**SECOR**
*International Incorporated*

#4008

December 7, 1999

Mr. Barney M. Chan
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

**TIER I AND TIER II RISK-BASED CORRECTIVE ACTION EVALUATION, SAN FRANCISCO FRENCH BREAD FACILITY, 580 JULIE ANN WAY, OAKLAND, CALIFORNIA, FOR METZ BAKING COMPANY**

Dear Mr. Chan:

SECOR International Incorporated (SECOR), on behalf of Metz Baking Company, is pleased to submit the enclosed Tier I and Tier II Risk Based Corrective Action (RBCA) Evaluation for the San Francisco French Bread facility located at 580 Julie Ann Way in Oakland, California. SECOR has performed this evaluation based on direction from the Alameda County Health Care Service Agency.

The RBCA evaluation indicates site-specific Target Levels (SSTLs) for benzene in soil and groundwater of 2 milligrams per kilogram (mg/kg) and 0.16 milligrams per liter (mg/l), respectively. Analytical results of groundwater samples collected during the most recent groundwater monitoring episode, March 17, 1999, indicate that concentrations of dissolved benzene in groundwater were below the groundwater SSTL in all wells. The RBCA also indicates that adverse impacts to a hypothetical onsite indoor commercial worker are not expected. However, based on the benzene analytical result (5.1 mg/kg) from one historic onsite soil sample collected during the removal of the former underground storage tanks in September 1995, risk above $10^{-5}$ to a hypothetical onsite construction worker would exist if onsite soil is disturbed during possible future construction activities. For that reason, a site-specific Risk Management Plan (RMP) has been included in Section 5.0 of the enclosed report to assist future construction workers in managing potential exposures to residual petroleum-related hydrocarbons at the site.

SECOR and Metz look forward to your review of the enclosed document. We trust that, based on the information included in the report, closure of the site will be forthcoming. If you have any questions or comments, please do not hesitate to contact me at (510) 285-2556.

*Sincerely,*

**SECOR International Incorporated**

Annette Duffy for
William E. Brasher, P.E.
Project Manager

cc: Mr. Christopher Rants, Metz Baking Company
Mr. David Graves, Interstate Brands

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SECOR
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# TIER I AND TIER II RISK-BASED CORRECTIVE ACTION EVALUATION METZ BAKING COMPANY 580 JULIE ANN WAY OAKLAND, CALIFORNIA

**SECOR PN: 005.02811.005**

**Prepared for:**

The Metz Baking Company
P.O. Box 448
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12-7-99

**Submitted by:**

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# 1.0 INTRODUCTION

A Tier I and Tier II Risk-Based Corrective Action (RBCA) evaluation was conducted for the San Francisco French Bread facility located at 580 Julie Ann Way, Oakland, California (the Site) and owned by the Metz Baking Company (Metz). This RBCA was conducted in direct response to the Alameda County Department of Environmental Health Services (ACDEH, 1999) letter dated July 21, 1999, in which the RBCA approach was recommended to expedite closure of the site.

The RBCA evaluation was conducted consistent with the American Society for Testing and Materials (ASTM) guidelines (ASTM, 1995). In general the tiered approach is designed as a step-wise process to evaluate potential exposures and associated risks to hypothetical receptors posed by releases of petroleum-derived chemicals, and to identify appropriate corrective actions to mitigate risks, if necessary, to levels considered acceptable to regulatory agencies. RBCA evaluations typically involve Tier I and Tier II methods. Results of the generic, conservative Tier I are used as the basis for conducting a more site-specific assessment in Tier II. At the end of the process either no further action is recommended, or site-specific risk target levels (i.e., risk-based) are identified that can serve as remediation goals. The remainder of this report is organized as follows:

- Site Description and Data Evaluation (Section 2.0);
- Tier I RBCA Evaluation (Section 3.0);
- Tier II RBCA Evaluation (Section 4.0); and
- Recommended Risk Management Plan (Section 5.0).

References cited in the report are presented in Section 6.0.

# 2.0 SITE DESCRIPTION AND DATA EVALUATION

The Site is located in a mixed commercial/industrial area of Oakland, California and consists of a large warehouse/bakery and an open asphalt parking/work area (Figure 2-1). The Site is expected to remain industrial. Baked food products are prepared and distributed at the Site, which historically included operation of one 8,000-gallon underground storage tank (UST) and one 10,000-gallon UST (SECOR, 1998). Previous site investigations conducted by Groundwater Technology, Inc. (GTI), indicate that one or both of the USTs leaked fuel into the surrounding soils prior to their removal in 1995.

A total of 15 soil samples were collected between September 1995 and May 1998 from 13 different locations between 1 and 12 feet below ground surface (bgs). Laboratory analysis indicated the presence of total recoverable petroleum hydrocarbons (TRPH); TPH as gasoline (TPHg), diesel (TPHd), and motor oil (TPHmo); BTEX (benzene; toluene; ethylbenzene; and xylenes); methyl-tert-butyl ether (MTBE); naphthalene; 2-methylnaphthalene; and di-n-butylphthalate. The results of these soil sampling analyses are summarized in Table A-1 of Appendix A.

Groundwater at the Site has been sampled since 1996 and on a quarterly basis since June 1998 (SECOR, 1998, 1999). Laboratory analysis indicated the presence of TRPH, TPHg, TPHd, and TPHmo, BTEX, MTBE, naphthalene, and 2-methylnaphthalene in groundwater. The results of these groundwater sampling analyses are summarized in Table A-2 of Appendix A.

As indicated above, several types of TPH have been detected in soil and groundwater. As discussed by ASTM (1995), it is not practical to evaluate every compound present in a petroleum mixture. For this reason, risk management decisions are generally based on assessing the potential impacts from a select group of indicator compounds. It is inherently assumed in this approach that a significant fraction of the total potential impact from all chemicals is due to these indicator compounds. The relatively low toxicities and dissolved-phase mobility of aliphatic hydrocarbons have made these chemicals of less concern relative to aromatic hydrocarbons. When additives are present, these should be separately considered. Therefore, "TPH data should not be used for risk assessment because the general measure of TPH provides insufficient information about the amounts of individual chemicals of concern present" (ASTM, 1995). ASTM (1995) further states that "of the large number of compounds present in petroleum products, aromatic hydrocarbons (BTEX, PAHs, and so forth) are the constituents that human and aquatic organisms tend to be most sensitive to". Because both BTEX and PAH data have been collected at the site, TPH data were not used in this RBCA consistent with these recommendations.

For groundwater, the last four quarters of analytical data for BTEX were used in the evaluation because these data are expected to best reflect current Site conditions. However, PAHs were only analyzed in samples collected in August 1996. Therefore, PAH data from these older samples were also used in this RBCA.

The BTEX and PAH data presented in Appendix A were used to conduct the Tier I and Tier II RBCA evaluation for this Site. As a conservative measure, it was assumed that all detected chemicals were present at their maximum detected concentrations.

Sections 3.0 and 4.0 present the results of the Tier I and Tier II RBCA evaluation, respectively.

# 3.0 TIER I RBCA EVALUATION

Consistent with ASTM (1995) recommended guidelines for a UST site, a Tier I evaluation was conducted comparing the maximum detected concentrations of chemicals against appropriate Risk Based Screening Levels (RBSLs). RBSLs represent media-specific conservatively developed values, below which adverse health effects are not expected. For the purposes of this evaluation, USEPA Region IX Preliminary Remediation Goals (PRGs; USEPA, 1999a) were selected as appropriate RBSLs for this Site.

As stated in USEPA (1999a), PRGs are estimated "...contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate." PRGs "...can be used to screen pollutants in environmental media". PRGs incorporate potential soil and groundwater exposure via ingestion, dermal contact, and inhalation of volatiles. Because these represent the primary pathways of potential exposure at this Site, they are relevant to use as RBSLs for this Tier I evaluation. Chemicals at concentrations below PRGs can be considered below levels of concern, and therefore can be excluded from further evaluation.

As indicated previously in Section 2.0, the Site is expected to remain exclusively "industrial" (i.e., no residences will be built on the Site). For this reason, industrial-based PRGs were selected as the most relevant Tier I RBSLs. However, industrial-based groundwater PRGs are currently not available. Instead, PRGs developed for domestic use scenarios (e.g., drinking water) were conservatively used as RBSLs to evaluate chemicals in groundwater. The results of the Tier I evaluation are discussed below and summarized in Tables 3-1 (soil) and 3-2 (groundwater).

what is the zoning?

Chemicals with maximum detected concentrations below its RBSL are not expected to adversely impact human health and were eliminated from further evaluation in this RBCA. However, detected chemicals were retained for Tier II under the following conditions:

- The maximum detected concentration of a chemical exceeded its PRG; or
- A PRG has not been developed for a detected chemical.

SSDE-12 → what about SB-F@7' 28 ppm - no GW encountered
SB-G@5½' 24 ppm, GW@7'
for drinking water

In soil, only the maximum detected concentration of benzene (5.1 mg/kg) exceeded it's PRG (1.5 mg/kg; Table 3-1). A PRG is currently not available for 2-methylnaphthalene which was detected at 3.6 mg/kg (Table 3-1). In groundwater, benzene, MTBE and naphthalene exceeded their PRGs (Table 3-2). In addition, a PRG is not available for 2-methylnaphthalene in groundwater. These chemicals were all retained for the Tier II RBCA evaluation (Section 4.0).

# 4.0 TIER II RBCA EVALUATION

As indicated earlier, a Tier II Evaluation was conducted to evaluate chemicals retained through the Tier I RBCA evaluation (Section 3.0). These chemicals include benzene and 2-methylnaphthalene in both soil and groundwater, and MTBE and naphthalene in groundwater only (Tables 3-1 and 3-2). This section summarizes the methods used to conduct the Tier II RBCA evaluation as described by ASTM (1995) . For this Site, this includes the following items:

- Developing a site-specific Conceptual Site Model;
- Identifying intake/exposure assumptions;
- Identifying chemical-specific toxicity values;
- Estimating exposure point concentrations;
- Discussing Tier II results; and
- Estimating chemical-specific SSTLs.

The conceptual site model is used to identify relevant receptors and exposure pathways for quantitative evaluation in the Tier II RBCA. Intake assumptions are used in combination with chemical-specific exposure point concentrations to estimate doses, and these are combined with chemical-specific toxicity values to generate noncancer hazards and excess cancer risks associated with the estimated doses. Each of above-listed bulleted items is discussed in more detail below.

## 4.1 DEVELOPING A SITE-SPECIFIC CONCEPTUAL SITE MODEL

A conceptual site model (CSM) was developed to identify complete and significant pathways based on current and expected future uses of the Site. As indicated earlier in Section 2.0, the Site is paved and contains a manufacturing and distribution facility. The Site will remain industrial in the future. Because the Site is paved, direct contact with soils or groundwater is not a complete exposure pathway for the commercial worker who is assumed to work primarily indoors. However, a construction worker involved in invasive activities (e.g., utility line repair) could directly contact both soil and shallow groundwater.

Based on this information and the analysis summarized in the CSM diagram (Figure 4-1) the following two hypothetical human receptors and complete and significant exposure pathways were evaluated in this assessment:

**I. Hypothetical Onsite Indoor Commercial Worker Receptor**

- Inhalation of chemical vapors emanating from soil and/or groundwater.

**II. Hypothetical Onsite Construction Worker Receptor; and**

- Incidental ingestion of soil;
- Dermal contact with soil;
- Inhalation of chemical vapors emanating from soil;
- Inhalation of fugitive dust; and
- Inhalation of chemical vapors emanating from groundwater.

Only the above-listed exposure pathways were quantified; although other exposure pathways might exist, they are considered minor and were not quantitatively evaluated in this Tier II assessment. Receptor-specific exposure pathways are summarized in Figure 4-1.

## 4.2 IDENTIFYING INTAKE/EXPOSURE ASSUMPTIONS

Exposure assumptions used to conduct the Tier II evaluation were based on those values developed by either USEPA (1989, 1991, 1992, 1997) or CalEPA (1992). In cases where agency-developed values were not available, SECOR applied best professional judgement (BPJ). A complete summary of all intake/exposure assumptions used to conduct the Tier II evaluation is provided in Tables 4-1 and 4-2. As indicated in the table, BPJ was applied to the following parameters:

- An exposure time of 8 hours per day for both the hypothetical onsite indoor commercial worker and the construction worker receptor; and
- An exposure duration of 90 days for a hypothetical onsite construction worker receptor.

All other parameters were compiled from the sources listed above.

## 4.3 IDENTIFYING CHEMICAL-SPECIFIC TOXICITY VALUES

Chemical-specific toxicity values were obtained from CalEPA and USEPA sources in the following order of priority:

- California Cancer Potency Factoors (CalEPA, 1994);
- Integrated Risk Information System (USEPA, 1999b); and
- Region 9 Preliminary Remediation Goal Memorandum (USEPA, 1999a).

Toxicity values are currently unavailable for 2-methylnaphthalene and a chronic oral reference dose is not yet available for MTBE. To fully quantify exposures associated with these two chemicals:

- Toxicity values developed for naphthalene were used to evaluate 2-methylnaphthalene; and
- The chronic MTBE inhalation reference dose was used to represent the chronic oral reference dose for MTBE to evaluate ingestion and dermal-related exposures (i.e., route-to-route extrapolation was conducted).

Reference doses (RfDs) used to evaluate noncancer effects are summarized in Table 4-3. Slope factors (SFs) used to evaluate cancer risks are summarized in Table 4-4.

## 4.4 ESTIMATING EXPOSURE POINT CONCENTRATIONS

As a conservative measure the exposure point concentrations (EPC) used in this Tier II evaluation are based on the maximum detected media concentrations. For the direct exposure pathways to chemicals in soil, the EPC is equal to the maximum detected concentration. Inhalation exposure pathways evaluated for both the hypothetical onsite construction worker and indoor commercial worker receptor were evaluated using "modeled" air concentrations. These concentrations were estimated using a two-step process by first estimating a vapor flux from soil or groundwater at the surface of the soil. The flux is then used to estimate chemical concentrations in either indoor or outdoor air. In the case of chemicals in soil, the flux was estimated using the Behavior Assessment Model (Jury et al., 1984). Flux associated with chemicals in groundwater were based on the models developed by Karimi et al., (1987) Shen, 1981; and USEPA, 1988. Indoor air vapors associated with chemicals in either soil or groundwater were estimated using models as described by ASTM (1995); Wadden and Scheff (1989); and Johnson and

Ettinger (1991). Chemical concentrations in outdoor air were estimated using the box model as described by USEPA, 1991; Dobbins, 1979, and CalEPA 1994a. All modeling inputs, outputs, and equations used to estimate chemical concentrations in indoor and outdoor air are presented in Appendix B. All EPCs used in this assessment are summarized in Table 4-5.

EPCs were then combined with intake/exposure factors to estimate daily doses. These doses were then used to estimate noncancer effects (hazard quotients [HQs] for individual chemicals and hazard indices [HIs] for multichemical and multipathway exposures) and cancer risks based on the methods outlined by USEPA (1989). Daily doses are summarized in Appendix C for the hypothetical onsite indoor commercial worker receptor and in Appendix D for the hypothetical onsite construction worker receptor. The daily dose resulting from dermal exposure to chemicals in groundwater requires development of an absorbed dose, which is different from the dose estimates derived for the ingestion and inhalation exposure pathways. The absorbed dose ($DA_{event}$) for each chemical in groundwater was calculated using methods consistent with USEPA (1992) which are summarized in Table 4-6. These $DA_{event}$ terms are then used in the exposure equations as summarized in Appendix D.

## 4.5 RESULTS OF THE TIER II EVALUATION

This section summarizes the results of the Tier II RBCA for the hypothetical onsite indoor commercial worker (Section 4.5.1) and onsite construction worker receptor (Section 4.5.2).

### 4.5.1 Hypothetical Onsite Indoor Commercial Worker Receptor

The estimated noncancer multipathway HI and the total excess cancer risk for this hypothetical receptor are 0.01 and $8 \times 10^{-7}$, respectively. In both cases, these values are well below the USEPA and CalEPA threshold levels of 1 (USEPA, 1989; CalEPA, 1992). The cancer risk is also below the State of California's threshold level of $1 \times 10^{-5}$ for workers (California Health and Welfare Agency, 1988). Pathway-specific HIs and cancer risks estimated for this receptor are summarized in Table 4-7. Individual and chemical-specific HQs and cancer risks are provided in Appendix C.

### 4.5.2 Hypothetical Onsite Construction Worker Receptor

The estimated noncancer multipathway HI and the total excess cancer risk for this hypothetical receptor are 5 and $1 \times 10^{-5}$, respectively. The HI exceeds the USEPA and CalEPA threshold level of 1 (USEPA, 1989; CalEPA, 1992). The cancer risk estimate is equal to the California cancer risk threshold of $1 \times 10^{-5}$ for workers (California, 1988). Exposures associated with the inhalation of benzene vapors emanating from soil (Table D-4) and dermal contact with benzene in groundwater (Table D-5) account for virtually the entire HI and cancer risks estimated for this hypothetical human receptor. Pathway-specific HIs and cancer risks estimated for this receptor are summarized in Table 4-7. Individual chemical-specific HQs and cancer risks are provided in Appendix D.

## 4.6 ESTIMATION OF SITE-SPECIFIC TARGET LEVELS (SSTLS)

Similar to RBSLs, site-specific Target Levels (SSTLs) represent chemical concentrations below which adverse health effects are not expected. However, unlike RBSLs, SSTLs are developed for a specific site. For this Site, *the results of the Tier II evaluation indicate (Section 4.5.1) that adverse impacts to a* hypothetical onsite indoor commercial worker are not expected. However, the estimated HIs estimated for the hypothetical onsite construction worker receptor exceed USEPA's (1989) threshold of 1 for noncancer effects. Inhaling benzene vapors emanating from soil (Table D-4) and dermal contact with benzene in groundwater (Table D-5) represent nearly all of the estimated HI for this receptor. Appropriate SSTLs benzene in soil and groundwater were estimated using the following equation:

$$SSTL_{soil\ or\ groundwater} = B_{s\ or\ gw} \times CHI^{-1} \times THI$$

Where:

| | | |
|---|---|---|
| $SSTL_{soil\ or\ gw}$ | = | Site specific target level for benzene in soil or groundwater; |
| $B_{s\ or\ gw}$ | = | Concentration of benzene in soil (mg/kg) or groundwater (mg/L); |
| CHI | = | The corresponding HI associated with $B_s$; and |
| THI | = | Target Hazard Index (1). |

Based on this equation, the SSTL for benzene in soil and groundwater are 2 mg/kg and 0.16 mg/L, respectively. Spreadsheets used to estimate these SSTLs are presented in Appendix E.

# 5.0 RISK MANAGEMENT PLAN

This Risk Management Plan (RMP) has been prepared to address the presence of residual petroleum-related hydrocarbons at and near the Site. The residual concentrations found in soil and groundwater do not pose a threat to current onsite workers based upon the detailed risk-based evaluation summarized in the previous sections of this report. However, exposure to petroleum-related hydrocarbons, and particularly benzene may pose a threat to a construction worker if soil is disturbed and/or groundwater is exposed at the Site. As a result, onsite workers performing short-term construction activities at the Site in the future will need to be notified and prepared for potential exposure to benzene, and minimal exposures to other TPH-related hydrocarbons. The RMP provides a decision framework to manage exposures to gasoline-related hydrocarbons and the potential short-term exposure to onsite construction workers, if soil or groundwater containing residual petroleum-related hydrocarbons are disturbed. This RMP also contains a description of monitoring well abandonment activities. These activities would be performed upon approval of Site closure and of this RMP by the RWQCB.

## 5.1 WELL ABANDONMENT PLAN

This section summarizes activities to be performed during well abandonment activities. Each of the seven groundwater monitoring wells at the Site will be abandoned by over-drilling, or as required by the Alameda County Water Resources Agency (ACWRA). A permit for abandonment of the wells will be obtained from the ACWRA and an encroachment permit will be obtained from the City of Oakland Engineering Division to perform work in the public right-of-way for those wells located in the street or on sidewalks. The wells will be over-drilled to just beyond the total depth of the original boring. These boreholes will then be backfilled with neat cement using a tremie pipe. All nearby storm drains will be protected from any accidental runoff, soil cuttings generated will be stockpiled onsite with plastic sheeting placed under and over the pile, and liquids generated will be stored in 55-gallon drums. Both soils and liquids will be disposed of at an offsite location after profiling of the waste materials. A report of the well abandonment activities will be prepared for submittal to the ACHSA, RWQCB and ACWRA.

### 5.1.1 Risk Management Protocols

This section identifies protocols to be followed to prepare for earthwork and construction at the Site that may be implemented by the current, or a future, owner. These protocols include:

- Establishing worker health and safety training requirements, worker notification and protection objectives, and worker health and safety monitoring procedures for workers who may directly contact hydrocarbon-containing soil or groundwater during Site preparation, grading, or foundation construction;

- Establishing notification objectives for offsite receptors who may be exposed to petroleum hydrocarbons; and

- Establishing procedures to manage soil and/or groundwater on the Site during construction to minimize worker or offsite receptor exposures.

### 5.1.2 Site-Specific Worker Health and Safety Planning Requirements

During construction activities those workers that may directly contact soil or groundwater will perform construction activities in accordance with a Site-specific health and safety plan (HASP). Preparation of the Site specific HASP will be required for earthwork construction (e.g., site preparation, grading and foundation construction) or other activity in which workers may directly contact soil or groundwater potentially containing petroleum hydrocarbons. The contractor or owner will be responsible for preparing the HASP. The HASP will be consistent with State and Federal Occupational Safety and Health Administration (OSHA) standards for potential hazardous waste operations (CCR, Title 8, Section 5192 and 29 CFR 1910.120, respectively).

### 5.1.3 Offsite Resident Notification

Prior to any construction activities, notification of pending construction activities shall be given to the ACHSA and RWQCB. If deemed necessary by the local regulatory agencies, a fact sheet can be prepared to notify nearby residents of potential exposures to petroleum-related hydrocarbons. The fact sheet will include owner, contractor, and regulatory contact names and telephone numbers that can be used by the public to gather information on Site conditions.

### 5.1.4 Soil Management Protocols

The general protocol for excavating and handling soil potentially containing petroleum hydrocarbons at the Site is as follows:

- Excavated or exposed soil will be managed in such a manner as to minimize exposure of onsite workers or offsite residents to petroleum-related hydrocarbons;

- Soil excavated from the Site with detectable concentrations of petroleum hydrocarbons will not be used as fill at the Site;

- Excavated soil is to be disposed offsite. Sampling frequencies and parameters will be determined by the disposal facility; and

- Excavated soil will be managed in such a manner as to minimize transport of sediments from the Site in surface water runoff, in airborne dust particles, or on the tires or shells of construction equipment.

Based on the results of the Tier II RBCA, a construction worker should not be allowed to work in a trench in excess of 30 days due to potential exposures to benzene vapors in areas where the soil concentration exceeds 2 mg/kg.

### 5.1.5 Groundwater Management Protocols

The general protocol for managing exposed groundwater or groundwater removed from beneath the Site is as follows:

- No shallow groundwater from beneath the Site will be used for irrigation or as drinking water;
- Exposed groundwater or groundwater removed during construction will be managed in such a manner as to minimize exposure by onsite workers or offsite residents to petroleum-related hydrocarbons; and
- Groundwater that is removed during construction activities will either be discharged to surface water under the terms of a National Pollutant Discharge Elimination System (NPDES) permit issued by the RWQCB or disposed appropriately at an offsite treatment facility.

Based on the results of the Tier II RBCA, a construction worker should either wear protective clothing to reduce skin contact with groundwater or implement appropriate engineering controls (e.g., dewatering) to prevent prolonged skin contact with groundwater containing benzene above 0.16 mg/L.

## 5.2 REPORTING PROTOCOLS

The following protocols will be followed by the current Site owners and their successors to maintain compliance with the RMP:

- If title to the property is transferred to a new owner, the former owner is responsible to notify the new owner of the conditions of this RMP; and
- If during activities associated with any construction, environmental conditions are found to differ from those described in the historic reports of investigation and remedial activities, then the ACHSA and RWQCB will be notified and risk management protocols may have to be modified to accommodate the differing conditions.

# 6.0 LITERATURE CITED


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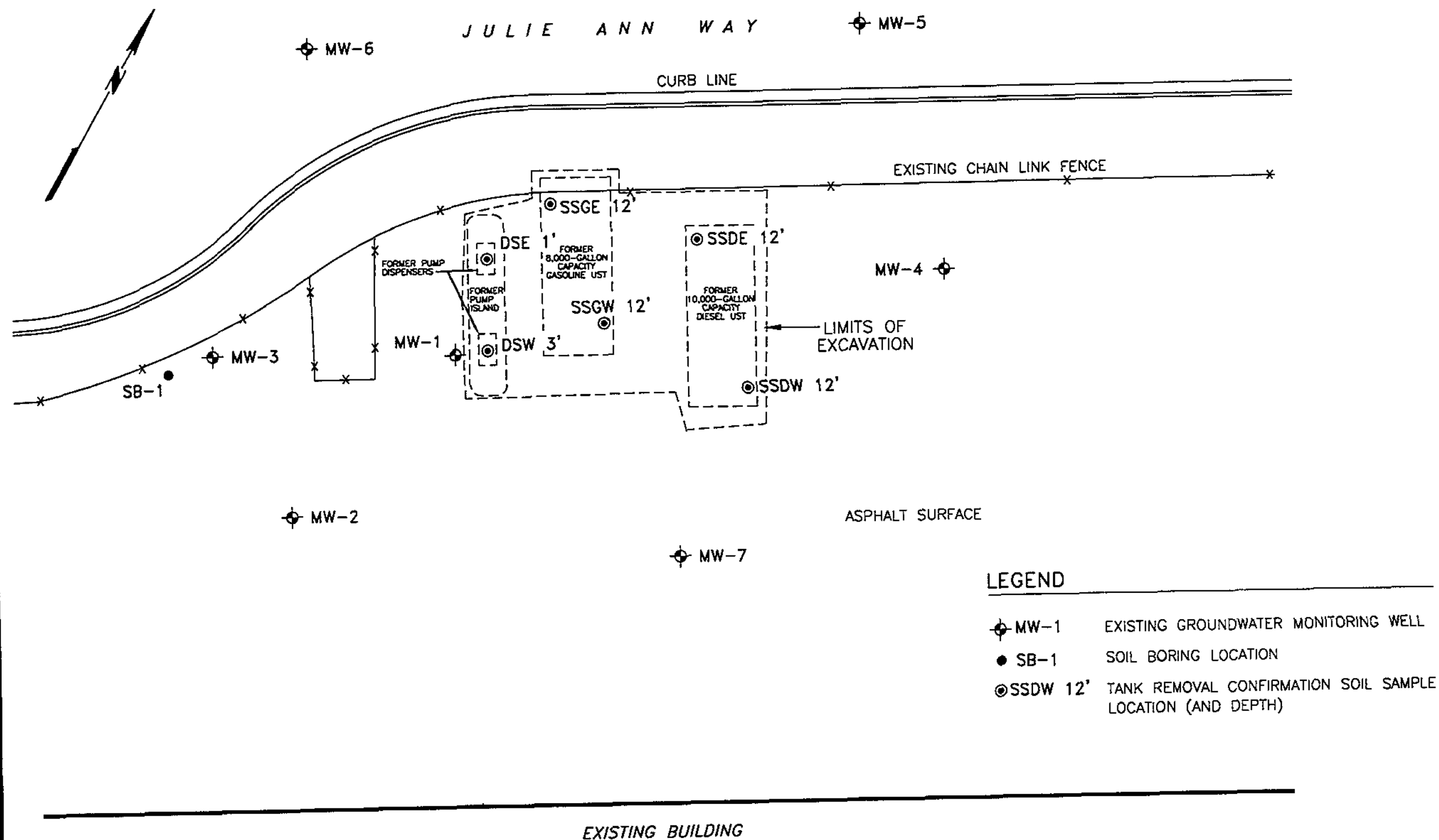
# MAIN TEXT FIGURES

199810.181210 X:\SF-BREAD\JULIE\SITE.DWG 12/7/99




REFERENCE: RON ARCHER CIVIL ENGINEER INC., DATED AUGUST 15, 1996.

0 20 40
APPROXIMATE SCALE IN FEET

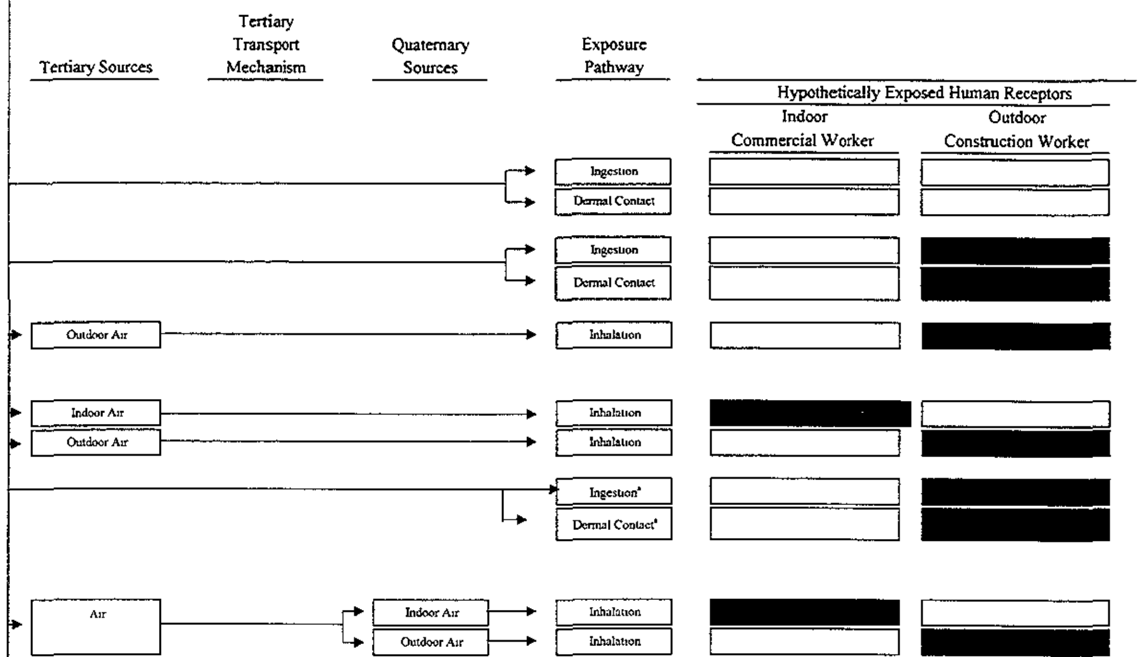
SECOR
International Incorporated

| | |
|---|---|
| DRAWN | GEL |
| APPR | WEB |
| DATE | 7DEC99 |
| JOB NO. | 005.02811.004 |

FIGURE 2-1
SAN FRANCISCO FRENCH BREAD
580 JULIE ANN WAY
OAKLAND, CALIFORNIA

# SITE PLAN

## Figure 4-1.
## Human Health Conceptual Site Model Diagram
## ıking Company Risk-Based Corrective Action Evaluation
## 580 Julie Ann Way
## Oakland, California
## Project No. 005.02811.002




ly complete.

contact) while performing soil invasive activities (e.g , construction)

# MAIN TEXT TABLES

**Table 3-1.**
**Tier I Assessment of Chemicals Detected in Soil**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Chemical | Maximum Detected Concentration (mg/kg)[a] | Region 9 PRG[b] | Does the Maximum Detected Concentration Exceed the PRG? | Chemical Retained for Tier II Evaluation |
|---|---|---|---|---|
| **Volatile Organic Compounds (VOCs)** | | | | |
| **Benzene** | **5.1** | **1.5** | **Yes** | **Yes** |
| Toluene | 1.4 | 520 | No | No |
| Ethylbenzene | 3.3 | 230 | No | No |
| Xylenes | 12 | 210 | No | No |
| | | | | |
| **Semi-Volatile Organic Compounds (SOCs)** | | | | |
| Naphthalene | 3.3 | 190 | No | No |
| **2-Methylnaphthalene** | **3.6** | **NA** | **Yes** | **Yes** |
| Di-n-Butylphthalate | 0.76 | 88,000 | No | No |

**Footnotes:**

[a] mg/kg = milligrams per kilogram

[b]Preliminary Remediation Goal (PRG) for industrial soil.

**References:**

United States Environmental Protection Agency (USEPA), 1999. Region 9 Preliminary Remediation Goals (PRGs), 1999a. Memo from Stanford J. Smucker, Ph.D. October 1.

**Table 3-2.**
**Tier I Assessment of Chemicals Detected in Groundwater**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

Highest conc in past 4 qtrly mon events

| Chemical | Maximum Detected Concentration (µg/L)[a] | N/A Region 9 PRG[b] | Does the Maximum Detected Concentration Exceed the PRG? | Chemical Retained for Tier II Evaluation |
|---|---|---|---|---|
| **Benzene** | **270** | **0.41** | **Yes** | **Yes** |
| Toluene | 15 | 720 | No | No |
| Ethylbenzene | 510 | 1300 | No | No |
| Xylenes | 41 | 1400 | No | No |
| **Methyl Tert Butyl Ether** | **60** | **20** | **Yes** | **Yes** |
| **Naphthalene** | **260** | **6.2** | **Yes** | **Yes** |
| **2-Methyl Naphthalene** | **93** | **NA** | **Yes** | **Yes** |

**Footnotes:**

[a] µg/L = Microgram per liter.

[b] Preliminary Remediation Goal (PRG) for tapwater.

**References:**

United States Environmental Protection Agency (USEPA), 1999.Region 9 Preliminary Remediation Goals (PRGs).
Memo from Stanford J. Smucker, Ph.D. October 1.

## Table 4-1.
## Exposure Intake Assumptions for Hypothetical Onsite Worker Receptors
## Metz Baking Company Risk-Based Corrective Action Evaluation
## 580 Julie Ann Way
## Oakland, California
## Project No. 005.02811.002

| Parameter | Acronym | Value | Unit[a] | Source |
|---|---|---|---|---|
| **For All Hypothetical Onsite Worker Receptors** | | | | |
| Target Cancer Risk | TR | 1.00E-05 | Unitless | USEPA, 1989 |
| Target Hazard Index | THI | 1 | Unitless | USEPA, 1989 |
| **Indoor Commercial Worker** | | | | |
| Averaging Time - Noncarcinogens | ATn | 9125 | days ≈25yr | USEPA, 1989 |
| Averaging Time - Carcinogens[b] | ATc | 25550 | days ≈70y | USEPA, 1989 |
| Lifetime | LT | 70 | years | USEPA, 1989 |
| Exposure Time | ET | 8 | hours/day | BPJ[h] |
| Exposure Frequency | EF | 250 | days/year | USEPA, 1991 |
| Exposure Duration | ED | 25 | years | USEPA, 1991, CalEPA, 1992 |
| Body Weight | BW | 70 | kg | USEPA, 1989, CalEPA, 1992 |
| Inhalation Rate[c] | InR | 1.0 | $m^3$/hour | USEPA, 1997, CalEPA, 1992 |
| **Outdoor Construction Worker** | | | | |
| Averaging Time - Noncarcinogens | ATn | 365 | days | USEPA, 1989 |
| Averaging Time - Carcinogens[b] | ATc | 25550 | days | USEPA, 1989 |
| Lifetime | LT | 70 | years | USEPA, 1989 |
| Exposure Time | ET | 8 | hours/day | BPJ |
| Exposure Frequency | EF | 90 | days/year | BPJ |
| Exposure Duration | ED | 1 | year | BPJ |
| Body Weight | BW | 70 | kg | USEPA, 1989 |
| Soil Ingestion Rate[d] | IR | 480 | mg/day | USEPA, 1997 |
| Conversion Factor | CF1 | 1.00E-06 | kg/mg | - -[i] |
| Skin Surface Area[e] | SA | 5800 | $cm^2$/day | USEPA, 1997, CalEPA, 1992 |
| Soil Adherence Factor[f] | AF | 0.24 | mg/$cm^2$ | USEPA, 1997 |
| Dermal Absorption Factor | DAF | Chemical-Specific | unitless | See Table 4-2 |
| Conversion Factor | CF2 | 1.00E-03 | L/$cm^3$ | - - |
| Inhalation Rate[g] | InR | 2.76 | $m^3$/hour | USEPA, 1997 |
| Particulate Emission Factor | PEF | 1.32E+09 | $m^3$/kg | USEPA, 1999a |

**Table 4-1.**
**Exposure Intake Assumptions for Hypothetical Onsite Worker Receptors**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

**Footnotes:**

[a] kg=kilograms; $m^3$/hour = cubic meters per hour; mg/day = milligrams per day; kg/mg = kilograms per milligram; $cm^2$/day = square centimeters per day; mg/$cm^2$ = milligrams per square centimeter; L/$cm^3$ = liters per cubic centimeter; $m^3$/kg = cubic meters per kilogram.

[b] Based on a 70-year lifetime.

[c] Based on a recommended hourly average inhalation rate for an adult engaged in light activities.

[d] Value for adult soil ingestion rate while performing outdoor work.

[e] Recommended upper percentile value for adult outdoor soil contact. Value assumes approximately 25-percent (i.e., head, hands, forearms, and lower legs) of the total skin area (23,000 $cm^2$) may be exposed to soil.

[f] Based on the data presented in Table 6-12 (USEPA, 1997), the maximum soil adherence value for construction workers of 0.24 mg/$cm^2$ is used. Activities for the construction worker field study included mixing bare earth and concrete surfaces, dust and debris (Table 6-11 in USEPA, 1997).

[g] 95th percentile value was estimated by adding two standard deviations of 0.66 $m^3$/hr to the mean inhalation rate of 1.44 $m^3$/hr for a general construction worker (GCW).

[h] Best professional judgement.

[i] "- -" = Not applicable.

**References:**


CalEPA 1992. Supplement Guidance

U.S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final. Office of Emergency and Remedial Response, Washington D.C., EPA/540/1-89/002, July.

U.S. Environmental Protection Agency (USEPA). 1991. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim. Office of Emergency and Remedial Response, Washington D.C., Publication 9285.7-01B. December.

U.S. Environmental Protection Agency (USEPA). 1997. Exposure Factors Handbook, Volume I, II, and III. Office of Research and Development, National Center for Environmental Assessment, Washington D.C., EPA/600/P-95/002Fa. August.

U.S. Environmental Protection Agency (USEPA). 1999a. Region 9 Preliminary Remediation Goals (PRGs). Memo from Stanford J. Smucker, Ph.D October 1.

**Table 4-2.**

**Soil Dermal Absorption Factors (DAFs)[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Chemical of Potential Concern | Value |
|---|---|
| Volatile Organic Compounds | |
| Benzene | 0.1 |
| Semi-Volatile Organic Compounds | |
| 2-methylnaphthalene | 0.15 |

**Footnotes:**

[a] From CalEPA, 1994a.

**References:**

California Environmental Protection Agency (CalEPA). 1994a. Preliminary Endangerment Assessment Guidance Manual. Department of Toxic Substances Control (DTSC). January.

Table 4-3.

**Toxicity Values - Reference Doses[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Chemical | Chronic Oral Reference Dose (RfDo)[b] | | Chronic Inhalation Reference Dose (RfDi) | | Subchronic Oral Reference Dose (RfDo)[b] | | Subchronic Inhalation Reference Dose (RfDi) | |
|---|---|---|---|---|---|---|---|---|
| | (mg/kg-day)[c] | | (mg/kg-day) | | (mg/kg-day) | | (mg/kg-day) | |
| | Value | Source | Value | Source | Value | Source | Value | Source |
| Volatile Organic Compounds | | | | | | | | |
| Benzene | 3.0E-03 | USEPA, 1999a | 1 7E-03 | USEPA, 1999a | 3.0E-03 | d | 1.7E-03 | d |
| Methyl-tert-butyl ether | 8E-01 | rtr[f] | 8E-01 | USEPA, 1999b | 8E-01 | USEPA, 1999b | 8E-01 | d |
| Semi-Volatile Organic Compounds | | | | | | | | |
| Naphthalene | 2E-02 | USEPA, 1999b | 8.6E-04 | USEPA, 1999b | 2E-01 | e | 8 6E-04 | d |
| 2-Methylnaphthalene[g] | 2E-02 | USEPA, 1999b | 8.6E-04 | USEPA, 1999b | 2E-01 | e | 8.6E-04 | d |

**Footnotes:**

[a] Toxicity values were obtained from the following sources of information in order of priority: USEPA, 1999b; 1997b; 1999a; and NCEA, as cited in USEPA, 1999a

[b] In the absence of dermal toxicity values the oral reference doses were used to evaluate dermal exposure.

[c] mg/kg-day = milligrams per kilogram body weight per day.

[d] In the absence of specific values for subchronic exposure, the chronic toxicity value was adopted as the subchronic toxicity value.

[e] The subchronic RfD was assumed by SECOR to be 10 times higher than the chronic RfD because an uncertainty factor of 10 was used by USEPA for extrapolation from subchronic to chronic exposure for the chronic RfD.

[f] rtr = route-to-route extrapolation conducted by SECOR.

[g] In the absence of chemical-specific toxicity values, the values for naphthalene were used to evaluate this chemical

**References:**


National Center for Environmental Assessment (NCEA). As cited in USEPA 1999a.

U.S. Environmental Protection Agency (USEPA) 1999. Region 9 Preliminary Remediation Goals (PRGs) 1999a. Memorandum from S.J. Smucker, USEPA Region 9, San Francisco, California October1

U S. Environmental Protection Agency (USEPA). 1999b. Integrated Risk Information System (IRIS). On-line computer database.

Table 4-4.

**Toxicity Values - Slope Factors[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Chemical | Oral Slope Factor (SFo)[b] (mg/kg-day)$^{-1}$ [d] | | Inhalation Slope Factor (SFi) (mg/kg-day)$^{-1}$ | | Carcinogenic Weight-of-Evidence[c] |
|---|---|---|---|---|---|
| | Value | Source | Value | Source | |
| Volatile Organic Compounds | | | | | |
| Benzene | 1.0E-01 | CalEPA, 1994 | 1.0E-01 | CalEPA, 1994 | A |
| Methyl-tert-butyl ether | - -[e] | USEPA, 1999b | - - | USEPA, 1999b | - - |
| Semi-Volatile Organic Compounds | | | | | |
| Naphthalene | - - | USEPA, 1999b | - - | USEPA, 1999b | C |
| 2-Methylnaphthalene | - - | USEPA, 1999b | - - | USEPA, 1999b | - - |

**Footnotes:**

[a] Toxicity values were obtained from the following sources of information in order of priority: CalEPA, 1994; USEPA, 1999b; 1997b; 1999a; and NCEA, as cited in USEPA, 1999a.

[b] In the absence of dermal toxicity values the oral slope factors were used to evaluate dermal exposure.

[c] Cancer weight-of-evidence categories are as follows:
Group A: Human Carcinogen (sufficient evidence of carcinogenicity in humans).
Group B Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans).
Group C Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data).
Group D Not Classifiable as to Human Carcinogenicity (inadequate or no evidence).
Group E: Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

[d] mg/kg/day = milligrams per kilogram body weight per day.

[e] "- -" = value was not available from the sources listed above or not applicable for this exposure route.

**References:**

CalEPA. 1994 California Cancer Potency Factors: Update November 1.
National Center for Environmental Assessment (NCEA). As cited in USEPA 1999a
U.S. Environmental Protection Agency (USEPA). 1997b. Health Effects Assessment Summary Tables (HEAST) FY 1997 Update. Office of Solid Waste and Emergency Response July.
U.S. Environmental Protection Agency (USEPA). 1999a. Region 9 Preliminary Remediation Goals (PRGs) 1999. Memorandum from S.J. Smucker, USEPA Region 9, San Francisco, California. October1.
U S. Environmental Protection Agency (USEPA). 1999b. Integrated Risk Information System (IRIS). On-line computer database.

Table 4-5.

Exposure Point Concentrations for the Chemicals Evaluated Under the Tier II RBCA Evaluation[a]

Metz Baking Company Risk-Based Corrective Action Evaluation

580 Julie Ann Way

Oakland, California

Project No. 005.02811.002

| | Construction Worker Receptor | | | | | Indoor Commercial Worker Receptor | |
|---|---|---|---|---|---|---|---|
| | | | Outdoor Air | | | Indoor Air | |
| COPC | Soil (mg/kg)[b] | Groundwater (mg/L)[c] | From Soil (mg/m³)[d] | From Groundwater (mg/m³) | Dust-in-Air (mg/m³) | From Soil (mg/m³) | From Groundwater (mg/m³) |
| <u>Volatile Organic Compounds</u> | | | | | | | |
| Benzene | 5.1 | 0.270 | 6 15E-02 | 8.96E-10 | --[f] | 2.80E-04 | 3.58E-10 |
| Methyl Tert Butyl Ether | -- | 0.060 | -- | 2 11E-11 | -- | -- | 8.43E-12 |
| <u>Semi-Volatile Organic Compounds</u> | | | | | | | |
| Naphthalene | NSC[e] | 0 26 | -- | -- | -- | | |
| 2-Methylnaphthalene | 3.6 | 0.093 | -- | -- | 2.74E-09 | | |

**Footnotes:**

[a] These outdoor and indoor air concentrations account for concentrations of chemicals of potential concern (COPCs) in either soil or groundwater. In all cases vapor fluxes were estimated separately for COPCs detected in both soil and groundwater.

[b] mg/kg = milligrams per kilogram.

[c] mg/L = milligrams per liter.

[d] $mg/m^3$ = milligrams per cubic meter.

[e] Chemical not identified as a COPC for this medium.

[f] Not applicable for this chemical and medium

# Table 4-6.
# Chemical-Specific Estimation of Dermally Absorbed Dose in Groundwater
# Metz Baking Company Risk-Based Corrective Action Evaluation
# 580 Julie Ann Way
# Oakland, California
# Project No. 005.02811.002

| Chemical of Potential Concern | B[a] (unitless) | Permeability Coefficient $(K_p)$[a] (cm/hr) | τ[a] (hr) | t*[a] (hr) | DAevent_gw[b] ($mg/cm^2$) |
|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | |
| Benzene[c] | 1.3E-02 | 1.1E-01 | 2.6E-01 | 6.3E-01 | 2.5E-04 |
| Methyl-tert-butyl ether[c,d] | 7.8E-04 | 1.7E-02 | 2.5E-01 | 5.9E-01 | 8.7E-06 |
| **Semi-Volatile Organic Compounds** | | | | | |
| Naphthalene[e] | 2.0E-01 | 6.9E-02 | 5.3E-01 | 2.2E+00 | 1.4E-04 |
| 2-Methyl Naphthalene[f] | 2.0E-01 | 6.9E-02 | 5.3E-01 | 2.2E+00 | 5.2E-05 |

**Footnotes:**

[a] All values obtained from USEPA (1992).

[b] $DAevent = K_p \times C_w \times 0.001\ L/cm^3 \times [(t_{event}/(1+B))+(2\tau((1+3B)/(1+B)))]$ Equation from USEPA (1992a) used reflects daily exposure time of 8 hours which is greater than t* for all chemicals.
$K_p$ = permeability coefficient from water (cm/hr).
$C_w$ = EPC in groundwater (mg/L).
$t_{event}$ = Duration of event (hr/event).
B = constant reflecting the partitioning properties of a compound.
τ = lag time (hour).

[c] Measured permeability coefficient $(K_p)$ for chemical from an aqueous media through the skin.

[d] Values for methyl-tert-butyl ether were not available. The values for ethyl ether, a structurally similar compound, were used.

[e] Measured $K_p$ for chemical from an aqueous media was not available; therefore an estimated $K_p$ for chemical from an unspecified vehicle through the skin was used.

[f] Chemical-specific values for 2-methylnaphtalene are not available. For this reason, values developed for naphthalene were used to evaluate this chemical.

**References:**

U.S. Environmental Protection Agency (USEPA). 1992. Dermal Exposure Assessment: Principles and Applications, Interim Report. Office of Research and Development, Washington D.C., EPA/600/8-91/011B. January.

*Table 4-7.*

**Summary of Noncancer Adverse Health Effects and Excess Cancer Risks for Hypothetical Onsite Receptors**

**Metz Baking Company Risk-Based Corrective Action Evaluation**

**580 Julie Ann Way**

**Oakland, California**

**Project No. 005.02811.002**

| Exposure Pathway | Hypothetical Potential Receptors | | | |
|---|---|---|---|---|
| | | | Onsite | |
| | Indoor Commercial Worker Receptor | | Onsite Construction Worker Receptor | |
| | Hazard Index | Cancer Risk | Hazard Index | Cancer Risk |
| Soil | | | | |
| Incidental Ingestion of Soil | - -[a] | - - | 3 E-03 | 1 E-08 |
| Dermal Contact with Soil | - - | - - | 8 E-04 | 4 E-09 |
| Inhalation of Fugitive Dust | - - | - - | 2 E-16 | - - |
| Inhalation of Vapors Emanating from Soil | 1 E-02 | 8 E-07 | 3 E+00 | 7 E-06 |
| ***Multipathway Total for Soil*** | **1 E-02** | **8 E-07** | **3 E+00** | **7 E-06** |
| Groundwater | | | | |
| Dermal Contact with Groundwater | - - | - - | 2 E+00 | 7 E-06 |
| Inhalation of Vapors Emanating From Groundwater | 2 E-08 | 1 E-12 | 4 E-08 | 1 E-13 |
| **Multipathway Total for Groundwater** | **2 E-08** | **1 E-12** | **2 E+00** | **7 E-06** |
| **Total Multipathway** | **1 E-02** | **8 E-07** | **5 E+00** | **1 E-05** |

**Footnote:**

[a] "- -" = Not applicable.

# APPENDIX A
# DATA USED TO CONDUCT THE TIER I AND TIER II RBCA EVALUATIONS

# LIST OF TABLES FOR APPENDIX A

TABLE A-1
SOIL ANALYTICAL RESULTS
letz Baking Company Risk-Based Corrective Action Evaluation
580 Julie Ann Way
Oakland, California
Project No. 005.02811.002

| TPHd[c] | TPHmo[d] | TRPH[d] | Benzene | Toluene | Ethylbenzene | Xylenes | MTBE[e] | Naphthalene | 2-Methylnaphthalene | Di-n-Butylphthalate |
|---|---|---|---|---|---|---|---|---|---|---|
| ND [g] | 240 | | 0.17 | 0.03 | 1.3 | 0.84 | | 3.3 | 3.6 | 0.76 |
| ND | 110 | | 0.13 | 0.02 | 0 57 | 1.8 | | | | |
| ND | 220 | | ND | ND | ND | 0.01 | | | | |
| ND | 1,000 | | ND | 0.049 | 0.046 | 0.072 | | | | |
| ND | ND | | 2 1 | ND | ND | 1.2 | ND | | | |
| 12 [h] | 110 | | ND | ND | ND | ND | ND | | | |
| 3 3 [h] | ND | | ND | ND | ND | ND | ND | | | |
| 12 [n] | | 20 | 5.1 | 1.4 | 3 3 | 12 | | | | |
| 220 [k o] | | 2100 | 0.75 | 0.084 | 0.35 | 0.35 | | | | |
| 11 [n] | | 17 | 1.1 | 0.17 | 0.48 | 1.3 | | | | |
| | | 23 | 0 75 | 0.010 | 0 043 | 0 063 | | | | |
| 41 [k,n] | | 120 | 0.034 | ND | 0.10 | 0.22 | | | | |
| 840 [k] | | 2000 | 0 59 | 0 59 | 0.38 | 1.2 | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **840** | **1000** | **2100** | **5.1** | **1.4** | **3.3** | **12** | **ND** | **3.3** | **3.6** | **0.76** |
| **3.3** | **110** | **17** | **0.034** | **0.02** | **0.043** | **0.01** | **ND** | **3.3** | **3.6** | |
| **162.76** | **336.00** | **713.33** | **1.192** | **0.335** | **0.809** | **1.732** | **ND** | **3.3** | **3.6** | **0.76** |

el standard.

ically altered gasoline?



3:34 PM
12/8/99

## TABLE A-2
## GROUNDWATER ANALYTICAL RESULTS
Metz Baking Company Risk-Based Corrective Action Evaluation
580 Julie Ann Way
Oakland, California
Project No. 005.02811.002

| SampleDate | Units | TPHg[a] | TPHd[b] | TPHmo[c] | Benzene | Toluene | Ethylbenzene | Xylenes | MTBE[d] | Naphthalene | 2-Methyl Naphthalene | Lead |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28/96 | (µg/L)[e] | 5,900 | ND [f] | 1,700 | 540 | 9 | 950 | 110 | | | | |
| /96 | (µg/L) | 5,900 | ND | 1,700 | 540 | 9 | 950 | 110 | | | | |
| 5 | (µg/L) | 5,600 | 5,400 [g] | 4,000 | 540 | 7.3 | 950 | 110 | | 260 | 93 | ND |
| | (µg/L) | 2,700 | 3,000 [g] | 1,800 | 63 | 36 | 65 | 100 | | | | ND |
| | (µg/L) | ND | 730 [g] | 640 | 3.1 | ND | ND | ND | | | | ND |
| | (µg/L) | 460 | 2,800 [j] | 3,000 | 17 | 1 | 9 1 | 1.4 | | | | ND |
| | g/L) | 5,900 | 3 200 | 1,600 | 630 | 8 | 900 | 34 | ND | | | |
| | L) | 1,800 | 3,300 | 1,800 | 20 | 1.8 | 22 | 4.6 | 7 | | | |
| | | ND | 1,600 | 1,500 | ND | ND | ND | ND | ND | | | |
| | | 360 | 2,000 | 1,800 | 1.8 | 0.6 | 7 6 | 0 8 | ND | | | |
| | | 1,800 | 1,600 | 640 | 160 | 2.6 | 300 | 1 6 | ND | | | |
| | | D | 4,100 [h] | ND | 10 | 0.72 | 2 3 | 3.5 | ND | | | |
| | | D | 860 [h] | ND | 3.9 | ND | ND | ND | ND | | | |
| | | D | 1,400 [h] | 710 [i] | 18 | 1.6 | 2 5 | 1.9 | ND | | | |
| | | D | 970 [h] | ND | 7.2 | ND | ND | ND | ND | | | |
| | | D | 120 [h] | ND | ND | ND | ND | ND | ND | | | |
| | | D | 900 [h] | 540 | ND | ND | ND | ND | ND | | | |
| | | 00 | 3,300 [j] | 900 | 270 | 15 | 510 | 41 | ND | | | |
| | | D | 3,700 [j] | 750 | 65 | 15 | 39 | 5.7 | ND | | | |
| | | D | 570 [h] | ND | 4 | ND | ND | ND | ND | | | |
| | | D | 1,200 [h] | ND | 0.93 | ND | 1 | ND | ND | | | |
| | | D | 810 [h] | ND | 5.7 | ND | ND | ND | 10 | | | |
| | | D | 410 [j] | ND | ND | ND | ND | ND | ND | | | |
| | | D | 3,700 [j] | ND | ND | ND | ND | ND | ND | | | |
| | | D | 1,500 [h] | ND | 140 | 5.7 | 170 | 1 4 | ND | | | |
| | | D | 3,800 [h] | ND | 15 | 4.3 | 3 5 | 5 3 | ND | | | |
| | | D | 1,200 [h] | ND | 3 3 | 2.1 | ND | ND | ND | | | |
| | | D | 1,700 [h] | 980 | 23 | 2 1 | 2 3 | 2.4 | ND | | | |
| | | D | 840 [h] | ND | 8.4 | ND | ND | ND | ND | | | |
| | | D | 350 [h] | ND | ND | 2 6 | ND | ND | ND | | | |
| | | D | 780 [h] | ND | ND | ND | ND | ND | ND | | | |
| | | 000 | 1,000 [h] | 740 | 88 | 3 3 | 190 | 1.2 | 60 | | | |
| | | 500 | 1,400 [h] | ND | 33 | 3.7 | 28 | 1 7 | 21 | | | |
| | | D | 870 [h] | 590 | ND | ND | ND | ND | ND | | | |
| | | 00 | 840 [h] | 900 | 2 2 | ND | ND | ND | 39 | | | |
| | | 30 | 820 [h] | 640 | 7 4 | ND | ND | ND | 17 | | | |
| | | D | 290 [h] | 770 | ND | ND | ND | ND | ND | | | |
| | | D | 700 [h] | 600 | ND | ND | ND | ND | ND | | | |
| | | 800 | 4100 | 980 | 270 | 15 | 510 | 41 | 60 | 260 | 93 | ND[f] |
| | | 0.0 | 120.0 | 540.0 | 0.9 | 0.7 | 1.0 | 1.2 | 10.0 | 260 | 93 | ND |
| | | 138 | 1419 | 730 | 46 | 5 | 114 | 7 | 29 | 260 | 93 | ND |

ge of diesel, but do not resemble a diesel fingerprint. *Possible gasoline and motor oil.*
laboratory diesel standard
laboratory motor oil standard
es not match the laboratory diesel standard

# APPENDIX B

# METHODS USED TO ESTIMATE CHEMICAL VAPORS IN AIR

# LIST OF TABLES FOR APPENDIX B

## Table B-1.
## Vapor Flux from Soil at Soil Surface for the Hypothetical Onsite Indoor Commercial Worker Receptor [a]
## Metz Baking Company Risk-Based Corrective Action Evaluation
## 580 Julie Ann Way
## Oakland, California
## Project No. 005.02811.002

| Parameter definition | Units | Symbol | Benzene |
|---|---|---|---|
| Maximum detected concentration in soil[b] | mg/kg | $C_s$ | 5.1 |
| Air-filled porosity [c] | -- | $\theta_a$ | 0.28 |
| Water-filled porosity [c] | -- | $\theta_w$ | 0 15 |
| Total soil porosity [c d] | -- | n | 0 43 |
| Chemical diffusivity in air [c] | $cm^2/sec$ | $D_i$ | 8.80E-02 |
| Dimensionless Henry's Law constant [c] | -- | H' | 2.28E-01 |
| Chemical diffusivity in water [c] | $cm^2/sec$ | $D_w$ | 9.80E-06 |
| Dry soil bulk density [c] | $g/cm^3$ | $\rho_b$ | 1.50 |
| Soil particle density [c] | $g/cm^3$ | $\rho_s$ | 2.65 |
| Soil organic carbon partition coefficient [c] | $cm^3/g$ | $K_{oc}$ | 3 07E+03 |
| Fraction of organic carbon in soil [c] | g/g | $f_{oc}$ | 0.006 |
| Soil-water partition coefficient [e] | $cm^3/g$ | $K_d$ | 1.84E+01 |
| Exposure interval [f] | secs | T | 7 88E+08 |
| Apparent diffusivity[g] | $cm^2/sec$ | $D_A$ | 5.78E-05 |
| **Vapor flux at soil surface from shallow soils[h]** | **$mg/m^2$-sec** | **F** | **2.34E-05** |

**Footnotes:**

[a] Chemical vapor flux at soil surface from volatilization is based on Jury et al (1984) model, as described in Soil Screening Guidance User's Guide (USEPA 1996c)

[b] From Table 4-5.

[c] Chemical and default soil properties were obtained from USEPA Soil Screening Guidance User's Guide (USEPA, 1996c)

[d] $(1 - (\rho_b / \rho_s))$

[e] $K_{oc} \times f_{oc}$

[f] Represents the number of seconds in 25 years of exposure

[g] $[(\theta_a^{10/3} \times D_i \times H' + \theta_w^{10/3} \times D_w) / n^2] / (\rho_b \times K_d + \theta_w + \theta_a \times H')$

[h] $[C_s \times ((2 \times \rho_b \times D_A) / (3.14 \times D_A \times T)^{1/2} \times 10^{-4})] \times 0\ 001$ kg soil/g soil

**References:**


Jury, W A , W J Farmer, and W F Spencer 1984 Behavior Assessment Model for Trace Organics in Soil II Chemical Classification and Parameter Sensitivity J Environ Qual 13(4) 567-572

Mackay, D , W.Y. Shiu, and K C Ma 1992 Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol I, Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs Lewis Publishers, Inc , Chelsea, Michigan

Mackay, D , W Y Shiu, and K C Ma 1993 Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol III, Volatile Organic Compounds Lewis Publishers, Inc., Chelsea, Michigan

USEPA 1996c Soil Screening Guidance User's Guide

**Table B-2.**
**Estimated Indoor Chemical Vapor Air Concentrations**
**from Soil for the Hypothetical Onsite Indoor Commercial Worker Receptor[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter Definition | Units [b] | Symbol | Benzene |
|---|---|---|---|
| Estimated vapor flux at soil surface from soil[c] | $mg/sec\text{-}m^2$ | F | 1.99E-10 |
| Aerial fraction of cracks in concrete slab-on-grade foundation [d] | - - | Fc | 1.00E-02 |
| Sensitivity of crack fraction to vapor retardation[e] | – | Sc | 5.00E-01 |
| Adjusted vapor flux at building floor surface[f] | $mg/sec\text{-}m^2$ | F" | 3.99E-12 |
| Volumetric flow rate for infiltration air per unit area[g] | $L/sec\text{-}m^2$ | Q | 6.49E-01 |
| Unit conversion factor | $m^3/L$ | CF | 1.00E-03 |
| Volumetric flow rate for infiltration air per unit area[h] | $m^3/sec\text{-}m^2$ | Q' | 6.49E-04 |
| Concentration of chemical in indoor air[i] | $mg/m^3$ | $C_{in}$ | 6.14E-09 |

**Footnotes:**

[a] Model for estimating chemical vapors in indoor air from ASTM, 1995; Wadden and Scheff, 1983; Johnson and Ettinger, 1991

[b] $mg/sec\text{-}m^2$ = milligrams per second per square meter; $L/sec\text{-}m^2$ = liters per second per square meter; $m^3/L$ = cubic meters per liter; $m^3/sec\text{-}m^2$ = cubic meters per second per square meter; $mg/m^3$ = milligrams per cubic meter.

[c] From Table B-1.

[d] Default value from ASTM, 1995.

[e] Based on Johnson and Ettinger (1991) for medium permeability vadose soils. The vadose soil type is characterized as "sandy silty clays" (SECOR

[f] (F' x [Fc/ Sc]).

[g] Value based on the average of ASHRAE's reported range of 0.75 to 2 $cfm/ft^2$, which was multiplied by 0.472 to obtain a value of 0.649.

[h] (Q x CF).

[i] (F" / Q').

**References:**


American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). 1999. ASHRAE Handbook: Heating, Ventilating, and A

American Society for Testing and Materials (ASTM). 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. Designation E 1739-95.American Society for Testing and Materials, West Conshohocken, PA. November.

Johnson and Ettinger. 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminated Vapors into Buildings. P.C. Johnson and R.A. Ettinger, Environ. Sci Technol.25: 1445-1452.

SECOR International, Inc. 1999. Quarterly Groundwater Monitoring Report for First Quarter 1999, 580 Julie Ann Way, Oakland, CA,

Wadden and Scheff. 1983. Air Quality Models. Chapter 6 in Indoor Air Pollution. R.A. Wadden and P.A. Scheff, J. Wiley & Sons, Interscience.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). 1989. ASHRAE Standard: Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigerating, and Air-Conditioning Engineers. Inc., Atlanta, GA. ASHRAE 62-1989

**Table B-3.**

**Estimated Vapor Flux at Soil Surface for Hypothetical Onsite Construction Worker Receptor [a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter definition | Units | Symbol | Benzene |
|---|---|---|---|
| Maximum Detected Concentration in soil [b] | mg/kg | $C_s$ | 5.1 |
| Air-filled porosity [c] | -- | $\theta_a$ | 0.28 |
| Water-filled porosity [d] | -- | $\theta_w$ | 0.15 |
| Total soil porosity [e,f] | -- | n | 0.43 |
| Chemical diffusivity in air [c] | $cm^2$/sec | $D_i$ | 8.80E-02 |
| Dimensionless Henry's Law constant [c] | -- | H' | 2.28E-01 |
| Chemical diffusivity in water [c] | $cm^2$/sec | $D_w$ | 9.80E-06 |
| Dry soil bulk density [c] | $g/cm^3$ | $\rho_b$ | 1.50 |
| Soil particle density [c] | $g/cm^3$ | $\rho_s$ | 2.65 |
| Soil organic carbon partition coefficient [c] | $cm^3$/g | $K_{oc}$ | 3.07E+03 |
| Fraction of organic carbon in soil [c] | g/g | $f_{oc}$ | 0.006 |
| Soil-water partition coefficient [e] | $cm^3$/g | $K_d$ | 1.84E+01 |
| Exposure interval [f] | secs | T | 3.15E+07 |
| Apparent diffusivity [g] | $cm^2$/sec | $D_A$ | 5.78E-05 |
| **Vapor flux at soil surface [h]** | **$mg/m^2$-sec** | **F** | **1.17E-04** |
| Agitation factor [j] | -- | AF | 37 |
| **Adjusted vapor flux at soil surface from shallow soils [k]** | **$mg/m^2$-sec** | **F'** | **4.32E-03** |

**Footnotes:**

[a] Chemical vapor flux at soil surface from volatilization is based on Jury et al (1984) model, as described in Soil Screening Guidance: User's Guide (USEPA, 1996c)

[b] From Table 4-5

[c] Chemical and default soil properties were obtained from USEPA Soil Screening Guidance User's Guide (USEPA, 1996c),

[d] $(1 - (\rho_b / \rho_s))$

[e] $K_{oc} \times f_{oc}$

[f] Represents the number of seconds in 1 year of exposure

[g] $[(\theta_a^{10/3} \times D_i \times H' + \theta_w^{10/3} \times D_w) / n^2 ] / (\rho_b \times K_d + \theta_w + \theta_a \times H')$

[h] $[C_s \times ((2 \times \rho_b \times D_A) / (3.14 \times D_A \times T)^{1/2} \times 10^{-4})] \times 0.001$ kg soil/g soil

[i] The average agitation factor of 37 was used to represent construction worker soil handling (USEPA, 1989a).

[j] (AF x F)

**References:**


Jury, W.A , W J. Farmer, and W.F Spencer. 1984 Behavior Assessment Model for Trace Organics in Soil II Chemical Classification and Parameter Sensitivity. J. Environ Qual. 13(4):567-572.

Mackay, D , W.Y. Shiu, and K C. Ma. 1992 Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol I, Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs Lewis Publishers, Inc., Chelsea, Michigan

Mackay, D , W Y Shiu, and K C Ma 1993. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol III, Volatile Organic Compounds. Lewis Publishers, Inc , Chelsea, Michigan

USEPA 1988 Superfund Exposure Assessment Manual

USEPA. 1989a Air/Superfund National Technical Guidance Study Series. Vol III - Estimation of Air Emissions from Cleanup Activities at Superfund Sites

USEPA. 1996c Soil Screening Guidance User's Guide

# Table B-4
## Concentration in Ambient Air from Soils
## for the Hypothetical Onsite Construction Worker Receptor[a]
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter definition | Units | Symbol | Benzene |
|---|---|---|---|
| Adjusted vapor flux at soil surface from shallow soils [b] | mg/sec-m$^2$ | F' | 4.32E-03 |
| Area of source [c] | m$^2$ | A | 80 |
| Length dimension perpendicular to the wind [d] | m | LS | 12.5 |
| Wind speed [e] | m/sec | V | 0.225 |
| Ambient air mixing zone [f] | m | MH | 2 |
| **Concentration of chemical in ambient air [g]** | **mg/m$^3$** | **$C_a$** | **6.15E-02** |

**Footnotes:**

[a] Concentration in ambient air is evaluated based on the model described in the Preliminary Endangerment Assessment Guidance Manual (California,1994).

[b] Based on adjusted vapor flux at soil surface for the construction worker receptor (Table B-3).

[c] Based on the excavated area of the UST area, 21ft x 41ft (SECOR, 1999).

[d] Estimated based on the area of impacted area (former location of USTs) - 21 ft x 41 ft. Using a conversion factor of 0.305, 41 ft is equal to 12

[e] Estimated based on the largest impacted area assessed, assuming wind direction is west to east. This includes a stagnation factor for the expected lower winds in a trench.

[f] Default value for California (1994).

[g] (F x A) / (LS x V x MH)

**References:**

California 1994. Preliminary Endangerment Assessment Guidance Manual State of California Environmental Protection Agency,

**Table B-5.**

**Emissions of Chemical Vapors from Groundwater for the Hypothetical Onsite Indoor Commercial Worker Receptor[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter Definition | Units | Symbol | Benzene | Methyl-tert-Butyl Ether |
|---|---|---|---|---|
| Groundwater concentration[b] | ug/l | Cp | 270 | 60 |
| Temperature of groundwater | degsK | T | 293 | 293 |
| Gas constant | atm-m$^3$/mole-degK | R | 0.000082 | 0.000082 |
| Dimensionless Henry's Law constant[c] | ug/l//ug/l | H' | 2.28E-01 | 4.22E-01 |
| Soil gas concentration[d] | ug/l | Cm | 6.16E+01 | 2.53E+01 |
| Air diffusion coefficient[c] | cm$^2$/sec | Di | 1 04E-01 | 7.90E-02 |
| Unit conversion factor | mg-l/ug-cm$^3$ | CF1 | 1.00E-06 | 1.00E-06 |
| Soil gas concentration[e] | mg/cm$^3$ | Cm' | 6.16E-05 | 2.53E-05 |
| Air-filled soil porosity[f] | -- | Pa | 0.28 | 0.28 |
| Total soil porosity [f] | -- | Pt | 0.43 | 0.43 |
| Depth of soil cover [g] | cm | L | 140.8176 | 140.8176 |
| Estimated flux rate at soil surface[h] | mg/cm$^2$-sec | F | 3.63E-09 | 1.14E-09 |
| Unit conversion factor | cm$^2$/m$^2$ | CF2 | 1.00E+04 | 1.00E+04 |
| Estimated flux rate at soil surface[i] | mg/m$^2$-sec | F' | 3.63E-05 | 1.14E-05 |

**Footnotes:**

[a] Model from Karimi et al., 1987, based on Shen's model (Shen, 1981; USEPA, 1988).
[b] Maximum detected chemical concentration. From Table 4-5.
[c] Values from USEPA (1996).
[d] H' x Cp
[e] Cm x CF1
[f] Default screening values (California, 1994)
[g] Average based on SECOR's reported range of 3.52 to 5.79 feet below ground surface (SECOR, 1999)
[h] [(Di)(Cm')(Pa^3.333/Pt^2)]/L
[i] F x CF2

**References:**

California. 1994. Preliminary endangerment assessment guidance manual. State of California Environmental Protection Agency,

Karimi et al. 1987. Vapor-Phase Diffusion of Benzene in Soil. A.A. Karimi, W.J. Farmer, and M.M. Cliath, J Environ. Qual. 16(1): 38-43.

SECOR International, Inc 1999. Quarterly Groundwater Monitoring Report for First Quarter 1999, 580 Julie Ann Way, Oakland, CA, ST ID #4008, for Metz Baking Company. May 20.

Shen. 1981. Estimating Hazardous Air Emissions from Disposal Sites. T.T. Shen, Poll. Engin. 13(8): 31-34

USEPA. 1988. Superfund exposure assessment manual. U.S. Environmental Protection Agency, Office of Remedial Response, Washington, D.C., EPA/540/1-88/001. April

USEPA. 1996. Soil Screening Guidance. User's Guide. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington D.C , Publication 9355.4-23, July.

**Table B-6.**

**Estimated Indoor Chemical Vapor Air Concentrations for the Onsite Indoor Commercial Worker Receptor[a]**

**Metz Baking Company Risk-Based Corrective Action Evaluation**

**580 Julie Ann Way**

**Oakland, California**

**Project No. 005.02811.002**

| Parameter Definition | Units [b] | Symbol | Benzene | Methyl-tert-Butyl Ether |
|---|---|---|---|---|
| Estimated vapor flux at soil surface from groundwater volatilization[c] | mg/sec-m$^2$ | F' | 3.63E-05 | 1.14E-05 |
| Aerial fraction of cracks in concrete slab-on-grade foundation [d] | - - | Fc | 1.00E-02 | 1.00E-02 |
| Sensitivity of crack fraction to vapor retardation[e] | -- | Sc | 5.00E-01 | 5 00E-01 |
| Adjusted vapor flux at building floor surface[f] | mg/sec-m$^2$ | F" | 7.27E-07 | 2.27E-07 |
| Volumetric flow rate for infiltration air per unit area[g] | L/sec-m$^2$ | Q | 6.49E-01 | 6.49E-01 |
| Unit conversion factor | m$^3$/L | CF | 1.00E-03 | 1.00E-03 |
| Volumetric flow rate for infiltration air per unit area[h] | m$^3$/sec-m$^2$ | Q' | 6.49E-04 | 6.49E-04 |
| Concentration of chemical in indoor air[i] | mg/m$^3$ | $C_{in}$ | 1.12E-03 | 3.50E-04 |

**Footnotes:**

[a] Model for estimating chemical vapors in indoor air from ASTM. 1995; Wadden and Scheff, 1983, Johnson and Ettinger, 1991.

[b] mg/sec-m$^2$ = milligrams per second per square meter; L/sec-m$^2$ = liters per second per square meter; m$^3$/L = cubic meters per liter; m$^3$/sec-m$^2$ = cubic meters per second per square meter; mg/m$^3$ = milligrams per cubic meter.

[c] From Table B-5.

[d] Default value from ASTM. 1995.

[e] Based on Johnson and Ettinger (1991) for medium permeability vadose soils. The vadose soil type at the site can be characterized as "sandy silty clays".

[f] (F' x [Fc/ Sc]).

[g] Refer to Footnote g from Table B-2

[h] (Q x CF).

[i] (F" / Q')

**References:**


American Society for Testing and Materials (ASTM) 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. Designation E 1739-95.American Society for Testing and Materials, West Conshohocken, PA. November.

Johnson and Ettinger. 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminated Vapors into Buildings. P.C. Johnson and R.A. Ettinger, Environ Sci. Technol.25: 1445-1452.

Wadden and Scheff 1983 Air Quality Models. Chapter 6 in Indoor Air Pollution R.A. Wadden and P.A Scheff, J. Wiley & Sons, Interscience.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 1989. ASHRAE Standard: Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigerating, and Air-Conditioning Engineers. Inc., Atlanta, GA. ASHRAE 62-1989

**Table B-7.**
**Estimated Chemical Vapor Flux from Groundwater for the Hypothetical Onsite Construction Worker Receptor**
**Onsite Construction Worker Receptor[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter definition | Units[b] | Symbol | Benzene | Methyl-tert-Butyl Ether |
|---|---|---|---|---|
| Groundwater concentration [c] | ug/L | Cp | 270 | 60 |
| Dimensionless Henry's Law constant[d] | ug/L//ug/L | H' | 2.28E-01 | 2.20E-02 |
| Soil gas concentration[e] | ug/L | Cm | 6.16E+01 | 1.32E+00 |
| Air diffusion coefficient[d] | $cm^2/sec$ | Di | 7.20E-02 | 7.90E-02 |
| Unit conversion factor | g-L/ug-cm | CF1 | 1.00E-06 | 1.00E-06 |
| Soil gas concentration[f] | $mg/cm^3$ | Cm' | 6.16E-05 | 1.32E-06 |
| Air-filled soil porosity[g] | -- | Pa | 2.80E-01 | 2 80E-01 |
| Total soil porosity [g] | -- | Pt | 0.43 | 0.43 |
| Depth of soil cover [h] | cm | L | 30 | 30 |
| Estimated flux rate at soil surface[i] | $mg/cm^2$-sec | F | 1.13E-08 | 2.66E-10 |
| Unit conversion factor | $cm^2/m^2$ | CF2 | 1.00E+04 | 1.00E+04 |
| Estimated vapor flux at soil surface from groundwater volatilization[j] | $mg/m^2$-sec | F' | 1.13E-04 | 2.66E-06 |

Footnotes:

[a] Model from Karimi et al., 1987; based on Shen's model (Shen, 1981; USEPA, 1988).

[b] ug = micrograms; L = liters; cm = centimeters; sec = seconds; m = meters; mg = milligrams; g = grams; kg = kilogram.

[c] Maximum detected concentration as reported in Table 4-5.

[d] USEPA (1996)

[e] H' x Cp.

[f] Cm x CF1.

[g] Default ASTM, 1995.

[h] Corresponds to one foot of vadose zone.

[i] [(Di)(Cm')(Pa^3.333/Pt^2))]/L

[j] F x CF2

References:

Karimi et al. 1987. Vapor-Phase Diffusion of Benzene in Soil A A. Karimi, W.J. Farmer, and M M. Cliath, J. Environ. Qual 16(1). 38-43.
Shen. 1981. Estimating Hazardous Air Emissions from Disposal Sites. T.T. Shen, Poll. Engin. 13(8): 31-34.
USEPA. 1988. Superfund exposure assessment manual. U.S. Environmental Protection Agency, Office of Remedial Response, Washington, D.C., EPA/540/1-88/001. April.
USEPA. 1996. Soil Screening Guidance: User's Guide. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington D.C., Publication 9355.4-23, July.

**Table B-8.**
**Estimated Outdoor Chemical Vapor Air Concentrations for the Onsite Construction Worker Receptor[a]**
**Metz Baking Company Risk-Based Corrective Action Evaluation**
**580 Julie Ann Way**
**Oakland, California**
**Project No. 005.02811.002**

| Parameter definition | Units[b] | Symbol | Benzene | Methyl-tert-Butyl Ether |
|---|---|---|---|---|
| Estimated vapor flux at soil surface from groundwater volatilization[c] | mg/sec-m$^2$ | F' | 1.13E-04 | 2.66E-06 |
| Length of emissions source[d] | m | d | 15 | 15 |
| Site wind speed[e] | m/sec | $u_s$ | 2.25 | 2.25 |
| Trench wind speed stagnation factor[f] | -- | Tf | 0.1 | 0.1 |
| Trench wind speed[g] | m/sec | u | 0.225 | 0.225 |
| Air mixing zone height[e] | m | h | 2 | 2 |
| Air concentration of vapor[h] | mg/m$^3$ | Ca | 3.77E-03 | 8.86E-05 |

**Footnotes:**

[a] Model based on box model (USEPA. 1991; Dobbins, 1979; California. 1994)

[b] mg = milligrams: sec = seconds, m = meters.

[c] From Table B-7.

[d] Assumed dimension of trench parallel to predominant wind direction

[e] Standard default assumption for box model (USEPA, 1991; California, 1994).

[f] Assumed stagnation factor for below ground trench

[g] $u_s$ x Tf.

[h] (F' x d)/(u x h)

**References:**


California. 1994. Preliminary endangerment assessment guidance manual. State of California Environmental Protection Agency, Department of Toxic Substances Control January.

Dobbins. 1979. Dispersion of Pollutants- Reacting Components and Unsteady Flows. Chapter 11 in Atmospheric Motion and Air Pollution, R.A. Dobbins, John Wiley and Sons, New York.

Kansas. 1998 Telephone conversation between Trish Miller (SECOR) and Mary Knapp (Kansas University Climatological Library), March. 23

USEPA. 1991. Risk assessment guidance for Superfund: volume I- human health evaluation manual (part b, development of risk-based preliminary remediation goals), interim Office of Emergency and Remedial Response, Washington. D.C , December, Publication 9.

# APPENDIX C

# PATHWAY-SPECIFIC RISK CHARACTERIZATION TABLES FOR THE HYPOTHETICAL ONSITE INDOOR COMMERCIAL WORKER RECEPTOR

# LIST OF TABLES FOR APPENDIX C

# Table C-1. Risk Characterization for the Hypothetical Onsite Indoor Commercial Worker Receptor Inhalation of Chemical Vapors Volatilizing from Soil Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

**Pathway: Inhalation of Chemical Vapors Volatilizing from Soil[a]**

Chronic Daily Intake (CDI)[b] = (Cas_in x InR x ET x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | CDI (mg/kg-day)[c] | Inhalation Reference Dose (RfDi) (mg/kg-day) | Hazard Quotient (HQ) (unitless) | CDI (mg/kg-day) | Inhalation Slope Factor (SFi) $(mg/kg\text{-}day)^{-1}$ | Excess Cancer Risk (unitless) |
| <u>Volatile Organic Compounds</u> | | | | | | |
| Benzene | 2.2E-05 | 1.7E-03 | 1 E-02 | 7.8E-06 | 1.0E-01 | 8 E-07 |
| | | Total Hazard Index = | 1 E-02 | Total Excess Cancer Risk = | | 8 E-07 |

**Footnotes:**

[a] For the purposes of this assessment, it is assumed that this receptor will be exposed to chemical vapors volatilizing from the subsurface soil.

[b] Refer to Table 4-1 for explanation of acronyms used in equation.

[c] mg/kg-day = milligrams per kilogram body weight per day.

[d] "- -" = Not applicable.

## Table C-2. Risk Characterization for the Hypothetical Onsite Indoor Commercial Worker Receptor Inhalation of Chemical Vapors Volatilizing from Groundwater Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

**Pathway: Inhalation of Chemical Vapors Volatilizing from Groundwater**[a]

Chronic Daily Intake (CDI)[b] = (Cas_in x InR x ET x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | CDI (mg/kg-day)[c] | Inhalation Reference Dose (RfDi) (mg/kg-day) | Hazard Quotient (HQ) (unitless) | CDI (mg/kg-day) | Inhalation Slope Factor (SFi) $(mg/kg\text{-}day)^{-1}$ | Excess Cancer Risk (unitless) |
| **Volatile Organic Compounds** | | | | | | |
| Benzene | 2.8E-11 | 1.7E-03 | 2 E-08 | 1.0E-11 | 1.0E-01 | 1 E-12 |
| Methyl-tert-butyl ether | 6.6E-13 | 8.0E-01 | 8 E-13 | 2.4E-13 | - - | - - |
| | | **Total Hazard Index =** | 2 E-08 | | **Total Excess Cancer Risk =** | 1 E-12 |

**Footnotes:**

[a] For the purposes of this assessment, it is assumed that this receptor will be exposed to chemical vapors volatilizing from groundwater up through the subsurface soil.

[b] Refer to Table 4-1 for explanation of acronyms used in equation.

[c] mg/kg-day = milligrams per kilogram body weight per day.

[d] "- -" = Not applicable.

# APPENDIX D

# PATHWAY-SPECIFIC RISK CHARACTERIZATION TABLES FOR THE HYPOTHETICAL ONSITE CONSTRUCTION WORKER RECEPTOR

# LIST OF TABLES FOR APPENDIX D

# Table D-1. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Incidental Ingestion of Soil Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

conv. factor

**Pathway: Incidental Ingestion of Soil**

Chronic Daily Intake (CDI)[a] = (Cs x IR x CF1 x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | **CDI** (mg/kg-day)[b] | **Subchronic Oral Reference Dose (RfDo)** (mg/kg-day) | **Hazard Quotient (HQ)** (unitless) | **CDI** (mg/kg-day) | **Oral Slope Factor (SFo)** $(mg/kg\text{-}day)^{-1}$ | **Excess Cancer Risk** (unitless) |
| **Volatile Organic Compounds** | | | | | | |
| Benzene | 8.6E-06 | 3.0E-03 | 2.9E-03 | 1.2E-07 | 1.0E-01 | 1 E-08 |
| **Semi-Volatile Organic Compounds** | | | | | | |
| 2-Methylnaphthalene | 6.1E-06 | - - | - - | 8.7E-08 | - -[c] | - - |
| | | **Total Hazard Index =** | 3 E-03 | | **Total Excess Cancer Risk =** | 1 E-08 |

**Footnotes:**

[a] Refer to Table 4-1 for explanation of acronyms used in equation.

[b] mg/kg-day = milligrams per kilogram body weight per day.

[c] "- -" = Not applicable.

**Table D-2. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Dermal Contact with Soil Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002**

**Pathway: Dermal Contact with Soil**

Chronic Daily Intake (CDI)[a] = (Cs x CF1 x SA x AF x DAF x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | CDI (mg/kg-day)[c] | Subchronic Oral Reference Dose (RfDo) (mg/kg-day) | Hazard Quotient (HQ) (unitless) | CDI (mg/kg-day) | Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$ | Excess Cancer Risk (unitless) |
| Volatile Organic Compounds | | | | | | |
| Benzene | 2.5E-06 | 3.0E-03 | 8 E-04 | 3.6E-08 | 1.0E-01 | 4 E-09 |
| Semi-Volatile Organic Compounds | | | | | | |
| 2-Methylnaphthalene | 2.6E-06 | - - | - - | 3.8E-08 | - -[d] | - - |
| | | Total Hazard Index = | 8 E-04 | Total Excess Cancer Risk = | | 4 E-09 |

**Footnotes:**

[a] Refer to Table 4-1 for explanation of acronyms used in equation.

[b] mg/kg-day = milligrams per kilogram body weight per day.

[c] "- -" = Not applicable.

## Table D-3. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Inhalation of Fugitive Dust Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

**Pathway: Inhalation of Fugitive Dust**

Chronic Daily Intake (CDI)[a] = (Cs x InR x ET x EF x ED x (1/PEF)) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | **CDI** (mg/kg/day)[b] | **Subchronic Inhalation Reference Dose (RfDi)** (mg/kg/day) | **Hazard Quotient (HQ)** (unitless) | **CDI** (mg/kg/day) | **Inhalation Slope Factor (SFi)** $(mg/kg/day)^{-1}$ | **Excess Cancer Risk** (unitless) |
| <u>**Semi-Volatile Organic Compounds**</u> | | | | | | |
| 2-methylnaphthalene | 1.6E-19 | - - | 2 E-16 | 2.3E-21 | - - | - - |
| | | **Total Hazard Index =** | 2 E-16 | **Total Excess Cancer Risk =** | | - - |

**Footnotes:**

[b] Refer to Table 4-1 for explanation of acronyms used in equation.

[c] mg/kg/day = milligrams per kilogram body weight per day.

[d] "- -" = Not applicable.

## Table D-4. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Inhalation of Chemical Vapors Volatilizing from Soil Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

**Pathway: Inhalation of Chemical Vapors Volatilizing from Soil**

Chronic Daily Intake (CDI)[a] = (Cas_out x InR x ET x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | CDI (mg/kg-day)[b] | Subchronic Inhalation Reference Dose (RfDi) (mg/kg-day) | Hazard Quotient (HQ) (unitless) | CDI (mg/kg-day) | Inhalation Slope Factor (SFi) $(mg/kg\text{-}day)^{-1}$ | Excess Cancer Risk (unitless) |
| Volatile Organic Compounds | | | | | | |
| Benzene | 4.8E-03 | 1.7E-03 | 3 E+00 | 6.8E-05 | 1.0E-01 | 7 E-06 |
| | | Total Hazard Index = | 3 E+00 | | Total Excess Cancer Risk = | 7 E-06 |

**Footnotes:**

[a] Refer to Table 4-1 for explanation of acronyms used in equation.

[b] mg/kg/day = milligrams per kilogram body weight per day.

## Table D-5. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Dermal Contact with Groundwater Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002

**Pathway: Dermal Contact with Groundwater**

Chronic Daily Intake (CDI)[a] = (DAevent_gw x SA x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | **CDI** (mg/kg-day)[b] | **Subchronic Oral Reference Dose (RfDo)** (mg/kg-day) | **Hazard Quotient (HQ)** (unitless) | **CDI** (mg/kg-day) | **Oral Slope Factor (SFo)** $(mg/kg\text{-}day)^{-1}$ | **Excess Cancer Risk** (unitless) |
| **Volatile Organic Compounds** | | | | | | |
| Benzene | 5.1E-03 | 3.0E-03 | 2 E+00 | 7.3E-05 | 1.0E-01 | 7 E-06 |
| Methyl-tert-butyl ether | 1.8E-04 | 8.0E-01 | 2 E-04 | 2.5E-06 | - -e | - - |
| **Semi-Volatile Organic Compounds** | | | | | | |
| Naphthalene | 3.0E-03 | 2.0E-01 | 1 E-02 | 4.2E-05 | - - | - - |
| 2-Methylnaphthalene | 1.1E-03 | 2.0E-01 | 5 E-03 | 1.5E-05 | - - | - - |
| | | **Total Hazard Index =** | 2 E+00 | | **Total Excess Cancer Risk =** | 7 E-06 |

Footnotes:

[a] Refer to Table 4-1 for explanation of acronyms used in equation.

[b] mg/kg-day = milligrams per kilogram body weight per day.

[c] "- -" = Not applicable.

**Table D-6. Risk Characterization for the Hypothetical Onsite Outdoor Construction Worker Receptor Inhalation of Chemical Vapors Volatilizing from Groundwater Metz Baking Company Risk-Based Corrective Action Evaluation 580 Julie Ann Way Oakland, California Project No. 005.02811.002**

**Pathway: Inhalation of Chemical Vapors Volatilizing from Groundwater**

Chronic Daily Intake (CDI)[a] = (Caw_out x InR x ET x EF x ED) / (BW x AT)

| Chemical | Noncarcinogenic Effects | | | Carcinogenic Effects | | |
|---|---|---|---|---|---|---|
| | CDI (mg/kg-day)[b] | Subchronic Inhalation Reference Dose (RfDi) (mg/kg-day) | Hazard Quotient (HQ) (unitless) | CDI (mg/kg-day) | Inhalation Slope Factor (SFi) $(mg/kg\text{-}day)^{-1}$ | Excess Cancer Risk (unitless) |
| Volatile Organic Compounds | | | | | | |
| Benzene | 7.0E-11 | 1.7E-03 | 4.09813E-08 | 1.0E-12 | 1.0E-01 | 9.9526E-14 |
| Methyl-tert-butyl ether | 1.6E-12 | 8.0E-01 | 2.04887E-12 | 2.3E-14 | - - | - - |
| | | Total Hazard Index = | 4 E-08 | Total Excess Cancer Risk = | | 1 E-13 |

**Footnotes:**

[a] Refer to Table 4-1 for explanation of acronyms used in equation.

[b] mg/kg-day = milligrams per kilogram body weight per day.

# APPENDIX E

# METHODS USED TO ESTIMATE SSTLS

Table E-1
Methods Used to Estimate Site-Specific Target Levels (SSTLs) for Benzene in Soil and Groundwater
for the Hypothetical Onsite Construction Worker Receptor Only
Metz Baking Company Risk-Based Corrective Action Evaluation
580 Julie Ann Way
Oakland, California
Project No. 005.02811.002

**Estimating SSTL for Benzene in Soil**[a]

| CHI[b] | $B_s$ | THI | $SSTL_{soil}$ |
|---|---|---|---|
| (Unitless) | (mg/kg)[c] | (Unitless) | (mg/kg) |
| 3 | 5.1 | 1 | 2 |

SSTL = 5.1 × 1/3 = 5/3 = 1.7

**Estimating SSTL for Benzene in Groundwater**[d]

| CHI | $B_{gw}$ | THI | $SSTL_{gw}$ |
|---|---|---|---|
| (Unitless) | (mg/L)[e] | (Unitless) | (mg/L) |
| 2 | 0.27 | 1 | 0.2 |

**Footnotes:**

[a]This SSTL applies to benzene vapors emanating from soil. Refer to Section 4.5 and 4.6 for more information.

[b]Refer to Section 4.6 for a complete description of all parameters.

[c]mg/kg = milligrams per kilogram.

[d]This SSTL applies to dermal contact with benzene in groundwater. Refer to Section 4.5 and 4.6 for more information.

[e]mg/L = milligrams per liter.