ISSUE PAPER

ESTABLISHMENT OF A VAPOR CONTAMINATION, MITIGATION, and STEWARDSHIP CLEANUP FUND

Funding Sustainability EAG Subgroup

Contributors: Mark A Rutkowski (Shannon & Wilson), Kurt McClung (SET Environmental), Chris Valcheff (True North Consultants), Shar TeBeest (DOT)

This proposal and recommendations were developed by the Remediation and Redevelopment External Advisory Group and members of the public, and do not necessarily represent the opinions or the position of the Wisconsin Department of Natural Resources or other state agencies.

ISSUE STATEMENTS

According to the Wisconsin Department of Health Services (DHS), the vapor intrusion pathway poses a significant risk to human health. Acute risks from contaminants of concern (specifically perchloroethene [PCE] and trichloroethene [TCE]) necessitate immediate corrective action consistent with the EPA Regional Removal Management Users Guide. An immediate corrective action is a short-term clean up intended to stabilize or clean up a site that poses an imminent and substantial threat to human life and the environment.[1]

Currently, there are no dedicated funding programs in place to provide financial assistance for the identification, investigation, mitigation, long-term monitoring and stewardship of properties affected by harmful chemical vapors associated with abandoned drycleaners, manufacturing facilities, automobile maintenance/repair, or any other facility or operation that used and released volatile organic compounds (specifically PCE and TCE) to the environment.

The current Dry Cleaner Environmental Response Fund (DERF) is insolvent and is not able to keep up with the existing reimbursement requests. Governor Evers' FY26-27 budget proposed establishment of a new funding program (Revitalize Wisconsin) intended to replace DERF and provide financial assistance in the form of grants or direct services to local governments, dry cleaners, and private parties, and others. This budget proposal was not enacted.

PROPOSAL

This proposal is for the establishment of a vapor contamination, mitigation and stewardship cleanup fund to address the risks to human health associated with the vapor intrusion pathway. This proposal includes a discussion on:

[1] EPA Regional Removal Management Levels (RMLs) Users Guide; November 2024.

- A site scoring matrix model for determining eligibility criteria for selecting sites to receive funding;
- Specifying sensitive populations exposed to intrusive vapors; and
- Identifying unresolved issues and recommendations associated with previous funding mechanisms.

BACKGROUND

According to the DHS, the vapor intrusion pathway poses a significant risk to human health. Numerous studies have demonstrated that the air in buildings overlying soil or groundwater contaminated with toxic vapor-forming substances may contain potentially harmful concentrations of these contaminants due to vapor intrusion.[2]

Vapor Intrusion Health Risks

Vapor intrusion refers to subsurface contamination that can volatilize and the vapors enter the breathing space of buildings. Vapor intrusion may also occur when contaminated groundwater infiltrates buildings, and contaminants directly volatilize into the indoor air. Vapors can migrate through air space in permeable soils, fractures in bedrock or clay till, utilities, sumps, or cracks in the building foundation.

Chlorinated solvents like PCE and TCE do not degrade in the vadose zone[3] when volatilized and can migrate long distances from the source of contamination via groundwater in a dissolved phase or via preferential pathways in the vapor phase. Additionally, PCE and TCE are known to have potential health effects at low concentrations that cannot be detected by their odor.

There is a significant risk to human health associated with inhaling volatile organic vapors, specifically from chlorinated solvents PCE and TCE migrating from contaminated soil and groundwater into buildings. Vulnerable groups for PCE and TCE exposure include children, the elderly and especially persons who can be or are pregnant and unborn children. With exposure to PCE or TCE the following pregnancy and fetal development health effects have been found: choanal atresia,[1,2] eye defects,[1,2] low birth weight,[3,4] fetal death,[1,3,5] major malformations,[6,7] miscarriage,[8,9] neural tube defects,[1,2,3] oral cleft defects,[1,2,3] and small for gestational age.[1] Additionally, breast,[10] cervical,[11] and ovarian[11] cancer were found in women exposed to PCE or TCE. Lastly, esophageal cancer,[12,13,14] lung cancer,[15] Hodgkins disease,[11] prostate cancer,[11] rectal cancer,[14] impaired immune systems function,[16] neurological effects,[9] neurobehavioral performance deficits,[16,17] and severe generalized hypersensitivity disorder[18] were all associated with elevated PCE or TCE exposure.

[2] EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings. EPA Publication EPA 530-R-10-002 (March 2012).

[3] The vadose zone, also known as the unsaturated zone, is the area between the upper land surface and the top of the water table. *Groundwater*; Freeze & Cherry 1979.

The nature and extent of the health risks associated with acute and long-term exposure to volatile organic vapors (especially PCE and TCE) have also been presented to the DNR in a series of interdepartmental letters from DHS. These letters are attached as reference confirming the risks associated with acute and chronic exposure to chlorinated solvent vapors in air, particularly TCE.

Long Term Stewardship

One concern regarding vapor intrusion sites is identifying someone who can maintain and monitor a vapor mitigation system long term. This is an issue for sites with viable RPs and those without. Currently, there are no funding mechanisms available for long term operation, monitoring and maintenance (OM&M) of vapor mitigation systems for sites without a viable RP. DNR is only able to fund OM&M of existing vapor mitigation systems in a very limited number of cases using state environmental repair funds. In addition, sites with a viable RP typically do not pay for long-term OM&M beyond case closure. The need to ensure protection of human health after an interim action to install the vapor mitigation system or beyond closure is very important. The current system of assigning continuing obligations that the property owner must follow is generally not effective with regards to successfully maintaining vapor mitigation systems.

VAPOR CONTAMINATION, MITIGATION, AND STEWARDSHIP CLEANUP FUND SCOPE OF WORK

Objectives

The Funding Sustainability subgroup of the EAG proposes the fund to be a stand-alone program that provides financial relief for the investigation, mitigation, and long-term OM&M of systems designed to reduce the concentrations of vapors as result of historical and existing releases of volatile organic vapors (especially PCE and TCE) to the environment as well as to reduce the mass and source of contamination. As proposed, the fund will provide financial assistance for:

- Source identification (soil, groundwater, and vapor investigations);
- Protection of building occupants (design, installation, and commissioning of vapor mitigation systems);
- Long-term stewardship of vapor mitigation systems, including OM&M costs (pre- and post-case closure); and
- Source cleanup/reduction to reduce or eliminate need for vapor mitigation.

As proposed, the fund will be administered by the DNR. The DNR has experience managing funding programs including the Petroleum Environmental Cleanup Fund Act (PECFA), the Drycleaner Environmental Response Fund (DERF), Wisconsin Assessment Monies (WAM) and Ready for Reuse. The DNR could establish similar forms, procedures and staff to administer this new fund.

Site Eligibility

The Funding Sustainability EAG Subgroup (FS Subgroup) proposes criteria for site selection based on a Site Selection Scoring-Matrix that provides a tool for relative comparative analysis of sites that apply for funding under this program.

The Site-Selection – Scoring Matrix simplifies the site eligibility determination by utilizing human health risk-based criteria as the basis for fund award prioritization.

For the sake of fund eligibility, an innocent landowner is defined as a bona fide purchaser of an inactive hazardous substance or waste disposal site without knowledge or without reasonable basis for knowing that hazardous substance or waste disposal had occurred or a person whose interest or ownership in the inactive hazardous substance or waste disposal site is based on or derived from a security interest in the property.[4]

Site Selection - Scoring Matrix

A model for a site Scoring Matrix is proposed as a screening tool for relative comparative analysis to determine which sites would be eligible for funding. Scores ranging from 0 to 10 points were assigned to a site based on three categories and ten subcategories. Sites with the highest scores would be the ones eligible for funding. An example of the type of scoring matrix that could be used is attached.

The Scoring Matrix was divided into these three separate categories:

- Site Specific
- Regulatory/Compliance
- Public Interest

Factors considered for the Site-Specific assessment included a cumulative hazard index, occupancy, unmitigated exposure levels, and type of building. Regulatory/compliance considerations based on whether or not the source area was defined or delineated, if a RP was identified, the financial solvency of the RP and if access agreements were in place to complete any inspections or site assessment work. The sites selection process should also consider other public policy goals stated in law .

Sensitive Populations

The impact of intrusive vapors, even at short exposure durations, can have a disproportional detrimental effect on sensitive populations that may result in adverse health impacts or even hazardous conditions. Sensitive populations are more likely than other persons in the general population to experience illness due to exposure to intrusive vapors.

[4] Notification of an Inactive Hazardous Substance or Waste Disposal Site. North Carolina Department of Environmental Quality.

As a result of their health condition, age, or previous exposure to intrusive vapors, members of the sensitive population may spend more time inside buildings than out. Examples of intrusive vapor exposure pathways for the sensitive population includes:

- A legally permitted residence, including, but not limited to, a private home, apartment, condominium unit, group home, dormitory unit, retirement home, or shelter
- A health care facility, including, but not limited to, any hospital, medical clinic, community clinic, medical center, nursing home, elderly housing, long-term care facility, hospices, convalescent facility, or similar live-in housing
- A school, including, but not limited to, preschool, prekindergarten, or school maintaining kindergarten or any of grades 1 to 12, inclusive
- A licensed daycare facility
- A community center
- An established community place of worship
- A public playground, public recreation field, or public recreation center

This program should be created to consider targeting funding to sites based in part on the risk of vapor exposure to sensitive populations. The site scoring matrix should include consideration of exposure to sensitive populations.

Potential Funding Sources

To accomplish the objectives listed above, the subgroup also proposes the following funding mechanisms for consideration.

- Reintroduction of Revitalize Wisconsin (former Assembly Bill 1055);
- Creation of an Environmental Stewardship tax credit program for companies doing business in the State of Wisconsin;
- Capture gas tax revenue used on former PECFA program;
- Lottery Credits/Funding;
- Movement of fees for environmental programs (matching funds, cost-recovery, fines) from general fund back to DNR;
- Stand-alone program funded though legislative/statutory process;
- Vapor Mitigation System Inspection Fees;
- Create Environmental Bonding Authority exclusively for Environmental Repair Sites;
- Environmental surcharges for development at non-brownfield sites; and
- Prime Real Estate development fees.

Some of these revenue sources would require additional research/analysis as well as additional resources for fee collection and implementation. It is the opinion of this subgroup that legislative support is needed to establish the fund as a solution to the vapor intrusion health risks discussed in this issue paper.

FUND Awards

Developers, private property owners, tribes and local units of government will be eligible to apply for funding as long as the applicant did not cause the hazardous substance discharge. The intent of the fund is to provide protection of human health from harmful intrusive vapors under risk scenarios as ranked by the Site Selection – Scoring Matrix. An applicant would need to demonstrate financial need via a thorough vetting process and according to their Site Selection – Scoring Matrix ranking.

Since the potential health risks may be unknown, use of the fund can also be accessed by local and state government administrative staff (e.g., local health departments, DNR). Administrative fund use would apply to any of the direct services determined by the governing agency. Administrative fund use would include investigation, remediation and long-term OM&M costs.

All of the money used under the fund would be subject to cost-recovery either via a RP, insurance policy reimbursement or formal legal action or other mechanism not identified here. Entities that apply for funding that have assets above threshold values (to be determined) may utilize the fund but would be subject to cost recovery with an interest component. Any funds obtained from the cost recovery process would come back to the DNR to be used for administrative support (FTE/LTE) and fund program continuation.

Funds dispersed would be in the form of:

- Grants
- Short-term loans
- Cost reimbursement (similar to PECFA)
- Any method previously employed by the DNR from previous program administration

RECOMMENDATIONS

The FS Subgroup recommends:

- Not to redefine the terms that are already defined in state and federal statutes;
- Agency Discretion similar to that of the EPA Enforcement Discretion be employed to determine the eligibility of an innocent landowner under the fund;
- A first-in/first-out policy is **not** implemented for the fund. First-in/first-out can limit funding opportunities for the general public and create funding inequities in the fund seen in other programs; and
- Funding should also be available to innocent landowners required to mitigate hazardous vapors as part of an emergency response.
- The establishment of the fund would support remediation and continuing obligation system OM&M at all sites, not just those that are desirable for redevelopment.

RESOURCES NEEDED

Bipartisan Legislative support is needed to establish the fund as a mechanism to provide financial relief support and resources to the DNR to administer the program.

The fund proposal and recommendations were created under the assumptions that the Funding Sustainability Subgroup was to approach the issue statements from a high level. It would be the DNR's responsibility for refining the recommended methods and implementation of the fund.

ATTACHMENTS

Attachment A: DHS letters to the DNR

Attachment B: Site Scoring Matrix

Attachment C: DNR Comments

SOURCES

[1] Massachusetts Department of Public Health, Centers for Disease Control and Prevention, Massachusetts Health Research Institute. 1996. Final report of the Woburn environmental and birth study. Boston, Massachusetts: Massachusetts Department of Public Health.

[2] Bove F, Shim Y, Zeitz P. 2002. Drinking water contaminants and adverse pregnancy outcomes: a Review. Environ Health Perspect 110(S): 61-73.

[3] Bove FJ, Fulcomer MC, Klotz JB, Esmart J, et al. 1995. Public drinking water contamination and birth outcomes. Am J Epidemiol 141:850-62.

[4] Rodenbeck SE, Sanderson LM, Rene A. 2000. Maternal exposure to trichloroethylene in drinking water and birthweight outcomes. Arch Environ Health 55:188–194.

[5] Bove FJ, Fulcomer MC, Klotz JB, Esmart J, et al. 1995. Public drinking water contamination and birth outcomes. Am J Epidemiol 141:850-62.

[6] Khattak S, K-Moghtader G, McMartin K, Barrera M, et al. 1999. Pregnancy outcome following gestational exposure to organic solvents: a prospective controlled study. JAMA 281(12): 1106-09.

[7] U.S. EPA, 2014a. EPA Region 9 Response Action Levels and Recommendations to Address Near-Term
Inhalation Exposures to TCE in Air from Subsurface Vapor Intrusion. July 9, 2014.

[8] Pesticide and Environmental Toxicology Section, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. 1999. Public health goal for trichloroethylene in drinking water. Sacramento, California.

[9] Pesticide and Environmental Toxicology Section, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. 2001. Public health goal for tetrachloroethylene in drinking water. Sacramento, California.

[10] Aschengrau A, Rogers S, Ozonoff D. 2003. Perchloroethylene-contaminated drinking water and the risk of breast cancer: additional results from Cape Cod, Massachusetts, USA. Environ Health Perspect 111(2):167-73.

[11] Wartenberg D, Reyner D, Scott CS. 2000. Trichloroethylene and cancer: epidemiologic evidence. Environ Health Perspect 108(S2):161-176.

[12] National Toxicology Program (NTP). Report on carcinogens. 14th edition. Research Triangle Park, NC: US Department of Health and Human Services; 2016.

[13] Mundt KA, Birk T, Burch MT. 2003. Critical review of the epidemiological literature on occupational exposure to perchloroethylene and cancer. Int Arch Occup Environ Health. 76:473-91.

[14] Paulu C, Aschengrau A, Ozonoff D. 1999. Tetrachloroethylene-contaminated drinking water in Massachusetts and the risk of colon-rectum, lung, and other cancers. Environ Health Perspect 107(4):265-71.

[15] Chiu WA, Jinot J, Scott CS, Makris SL et al. 2013. Human health effects of trichloroethylene: key findings and scientific issues. Environ Health Perspect 121:303-311.

[16]Reif JS, Burch JB, Nuckols JR, Metzgar L, et al. 2003. Neurobehavioral effects of exposure to trichloroethylene through a municipal water supply. Environ Res 93:248-258

[17] Feldman RG, Chirico-Post J, Proctor SP. 1988. Blink reflex latency after exposure to trichloroethylene in well water. Environ Health 43: 143-148.

[18] Cooper GS, Makris SL, Nietert PJ, Jinot J. 2009. Evidence of Autoimmune-Related Effects of Trichloroethylene Exposure from Studies in Mice and Humans. Environ Health Perspect 117:696–702.

[19] Cichocki, J. A., Guyton, K. Z., Guha, N., Chiu, W. A., Rusyn, I., & Lash, L. H. (2016). Target Organ Metabolism, Toxicity, and Mechanisms of Trichloroethylene and Perchloroethylene: Key Similarities, Differences, and Data Gaps. The Journal of pharmacology and experimental therapeutics, 359(1), 110–123. https://doi.org/10.1124/jpet.116.232629.

[20] Notification of an Inactive Hazardous Substance or Waste Disposal Site. North Carolina Department of Environmental Quality.

ATTACHMENT A: DHS LETTERS TO THE DNR

Scott Walker
Governor

Linda Seemeyer
Secretary

DIVISION OF PUBLIC HEALTH

1 WEST WILSON STREET
PO BOX 2659
MADISON WI 53701-2659

State of Wisconsin
Department of Health Services

Telephone: 608-266-1251
Fax: 608-267-2832
TTY: 711 or 800-947-3529

December 7, 2017

Darsi Foss
Director, Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
101 S. Webster Street, Box 7921
Madison WI 53707-7921

Subject: DHS response to Request for Opinion on risk guidelines in DNR's Vapor Intrusion Guidance RR800; comments to immediate action criteria and Trichloroethylene (TCE) acute risk.

Dear Ms. Foss:

In your October 26, 2017 letter, you asked for a formal response from the Department of Health Services (DHS) to two areas of comments received on the Wisconsin Department of Natural Resources (DNR) draft revision to RR800 – Addressing Vapor Intrusion at Remediation and Redevelopment Sites in Wisconsin:

1. Immediate action criteria. *Please review the guidelines for immediate action in RR800, and provide written opinion of the DNR's proposed immediate action guidelines (sec. 7.1, RR800 draft).*
2. Trichloroethylene (TCE) Acute Risk. *Please review the ACC's September 8, 2017 letter to DNR under the heading "DNR should not adopt a policy for TCE remediation based on potential acute (short-term) risks," and provide written opinion if there is sufficient weight of scientific evidence to continue with more urgent/immediate response when TCE is the contaminant of concern and women of childbearing age are present.*

DHS response:

Immediate Action Criteria: **DHS concurs with DNR's proposed immediate action guidelines**.

The central feature of the immediate action criteria allows for immediate intervention if:

- indoor air concentrations are over 10 times the Vapor Action Limit (VAL) for carcinogens or,
- indoor air concentrations are over 3 times the VAL, for non-carcinogens

These immediate action guidelines are consistent with EPA guidance for a Category 4 – High priority removal site.[1] They are also consistent with the EPA *Regional Removal management Levels Users Guide,* [2] which includes supporting RML tables that use a 10^{-4} risk level for carcinogens (equivalent to 10-fold over the 10^{-5} target risk level for the VAL) and an HQ (hazard quotient) of 3 for noncarcinogens (3-fold over the VAL). There is a mechanistic basis for using differing concentration magnitudes over the Vapor Action Limits with regard to acute exposures to carcinogens versus non-carcinogens. The EPA has noted there is a reasonable assumption that non-carcinogenic effects result from acute to subacute exposures, and plausibly from a single exposure: "In most cases, it is assumed that a single exposure at any of several developmental stages may be sufficient to produce an adverse developmental effect, but the RfC for a single exposure hasn't been determined yet by EPA."[3] For these reasons DHS agrees with the precaution of using DNR's proposed immediate action criteria. As noted, these would be 3 times the VAL for non-carcinogenic (including developmental) effects, and 10 times the VAL for carcinogenic effects, where the probability of genotoxic carcinogenesis is calculated on the basis of exposures over long exposure durations at low concentrations not expected to cause acute effects.

***TCE Acute Risk:* DHS recommends urgent/immediate response when TCE is the contaminant of concern and women of childbearing age are present.**

In a September 8, 2017 letter to DNR, one commenter, the American Chemistry Council (ACC), disagrees with using the acute risk of fetal heart malformation as basis for decisions for sites with TCE contamination because of controversy over the risk assessments. There is a substantial body of literature on the toxicological effects of TCE that considers both cancer and non-cancer endpoints, including the effects of TCE on fetal heart development in rodent and avian models (for more information, see reviews by the U.S. Environmental Protection Agency[4] and the Agency for Toxic Substances and Disease Registry[5]). This literature will be more complete with better demonstrations of congenital fetal heart defects through the inhalation route. There are uncertainties in the use of animal models, such as subtle differences in the developmental windows of rats, chickens, and humans; species-level metabolism; and metabolic differences in oral exposure vs respiratory exposure (*i.e.,* uptake rates and tissue-specific enzyme expression). Any of these could confound the extrapolation of a relevant drinking water dose to a comparable respiratory dose calculated solely on the basis of ventilation rates. Nonetheless, based upon

---

[1] EPA. 2010. Vapor Intrusion Guidebook. United States Environmental Protection Agency. Internet https://www.epaosc.org/sites/3806/files/VI%20Guidebook%20-%20%2010-1-10%20-%20final%20version.pdf.

[2] EPA. 2017. Regional Removal Management Levels for Chemicals (RMLs). United States Environmental Protection Agency. Internet https://www.epa.gov/risk/regional-removal-management-levels-chemicals-rmls

[3] Richardson, RH. Aug 27 2014. EPA Memo from Office of Superfund Remediation and Technology Innovation: *Compilation of Information Relating to Early/Interim Actions at Superfund Sites and the TCE IRIS Assessment.*

[4] EPA. 2011. Toxicological Review of Trichloroethylene. United States Environmental Protection Agency, Integrated Risk Information System. EPA/635/R-09/011F. Internet https://www.epa.gov/iris/supporting-documents-trichloroethylene

[5] ATSDR. 2014. Toxicological profile for Trichloroethylene (TCE) (Draft for Public Comment). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. Internet https://www.atsdr.cdc.gov/toxprofiles/TP.asp?id=173&tid=30.

available evidence, we cannot exclude the relationship between TCE exposure and heart defects, and recommend a precautionary approach to continue with a more urgent and immediate response when TCE is the contaminant of concern and women of childbearing age are present.

Of note, we reviewed the reviewed the California Office of Environmental Health Hazard Assessment (OEHHA) document showcased in the argument by the ACC. The ACC provides a long quote from OEHHA,[6] presenting this as the basis of OEHHA decision to "reject the findings" of TCE-related fetal heart malformations. We disagree with this characterization. In our review of this 2009 document, it appears that OEHHA thoroughly reviews the TCE/heart malformation literature, noting both strengths and shortcomings of this research, but the 2009 document does not present an independent conclusion or policy recommendation based on this review. Later, in a 2013 OEHHE *Request for Information*,[7] OEHHA clearly states their determination that *"TCE appears to meet the criteria for listing as known to the State to cause reproductive toxicity under Proposition 65, based on findings of the U.S. EPA ...."* This reference goes on to detail their determination, on the basis of male reproductive toxicity and developmental toxicity:

> "The critical effects identified as the basis for the chronic oral reference dose (RfC) in the TCE IRIS entry (U.S. EPA, 2011a) and the Toxicological Review (U.S. EPA, 2011b) include developmental toxicity manifested as increased fetal cardiac malformations in rats and developmental immunotoxicity in mice following prenatal exposure. This appears to meet the criterion in Section 25306(d)(1) that the chemical "has otherwise been identified as causing ...reproductive toxicity by the authoritative body in a document that indicates that such identification is a final action".

We refer you to these OEHHA documents for more information. It should be noted that California's review is focused on drinking water, not indoor air. With regard to ACC's reference to conclusions made by the Indiana Department of Environmental Management (IDEM), ACC quotes a one-page memo from IDEM that concludes "an accelerated response [to TCE and fetal cardiac malformations] is not scientifically supportable based upon current information." Although the ACC accurately quotes the memo, the memo provides no details or references supporting IDEM's conclusion. Several other states, including Alaska, Massachusetts, New Jersey, Connecticut, Minnesota, and New Hampshire have revised their TCE action levels in response to the EPA assessment (reviewed by Clapp et al.[8]). We have not examined these other

---

[6] OEHHA. 2009. Public Health Goals for Chemicals in Drinking Water: Trichlorothylene. California Office of Environmental Health Hazard Assessment. Internet https://oehha.ca.gov/media/downloads/water/chemicals/phg/tcephg070909_0.pdf

[7] OEHHA. 2013. Request for Relevant Information: Trichloroethylene (TCE). California Office of Environmental Health Hazard Assessment. Internet https://oehha.ca.gov/proposition-65/crnr/request-relevant-information-trichloroethylene-tce.

[8] Clapp B, Frost DJ, Kray SE. 2016. Environmental Law News (25)31-39. Internet https://files.skadden.com/sites%2Fdefault%2Ffiles%2Fpublications%2FThe_Evolving_Regulation_of_TCE_Vapor_Intrusion_Issues.pdf.

state's revisions in detail, but are aware that the Wisconsin DNR regularly discusses these topics with other U.S. EPA Region 5 states. DHS is available to participate in discussions with other states as needed.

Thank you for the opportunity to comment on this topic. For further discussion, please contact Robert Thiboldeaux, robert.thiboldeaux@wi.gov, 608-267-6844.

Sincerely,

Jeffrey Phillips
Acting Director, Bureau of Environmental and Occupational Health

cc: Robert Thiboldeaux, PhD, Senior Toxicologist, BEOH
Roy Irving, PhD, Chief, Hazard Assessment Section, BEOH
Jonathan Meiman, MD, Chief Medical Officer, BEOH

Tony Evers
Governor

Karen E. Timberlake
Secretary

State of Wisconsin
Department of Health Services

DIVISION OF PUBLIC HEALTH

1 WEST WILSON STREET
PO BOX 2659
MADISON WI 53701-2659

Telephone: 608-266-1251
Fax: 608-267-2832
TTY: 711 or 800-947-3529

March 25, 2021

Christine Haag
Program Director
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
101 S. Webster Street, P.O. Box 7921
Madison, WI 53707-7921

Subject: DHS response to Request for Assistance: Actions for Trichloroethylene at Acute Risk Levels

Dear Ms. Haag:

The Wisconsin Department of Health Services (DHS) received your letter dated October 18, 2019 requesting clarification on the definition of acute risk and timeline justifications for responding to various scenarios where the acute risk is related to volatile organic compounds (VOCs) and vapor intrusion (VI).

This request for clarification is intended to augment a December 7, 2017 DHS letter to the Wisconsin Department of Natural Resources (DNR) providing recommendations for when immediate action is needed in response to written comments on proposed revisions to the RR-800 document. Specifically, DHS concurred with DNR's position that immediate action is justified when indoor air is found to be present at three (3) times the indoor air vapor action level (VAL) or sub-slab vapor risk screening level (VRSL) for a non-carcinogen or ten (10) times the VAL or VRSL for a carcinogen. In addition, DHS supported the DNR's position that immediate action be taken when trichloroethylene (TCE) is present in indoor air above the VAL and when women of child-bearing age are present.

DHS response:

DHS clarification statements defining acute risk and justifying timelines for responding to acute risk follow for each of the DNR scenarios presented in the request letter:

1. **Clarification from DHS that acute risk necessitates immediate action as defined in s. NR 700.03(28), Wis. Admin. Code.**

   To reinforce the finding in the December 7, 2017 letter, DHS is in agreement that DNR's immediate action as defined in s. NR 700.03(28), Wis. Admin. Code is warranted when acute risk is observed as discussed in DNR's Vapor Intrusion Guidance RR800 (2018). For all contaminants with the exception of trichloroethylene (TCE) when women of childbearing years (age 15 to 44) are present, acute risk is defined as indoor air concentrations that are three times over the vapor action limit (VAL) for non-carcinogens

or ten times over the VAL for carcinogens. For TCE where people who are or may become pregnant occupy a dwelling, acute risk is defined as indoor air concentrations that are equal to or over the VAL (HI $\geq$ 1). These immediate action guidelines are in agreement with EPA guidance. The following statement is from the EPA OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (EPA 2015): "Although the indoor air concentrations may vary temporally, an appropriate exposure concentration estimate (e.g., time-integrated or time-averaged indoor air concentration measurement in an occupied space) that exceeds the health-protective concentration levels for acute or short-term exposure (i.e., generally considered to be a hazard quotient (HQ) greater than one for an acute or short-term exposure period) indicates vapor concentrations that are generally considered to pose an unacceptable human health risk."

2. **Clarification from DHS that trichloroethylene (TCE) present in indoor air above the applicable VAL qualifies as an acute risk to women of child-bearing years.**

DNR basis its VAL and VRSL values on EPA regional screening levels (RSLs) for indoor air. These values are developed using reference concentrations (RfCs) from EPA's toxicological assessments developed for its Integrated Risk Information System (IRIS). The non-cancer chronic inhalation RfC of $2x10^{-3}$ mg/m^3 in EPAs toxicological assessment for TCE (2011) is based upon two rodent drinking water exposure studies. One study (Kiel et al., 2009) reported an immunotoxic effect of TCE presenting as a reduced thymus weight in female mice. The other study reported an increased incidence of fetal cardiac malformations (Johnson et al., 2003). The cardiac malformation developmental endpoint drives the concern over short term exposure to TCE. Although some limitations were reported with the Johnson et al. study (2003), the cardiac malformations finding has been confirmed by several reviews since, including the EPA Office of Solid Waste and Emergency Response (2014), ATSDR (2014), the Massachusetts Department of Environmental Protection (MADEP, 2014), a group of EPA researchers (Makris et al, 2016), and the North Carolina Department of Environmental Quality (NC DEQ, 2018). These reviews found that a two- to three-fold increase in congenital heart defects were observed in multiple animal studies and that the most frequently observed heart defects were also reported in humans exposed to TCE-containing VOCs in several epidemiological studies (Brender et al. 2014, Dawson et al. 1993). These reviews also found that mechanistic support exists with studies in avian and mammalian cells demonstrating that TCE exposure alters processes that are critical to normal valve and septum formation. Although a recent EPA TSCA Risk Evaluation for TCE (2019) used the immunotoxic end point and not the fetal cardiac malformation end point for their risk determinations, the EPA Science Advisory Committee on Chemicals (SACC) was split on whether to use the fetal heart malformations endpoint for risk consideration and the TSCA Risk Evaluation was not allowed to consider epidemiological evidence or the effects of TCE exposure from air, contaminated waste sites, groundwater used for drinking water, and food in their evaluation.

The EPA identifies that a single exposure at any of several developmental stages may be sufficient to produce an adverse developmental effect (EPA, 1991). In humans, the cardiac system is the second to develop following fertilization, with cardiac development beginning at approximately 3 weeks following implantation. Substantial cardiac system development continues through 8 to 9 weeks post implantation, with the most sensitive period of cardiac development occurring in 3 to 6 weeks (Smart and Hodgson, 2018). These critical fetal heart development windows occur during a time period when an individual may not yet know they are pregnant. Rapid actions should be taken to minimize the potential for TCE exposures during these timeframes (EPA 2014, EPA Region V, 2020).

3. **Health-based recommended responses including the definition of critical exposure windows with scientific justification to help inform DNR determination of time lines for immediate (s. NR 700.03(28), Wis. Admin. Code) and interim (s. NR 700.03(29), Wis. Admin. Code) actions in the following scenarios:**

    a. **TCE is present beyond the envelope of a building at or above the applicable Vapor Risk Screening Level (VRSL);**

    DHS recommends an evaluation of the demographics for the building. If persons of childbearing years occupy the dwelling, indoor air samples should have a quick turnaround time (24 to 72 hours, EPA Region 9, 2014). Women in the sensitive demographic should be consulted about the potential TCE developmental toxicity risk so they may make informed decisions in terms of staying in the dwelling during the timeframe of the indoor air assessment. DHS or local health can assist with this consultation. If the indoor air TCE sample result exceeds the VAL, DHS recommends interim action (carbon filter unit) and rapid installation of sub-slab depressurization system within two weeks. If the indoor air TCE sample result is less than the VAL, mitigate and monitor indoor air in interim to ensure exposure is not occurring and move toward installation of a mitigation system within 4 to 8 weeks, depending upon the building's complexity and need for system design.

    b. **Non-carcinogenic compounds are present beyond the envelope of a building at or above three (3) times the applicable VRSL;**

    The U.S. EPA defines a reference concentration (RfC) as an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure of a chemical to the human population through inhalation (including sensitive subpopulations), that is likely to be without an appreciable risk of deleterious effects during a lifetime (IRIS Glossary, 2020). When a non-carcinogenic VOC is three times above the applicable VRSL, the risk of that VOC being present in indoor air at levels that can cause an adverse health effect is high enough to warrant urgent action including indoor air sampling with 24 to 72 hour turnaround time and mitigation within 4 to 8 weeks, or sooner where indoor air sampling results indicates a VAL exceedance.

c. Carcinogenic compounds are present beyond the envelope of a building at or above ten (10) times the applicable VRSL;

VRSLs are established in Wisconsin with a 10^{-5} cancer risk. When a carcinogenic compound is present in indoor air at or above ten times the applicable VRSL, the cancer risk exceeds 10^{-4} cancer risk. The risk of cancer occurrences from continuous exposure is therefore high enough to warrant the installation of a mitigation system within 4 to 8 weeks, depending upon the building's complexity and need for system design.

d. TCE is present in indoor air below the applicable VAL

Review sub-slab results when available. If sub-slab TCE data is also below VRSL, additional assessment should take place with normal laboratory turnaround time to confirm results are below action levels. If women of childbearing years occupy the building, an additional sampling round should take place as soon as feasible to ensure levels above VAL/VRSL is not present.

e. Non-carcinogenic compounds are present in indoor air between the applicable VAL and three (3) times the applicable VAL;

Move toward mitigation system installation within 4 to 8 weeks, depending upon complexity and need for system design. Perform indoor air sampling to confirm mitigation system is effective.

f. Carcinogenic compounds are present in indoor air between the applicable VAL and ten (10) times the applicable VAL;

Move toward mitigation with a recommended timeframe of 4 to 8 weeks, depending upon complexity and need for system design. Perform indoor air sampling to confirm mitigation system is effective.

g. TCE is present in indoor air at or above the applicable VAL;

DHS recommends an evaluation of the demographics for the building. If women of childbearing years occupy the building, implement interim actions such as carbon filtration units to interrupt the TCE exposure. Move toward installation of a mitigation system within two weeks. Women in the sensitive demographic should be consulted about the potential TCE developmental toxicity risk so they may make informed decisions in terms of staying in the dwelling during the timeframe of the indoor air assessment.

h. Non-carcinogenic compounds are present in indoor air at or above three (3) times the applicable VAL;

The U.S. EPA defines a reference concentration (RfC) as an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure of a chemical to the human population through inhalation (including sensitive subpopulations), that is likely to be without an appreciable risk of deleterious effects during a lifetime (IRIS Glossary, 2020). When a non-carcinogenic VOC is three times above the applicable VAL, the risk of adverse health effects occurring from continuous exposure is high enough to warrant the installation of a mitigation system within 4 to 8 weeks, depending upon the building's complexity and need for system design. Depending upon how far above the VAL the concentration is, more urgent actions may be needed, and the local health officer should be consulted for potential abatement orders, placarding, and temporary relocation of occupants per Section 254 Wis. Admin. Code.

i. Carcinogenic compounds are present in indoor air at or above ten (10) times the applicable VAL.

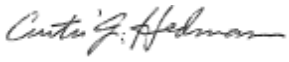
When a carcinogenic compound is present in indoor air at or above ten times the applicable VAL, the cancer risk exceeds 10^{-4} cancer risk. The risk of cancer occurrences from continuous exposure is therefore high enough to warrant the installation of a mitigation system within 4 to 8 weeks, depending upon the building's complexity and need for system design. Depending upon how far above the VAL the concentration is, more urgent actions may be needed, and the local health officer should be consulted for potential abatement orders, placarding, and temporary relocation of occupants per Section 254 Wis. Admin. Code.

4. Health-based recommendations for when sampling indoor air at commercial or industrial businesses is necessary in light of the recent Department of Defense study on sewers and utility tunnels as preferential pathways (*Sewers and Utility Tunnels as Preferential Pathways for Volatile Organic Compound Migration into Buildings: Risk Factors And Investigation Protocol,* ESTCP Project ER-201505).

DHS agrees with the finding in the DoD study that indoor air should be part of the VI assessment where evidence of preferential pathways might be feasible. This evidence may include detection of VOCs in sewer lines or utility corridors. Recent experience has shown instances where indoor air levels are found at high levels due to preferential pathway contamination through open sumps, openings in foundations, and poorly sealed conduits. DHS also recommends sampling indoor air when environmental sampling (groundwater, soil, or soil gas) indicates that indoor air action levels could be exceeded. When TCE is the contaminant of concern, indoor air should always be evaluated to assist with the risk assessment and be able to interrupt exposures as soon as possible to sensitive populations to prevent the known reproductive/developmental endpoint. When commercial or industrial businesses are users of the VOCs being studied, those chemicals may need to be temporarily removed prior to the indoor air assessment, where feasible.

Thank you for the opportunity to provide feedback on this topic. Please contact me at (608) 266-6677, or curtis.hedman@wisconsin.gov if you have any follow up questions or comments about this response.

Sincerely,



Curtis Hedman, Ph.D.
Toxicologist
Bureau of Environmental and Occupational Health

Cc: Jennifer Borski, Vapor Intrusion Team Leader, DNR R&R Program
Judy Fassbender, NR Program Manager, DNR R&R Program
Roy Irving, Chief, DHS Hazard Assessment Section, BEOH
Mark Werner, Chief, DHS BEOH

Enc: Summary of DHS response to Request for Assistance: Actions for Trichloroethylene at Acute Risk Levels

References:

WI DNR Remediation and Redevelopment Program Publication RR-800 (2018). *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin*. Available at: https://dnr.wi.gov/files/PDF/pubs/rr/RR800.pdf

U.S. EPA, Office of Solid Waste and Emergency Response, 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. OSWER Publication 9200.2-154 http://www.epa.gov/vaporintrusion/technical-guide-assessing-and-mitigating-vapor-intrusion-pathway-subsurface-vapor

IRIS 2011a. *Trichloroethylene; CASN 79-01-6*. Integrated Risk Information System (IRIS) Chemical Assessment Summary. U.S. Environmental Protection Agency. National Center for Environmental Assessment. Available at: https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=199

IRIS 2011b. *Toxicological Review of Trichloroethylene (CAS No. 79-01-6) In Support of Summary Information on the Integrated Risk Information System (IRIS)*. U.S. Environmental Protection Agency, Washington, DC. September 2011. EPA/635/R-09/011F. Available at: https://www.epa.gov/iris/supporting-documents-trichloroethylene

IRIS 2011c. *Toxicological Review of Trichloroethylene Appendices (CAS No. 79-01-6) In Support of Summary Information on the Integrated Risk Information System (IRIS)*. U.S. Environmental Protection Agency, Washington, DC. September 2011. EPA/635/R-09/011F. Available at: https://www.epa.gov/iris/supporting-documents-trichloroethylene

Keil, D; Peden-Adams, M; Wallace, S; Ruiz, P; Gilkeson, G. (2009). *Assessment of trichloroethylene (TCE) exposure in murine strains genetically-prone and non-prone to develop autoimmune disease*. J Environ Sci Health A Tox Hazard Subst Environ Eng 44: 443-453.

Johnson, P; Goldberg, S; Mays, M; Dawson, B. (2003). *Threshold of trichloroethylene contamination in maternal drinking waters affecting fetal heart development in the rat*. Environ Health Perspect 111: 289-292.

U.S. EPA, Office of Solid Waste and Emergency Response, 2014. *Compilation of Information Relating to Early/Interim Actions at Superfund Sites and The TCE IRIS Assessment.* https://clu-in.org/download/contaminantfocus/tce/TCE-compilation-final-2014.pdf

ATSDR (2019) Agency for Toxic Substances and Disease Registry (ATSDR). 2019. *Toxicological profile for Trichloroethylene (TCE)*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

(MADEP, 2014) MADEP, 2014. *Assessing the Congenital Cardiac Toxicity of Trichloroethylene: Key Scientific Issues*. Massachusetts Department of Environmental Protection Office of Research and Standards. March 2014.

Wikipedia The Free Encyclopedia. Trichloroethylene, available at: https://en.wikipedia.org/wiki/Trichloroethylene

(Makris et al, 2016) Makris et al., 2016. *A Systemic Evaluation of the Potential Effects of Trichloroethylene Exposure on Cardiac Development*. Reproductive Toxicology. 2016, 65:321-358. August 2016. http://dx.doi.org/10.1016/j.reprotox.2016.08.014

NC Department of Environmental Quality Report to the Secretaries' Science Advisory Board (2018). *Trichloroethylene (TCE) Inhalation Immediate Action Levels and Response Guidance for Indoor Air Protective of Cardiac Developmental Defects*. Available at: https://files.nc.gov/ncdeq/GenX/SAB/DEQ-TCE-IA-AL-Report-101518.pdf

Brender et al., 2014. *Maternal Residential Proximity to Chlorinated Solvent Emissions and Birth Defects in Offspring: A Case–Control Study*. Environmental Health 2014, 13:96.

Dawson et al., 1993. Dawson, B., Johnson, P., Goldberg, S., Ulreich, J. *Cardiac teratogenesis of halogenated hydrocarbon-contaminated drinking water*, J. Am. Coll. Cardiol.21 (1993) 1466–1472, http://dx.doi.org/10.1016/0735-1097(93)90325-U .

U.S. EPA 1991b. U.S. Environmental Protection Agency. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decis*ions. OSWER Directive 9355.0-30.

Smart and Hodgson, 2018. *Molecular and Biochemical Toxicology*. Edited by Smart, Robert C.; Hodgson, Ernest, North Carolina State University, Raleigh, NC, USA. Wiley & Sons, Inc. Hoboken, NJ.

U.S. EPA Region 5 (2020). Superfund and Emergency Management Division Vapor Intrusion Handbook.

U.S. EPA *IRIS Glossary*. Terminology Services (TS). U.S. Environmental Protection Agency, Washington, DC. Available at: https://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

US DOD (2018). *Sewers and Utility Tunnels as Preferential Pathways for Volatile Organic Compound Migration into Buildings: Risk Factors and Investigation Protocol*, ESTCP Project ER-201505

Enclosure: Summary of DHS response to Request for Assistance: Actions for Trichloroethylene at Acute Risk Levels

DNR Ask	DHS Response	Supporting Reference(s)
1) Clarification from DHS that acute risk necessitates immediate action as defined in s. NR 700.03(28), Wis. Admin. Code.	**A)** Immediate action as defined in NR 700.03(28) warranted if: for compounds except TCE = 3x VAL, or 10x VAL carcinogens; TCE w/ women age 15-44 = VAL	**A)** December 7, 2017 DHS letter and EPA OSWER Tech Guide (2015)
2) Clarification from DHS that trichloroethylene (TCE) present in indoor air above the applicable VAL qualifies as an acute risk to women of child-bearing years	**A)** VALs&VRSLs based on EPA RSLs **B)** RSL for TCE is based on immunotox. and fetal cardiac development endpoints **C)** findings confirmed by reviews **D)** also consistent with epi study findings **E)** single exposure during development can have harmful effect **F)** critical development window 3 to 6 weeks **G)** rapid action warranted for TCE > RSL	**A)** EPA tox assessment TCE (2011) **B)** Kiel et al. (2009) Johnson et al. (2003) **C)**EPA OSWER (2014), ATSDR (2014), MADEP (2014), Makris et al (2016), NC DEQ (2018) **D)**Brender et al. (2014), Dawson et al. (1993) **E)**EPA (1991) **F)** Smart and Hodgson (2018) **G)** EPA 2014, EPA Region V (2020)
3) Health-based recommended responses including the definition of critical exposure windows with scientific justification to help inform DNR determination of time lines for immediate (s. NR 700.03(28), Wis. Admin. Code) and interim (s. NR 700.03(29), Wis. Admin. Code) actions in the following scenarios:		
a) TCE is present beyond the envelope of a building at or above the applicable Vapor Risk Screening Level (VRSL)	**A)** evaluate demographics in building **B)** sample indoor air with 24-72 hour TAT **C)** consult w/ women 15-44 about TCE **D)** if TCE >VAL, carbon filtration w/in 48 hours and sub-slab system w/in 2 weeks **E)** if TCE <VAL, perform another indoor air sample and sub-slab system w/in 4-8 weeks	**B)** EPA Region 9, (2014) WI DNR RR800 (2018), EPA Reg V (2020)
b) Non-carcinogenic compounds are present beyond the envelope of a building at or above three (3) times the applicable VRSL	**A)** RfC is estimate, ca. order of magnitude, of concentration w/o harm over lifetime **B)** >3x that level cuts significantly into that safety factor **C)** indoor air sampling with 24-72 hour TAT **D)** sub-slab system w/in 4-8 weeks if >VAL	**C)** EPA Region 9, (2014) WI DNR RR800 (2018), EPA Reg V (2020)
c) Carcinogenic compounds are	**A)** VRSLs est. w/ 10^{-5} cancer risk	WI DNR RR800 (2018), EPA Reg. V (2020)

present beyond the envelope of a building at or above ten (10) times the applicable VRSL	**B)** >10x that exceeds 10^{-4} cancer risk **C)** sub-slab system w/in 4-8 weeks if >10x VRSL	
d) TCE is present in indoor air below the applicable VAL	**A)** verify TCE in sub-slab is not >VRSL **B)** If TCE also <VRSL; one more sampling event **C)** do follow up samples soon as possible if women age 15-44 live in building	WI DNR RR800 (2018), EPA Reg. V (2020)
e) Non-carcinogenic compounds are present in indoor air between the applicable VAL and three (3) times the applicable VAL	**A)** sub-slab system w/in 4-8 weeks **B)** sample to confirm system is effective	WI DNR RR800 (2018), EPA Reg. V (2020)
f) Carcinogenic compounds are present in indoor air between the applicable VAL and ten (10) times the applicable VAL	**A)** sub-slab system w/in 4-8 weeks **B)** sample to confirm system is effective	WI DNR RR800 (2018), EPA Reg. V (2020)
g) TCE is present in indoor air at or above the applicable VAL	**A)** evaluate demographics in building **B)** consult w/ women 15-44 about TCE **C)** carbon filtration w/in 48 hours and sub-slab system w/in 2 weeks	WI DNR RR800 (2018), EPA Reg. V (2020)
h) Non-carcinogenic compounds are present in indoor air at or above three (3) times the applicable VAL	**A)** RfC is estimate, ca. order of magnitude, of concentration w/o harm over lifetime **B)** >3x that level cuts significantly into that safety factor **C)** sub-slab system w/in 4-8 weeks **D)** if >>VAL, consult health officer for actions available under Section 254 WI Administrative Code	WI DNR RR800 (2018), EPA Reg. V (2020)
i) Carcinogenic compounds are present in indoor air at or above ten (10)	**A)** VRSLs est. w/ 10^{-5} cancer risk **B)** >10x that exceeds 10^{-4} cancer risk **C)** sub-slab system w/in 4-8 weeks	WI DNR RR800 (2018), EPA Reg. V (2020)

times the applicable VAL	**D)** if >>VAL, consult health officer for actions available under Section 254 WI Administrative Code	
4) Health-based recommendations for when sampling indoor air at commercial or industrial businesses is necessary in light of the recent Department of Defense study on sewers and utility tunnels as preferential pathways (*Sewers and Utility Tunnels as Preferential Pathways for Volatile Organic Compound Migration into Buildings: Risk Factors And Investigation Protocol*, ESTCP Project ER-201505)	**A)** DHS agrees with DOD study findings **B)** DHS recommends sampling indoor air when soil gas results suggest indoor air levels may be exceeded **C)** Indoor air should always be assessed where TCE is contaminant of concern due to acute reproductive endpoint **D)** when assessing indoor air in commercial buildings, may need to relocate COCs that are used in production during sampling	US DOD ESTCP Project ER-201505 (2018)

Tony Evers
Governor

Karen E. Timberlake
Secretary

State of Wisconsin
Department of Health Services

DIVISION OF PUBLIC HEALTH

1 WEST WILSON STREET
PO BOX 2659
MADISON WI 53701-2659

Telephone: 608-266-1251
Fax: 608-267-2832
TTY: 711 or 800-947-3529

June 6, 2022

Christine Haag
Program Director
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
101 S. Webster Street
Madison, WI 53707-7921

Subject: DHS response to Request for Assistance: Clarification of single exposure for trichloroethylene (TCE)

Dear Ms. Haag:

The Wisconsin Department of Health Services (DHS) received an email on October 18, 2021, from Vapor Intrusion Team Leader, Jennifer Borski, requesting clarification of what constitutes a *single exposure* for Wisconsin's trichloroethylene (TCE) vapor action level (VAL) of 2.1 $\mu g/m^3$ for residential exposures and 8.8 $\mu g/m^3$ for small and large commercial and industrial exposures. This information is sought to support DHS immediate action recommendations for TCE provided in a letter dated March 25, 2021.

DHS response:

Environmental Protection Agency (EPA) regional screening levels for air are based on inhalation unit risk (IUR) for carcinogenic toxicological endpoints and reference concentration (RfC) for non-cancer endpoints. These toxicological values are based on a daily oral slope factor (cancer) or reference dose (RfD) (non-cancer) exposure parameter (in $(mg/kg\text{-}day)^{-1}$). The current environmental assessment levels are also based on a daily assessment of eight-hour samples for occupational settings and 24-hour samples for residential scenarios.

Based on these observations, the optimally resolved values achievable are daily (8-hour for occupational, 24-hour for residential) exposure and assessment values, and these values constitute a single exposure for TCE for risk evaluation purposes.

Thank you for the opportunity to provide feedback on this topic. Please contact me at (608) 266-6677, or curtis.hedman@wisconsin.gov if you have any follow up questions or comments about this response.

Sincerely,

Curtis G. Hedman

Curtis Hedman, Ph.D.
Toxicologist, Bureau of Environmental and Occupational Health

Cc: Jennifer Borski, Vapor Intrusion Team Leader, DNR R&R Program
Judy Fassbender, NR Program Manager, DNR R&R Program
Roy Irving, Chief, DHS Hazard Assessment Section, BEOH
Mark Werner, Chief, DHS BEOH

References:

Wisconsin Vapor Quick Look-Up Table, Indoor Air Vapor Action Levels and Vapor Risk Screening Levels, https://dnr.wi.gov/DocLink/RR/RR0136.pdf, February 2022.

DNR RR 800, Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin, https://dnr.wi.gov/DocLink/RR/RR800.pdf, January 2018

US EPA Regional Screening Levels (RSLs) – Generic Tables, https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables, May 2022.

US EPA Region V VI Handbook, https://rrt5.org/Portals/0/images/thumb_VI.png?ver=2021-05-19-101609-580, March 2020.

ATTACHMENT B: SCORING MATRIX

Possible Scoring Matrix

Cumulative Hazard	Occupancy
Multiple Contaminants - 10 Single with High hazard index -5 Single with Low hazard index – 3	High Risk Occupants – 10 Occupied Space 10+ hours/day – 10 Occupied Space 5-9 hrs/day -5 Average intermittent occupation (< 5 hrs/day) 3
Unmitigated Exposure Level	**Type of Building**
5x's calculated exposure limit – 10 2-4 x's calculated exposure limit – 5 At or below calculated exposure limit - 1	Residence – 10 Business – 5 Intermittently occupied space -3

ATTACHMENT C: DNR COMMENTS

The RR Program appreciates the efforts of the Fees and Funding Sustainability Subgroup.

Statutory and rule changes would be required to implement some of the options presented. Recommendations in this proposal will require careful consideration of the RR Program's ability to implement, such as capacity for increased workload and whether the program could acquire the expertise to determine financial need.

Responsible parties (RPs) are required by Wis. Stat § 292.11 and the Wis. Admin. Rule Series NR 700-799 to address vapor intrusion on the source property, in rights-of-way (ROWs) and any affected off-site properties. As a result, many sites are investigated, remediated and mitigated for vapor intrusion effectively by the RP. Also, some brownfield properties that are cleaned up and redeveloped by local governments and the private sector include vapor intrusion concerns that are addressed as part of the site cleanup and redevelopment. However, many sites with significant health concerns are not of interest for redevelopment and there are a large number of sites that do not have a financially viable RP to address vapor intrusion.

The DNR has federal funds from its EPA Brownfields Assessment Grant to conduct a limited amount of vapor investigation work at properties that are suspected to be highly contaminated due to historical uses. This funding is only available for a limited time and not sufficient to address all locations with health concerns. These brownfields grant funds are restricted to address properties with historical use of chlorinated solvent, with the initial effort looking at only three out of hundreds of historical dry cleaner locations in the city of Milwaukee.

The DNR also has a limited amount of state environmental repair fund dollars that are used statewide for vapor assessment and mitigation at open sites with significant health concerns that are not moving forward by the identified RP. The environmental repair funds are used:

1. to sample sub-slab and indoor air at residential properties potentially impacted by vapor intrusion and
2. to sample soil gas and sanitary sewers to evaluate the extent of the vapor issues in the ROW.

DNR investigated five sites in FY 2023 as described above, four sites in FY 2024 and two sites in 2025. Additional sites may be investigated if funding is available. DNR is aware of more than 100 open sites with known or potential VI impacting residential properties that are not being adequately addressed.