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FAX TRANSMITTAL

To:	Madhulla Logan	**From:**	Pete McKereghan
Company:	Alameda County Health Agency	**Date:**	August 28, 1998
Fax #:	(510) 337-9335	**Project #:**	310-0675
Re:	Soil vapor SSTL calculation Former Chevron Service Station # 9-1723 9757 San Leandro Blvd. Oakland, California	**No. Pages (incl. cover):**	4
cc:	Phil Briggs, Chevron Products Company		

Soil

Dear Madhulla:

This fax is in response to your recent questions regarding Cambria's *Tier 2 RBCA Analysis and Closure Request* report, dated July 7, 1998, for former Chevron Service Station 9-1723. Specifically, you requested:

1) An explanation of how measured soil gas concentration data are used to estimate the indoor air concentration of a chemical detected in underlying soil.

2) Site-specific soil physical property data used to estimate representative values of:

- soil bulk density,
- porosity, and
- volumetric air and water content values.

3) Construction worker scenario.

Attached are:

1) A derivation of the soil vapor to indoor air concentration equation based on ASTM E1739-95,

2) Site-specific soil property data.

Note that the site-specific moisture content data, which is reported as weight percent, not volumetric as used in ASTM 1739-95, was not used in the RBCA calculations. To be consistent with the original RBCA

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Ms. Madhulla Logan
August 28, 1998

analysis conducted by Chevron (Attachment C), the ASTM default ratio of volumetric water to air were used to estimate the actual volumetric water and air values for the capillary fringe, vadose zone, and foundation using the mean site-specific porosity value of 0.42.

The volumetric water content value calculated from site-specific moisture content and bulk density data collected 5 ft below ground surface (bgs) is greater than the value used for the vadose zone in the RBCA analysis (0.36 vs. 0.287). Therefore the analysis is conservative. ✓

3) The site is currently paved, therefore the surficial soil ingestion/dermal/inhalation pathway was not considered complete. In addition, no soil samples were collected less than 5 ft bgs, therefore representative soil quality data are not available to accurately assess this risk associated with surficial soil (i.e. < 3.3 ft bgs). The maximum benzene concentration detected in shallow soil (i.e. 5 ft bgs) was 3.7 mg/kg in sample SB-10-5, collected April 4, 1996 (Attachment C). As shown in the table below, this value is less than the ASTM E 1739-95 Tier 1 benzene RBSL for this pathway. These results indicate there is no significant risk to future on-site construction workers. ✓

Exposure Scenario	Target Risk Level	Cal-EPA RBSL	COCC	Calculated Risk Level	Result
Soil ingestion/ dermal/inhalation	1E-05	29	3.7	1×10^{-6}	Site-specific soil concentration is less than ASTM Tier RBSL.[a]

[a]USEPA-based RBSL multiplied by 0.29 to calculate Cal-EPA RBSL assuming a benzene cancer slope factor of 0.1 $(mg/kg\text{-}d)^{-1}$.
RBSL - Risk-Based Screening Level
COCC - Chemical of Concern Concentration (Benzene)
Soil concentrations are in mg/kg.

I hope that this information answers your questions. Please contact me if you have any additional questions or need further clarification regarding these topics.

Sincerely,

Pete McKereghan, CHG
Principal Hydrogeologist

Pete will also evaluate risk to ~~consider~~ construction workers + trending (w/o attenuation of SV).

Table X3.1 (Pg 31)

(1) Max. vapor concentration in soil pores: $C_{v,eq} = \frac{H C_{soil} \rho_s}{[\theta_w + K_s \rho_s + H\theta_v]}$

Max. vapor concentration above dissolved hydrocarbons: $C_{v,eq} = H C_{w,eq}$

Max. dissolved concentration in soil pores: $C_{w,eq} = \frac{C_{soil} \rho_s}{[\theta_w + K_s \rho_s + H\theta_v]}$

Table X 2.5 (pg. 26)

$$V_{sesp} = \frac{\frac{H\rho_s}{[\theta_{ws} + K_s\rho_s + H\theta_{as}]}\left[\frac{D_s^{eff}/L_s}{ER \cdot L_B}\right]}{1 + \left[\frac{D_s^{eff}/L_s}{ER \cdot L_B}\right] + \left[\frac{D_s^{eff}/L_s}{(D_{crack}^{eff}/L_{crack})\eta}\right]} = \frac{C_{air}}{C_{soil}}$$

Soil to Indoor

$$\Rightarrow C_{air} = V_{sesp} \cdot C_{soil} = \frac{C_{soil} \cdot H\rho_s}{[\theta_{ws} + K_s\rho_s + H\theta_{as}]}\left[\frac{D_s^{eff}/L_s}{ER \cdot L_B}\right] \Big/ \left(1 + \left[\frac{D_s^{eff}/L_s}{ER \cdot L_B}\right] + \left[\frac{D_s^{eff}/L_s}{(D_{crack}^{eff}/L_{crack})\eta}\right]\right)$$

Substituting Eq. (1) from above:

$$\Rightarrow C_{air} = \frac{C_{vapor}\left[\frac{D_s^{eff}/L_s}{ER \cdot L_B}\right]}{1 + \left[\frac{D_s^{eff}/L_s}{ER \cdot L_s}\right] + \left[\frac{D_s^{eff}/L_s}{(D_{crack}^{eff}/L_{crack})\eta}\right]}$$

Peter McKeregham
Cambria Environmental Tech.
August 27, 1998

Table 2
SOIL SAMPLE ANALYTICAL RESULTS
PHYSICAL PARAMETERS AND TOTAL ORGANIC CARBON

APRIL 1-4, 1996

CHEVRON SERVICE STATION #9-1723
9757 SAN LEANDRO BOULEVARD, OAKLAND, CALIFORNIA

SAMPLE NUMBER		DATE	PERCENT MOISTURE	BULK DENSITY (g/m3)	POROSITY	TOTAL ORGANIC CARBON (mg/kg)
BORING	DEPTH (feet BGS)					
SB-3	5	04-01-96	16	2.1	34	1,100
SB-8	5	04-04-96	19	2.0	42	870
SB-10	5	04-04-96	20	1.9	44	3,300
	10		20	2.1	46	1,500
SB-20	10	04-03-96	18	2.0	42	870
SB-21	5	04-02-96	16	2.1	44	820

EXPLANATION
BGS = Below ground surface
g/m3 = grams per cubic meter
mg/kg = milligrams per kilogram, equivalent to parts per million (ppm)

CAMDST\A2.WK4

mean value

$\frac{\rho_b}{2.0}$ $\frac{n}{42\%}$ $\frac{f_{oc}}{1,410 \text{ mg/kg}} = 0.0014$ g/g

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