



STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Remediation and Solid Waste Management
Division of Technical Services



MEMORANDUM

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DATE: December 10, 2013

PROGRAM: Uncontrolled Sites

SUBJECT: Vapor Intrusion Attenuation Factor

The purpose of this memo is to provide a recommendation for your consideration to change the current attenuation factor for risk based screening of subslab soil gas sample results related to persistent chemical (i.e. chlorinated solvent) contamination. The reason for the recommendation is based on the April 2013 USEPA recommended vapor attenuation factors for risk based screening of the vapor intrusion pathway for sub-slab soil gas. If you have any comments or questions, please contact me.

1.0 Background

USEPA has issued final guidance for vapor intrusion for persistent chemicals under the title OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft), April 11, 2013. Table 6-1 on page 75 presents a summary of the recommended vapor attenuation factors for risk based screening of the vapor intrusion pathway. Appendix B provides the explanation supporting the recommended values. Section B.3.1 provides a description of the dataset used in deriving the attenuation factors. The first paragraph concludes that the EPA's vapor intrusion database consists of numerous pairings of concentrations in indoor air and subsurface samples and represents that most comprehensive compilation of vapor intrusion data for chlorinated hydrocarbons (CHCs) available at this time. Section B.3.3 provides text justifying the recommended generic attenuation factor for subslab soil gas. The first paragraph states that the 95th

percentile value of the source-screened subslab data set in the EPA database was selected to account for inherent temporal and spatial variability in indoor air and subsurface vapor concentrations. This section references a 2012 document prepared by USEPA titled: U.S. EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings [EPA 530-R-10-002], March 16, 2012. Based on the text of 2012 document, 1,582 paired subslab soil gas and indoor air samples were evaluated. The database used to derive all the attenuation factors contains sample concentrations for chlorinated VOCs and volatile petroleum hydrocarbons (PHCs). The PHC reportedly comprise 3% of the entire data set. In reviewing Table 1 of the 2012 document, it appears that only one sample in the subslab soil gas data set is from a PCH only site (Alameda Air Station). Nine other samples in the subslab soil gas data set were collected from a site in Denver (Denver PCEBB) where chlorinated solvents (TCE, PCE, 1,1,1TCA, and other CHCs) and PHCs were detected. Additionally, Section 4.5 states that a series of screening criteria was used "to generate subsets of the database that can be used to calculate empirical attenuation factors for which subsurface sources of vapors (rather than background sources) were likely to be the principal contributor to the chlorinated VOCs observed in residential indoor air." The first baseline screen applied was to extract the subset of data containing only those attenuation factors calculated for chlorinated hydrocarbons measured in residential settings. Other screening criteria included removing sample sets where the subslab soil gas concentration was below the reporting limit and excluding indoor air concentrations potentially influenced by background sources (three different criteria applied for background influences). The result of the data screening allowed the authors to evaluate subslab soil gas attenuation factors for only those situations where chlorinated hydrocarbons were detected in soil gas and were not attributable to potential indoor air background conditions. The screening resulted in selecting subslab soil gas attenuation factors for residential houses from 411 datasets at 12 sites for chlorinated hydrocarbons. All 12 sites are located in states that can be considered cold weather climates, except for Orion Park, which is located in Mountain View California. Sixty-five percent (65%) of the samples are from two sites in Endicott, New York, and Raymark, Connecticut.

2.0 Maine Dry Cleaner Initiative Data

Most of the DCI sites under investigation include preferential pathway migration from the former dry cleaner to a receptor. Very

few combined subslab and indoor air basement samples have been collected within single family residential homes. Most of the DCI sites under investigation include larger apartment buildings or commercial buildings. The table below presents a summary of conditions and attenuation factors calculated in residential homes at DCI Sites. In reviewing data from sites where preferential pathways are present, bedrock outcrops in the basement, groundwater is within the envelope of the building, or the basement has a dirt floor there is very little attenuation between subslab and indoor air concentrations. There are a few locations that fit the conceptual model of groundwater off-gassing to soil gas and vapors are intruding into the building. In these settings, the recommended attenuation factor of 0.03 appears to be appropriately conservative (SSIA-4, SSIA-5, and SSIA-6). In the case of SSIA-5 and SSIA-6, the indoor air concentration was below the laboratory reporting limit so the reporting limit was used to calculate a minimum attenuation factor.

Summary of Dry Cleaner Initiative Attenuation Factors

Sample ID	SSIA-1	SSIA-2	SSIA-3	SSIA-4	SSIA-5
Condition(s) at receptor	GW, PDF	BR, PP	PP		
Tetrachloroethylene	0.81	0.20	0.59	0.03	>0.002
Trichloroethylene		0.83	0.21		
cis-1,2-Dichloroethane			0.16		

BR - Bedrock outcrop in basement
 GW - Groundwater in contact with building envelope
 PP - Preferential pathway migration confirmed
 PDF - Partial dirt floor basement

3.0 Recommendation

Based on the large database of chlorinated hydrocarbon concentrations within the EPA database and the very small data set within the Maine DCI, it appears appropriate to adopt the USEPA recommendation for those situations that fit the conceptual site model and no potential preferential pathways are present. Therefore the following conditions would need to be met in order to utilize the subslab soil gas attenuation factor:

- Evaluate all the potential preferential pathways (i.e. sewer, water, gas, telephone, drain pipes) with soil gas samples where possible,

- The attenuation factor are not applied to soil gas concentrations collected within a preferential pathway,
- Soil gas concentrations within all the preferential pathways attenuate below the IAT before they contact the envelope of the building foot print (including associated fill material),
- There is no direct connection of intersecting preferential pathways into the envelope of the receptor building,
- Seasonal groundwater does not enter the envelope of the building,
- Bedrock does not outcrop in the basement or does not contact the envelope of the building.