



CALIFORNIA HUMAN HEALTH SCREENING LEVELS FOR ETHYLBENZENE

**Draft Report
November 2009**



**Integrated Risk Assessment Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency**

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Revised California Human Health Screening Levels for Ethylbenzene

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Introduction

In 2005, the California Office of Environmental Health Hazard Assessment (OEHHA) released a final document on the development of a list of soil screening numbers based on “protection of public health and safety” as required by Health and Safety Code Section 57008 (OEHHA, 2005 revision). The screening numbers are not intended for use by regulatory agencies that have authority to require remediation of contaminated soil, but are solely advisory numbers. These numbers have no regulatory effect, and are published solely as reference values that may be used by citizen groups, community organizations, property owners, developers, and local government officials to estimate the degree of effort that may be necessary to remediate a contaminated property. How these soil screening levels should be applied is explained in “Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties,” (Cal/EPA, 2005).

At the time the OEHHA document was released, a quantitative health risk assessment for the carcinogenic effect of ethylbenzene was underway by OEHHA. OEHHA postponed development of a CHHSL for ethylbenzene until the risk assessment was completed. The assessment has since been completed and released (OEHHA, 2007). The assessment identified a unit risk value for ethylbenzene of $2.5 \times 10^{-6}(\mu\text{g}/\text{m}^3)^{-1}$. The unit risk factor is used to estimate lifetime excess cancer risk from the inhalation exposure to ethylbenzene. It is now possible to develop the soil screening numbers for the chemical.

Methods

For volatile chemicals, the CHHSLs are based on inhalation of indoor air contaminated by soil gas. Assumptions and parameters used in these calculations are listed in Appendix B of the OEHHA (2005 revision) document. There is a discussion in this 2005 document on why soil gas analyses for screening purposes should be used whenever site history or soil analysis indicates that any of the volatile chemicals listed in Table 1 of the OEHHA document are encountered.

The soil-gas-screening numbers for ethylbenzene were calculated, as was done for the other chemicals in the OEHHA (2005 revision) document, for both residential and commercial/industrial property, and for buildings constructed on engineered fill below sub-slab gravel and those constructed on the base soil. For each of the four scenarios, the attenuation factor, the ratio of indoor air chemical concentration to soil gas chemical concentration, α , had been calculated in the OEHHA document using the Johnson and Ettinger model (1991) as described by U.S. EPA (2003).

The scenarios include the standard scenarios for residential and commercial/industrial future land use. Residential use requires lower residual contamination. The other two scenarios also are for residential and commercial/industrial future land use, but differs from the first group in the construction process. Older construction methods left existing base soil immediately under the foundation while new construction removes a foot of base soil

and replaces it with engineered fill. Engineered fill is assumed to be clean and therefore reduces the attenuation factor needed to estimate the CHHSL. This is important when existing structures on the site are to be in continued use.

For the volatile chemicals that are assessed as carcinogens, the target indoor air concentration was calculated as the level giving an estimated lifetime cancer risk of one in one million. For ethylbenzene the target residential indoor air concentration is $0.97 \mu\text{g}/\text{m}^3$. The target commercial/industrial indoor air concentration is $1.6 \mu\text{g}/\text{m}^3$. These target residential indoor air concentrations were calculated as shown below.

$$\text{TIDC} = \frac{\text{TR} \times \text{AT}_c \times 365 \text{ days/year}}{\text{URF} \times \text{EF} \times \text{ED}}$$

where,

- TIDC = Target Indoor Air Concentration, $\mu\text{g}/\text{m}^3$
- TR = Target Risk Level, unitless
- AT_c = Averaging Time for Carcinogens, yr
- URF = Unit Risk Factor, $(\mu\text{g}/\text{m}^3)^{-1}$
- EF = Exposure Frequency, days/yr
- ED = Exposure Duration, yr

and,

Parameter	Land Use	
	Residential	Commercial/Industrial
AT_c	70	70
EF	350	250
ED	30	25
TR	1×10^{-6}	1×10^{-6}
URF	2.5×10^{-6}	2.5×10^{-6}

The target indoor air concentrations remains the same for each land use, independent of the soil type under the structure. Each target indoor air concentration was divided by the calculated value of α , based on the soil type under the structure, to give the soil-gas-screening number or CHHSL, using the following equation.

$$\text{CHHSL} = \frac{\text{TIDC}}{1000 \text{ L}/\text{m}^3 \times \alpha}$$

where,

- CHHSL = California Human Health Screening Level
- TIDC = Target Indoor Air Concentration

α = Attenuation Factor

Values of the target indoor air concentrations, attenuation factor, and the CHHSL for ethylbenzene are listed in the table below.

Results

Ethylbenzene

Target Indoor Air Concentrations, Attenuation Factors and Soil-Gas-Screening Numbers under the Residential and Commercial/Industrial Land Use for Construction on Engineered Fill and Base Soil

Property Type	Soil Under Structure	Target Indoor Air Concentration ($\mu\text{g}/\text{m}^3$)	Attenuation Factor, α^1 (Unitless)	CHHSL ($\mu\text{g}/\text{L}$)
Residential	Engineered Fill	0.97	9.0×10^{-4}	1.1
Commercial/Industrial	Engineered Fill	1.6	4.5×10^{-4}	3.6
Residential	Base Soil	0.97	2.3×10^{-3}	0.42
Commercial/Industrial	Base Soil	1.6	1.2×10^{-3}	1.4

¹ The attenuation factors for ethylbenzene were taken from the OEHHA document (2005 revision), which describes how they were calculated.

References

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