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Alameda County
Environmental Health

March 7. 2012

Mr. Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbour Bay Pkwy. Suite 250
Alameda. CA. 94502

Subject:

Lucasey manufacturing
2744 E.11th St
Oakland, CA 94601

Dear Mr. Wickham:

As the legally authorized representative of the above referenced project location, I have reviewed the corrective action plan (March 3, 2012) prepared by my consultant of record, ERM. I declare, under penalty of perjury, that the information/or recommendations contained in this report are true and correct to the best of my knowledge.

Sincerely,

Mr. Charles J Lucasey

Memorandum

Environmental Resources Management

2525 Natomas Park Drive
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Sacramento, CA 95833
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(916) 920-9378 (fax)

To: Jerry Wickham, ACEH

From: Mark Bowland
ERM Health, Ecology and Risk Services Practice

Date: 3/2/12

Subject: Human Health Risk Assessment/Evaluation; Lucasey Site

ERM

The intent of this memorandum is to transmit the results of the human health screening and indoor air evaluation for the Lucasey Site, Oakland California. This assessment/evaluation was conducted to supplement information presented in the Corrective Action Plan (ERM, 2011) previously submitted for the site. A map depicting the site and including on and offsite sampling locations is attached hereto as Exhibit 1, The screening assessment focused on determining if residual concentrations of total petroleum hydrocarbons (TPH) in soil vapor and groundwater in offsite locations with likely human receptors may present potential human health risks to current and future potential human receptors.

The assessment/evaluation was conducted consistent with Cal/EPA Department of Toxic Substances Control (DTSC, 2011), Office of Environmental Health Hazard Assessment (OEHHA, 2005) and San Francisco Regional Water Quality Control Board (RWQCB, 2008) guidance.

Off-site Data Review

Soil. As shown on Exhibit 1, soils were sampled at three locations proximal to the off-site residences: SB-22, SB-21, and B-2. Samples were collected at these locations in profiled fashion such that vertical delineation of chemical concentrations could be observed, and analyzed for petroleum hydrocarbons (TPH), volatile organic compounds (VOCs, including benzene, toluene, ethylbenzene, xylenes [BTEX], and oxygenates such as MTBE). At location B-2, no TPH was detected in any samples collected from 5 to 20 feet below ground surface (BGS). In SB-21, nominal concentrations of TPH-gasoline (TPH-G, 1 mg/kg @ 11 feet bgs) and TPH-diesel (TPH-D, 770 mg/kg and 520 mg/kg at 11 ft bgs and 13.5 ft bgs respectively) were detected. In SB-22, nominal concentrations of TPH-G (4.3 mg/kg at 11.5 feet bgs) and low concentrations of TPH-D (2,600 mg/kg at 11.5 ft bgs) were detected. All concentrations were below ESLs (assuming groundwater is not a drinking water supply). However more

importantly, no VOCs were detected in any of the samples collected at these three locations, SB-22, SB-21, and B-2.

As described in the Corrective Action Plan, the most likely source of the residual TPH was a heavy fuel oil UST on the Lucasey Site. The UST is no longer present; evidence of its former existence was discovered during the AEI Phase I. The heavy fuel oil UST was likely not used after the early 1970s, because the cannery then operating at the site switched over to natural gas at that time. The tank was likely removed prior to or at about that time. Therefore, the oil source (and driving head) has not been present for at least 40 years. Furthermore, as part of the corrective action plan evaluation chromatograms for the previous investigations were examined; the examination determined that the TPH detected in the samples is a highly weathered heavy fuel oil. This is consistent with the observations noted in the soil samples described above, that is, no detected VOC concentrations associated with detected TPH concentrations.

Groundwater. Groundwater was sampled at several locations proximal to the off-site residences: PMW-3, SB-22, SB-21, and B-2. A minimal amount of visible product (TPH) was noted at PMW-3 after installation. The product rapidly attenuated over time and was not observed after one month of monitoring.

In groundwater samples collected at SB-21, no TPH-G and low concentrations of TPH-D (0.73 to 1.5 mg/L) were detected. No health-risk-based ESLs are available for TPH for potentially complete pathways from groundwater to off-site receptors (vapor intrusion only); the ESL tables recommend the use of soil vapor measurements.

No VOCs were detected in SB-21-W17; nominal concentrations of toluene, ethylbenzene, and xylenes were detected in SB-21-W26 (well below groundwater to indoor air ESLs presented in Table F-1b of the ESL document, SFRWQCB, 2008). Neither TPH nor VOCs were detected in sample B-2.

These data collectively suggest that while nominal amounts of product are potentially (if at all) present underlying off-site locations, any product present in the groundwater is so weathered as to render it effectively immobile and absent of significant amounts of VOCs.

Soil Vapor. Soil vapor was sampled at several locations proximal to the off-site residences: ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15. In locations ASV-3, ASV-4, and ASV-5, VOCs were detected and included

BTEX. In locations ASV-3 and ASV-4, benzene (740 ug/m3 and 570 ug/m3) and ethylbenzene (1,900 and 2,600 ug/m3) concentrations were greater than one or more CHHSL or ESL values. In ASV-5, all detected BTEX concentrations were below CHHSLs and ESLs.

ASV-14 and ASV-15 are located closest to the potentially exposed receptors and therefore are considered by ERM to be most representative of potential exposure source concentrations. In ASV-14 and ASV-15, BTEX and TPH were not detected, and other VOCs (methylene chloride, acetone) when detected, were substantially lower than their respective ESLs. Based on these comparisons it is considered unlikely that any remaining vapors emanating from chemicals detected in soils proximal to the off-site residences present a significant risk to off-site receptors.

Receptors of Potential Concern

In accordance with DTSC, OEHHA and RWQCB Health Risk Assessment guidance, current and future land uses were considered when developing the identification of people (i.e., receptors) that could potentially be exposed to chemicals at the offsite. Currently, the area contains single family residences; thus the current and future potential on-site receptors include residents.

Indoor Air Modeling

As noted above, comparison of ASV-14 and ASV-15 (located closest to the potentially exposed receptors and considered most representative of potential exposures) results to ESLs indicate that detected chemical concentrations in soil vapor are unlikely to represent a significant risk to off-site receptors. As further support for that conclusion, several tiered quantitative evaluations were undertaken.

Tier 1 Modeling

Flux estimates of VOCs soil vapor and dispersion into indoor air were determined using the spreadsheet-based model developed by USEPA (2003; herein referred to as the J&E model). This model is based on the vapor intrusion model published by Johnson and Ettinger (1991). The J&E vapor intrusion model is a screening-level model, which incorporates both convective and diffusive mechanisms for estimating the transport of constituent VOCs emanating from subsurface soils (and subsequently groundwater by transfer) into indoor spaces located above the potential source of these chemicals. The model is constructed to calculate steady-state vapor transport (infinite source).

Soil Types. Based on soil characteristics and the cross sections presented in the CAP (ERM, 2011), for offsite areas loamy sand was selected to represent ground surface to 4 feet bgs, and silt was selected to represent 4 to 5 feet bgs.

Soil Characteristics. Default soil physical parameters present in the model for each soil type were utilized in the modeling.

Building Characteristics. As a conservative measure, the default values recommended in vapor intrusion guidance (SFRWQCB, 2008; DTSC, 2011) were incorporated for the following model parameters: depth below grade to the bottom of enclosed floor space, enclosed floor space thickness, soil-building pressure differential, enclosed space floor length, enclosed space floor width, enclosed space height, floor-wall seam crack width, indoor air exchange rate, and average vapor flow rate into building.

Values for residential modeling parameters are presented in Table 2.

Source Concentrations. Two evaluations were conducted:

1. Modeling of the maximum detected concentrations of chemicals selected from all vapor sample locations proximal to off-site areas, including ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15, and

2. Modeling of the maximum detected concentrations of chemicals selected from vapor sample locations closest to potential receptors (considered most relevant in assessing potential off-site exposures) - ASV-14, and ASV-15.

All data collected from these locations were collected from 5 feet bgs.

Tier 2 Modeling

There is significant uncertainty in the modeling of the intrusion of TPH related constituent vapors into indoor air. USEPA and other authors have identified specific uncertainties and limitations of the J&E model for providing robust analytical solutions for the vapor intrusion to indoor air pathway for vapors from TPH-related compounds. More specifically, a significant concern is that the J&E model does not sufficiently account for attenuation and biodegradation of the vapors from petroleum-related compounds during migration through the vadose zone:

"EPA is not recommending that the J&E Model be used for sites contaminated with petroleum products…The J&E Model does not account for contaminant attenuation (biodegradation, hydrolysis, sorption, and oxidation/reduction). Attenuation is potentially a significant concern for these type of sites" (USEPA 2003).

"An empirical field study (Fitzpatrick and Fitzgerald 1997) indicated that the model may be overly conservative for nonchlorinated species (e.g., benzene, toluene, ethylbenzene and xylene) …The authors contribute the likely cause for this discrepancy is the significant biodegradation of the nonchlorinated compounds" (USEPA 2003a).

"…Second, aerobic biodegradation was deemed significant in determining the observed profiles at a large proportion of sites. This observation…can be used to argue that predictive models not accounting for biodegradation could overestimate the risks from upward vapor fluxes by 10-10,000 times at some sites" (Roggemans et al. 2001).

Biodegradation is a potentially significant attentuation process for vapors not accounted for tin the J&E model.

For purposes of this risk assessment, the API BioVapor model (2010; v2.0) was utilized to further assess migration potential of petroleum hydrocarbons into off-site residences, specifically to evaluate whether bioattentuation would be expected to significantly reduce migration potential of benzene and ehtylbenzene vapors into indoor air. The BioVapor model utilizes the same mechanistic approach for estimating potential indoor air concentrations, while estimating the potential bioattenuation of organic vapors to take place[1].

The same inputs utilized in the J&E model were utilized in the BioVapor model. The results of the modeling (estimated indoor air concentration of benzene vapors from ASV-3 and ethylbenzene vapors from ASV-4) are presented in Table 2.

[1] The BioVapor model also estimates the indoor air concentration assuming bioattenuation does not occur; the model estimated the indoor air concentrations under these conditions that are essentially identical to those estimated by the J&E model.

Exposure Assessment

Default values for exposure parameters and exposure equations (similar to those utilized in the J&E model) were tuilized in the evaluation, and are presented in Table 3.

Toxicity Assessment

Toxicity assessment is the process of describing the potential for a chemical to cause both cancer and/or non-cancerous effects (for example liver effects). Standard Cal/EPA (Office of Environmental Health Hazard Assessment; OEHHA; 2012) and USEPA (2012) toxicity criteria are applied in the present risk assessment. These criteria were selected in accordance with the following regulatory hierarchy:

1. Cal/EPA OEHHA Toxicity Criteria Database;
2. IRIS;
3. USEPA's Provisional Peer Reviewed Toxicity Values;
4. National Center for Environmental Assessment (NCEA, or other current USEPA sources);

For Compounds of Potential Concern (COPCs) for which both Cal/EPA and USEPA toxicity criteria exist, the most conservative value is utilized. All toxicity criteria applied in the present risk assessment for vapor intrusion into indoor air, are presented in Tables 4 and 5.

Results

The results of the vapor modeling and hazard/risk estimates are presented in Table 2.

Tier 1 Modeling

Conservative proximal soil vapor samples. The hazard indices (HI) associated with assumed residential indoor air exposure to maximum detected soil gas concentrations in ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15 was 0.058. This is less than the target value of 1.0.

The incremental lifetime cancer risk (ILCR) associated with the maximum detected concentrations of benzene in soil gas in ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15 was 4×10^{-6}. This is consistent with the most conservative end of the USEPA (1990) acceptable risk range (10^{-4} to 10^{-6}). It should be noted that this estimate is based on the conservative assumption that the benzene concentrations in soil gas from ASV-3 are potentially relevant source concentrations for off-site residence modeling even though samples collected immediately adjacent to off-site residences (ASV-14 and ASV-15) are non-detect for benzene and ethylbenzene. Therefore, the evaluation is overly conservative because it does not reflect potential source concentrations relevant to the receptor of interest (ASV-3 and ASV-4). And, more importantly, the evaluation still indicates, even using the most conservative assumption, that estimated risks are within the acceptable range.

Relevant proximal soil vapor samples. The HI associated with assumed residential indoor air exposure to maximum detected soil gas concentrations in ASV-14 and ASV-15 was 0.0014. This is considerably less than the target value of 1.0.

The ILCR associated with the maximum detected concentrations in ASV-14 and ASV-15 was 2×10^{-7}. This is less than the most conservative end of the USEPA (1990) acceptable risk range (10^{-4} to 10^{-6}). Due to their proximity to off-site receptors, these locations are considered the most relevant for estimating potential source concentrations that may intrude into indoor air.

Tier 2 Modeling

The results of the BioVapor modeling for the maximum detected benzene and ethylbenzene proximal soil gas concentrations in ASV-3 and ASV-4 are also presented in Table 2. The results indicate that bioattenuation of potential TPH vapors as they migrate through the vadose zone represents a significant attenuating mechanism. Estimated HI (0.000000048) and ILCR (2×10^{-11}) are five orders of magnitude less than those estimated using the J&E model.

The results of the modeling efforts provides evidence to suggest that detected concentrations of petroleum related hydrocarbon vapors in the subsurface proximal to off-site residences are unlikely to pose a significant risk to human health.

Conclusions

The following evidence was developed as part of this evaluation:

- The last potential introduction of a TPH source occurred more than 30 years;
- The Correction Action Plan(ERM, 2011) review of chromatograms indicated the TPH source is a highly weathered heavy fuel oil; consequently, significant VOC concentrations are not expected;
    - This conclusion is consistent with observations of the soil samples collected off-site; no detected VOC concentrations were associated with detected TPH concentrations;
- Concentrations of TPH have been observed in off-site groundwater in PMW-3, SB-22, SB-21, but not in B-2. In PMW-3, a small amount of product was observed when the well was first installed, but rapidly attenuated over a one month period and was not observed again over the following 9 month period;
    - If nominal amounts of product are present in off-site locations, the product has been weathered sufficiently to render it effectively immobile
    - Significant amounts of VOCs were not present (also observed in the groundwater data);
- Soil vapor samples collected generally proximal to off-site locations (ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15) demonstrate low concentration of VOCs;
- Conservative Tier 1 modeling of soil vapor samples generally proximal to off-site locations (ASV-3, ASV-4, ASV-5, ASV-14, and ASV-15) result in conservative risk estimates consistent with the most conservative end of the USEPA acceptable risk range;
- Soil vapor samples collected immediately proximal to off-site locations (ASV-14 and ASV-15) detected nominal concentrations of VOCs substantially less than ESLs, with no detected concentrations of BTEX;
- Conservative Tier 1 modeling of soil vapor samples immediately proximal to off-site locations (ASV-14 and ASV-15) result in conservative risk estimates significantly less than the most conservative end of the USEPA acceptable risk range;
- Tier 2 modeling of measured benzene and ethylbenzene in soil vapor at ASV-3 and ASV-4 demonstrates significant bioattenuation

potential for petroleum hydrocarbons and estimated risks significantly less than acceptable risk levels (5 orders of magnitude less).

Based upon this evidence, the conclusion that detected concentrations of petroleum hydrocarbons in off-site locations are not likely to present a significant risk to off-site receptors is well supported.

References

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U.S. Environmental Protection Agency (USEPA). 2012. *Integrated Risk Information Service (IRIS)*. On-line database, Washington, DC.

FIGURE

CAD File:	Drawn By:	Date:	Project No.
g:\\0097888\009788800-05.dwg	J. Estrada	03/21/11	0097888.00

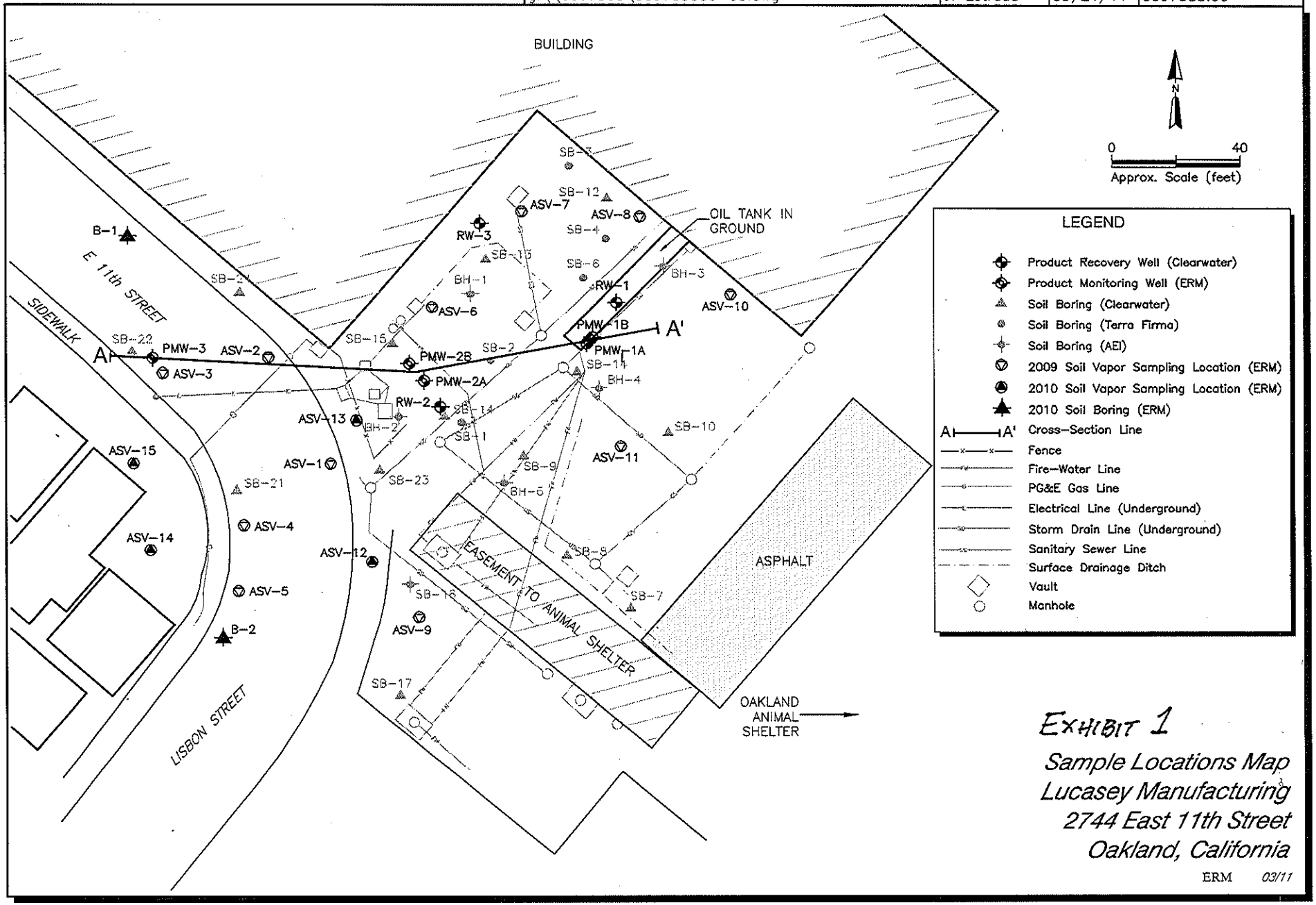

EXHIBIT 1

Sample Locations Map
Lucasey Manufacturing
2744 East 11th Street
Oakland, California

ERM 03/11

TABLES

Table 1
Indoor Air Modeling Inputs - Onsite
Lucasey Site - 2744 E. 11th Street
Oakland, California

Parameter	Value	Reference	
Depth to soil vapor (cm)	152		
Soil Characteristics			
Average soil/gw temperature (C)	18.0	USEPA, 2003	
Stratum A thickness (cm)	122	Measured	Stratum A
Stratum A vadose zone soil type	LS	Measured; Loamy sand (silty sand)	
Vadose zone dry bulk density (g/cm^3)	1.62	Default	
Vadose zone total porosity (unitless)	0.390	Default	
Vadose zone water-filled porosity (unitless)	0.076	Default	
Vadose zone air-filled porosity (unitless)	0.314	Default	
Stratum B thickness (cm)	30	Measured	Stratum B
Stratum B vadose zone soil type	Si	Measured; silt	
Vadose zone dry bulk density (g/cm^3)	1.35	Measured	
Vadose zone total porosity (unitless)	0.489	Measured	
Vadose zone water-filled porosity (unitless)	0.167	Measured	
Vadose zone air-filled porosity (unitless)	0.322	Measured	
Building Characteristics			
Depth below grade to bottom of enclosed floor space (cm)	15	DTSC Default	
Air exchange rate (1/hr)	2.00	SFRWQCB, 2008	
Average vapor flow rate into interior space, Qsoil (L/m)	5.0	DTSC Default	
Enclosed space length (cm)	1,000	DTSC Default	
Enclosed space width (cm)	1,000	DTSC Default	
Enclosed space height (cm)	244	DTSC Default	
Building Pressure Differential (cm)	40	DTSC Default	

Table 2
Residential Soil Vapor Model Results and Risk Estimates - Indoor Air
Lucasey Site - 2744 E. 11th Street
Oakland, California

Chemical	Maximum Offsite Vapor Concentration ($\mu g/m^3$)	Location of Maximum	Indoor Air Concentration ($\mu g/m^3$)	Average Daily Concentration (mg/m^3)	Lifetime Average Daily Concentration ($\mu g/m^3$)	Reference Concentration (mg/m^3)	Unit Risk $(\mu g/m^3)^{-1}$	Hazard Index[a]	Cancer Risk[b]
ASV-3, ASV-4, ASV-5, ASV-14, ASV-15									
Benzene	7.4E+02	ASV-3	2.3E-01	2.2E-04	9.5E-02	3.0 E-2	2.9 E-5	7.4 E-3	3 E-6
Ethylbenzene	2.6E+03	ASV-4	7.5E-01	7.2E-04	3.1E-01	1.0 E+0	2.5 E-6	7.2 E-4	8 E-7
Methylene chloride	1.8E+03	ASV-15	6.0E-01	5.7E-04	2.5E-01	4.0 E-1	1.0 E-6	1.4 E-3	2 E-7
Toluene	2.2E+04	ASV-4	6.8E+00	6.5E-03	NA	3.0 E-1	NA	2.2 E-2	NA
m,p-Xylene	1.0E+04	ASV-4	2.8E+00	2.7E-03	NA	1.0 E-1	NA	2.7 E-2	NA
o-Xylene	2.9E+03	ASV-4	9.0E-01	8.6E-04	NA	1.0 E-1	NA	8.6 E-3	NA
Total								**5.8 E-2**	**4 E-6**
ASV-14, ASV-15 (Closest to residences)									
Benzene	<42		NA	NA	NA	3.0 E-2	2.9 E-5	NA	NA
Ethylbenzene	<57		NA	NA	NA	1.0 E+0	2.5 E-6	NA	NA
Methylene chloride	1.8E+03	ASV-15	6.0E-01	5.7E-04	2.5E-01	4.0 E-1	1.0 E-6	1.4 E-3	2 E-7
Toluene	<50		NA	NA	NA	3.0 E-1	NA	NA	NA
m,p-Xylene	<57		NA	NA	NA	1.0 E-1	NA	NA	NA
o-Xylene	<57		NA	NA	NA	1.0 E-1	NA	NA	NA
Total								**1.4 E-3**	**2 E-7**
ASV-3 BioVapor Model									
Benzene	7.4E+02	ASV-3	1.5E-06	1.4E-09	6.2E-07	3.0 E-2	2.9 E-5	4.8 E-8	2 E-11
Ethylbenzene	2.6E+03	ASV-4	1.1E-05	1.0E-08	4.5E-06	1.0 E+0	2.5 E-6	1.0 E-8	1 E-11
Total								**4.8 E-8**	**2 E-11**

[a] Per RAGS F (2009); Hazard Index = Concentration ($\mu g/m^3$)/(1000 mg/μg) / Reference concentration (mg/m^3) x 24 hr/d x 350 d/yr x 30 yrs/(30 yrs x 365 d/yr x 24 hr/day)).

[b] Per RAGS F (2009); Cancer Risk = Concentration ($\mu g/m^3$) x Unit risk factor $(\mu g/m^3)^{-1}$ x 24 hr/d x 350 d/yr x 30 yrs/(70 year x 365 d/y x 24 hr/d).

NA = not assessed/not analyzed

Zero values for concentration indicate the chemical was not detected and is not quantified here. The detection limits are discussed in the uncertainty section of the report.

Table 3
Resident Exposure Parameters
Lucasey Site - 2744 E. 11th Street
Oakland, California

Parameter	Abbrev.	Value	Units	Reference
Averaging time, carcinogenic	AT_c	70	years	SFRWQCB, 2008; USEPA 2002
Resident exposure frequency	EFr	350	days/year	SFRWQCB, 2008; USEPA 2002
Exposure duration, Resident	ED_r	30	years	SFRWQCB, 2008; USEPA 2002
Exposure Time	ET_{res}	24	hours/day	
Hours per day		24	hours/day	

Key:

SFRWQCB = Regional Water Quality Control Board, San Francisco Bay Region

USEPA = United States Environmental Protection Agency

Table 4
Noncancer Toxicity Criteria
Lucasey Site - 2744 E. 11th Street
Oakland, California

	Inhalation - Chronic (mg/m^3)	
Chemical	**Value**	**Reference**
Non-Carcinogenic		
Benzene	3.0 E-2	USEPA, 2012
Ethylbenzene	1.0 E+0	USEPA, 2012
Methylene chloride	4.0 E-1	OEHHA 2012
Toluene	3.0 E-1	OEHHA 2012
Xylene	1.0 E-1	USEPA, 2012

Notes and Key:
NA = Not applicable. Data either not applicable (e.g., not carcinogenic), not available, or chemical not assessed for this pathway.
USEPA = United States Environmental Protection Agency
OEHHA = Office of Environmental Health Hazard Assessment

Table 5
Carcinogenic Toxicity Criteria
Lucasey Site - 2744 E. 11th Street
Oakland, California

	Inhalation ($ug/m^3)^{-1}$	
Chemical	**Value**	**Reference**
Carcinogenic		
Benzene	2.9 E-5	OEHHA 2012
Ethylbenzene	2.5 E-6	OEHHA 2012
Methylene chloride	1.0 E-6	OEHHA 2012
Toluene	NA	
Xylene	NA	

Notes and Key:
NA = Not applicable. Data are either not applicable for this chemical (e.g., not carcinogenic),
OEHHA = Office of Environmental Health Hazard Assessment
USEPA = United States Environmental Protection Agency