

McClellan Environmental Technology

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Pages: 6	Fax Number : 650/359-5873

Madhulla,

As we left it on Tuesday, I was going to get back to you as soon as I could get a copy of the October report. I just received it by fax about the time I left a message. There seems to be little, if anything different from the draft, and I also have a letter dated October 8, 1996 for the transmittal of an original of this report to you. I remember that your file is out, so here are the relevant pages. I can fax the entire report if you want it, feel free to request it. I also have an original due by mail any day.

From what I can see, the report concludes that there is little risk from exposure to vapors emanating from groundwater. Our client wishes to obtain closure on the groundwater issue and wishes to know what is expected next. Based on the conservative calculations of the ASTM RBCA technique, it would appear that no further work is needed, however I would like to have your read on that before getting back to the client.

I have a site similar to this in Fresno County and they had to refer it back to the RWQCB due to the presence of halogenated organics in groundwater. Will it be necessary for this site to be referred to the Bay Area RWQCB in order to obtain final closure? If so, is there anyone in particular at the board that we should get in contact with?

Sincerely,
Bill McClenney

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risks present at the site as a substantial portion of the site is currently paved.

4.1 Groundwater—Inhalation of Outdoor Vapors

In this case, chemical intake is a result of inhalation of outdoor vapors which originate from dissolved chemicals in groundwater located some distance below ground surface.

The relationship between outdoor air and dissolved groundwater concentrations is represented by the "volatilization factor," VF_{wamb} [(mg/m³-air)/(mg/L-H₂O)]. It is based on the following assumptions:


- ▶ A constant dissolved chemical concentration in groundwater;
- ▶ Linear equilibrium partitioning between dissolved chemicals in groundwater and chemical vapors at the groundwater table;
- ▶ Steady-state vapor- and liquid-phase diffusion through the capillary fringe and vadose zones to ground surface;
- ▶ No loss of chemical as it diffuses toward ground surface (that is, no biodegradation); and
- ▶ Steady well-mixed atmospheric dispersion of the emanating vapors within the breathing zone as modeled by a "box model" for air dispersion.

4.2 Groundwater—Inhalation of Enclosed-Space (Indoor) Vapors

In this case, chemical intake results from the inhalation of vapors in enclosed spaces. The chemical vapors originate from dissolved chemicals in groundwater located some distance below ground surface.

For simplicity, the relationship between enclosed-space air and dissolved groundwater concentrations is represented by the "volatilization factor" VF_{wep} [(mg/m³-air)/(mg/L-H₂O)]. It is based on the following assumptions:

- ▶ A constant dissolved chemical concentration in groundwater;
- ▶ Equilibrium partitioning between dissolved chemicals in groundwater and chemical vapors at the groundwater table;
- ▶ Steady-state vapor- and liquid-phase diffusion through the capillary fringe, vadose zone, and foundation cracks;
- ▶ No loss of chemical as it diffuses toward ground surface (that is, no biodegradation); and
- ▶ Steady, well-mixed atmospheric dispersion of the emanating vapors within the enclosed space, where the convective transport into the



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building through foundation cracks or openings is negligible in comparison with diffusive transport.

4.3 Subsurface Soils—Inhalation of Outdoor Vapors

In this case, chemical intake is a result of inhalation of outdoor vapors which originate from chemicals contained in subsurface soils located some distance below ground surface.

For simplicity, the relationship between outdoor air and soil concentration is represented in the "volatilization factor," $VF_{\text{sub}} [(mg/m^3\text{-air})/kg\text{-soil}]$. It is based on the following assumptions:


- ▶ A constant chemical concentration in subsurface soils;
- ▶ Linear equilibrium partitioning within the soil matrix between sorbed, dissolved, and vapor phases, where the partitioning is a function of constant chemical- and soil-specific parameters;
- ▶ Steady-state vapor- and liquid-phase diffusion through the vadose zone to ground surface;
- ▶ No loss of chemical as it diffuses toward ground surface (that is, no biodegradation); and
- ▶ Steady well-mixed atmospheric dispersion of the emanating vapors within the breathing zone as modeled by a "box model" for air dispersion.

4.4 Subsurface Soils—Inhalation of Enclosed Space (Indoor) Vapors

In this case, chemical intake is a result of inhalation of enclosed-space vapors which originate from chemicals contained in subsurface soils located some distance below ground surface.

For simplicity, the relationship between indoor air and soil concentrations is represented by the "volatilization factor," $VF_{\text{sub}} [(mg/m^3\text{-air})/kg\text{-soil}]$. It is based on the following assumptions:

- ▶ A constant chemical concentration in subsurface soils;
- ▶ Linear equilibrium partitioning within the soil matrix between sorbed, dissolved, and vapor phases, where the partitioning is a function of constant chemical- and soil-specific parameters;
- ▶ Steady-state vapor- and liquid-phase diffusion through the vadose zone and foundation cracks;
- ▶ No loss of chemical as it diffuses toward ground surface (that is, no biodegradation); and
- ▶ Well-mixed atmospheric dispersion of the emanating vapors within the enclosed space.



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The exposure parameters are presented in Table 2 as obtained from the Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites (ASTM, 1995). Since additivity of risks is not considered, a conservative target excess cancer risk of 1×10^{-6} was selected. Soil, building, surface, and subsurface parameters are listed in Table 3. The depth to groundwater was assumed to be 27 feet (upper value in the range reported by Hart Crowser, 1996). The depth to subsurface soil sources was assumed to be 8 feet, which is the location of the highest detected soil concentrations of chemicals of concern. Porosity data were selected based on test data, soil descriptions, and engineering judgment. Other non-chemical-specific parameters retained their values as presented in ASTM (1995). Chemical-specific data are shown in Table 4.

5.0 RISK CHARACTERIZATION

In the risk characterization step of a risk assessment, the chemical intakes estimated in the exposure assessment are combined with the appropriate critical toxicity values identified in the toxicity assessment. The results are the estimated cancer risks and non-carcinogenic health hazards posed by the modeled exposures. In a RBCA Tier 1 analysis, this step is modified by incorporating the exposure parameters along with toxicity values and a predetermined level of acceptable risk in calculating RBSLs for specific media and chemicals of concern. For this risk assessment, RBSLs were calculated for subsurface soils and groundwater evaluating the exposure pathways presented in Section 2.1. RBSLs were calculated under both residential and industrial exposure scenarios with residential exposure considered the "worst-case future" exposure scenario for this site. The residential use scenario is considered a "worst-case" exposure scenario as it utilizes a higher level of exposure duration and frequency than the commercial/industrial use scenario (Table 2). It is assumed that if site chemical concentrations are below the appropriate residential RBSLs, that the current site conditions pose no unacceptable human health risks for all possible present and future uses of the property.

The RBSLs for each exposure scenario and constituents of concern are presented along with the maximum detected concentration of site chemicals in subsurface soil and groundwater samples in Table 5. As previously stated, these RBSLs correspond to a chemical concentration in the selected environmental media resulting in a non-carcinogenic hazard quotient of 1 and a carcinogenic risk level 1×10^{-6} . These RBSLs were compared with the maximum concentration of the chemical found in the corresponding media on site. The use of the maximum detected concentration of chemical is a conservative assumption and will overestimate the actual or potential risks associated with current site conditions.



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No exceedences are noted of RBSLs in either subsurface soil or from vapors in the soil from groundwater under either the residential or industrial exposure scenario. In subsurface soil, both benzene and PCE have maximum detected concentrations within an order of magnitude of their respective RBSL but are still below the RBSL even under the most conservative or protective use scenarios. The remaining chemicals detected in subsurface soils are several orders of magnitude below their respective RBSLs. Therefore, the residual presence of chemicals in subsurface soils, including potential vapors, does not pose an unacceptable risk to human health under current or potential future site uses and the site satisfies the conditions for regulatory site closure from a human health risk perspective.

6.0 REFERENCES

- Alameda County, 1988. Geohydrology and Groundwater-Quality Overview, East Bay Plain Area, Alameda County, California; 205(J) Report, Alameda County Flood Control and Water Conservation District, June 1988.
- AllWest Environmental, 1995. Phase I Environmental Site Assessment: Grand Auto Store No. 43. Appendix A of Hart Crowser Facility Closure Report 1996.
- ASTM E 1739-95, 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, 1995.
- EPA, 1987. Hazardous Waste Treatment, Storage, and Disposal Facilities - Air Emission Models. PB88-198619.
- EPA, 1991. HEAST - Health Effects Assessment Summary Tables, Annual FY 1991. OERR 9200.6-303 (91-2).
- EPA, 1995. HEAST - Health Effects Assessment Summary Tables, Annual FY 1995. OERR 9200.6-303 (95-2).
- EPA, 1996a. IRIS - Integrated Risk Information System (Database), EPA Office of Research and Development.
- EPA, 1996b. Risk-Based Concentration Table, EPA Region III, April 30, 1996.
- Hart Crowser, 1992a. Sampling and Analysis Plan, Grand Auto/Super Tire Facilities.



Table 5 - RBSL Table

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Constituent of Concern	RBSL for Non-Carcinogenic Effects		RBSL for Carcinogenic Effects		Maximum Detected Concentrations (1)	Units
	Residential	Commercial/Industrial	Residential	Commercial/Industrial		
Benzene						
Air indoor			0.392	0.493		µg/m ³ -air
Air outdoor			0.294	0.493		µg/m ³ -air
subsurface soil to ambient air			0.020	0.034	0.011	mg/kg-soil
subsurface soil to indoor air			0.013	0.040	0.011	mg/kg-soil
Ethylbenzene						
Air indoor	1390	1460				µg/m ³ -air
Air outdoor	1043	1460				µg/m ³ -air
subsurface soil to ambient air	128	180			0.064	mg/kg-soil
subsurface soil to indoor air	81	210			0.064	mg/kg-soil
Toluene						
Air indoor	56	58				µg/m ³ -air
Air outdoor	42	58				µg/m ³ -air
subsurface soil to ambient air	8	11			0.065	mg/kg-soil
subsurface soil to indoor air	5	12			0.065	mg/kg-soil
Xylenes						
Air indoor	973	1032				µg/m ³ -air
Air outdoor	730	1032				µg/m ³ -air
subsurface soil to ambient air	339	335			1.5	mg/kg-soil
subsurface soil to indoor air	151	392			1.5	mg/kg-soil
Perchloroethylene (PCE)						
Air indoor	48.7	51.1	5.594	7.048		µg/m ³ -air
Air outdoor	37	51	4.195	7.048		µg/m ³ -air
Groundwater to indoor vapor	>S	>S	79.635	595.424	0.3	mg/L-H ₂ O
Groundwater to outdoor vapor	>S	>S	33.646	36.526	0.3	mg/L-H ₂ O
subsurface soil to ambient air	6	8	0.643	1.081	0.104	mg/kg-soil
subsurface soil to indoor air	4	9	0.407	1.264	0.104	mg/kg-soil
Trichloroethylene (TCE)						
Air indoor			0.668	0.842		µg/m ³ -air
Air outdoor			0.501	0.842		µg/m ³ -air
Groundwater to indoor vapor			14.142	105.699	0.13	mg/L-H ₂ O
Groundwater to outdoor vapor			3.971	10.032	0.13	mg/L-H ₂ O
Cis-1,2-Dichloroethylene						
Air indoor	49	51				µg/m ³ -air
Air outdoor	37	51				µg/m ³ -air
Groundwater to indoor vapor	780.25	>S			0.036	mg/L-H ₂ O
Groundwater to outdoor vapor	329.50	461.31			0.036	mg/L-H ₂ O
Chloroform						
Air indoor			0.140	0.177		µg/m ³ -air
Air outdoor			0.105	0.177		µg/m ³ -air
Groundwater to indoor vapor			3.447	25.745	0.0019	mg/L-H ₂ O
Groundwater to outdoor vapor			1.454	2.442	0.0019	mg/L-H ₂ O
1,1,1-Trichloroethane						
Air indoor	14600	15330				µg/m ³ -air
Air outdoor	10950	15330				µg/m ³ -air
Groundwater to indoor vapor	>S	>S			0.0009	mg/L-H ₂ O
Groundwater to outdoor vapor	>S	>S			0.0009	mg/L-H ₂ O
1,2-Dichloroethane						
Air indoor			0.125	0.157		µg/m ³ -air
Air outdoor			0.094	0.157		µg/m ³ -air
Groundwater to indoor vapor			4.077	30.375	0.0018	mg/L-H ₂ O
Groundwater to outdoor vapor			1.712	2.876	0.0018	mg/L-H ₂ O
Vinyl Chloride						
Air indoor			0.038	0.048		µg/m ³ -air
Air outdoor			0.028	0.048		µg/m ³ -air
Groundwater to indoor vapor			0.547	4.087	0.0009	mg/L-H ₂ O
Groundwater to outdoor vapor			0.231	0.388	0.0009	mg/L-H ₂ O

>S = above maximum solubility of compound.

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(1) Data from Hart Crowser, 1996