

MRBCA Vapor Intrusion Subgroup Meeting  
May 18, 2016  
Meeting Notes

Participants:

Chris Cady, MDNR-BVCP  
Mike Washburn, MDNR-BVCP  
Tim Chibnall, MDNR-HWP\*  
Michelle Hartman, DHSS- BEE

Blayne Hartman, Hartman Env.\*  
April Gowing and Vince Nero, GHD Env.\*  
Diane Saftic, Ameren  
Wesley Robb, Wellington Env.  
Lisa Schipper, Tetra Tech  
Kevin Perry, REGFORM

\*Joined by phone

Chris Cady opened the meeting and explained MoDNR's goals for this initial meeting: to hear from stakeholders about their experiences with VI issues in MO and elsewhere. The agenda was organized to parallel the process of working through a site (preliminary screening, site investigation, risk assessment, remediation, institutional controls). Although MoDNR has begun working on rough drafts in some of these areas, we did not plan to hand out draft guidance at this first meeting in order to create an open atmosphere for sharing ideas.

### **Preliminary Site Screening**

Cady: As mentioned at the larger stakeholder group, we do want to include a VI screening process similar to the 'DTL Stage' in MRBCA. Major questions:

- Can we base anything on soil sampling at this stage as traditionally done for site investigation, or do we need vapor sampling to get off square 1? [The updated RBTLs most likely will not include RBTLs for VI from soil; this question pertained to the idea of using detections in soil for initial screening to determine whether to proceed to vapor sampling, along with other site information]
- How should one decide when to do vapor sampling? Should Phase I information about use, release etc. of VOCs be enough to drive a VI investigation and/or vapor sampling? Or concentrations detected in soil samples – e.g. any detection in soil requires vapor sampling?

Wes R. asked whether a VI problem can exist without soil or groundwater contamination?

Blayne H. remarked that this has occurred at dry cleaners and military bases due to VOC vapors migrating from the building into the subsurface creating a "vapor cloud." He recommends always doing vapor sampling if chlorinated VOCs are known to have been used at the site.

Discussion progressed to how to approach a VI investigation assuming there is a known release. Michelle H. remarked that if there is a known/suspected source, near-source vapor sampling could be considered if screening levels are exceeded. But most sites she is involved with [assisting Superfund] have occupied buildings and when preliminary screening (primarily using groundwater vapor intrusion screening levels (VISLs)) indicate a potential for VI, current

practice is to go straight into a building-specific VI investigation using a multiple lines of evidence approach (concurrent subslab, indoor, and outdoor air sampling). She remarked that there is a potential for this getting out of hand if virtually ANY building is subjected to VI testing and that a more thorough process of screening sites in or out should be considered with this guidance.

Cady said that DNR is trying to make sure that there are ‘off-ramps’ so that extensive investigations are not done needlessly and that there is a reasonable way to screen out sites. However there may not be much of an off-ramp at the preliminary screening stage of the process.

Blayne remarked that wherever there is any history of TCE use, the liability is just too high NOT to sample. Liability is driving a lot of investigations. Virtually everyone is sampling soil vapor in these circumstances.

Michelle said that the potential for fetal heart malformations (FHM) from TCE exposure is the major concern driving policy developments. Regions and states are taking accelerated response actions using a variety of numbers [risk-based target levels]. EPA’s VISL calculator recommends  $8.8 \mu\text{g}/\text{m}^3$  over a 3-wk exposure duration; however, (based on FHM).EPA may soon go to  $6 \mu\text{g}/\text{m}^3$  based on a one-day exposure duration.

Blayne said that IN is the only state that has not jumped on this TCE bandwagon. There is an industry group opposed to the new EPA TCE screening levels.

Some states have adopted the EPA attenuation factors.

On the topic of ‘prior knowledge of potential sources’, Wes mentioned the ASTM ‘vapor encroachment’ standard of 1700 ft. In an urban area this could encompass a lot of properties in a radius from a subject property. Blayne said that with a site surrounded by many other properties, it pays to work the site from the inside out.

Blayne also recommended that we not limit or lock in technologies for site investigation. The guidance should encourage the use of various techniques for site investigation. ITRC VI guidance has a toolbox appendix that may be helpful. Also WI DNR has a bunch of documents.

## **Site Investigation**

This section had to do with what happens once the screening process sends the site into ‘further investigation’. Cady remarked that it is difficult to construct a clear flow chart that accounts for every situation – i.e. the source is soil or groundwater, shallow or deep, or unknown; buildings present or not; who occupies the building(s) and for what purposes; etc.

*What to Sample* - Michelle said that a combination of subslab and indoor air can be very useful when taken together. Sites with occupied buildings that DHSS is involved in, are doing a combination of subslab and indoor air sampling plus ambient air (background). They have found some sites with high subslab concentrations but no indoor air hits. For these sites they recommended preemptive mitigation to protect against potential future vapor intrusion into the building. Some sites have had similar concentrations in ambient air and indoor air, which can be

considered background. If subslab is low and indoor air is high, that points to a potential source inside the building. An indoor building survey should be done prior to sampling and sources removed 48 hours ahead to prevent interference. Cady agreed that even in the case where you did subslab first and then progressed to indoor air (which is 'traditional' the past few years in BVCP), you should keep sampling subslab to allow comparison.

*Site Specific Attenuation Factors* - Tim C. said that there is a process for calculating a site specific AF. This could help with the issue of EPA's AF's being the same for subslab and near source: i.e., it. this potentially overestimates risk from near source vapors since it does not consider any attenuation during vertical transport. No one present has actually calculated a site specific AF. Cady agreed the guidance should allow for it.

*Leak detection* - Michelle said that most projects she has encountered use He. It has advantages of giving instant results so that leaks can be addressed prior to sampling, rather than waiting for the sample results to come back as with other methods such as isopropyl alcohol. It is more expensive. He prices have been increasing and the method also requires a He meter, so the cost is higher. Michelle remarked it is essential to use high grade (UHP) He (not party balloon grade for example) due to the risk of VOC contaminants in the He.

The Vapor Pin has an SOP for a 'water dam' method of testing Vapor Pin installations. It simply places water around the seal and tests qualitatively if it penetrates. DHSS/MoDNR-SPF have an SOP for this.

*Summa Canisters vs. Bags* – Michelle suggested we not prohibit any particular sampling method but provide guidance on how to do each properly. Michelle and Wes both said typical Summa size for short term or grab sampling is 1L but 6L will give lower detection limits if needed as well as allowing a longer time integration for indoor air sampling. Michelle recommended TO-15 SIM method for residential indoor air (SIM generally not necessary for indoor air or sub-slab at commercial sites nor for sub-slab at residential sites). Passive samplers can get to a very low detection limit also, depending on time deployed. Vinyl chloride tends to have det. limit problems with passive samplers. We may see more passive sampling in the future due to the potential to sample over a longer period. Some samplers may have a problem with humidity.

*Sampling Density* – Cady brought up the 1 sample per 1500 sq ft EPA recommendation. Given the range of building sizes and types, this seems like a risky one size fits all approach. Wes said that you cannot assume indoor air or subslab vapor is homogenous. He directs sampling always toward potential source areas first. Michelle said that a few residential houses she worked on may have had only one subslab point, but it would be better to have at least two regardless of the size. Cady said that building specific factors should always be considered – subslab/foundation construction, interior design (dividing walls), and HVAC.

*Sampling frequency* – Most agreed quarterly for at least one year is required to get any kind of baseline. If additional sampling points are installed, continue monitoring until at least 4Q events collected on ALL locations. Blayne said that conventional wisdom is that highest indoor air concentrations should occur in winter, but with shallow groundwater, can be highest in spring when water table is up. Also you should look for water infiltration – leaky basements, sumps

etc. which can be major sources. Michelle said that sampling time/duration should mimic exposure; commercial bldg. generally sample during 8-hr work day, if addnl shifts sample when occupied, homes 24 hrs. etc. Cady said that early on, BVCP had sites sampling over the weekend with HVAC shut off as a conservative approach, but agreed it makes more sense to sample during typical building occupation and use. Sampling conditions should always be documented in detail.

*Exterior Soil Gas* - Cady asked whether we need provisions for exterior soil gas outside the building footprint – is anyone doing this or is everyone doing sub slab/indoor air? Tim said that data now suggests that if a building is large, exterior soil gas should only be used for screening and that subslab (at least) would be needed to characterize a large building. Michelle said that soil vapor outside the footprint should be considered in context of the building and construction – for example there is usually artificial fill under a building slab so conditions would be different in soil outside the footprint. The preference for occupied buildings has been to conduct subslab and indoor air. If exterior soil gas is used, the preference at this point is near-source sampling. Again, though, we should not lock ourselves in but allow the approach to grow with technology/science. In any case, exterior soil gas is useful for plume delineation.

*Representative Concentrations* – Michelle said that DHSS is following EPA R7 guidance; each sample compared individually to screening levels. This is a conservative approach and is based on the fact that quarterly sampling is not all that representative (i.e. 1 day to represent 90 days). DHSS also uses a decision matrix from the beginning and may recommend interim actions after a sampling event rather than waiting for 4Q to be collected. For example if risk limits exceeded in an occupied residence, immediate action would be recommended to mitigate. Michelle said it would be OK for us to share the DHSS VI decision matrix with the stakeholder group. Cady said that we should look at decision matrices for other states as well. Tim remarked that we will need to make some decisions on the use of representative concentrations for VI.

Mike described a BVCP site that was a large open manufacturing plant with multiple subslab sample locations. One exceeded target levels. The group discussed how to respond to that type of situation and how to write that into the guidance. It would make a difference if the exceedance was subslab or indoor air. Typically indoor air would be sampled next or in conjunction. In a large space it may be possible for indoor air to vary across the building. There should be hot spot criteria in the guidance to evaluate this situation. Michelle had a situation where a large building, part office and part warehouse, had very high subslab concentrations. There was an exceedance in indoor air in the office portion of the building, but not in the warehouse. They recommended mitigation of the office area as well as pre-emptive mitigation in the warehouse given the high subslab concentrations, but EPA opted to only require mitigation of the office area given the current use of the warehouse portion. She also pointed out that large existing buildings can get very complex to mitigate.

Wes mentioned that decisions made based on current use of a building may not be protective if the building use or the building itself changes (such as dividing up into smaller spaces). Michelle said that SPF sites would have O&M plans for mitigation systems and that 5-year reviews would address changes. Cady said that BVCP would use an O&M plan as well, but the program lacks the 5-year review capability of SPF in order to offer the ‘bright line’ closure

necessary for brownfield redevelopment. However we could incorporate ‘changes in building structure or use’ in covenant restrictions if necessary and as post-closure inspection elements.

*Target Levels – RBTLs* – Michelle indicated that subslab vapor and groundwater columns have been included in the draft MRBCA RBTL tables. DTLs were discussed – group agreed it seems appropriate to add a vapor column to the DTL table to go along with soil and groundwater columns. Michelle went on to say that Tier 1 could use the EPA default AF’s for groundwater and soil gas. Tier 2 at this point is pretty open. Other models can be used to calculate site-specific AF. The MRBCA software would have a place to enter a site specific AF. Cady said that we should give examples of acceptable models for determining AF. Michelle said that EPA as we are aware no longer endorses the J&E model and has pulled the calculator from its web page, but EPA may make modifications and re-release a version. VISL does not provide AFs, it uses default values. For groundwater, the EPA guidance has AFs based on soil types. One important site specific factor is groundwater temperature. VISL uses 20C, 14 is more typical in MO. The guidance should require justification for any site specific inputs – such as onsite temp data for groundwater.

Tim suggested we bring this topic up with Bob Veenstra’s modeling experts and that Helen Dawson has been out front in this area.

Cady asked whether AF can be calculated simply by comparing subslab and indoor air concentrations. Michelle said that it has been done with subslab vs. indoor air. However it varies by building, e.g. one house is not comparable to the one next door.

Cady brought up the problem of active facilities using the same solvents potentially found in the subsurface, such as active dry cleaners. Michelle said that EPA and OSHA have an MOU on this for sites EPA is involved in. If they are actively using the specific chemicals of concern, OSHA levels may apply inside the building and a site-specific determination may need to be made depending on use. Michelle also pointed out that OSHA levels are out of date by as much as 30 years. If the building is being reused for a different purpose, and the specific chemicals are not currently being used, EPA levels would apply. Subslab sampling only as opposed to subslab combined with indoor air would be a good idea depending on the chemicals in use in the building. Mike said that indoor air has been known to affect subslab vapor – i.e. the reverse of vapor intrusion. Michelle indicated that near-source would be preferable in that case. Cady said that would depend on depth to source – i.e. if the source was deeper/below the base rock it would not be affected by indoor air, but floor spills seeping through into the subslab and creating a vapor source from there, when solvents are still being used, may result in both high subslab and high indoor air. There is also a post-closure angle: if we do not require MRBCA target levels for an active dry cleaner but instead use much less stringent OSHA levels, how do we control exposures in the future if the building’s use changes? How would anyone know what the indoor air levels would be after the usage stops and the only contribution is from intrusion? Once again, a large number of permutations to account for.

*TCE – New Health Effects* – Cady asked Michelle to fill us in on the mutagenicity and fetal heart malformation issues that are driving TCE risk. Particularly since the fetal heart effect is a

potential problem on a scale of days or weeks of exposure during pregnancy, rather than years or decades for cancer effects, this can potentially change the landscape for TCE VI.sites.

Generally, mutagenicity is now incorporated into the RSL cancer equation using ‘age-dependent adjustment factors’. For TCE, there are liver, kidney and non-Hodgkins lymphoma cancer effects. Only the kidney is proven to have a mutagenic root. Therefore, TCE has its own separate mutagenicity equation (so does vinyl chloride). DHSS plans to incorporate this into the draft RBTL tables.

The fetal heart malformation (FHM) effect is a non-cancer effect and was used by EPA along with other non-cancer effects to develop the non-cancer oral Reference Dose (RfD) and inhalation Reference Concentration (RfC). There is a lot of controversy over this and uncertainty with the study used as the basis for the FHM effect. Some oral studies were positive for FHM but some were not. Inhalation studies have NOT shown the FHM effect. EPA therefore used a route-to-route extrapolation method to calculate the RfC. Cady asked why that was OK because we have stopped doing that for our MRBCA tables. Michelle explained that slope factors or RfD/RfC values should not be simply plugged into other pathways, but EPA does have a scientifically based method to extrapolate in the development of toxicity values using physiologically based pharmacokinetic (PBPK) modeling. There are a number of specific uncertainties such as EPA did not include a ‘pregnancy box’ in the model to account for transfer of contaminants to the fetus and the applicability of this to developmental toxicity could be questioned. A number of other uncertainties exist including how other issues are accounted for such as the fact that congenital heart defects are the most common birth defect, and the TCE RSLs are within the range of background TCE concentrations noted in some studies. The other side of this issue is risk management, i.e. rapid response and mitigation actions, which is DNR’s purview. DNR will have to decide how to address situations where people are currently being exposed, and we should keep in mind the state of the science when contemplating mitigation measures, especially rapid response based on a sample event. EPA Region 7 has indicated that EPA HQ is planning to put something in writing on this soon and to update the RSL tables. EPA may change the target levels to be based on a 1-day average concentration. One site in MO has been forced to actually close its facility entirely due to TCE levels exceeding the short term limits. Cady remarked that 3 weeks is a very short time in terms of BVCP getting results back from sampling events for sites in the program.

The topic of consistency between programs was mentioned; Michelle pointed out that we did not have complete EPA buy-in on MRBCA 2006 [i.e. for use at SPF or RCRA sites], but consistency between different MoDNR programs may be important. Kevin Perry said that it is a foregone conclusion that we will never be 100% consistent amongst our programs. Cady said that currently MRBCA 2006 has the same target levels for petroleum as Tanks MRBCA, but of course when we update, that will change, so he is right about that.

*Tier 2* – As previously mentioned, a site-specific AF could be incorporated at a Tier 2. Unfortunately there are not many widely-used AF models at this point, but leaving this open will allow for the use of additional models as they are developed. For the VISL calculator, there is not much more you can tinker with besides site specific groundwater temp and use of the alternate groundwater AF as previously discussed. For petroleum, Bio-Vapor was mentioned.

MoDNR staff would like to consult with Veenstra/Geotech and Blayne Hartman on this. Michelle said that EPA has published a document on AFs that has the background for the AFs they use in the VI guidance. We might possibly make use of EPA's existing database of VI sites to look for sites with similar conditions to a subject site.

## **Remediation**

*Mitigation System Requirements* - Cady said that BVCP has some internal guidance on mitigation system design requirements but we have not put out anything public/official. For example we have a checklist of items to look for in a remedial plan for installation of a vapor barrier under a new foundation. Michelle said that different products have specific installation instructions that must be followed. Cady replied that BVCP requires trained/certified installers to be used if required by the manufacturer. Michelle suggested we also allow for spray-applied barriers for existing buildings.

Cady said that the guidance should emphasize performance criteria over specific product requirements to allow for innovative technologies to be used as they are developed.

Michelle said that for existing bldgs., there are other measures besides venting/coatings such as tweaking the HVAC, sealing floor cracks, portable air purifiers, etc. These may be especially useful in a rapid response situation – things you can do almost immediately.

*Post installation sampling* – Cady said that to his knowledge BVCP has not required post-installation vapor sampling to verify performance, mainly because the systems installed were vapor barrier/vent systems for new buildings rather than retrofits for existing. As a result there was no baseline of contaminated subslab vapor or indoor air to compare to. Add to that the complications of equilibration time after disturbing the surface, plus the potential for interference from building materials. BVCP does ensure that smoke testing, coupons etc. are done and meet performance specs.

For existing structure mitigation systems, Michelle recommended post installation sampling several times in the first year, then annually. DHSS is currently involved in only one new construction project, which has a vapor barrier and passive venting. They did require sampling of indoor air and subslab through ports built in during construction. Indoor air was sampled away from potential sources (paint dept. etc.). Post closure inspections and sample results were considered together.

*Excavation Verification* – Cady described the problem of how to evaluate wall/floor samples of a source-removal excavation if there are no subsurface soil RBTLs (as proposed). EPA has put out an 'Engineering Paper' on this topic. Michelle said that there may also be a slide presentation on it that she may have a copy of. The question was raised of how many sites this would affect. Cady said that many BVCP sites are petroleum-contaminated and may screen out of VI based on separation distances; however, excavations are still done to remove tanks, heavily contaminated soil, and there are chlorinated solvent excavations. BVCP has not made an accurate count. [Note: Out of approx. 30+ active sites overseen by Cady at present, 10 are FMGPs or other petroleum sites with excavations, and 5 with chlorinated contaminants in shallow soil that are or

may perform excavation. Therefore, this will be a common situation.]. It is possible however that less excavation will be done as a result of changing standards, and more reliance will be placed on vapor sampling and vapor mitigation.

One or more states are using leaching criteria for soil. Cady remarked this will presumably avoid future groundwater contamination but the values are arbitrary with respect to VI. MichelleMichelle said that Andrew McKinney (DHSS) had mentioned using volatilization factors to calculate soil target levels – i.e. based on volatilization to ambient air; however, these may be relatively high compared to other subsurface soil RBTLs. The method is similar to J&E which is the basis of current MRBCA values.

### **Next Steps**

DNR will provide meeting notes. The next VI subgroup meeting is not yet scheduled but there is a full Stakeholder group meeting scheduled for June 9. MoDNR would anticipate having a VI meeting after that with the intent to present draft guidance or at least an outline of pertinent points.

Meeting adjourned about 3:30 pm.