CONESTOGA-ROVERS
& ASSOCIATES

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May 25, 2007

Mr. Barney Chan
Alameda County Department of Environmental Health (ACDEH)
1131 Harbor Bay Parkway
Alameda, CA 94502

Re: **Risk Assessment and Proposed Vapor Survey**
Former Chevron Station 9-0020
1633 Harrison Street
Oakland, California
CRA Project No. 311956

Dear Mr. Chan:

Conestoga-Rovers & Associates (CRA) has prepared this *Risk Assessment and Proposed Vapor Survey* on behalf of Chevron Environmental Management Company (Chevron) for the site referenced above. On April 16, 2007, Chevron and CRA recently met with the Oakland Housing Authority, the proposed developer of the site and their consultant, to discuss measures necessary to facilitate submittal of a U.S Department of Housing and Urban Development (HUD) application for financing for the construction of senior housing on the subject site. Requirements for HUD financing include an approved Remedial Action Plan. Chevron conducted an onsite Tier II Risk-Based Corrective Action (RBCA) evaluation to estimate hazards due to exposures of residual concentrations of petroleum hydrocarbons and to identify any data gaps at the request of ACDEH in a letter dated April 27, 2007 (Attachment A). A brief description of the site background, the results of the RBCA, and our proposed investigation scope of work are described below.

SITE BACKGROUND

Site Description: The site is a former Chevron gasoline service station located on the southwest of 17th and Harrison Streets in Oakland, California. Chevron operated on the site until 1972 when the station was shut down. Since that time the site has been used for parking. The site is located in downtown Oakland in an area of commercial and multi-unit residential. Local topography is flat at an elevation of approximately 40 ft above mean sea level (Figure 1).

1988 Soil Vapor Survey Investigation: A soil vapor survey was conducted in January 1988 when 22 samples were collected at 11 locations around the site. The highest hydrocarbon concentrations were detected in the vicinity of the former waste oilunderground storage tank (UST) in the westcentral section of the site.

1988 Monitoring Well Installation: Western Geologic Resources (WGR) drilled and installed wells MW-1 through MW-3 in October 1988. No benzene, toluene, ethylbenzene, and xylenes (BTEX) nor total fuel hydrocarbons were detected in groundwater samples from the three wells. However, halogenated volatile organics (HVOs) were detected. These compounds were later identified as originating from another source, likely one of several nearby former dry cleaners.

1989 Soil Boring and Monitoring Well Installation: WGR drilled five soil borings and four wells (MW-4 through MW-8). Total petroleum hydrocarbons as diesel (TPHd) was detected in soil up to 600 parts-per-million (ppm) at 9.6 feet below grade (fbg) near the former waste oil UST. Total petroleum hydrocarbons as gasoline (TPHg) was detected at a reported concentration of 50,000 ppm at 23.5 fbg in MW7 near the northeastern corner of the property.

June 1990 Offsite Well Installation: WGR installed four offsite wells, MW-9 through MW-12, in June 1990. The purpose of this was to delineate the extent of hydrocarbons down-gradient and cross-gradient of the site. No hydrocarbons were detected in any soil samples collected during this phase of investigation. A groundwater sample from well MW-9 contained 5,700 ppb TPHg and 47 ppb benzene. Offsite wells MW-10 through MW-12 contained HVOs which had been determined to originate from other sources in the area.

October 1991 Offsite Well Installation: Pacific Environmental Group (PEG) installed well MW-13 to further evaluate the extent of the dissolved hydrocarbon plume. Up-gradient monitoring well MW-14 was installed to investigate suspected, and subsequently confirmed, offsite origination of halogenated volatile organics (HVOs). Additionally, four soil borings, B-A through B-D, were drilled to assess the extent of hydrocarbons in the vicinity of MW-7 due to a reported soil sample at 23.5 fbg containing 50,000 ppm TPHg. Only B-D contained detected hydrocarbons at 120 ppm TPHg and up to 1.8 ppm BTEX.

November-December 1992 Offsite Well Installation: Groundwater Technology Inc. (GTI) installed offsite wells MW-15 and MW-16 to further delineate the dissolved hydrocarbon plume. No hydrocarbons were detected in soil samples collected at 20 and 30 fbg in well MW-15 and at 10 and 20 fbg in well MW-16.

SVE Remediation System Installation and Operation: A soil vapor extraction (SVE) system was installed and operated at the site from July 1, 1993 through December 12, 1993. Evaluation of the system showed minimal effectiveness. Augmentation of the system with additional wells was evaluated and, due to low permeability soils, it was determined that efficiency would not be appreciably enhanced. The system was shut down in December 1993 and all system equipment was removedin December 1996.

January 1992 Soil Excavation: PEG oversaw removal of hydrocarbon impacted soil from the vicinity of well MW-4 and excavation of a 30-foot long by 5-foot deep trench across the area of the former USTs to confirm that the USTs had been removed from the site. Removal of the USTs was confirmed, however construction debris such as concrete slabs and piping were observed beneath the surface in the area of the fomer USTs.

June 2004 Additional Subsurface Investigation: In anticipation of future site development, which was proposed to include subsurface parking, Cambria conducted additional subsurface investigation to further define residual hydrocarbon impacts in soils beneath the site to pre-profile soils for appropriate disposal options. Results confirmed hydrocarbon impacts to soil in the vicinity of well MW-7 that appear to have originated from the first generation dispenser islandthat had been located approximately 15 feet upgradient of the well.

April 2007 Additional Subsurface Investigation: CRA advanced four soil borings upgradient of MW-7 to define the extent of hydrocarbon impacts associated with a first generation dispenser island. TPHg and benzene in soil were only detected in boring SB1, SB2, and SB3 at 19.5 fbg, with maximum concentrations of 140 mg/kg and 0.002 mg/kg, respectively. TPHg was detected in groundwater samples from each boring, and benzene was detected in all borings but SB4.

RISK ASSESSMENT

Chevron conducted an onsite Tier II RBCA evaluation to estimate hazards resulting from potential exposure to residual concentrations of petroleum hydrocarbons in soil and groundwater and to identify any data gaps (Attachment B). Exposure pathways were evaluated for ingestion of soil, dermal contact with soil, ingestion of groundwater, dermal contact with groundwater and inhalation of dust and vapors.

The proposed senior housing development plans call for the entire site to be covered by buildings or concrete floors. Landscaping will only be along the street fronts and there is a planned exterior landscaped courtyard that will be located above the garage area on the second floor. Future residents should have no direct contact with soil. The only potential direct contact with impacted soil would be by construction/utility workers during construction or

in the future. The maximum detected concentration of TPHg in soil is 600 mg/kg and does not exceed the TPHg environmental screening level (ESL)for construction/trench workers of 6,000 mg/kg.

Historical depth to groundwater across the site ranges from 11.62 fbg to 22.12 fbg, so there is no expected direct contact for either future residents or construction/utility workers.

Hazards due to vapor inhalation of future residents were not evaluated due to the fact that soil vapor data was last collected on December 17, 1987. This represents a data gap for the risk assessment. Data collected will be used to evaluate human health risks and hazards to future residents as established in guidance recommended by the California Environmental Protection Agency and the United States Environmental Protection Agency. Based on concerns addressed in an email dated May 11, 2007 from ACDEH, HVOs will be analyzed in all soil and soil vapor samples (Attachment A). CRA will use the results of the risk assessment to determine if any remedial actions are necessary.

PROPOSED SCOPE OF WORK

The objective of the proposed scope of work is to provide soil gas data to determine if vapor inhalation poses a risk to future residents of the proposed senior housing development. Vapor probes will be installed within the footprint of the proposed housing development along Harrison and 17th Streets (Figure 2). In order to accomplish these goals, CRA will conduct the following activities.

Underground Utility Location: CRA will contact Underground Services Alert (USA), an underground utility locating service, to reconfirm that no utilities exist at and near the boring locations.

Site Health and Safety Plan: CRA will prepare a site safety plan to protect site workers. The plan will be reviewed and signed by all site workersand visitors. The plan will be kept onsite during all field activities.

Permits: CRA will obtain soil boring permits from the Alameda County Department of Public Works prior to beginning field operations.

Soil Borings and Sampling: CRA will install nested probes at 5 fbg and 10 fbg in four borings to be advanced along Harrison and 17th Streets, within the footprint of the proposed housing development (Figure 2). It is estimated that the total depth of borings will not exceed 11 fbg. Soil samples will be collected using a hand-auger above 8 fbg and using a split-spoon sampler at depths greater than 8 fbg.

Vapor Probes Construction and Sampling: Vapor probes will be constructed of 6-inch screen attached to ¼-inch Teflon tubing. Each probe will be placed at the desired depth and surrounded by a sand pack. Each probe will be isolated from the others by a bentonite grout mixture. Vapor points will be finished at the surface using a traditional well vault. Collection of soil vapor samples will be conducted at least 48 hours after the placement of the probes. Samples from soil vapor points will be collected using flow meters and 1-liter Summa™ canisters connected to the sampling tubing at each vapor point. A battery powered air pump with attached vacuum-chamber and Tedlar™ bag will be used to purge an appropriate volume from the sampling point tubing. After purging, the valve between the purge pump and Summa™ canister will be closed and the Summa™ canister valve will be opened. The vacuum of the Summa™ canister will be used to draw the soil vapor through the flow controller until a negative pressure of approximately 5-inches of Hg is observed on the vacuum gauge. In accordance with the Department of Toxic Substances Control (DTSC) *Advisory-Active Soil Gas Investigations* guidance document, dated January 28, 2003, leak testing will be performed during sampling. After sampling, the Summa™ canisters will be packaged and sent to the Air Toxics laboratory under chain-of-custody for analysis. Standard Field Procedures for Soil Vapor Probe Installation and Sampling are presented as Attachment C.

Vapor Chemical Analysis: Vapor samples will be analyzed for the following:

- TPHg by EPA Method TO-3,
- BTEX, naphthalene and HVOs by EPA Method TO-15,
- O_2 and CO_2 by ASTM 1946 (GC/TCD).

Soil Chemical Analysis: Select soil samples will be analyzed for the following:

- TPHg by EPA Method 8015 modified,
- BTEX and HVOs by EPA Method 8260B, and
- Physical parameters including moisture content, bulk density, total porosity, air- and water-filled porosity, organic carbon and effective permeability in soil samples collected below 8 fbg. Samples collected above 8 fbg will be disturbed and any measurement of physical parameter will be meaningless.

Soil and Water Disposal: Soil cuttings generated will be placed in drums and labeled appropriately. Wastewater will be stored in drums pending proper disposal. These wastes will be transported to the appropriate Chevron-approved disposal facility following receipt of profiling analytic results.

Reporting: Upon completion of field activities and review of the analytic results, we will prepare an investigation/risk evaluation report that, at a minimum, will contain:

- Descriptions of the installation and sampling methods;
- Boring logs;
- Tabulated soil and groundwater analytic results;
- Analytic reports and chain-of-custody forms;
- Soil and wastewater disposal details;
- An evaluation of vapor inhalation risk to future residents based on data acquired from this phase of work; and
- Conclusions and recommendations.

SCHEDULE

Due to the short timeframe required for the Oakland Housing Authority's submittal of their HUD financing application, CRA has scheduled this fieldwork to take place on June 11-12, 2007. We would appreciate comments on the proposed work by June 7, 2007 so they may be incorporated into the planned phase of work.

CLOSING

We appreciate this opportunity to work with your organization toward redevelopment and case closure of this property. Please contact Charlotte Evans at (510) 420-3351 or Satya Sinha of Chevron at (925) 842-9876 if you have any questions orcomments.

Sincerely,
Conestoga-Rovers & Associates

Charlotte Evans

Robert Foss, P.G. #7445

Figures: 1 – Vicinity Map
2 – Proposed Vapor Probe Locations

Attachments: A – Regulatory Correspondence
B – Onsite Tier II Risk-Based Corrective Action Evaluation
C – Standard Field Procedures for Soil Vapor Probe Installation and Sampling

cc: Mr. Satya Sinha, Chevron Environmental Management Company,P.O. Box 6012, San Ramon, CA 94583
Ms. Jeriann Alexander, FugroWest, Inc., 1000 Broadway, Suite 200, Oakland, CA 94607
Mr. Shaddrick Small, Oakland Housing Authority, 1805 Harrison Street, Oakland, CA 94612
Mr. William Pickel, Christian Church Homes/California Community Housing, 303 Hegenberger Road, Suite 201, Oakland, CA 94621

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04/23/07

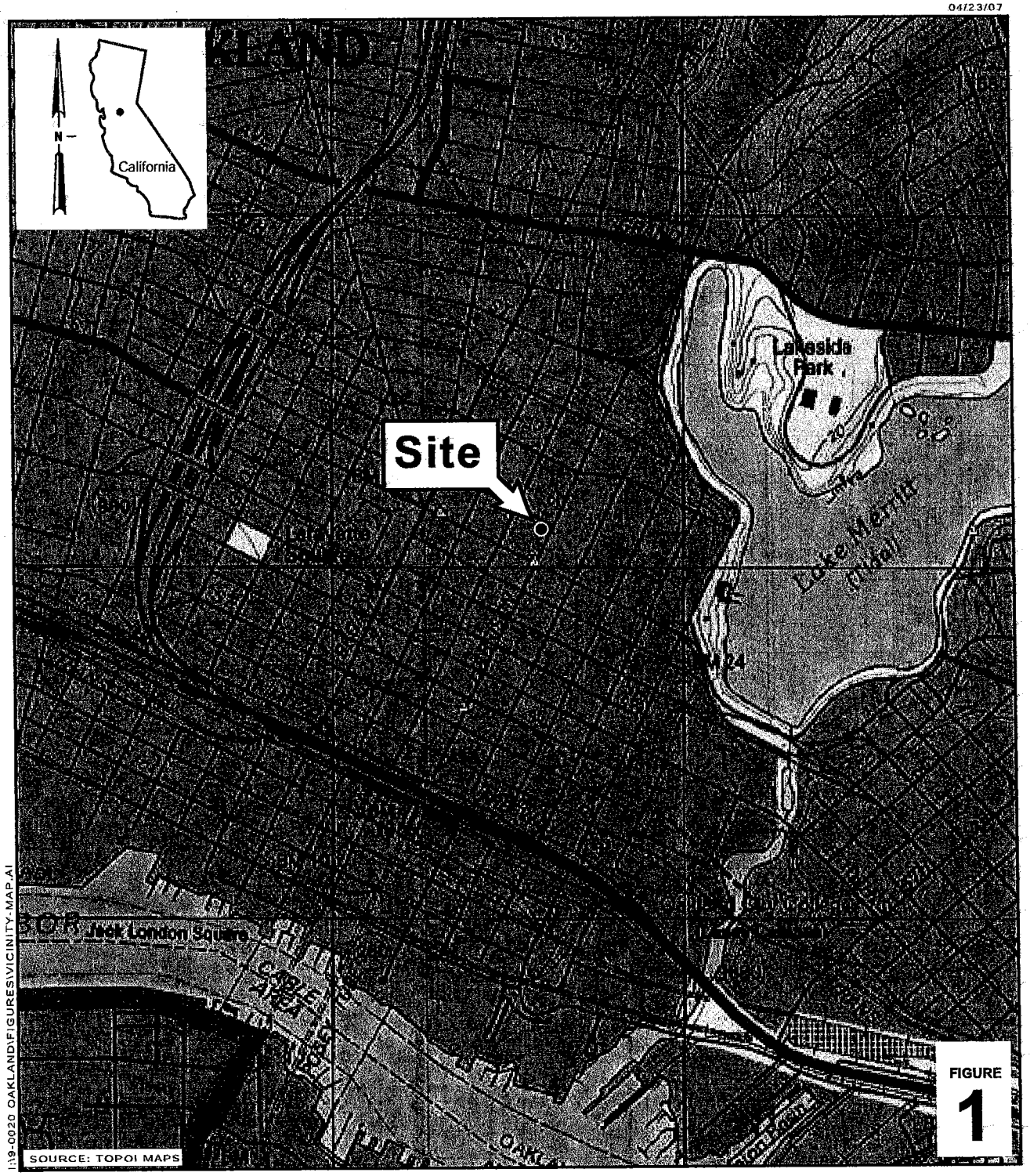

FIGURE 1

0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

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Former Chevron Station 9-0020

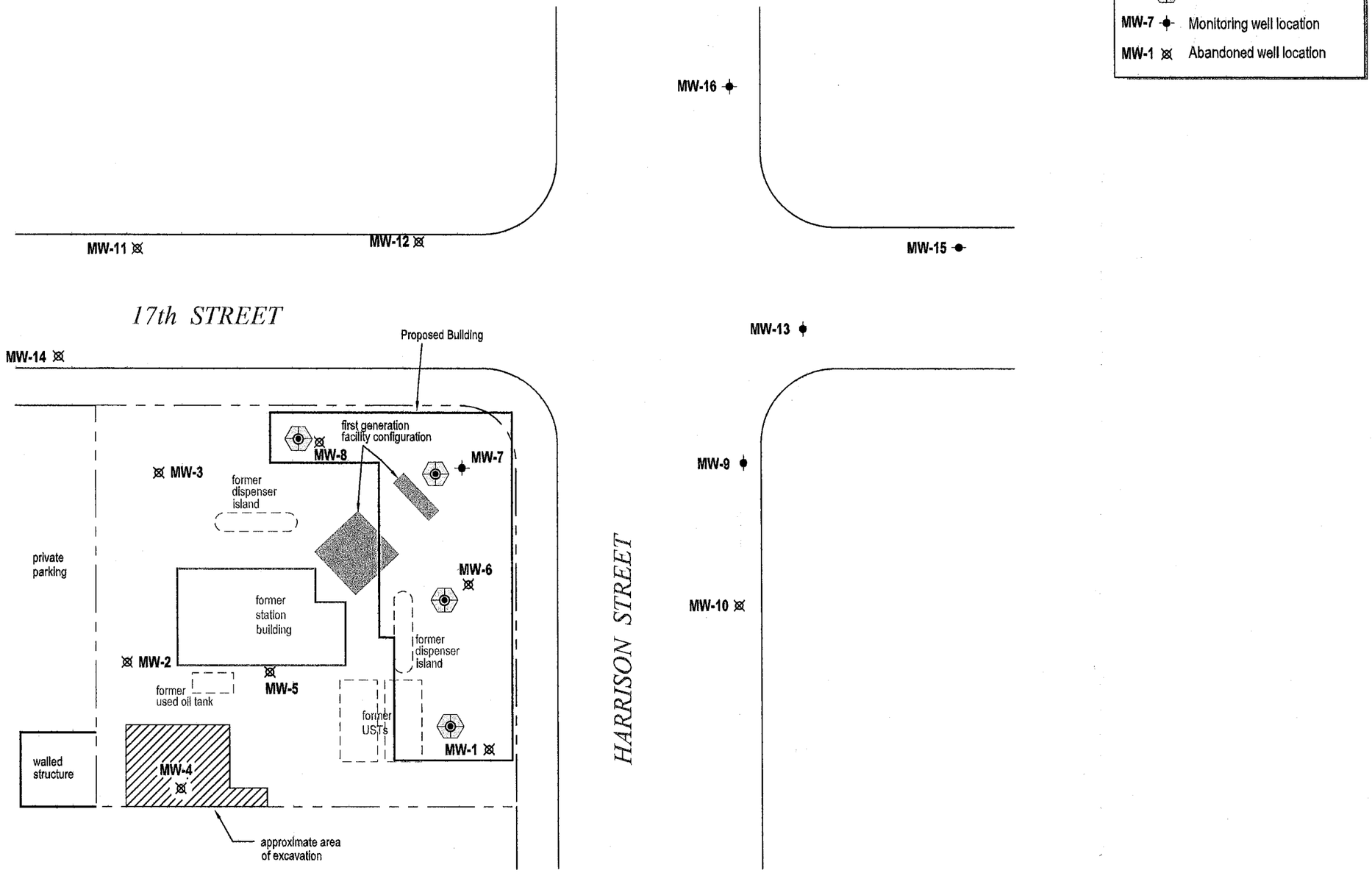
1633 Harrison Street

Oakland, California

CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map

05/25/07



Proposed Vapor Probe Locations

CONESTOGA-ROVERS & ASSOCIATES

Former Chevron Station 9-0020

1633 Harrison Street

Oakland, California

FIGURE

2

I:\9-0020 OAKLAND\FIGURES\SITEPLAN.DWG

ATTACHMENT A

Regulatory Correspondence

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

April 27, 2007

Mr. Satya Sinha
Chevron Environmental Management Co.
P.O. Box 6012, Room K2256
San Ramon, CA 94583

Mr. Shaddrick Small, Oakland Housing Authority
1805 Harrison St.
Oakland, CA 94612

Dear Messrs. Sinha and Small:

Subject: Fuel Leak Case RO0000143 & Global ID T0600100304, Chevron #9-0020, 1633 Harrison St., Oakland, CA 94612

Alameda County Environmental Health (ACEH) has reviewed the files for the subject site including the April 23, 2007 Workplan for Additional Soil Impact Definition prepared by Conestoga-Rovers & Associates (CRA). The work plan proposes to delineate the assumed source of petroleum contamination in the northeast corner of this site by drilling 2-3 borings up-gradient of MW-7 and sampling soil and groundwater. Although we have no objections with this work we request you address the following technical comments when performing the proposed work.

TECHNICAL COMMENTS

1. Proposed boring depths- We request that you attempt to determine the lateral and vertical extent of contamination. Therefore, you should if necessary increase the number of borings and the depth of the borings to accomplish this request.
2. Proposed boring samples- We request that you minimally sample and screen soil at 5' depth intervals, at changes in lithology and at signs of contamination. Samples should be analyzed at any sign of contamination.
3. Extent of contamination- We believe the contamination detected in off-site well MW-16 is from the release from this site. MW-16 is down-gradient of the known contamination area. Future actions should include the further delineation of the plume off-site and determination if remediation is necessary. An evaluation of impact and risk to off-site receptors must also be performed.

TECHNICAL REPORT REQUEST

Please submit the following technical reports according to the following schedule:

- May 28, 2007- Soil and Groundwater Investigation Report
- May 28, 2007- Risk Assessment and Feasibility Study

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline

the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

ELECTRONIC SUBMITTAL OF REPORTS

ACEH's Environmental Cleanup Oversight Programs (LOP and SLIC) now request submission of reports in electronic form. The electronic copy is intended to replace the need for a paper copy and is expected to be used for all public information requests, regulatory review, and compliance/enforcement activities. Submission of reports to the Alameda County FTP site is an addition to existing requirements for electronic submittal of information to the State Water Resources Control Board (SWRCB) Geotracker website. In September 2004, the SWRCB adopted regulations that require electronic submittal of information for groundwater cleanup programs. For several years, responsible parties for cleanup of leaks from underground storage tanks (USTs) have been required to submit groundwater analytical data, surveyed locations of monitoring wells, and other data to the Geotracker database over the Internet. Beginning July 1, 2005, electronic submittal of a complete copy of all reports is required in Geotracker (in PDF format). Please visit the State Water Resources Control Board for more information at (http://www.swrcb.ca.gov/ust/cleanup/electronic_reporting).

PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "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." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

UNDERGROUND STORAGE TANK CLEANUP FUND

Please note that delays in investigation, later reports, or enforcement actions may result in your becoming ineligible to receive grant money from the state's Underground Storage Tank Cleanup Fund (Senate Bill 2004) to reimburse you for the cost of cleanup.

If you have any questions, please call me at (510) 567-6765.

Sincerely,

Barney M. Chan
Hazardous Materials Specialist

cc: files, D. Drogos
Ms. Charlotte Evans, CRA, 5900 Hollis St., Suite A, Emeryville, CA 94608
Ms. Jeriann Alexander, FugroWest, Inc., 1000 Broadway, Suite 200, Oakland, CA 94607

4_26_07 1633 Harrison St

Evans, Charlotte

From: Sinha, Satya P [SatyaSinha@chevron.com]
Sent: Wednesday, May 23, 2007 2:07 PM
To: Evans, Charlotte; Foss, Bob (Robert)
Subject: FW: 1633 Harrison St., Oakland

FYI

Sincerely,

Satya Sinha
Project Manager
Retail and Terminal Business Unit

Chevron Environmental Management Company
6001 Bollinger Canyon Rd., Room K2256
San Ramon, CA 94583
Tel 925 842 9876
Cell 925 548 0019
Fax 925 842 8370
satyasinha@chevron.com

From: Chan, Barney, Env. Health [mailto:barney.chan@acgov.org]
Sent: Friday, May 11, 2007 5:12 PM
To: Shad Small; Sinha, Satya P
Cc: Drogos, Donna, Env. Health
Subject: 1633 Harrison St., Oakland

Mr. Small: Because the site is proposed for senior housing, residential exposure evaluation must be done. Because of past halogenated solvent concentrations in groundwater, past gasoline benzene and toluene concentrations in groundwater and residual gasoline in soil, shallow soil vapor sampling will be required prior to onsite residential development concurrence. In addition, because of off-site contamination, an evaluation of whether on-site remediation is required as part of the requested feasibility study and corrective action plan (FS/CAP). Additional off-site investigation and risk evaluation will be required for site closure. If this jeopardizes your project, you may not be able to meet your HUD deadlines. We can discuss this next week, Tues PM or Wed AM if you like.

Sincerely,

Barney M. Chan
Hazardous Materials Specialist
Alameda County Environmental Health
510-567-6765

ATTACHMENT B

Onsite Tier II Risk-Based Corrective Action Evaluation

ONSITE TIER II RISK-BASED CORRECTIVE ACTION EVALUATION
FORMER CHEVRON STATION NUMBER 9-0020

Introduction

At the request of the Alameda County Health Care Services (ACHS), hazards due to exposures to residual concentrations of petroleum hydrocarbons were estimated for chemicals of potential concern (COPCs) identified in soil at the former Chevron Service Station Number 9-0020 located at 1633 Harrison Street, Oakland, California. The main purpose of this report is to answer the question, "Could residual concentrations of chemicals in soil pose adverse health effects to future occupants of a residential building located on the site and to future construction/utility workers on the site?" In general, risk and hazard estimates provide an answer to that question. It is understood that in order to develop a residential building at the site, the Oakland Housing Authority will be required to conduct a Tier II Risk-Based Corrective Action (RBCA) evaluation for the site in order to obtain a grant from the United States Department of Housing and Urban Development. The results of this evaluation may be used to support a RBCA process and closure for the site.

The focus of this evaluation is to assess potential exposures to future residents and construction/utility workers at the site to COPCs in onsite subsurface soil. The specific exposure pathways evaluated include; ingestion of soil, dermal contact with soil, and inhalation of dust and vapors. Potential exposures to constituents that may have migrated offsite are not considered in this scope of work and, following an understanding with ACHS, will be addressed in a separate evaluation.

Direct contact groundwater exposure pathways are not expected to be complete for future onsite residents. However, dissolved phase constituents have been detected historically in an onsite groundwater monitoring well at low concentrations. Given this fact, it is possible that the volatile constituents may migrate from groundwater to soil vapor into the indoor air spaces of future onsite residences.

Potential exposures to constituents in soil vapor are not evaluated due to the fact that the analytical results for soil vapor collected onsite are almost twenty years old. In order to evaluate potential inhalation of vapors in indoor air, to be health protective it is recommended that soil vapor data be collected at the site prior to construction of a residential complex.

The following sections describe information that was used to estimate hazards. Included are relevant discussions on site history and characterization, the approach used to select COPCs in soil, exposure assessment, toxicity criteria, and lastly hazard characterization. This report follows risk assessment guidance recommended by the California Environmental Protection Agency (Cal/EPA) and the United States Environmental Protection Agency (USEPA). This report does not include an evaluation of potential ecological receptors.

Site History

Chevron operated a service station on the site until 1972. At the time of closure, all underground storage tanks were removed. In 1992, areas impacted with petroleum hydrocarbons in soil were excavated.

From 1988 to 1992, sixteen groundwater monitoring wells were installed; GW-1 to GW-8 (onsite) and GW-9 to GW-16 (offsite). Groundwater at the site has been monitored quarterly since 1988. GW-7 is the only current onsite groundwater monitoring well. In the last 4 sampling events, benzene, toluene, ethylbenzene, and xylenes (BTEX) have been detected at maximum concentrations of 53 µg/L, 12 µg/L, 26 µg/L, and 16 µg/L, respectively.

From October 1988 to April 2007, subsurface soil, from as shallow as 4.2 feet below grade (fbg) to as deep as 34.5 fbg, has been sampled and analyzed for Total Petroleum Hydrocarbons as gasoline (TPHg) and BTEX. No surface soil data are available for the site. Benzene has not been detected in subsurface soil down to 10 fbg.

A soil vapor survey was conducted at the site in January 1988. Twenty-two samples were collected at eleven locations around the site ranging from 3 to 13 fbg. The highest TPHg concentrations were detected in the vicinity of the former used-oil UST. BTEX were all nondetect, with the exception of toluene and xylenes detected in one sample at low concentrations.

In 2001, a "limited" Tier RBCA evaluation was prepared to assess potential vapor intrusion of TPHg and benzene from soil and groundwater at the site. Maximum and average concentrations of benzene in subsurface soil and groundwater were compared with Oakland Tier 1 Risk-Based Screening Levels (RBSLs) for residential receptors. Maximum and average concentrations of TPHg in subsurface soil and groundwater were compared with Massachusetts Department of Environmental Protection (MADEP) Method 1 Cleanup Standards (Delta, 2001). Based on results of this evaluation, site concentrations were below the RBSLs and cleanup standards.

Site Characterization

The site consists primarily of silty sands with some intermittent sandy, clayey and gravelly silts to approximately 30 fbg. The depth to groundwater at the site ranges from 11.5 fbg to 22 fbg.

Selection of COPCs in Subsurface Soil

A list of COPCs in subsurface soil was derived based on chemicals detected in soil down to 10 fbg during sampling conducted at the site from October 1988 to April 2007. Volatile organic chemicals (VOCs) detected in subsurface soil at least once above the method reporting limit were considered COPCs. Table 1 presents the list of COPCs and their detected concentrations by sample location. The list of COPCs includes: toluene, ethylbenzene, and xylenes (TEX). The maximum concentrations of TEX detected in subsurface soil are 0.003 mg/kg, 0.88 mg/kg, and 2.8 mg/kg, respectively.

As shown in Table 1, in 1989 TPHg was detected in subsurface soil at one sample location at a maximum concentration of 600 mg/kg. The frequency of detection of TPHg in subsurface soil is 4/59 or about 7% of the samples.

Exposure Assessment

Land Use

The site is currently used as a parking lot. The areas immediately adjacent to the site are commercial and multi-unit residences. The site is expected to be developed as a multi-story

senior housing facility with a level of underground parking. Due to the proximity to the San Francisco Bay, groundwater beneath the site is not used as a drinking water source and it is not expected to be used as a potable source in the future.

Conceptual Site Model

Figure 1 presents a conceptual site model of the site. For this evaluation, the potentially complete exposure pathways include; future onsite construction/utility workers ingestion of, dermal contact with and inhalation of dust and vapors from COPCs in subsurface soil. Future onsite construction/utility workers are not expected to come into contact with groundwater as the shallowest historic depth to groundwater reported is 11.5 fbg.

Future onsite residents are not expected to come into direct contact with COPCs in soil because the portions of the site not occupied with buildings will be paved. In addition, future landscaping is expected to consist of potted vegetation.

An exposure pathway considered to be complete is future onsite adult and child residents' inhalation of VOCs in indoor air from soil vapor. Risks and hazards were not estimated for this exposure pathway.

Quantification of Exposure

Hazard estimates were calculated using standard risk assessment algorithms. The exposure parameters used to estimate hazards to future onsite construction/utility workers are presented in Table 3. Most of the exposure parameters are from USEPA sources. For example, construction worker soil ingestion and inhalation rates of 330 mg/day and 20 m^3/day, respectively are from USEPA (1997), and exposed surface area (3,300 cm^2/day) and adherence factor (0.3 mg/cm^2) are from USEPA (2004a). Average adult body weight is from USEPA (1989). The other reference used is the San Francisco Region-Regional Water Quality Control Board (2005) for a construction worker exposure frequency of 20 days per year, an exposure duration of 7 years and a particulate emission factor of 1.44×10^6 m^3/kg.

Typically, for Tier II RBCA evaluations representative COPC concentrations, such as 95 percent upper confidence limit (UCL) of the mean concentrations, are evaluated. However, for this site maximum concentrations of TEX in subsurface soil down to 10 fbg were assessed.

Toxicity Assessment

Table 3 presents the oral and inhalation toxicity criteria used to estimate risks and hazards. The primary source of oral inhalation cancer slope factors (CSFs) is Cal/EPA's (2007) Office of Environmental Health Hazard Assessment's (OEHHA) Toxicity Criteria Database, and secondarily from USEPA's (2007) Integrated Risk Information System (IRIS). Oral and inhalation reference doses (RfDs) were obtained from IRIS (2007). Soil-to-skin absorption (ABS) and volatilization factors (VF) were obtained from the USEPA (2004b) Preliminary Remediation Goals table.

Hazard Characterization

A hazard estimate for future onsite construction/utility workers was calculated using standard risk assessment algorithms. It is provided in Table 4. The noncarcinogenic hazard index for future onsite construction/utility workers is 0.0003. This value is well below USEPA's target risk level

of 1.0 for noncarcinogenic effects. Exposure to xylenes contributed the majority to the overall hazard index.

Risk and hazards are not usually estimated for THPg, as it represents a mixture of petroleum hydrocarbons of varying toxicity. Therefore, TPHg measurements were compared with the San Francisco Region-Regional Water Quality Control Board's Environmental Screening Level (ESL) for potential construction/trench worker exposures. The maximum detected concentration of TPHg in subsurface soil, 600 mg/kg, does not exceed the TPHg ESL for construction/trench workers of 6,000 mg/kg.

Uncertainties

Maximum concentrations of TEX in subsurface soil down to 10 fbg were assessed for the direct contact exposure pathway. The majority of soil data for TEX are nondetect at this site, and estimated risks assuming 95% UCL concentrations, e.g., representative concentrations, would be even lower than those presented in this evaluation.

Risks and hazards were not estimated for future onsite adult and child residents' inhalation of VOCs in indoor air from soil vapor exposure pathway because site-specific soil vapor data are almost 20 years old. This represents a data gap in the evaluation. However, if the older data were used to represent the concentrations of COPCs beneath future building structures, estimated risks and hazards would be insignificant as benzene was not detected.

Conclusions

Hazards were estimated for potential future onsite construction/utility worker direct contact exposures to COPCs in subsurface soil at the former Chevron Service Station Number 9-0020 located in Oakland, California. Based on the maximum detected concentrations of COPCs in subsurface soil down to 10 fbg, the estimated hazard index is well below the USEPA's established target level. Potential direct contact exposure pathways to future onsite residents were not considered to be complete with the exception of inhalation of VOCs in indoor air. However, this pathway was not quantitatively evaluated due to the age of site-specific soil vapor data for BTEX. In order to evaluate potential inhalation of vapors in indoor air, it is recommended that soil vapor data be collected at the site prior to construction of a residential complex.

References

Cal/EPA (California Environmental Protection Agency). 2007. Office of Environmental Health Hazard Assessment, OEHHA Toxicity Criteria Database.

CRA. Conestoga Rovers Associates. 2007. Comprehensive Analytic Results for Soil.

Delta (Delta Environmental Consultants, Inc.). 2001. Tier 1 RBCA Evaluation Addendum, Former Chevron Station #9-0020. November 14.

SFR-RWQCB (San Francisco Region-Regional Water Quality Control Board). 2005. Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater (4th edition, February 2005).

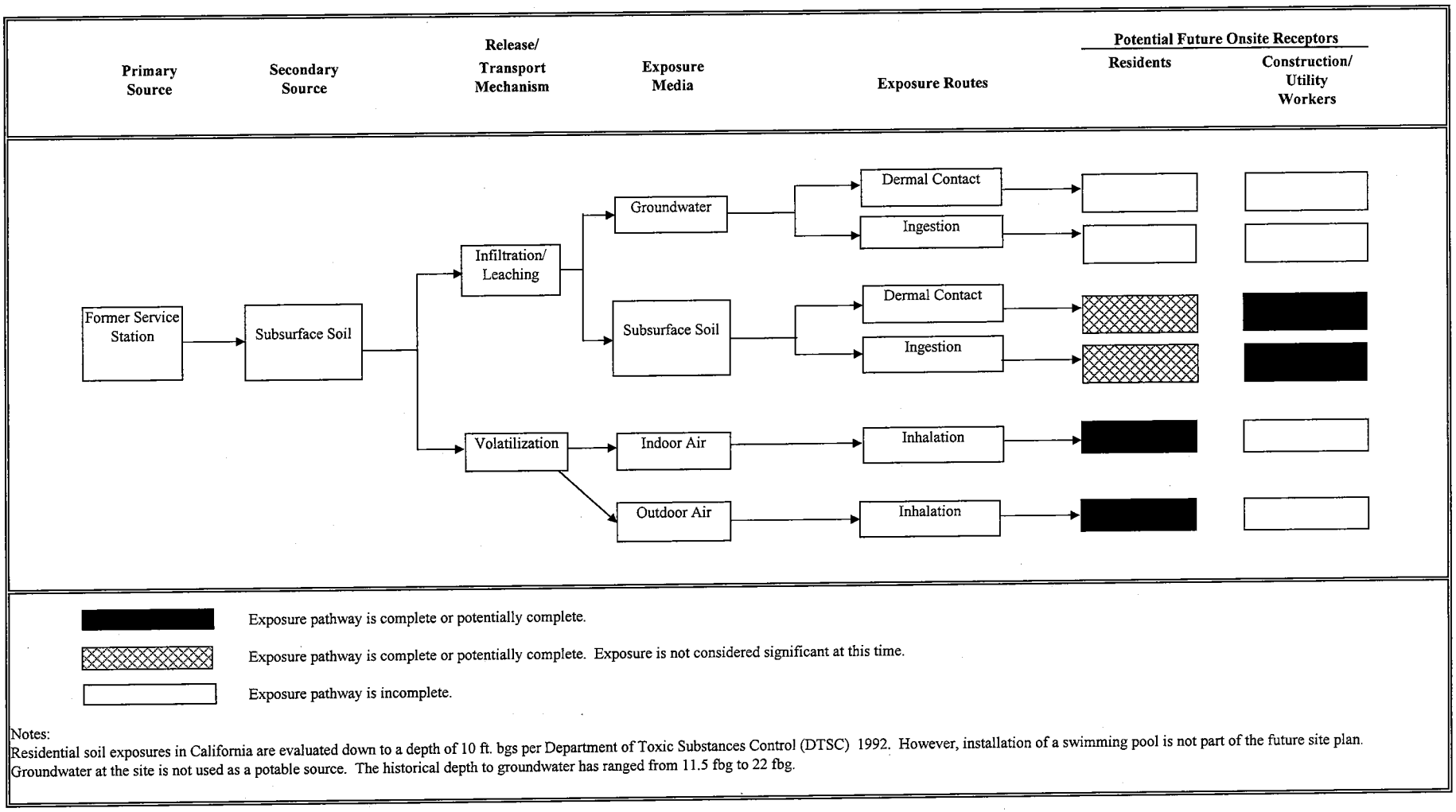
USEPA (United States Environmental Protection Agency). 1997. Exposure Factors Handbook. Office of Research and Development. EPA/600/P-95/002Fa. August.

USEPA (United States Environmental Protection Agency). 2004a. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. EPA/540/R/99/005.

USEPA (United States Environmental Protection Agency). 2004b. Region 9 Preliminary Remediation Goals Table.

USEPA (United States Environmental Protection Agency). 2007. Integrated Risk Information System. Duluth, MN.

Figure 1. Conceptual Site Model for Former Chevron Station 9-0020, Oakland, California



Notes:
Residential soil exposures in California are evaluated down to a depth of 10 ft. bgs per Department of Toxic Substances Control (DTSC) 1992. However, installation of a swimming pool is not part of the future site plan.
Groundwater at the site is not used as a potable source. The historical depth to groundwater has ranged from 11.5 fbg to 22 fbg.

Table 1. Comprehensive Analytic Results for Onsite Soil[1]
Former Chevron Service Station 9-0020

Sample ID	Sample Date	Sample Depth (fbg)	TPHg	B	T	E	X
B-1	10/26/88	5	<10*	<0.3	<0.3	<0.3	<0.3
B-1	10/26/88	10	<10*	<0.3	<0.3	<0.3	<0.3
B-2	10/26/88	5	<10*	<0.3	<0.3	<0.3	<0.3
B-2	10/26/88	10	<10*	<0.3	<0.3	<0.3	<0.3
B-3	10/26/88	5	<10*	<0.3	<0.3	<0.3	<0.3
B-3	10/26/88	10	<10*	<0.3	<0.3	<0.3	<0.3
B-4	1989	6	<5.0**	<0.005	<0.005	<0.005	<0.01
B-5	1989	9.5	<2.0**	<0.002	<0.002	<0.002	<0.004
B-6	1989	9.5	<2.0**	<0.002	<0.002	<0.002	<0.004
B-7	1989	4.2	<1.0**	<0.001	<0.001	<0.001	<0.002
B-7	1989	9.2	<1.0**	<0.001	<0.001	<0.001	<0.002
B-8	1989	4.5	**600****	<0.001	<0.001	<0.001	<0.002
B-8	1989	9.6	**600****	<0.01	<0.01	<0.01	<0.02
B-8	1989	9.6	**450****	<0.02	<0.02	<0.02	<0.04
B-9	1989	9	<0.5**	<0.005	<0.005	<0.005	<0.010
B-10	1989	9.5	<1.0**	<0.002	<0.002	<0.002	<0.004
B-11	1989	9.5	<0.1**	<0.002	<0.002	<0.002	<0.004
B-12	1989	9.5	<1.0**	<0.002	**0.003**	<0.002	<0.004
B-16	6/21/1990	6.2	<1.0**	<0.005	<0.005	<0.005	<0.005
B-A	10/5/91	10	ND	ND	ND	ND	ND
B-B	10/5/91	10	ND	ND	ND	ND	ND
B-C	10/5/91	10	ND	ND	ND	ND	ND
B-D	10/5/91	10	ND	ND	ND	ND	ND
ES-10W	1/9/2007	10	ND	ND	ND	ND	ND
ES-8C	1/9/2007	8	**310**	ND	ND	**0.88**	**2.8**
EE-5N	1/9/2007	5	ND	ND	ND	ND	ND
EE-10S	1/9/2007	10	ND	ND	ND	ND	ND
EN-5W	1/9/2007	5	ND	ND	ND	ND	ND
EN-10E	1/9/2007	10	ND	ND	ND	ND	ND
EW-5S	1/9/2007	5	ND	ND	ND	ND	ND
EW-10N	1/9/2007	10	ND	ND	ND	ND	ND
B-17	6/28/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-17	6/28/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-18	6/28/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-18	6/28/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-19	6/28/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-19	6/28/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-20	6/28/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-20	6/28/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-21	6/29/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-21	6/29/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-22	6/29/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-22	6/29/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-23	6/29/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-23	6/29/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001

Table 1. Comprehensive Analytic Results for Onsite Soil[1]
Former Chevron Service Station 9-0020

Sample ID	Sample Date	Sample Depth (fbg)	TPHg	B	T	E	X
B-24	6/29/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-24	6/29/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
B-25	7/29/04	5	<1.0	<0.0005	<0.001	<0.001	<0.001
B-25	7/29/04	10	<1.0	<0.0005	<0.001	<0.001	<0.001
SB1	4/27/07	5	<1.0	<0.0005	<0.001	<0.001	<0.001
SB1	4/27/07	10	<1.0	<0.0005	<0.001	<0.001	<0.001
SB2	4/27/07	5	<1.0	<0.0005	<0.001	<0.001	<0.001
SB2	4/27/07	10	<1.0	<0.0005	<0.001	<0.001	<0.001
SB3	4/27/07	5	<1.0	<0.0005	<0.001	<0.001	<0.001
SB3	4/27/07	10	<1.0	<0.0005	<0.001	<0.001	<0.001
SB4	4/27/07	5	<1.0	<0.0005	<0.001	<0.001	<0.001
SB4	4/27/07	10	<1.0	<0.0005	<0.001	<0.001	<0.001
		Maximum	**310**	**0.0**	**0.003**	**0.88**	**2.8**

Abbreviations/Notes:

[1] Source: Conestoga-Rovers & Associates

Concentration units are in milligrams per kilogram

Total petroleum hydrocarbons as gasoline (TPHg) by several methods

Benzene, toluene, ethylbenzene, xylenes (BTEX) by several methods

fbg = Feet below grade

* = Values reported for Total Fuel Hydrocarbons by unknown method

** = Total Purgeable Petroleum Hydrocarbons by unknown method

ND = Not detectable above laboratory detection limits

<x = Not detected above method detection limit

Table 2. Exposure Parameters Used to Estimate Hazards
Former Chevron Service Station 9-0020

Subsurface Soil Concentration	C_{soil}	mg/kg	CS	Table 1
Ingestion Rate of Soil-Construction/Utility Worker	IRS_{cw}	mg/day	330	USEPA, 1997
Exposed Surface Area-Soil Contact-Construction Worker	SA_{cw}	cm^2/day	3,300	USEPA, 2004a
Adherence Factor-Construction/Utility Worker	AF_{cw}	mg/cm^2	0.3	USEPA, 2004a
Soil-to-Skin Absorption Factor	ABS	unitless	CS	Table 3
Inhalation Rate-Construction/Utility Worker	IRA_{cw}	m^3/day	20	USEPA, 1997
Exposure Frequency-Construction/Utility Worker	EF_{cw}	days/year	20	SFBRWQCB, 2005
Exposure Duration-Construction/Utility Worker	ED_{cw}	years	7	SFBRWQCB, 2005
Averaging Time-Construction Worker (Noncarcinogens)	AT_{nc-cw}	days	2,555	ED x 365
Conversion Factor	CF	mg/kg	1.E+06	-
Body Weight-Adult	BW_{adult}	kg	70	USEPA, 1989
Volatilization Factor	VF	m^3/kg	CS	USEPA, 2004b
Particulate Emission Factor-Construction/Utility Worker	PEF_{cw}	m^3/kg	1.44E+06	SFBRWQCB, 2005

CS = Chemical-specific. See Table 3.
USEPA (1989) Risk Assessment Guidance for Superfund. Human Health Evaluation Manual.
USEPA (1997). Exposure Factors Handbook. Recommened soil ingestion rate for people involved in activities with heavy soil contact.
USEPA (2004a). Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).
USEPA (2004b). Preliminary Remediation Goals Table.
SFBRWQCB (2005). Environmental Screening Levels.

Table 3. Toxicity Criteria
Former Chevron Service Station 9-0020

Chemical	Oral RfD mg/kg/day	Inhalation RfD mg/kg/day	Inhalation RfC (mg/m^3)	ABS (unitless)	VF (m^3/kg)
Benzene	4.00E-03	8.57E-03	3.00E-02	0.00E+00	2.7E+03
Ethylbenzene	1.00E-01	2.86E-01	1.00E+00	0.00E+00	5.4E+03
Toluene	8.00E-02	1.43E+00	5.00E+00	0.00E+00	4.0E+03
Xylenes	2.00E-01	2.86E-02	1.00E-01	1.00E-01	6.1E+03

RfD = Reference dose. Source = USEPA (2007) Integrated Risk Information System
RfC = Inhalation reference concentration.
ABS = Soil-to-skin absorption factor. Source = USEPA (2004b) Region 9 Preliminary Remediation Goals Table.
VF = Volatilization factor. Source = USEPA (2004b) Region 9 Preliminary Remediation Goals Table.
NC = Noncarcinogen

Table 4. Estimated Noncarcinogenic Hazards
Former Chevron Service Station 9-0020

Chemical	Maximum Onsite Subsurface Soil Concentration[a] (mg/kg)	Construction/Utility Worker Noncancer Hazard
Benzene	NA	NA
Ethylbenzene	0.88	1.1E-05
Toluene	0.003	1.8E-08
Xylenes	2.8	2.6E-04
Total		**2.69E-04**

[a] Table 1.
NA = Not available. Benzene was not detected in subsurface soil down to 10 fbg.

ATTACHMENT C

Standard Field Procedures for Soil Vapor Probe Installation and Sampling

STANDARD FIELD PROCEDURES FOR SOIL VAPOR PROBE INSTALLATION AND SAMPLING

DIRECT PUSH AND VAPOR POINT METHODS

This document describes Conestoga-Rovers & Associates' standard field methods for soil vapor sampling. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Objectives

Soil vapor samples are collected and analyzed to assess whether vapor-phase subsurface contaminants pose a threat to human health or theenvironment.

Direct Push Method for Soil Vapor Sampling

The direct push method for soil vapor sampling uses a hollow vapor probe, which is pushed into the ground, rather than augured, and the stratigraphy forms a vapor seal between the surface and subsurface environments ensuring that the surface and subsurface gases do not mix. Once the desired soil vapor sampling depth has been reached, the field technician installs disposable polyethylene tubing with a threaded adapter that screw into the bottom of the rods. The screw adapter ensures that the vapor sample comes directly from the bottom of the drill rods and does not mix with other vapor from inside the rod or from the ground surface. In addition, hydrated bentonite is placed around the sampling rod and the annulus of the boring to prevent ambient air from entering the boring. The operator then pulls up on the rods and exposes the desired stratigraphy by leaving an expendable drive point at the maximum depth. The required volume of soil vapor is then purged through the polyethylene tubing using a standard vacuum pump. The soil vapor can be sampled for direct injection into a field gas chromatograph, pumped into inert tedlar bags using a "bell jar" sampling device, or allowed to enter a Summa vacuum canister. Once collected, the vapor sample is transported under chain-of-custody to a state-certified laboratory. The ground surface immediately adjacent to the boring is used as a datum to measure sample depth. The horizontal location of each boring is measured in the field relative to a permanent on-site reference using a measuring wheel or tape measure. Drilling and sampling equipment is washed between samples with trisodium phosphate or

an equivalent EPA-approved detergent. Once the sampling is completed, the borings are filled to the ground surface with neat cement.

Shallow Soil Vapor Point Method for Soil Vapor Sampling

The shallow soil vapor point method for soil vapor sampling utilizes a hand auger or drill rig to advance a boring for the installation of a soil vapor sampling point. Once the boring is hand augered to the final depth, a 6-inch slotted probe, capped on either end with brass or Swagelok fittings, is placed within 12-inches of number 2/16 filter sand (Figure A). Nylon tubing of ¼-inch inner-diameter of known length is attached to the probe. A 2-inch to 12-inch layer of unhydrated bentonite chips is placed on top of the filter pack. Next pre-hydrated granular bentonite is then poured into the hole to approximately and topped with another 2-inch layer of unhydrated bentonite chips or concrete, depending if the boring will hold one probe or multiple probes. The tube is coiled and placed within a wellbox finished flush to the surface. Soil vapor samples will be collected no sooner than one week after installation of the soil-vapor points to allow adequate time for representative soil vapors to accumulate. Soil vapor sample collection will not be scheduled until after a minimum of three consecutive precipitation-free days and irrigation onsite has ceased. Figure B shows the soil vapor sampling apparatus. A measured volume of air will be purged from the tubing using a vacuum pump and a tedlar bag. Immediately after purging, soil-vapor samples will be collected using the appropriate size Summa canister with attached flow regulator and sediment filter. The soil-vapor points will be preserved until they are no longer needed for risk evaluation purposes. At that time, they will be destroyed by extracting the tubing, hand augering to remove the sand and bentonite, and backfilling the boring with neat cement. The boring will be patched with asphalt or concrete, as appropriate.

Vapor Sample Storage, Handling, and Transport

Samples are stored and transported under chain-of-custody to a state-certified analytic laboratory. Samples should never be cooled due to the possibility of condensation within the canister.

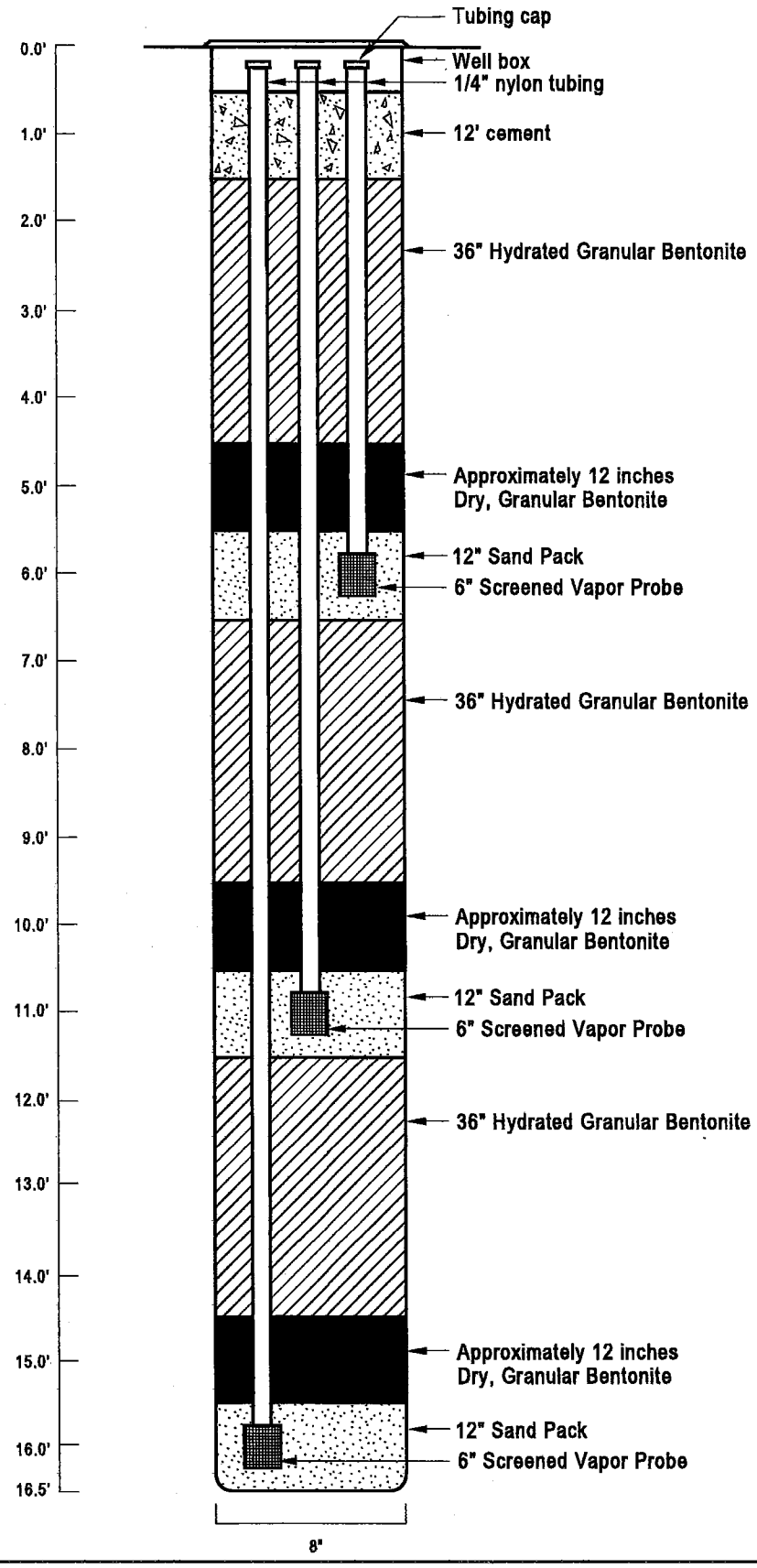


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FIGURE

A

Nested Soil Vapor Probe Construction

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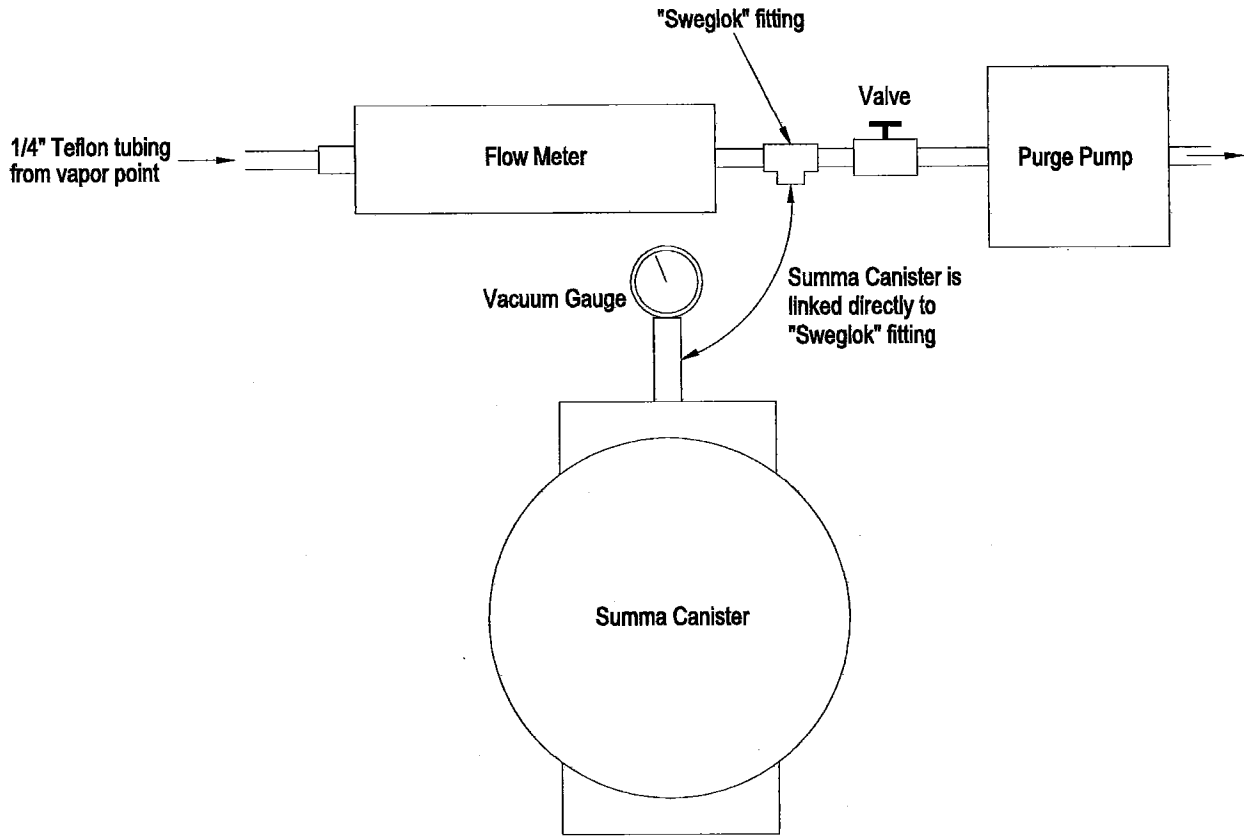
09/25/02



FIGURE

B

Schematic Not to Scale

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& ASSOCIATES

Soil Vapor Sampling Apparatus Diagram