

Research Protocol for State Laws on Soil Vapor Intrusion

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State Laws on Soil Vapor Intrusion

- I. **Date of Protocol:** August 1, 2017

- II. **Scope:** To examine state laws, regulations, and standards governing the Soil Vapor Intrusion (SVI) pathway, by which chemicals of concern migrate from the subsurface to indoor air. The dataset includes coding questions pertaining to whether states regulate the Soil Vapor Intrusion (SVI) Pathway and more specifically the types of sampling locations, chemicals of concern, types of buildings that are addressed, and mitigation/remedial strategies.

- III. **Primary Data Collection**
 - a. **Project Dates:** February 1, 2016 – August 1, 2017

 - b. **Dates Covered in the Dataset:** Current through August 1, 2017

 - c. **Data Collection Methods:** The team consisted of one supervising professor, 15 initial researchers (“Researchers”) and two project supervisors (“Supervisor”). To examine which states possessed SVI laws, regulations, and/or guidance, the Researchers conducted a preliminary literature review to compile relevant laws, regulations, and/or standards for all 50 states and the District of Columbia using LexisNexis. Researchers restricted the search to state statutes and regulations and restricted the search to include key search terms related to soil vapor intrusion and/or vapor intrusion. Applicable laws suitable for coding were collected and recorded. Researchers were tasked to develop questions suitable to the pre- identified coding scheme from applicable standards. Researchers entered the developed questions into the Law Atlas Workbench, a policy surveillance tool. Questions were answered and properly cited with applicable laws, regulations, and/or guidance. Coding was verified by a naïve coder, finished by a project supervisor and reviewed by the supervising professor.

 - d. **Search terms:** Keyword searches included “soil vapor intrusion”, “vapor intrusion”, “chemicals of concern”, “sampling locations”, “mitigation”, “buildings”, “volatile organic chemicals”, “VOC”, “petroleum contamination”, “chlorinated solvent contamination”, “superfund sites”

 - e. **Databases used:** LexisNexis State Laws and Regulations; state legislature websites; LegiScan

 - f. **Inclusion and Exclusion Criteria:** State-level statutes and regulations related to the Soil Vapor Intrusion were collected.

IV. Coding

- a. **Development of coding scheme:** Supervising professor and Researchers developed a set of questions after conducting a preliminary search of state laws and regulations that address the SVI pathway. The questions were based on commonality criteria with regards to the preliminary search about relevant information regarding the SVI pathway. The supervising professor and Researchers developed 23 questions and entered them into LawAtlas Workbench, after a consensus was reached on word choice and order of questions.
- b. **Dataset terminology:** Dataset terminology is a set of relevant terms recorded and defined by the team specifically for purposes of coding within this dataset. As the team developed the coding scheme, they recorded the dataset terminology below:
- i. **“Soil vapor”** – Also known as “soil gas.” Soil vapors are the “gaseous elements and compounds in the small spaces between particles of soil. Once the gaseous elements or compounds migrate into a structure, they are referred to as “vapor.” Source: <http://itrcweb.org/Guidance/GetDocument?documentID=104>.
 - ii. **“Vapor intrusion”** – The migration of volatile chemicals from the subsurface into overlying buildings. The process requires three components: a source, an inhabited building, and a pathway from the source to the inhabitants. Source: <http://www.itrcweb.org/Team/Public?teamID=22>.
 - iii. **Soil Vapor Intrusion Pathway”** – Soil gas can flow into a building due to a number of factors, including barometric pressure changes, wind load, thermal currents, or depressurization from building exhaust fans. Chemicals volatilize from impacted soil and/or groundwater beneath a building and diffuse toward regions of lower chemical concentration (e.g., the atmosphere, conduits, basements). Assessment of the pathway entails the identification of all known or suspected vapor sources of contamination (source), consideration of the contaminant migration routes, including an evaluation of methods and manner of access (mobility), and identification of those likely to be affected by the contaminants (receptors). Source: <http://itrcweb.org/Guidance/GetDocument?documentID=104>.
 - iv. **“ug/m3 (micrograms per cubic meter)”** – A measurement of the concentration of a soil vapor in a volume of air. A microgram is one- millionth of a gram.
 - v. **“Volatile organic compounds (VOCs)”** – Compounds emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. VOCs are emitted by a wide array of products numbering in the thousands. Both chlorinated solvents and petroleum hydrocarbons are classes of VOC. Source: <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality>.
 - vi. **“Chlorinated solvents”** – Compounds containing at least one covalently bonded atom of chlorine that has an effect on the chemical behavior of the molecule.

Examples include, trichloroethylene (TCE) and tetrachloroethylene (PCE or PERC). Degradation of chlorinated solvents can produce toxic degradation products such as dichloroethylene and vinyl chloride. Source:

<https://www.epa.gov/sites/production/files/2014-09/documents/pvicvi.pdf>

- vii. **“Petroleum hydrocarbons”** – A broad range of chemicals that comprise oil and products refined from oil, such as gasoline and diesel. Examples include benzene, ethylbenzene, xylene, toluene, and naphthalene. Degradation of petroleum hydrocarbons usually produces carbon dioxide, water, and sometimes methane or other simple hydrocarbons. Source:

<https://www.epa.gov/sites/production/files/2014-09/documents/pvicvi.pdf>.

- c. **Coding Methods:** Coding was based on the statutes and regulations collected, which answer the questions depicted in the dataset’s codebook.

V. **Quality Control**

- a. **Quality Control – Research:** To confirm that all relevant laws were collected, redundant research of all 51 jurisdictions was performed three distinct times by the Researchers. The supervising professor reviewed this redundant research and met two separate times with the Researchers to discuss and resolve all divergences. After meeting to resolve the divergences, the Researchers collected the final relevant laws. The Researchers consulted a combination of secondary sources to verify the states that do not have a law.
- b. **Quality Control – Coding:** After coding was completed by the Researchers, the Supervisor reviewed the coding records and verified coding as a redundant check on the coding. Discussions were held to ensure consistency and agreement amongst coders. Coding was verified by a naïve coder, finished by the final Researcher, and reviewed by the supervising professor. No divergence rates were recorded; however, all divergences were resolved by discussions between Researchers and the Supervisor.