



Technology, Engineering & Construction, Inc.

35 South Linden Ave. • So. San Francisco, CA 94080-6407 • Contractor's Lic. #762034
Tel: (650) 952-5551 • Fax: (650) 952-7631 • www.tecaccutite.com

Reviews 2/10/03
(Signature)

RO193V

January 2, 2003

Mr. Amir Gholami
Hazardous Materials Specialist
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, CA 94502

Alameda County
JAN 09 2003
Environmental Health

SUBJECT: SOIL VAPOR INVESTIGATION WORKPLAN
SITE: FORMER OLYMPIAN GASOLINE STATION
1435 WEBSTER STREET
ALAMEDA, CALIFORNIA

STATE
MUST

Dear Mr. Amir:

On behalf of the responsible parties of the above listed site, TEC Accutite is pleased to submit this workplan to conduct soil vapor sampling at the above referenced site. The site background and the proposed scope of work are outlined below. A site vicinity map and site map are presented as Figures 1 & 2.

SITE DESCRIPTION

The site is located on the corner of Webster Street and Taylor Avenue in Alameda, CA. Prior to 1989, the site was occupied by an Olympian Service Station. Station facilities consisted of two 10,000-gallon gasoline and one 7,500-gallon diesel underground storage tanks (USTs), two dispenser islands and a 500-gallon waste oil UST.

The surrounding topography is flat and the site is approximately 20 feet above mean sea level. The site is situated in a mixed commercial and residential area and is currently leased by the City of Alameda and operated as a metered parking lot.

SITE HISTORY

October 1988, Soil Gas Sampling: CHIPS Environmental Consultants, Inc. performed soil gas analysis at the subject site. High soil gas readings were found on the eastern side of one of the pump islands, between the pump islands, and from backfill between the gasoline storage tanks.

September 1989, UST Removal: TEC Accutite removed the following USTs:

- Two 10,000-gallon gasoline USTs
- One 7,500-gallon diesel UST
- One 500-gallon waste oil UST

Analysis of soil samples collected during removal of the USTs detected hydrocarbons at a maximum concentration of 220 parts per million (ppm) Total Petroleum Hydrocarbons as gasoline

(TPHg), 430 ppm Total Petroleum Hydrocarbons as diesel (TPHd), and 650 ppm Total Recoverable Petroleum Hydrocarbons as Oil and Grease (TRPH).

January 1991, Soil Excavation: Excavation of the hydrocarbon impacted soil was conducted by AAA Tank Removal / Forcade Excavations Services. Approximately 950 cubic yards of soil were removed from the former location of the USTs. This soil was bioremediated onsite and returned to the former excavation.

January 1993, Well Installation: Uriah Environmental Services, Inc. installed three groundwater monitoring wells onsite (MW-1 through MW-3). Soil samples collected during the well installation did not detect petroleum hydrocarbons at concentrations above laboratory reporting limits. Bi-annual groundwater monitoring was initiated. Dissolved phase hydrocarbons were detected in all wells at varying concentrations.

February 1999, Soil Borings: TEC Accutite advanced four borings on and offsite (B1 through B4) to determine the extent of hydrocarbon impact to soil and groundwater. Petroleum hydrocarbons were detected in soil at concentrations just above laboratory reporting limits. Petroleum hydrocarbons were detected in groundwater at concentrations up to 6,000 parts per billion (ppb) MTBE and 38,000 ppb benzene.

December 1999, Well Installation: TEC Accutite installed three additional wells MW-4 through MW-6. Analysis of soil samples detected petroleum hydrocarbons at maximum concentrations of 1,100 ppm TPHg, 200 ppm TPHd and 3.4 ppm benzene in soil 9.5 feet below grade (fbg) from well MW-5. No hydrocarbons were detected in soil samples collected during the installation of wells MW-4 and MW-6. Groundwater sampling from wells MW-6 and MW-3 defined the dissolved phase hydrocarbon plume upgradient of the former dispenser islands and cross-gradient of the former USTs.

November 2000, Site Conceptual Model: TEC Accutite completed a site conceptual model (SCM). Based on historical quarterly monitoring data, it was determined that the contaminant plume was not defined downgradient. An assessment of hydrogeological conditions, proximity to sensitive receptors and current groundwater usage, suggest that MTBE in groundwater is not the primary chemical of concern. Given the shallow groundwater elevation (9 fbg), estimated high permeability of soils beneath the site, the potential for benzene vapor phase migration from hydrocarbon impacted groundwater to indoor and ambient air was identified as an exposure pathway requiring further evaluation.

June 2001, Soil Borings: TEC Accutite drilled four soil borings to assess the extent of the dissolved phase hydrocarbons downgradient of the site. Soil samples were collected approximately 9 fbg within the capillary fringe from soil borings B1 through B4. Petroleum hydrocarbons were not detected in soil at concentrations above laboratory reporting limits. The greatest concentrations of dissolved phase petroleum hydrocarbons were detected in monitoring well MW-1 (18,000 ppb TPHg, 1,200 ppb benzene, and 1,500 ppb MTBE). Dissolved phase concentrations of TPHg, benzene, and MTBE in surrounding monitoring wells were either non-detect or just above laboratory reporting limits.

February 2002, Risk Assessment: To address the potential exposure pathway identified in the SCM, TEC Accutite performed a site-specific risk assessment. The risk assessment addressed the potential inhalation risk posed by hydrocarbon impacted groundwater beneath the site assuming both residential and commercial scenarios. The compounds of concern were TPHg and benzene. TPHg was assessed using the TPH fractional methodology developed by TPH Criteria Working Group. The calculated annual regional mean concentrations for benzene and TPHg were 2,988 ppb and 23,137 ppb, respectively. The results of the risk assessment found that concentrations of TPHg in groundwater beneath the site were below the calculated site specific target level concentrations (SSTL's) for residential and commercial scenarios. Therefore, TPHg remaining in groundwater beneath the site does not present an inhalation risk. Benzene



concentrations in groundwater exceed the SSTL for a residential scenario (110 ppb) but are less than the SSTL for a commercial scenario (6400 ppb).

SCOPE OF WORK

The results of the risk assessment suggest that benzene in groundwater beneath the site may present an inhalation risk, assuming residential site use. The risk assessment was based on the Johnson & Ettinger Vapor Transport Model, which forward calculates vapor-phase concentrations from dissolved phase concentrations and by incorporating some site specific parameters back-calculates a site specific dissolved phase target concentration (SSTL). It is well documented that calculations of vapor concentrations from soil and groundwater data often overestimate actual concentrations by factors of 10 to 100. The consensus is that the model assumes equilibrium partitioning between phases and ignores the effects of biodegradation, adsorption, and lithological variations. Therefore to obtain more accurate data, TEC Accutite proposes to collect soil vapor samples 3.5 fbg. Collection of soil vapor samples will enable a more detailed assessment of the potential inhalation risks because actual site specific data such as vapor concentration and sample depth can be entered into the model to calculate a concentration at the point of exposure (Cpoe). In conjunction with the exposure rate (ER), the chronic daily intake rate (Cdi) can be calculated and multiplied by the carcinogenic slope factor for benzene to determine the risk.

TEC Accutite proposes to conduct the following tasks.

TASK #1 HEALTH AND SAFETY PLAN

Prior to conducting field activities, a Health and Safety Plan will be prepared.

TASK #2 CLEARING UTILITIES

Underground Service Alert (USA) will be contacted at least 48 hours prior to conducting fieldwork to identify underground utilities.

TASK #3 ACTIVE VAPOR SAMPLING

TEC Accutite recommends collecting eight soil vapor samples at 3.5 fbg (SV1 – SV8). Soil vapor sample SV1 and SV2 will be paired to wells MW-1 and MW-2 which historically have consistently reported the highest concentrations of dissolved phase benzene (Figure 3). Soil vapor samples SV3 through SV5 will evaluate soil gas over the lateral extent of the dissolved phase benzene plume and adjacent to the former location of the product dispensing facilities. Soil vapor samples SV6 through SV8 will evaluate soil gas over the western extent of the dissolved phase benzene plume as well as in the vicinity of the former UST excavation (SV8).

The vapor samples will be collected by inserting a 1-inch diameter chrome-moly steel probe equipped with a steel drop off tip. The probe is driven into the ground by an electric rotary hammer. A 1/8-inch nylaflo tube runs down the center of the probe to sampling ports beneath the tip. Once the probe is inserted to the desired depth a bentonite seal is placed around the probe. The probe is retracted slightly, opening the tip and exposing the sample ports. Soil vapor is withdrawn using a small calibrated syringe connected via an on-off valve. The first five dead volumes of gas are purged to flush the sample tubing and fill it with in-situ soil vapor. The low-dead volume at the sampling point eliminates the risk of atmospheric breakthrough. After purging, the next 20 cubic centimeters of soil vapor is withdrawn into the syringe, plugged and immediately transferred to an onsite lab (State Certified) for analysis. As benzene was identified as the compound of concern, soil vapor samples will be analyzed for benzene by EPA Method 8260B. Standard operation procedures for soil gas sampling are included in Attachment A.



TASK #4 REAL TIME RISK ASSESSMENT

The results of the soil vapor samples will be compared onsite to the soil gas RBSLs, assuming residential land-use and coarse grained soils (Table E2b, CRWQCB Interim Final – December 2001). If a soil vapor sample exceeds the RBSL, a simplified risk calculation for indoor air will be conducted onsite and compared to the target cancer risk of 1.00E-6. The risk assessment is based on the vapor transport model presented by Johnson and Ettinger (Johnson and Ettinger, 1991) and ASTM PS-104 *Standard Provisional Guide for Risk Based Corrective Action* (ASTM, 1998). An example of the risk assessment spreadsheet including default parameters is included in Attachment B. In the event a soil vapor sample exceeds the target risk level, additional samples can be collected to map out any hotspots.

TASK #5 REPORT PREPARATION AND REGULATORY LIAISON

TEC Accutite will prepare a detailed report summarizing all field activities and results of the risk assessment. A copy of the report will be submitted to the Alameda County Health Care Services Agency (ACHCSA) and the client.

SCHEDULE OF ACTIVITIES

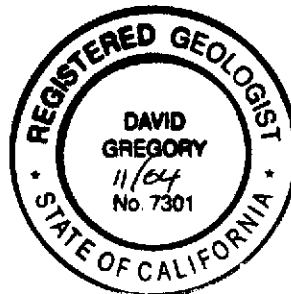
TEC Accutite will begin scheduling upon written approval of this workplan from the ACHCSA. TEC Accutite will implement the workplan within 90 days and prepare a report documenting the activities and results within 60 days.

TEC Accutite would like to thank you in advance for your assistance and prompt attention to this matter. I can be contacted at (650) 952-5551 Ext. 208 if you have any questions or comments.

Sincerely,
TEC ACCUTITE



David Gregory, R.G.
Project Manager



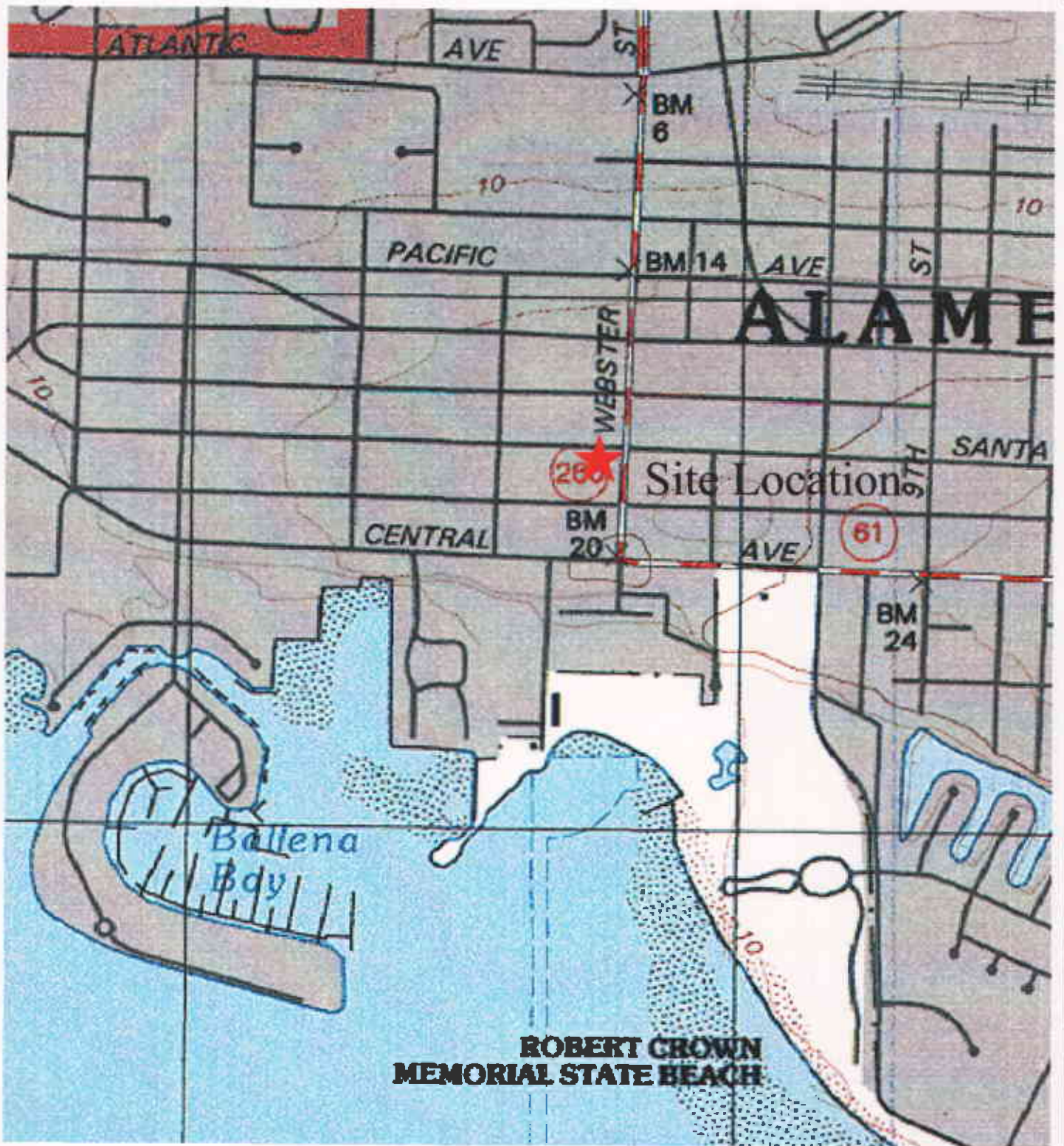
Figures: 1 – Vicinity Map
 2 – Site Map
 3 – Proposed Soil Vapor Sampling Locations

Attachment: A – Standard Soil Vapor Sampling Procedures
 B – Risk Assessment Spreadsheet

cc: Mr. Dan Koch, Olympian, 260 Michelle Court, South San Francisco, CA 94080.
 Mr. David Harris, Esq., Trump, Alioto, Trump & Prescott, LLP, 2280 Union Street, San Francisco, CA 94123
 Mr. Jeff Farrar, P.O. Box 1701, Chico, CA 95927
 Mr. Thomas Ballard, GHH Engineering, Inc., 8084 Old Auburn Road, Citrus Heights, CA 95610

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**ROBERT CROWN
MEMORIAL STATE BEACH**

DATE
11/17/00

PAGE
1 of 1

SCALE:
SHOWN ABOVE

LEGEND:



**35 SOUTH LINDEN AVENUE
SOUTH SAN FRANCISCO**

FIGURE 1

SITE VICINITY MAP

sis2.tcw

SITE:

**1435 WEBSTER STREET
ALAMEDA, CA**



**PUBLIC PARKING LOT
AND FORMER GAS STATION
1435 WEBSTER STREET
ALAMEDA, CALIFORNIA**

**PROPERTY
BOUNDARY**

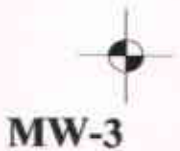
FORMER
GAS ISLAND



SIDEWALK



FORMER
GAS ISLAND



FORMER 7,500-GALLON
DIESEL UST

Fire Hydrant

WEBSTER STREET

SIDEWALK



TAYLOR AVENUE

REVISIONS

DATE
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PAGE
1 of 1



**FIGURE 2
SITE MAP**

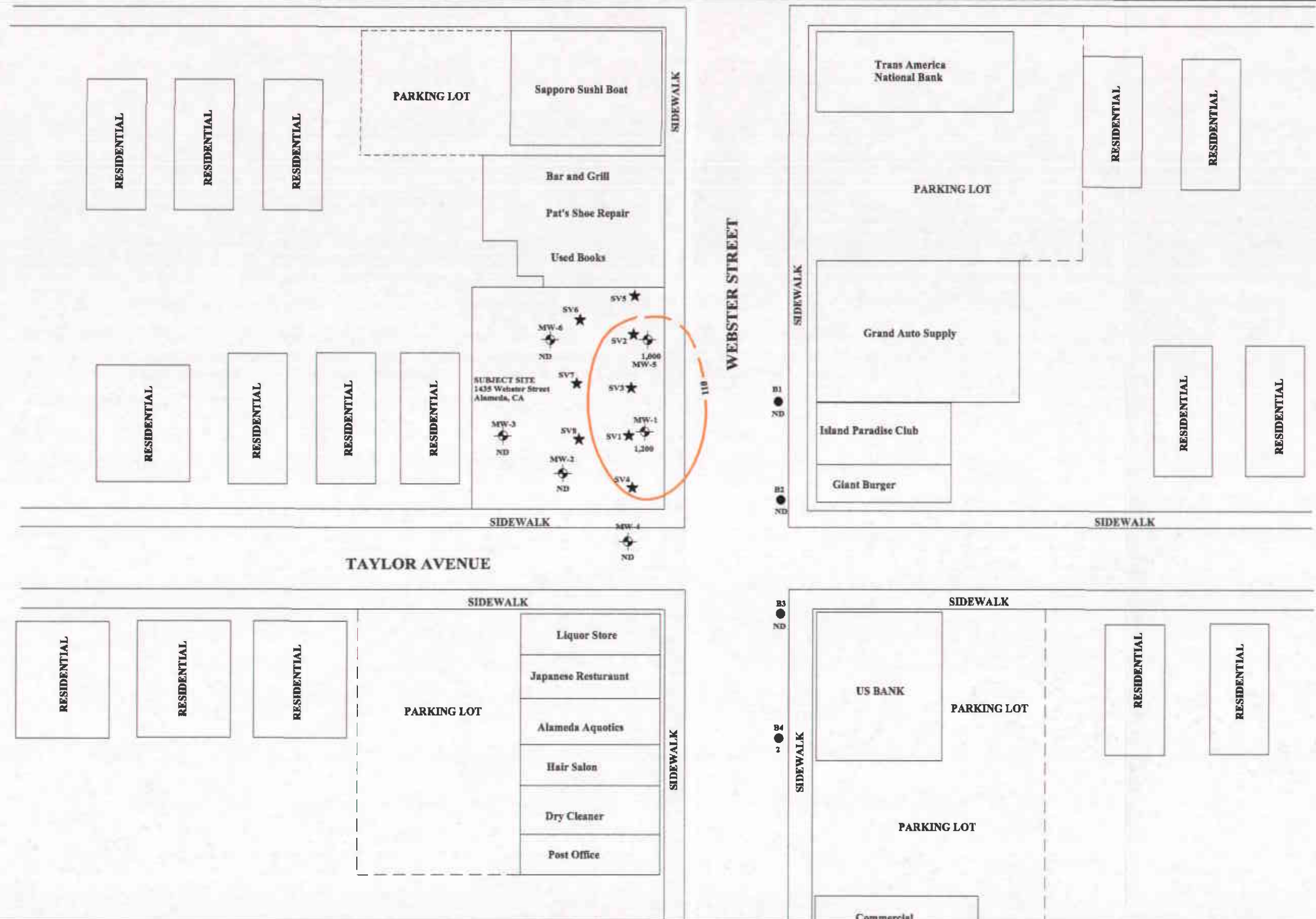


SCALE: ONE INCH = 20 FEET

**35 SOUTH LINDEN AVENUE
SOUTH SAN FRANCISCO**

KEY:





Legend:

- ◆₁₀₀ Monitoring Well, benzene concentration in groundwater (ppb)
- ₁₀₀ Soil Boring, benzene concentration in groundwater (ppb)
- ₁₁₀ Benzene in groundwater exceeding SSTL concentration July 2001 (ppb)
- ★_{SVN} Proposed soil vapor sample location

N
SCALE: 1" = 60'

TEC
ACCUTITE
35 SOUTH LINDEN AVENUE
SOUTH SAN FRANCISCO

Former Olympian Station
1435 Webster Street,
Alameda, CA

FIGURE 3:
Proposed Soil Vapor Sample Locations
January 2003

ATTACHMENT A
STANDARD SOIL VAPOR
SAMPLING PROCEDURES



Soil Vapor Standard Operating Procedures

Prepared by: **HP LABS/TEG**

Revised: June 2000

Soil Gas Sampling Procedures

Probe Construction and Insertion

Manual-Driven Probes

TEG's manually driven soil vapor probes are constructed of 0.625 inch outside diameter steel and equipped with a hardened steel tip. The probes are nominally 5 feet long and threaded together to reach multiple depths. An inert 1/8 inch nylaflo tube is threaded down the center of the probe and connected to a sampling port just above the tip. This internal sample tubing design eliminates any contact between the sample port and the gas sample.

The probe is driven into the ground by an electric rotary hammer. Once inserted to the desired depth, the probe is rotated approximately 3 turns to open the tip and exposes the vapor sampling ports. This design prevents clogging of the sampling ports and cross-contamination from soils during insertion.

Hydraulically-Driven Probes

TEG's hydraulically-driven soil vapor probes are constructed of either 1.0 or 1.5 inch outside diameter steel and equipped with a hardened drop-off steel tip. The probes are nominally 4 feet long and threaded together to reach multiple depths. The probe is driven into the subsurface with TEG's STRATAPROBE™ system. Once inserted to the desired depth, the probe is retracted slightly to expose the vapor sampling port. A small diameter inert tubing is then inserted through the center of the rod and threaded into a gas tight fitting just above the tip. After a sample is obtained the tubing is removed, the probe advanced to the next depth or removed. This design prevents clogging of the sampling port and cross-contamination from soils during insertion.

Soil Gas Sampling

Soil vapor is withdrawn from the inert nylaflow tubing using a 20 cubic centimeter (cc) syringe connected via an on-off valve. The first 3 dead volumes of gas are drawn and discarded at a minimum to flush the probe and fill it with in-situ soil vapor. The next 20 cc of gas are withdrawn in the syringe, plugged, and immediately transferred to the mobile lab for analysis within minutes of collection. The use of small calibrated syringes allowed for careful monitoring of purge and sample volumes. This procedure ensures adequate sample flow is obtained without excessive pumping of air or introduction of surface air into the sample.

If the time duration from sampling to analysis exceeds 15 minutes, soil gas samples are stored in gas-tight vials until analyzed.

Field Records

The field technician maintains a logsheet summarizing:

- Sample identification
- Probe location
- Date and time of sample collection
- Sampling depth
- Identity of samplers
- Weather conditions
- Sampling methods and devices
- Soil gas purge volumes
- Volume of soil gas extracted
- Observation of soil or subsurface characteristics (any condition that affects sample integrity)
- Apparent moisture content (dry, moist or saturated etc.) of the sampling zone
- Chain of custody protocols and records used to track samples from sampling point to analysis.

Analytical Methodology

Operating Conditions and Instrumentation

Halogenated, Aromatic Hydrocarbons & TPH by EPA Modified 8021 & 8015

Instrument: Shimadzu GC-14 or SRI 8610 Gas Chromatograph

Column: 30 to 75 meter DB-624, megabore capillary.

Carrier flow: Helium at 15 ml/min.

Detectors: Photoionization/Hall (EICD) or ECD detectors in series.

Detectors: Flame ionization detector on separate column.

Column oven: 45°C for 2 min, 45°C to 175°C at 5°C/min.

Fixed and Biogenic Gases (O₂, CO₂, and Methane)

Instrument: SRI 8610 or Carle AGC 311 Gas Chromatograph

Column: 6 foot CTR

Carrier flow: Helium at 15 ml/min.

Detectors: Thermoconductivity (TCD) detectors.

Standard Preparation

Primary (stock) standards: Made from certified neat components or from traceable standards purchased from certified suppliers.

Secondary (working) Standards: Made by diluting primary standard. Typical concentrations are 1ug/ml, 10 ug/ml, and 50 ug/ml.

Laboratory Check Samples are prepared at the midpoint concentration from a standard purchased from a source different than the primary standards.

Lot numbers and preparations of all standards are recorded on a log sheet and kept in the mobile laboratory.

Initial Multi-Point Calibration Curve

An initial calibration curve of a minimum of 3 points is performed:

- At the start of the project.
- When the GC column or operating conditions have changed
- When the daily mid-point calibration check cannot meet the requirements as specified below.

Calibration curves for each target component are prepared by analyzing low, mid, and high calibration standards covering the expected concentration range. The lowest standard concentration will not exceed 5 times the reporting limit for each compound.

A linearity check of the calibration curve for each compound is performed by computing a correlation coefficient and an average response factor. If a correlation coefficient of 0.990 or a percent relative standard deviation (%RSD) of $\pm 25\%$ is obtained, an average response factor is used over the entire calibration range. If the linearity criteria are not obtained, quantitation for that analyte is performed using a calibration curve.

After each initial multi-point calibration, the validity of the curve is further verified with a laboratory control standards (LCS) prepared at the mid-point of the calibration range. The LCS includes all target compounds and the response factor (RF) must fall within $\pm 20\%$ of the factor from the initial calibration curve.

Continuing Calibration (Daily Mid-point Calibration Check)

Continuing calibration standards prepared from a traceable source are analyzed at the beginning of each day. Acceptable continuing calibration agreement is set at $\pm 20\%$ to the average response factor from the calibration curve, except for freon, chloroethane, and vinyl chloride when a 25% agreement is required. When calibration checks fall outside this acceptable range for analytes detected on the site, corrective action, consisting of verification of the standard and/or a new calibration curve for the analytes out of specifications is performed by the on-site chemist.

The continuing calibration includes all compounds expected or detected at the site in addition to any specific compounds designated in the project workplan.

Detection Limits

Detection limits have been previously determined by the EPA method. Reporting limits for this program are defined as 5 times lower than the lowest concentration standard of the calibration curve, as follows:

| Compound | Detector | Report Limit |
|-------------------------------------|----------|-----------------------|
| Aromatic Hydrocarbons (BTEX): | PID | 1 ug/l-vapor for each |
| Halogenated Hydrocarbons (Solvents) | EICD | 1 ug/l-vapor for each |
| Fuel Hydrocarbons | FID | 10 ppm vapor |
| Methane | FID | 10 ppm vapor |

Injection of Soil Gas Samples

Vapor samples are withdrawn from the probe sampling syringe with a 1 cc syringe and injected directly into a sampling port on the gas chromatograph. The injection syringe is flushed 2 times with the sample prior to injection. Injection syringes are flushed several times with clean air or discarded between injections.

Compound Identification and Quantification

All analyses are performed with multiple detectors on megabore capillary columns following EPA Method 8000 protocols, modified for soil vapor. Modifications from the EPA methods consist of a site-specific analyte list, lack of matrix spike samples, lack of surrogates, and changes in calibration protocols as described in this SOP. All compounds detected in the soil gas samples are identified by chromatographic retention time and quantified using the average response factor from the active calibration curve. The analytical configuration provides the required compound separation as well as dual-detector confirmation. Further confirmation is provided by a second analysis on all samples using a second column with a flame ionization detector (FID).

Laboratory Data Logs

The field chemist maintains analytical records including date and time of analysis, sampler's name, chemist's name, sample id number, concentrations of compounds detected, calibration data, and any unusual conditions.

Quality Control Procedures

Compliance With Standards

Sampling and analytical procedures used by TEG complied with the American Society for Testing and Materials' *Standard Guide for Soil Gas Monitoring in the Vadose Zone* (ASTM D5314-93).

Staff Responsibilities

Staff responsibilities regarding operating and quality assurance procedures are assigned as follows:

Field Supervisor/Chemist:

- daily maintenance, startup and calibration of analytical equipment
- daily performance of quality control protocol
- sample and QA/QC sample analysis
- preparation of standards for linearity checks
- sample collection
- Chain-of-Custody Report completion
- documentation of analyses, problems, QA, maintenance of project files
- preparation of preliminary analytical report

Laboratory Director Responsibility:

- preparation of SOPs and QA/QC protocol
- implementation of QA program and technical training of personnel
- document control, security and confidentiality
- technical application and development
- verification of project data completeness
- verification of QA/QC compliance
- verification of client requirements
- preparation of QA report to include: technical difficulties, QA/QC results and conclusions

Sampling Quality Control

Method Blanks

Prior to sampling each day, all components of the sampling system are checked for contamination by drawing ambient air from above ground through the sampling equipment, and injecting a sample into a gas chromatograph. The analysis results are compared to that of the ambient air and recorded in the data tables as blanks.

Sample Quality Control

Each sample is given a unique identification number specifying location and depth. Purge and sample volumes are monitored closely using small calibrated syringes to assure a proper flow of soil gas. This ensures a representative sample is obtained from the sample zone without excessive pumping, which could result in sampling of surface air.

Decontamination Procedures

To minimize the potential for cross-contamination between sites, all external soil vapor probe parts are wiped or washed cleaned of excess dirt and moisture with solvents or de-ionized water as appropriate. The probe's internal nylaflow tubing is purged with clean air between sampling locations or replaced as necessary. Sampling syringes are flushed with clean air after each use or replaced.

Corrective Action

Corrective action is taken when unexpected contaminant levels are detected. First duplicate samples are taken to verify the initial detection of petroleum hydrocarbons. If contamination is suspected, then the sample probes are disassembled, wiped cleaned of excess dirt and moisture, rinsed with deionized water, washed with Alconox and water, and rinsed again with deionized water. The sample tubing in the probe is replaced. Contaminated sampling syringes are discarded.

Analytical Quality Control

Method Blanks

Method blanks are performed at the start of each day by drawing clean air through the sampling equipment and analyzing. These blanks verify all components of the sampling and analytical system are free of contamination. Additional blanks are performed more often as appropriate depending upon the measured concentrations, at a minimum 1 every 20 samples. The results of all blank analyses are recorded in the data tables. If a blank shows a measurable amount of any target compound, the on-site chemist will investigate and determine the source, and resolve the contamination problem prior to analyzing any samples.

Duplicate Samples

Duplicate (repetitive) analysis of a sample is performed when inconsistent data are observed, but at least one every 20 samples. Because soil vapor duplicates can vary widely, nominal relative percent difference (RPD) acceptance criteria is \pm a factor of 2.

Continuing Calibration (Daily Mid-point Calibration Check)

Continuing calibration standards prepared from a traceable source are analyzed at the beginning of each day. Acceptable continuing calibration agreement is set at \pm 20% to the average response factor from the calibration curve, except for freon, chloroethane, and vinyl chloride when a 25% agreement is required. When calibration checks fall outside this acceptable range for analytes detected on the site, corrective action, consisting of verification of the standard and/or a new calibration curve for the analytes out of specifications, is performed by the on-site chemist.

The continuing calibration includes all compounds expected or detected at the site and any specific compounds designated in the project workplan.

Laboratory Check Samples (LCS)

Laboratory check samples, prepared at the midpoint concentration from a standard purchased from a source different than the calibration standards, are analyzed at the end of each day. Acceptance criteria is \pm 20% from the true value. If the LCS falls outside this acceptance range for analytes detected on site, corrective action, consisting of verification of the standard and/or a new calibration curve for the analytes out of specifications, is performed.

ATTACHMENT B
RISK ASSESSMENT
SPREADSHEET



TEC ACCUTITE**Soil Vapor - Indoor Air Risk Calculation****Residential Scenario**

SITE: 1435 Webster Street, Alameda, CA

COMPOUND: Benzene**Diffusive Transport In Unsaturated Soil**

| | | | | |
|---------------------------------|-----------|-----------------|-------------------|------------------------------|
| Henry's Constant | H | 2.30E-01 | dimensionless | Chemical Specific (3) |
| Total porosity | N | 4.30E-01 | dimensionless | Default (1) |
| Air filled porosity | Na | 2.80E-01 | dimensionless | Default (1) |
| Water filled porosity | Nw | 1.50E-01 | dimensionless | Default (1) |
| Diffusion Co-efficient in air | Da | 8.80E-02 | cm2/sec | Chemical Specific (3) |
| Diffusion Co-efficient in water | Dw | 9.80E-06 | cm2/sec | Chemical Specific (3) |
| Effective Diffusion Coefficient | De | 6.86E-03 | cm2/sec | Calculated |
| Depth of contamination or Csg | X | 1.2 | m | Site Specific |
| Soil Gas Concentration | Csg | 1.80E+02 | mg/m3 | Example Concentration |
| Calculated Flux | Fx | 3.71E-01 | mg/m2-hour | Calculated |

Concentration at Point of Exposure (Indoor-air)

| | | | | |
|------------------------------------|-------------|-----------------|---------------|-------------|
| Slab (crack factor) | Cf | 1.00E-03 | dimensionless | Default (1) |
| Flux | Fx | 3.71E-01 | mg/m2-hour | |
| Floor area of building | A | 1.00E+00 | m2 | Default (1) |
| Volume of building | V | 2.44E+00 | m3 | Default (1) |
| Exchange Rate | E | 2.00E+00 | exchanges/hr | Default (2) |
| Concentration at Point of Exposure | Cpoe | 7.60E-05 | mg/m3 | |

Exposure Scenario

| | | | | |
|-------------------------------------|-----------|----------------|-----------|-------------|
| Inhalation Rate | Ir | 20 | m3/day | Default (1) |
| Body weight | Bw | 7.00E+01 | kg | Default (1) |
| Exposure Frequency | Ef | 350 | days/year | Default (1) |
| Exposure Duration | Ed | 30 | years | Default (1) |
| Average Time (Carc) (70yrsx365days) | At | 2.56E+04 | days | Default (1) |
| Exposure Rate | Er | 1.2E-01 | m3/kg-day | Default (1) |

Chronic Daily Intake Rate (Carc.Risk)

| | | | | |
|------------------------------------|-------------|-----------------|-----------|--|
| Concentration at Point of Exposure | Cpoe | 7.60E-05 | mg/m3 | |
| Exposure Rate | Er | 1.2E-01 | m3/kg-day | |
| Chronic Daily Intake Rate | Cdi | 8.92E-06 | mg/kg-day | |

Cancer Risk (Cdi x Sf)

| | | | | |
|---------------------------|-------------|-----------------|---------------|--------------------------------|
| Chronic daily intake rate | Cdi | 8.92E-06 | mg/kg-day | |
| slope factor | Sf | 1.00E-01 | 1/mg/kg-day | Default (1) |
| Cancer Risk | Risk | 8.92E-07 | dimensionless | BELOW TARGET RISK LEVEL |
| TARGET RISK | Tr | 1.00E-06 | | Default (1) |

(1) USEPA, 1999, *Preliminary Remediation Goals*: U.S. Environmental Protection Agency, Region IX, October, 1999(2) Oakland, 1999, *Oakland Risk-Based Corrective Action: Technical Background Document*:

City of Oakland, Environmental Services Division

(3) Table J: CRWQCB Interim Final – August 2000