

SUBJECT: Near and Subslab Screening Levels for Petroleum Sites

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Near and Subslab Screening Levels Table

Soil Gas - Near and Sub-slab Screening Levels ($\mu\text{g}/\text{m}^3$)		
Chemical	Residential	Industrial
Benzene	10	60
Ethylbenzene	40	200
Toluene	20,000	70,000
Xylenes	300	1,000
MTBE	400	2,000
Naphthalene	3	10
C5-C8 Aliphatic	2,000	10,000
C9-C12 Aliphatic	700	3,000
C9-C10 Aromatic	200	700
1,2-Dichloroethane (DCA)	4	20
Ethylene dibromide (EDB)	0.2	0.8

Near and Subslab Screening Level Uses:

The Near and Subslab Screening Level Table is designed as a simple screening tool to determine if near and subslab soil vapor samples exceed generic risked-based screening levels at sites with ONLY petroleum contamination. This table is not meant to be used with solvent sites or mixed waste sites containing a combination of petroleum and other sources as those screening levels are not given in this table. The petroleum screening levels can be used at other sites as long as all other compounds are properly represented and adjusted for in the Tier 2 analysis (solvent/mixed waste sites are not specifically addressed in this memo).

Near and sub-slab screening levels are calculated using the EPA attenuation factor of 0.03 applied to the RSLs and rounded to one significant figure. To ensure the site soil vapor data can be screened against this table, see section 6.1.4 of the Montana VI Guide found here:

[Montana VI Guide FINAL.pdf](#).

VISLs are not appropriate at a site or building where conditions exist that would allow enhanced or unattenuated entry of soil gas into a building.

- Groundwater is at least five feet deeper than a building's foundation.
- Buildings have poured concrete foundations that may be susceptible to VI (for example, through standard utility penetrations), but do not have significant openings to the subsurface that would readily allow soil vapor into buildings (sumps, large openings in the concrete, earthen floors, unlined crawlspaces).
- There are no significant preferential pathways including fractured bedrock or utility corridors.
 - The vapor source at a site is not a landfill where methane generation is produced in amounts that induce advective transport in the vadose zone.
 - The vapor source is not a pressurized gas line or other pressurized source. (Vapors from pressurized sources likely necessitate immediate response.)
 - Vapor source cannot be of a type where concentrated vapors have been released within an enclosed space (likely at a commercial/industrial facility) and the density of the chemicals' vapor may result in significant advective transport of the vapors downward through cracks and openings in floors and into the vadose zone.

Near and subslab soil vapor levels can also undergo site-specific Tier 2 adjustments.

How to calculate Tier 2 screening levels:

The same process applies to APH as is outlined in DEQ's Risk Based Corrective Action (RBCA) for Petroleum Releases Guidance, 4.2.1 (DEQ, 2024).

The carcinogenic Tier-1 APH screening levels in Table 1 were developed with a TR of 1E-06, which means that “one person out of 1 million persons assumed to be exposed under similar conditions could develop cancer as a result of lifetime exposure to one or more potential carcinogens” (EPA, 2020 chapter 4: <https://www.epa.gov/sites/default/files/2020-09/documents/chap4.pdf>).

To calculate the noncarcinogenic screening levels for Table 1, a THQ of 0.1 was used, which is the potential for non-cancer health hazards to occur from exposure to a chemical with non-cancer health guidelines, or more specifically, the ratio of an exposure level for a specific time period over a reference concentration (RfC) for that chemical at a similar exposure period.

Tier I APH screening levels are derived to allow exposure to 10 compounds, either 10 non-carcinogens, represented in Table 1 as nc or 10 carcinogens, represented in Table 1 as C. Once a site is fully investigated, the same calculation used for Tier 2 soil RBSLs may be used to calculate a site-specific indoor air concentrations protective of human health at the cumulative carcinogenic risk level of 1E-05 and a cumulative non-carcinogenic Hazard Index (HI; sum of HQs) risk level.

$$\text{Tier 2 RBSL}_n = \text{Tier 1 RBSL}_n \times \left(\frac{10}{\# \text{ of non-Carcinogenic Exceedances}} \right)$$

$$\text{Tier 2 RBSL}_c = \text{Tier 1 RBSL}_c \times \left(\frac{10}{\# \text{ of Carcinogenic Exceedances}} \right)$$

Tier 3 adjustments:

The HI may be summed according to major health effects and the target organs or systems (US EPA, 1989a). It is important to sum the HQs for each common effect to ensure no segregated HI exceeds 1. This process is referred to as “segregating the HIs.”

The process is as follows:

- Generate a HQ for each chemical
- Assign each chemical to one or more target organs based upon information found in the toxicity references included in the EPA Toxicity Hierarchy (EPA, 2003).
- Sum the individual HQs for each chemical assigned to each organ or organ system to generate an HI for that target organ or system.
- If any HI exceeds 1, then there is an unacceptable risk for non-carcinogenic health effects.

Tier 3 adjustments can be made on soil, air, or soil gas screening levels. Adjustments are not allowed for water quality standards. DEQ does not sum the HI across various media (exposure pathways). DEQ recommends a risk assessor or toxicologist perform the segregated HI calculation (Tier 3 analyses).

References:

ATSDR, 2012. Toxicological Profile for 1,3-Butadiene. September. Available at <https://www.atsdr.cdc.gov/ToxProfiles/tp28-c6.pdf>.

DEQ, 2012. Typical Indoor Air Concentrations of Volatile Organic Compounds in Non-Smoking Montana Residences Not Impacted by Vapor Intrusion, A Montana Indoor Air Quality Investigation, August. Available at https://deq.mt.gov/Files/Land/StateSuperfund/Documents/VI_guide/CompleteIndoorVOCReport.pdf.

DEQ, 2021. Montana Vapor Intrusion Guide. September. Available at https://deq.mt.gov/Files/Land/StateSuperFund/Documents/VI_Guide/MontanaVI_Guide_FINAL.pdf.

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U.S. EPA. 1989a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A). EPA/540/1-89/002. Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. December. Available at <https://www.epa.gov/risk/human-health-toxicity-values-superfund-risk-assessments>.

U.S. EPA, 2020. RCRA Delisting Technical Support Document, July. Available at <https://www.epa.gov/sites/default/files/2020-09/documents/chap4.pdf>.

U.S. EPA. 2024. Regional Screening Level (RSL) Calculator available at https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search.