



Approach to Vapor Intrusion at Contaminated Dry Cleaner Sites August 2008

A Survey of Member States State Coalition for Remediation of Drycleaners (SCRD)

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Contaminant movement into buildings due to vapor migration from volatile organic chemical (VOC) contamination in soil and groundwater has become a significant concern to the public, business and regulatory agencies. Dry cleaning operations use a number of VOCs that, if released to the soil and groundwater, can lead to vapor migration into buildings and pose a health threat to people. This paper summarizes responses to a short survey conducted in 2007 regarding how SCRD-represented states approach vapor migration investigation, mitigation, and site closure at contaminated drycleaner properties.

The survey is intended to begin a dialogue regarding state approaches to vapor migration at drycleaners. The responses to the three questions in the survey are summarized here and all responses can be found in the attachment.

Question 1: How does each state approach vapor migration investigations?

Connecticut, Missouri, New York, and North Carolina have specific state guidance in place regarding assessment of vapor intrusion. Three states (Alabama, Oregon, and Wisconsin) indicated that they rely on current EPA (<http://www.epa.gov/correctiveaction/eis/vapor.htm>), ITRC, or other state's guidance to address investigation of vapor migration. Several states (Illinois, Kansas, Minnesota and Oregon) are in the process of developing state-specific guidance on this topic. Sub-slab vapor testing is the most common approach to defining the vapor pathway, although other approaches, including RBCA screening and use of the J&E model, are used. Six states will use indoor air testing during vapor investigations, while Alabama specifically does not use indoor air testing in defining this pathway. Currently, Florida has neither standards nor guidance for conducting vapor migration investigations. A pilot study is being conducted at a set of drycleaning and service station sites to determine what conditions exist in Florida relative to vapor migration.

Question 2: What remedial action is typically employed at properties where vapor migration has been confirmed?

There were nine detailed responses - Alabama and Texas have not implemented any remedies. In Florida, the type of remedial action employed would depend on site-specific conditions. All states that have mitigated the vapor pathway use sub-slab depressurization systems, although New York only accepts active systems rather than passive. Most states allow vapor barriers (only New York specifically does not) although these are only practical in new construction or major renovation. Most states also realize that external remediation, especially soil vapor extraction, can help mitigate vapor intrusion problems.

Question 3: Under what conditions will the State give final closure to dry cleaner sites where the vapor intrusion pathway has been shown to be complete?

Several states (Alabama, Illinois, Tennessee, and Texas) either have no closure policy or no sites identified with vapor intrusion problems. Contaminated sites in Florida, Missouri, North Carolina and Oregon must meet risk based targets to achieve closure. In Kansas and New York, specific state standards must be achieved prior to site closure. Several states will, at least in principal, grant closure to contaminated properties where the vapor pathway has been mitigated (e.g., an active SSDS is operating at the time of closure). These include: Connecticut, Minnesota, Missouri, North Carolina, and Wisconsin. Most of these states indicate that an operation and maintenance plan, restrictive covenant or land use control, and on-going monitoring would also be required as part of closure approval. Of the 13 states completing the survey only one (Wisconsin) has granted closure at dry cleaner sites where on-going operation of active vapor mitigation systems are needed to ensure protection of the vapor pathway. The closed cases in Wisconsin all involve vapor intrusion into the original dry cleaning building that has subsequently been redeveloped into other uses.

Attachment to SCRD Paper, Survey Responses

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Summary of SCRD member states response to the following 3 questions:

1. How does each state approach vapor migration investigations?
2. What remedial action is typically employed at properties where vapor migration has been confirmed?
3. Under what conditions will the State give final closure to dry cleaner sites where the vapor intrusion pathway has been shown to be complete?

1. How does each state approach vapor migration investigations?

Alabama:

Alabama's DEM has a Remediation Engineering Section of the Governmental Hazardous Waste Branch that deals with vapor intrusion. Alabama follows EPA guidelines for investigation and remediation. ADEM does not conduct indoor sampling. Sampling is only done under the slab to rule out other contaminants inside the building.

Connecticut:

We have published groundwater volatilization criteria, for either residential or industrial/commercial use of a site (that's the actual use of the site, not zoning, and it's assumed residential unless they have an environmental land use restriction on the site). The criteria were derived using conservative assumptions and (I believe) the J&E model. They must compare their groundwater concentrations to the criteria, and if they exceed they must remediate groundwater unless they can show through soil vapor sampling that the contaminants are not actually present in soil vapor. This is done through comparison of our published criteria for soil vapor. If the soil vapor samples are below those criteria, the assumption is that contaminants are not volatilizing from groundwater in concentrations that would cause a problem.

Florida:

Florida is currently researching vapor intrusion at drycleaner and service station sites. The data from these sites will be used to evaluate vapor migration in typical site settings around the state.

Illinois:

Illinois does not have an official vapor intrusion policy but is developing one. Currently cleanup levels are based on soil remediation objectives for the groundwater pathway and site specific contaminant soil saturation limits.

Kansas:

There is no set policy, but Kansas had developed a guidance document. Every site presents unique circumstances and sites will be addressed on a site-by-site basis as determined by the KDHE project manager. Project managers look at the contaminant concentrations, geology, land use, etc. to determine if vapor intrusion sampling is to be part of the source investigation, part of a separate expedited vapor intrusion sampling event, or not addressed at all.

Minnesota:

Minnesota's investigation approaches have focused on identifying and delineating potential vapor sources, evaluating associated subsurface soil gas concentrations in the direction of nearby receptors and conducting sub-slab or indoor air sampling as necessary to assess the potential risks posed to building occupants. Decision-making has been empirically based rather than relying on fate and transport models.

Missouri:

The Missouri Hazardous Waste Program has adopted a risk-based system for assessing sites called the Missouri Risk-Based Corrective Action (MRBCA). Default target levels, Tier 1 Risk-Based Target Level tables, site specific Tier 2 analysis and Tier 3 modeling are used to set cleanup levels. Soil type, residential or commercial use and site characteristics at Tier 2 and Tier 3 levels are some criteria. Indoor inhalation from groundwater is usually the most conservative measurement. The Vapor Migration to Indoor Air Pathway from soil and groundwater is addressed in MRBCA Technical Guidance 6.14 and Appendix H, Measurement of Soil Vapors. Testing of indoor air is also included as an option in MRBCA and can help to confirm vapor intrusion where there is an existing building and testing in other media indicates probability of vapor migration. MRBCA link: <http://www.dnr.mo.gov/env/hwp/mrbca/mrbca.htm>.

New York:

Every site in any one of New York's remedial programs is evaluated to determine if vapor intrusion is an issue. In addition New York is re-evaluating sites in our inactive hazardous waste site program where remedial decisions were made prior to 2003 to make sure that a vapor intrusion issue still doesn't exist. Investigation, evaluation and remediation of vapor intrusion in New York is conducted following guidance prepared by the NYS Department of Health in consultation with NYSDEC. The guidance is titled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" and is available at http://www.health.state.ny.us/environmental/investigations/soil_gas/svi_guidance/ Although the guidance does allow for the use of a wide variety of tools (including soil gas sampling and modeling) emphasis is placed on structure sampling (subslab, indoor and ambient sampling using TO-15). Two matrices have been developed which dictate the appropriate response to the investigation. The options are no action, monitoring or mitigation. These matrices are based on protection of residential exposure. In situations,

where a contaminant is still being used (such as an operating drycleaner using perchloroethene) the OSHA PEL would apply. However, in situations where the chemical is not being used (such as a drop off store) the matrices would be used.

North Carolina:

In North Carolina, a risk-based approach is employed. The first step is the comparison of representative concentrations in soil, groundwater and soil vapor to pre-calculated Tier 1 risk-based screening levels (RBSLs). The RBSLs have been calculated using default exposure and fate and transport parameters for various exposure scenarios, i.e., residential, non-residential, construction worker, etc. If the representative concentrations exceed the RBSLs, the next step is the identification of data gaps and additional information that may need to be collected for the performance of a Tier 2 site-specific risk assessment. For example, if subslab data has not been collected, we would most likely collect subslab or other soil vapor data. Once all necessary data has been collected, a Tier 2 site-specific risk assessment is conducted using software developed for the North Carolina DSCA Program. If the Tier 2 risk assessment indicates that the indoor air risk levels are unacceptable, the Program may collect indoor air samples or examine immediate mitigation options.

Oregon:

Oregon evaluates vapor intrusion at sites with VOC contamination. Oregon currently relies on published or emerging guidance from other states, the EPA and other sources (such as ITRC) when evaluating vapor intrusion at cleanup sites. Oregon currently relies heavily on sub-slab vapor or soil gas sampling (samples collected approximately 5 feet below ground surface) to evaluate the vapor intrusion pathway. Various remedial technologies may be considered to address vapor intrusion risks, depending on the situation and changes in remediation technologies. Oregon uses a risk-based approach to evaluating closure at dry cleaners and other sites. Vapor intrusion is one of several exposure pathways evaluated and, if necessary, addressed before an NFA can be issued. Remedies implemented to mitigate vapor intrusion risks must be shown to be protective, reliable over the short and long term, and relatively easy to implement. Oregon's cleanup standards are based on a 1×10^{-6} excess cancer risk (for individual carcinogens); 1×10^{-5} for multiple carcinogens and multiple exposure pathways; and a hazard index of 1 for non-carcinogens. Oregon is planning on developing its own vapor intrusion guidance in 2008.

Tennessee:

Tennessee does not have published vapor migration guidance. When sites are identified with free product or high levels of VOCs further review for vapor intrusion are conducted. Tennessee uses a modified J&E model with state specific values to estimate the potential for vapor intrusion. Once a vapor concern is identified, air samples are collected in areas of concern. The air sample results are forwarded to the Dept. of Health for their review, assessment of health hazard, and recommendation for action.

Texas:

Texas uses a site-specific approach to vapor migration investigation.

Wisconsin:

Wisconsin has not published any groundwater or soil vapor screening numbers nor written any guidance on investigating the vapor migration pathway. Wisconsin recommends that consultants and responsible parties use the 2002 draft EPA guidance and 2007 ITRC Vapor Intrusion document for direction on investigating the vapor intrusion pathway. In general, the agency expects that the vapor intrusion pathway will be defined at all sites with chlorinated VOCs and at petroleum sites where free product or high levels of PVOCs are located near building foundations. Soil vapor samples are collected if there is a possibility that CVOCs are volatilizing off a contaminated groundwater plume located near the water table. More commonly, subslab and indoor air vapor samples are collected at buildings near a source area. This includes neighboring businesses in strip malls adjacent to dry cleaners and homes nearby dry cleaners or industrial users of CVOCs. The agency has not relied on the J&E model, but rather uses recommendations of the Wisconsin Division of Health which calculates risk numbers based on carcinogenicity and toxicity values available from IRIS and other sources. The risk numbers usually reflect those found in EPA Region 3 or 9 Preliminary Remediation Goal tables.

2. What remedial action is typically employed at properties where vapor migration has been confirmed?

Alabama:

There are no sites with confirmed vapor intrusion in Alabama, so no remedial actions have been employed.

Connecticut:

Sub-slab depressurization is most commonly used to mitigate the intrusion pathway or SVE/pump & treat is used to remediate the source.

Florida:

There are no presumptive remedies for vapor intrusion. Florida is researching vapor intrusion and anticipates that vapor intrusion remedies will be site-specific considering emerging guidance and all available engineering controls.

Illinois:

If soil concentrations are near the soil contaminant saturation levels, the typical remedies used near the source include passive soil venting, SVE and excavation.

Kansas:

Sub-slab depressurization (e.g., radon-type systems) is specifically used for vapor intrusion. In addition, standard SVE systems are also used to address sub-slab contamination at the source area(s). A properly designed SVE system will minimize the potential of contaminated vapors entering the structures.

Minnesota:

Most remedial actions have been focused on redevelopment sites and have included passive vapor barrier systems with or without contingencies for being active, use of sub-slab depressurization systems, or source remediation with long term monitoring and contingency plans.

Missouri:

Remedial action for vapor intrusion has not been required yet at a Drycleaner Environmental Response Trust (DERT) Fund site. Several DERT sites are currently undertaking air monitoring, groundwater monitoring or soil tests because of possible vapor intrusion concerns. One DERT site did install a soil vapor mitigation system before entering the DERT Fund while working with our Voluntary Cleanup Program. The system is currently passively operated.

New York :

New York's guidance indicates that active sub slab depressurization systems are the preferred method of mitigation of structures impacted or potentially impacted by vapor intrusion. If active sub slab depressurization systems are not a practical alternative or if exposures will be mitigated concurrently by a method to remediate subsurface contamination, alternative methods may be considered. These alternatives include HVAC modification or soil vapor extraction systems. Passive extraction systems or sealing are not viewed as protective of the vapor intrusion pathway. The guidance document referenced above includes significant detail on this topic.

North Carolina:

In North Carolina, remedial actions must be taken to either meet the RBSLs or site-specific target levels established through performance or a site-specific risk assessment, or the indoor air pathway must be eliminated through the use of engineered controls. Some of the remedies utilized are:

- Soil excavation to remove source areas;
- Installation of a vapor barrier to eliminate the pathway;
- Installation of a sub-slab depressurization system to eliminate the pathway;
- The use of soil vapor extraction to remediate contaminated source areas.

Oregon:

There is no set or generic remedies for vapor intrusion. This is still an emerging issue. Vapor intrusion remedies are site specific. Depending on the situation, Oregon looks at vapor resistant (barrier) or vapor recovery (venting) technologies, such as radon systems. HVAC modifications are sometimes used as a temporary measure.

Tennessee:

Sub-slab depressurization systems are the first response. Passive systems are used when possible, otherwise active systems are employed. Vapor barriers may be employed on redevelopment sites.

Texas:

No remedial actions for vapor migration have occurred to date.

Wisconsin:

Sub-slab depressurization systems are the most commonly employed response. For source areas themselves (such as the dry cleaning facility), the concrete flooring is sometimes removed, the contaminated soils removed to the extent possible and/or piping laid beneath the floor in a hybrid SVE/sub-slab depressurization system. In areas of redevelopment, vapor barriers are typically built into the building foundation.

3. Under what conditions will the State give final closure to dry cleaner sites where the vapor intrusion pathway has been shown to be complete?

Alabama:

Not applicable. No sites with vapor intrusion have been identified.

Connecticut:

RP's can get approval or verification of a site that is not in compliance with volatilization criteria if measures have been taken to prevent migration into the building, and they have an O&M program in place. The State must approve the system and the O&M plan.

Florida:

Florida does not have a specific closure policy for vapor intrusion. Closure in Florida is risk-based and if vapor intrusion is identified as an issue, its risk must be addressed before closure.

Illinois:

Vapor intrusion is currently not part of closure decisions.

Kansas:

The Kansas Department of Health & Environment's (KDHE) Dry Cleaner Remediation Program only closes sites where groundwater contamination is below MCLs and soil is below KDHE Risk-Based Standards for Kansas (RSK). For PCE, the soil RSK is 180 ug/kg for both residential and non-residential scenarios. The KDHE does not believe vapor intrusion is a problem if the two conditions are met.

Minnesota:

Closure at sites where vapor intrusion is a concern typically involves identifying whether potential risks exist by the collection of subsurface soil gas, sub-slab or indoor air data as needed, and appropriately managing those risks through either active remediation or using monitoring and contingency plans where the potential for future risks or ongoing risks are uncertain. Final closure would involve verifying that there are no ongoing or future risks identified for all potential receptors and future receptors.

Missouri:

Closure where the vapor intrusion pathway is complete would depend on demonstrating that contaminant levels are lower than MRBCA target level numbers at the selected Tier level for the planned use. A restrictive covenant on the property title can be used where a site meets commercial but not unrestricted or residential use target levels. Remedial measures to remove source material followed by confirmation testing would be allowed. Engineered risk mitigation strategies such as installation of a vapor barrier on new construction or sub-slab vapor mitigation might be allowed on a case-by-case basis with long-term monitoring and a restrictive covenant.

New York:

Sites may be closed (with respect to vapor intrusion) when the investigation of the site indicates that vapor intrusion is not an issue. Generally this requires structure sampling to have occurred and the results indicate that mitigation or monitoring is not required. For sites that have been mitigated, they may be closed after the site has been remediated and sampling indicates that mitigation is no longer needed.

North Carolina:

In North Carolina, final closure would be given if:

- RBSLs or site-specific target levels have been achieved
- The stability of the plume has been verified by an acceptable monitoring period; and

- Any required land use restrictions and notices have been recorded.

If an engineering control such as a vapor barrier or sub-slab depressurization system was used to eliminate the vapor intrusion pathway, a land use restriction would be required to ensure that the control was maintained.

Oregon:

No closures have occurred where vapor intrusion was a risk pathway. Closure in Oregon is always based on risk. If vapor intrusion was identified as an issue, it must be shown that the risk has been properly addressed before closure. The issue of “active cleaners” is a big question when considering closure.

Tennessee:

The Tennessee dry cleaner program has not yet established a policy site closure where vapor intrusion exists. Site specific data and site conditions, including the presence of an active SSDS are reviewed individually to determine if site closure is appropriate.

Texas:

Texas does not have a policy on closure of sites where the vapor intrusion pathway has been shown to be complete.

Wisconsin:

Wisconsin will approve final closure if a mitigation system is in place to protect the receptor (usually a sub-slab depressurization system) and steps have been taken to cleanup the source area. How much cleanup must take place and the expected longevity of the SSDS is an active area of policy making at this time. Contaminated sites seeking closure must submit a long-term O&M plan and this plan becomes part of the land use control that is entered into the State’s GIS Registry of Closed Remediation Sites. The State plans to inspect SSDS and other mitigation systems after site closure to ensure these systems continue to protect the vapor migration pathway.