	140 E	1.8	340 E
2-Propanol	0.78	1.2	1.9	2.9
Carbon Disulfide	0.78	0.83	2.4	2.6

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-3-20100106

Lab ID#: 1001109R2-04A

Methylene Chloride	0.31	0.56	1.1	1.9
Hexane	0.16	0.83	0.55	2.9
2-Butanone (Methyl Ethyl Ketone)	0.16	4.8	0.46	14
Cyclohexane	0.16	0.82	0.53	2.8
Benzene	0.16	6.3	0.50	20
Heptane	0.16	0.57	0.64	2.4
4-Methyl-2-pentanone	0.16	1.1	0.63	4.6
Toluene	0.16	18	0.58	69
Tetrachloroethene	0.16	6.5	1.0	44
Ethyl Benzene	0.16	3.3	0.67	14
m,p-Xylene	0.16	15	0.67	65
o-Xylene	0.16	5.8	0.67	25
Styrene	0.16	0.44	0.66	1.9
4-Ethyltoluene	0.16	6.4	0.76	32
1,3,5-Trimethylbenzene	0.16	2.6	0.76	13
1,2,4-Trimethylbenzene	0.16	7.1	0.76	35
TPH ref. to Gasoline (MW=100)	3.1	880	13	3600

Client Sample ID: SSG-4-20100106

Lab ID#: 1001109R2-05A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.49	0.80	2.4
1,3-Butadiene	0.16	0.35	0.36	0.78
Freon 11	0.16	3.2	0.90	18
Ethanol	0.80	1.5	1.5	2.9
Acetone	0.80	17	1.9	40
Hexane	0.16	110 E	0.57	390 E
2-Butanone (Methyl Ethyl Ketone)	0.16	1.7	0.47	4.9
Cyclohexane	0.16	47	0.55	160
Benzene	0.16	4.3	0.51	14
Heptane	0.16	100 E	0.66	420 E
Toluene	0.16	11	0.61	42
Ethyl Benzene	0.16	4.1	0.70	18
m,p-Xylene	0.16	19	0.70	83
o-Xylene	0.16	6.7	0.70	29
4-Ethyltoluene	0.16	6.9	0.79	34
1,3,5-Trimethylbenzene	0.16	2.1	0.79	10

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-4-20100106

Lab ID#: 1001109R2-05A

1,2,4-Trimethylbenzene	0.16	5.9	0.79	29
Naphthalene	0.80	2.5	4.2	13
TPH ref. to Gasoline (MW=100)	3.2	2900	13	12000

Client Sample ID: SSG-4-20100106 Lab Duplicate

Lab ID#: 1001109R2-05AA

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.48	0.80	2.4
1,3-Butadiene	0.16	0.38	0.36	0.84
Freon 11	0.16	3.0	0.90	17
Ethanol	0.80	1.9	1.5	3.6
Acetone	0.80	17	1.9	40
Hexane	0.16	110 E	0.57	380 E
2-Butanone (Methyl Ethyl Ketone)	0.16	1.6	0.47	4.8
Cyclohexane	0.16	47	0.55	160
Benzene	0.16	4.2	0.51	14
Heptane	0.16	100 E	0.66	420 E
Toluene	0.16	11	0.61	41
Ethyl Benzene	0.16	4.1	0.70	18
m,p-Xylene	0.16	18	0.70	80
o-Xylene	0.16	6.5	0.70	28
4-Ethyltoluene	0.16	6.6	0.79	32
1,3,5-Trimethylbenzene	0.16	2.1	0.79	10
1,2,4-Trimethylbenzene	0.16	5.8	0.79	28
Naphthalene	0.80	2.4	4.2	12
TPH ref. to Gasoline (MW=100)	3.2	3200	13	13000

Client Sample ID: SSG-5-20100106

Lab ID#: 1001109R2-06A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.33	0.52	1.6	2.6
Freon 11	0.33	0.36	1.8	2.0
Ethanol	1.6	7.1	3.1	13
Acetone	1.6	87	3.9	210
2-Propanol	1.6	1.9	4.0	4.7
Hexane	0.33	0.76	1.1	2.7

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-5-20100106

Lab ID#: 1001109R2-06A

2-Butanone (Methyl Ethyl Ketone)	0.33	2.2	0.96	6.4
Cyclohexane	0.33	0.84	1.1	2.9
Benzene	0.33	4.2	1.0	13
Heptane	0.33	0.67	1.3	2.7
1,4-Dioxane	0.33	0.48	1.2	1.7
4-Methyl-2-pentanone	0.33	0.57	1.3	2.3
Toluene	0.33	7.5	1.2	28
Ethyl Benzene	0.33	1.2	1.4	5.5
m,p-Xylene	0.33	4.8	1.4	21
o-Xylene	0.33	1.6	1.4	7.0
4-Ethyltoluene	0.33	0.98	1.6	4.8
1,3,5-Trimethylbenzene	0.33	0.48	1.6	2.4
1,2,4-Trimethylbenzene	0.33	1.2	1.6	5.9
TPH ref. to Gasoline (MW=100)	6.5	370	27	1500

Client Sample ID: SSG-6-20100106

Lab ID#: 1001109R2-07A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.15	0.44	0.76	2.2
Freon 11	0.15	7.2	0.86	41
Ethanol	0.76	1.1	1.4	2.0
Freon 113	0.15	0.27	1.2	2.1
Acetone	0.76	20	1.8	48
Methylene Chloride	0.31	0.40	1.1	1.4
Hexane	0.15	0.55	0.54	1.9
2-Butanone (Methyl Ethyl Ketone)	0.15	2.1	0.45	6.2
Cyclohexane	0.15	0.42	0.53	1.4
Benzene	0.15	1.6	0.49	5.1
Heptane	0.15	0.39	0.63	1.6
Trichloroethene	0.15	1.4	0.82	7.8
Toluene	0.15	18	0.58	69
Tetrachloroethene	0.15	0.80	1.0	5.4
Ethyl Benzene	0.15	1.4	0.66	6.3
m,p-Xylene	0.15	4.8	0.66	21
o-Xylene	0.15	1.4	0.66	6.1
4-Ethyltoluene	0.15	1.5	0.75	7.3
1,3,5-Trimethylbenzene	0.15	0.55	0.75	2.7

Air Toxics LTD.
Laboratory Services Since 1989

Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: SSG-6-20100106

Lab ID#: 1001109R2-07A

1,2,4-Trimethylbenzene	0.15	1.2	0.75	5.7
TPH ref. to Gasoline (MW=100)	3.1	470	12	1900

Client Sample ID: Trip Blank

Lab ID#: 1001109R2-08A

No Detections Were Found.

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-1-20100106

Lab ID#: 1001109R2-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012021r1**	**Date of Collection: 1/6/10 12:20:00 PM**	
Dil. Factor:	**1.52**	**Date of Analysis: 1/21/10 10:25 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.15	1.6	0.75	8.1
Chloromethane	0.15	Not Detected	0.31	Not Detected
1,3-Butadiene	0.15	Not Detected	0.34	Not Detected
Freon 11	0.15	0.37	0.85	2.1
Ethanol	0.76	1.9	1.4	3.6
Freon 113	0.15	Not Detected	1.2	Not Detected
1,1-Dichloroethene	0.15	Not Detected	0.60	Not Detected
Acetone	0.76	18	1.8	43
2-Propanol	0.76	Not Detected	1.9	Not Detected
Carbon Disulfide	0.76	Not Detected	2.4	Not Detected
Methylene Chloride	0.30	0.34	1.0	1.2
Methyl tert-butyl ether	0.15	Not Detected	0.55	Not Detected
Hexane	0.15	0.63	0.54	2.2
1,1-Dichloroethane	0.15	Not Detected	0.62	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.15	2.5	0.45	7.5
cis-1,2-Dichloroethene	0.15	Not Detected	0.60	Not Detected
Tetrahydrofuran	0.76	Not Detected	2.2	Not Detected
Chloroform	0.15	Not Detected	0.74	Not Detected
1,1,1-Trichloroethane	0.15	Not Detected	0.83	Not Detected
Cyclohexane	0.15	0.81	0.52	2.8
Benzene	0.15	2.0	0.48	6.5
1,2-Dichloroethane	0.15	Not Detected	0.62	Not Detected
Heptane	0.15	0.61	0.62	2.5
Trichloroethene	0.15	Not Detected	0.82	Not Detected
1,4-Dioxane	0.15	Not Detected	0.55	Not Detected
4-Methyl-2-pentanone	0.15	0.52	0.62	2.2
Toluene	0.15	14	0.57	54
Tetrachloroethene	0.15	Not Detected	1.0	Not Detected
Chlorobenzene	0.15	Not Detected	0.70	Not Detected
Ethyl Benzene	0.15	1.7	0.66	7.2
m,p-Xylene	0.15	7.7	0.66	33
o-Xylene	0.15	3.0	0.66	13
Styrene	0.15	Not Detected	0.65	Not Detected
4-Ethyltoluene	0.15	4.4	0.75	22
1,3,5-Trimethylbenzene	0.15	1.6	0.75	8.0
1,2,4-Trimethylbenzene	0.15	5.4	0.75	26
1,3-Dichlorobenzene	0.15	Not Detected	0.91	Not Detected
1,4-Dichlorobenzene	0.15	Not Detected	0.91	Not Detected
1,2-Dichlorobenzene	0.15	Not Detected	0.91	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-1-20100106

Lab ID#: 1001109R2-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012021r1**	**Date of Collection: 1/6/10 12:20:00 PM**	
Dil. Factor:	**1.52**	**Date of Analysis: 1/21/10 10:25 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.76	Not Detected	4.0	Not Detected
TPH ref. to Gasoline (MW=100)	3.0	280	12	1200

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	106	70-130
Toluene-d8	101	70-130
4-Bromofluorobenzene	103	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-2-20100106

Lab ID#: 1001109R2-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012022r1**	**Date of Collection: 1/6/10 1:40:00 PM**	
Dil. Factor:	**1.63**	**Date of Analysis: 1/21/10 11:03 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.52	0.81	2.6
Chloromethane	0.16	Not Detected	0.34	Not Detected
1,3-Butadiene	0.16	Not Detected	0.36	Not Detected
Freon 11	0.16	0.21	0.92	1.2
Ethanol	0.82	1.0	1.5	1.9
Freon 113	0.16	Not Detected	1.2	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.65	Not Detected
Acetone	0.82	13	1.9	30
2-Propanol	0.82	Not Detected	2.0	Not Detected
Carbon Disulfide	0.82	Not Detected	2.5	Not Detected
Methylene Chloride	0.33	Not Detected	1.1	Not Detected
Methyl tert-butyl ether	0.16	Not Detected	0.59	Not Detected
Hexane	0.16	0.18	0.57	0.64
1,1-Dichloroethane	0.16	Not Detected	0.66	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.16	0.95	0.48	2.8
cis-1,2-Dichloroethene	0.16	Not Detected	0.65	Not Detected
Tetrahydrofuran	0.82	Not Detected	2.4	Not Detected
Chloroform	0.16	Not Detected	0.80	Not Detected
1,1,1-Trichloroethane	0.16	Not Detected	0.89	Not Detected
Cyclohexane	0.16	Not Detected	0.56	Not Detected
Benzene	0.16	1.3	0.52	4.3
1,2-Dichloroethane	0.16	Not Detected	0.66	Not Detected
Heptane	0.16	Not Detected	0.67	Not Detected
Trichloroethene	0.16	Not Detected	0.88	Not Detected
1,4-Dioxane	0.16	Not Detected	0.59	Not Detected
4-Methyl-2-pentanone	0.16	0.19	0.67	0.79
Toluene	0.16	2.4	0.61	9.0
Tetrachloroethene	0.16	0.39	1.1	2.7
Chlorobenzene	0.16	Not Detected	0.75	Not Detected
Ethyl Benzene	0.16	0.50	0.71	2.2
m,p-Xylene	0.16	2.8	0.71	12
o-Xylene	0.16	1.4	0.71	6.0
Styrene	0.16	Not Detected	0.69	Not Detected
4-Ethyltoluene	0.16	0.71	0.80	3.5
1,3,5-Trimethylbenzene	0.16	0.40	0.80	2.0
1,2,4-Trimethylbenzene	0.16	0.96	0.80	4.7
1,3-Dichlorobenzene	0.16	Not Detected	0.98	Not Detected
1,4-Dichlorobenzene	0.16	Not Detected	0.98	Not Detected
1,2-Dichlorobenzene	0.16	Not Detected	0.98	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-2-20100106

Lab ID#: 1001109R2-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012022r1**	**Date of Collection: 1/6/10 1:40:00 PM**	
Dil. Factor:	**1.63**	**Date of Analysis: 1/21/10 11:03 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.82	Not Detected	4.3	Not Detected
TPH ref. to Gasoline (MW=100)	3.3	150	13	600

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	107	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-2-20100106-DUP

Lab ID#: 1001109R2-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012023r1**	**Date of Collection: 1/6/10 1:40:00 PM**	
Dil. Factor:	**1.65**	**Date of Analysis: 1/21/10 11:47 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.50	0.82	2.5
Chloromethane	0.16	Not Detected	0.34	Not Detected
1,3-Butadiene	0.16	Not Detected	0.36	Not Detected
Freon 11	0.16	0.20	0.93	1.2
Ethanol	0.82	1.8	1.6	3.4
Freon 113	0.16	Not Detected	1.3	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.65	Not Detected
Acetone	0.82	18	2.0	43
2-Propanol	0.82	Not Detected	2.0	Not Detected
Carbon Disulfide	0.82	Not Detected	2.6	Not Detected
Methylene Chloride	0.33	Not Detected	1.1	Not Detected
Methyl tert-butyl ether	0.16	Not Detected	0.59	Not Detected
Hexane	0.16	Not Detected	0.58	Not Detected
1,1-Dichloroethane	0.16	Not Detected	0.67	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.16	1.8	0.49	5.2
cis-1,2-Dichloroethene	0.16	Not Detected	0.65	Not Detected
Tetrahydrofuran	0.82	Not Detected	2.4	Not Detected
Chloroform	0.16	Not Detected	0.80	Not Detected
1,1,1-Trichloroethane	0.16	Not Detected	0.90	Not Detected
Cyclohexane	0.16	Not Detected	0.57	Not Detected
Benzene	0.16	1.3	0.53	4.3
1,2-Dichloroethane	0.16	Not Detected	0.67	Not Detected
Heptane	0.16	Not Detected	0.68	Not Detected
Trichloroethene	0.16	Not Detected	0.89	Not Detected
1,4-Dioxane	0.16	Not Detected	0.59	Not Detected
4-Methyl-2-pentanone	0.16	0.24	0.68	1.0
Toluene	0.16	2.4	0.62	8.9
Tetrachloroethene	0.16	0.44	1.1	3.0
Chlorobenzene	0.16	Not Detected	0.76	Not Detected
Ethyl Benzene	0.16	0.50	0.72	2.2
m,p-Xylene	0.16	2.7	0.72	12
o-Xylene	0.16	1.2	0.72	5.3
Styrene	0.16	Not Detected	0.70	Not Detected
4-Ethyltoluene	0.16	0.60	0.81	3.0
1,3,5-Trimethylbenzene	0.16	0.38	0.81	1.9
1,2,4-Trimethylbenzene	0.16	0.93	0.81	4.6
1,3-Dichlorobenzene	0.16	Not Detected	0.99	Not Detected
1,4-Dichlorobenzene	0.16	Not Detected	0.99	Not Detected
1,2-Dichlorobenzene	0.16	Not Detected	0.99	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-2-20100106-DUP

Lab ID#: 1001109R2-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012023r1**	**Date of Collection: 1/6/10 1:40:00 PM**	
Dil. Factor:	**1.65**	**Date of Analysis: 1/21/10 11:47 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.82	Not Detected	4.3	Not Detected
TPH ref. to Gasoline (MW=100)	3.3	140	13	580

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	106	70-130
Toluene-d8	101	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-3-20100106

Lab ID#: 1001109R2-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012024r1**	**Date of Collection: 1/6/10 2:50:00 PM**	
Dil. Factor:	**1.55**	**Date of Analysis: 1/21/10 12:42 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.61	0.77	3.0
Chloromethane	0.16	0.18	0.32	0.38
1,3-Butadiene	0.16	0.42	0.34	0.92
Freon 11	0.16	Not Detected	0.87	Not Detected
Ethanol	0.78	3.2	1.5	6.1
Freon 113	0.16	Not Detected	1.2	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.61	Not Detected
Acetone	0.78	140 E	1.8	340 E
2-Propanol	0.78	1.2	1.9	2.9
Carbon Disulfide	0.78	0.83	2.4	2.6
Methylene Chloride	0.31	0.56	1.1	1.9
Methyl tert-butyl ether	0.16	Not Detected	0.56	Not Detected
Hexane	0.16	0.83	0.55	2.9
1,1-Dichloroethane	0.16	Not Detected	0.63	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.16	4.8	0.46	14
cis-1,2-Dichloroethene	0.16	Not Detected	0.61	Not Detected
Tetrahydrofuran	0.78	Not Detected	2.3	Not Detected
Chloroform	0.16	Not Detected	0.76	Not Detected
1,1,1-Trichloroethane	0.16	Not Detected	0.84	Not Detected
Cyclohexane	0.16	0.82	0.53	2.8
Benzene	0.16	6.3	0.50	20
1,2-Dichloroethane	0.16	Not Detected	0.63	Not Detected
Heptane	0.16	0.57	0.64	2.4
Trichloroethene	0.16	Not Detected	0.83	Not Detected
1,4-Dioxane	0.16	Not Detected	0.56	Not Detected
4-Methyl-2-pentanone	0.16	1.1	0.63	4.6
Toluene	0.16	18	0.58	69
Tetrachloroethene	0.16	6.5	1.0	44
Chlorobenzene	0.16	Not Detected	0.71	Not Detected
Ethyl Benzene	0.16	3.3	0.67	14
m,p-Xylene	0.16	15	0.67	65
o-Xylene	0.16	5.8	0.67	25
Styrene	0.16	0.44	0.66	1.9
4-Ethyltoluene	0.16	6.4	0.76	32
1,3,5-Trimethylbenzene	0.16	2.6	0.76	13
1,2,4-Trimethylbenzene	0.16	7.1	0.76	35
1,3-Dichlorobenzene	0.16	Not Detected	0.93	Not Detected
1,4-Dichlorobenzene	0.16	Not Detected	0.93	Not Detected
1,2-Dichlorobenzene	0.16	Not Detected	0.93	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-3-20100106

Lab ID#: 1001109R2-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012024r1**	**Date of Collection: 1/6/10 2:50:00 PM**	
Dil. Factor:	**1.55**	**Date of Analysis: 1/21/10 12:42 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.78	Not Detected	4.1	Not Detected
TPH ref. to Gasoline (MW=100)	3.1	880	13	3600

E = Exceeds instrument calibration range.

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	102	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	104	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-4-20100106

Lab ID#: 1001109R2-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012107r1**	**Date of Collection: 1/6/10 3:50:00 PM**	
Dil. Factor:	**1.61**	**Date of Analysis: 1/21/10 05:18 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.49	0.80	2.4
Chloromethane	0.16	Not Detected	0.33	Not Detected
1,3-Butadiene	0.16	0.35	0.36	0.78
Freon 11	0.16	3.2	0.90	18
Ethanol	0.80	1.5	1.5	2.9
Freon 113	0.16	Not Detected	1.2	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.64	Not Detected
Acetone	0.80	17	1.9	40
2-Propanol	0.80	Not Detected	2.0	Not Detected
Carbon Disulfide	0.80	Not Detected	2.5	Not Detected
Methylene Chloride	0.32	Not Detected	1.1	Not Detected
Methyl tert-butyl ether	0.16	Not Detected	0.58	Not Detected
Hexane	0.16	110 E	0.57	390 E
1,1-Dichloroethane	0.16	Not Detected	0.65	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.16	1.7	0.47	4.9
cis-1,2-Dichloroethene	0.16	Not Detected	0.64	Not Detected
Tetrahydrofuran	0.80	Not Detected	2.4	Not Detected
Chloroform	0.16	Not Detected	0.79	Not Detected
1,1,1-Trichloroethane	0.16	Not Detected	0.88	Not Detected
Cyclohexane	0.16	47	0.55	160
Benzene	0.16	4.3	0.51	14
1,2-Dichloroethane	0.16	Not Detected	0.65	Not Detected
Heptane	0.16	100 E	0.66	420 E
Trichloroethene	0.16	Not Detected	0.86	Not Detected
1,4-Dioxane	0.16	Not Detected	0.58	Not Detected
4-Methyl-2-pentanone	0.16	Not Detected	0.66	Not Detected
Toluene	0.16	11	0.61	42
Tetrachloroethene	0.16	Not Detected	1.1	Not Detected
Chlorobenzene	0.16	Not Detected	0.74	Not Detected
Ethyl Benzene	0.16	4.1	0.70	18
m,p-Xylene	0.16	19	0.70	83
o-Xylene	0.16	6.7	0.70	29
Styrene	0.16	Not Detected	0.68	Not Detected
4-Ethyltoluene	0.16	6.9	0.79	34
1,3,5-Trimethylbenzene	0.16	2.1	0.79	10
1,2,4-Trimethylbenzene	0.16	5.9	0.79	29
1,3-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected
1,4-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected
1,2-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-4-20100106

Lab ID#: 1001109R2-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012107r1**	**Date of Collection: 1/6/10 3:50:00 PM**	
Dil. Factor:	**1.61**	**Date of Analysis: 1/21/10 05:18 PM**	

Compound	**Rpt. Limit (ppbv)**	**Amount (ppbv)**	**Rpt. Limit (ug/m3)**	**Amount (ug/m3)**
Naphthalene	0.80	2.5	4.2	13
TPH ref. to Gasoline (MW=100)	3.2	2900	13	12000

E = Exceeds instrument calibration range.

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	125	70-130
Toluene-d8	101	70-130
4-Bromofluorobenzene	104	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-4-20100106 Lab Duplicate

Lab ID#: 1001109R2-05AA

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012108r1**	**Date of Collection: 1/6/10 3:50:00 PM**	
Dil. Factor:	**1.61**	**Date of Analysis: 1/21/10 05:54 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.16	0.48	0.80	2.4
Chloromethane	0.16	Not Detected	0.33	Not Detected
1,3-Butadiene	0.16	0.38	0.36	0.84
Freon 11	0.16	3.0	0.90	17
Ethanol	0.80	1.9	1.5	3.6
Freon 113	0.16	Not Detected	1.2	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.64	Not Detected
Acetone	0.80	17	1.9	40
2-Propanol	0.80	Not Detected	2.0	Not Detected
Carbon Disulfide	0.80	Not Detected	2.5	Not Detected
Methylene Chloride	0.32	Not Detected	1.1	Not Detected
Methyl tert-butyl ether	0.16	Not Detected	0.58	Not Detected
Hexane	0.16	110 E	0.57	380 E
1,1-Dichloroethane	0.16	Not Detected	0.65	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.16	1.6	0.47	4.8
cis-1,2-Dichloroethene	0.16	Not Detected	0.64	Not Detected
Tetrahydrofuran	0.80	Not Detected	2.4	Not Detected
Chloroform	0.16	Not Detected	0.79	Not Detected
1,1,1-Trichloroethane	0.16	Not Detected	0.88	Not Detected
Cyclohexane	0.16	47	0.55	160
Benzene	0.16	4.2	0.51	14
1,2-Dichloroethane	0.16	Not Detected	0.65	Not Detected
Heptane	0.16	100 E	0.66	420 E
Trichloroethene	0.16	Not Detected	0.86	Not Detected
1,4-Dioxane	0.16	Not Detected	0.58	Not Detected
4-Methyl-2-pentanone	0.16	Not Detected	0.66	Not Detected
Toluene	0.16	11	0.61	41
Tetrachloroethene	0.16	Not Detected	1.1	Not Detected
Chlorobenzene	0.16	Not Detected	0.74	Not Detected
Ethyl Benzene	0.16	4.1	0.70	18
m,p-Xylene	0.16	18	0.70	80
o-Xylene	0.16	6.5	0.70	28
Styrene	0.16	Not Detected	0.68	Not Detected
4-Ethyltoluene	0.16	6.6	0.79	32
1,3,5-Trimethylbenzene	0.16	2.1	0.79	10
1,2,4-Trimethylbenzene	0.16	5.8	0.79	28
1,3-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected
1,4-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected
1,2-Dichlorobenzene	0.16	Not Detected	0.97	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-4-20100106 Lab Duplicate

Lab ID#: 1001109R2-05AA

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012108r1**	**Date of Collection: 1/6/10 3:50:00 PM**	
Dil. Factor:	**1.61**	**Date of Analysis: 1/21/10 05:54 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.80	2.4	4.2	12
TPH ref. to Gasoline (MW=100)	3.2	3200	13	13000

E = Exceeds instrument calibration range.

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	119	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-5-20100106

Lab ID#: 1001109R2-06A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012116r1**	**Date of Collection: 1/6/10 4:50:00 PM**	
Dil. Factor:	**3.26**	**Date of Analysis: 1/21/10 11:13 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.33	0.52	1.6	2.6
Chloromethane	0.33	Not Detected	0.67	Not Detected
1,3-Butadiene	0.33	Not Detected	0.72	Not Detected
Freon 11	0.33	0.36	1.8	2.0
Ethanol	1.6	7.1	3.1	13
Freon 113	0.33	Not Detected	2.5	Not Detected
1,1-Dichloroethene	0.33	Not Detected	1.3	Not Detected
Acetone	1.6	87	3.9	210
2-Propanol	1.6	1.9	4.0	4.7
Carbon Disulfide	1.6	Not Detected	5.1	Not Detected
Methylene Chloride	0.65	Not Detected	2.3	Not Detected
Methyl tert-butyl ether	0.33	Not Detected	1.2	Not Detected
Hexane	0.33	0.76	1.1	2.7
1,1-Dichloroethane	0.33	Not Detected	1.3	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.33	2.2	0.96	6.4
cis-1,2-Dichloroethene	0.33	Not Detected	1.3	Not Detected
Tetrahydrofuran	1.6	Not Detected	4.8	Not Detected
Chloroform	0.33	Not Detected	1.6	Not Detected
1,1,1-Trichloroethane	0.33	Not Detected	1.8	Not Detected
Cyclohexane	0.33	0.84	1.1	2.9
Benzene	0.33	4.2	1.0	13
1,2-Dichloroethane	0.33	Not Detected	1.3	Not Detected
Heptane	0.33	0.67	1.3	2.7
Trichloroethene	0.33	Not Detected	1.8	Not Detected
1,4-Dioxane	0.33	0.48	1.2	1.7
4-Methyl-2-pentanone	0.33	0.57	1.3	2.3
Toluene	0.33	7.5	1.2	28
Tetrachloroethene	0.33	Not Detected	2.2	Not Detected
Chlorobenzene	0.33	Not Detected	1.5	Not Detected
Ethyl Benzene	0.33	1.2	1.4	5.5
m,p-Xylene	0.33	4.8	1.4	21
o-Xylene	0.33	1.6	1.4	7.0
Styrene	0.33	Not Detected	1.4	Not Detected
4-Ethyltoluene	0.33	0.98	1.6	4.8
1,3,5-Trimethylbenzene	0.33	0.48	1.6	2.4
1,2,4-Trimethylbenzene	0.33	1.2	1.6	5.9
1,3-Dichlorobenzene	0.33	Not Detected	2.0	Not Detected
1,4-Dichlorobenzene	0.33	Not Detected	2.0	Not Detected
1,2-Dichlorobenzene	0.33	Not Detected	2.0	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-5-20100106

Lab ID#: 1001109R2-06A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012116r1**	**Date of Collection: 1/6/10 4:50:00 PM**	
Dil. Factor:	**3.26**	**Date of Analysis: 1/21/10 11:13 PM**	

Compound	**Rpt. Limit (ppbv)**	**Amount (ppbv)**	**Rpt. Limit (ug/m3)**	**Amount (ug/m3)**
Naphthalene	1.6	Not Detected	8.5	Not Detected
TPH ref. to Gasoline (MW=100)	6.5	370	27	1500

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	106	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	103	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-6-20100106

Lab ID#: 1001109R2-07A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012117r1**	**Date of Collection: 1/6/10 5:45:00 PM**	
Dil. Factor:	**1.53**	**Date of Analysis: 1/21/10 11:49 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.15	0.44	0.76	2.2
Chloromethane	0.15	Not Detected	0.32	Not Detected
1,3-Butadiene	0.15	Not Detected	0.34	Not Detected
Freon 11	0.15	7.2	0.86	41
Ethanol	0.76	1.1	1.4	2.0
Freon 113	0.15	0.27	1.2	2.1
1,1-Dichloroethene	0.15	Not Detected	0.61	Not Detected
Acetone	0.76	20	1.8	48
2-Propanol	0.76	Not Detected	1.9	Not Detected
Carbon Disulfide	0.76	Not Detected	2.4	Not Detected
Methylene Chloride	0.31	0.40	1.1	1.4
Methyl tert-butyl ether	0.15	Not Detected	0.55	Not Detected
Hexane	0.15	0.55	0.54	1.9
1,1-Dichloroethane	0.15	Not Detected	0.62	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.15	2.1	0.45	6.2
cis-1,2-Dichloroethene	0.15	Not Detected	0.61	Not Detected
Tetrahydrofuran	0.76	Not Detected	2.2	Not Detected
Chloroform	0.15	Not Detected	0.75	Not Detected
1,1,1-Trichloroethane	0.15	Not Detected	0.83	Not Detected
Cyclohexane	0.15	0.42	0.53	1.4
Benzene	0.15	1.6	0.49	5.1
1,2-Dichloroethane	0.15	Not Detected	0.62	Not Detected
Heptane	0.15	0.39	0.63	1.6
Trichloroethene	0.15	1.4	0.82	7.8
1,4-Dioxane	0.15	Not Detected	0.55	Not Detected
4-Methyl-2-pentanone	0.15	Not Detected	0.63	Not Detected
Toluene	0.15	18	0.58	69
Tetrachloroethene	0.15	0.80	1.0	5.4
Chlorobenzene	0.15	Not Detected	0.70	Not Detected
Ethyl Benzene	0.15	1.4	0.66	6.3
m,p-Xylene	0.15	4.8	0.66	21
o-Xylene	0.15	1.4	0.66	6.1
Styrene	0.15	Not Detected	0.65	Not Detected
4-Ethyltoluene	0.15	1.5	0.75	7.3
1,3,5-Trimethylbenzene	0.15	0.55	0.75	2.7
1,2,4-Trimethylbenzene	0.15	1.2	0.75	5.7
1,3-Dichlorobenzene	0.15	Not Detected	0.92	Not Detected
1,4-Dichlorobenzene	0.15	Not Detected	0.92	Not Detected
1,2-Dichlorobenzene	0.15	Not Detected	0.92	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: SSG-6-20100106

Lab ID#: 1001109R2-07A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012117r1**	**Date of Collection: 1/6/10 5:45:00 PM**	
Dil. Factor:	**1.53**	**Date of Analysis: 1/21/10 11:49 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.76	Not Detected	4.0	Not Detected
TPH ref. to Gasoline (MW=100)	3.1	470	12	1900

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	108	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	104	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Trip Blank

Lab ID#: 1001109R2-08A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012118r1**	**Date of Collection: 1/6/10**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/22/10 07:01 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.10	Not Detected	0.49	Not Detected
Chloromethane	0.10	Not Detected	0.21	Not Detected
1,3-Butadiene	0.10	Not Detected	0.22	Not Detected
Freon 11	0.10	Not Detected	0.56	Not Detected
Ethanol	0.50	Not Detected	0.94	Not Detected
Freon 113	0.10	Not Detected	0.77	Not Detected
1,1-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Acetone	0.50	Not Detected	1.2	Not Detected
2-Propanol	0.50	Not Detected	1.2	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
Methylene Chloride	0.20	Not Detected	0.69	Not Detected
Methyl tert-butyl ether	0.10	Not Detected	0.36	Not Detected
Hexane	0.10	Not Detected	0.35	Not Detected
1,1-Dichloroethane	0.10	Not Detected	0.40	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.10	Not Detected	0.29	Not Detected
cis-1,2-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.10	Not Detected	0.49	Not Detected
1,1,1-Trichloroethane	0.10	Not Detected	0.54	Not Detected
Cyclohexane	0.10	Not Detected	0.34	Not Detected
Benzene	0.10	Not Detected	0.32	Not Detected
1,2-Dichloroethane	0.10	Not Detected	0.40	Not Detected
Heptane	0.10	Not Detected	0.41	Not Detected
Trichloroethene	0.10	Not Detected	0.54	Not Detected
1,4-Dioxane	0.10	Not Detected	0.36	Not Detected
4-Methyl-2-pentanone	0.10	Not Detected	0.41	Not Detected
Toluene	0.10	Not Detected	0.38	Not Detected
Tetrachloroethene	0.10	Not Detected	0.68	Not Detected
Chlorobenzene	0.10	Not Detected	0.46	Not Detected
Ethyl Benzene	0.10	Not Detected	0.43	Not Detected
m,p-Xylene	0.10	Not Detected	0.43	Not Detected
o-Xylene	0.10	Not Detected	0.43	Not Detected
Styrene	0.10	Not Detected	0.42	Not Detected
4-Ethyltoluene	0.10	Not Detected	0.49	Not Detected
1,3,5-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,2,4-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,3-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,4-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,2-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Trip Blank

Lab ID#: 1001109R2-08A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012118r1**	**Date of Collection: 1/6/10**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/22/10 07:01 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.50	Not Detected	2.6	Not Detected
TPH ref. to Gasoline (MW=100)	2.0	Not Detected	8.2	Not Detected

Container Type: 6 Liter Summa Canister (100% Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	103	70-130
Toluene-d8	101	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Lab Blank

Lab ID#: 1001109R2-09A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012012**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 08:06 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.10	Not Detected	0.49	Not Detected
Chloromethane	0.10	Not Detected	0.21	Not Detected
1,3-Butadiene	0.10	Not Detected	0.22	Not Detected
Freon 11	0.10	Not Detected	0.56	Not Detected
Ethanol	0.50	Not Detected	0.94	Not Detected
Freon 113	0.10	Not Detected	0.77	Not Detected
1,1-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Acetone	0.50	Not Detected	1.2	Not Detected
2-Propanol	0.50	Not Detected	1.2	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
Methylene Chloride	0.20	Not Detected	0.69	Not Detected
Methyl tert-butyl ether	0.10	Not Detected	0.36	Not Detected
Hexane	0.10	Not Detected	0.35	Not Detected
1,1-Dichloroethane	0.10	Not Detected	0.40	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.10	Not Detected	0.29	Not Detected
cis-1,2-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.10	Not Detected	0.49	Not Detected
1,1,1-Trichloroethane	0.10	Not Detected	0.54	Not Detected
Cyclohexane	0.10	Not Detected	0.34	Not Detected
Benzene	0.10	Not Detected	0.32	Not Detected
1,2-Dichloroethane	0.10	Not Detected	0.40	Not Detected
Heptane	0.10	Not Detected	0.41	Not Detected
Trichloroethene	0.10	Not Detected	0.54	Not Detected
1,4-Dioxane	0.10	Not Detected	0.36	Not Detected
4-Methyl-2-pentanone	0.10	Not Detected	0.41	Not Detected
Toluene	0.10	Not Detected	0.38	Not Detected
Tetrachloroethene	0.10	Not Detected	0.68	Not Detected
Chlorobenzene	0.10	Not Detected	0.46	Not Detected
Ethyl Benzene	0.10	Not Detected	0.43	Not Detected
m,p-Xylene	0.10	Not Detected	0.43	Not Detected
o-Xylene	0.10	Not Detected	0.43	Not Detected
Styrene	0.10	Not Detected	0.42	Not Detected
4-Ethyltoluene	0.10	Not Detected	0.49	Not Detected
1,3,5-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,2,4-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,3-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,4-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,2-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Lab Blank

Lab ID#: 1001109R2-09A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012012**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 08:06 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.50	Not Detected	2.6	Not Detected
TPH ref. to Gasoline (MW=100)	2.0	Not Detected	8.2	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	99	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	104	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Lab Blank

Lab ID#: 1001109R2-09B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012106**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 04:34 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.10	Not Detected	0.49	Not Detected
Chloromethane	0.10	Not Detected	0.21	Not Detected
1,3-Butadiene	0.10	Not Detected	0.22	Not Detected
Freon 11	0.10	Not Detected	0.56	Not Detected
Ethanol	0.50	Not Detected	0.94	Not Detected
Freon 113	0.10	Not Detected	0.77	Not Detected
1,1-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Acetone	0.50	Not Detected	1.2	Not Detected
2-Propanol	0.50	Not Detected	1.2	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
Methylene Chloride	0.20	Not Detected	0.69	Not Detected
Methyl tert-butyl ether	0.10	Not Detected	0.36	Not Detected
Hexane	0.10	Not Detected	0.35	Not Detected
1,1-Dichloroethane	0.10	Not Detected	0.40	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.10	Not Detected	0.29	Not Detected
cis-1,2-Dichloroethene	0.10	Not Detected	0.40	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.10	Not Detected	0.49	Not Detected
1,1,1-Trichloroethane	0.10	Not Detected	0.54	Not Detected
Cyclohexane	0.10	Not Detected	0.34	Not Detected
Benzene	0.10	Not Detected	0.32	Not Detected
1,2-Dichloroethane	0.10	Not Detected	0.40	Not Detected
Heptane	0.10	Not Detected	0.41	Not Detected
Trichloroethene	0.10	Not Detected	0.54	Not Detected
1,4-Dioxane	0.10	Not Detected	0.36	Not Detected
4-Methyl-2-pentanone	0.10	Not Detected	0.41	Not Detected
Toluene	0.10	Not Detected	0.38	Not Detected
Tetrachloroethene	0.10	Not Detected	0.68	Not Detected
Chlorobenzene	0.10	Not Detected	0.46	Not Detected
Ethyl Benzene	0.10	Not Detected	0.43	Not Detected
m,p-Xylene	0.10	Not Detected	0.43	Not Detected
o-Xylene	0.10	Not Detected	0.43	Not Detected
Styrene	0.10	Not Detected	0.42	Not Detected
4-Ethyltoluene	0.10	Not Detected	0.49	Not Detected
1,3,5-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,2,4-Trimethylbenzene	0.10	Not Detected	0.49	Not Detected
1,3-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,4-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected
1,2-Dichlorobenzene	0.10	Not Detected	0.60	Not Detected

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: Lab Blank

Lab ID#: 1001109R2-09B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012106**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 04:34 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Naphthalene	0.50	Not Detected	2.6	Not Detected
TPH ref. to Gasoline (MW=100)	2.0	Not Detected	8.2	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	103	70-130
Toluene-d8	99	70-130
4-Bromofluorobenzene	98	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: CCV

Lab ID#: 1001109R2-10A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012009**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 06:13 PM**	

Compound	%Recovery
Freon 12	97
Chloromethane	70
1,3-Butadiene	83
Freon 11	98
Ethanol	82
Freon 113	96
1,1-Dichloroethene	92
Acetone	87
2-Propanol	89
Carbon Disulfide	88
Methylene Chloride	76
Methyl tert-butyl ether	93
Hexane	89
1,1-Dichloroethane	91
2-Butanone (Methyl Ethyl Ketone)	88
cis-1,2-Dichloroethene	90
Tetrahydrofuran	87
Chloroform	95
1,1,1-Trichloroethane	98
Cyclohexane	90
Benzene	89
1,2-Dichloroethane	101
Heptane	89
Trichloroethene	97
1,4-Dioxane	90
4-Methyl-2-pentanone	92
Toluene	94
Tetrachloroethene	96
Chlorobenzene	93
Ethyl Benzene	91
m,p-Xylene	95
o-Xylene	96
Styrene	94
4-Ethyltoluene	103
1,3,5-Trimethylbenzene	93
1,2,4-Trimethylbenzene	103
1,3-Dichlorobenzene	100
1,4-Dichlorobenzene	103
1,2-Dichlorobenzene	99

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: CCV

Lab ID#: 1001109R2-10A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012009**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 06:13 PM**	

Compound	**%Recovery**
Naphthalene	109
TPH ref. to Gasoline (MW=100)	114

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	105	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	105	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: CCV

Lab ID#: 1001109R2-10B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012103**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 02:34 PM**	

Compound	%Recovery
Freon 12	96
Chloromethane	73
1,3-Butadiene	83
Freon 11	96
Ethanol	88
Freon 113	96
1,1-Dichloroethene	95
Acetone	88
2-Propanol	91
Carbon Disulfide	90
Methylene Chloride	74
Methyl tert-butyl ether	92
Hexane	89
1,1-Dichloroethane	91
2-Butanone (Methyl Ethyl Ketone)	89
cis-1,2-Dichloroethene	93
Tetrahydrofuran	87
Chloroform	95
1,1,1-Trichloroethane	96
Cyclohexane	90
Benzene	89
1,2-Dichloroethane	96
Heptane	89
Trichloroethene	96
1,4-Dioxane	87
4-Methyl-2-pentanone	91
Toluene	93
Tetrachloroethene	97
Chlorobenzene	94
Ethyl Benzene	92
m,p-Xylene	96
o-Xylene	100
Styrene	96
4-Ethyltoluene	105
1,3,5-Trimethylbenzene	92
1,2,4-Trimethylbenzene	104
1,3-Dichlorobenzene	100
1,4-Dichlorobenzene	101
1,2-Dichlorobenzene	99

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: CCV

Lab ID#: 1001109R2-10B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012103**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 02:34 PM**	

Compound	**%Recovery**
Naphthalene	109
TPH ref. to Gasoline (MW=100)	111

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	101	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	104	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: LCS

Lab ID#: 1001109R2-11A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012010**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 06:49 PM**	

Compound	%Recovery
Freon 12	87
Chloromethane	67 Q
1,3-Butadiene	76
Freon 11	87
Ethanol	67
Freon 113	78
1,1-Dichloroethene	76
Acetone	78
2-Propanol	78
Carbon Disulfide	80
Methylene Chloride	67 Q
Methyl tert-butyl ether	83
Hexane	78
1,1-Dichloroethane	79
2-Butanone (Methyl Ethyl Ketone)	76
cis-1,2-Dichloroethene	81
Tetrahydrofuran	78
Chloroform	82
1,1,1-Trichloroethane	85
Cyclohexane	80
Benzene	78
1,2-Dichloroethane	85
Heptane	77
Trichloroethene	86
1,4-Dioxane	77
4-Methyl-2-pentanone	80
Toluene	78
Tetrachloroethene	86
Chlorobenzene	85
Ethyl Benzene	84
m,p-Xylene	86
o-Xylene	86
Styrene	85
4-Ethyltoluene	93
1,3,5-Trimethylbenzene	80
1,2,4-Trimethylbenzene	91
1,3-Dichlorobenzene	89
1,4-Dichlorobenzene	91
1,2-Dichlorobenzene	88

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: LCS

Lab ID#: 1001109R2-11A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012010**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/20/10 06:49 PM**	

Compound	**%Recovery**
Naphthalene	83
TPH ref. to Gasoline (MW=100)	Not Spiked

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	104	70-130
Toluene-d8	99	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: LCS

Lab ID#: 1001109R2-11B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012104**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 03:14 PM**	

Compound	%Recovery
Freon 12	86
Chloromethane	65 Q
1,3-Butadiene	74
Freon 11	86
Ethanol	66
Freon 113	77
1,1-Dichloroethene	74
Acetone	77
2-Propanol	76
Carbon Disulfide	79
Methylene Chloride	62 Q
Methyl tert-butyl ether	82
Hexane	78
1,1-Dichloroethane	79
2-Butanone (Methyl Ethyl Ketone)	75
cis-1,2-Dichloroethene	83
Tetrahydrofuran	78
Chloroform	82
1,1,1-Trichloroethane	84
Cyclohexane	80
Benzene	78
1,2-Dichloroethane	84
Heptane	77
Trichloroethene	84
1,4-Dioxane	78
4-Methyl-2-pentanone	80
Toluene	79
Tetrachloroethene	84
Chlorobenzene	85
Ethyl Benzene	83
m,p-Xylene	86
o-Xylene	87
Styrene	86
4-Ethyltoluene	94
1,3,5-Trimethylbenzene	85
1,2,4-Trimethylbenzene	95
1,3-Dichlorobenzene	90
1,4-Dichlorobenzene	94
1,2-Dichlorobenzene	89

Air Toxics LTD.
Laboratory Services Since 1989

Client Sample ID: LCS

Lab ID#: 1001109R2-11B

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**e012104**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 1/21/10 03:14 PM**	

Compound	**%Recovery**
Naphthalene	89
TPH ref. to Gasoline (MW=100)	Not Spiked

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	100	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	103	70-130

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager: Greg Nobleit
Collected by: (Print and Sign) Rebecca Lawrence
Company: ITS Environmental Email: gnobleit@its-enviro.com
Address: 1438 Webster St. Ste 303 City: Oakland State: CA Zip: 94612
Phone: (510) 834-4749 Fax: (510) 834-4199

Project Info:
P.O. #:
Project #: 07-557B
Project Name: Carnation Dairy

Turn Around Time:
☒ Normal
☐ Rush
specify

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
01A	SSG-1-20100106	12938	1/6/10	12:20	TO-15LL+naphthalene +TPH-g	-30	-6		
02A	SSG-2-20100106	05699	1/6/10	13:40	TO-15LL+naphthalene+TPH-g	-30	-7		
03A	SSG-2-20100106-DUP	5744	1/6/10	13:40	TO-15LL+naphthalene +TPH-g	-30	-6		
04A	SSG-3-20100106	10973	1/6/10	14:50	TO-15LL+naphthalene +TPH-g	-30	-7		
05A	SSG-4-20100106	13670	1/6/10	15:50	TO-15LL+naphthalene +TPH-g	-30	-7		
06A	SSG-5-20100106	33547	1/6/10	16:50	TO-15LL+naphthalene +TPH-g	-30	-7		
07A	SSG-6-20100106	23993	1/6/10	17:45	TO-15LL+naphthalene +TPH-g	-30	-7		
08A	Trip Blank	931	1/6/10	NA	TO-15LL+naphthalene +TPH-g	-30	-30		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Rebecca Lawrence	1/7/10 1330	Monica Gregen ATL	
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
			1/8/10 945
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
Please analyze TPH-g by TO-15.
Add naphthalene to TO-15-Low-Level.

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed Ex		NA	Good	Yes / No / (None)	1001109

Form 1383 rev.11

Appendix B

Field Notes

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #:** 07-557B	**Boring #:** SSG-1
Date: 1/6/10	**Weather:**	**Sampler:**
# of purge volumes: 3 ~~2.150 mL~~ RLL	**Leak check compound:** Helium	**Sample flow rate:** 167 mL/min

Helium Shroud

% Helium in shroud prior to sampling: 53.2%	**% Helium in shroud post sampling:** 50.5%
Added Helium to shroud during sampling? (Y) / N	
% Helium in sample line prior to sampling: 2.5%	**% Helium in sample line post sampling:** 2.7%

Sample ID: SSG-1 ~~20090106~~ 20100106

Depth: 8.0"	**Time installed:** 9:15	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3): 3/16"
Sample start time: 12:20	**Sample finish time:** 12:55	**Sample volume:** ~6 L
Initial Summa vacuum: -30"	**Final Summa vacuum:** -6	
Analyses: TO15 Low-level + naphthalene + TO-3 (TPH-g)	**Summa ID#:** 12938	**Flow Controller ID#:** 06073
Notes: fine sand/silt beneath slab; 8" thick slab; probe length = 3 3/4"; 2 1/2 ft tubing; 1 1/2" sandpack		

Sample ID (Duplicate): _____

Depth:	**Time installed:**	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time:	**Sample finish time:**	**Sample volume:** ~6 L
Initial Summa vacuum:	**Final Summa vacuum:**	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:**	**Flow Controller ID#:**
Notes:		

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #:** 07-557B	**Boring #:** SSG-2
Date: 1/6/10	**Weather:**	**Sampler:**
# of purge volumes: 3 78mL	**Leak check compound:** Helium	**Sample flow rate:** 167 mL/min

Helium Shroud

% Helium in shroud prior to sampling: 49.9	**% Helium in shroud post sampling:** 47.6
Added Helium to shroud during sampling? (Y) N	
% Helium in sample line prior to sampling: 2.58	**% Helium in sample line post sampling:** 0.08

Sample ID: SSG-2-20100106

Depth: ~~7 3/4~~" 8"	**Time installed:** 9:39	**Calculated purge volume** (R_{tube} (3/16")^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time: 13:40	**Sample finish time:** 14:09	**Sample volume:** ~6 L
Initial Summa vacuum: -30"	**Final Summa vacuum:** -7	4
Analyses: TO15 Low-level + naphthalene + TO-3 (TPH)	**Summa ID#:** 05699	**Flow Controller ID#:** 247
Notes: 6"x5 lab Probe Length = 7 3/4"	11/2" sand layer Tubing Length = 2 1/2 ft	

Sample ID (Duplicate): SSG-2-20100106-DUP

Depth: same	**Time installed:** same	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time: 13:40	**Sample finish time:** 14:13	**Sample volume:** ~6 L
Initial Summa vacuum: -30"	**Final Summa vacuum:** -6	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:** 5744	**Flow Controller ID#:** 354
Notes:		

-7 14:09

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #: 07-557B**	**Boring #:** SSG-3
Date:	**Weather:**	**Sampler:**
# of purge volumes: 3	**Leak check compound: Helium**	**Sample flow rate: 167 mL/min**

Helium Shroud

% Helium in shroud prior to sampling: 49.78	**% Helium in shroud post sampling:** 48.4
Added Helium to shroud during sampling? (Y)/ N	
% Helium in sample line prior to sampling: 14,425 ppm	**% Helium in sample line post sampling:** 3.2%

Sample ID: SSG-3- 20100106

Depth: ~~8~~ 7"	**Time installed:** 10:01	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3): 3/16"
Sample start time: 14:50	**Sample finish time:** 15:30	**Sample volume: ~6 L**
Initial Summa vacuum: -30"	**Final Summa vacuum:** -7	
Analyses: TO15 Low-level + naphthalene +TO-3 (TPH-g)	**Summa ID#:** 10973	**Flow Controller ID#:** 820
Notes: ~~7" Slab 8" hole~~ 6" slab 7" hole Probe length = 6 3/4"		

Sample ID (Duplicate): _____

Depth:	**Time installed:**	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time:	**Sample finish time:**	**Sample volume: ~6 L**
Initial Summa vacuum:	**Final Summa vacuum:**	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:**	**Flow Controller ID#:**
Notes:		

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #: 07-557B**	**Boring #:** SSG-4
Date:	**Weather:**	**Sampler:**
# of purge volumes: 3 78 mL	**Leak check compound: Helium**	**Sample flow rate: 167 mL/min**

Helium Shroud

% Helium in shroud prior to sampling: 50.0	**% Helium in shroud post sampling:** 47.68
Added Helium to shroud during sampling? (Y) / N	
% Helium in sample line prior to sampling: 0 ppm	**% Helium in sample line post sampling:** 0ppm

Sample ID: SSG-4-20100106

Depth: 11"	**Time installed:** 10:24	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3): 3/16"
Sample start time: 15:50	**Sample finish time:** 16:24	**Sample volume: ~6 L**
Initial Summa vacuum: -30"	**Final Summa vacuum:** -7	
Analyses: TO15 Low-level + naphthalene +TO-3 (TPH-g)	**Summa ID#:** 13670	**Flow Controller ID#:** 893
Notes: 8 1/2" slab 11" hole 10 3/4" probe 2" sandpack 2 1/2 ft tubing		

Sample ID (Duplicate): _____

Depth:	**Time installed:**	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time:	**Sample finish time:**	**Sample volume: ~6 L**
Initial Summa vacuum:	**Final Summa vacuum:**	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:**	**Flow Controller ID#:**
Notes:		

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #: 07-557B**	**Boring #:** SSG-5
Date:	**Weather:**	**Sampler:**
# of purge volumes: 3	**Leak check compound: Helium**	**Sample flow rate: 167 mL/min**

Helium Shroud

% Helium in shroud prior to sampling: 40.2	**% Helium in shroud post sampling:** 38.5
Added Helium to shroud during sampling? (Y) / N	
% Helium in sample line prior to sampling: 0.0	**% Helium in sample line post sampling:** 7000 ppm

Sample ID:_____

Depth: 8 1/2"	**Time installed:** 10:53	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3): 3/16"
Sample start time: 16:50	**Sample finish time:** 17:24	**Sample volume: ~6 L**
Initial Summa vacuum: -30"	**Final Summa vacuum:** -7	
Analyses: TO15 Low-level + naphthalene +TO-3 (TPH-g)	**Summa ID#:** 33547	**Flow Controller ID#:** 40786
Notes: 8 1/2" hole 8" slab	1 1/2" sandpack 6 1/4" probe	

Sample ID (Duplicate):_____

Depth:	**Time installed:**	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3):
Sample start time:	**Sample finish time:**	**Sample volume: ~6 L**
Initial Summa vacuum:	**Final Summa vacuum:**	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:**	**Flow Controller ID#:**
Notes:		

SOIL GAS SAMPLING LOG
IRIS ENVIRONMENTAL

COMPLETE ONE LOG PER SAMPLING LOCATION 1 in^3=16.387 ml, 1 gallon=2785.412 ml

Project: Carnation Dairy	**Contract #: 07-557B**	**Boring #:** SSG-6
Date:	**Weather:**	**Sampler:**
# of purge volumes: 3	**Leak check compound: Helium**	**Sample flow rate: 167 mL/min**

Helium Shroud

% Helium in shroud prior to sampling: 41.2	**% Helium in shroud post sampling:** 48.2
Added Helium to shroud during sampling? Y / N	
% Helium in sample line prior to sampling: 825 ppm	**% Helium in sample line post sampling:** 3.1%

Sample ID:_____

Depth:	**Time installed:** 1115	**Calculated purge volume** (R_{tube} (3/16")^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3)**:**
Sample start time: 1815 ~~1745~~	**Sample finish time:** 1849	**Sample volume: ~6 L**
Initial Summa vacuum: -30"	**Final Summa vacuum:** -7	
Analyses: TO15 Low-level + naphthalene +TO-3 (TPH-g)	**Summa ID#:** 23993	**Flow Controller ID#:** 6748
Notes: 9 1/2" hole 6" slab		

Sample ID (Duplicate):_____

Depth:	**Time installed:**	**Calculated purge volume** (R_{tube}^2*3.14*L_{tube} + $R_{borehole}^2$*3.14*$H_{sandpack}$*0.3)**:**
Sample start time:	**Sample finish time:**	**Sample volume: ~6 L**
Initial Summa vacuum: ~~-30"~~	**Final Summa vacuum:**	
Analyses: TO15 Low-level + naphthalene	**Summa ID#:** ~~5744~~ ~~36045~~ (AB)	**Flow Controller ID#:** ~~354~~ ~~146~~ (AB)
Notes: moved to SSG-2 (dup)		