Issues & Trends 2020

Wednesday, July 15

Zoom recording at DNR.WI.GOV (search: rr training)

Questions/Comments/Suggestions to:
DNRRRRCOMMENTS@wisconsin.gov
Vapor Intrusion Update & Preferential Pathways
Today’s Schedule

• 15 minutes  VI Developments since 2018

• 5 minutes  Q&A with Jennifer Borski and Jim Walden

• 30 minutes  Vapor migration through preferential pathways (focus on sanitary sewers)

• 10 minutes  Q&A with Jennifer Borski and Jim Walden
Vapor Intrusion (VI) 2020

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- 2018-2019: VI Continuing Obligation (CO) Audits
- July 2019: DNR VI Personnel Changes & VI Updates
- July 15, 2020: Webinar: Preferential Pathways
Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin
Wis. Stat. ch. 292; Wis. Admin. Code ch. NR 700

Purpose
The purpose of this guidance is to provide approaches for complying with the requirements in Wis. Stat.ch. 292 and Wis. Admin. Code ch. NR 700 that relate to vapor intrusion. This guidance identifies the conditions where assessment of the vapor intrusion pathway is necessary at contaminated sites; sets out the criteria for evaluating health risk; identifies appropriate responses; explains long-term stewardship; and clarifies when sites with a complete or potential vapor migration pathway may achieve closure.

This guidance is applicable to contaminated sites where volatilization of subsurface contaminants has migrated or has the potential to migrate to current or future occupied buildings. Unless otherwise noted, all provisions in this guidance apply to the responsible party (RP) and/or property owner of a contaminated site.
Vapor Intrusion (VI) 2020

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### Issues and Trends webinars

The Issues and Trends training sessions cover a variety of technical and policy issues affecting environmental practitioners, local government specialists and others whose work involves assistance or oversight by the RR Program.

<table>
<thead>
<tr>
<th>Date</th>
<th>Presentation</th>
<th>Audio/Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/4/18</td>
<td>The DNR's Vapor Intrusion Guidance Summary [PDF]</td>
<td>Audio [MP3 Length 00:18:31]</td>
</tr>
<tr>
<td>10/4/17</td>
<td>An Alternative for Determining Soil RCLs for PAHs [PDF]</td>
<td>Audio [MP3 Length 00:14:21]</td>
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<tr>
<td>8/9/17</td>
<td>A Preview and Discussion of the DNR’s New Vapor Intrusion Guidance - RR-800 Revisions [PDF]</td>
<td>Audio [MP3 Length 00:13:02]</td>
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<tr>
<td>2/8/17</td>
<td>Asbestos Issues During Building Demolitions [PDF]</td>
<td>Audio [MP3 Length 00:12:35]</td>
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<tr>
<td>1/11/17</td>
<td>PCB Remediation in Wisconsin: How PCB Sample Results are Used, Cleanup Options and Steps [PDF]</td>
<td>Audio [MP3 Length 00:12:32]</td>
</tr>
</tbody>
</table>
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- Oct. & Dec. 2020  Webinars TBD
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## Drycleaner and Vapor Intrusion Team (DVIT)

<table>
<thead>
<tr>
<th>Role</th>
<th>Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor Intrusion Team Leader</td>
<td>Jennifer Borski</td>
</tr>
<tr>
<td>Statewide VI Technical Expert</td>
<td>Jim Walden</td>
</tr>
<tr>
<td>NOR VI Expert</td>
<td>John Hunt</td>
</tr>
<tr>
<td>NER VI Expert</td>
<td>Josie Schultz</td>
</tr>
<tr>
<td>WCR VI Expert</td>
<td>Candace Sykora</td>
</tr>
<tr>
<td>SCR VI Expert</td>
<td>Jeff Ackerman</td>
</tr>
<tr>
<td>SER VI Experts</td>
<td>Greg Michael, Joe Martinez</td>
</tr>
<tr>
<td>Team Sponsor</td>
<td>Pam Mylotta</td>
</tr>
<tr>
<td>DERF Grant Manager</td>
<td>Sandy Chancellor</td>
</tr>
</tbody>
</table>

DERF = Drycleaner and Environmental Response Fund (Wis. Admin. Code ch. NR 169)
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- Oct. & Dec. 2020: Webinars TBD:
TCE in the Air
Trichloroethylene (TCE) health effects and actions you can take to protect your home’s air

TCE is a man-made chemical used at dry cleaners, in some factories to clean metal, and in some household items like paint, spot removers, and varnishes. If spilled, it can stay in the ground for a long time.

Why should I care?
- It can enter your home through cracks in the floor or walls of your basement, and other openings.
- It evaporates quickly and breathing the vapors is not healthy.
- It can cause cancer if you breathe it over a long period of time.

What if TCE is in my community?
If there is a known concern, environmental professionals will ask to check your home to make sure there is no TCE inside.
- They need your permission to test the air in and below your basement.
- If they find high levels of TCE, they will suggest that you have a special system installed to fix the problem.

Do I have to pay?
The people responsible for the contamination will probably have to pay for the testing and any system that has to be installed.

Who has more risk?
Babies whose mother’s breathe in TCE while pregnant can have:
- Lower birth weights
- Heart defects
- Nervous or immune system problems

What else can I do?
- Wear protective gloves if you use products with TCE (like paint remover).
- Use only small amounts of products containing TCE.
- Use the chemical in well-ventilated areas.
- Do not stay in the room for long periods of time if you can smell the chemical while using it or after using it.

Where can I learn more?
- TCE chemical basics: www.dhs.wisconsin.gov/chemical/trichloroethylene.htm
- Vapor intrusion health concerns: www.dhs.wisconsin.gov/air/vi.htm
- Vapor intrusion 101 video: www.youtube.com/watch?v=izo0QKqCTIo

Wisconsin Department of Health Services
Division of Public Health
Bureau of Environmental and Occupational Health
P-02480 (6/2019)
TCE in the Air
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Wisconsin Department of Health Services
Division of Public Health
Bureau of Environmental and Occupational Health
P-02480 (8/2019)
RR-800 TCE Provisions

• Section 3.4.1
  • Quickly determine demographics
  • Quickly sample if developmental risk

• Section 7.1  Immediate Actions (Residential)
  • Developmental 1X VAL  2.1 µg/m³
  • Non-carcinogens 3X VAL  6.2 µg/m³
Challenge of Vapor Data Variability – Indoor Air TCE, Utah Study House

2002 RP Letter Issued

2009 Initial VI SSDS installed

2010 RR-800 Published (Soil Gas/Sub-slab/Indoor Air)

2011 Groundwater Injection Increased TCE Concentrations

2012 Additional VI Properties Screened Out

2018 RR-800 Revised & Expanded (More rigorous assessment and commissioning recommended, TCE)

2019 Water Table Raised 5 Feet Since 2009

2019 Adjacent Vacant Lot Developed

2020 Preferential Pathways (Conduit VI) Concern

2021 New VI Guidance?

?? Routinely Re-assess VI Conceptual Model from RP Letter to Closure

?? Closure
DHS Recommended NR 140 Changes

<table>
<thead>
<tr>
<th></th>
<th>TCE</th>
<th>PCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAL (Current)</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>PAL (Proposed)</td>
<td>0.05</td>
<td>2</td>
</tr>
<tr>
<td>ES (Current)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>ES (Proposed)</td>
<td>0.5</td>
<td>20</td>
</tr>
</tbody>
</table>

TCE = trichloroethylene
PCE = tetrachloroethylene
Vapor Intrusion Prevention Partnership Initiative

Through the cracks
Preventing vapor intrusion exposure and keeping children and families safe
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- Oct. & Dec. 2020 VI Webinars: Topics TBD
Questions?
Preferential Pathways
Updated VI Conceptual Model

- **Sewer Main**
- **Sewer Lateral**
- **Contaminants**
- **Diffusion**
- **Advection**
NR 716.11  Field investigation. (5) The field investigation shall include an evaluation of all of the following items:

(a) Potential pathways for migration of the contamination, including drainage improvements, utility corridors, bedrock and permeable material or soil along which vapors, free product or contaminated water may flow.
3.3 PREFERENTIAL PATHWAYS & FACTORS AFFECTING SCREENING GUIDELINES

Vapors have the potential to migrate along preferential flow pathways in the subsurface (e.g. sewer lines, bedrock fractures, or utility corridors\(^7\)). These preferential pathways can have a strong effect on movement and accumulation of contaminated vapors to indoor air. Screening should include evaluation of preferential pathways, especially at sites where volatile contaminants could have been disposed into sewer lines via floor drains, sinks, toilets, sumps, or storm grates.

Guidance for Documenting the Investigation of Utility Corridors

RR-649

October 2013
“Preferential pathway” is a general term used to define all high-capacity transport pathways for vapors from the subsurface source to the building foundation or into the building (USEPA, 2015a; McHugh et al., 2017b). Examples of preferential pathways are bedrock fractures, sand lenses, dry wells, rodent tunnels, vapor pathways inside conduits (e.g., sewers, storm drains, utilities, fiber optic cable housing), and engineered backfill material along conduits.

Source: CA DTSC Draft Supplemental Guidance: Screening and Evaluating Vapor Intrusion February 2020
“Vapor conduit” is a subset of preferential pathways that provide little to no resistance to vapor flow. For example, vapors can flow through the pipes of the sanitary sewer, utility conduits, or other drains or conduits. When a vapor conduit penetrates the building foundation, the preferential pathway can also serve as a potential vapor entry point.

(Through the pipe VI also known as “Conduit VI”, ”Sewer VI” or “Atypical VI”)

Source: CA DTSC Draft Supplemental Guidance: Screening and Evaluating Vapor Intrusion February 2020
Sewer Disposal
### DRY CLEANERS SAMPLING RESULTS FROM CONDENSATE LIQUID

<table>
<thead>
<tr>
<th>CLEANER</th>
<th>CITY</th>
<th>DATE</th>
<th>RESULT in ppb</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy Bee</td>
<td>Lodi</td>
<td>9/11/90</td>
<td>60,699</td>
<td>Reclaimer</td>
</tr>
<tr>
<td>Turlock Cleaners</td>
<td>Turlock</td>
<td>4/29/91</td>
<td>62,755</td>
<td>Cooker</td>
</tr>
<tr>
<td>Snow White</td>
<td>Turlock</td>
<td>1/26/89</td>
<td>140</td>
<td>Reclaimer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>56</td>
<td>Cooker</td>
</tr>
<tr>
<td>Durito Cleaners</td>
<td>Turlock</td>
<td>1/30/89</td>
<td>15,000</td>
<td>Sniffer &amp; Reclaimer I</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>150,000</td>
<td>Reclaimer II</td>
</tr>
<tr>
<td>Brite Cleaners</td>
<td>Turlock</td>
<td>5/11/89</td>
<td>66,000</td>
<td>Reclaimer</td>
</tr>
<tr>
<td>Southgate Norge</td>
<td>Sacramento</td>
<td>3/20/91</td>
<td>247,000</td>
<td>Sniffer &amp; Reclaimer</td>
</tr>
<tr>
<td>Tillet Cleaners</td>
<td>Roseville</td>
<td>4/11/89</td>
<td>74,000</td>
<td>Reclaimer</td>
</tr>
<tr>
<td>Merced Laundry</td>
<td>Merced</td>
<td>11/29/88</td>
<td>130,000</td>
<td>Sniffer</td>
</tr>
<tr>
<td>Modesto Steam</td>
<td>Modesto</td>
<td>4/30/91</td>
<td>1,119,300</td>
<td>Reclaimer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>139,087</td>
<td>Cooker</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8,120</td>
<td>Chiller</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,618</td>
<td>Recalimer</td>
</tr>
</tbody>
</table>

**Median**: 64,000  
**Average**: 151,800

Source: Drycleaners a Major Source of PCE in Groundwater, 1992, California Water Control Board
Soil PCE µg/Kg

258,000,000

13,000
PCE in Soil Gas Around Sewers

Red > 10,000 μg/m³

Conduit VI
- Sewer Main
- Sewer Lateral
- Dried out P trap
- Cracked Vent Pipe
- Faulty Wax Ring

Conduit VI
Leaking Vent Pipes

Source: Nielson, 2017, Remediation techniques for mitigating vapor intrusion from sewer systems to indoor air.
INVESTIGATION PROTOCOL

Sewers And Utility Tunnels As Preferential Pathways For Volatile Organic Compound Migration Into Buildings: Risk Factors And Investigation Protocol

ESTCP Project ER-201505

NOVEMBER 2018

Thomas McHugh
Lila Beckley
GSI Environmental
Vapor intrusion resources for environmental professionals

Screening for the vapor intrusion (VI) pathway must be conducted at every contaminated site in Wisconsin. The need to investigate VI is elevated when screening indicates the potential for VI is present, especially when trichloroethylene ("TCE") is present due to its potential for acute (short-term) health risks. Mitigation is the process of interrupting the VI exposure pathway such that the vapors no longer affect occupants. Mitigation is not a form of remediation. This page provides resources to help environmental consultants screen the vapor pathway, assess vapor risk and, where necessary, investigate and mitigate vapor intrusion at specific buildings. General information about vapor intrusion for property owners, tenants and the general public is available on the vapor intrusion page.

Websites

CLU-IN
- CLU-IN Focus Website for Vapor Intrusion provides links to technical publications on sampling and analysis, and mitigation for vapor intrusion.

Workshops and Conferences
- Indoor Air Vapor Intrusion Database Workshops and Conferences provides access to presentations from past US EPA sponsored workshops and conferences focused on innovative and evolving ways to address vapor intrusion.

Publications

Department of Defense Environmental Security Technology Certification Program (ESTCP)
- Sewers and Utility Tunnels as Preferential Pathways for Volatile Organic Compound Migration into Buildings: Risk Factors and Investigation Protocol provides results from a study on the migration of vapors from a source area within sewers and utilities directly into homes and businesses, identifying a preferential pathway that needs to be considered in the conceptual site model. The final work products include an executive summary, a report, and a technical report.
Contributions of the DOD Study

- Extensive literature review
- Typical background VOC concentrations in Sewer Gases
- Strategy for choosing which sites to investigate
- Sewer sampling methodology
- Suggested Groundwater to Sewer and Sewer to Building Attenuation Factors
High vs Low Risk Sites

Figure 2.1  Higher and Lower Risk Sites for Sewers/Utility Tunnel Vapor Intrusion

Source: DOD ESTCP, ER-201505, Sewer and utility tunnels as preferential pathways for volatile organic compound migration into buildings, risk factors and investigation protocol.
Figure ES.3  Example Initial Field Investigation Sample Locations

Source: DOD ESTCP, ER-201505.

Initial Sampling
## Sewer Vapor and Screening Levels

<table>
<thead>
<tr>
<th>Parameter - PCE</th>
<th>Value µg/m³</th>
<th>Parameter - TCE</th>
<th>Value µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background Average PCE (90% of samples)</td>
<td>3.2</td>
<td>Background Average TCE (70% of samples)</td>
<td>2.6</td>
</tr>
<tr>
<td>Sewer to Building Attenuation Factor (unitless)</td>
<td>0.03</td>
<td>Sewer to Building Attenuation Factor (unitless)</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>PCE Sewer Screening Concentration - Residential</strong></td>
<td>1,400</td>
<td><strong>TCE Sewer Screening Concentration - Residential</strong></td>
<td>70</td>
</tr>
<tr>
<td><strong>PCE Sewer Screening Concentration - Commercial/Industrial</strong></td>
<td>6,000</td>
<td><strong>TCE Sewer Screening Concentration - Commercial/Industrial</strong></td>
<td>290</td>
</tr>
</tbody>
</table>
DOD Study – Variability

• 1-3 Days: 80% within 2X of average concentrations
• 12-18 Months: 33% within 2X of average concentrations
• Single grab sample reasonable estimate of short-term average
• Initial Testing: Any value near screening value? Yes, seasonal sampling.
• Guo, et al 2020: Seasonal variability greater than short term
Building Assessment

- Create schematic of plumbing
- Real time: portable GC/MS
- Smoke testing
- Measuring pressure gradient - building to sewer
- Sample behind traps, cleanouts
- Focused indoor air sampling
- Tracers
- Manipulate building or sewer pressure
Sample Collection from Sewer Lateral

Source: DOD ESTCP, ER-201505, Sewer and utility tunnels as preferential pathways for volatile organic compound migration into buildings, risk factors and investigation protocol.
Typical Household Cleanouts
Cleanout Sampling – Draft CA VI Guidance

“For sampling, the cleanout cap should be removed, and the sampling tubing should be inserted as far as possible without contacting sewage. To place the sampling tubing into the center of the cleanout pipe, a collar should be installed at the end of the tubing to suspend the tubing off the cleanout pipe wall. A temporary cover should be placed on the cleanout opening to minimize the introduction of ambient air into the sewer. After the temporary cover is installed, the sewer should be allowed to equilibrate for about an hour before sample collection. At least three volumes of air should be purged from the tubing prior to sample collection.”

Source: CA DTSC Draft Supplemental Guidance: Screening and Evaluating Vapor Intrusion February 2020
Photo 31: Plumbing vent in roof of 1219 unit with elevated PID reading (4/3/20; 14:36).

PCE in Plumbing Vent

4958 ppbv
Conduit VI Mitigation Options

- Lining sewer pipes
- Relocation of sewer lines
- Venting manholes
- Activated charcoal dams
- Vapor dams
- Sealing plumbing system in building
**Manhole Vapor Results Wisconsin Sites**  
*(all μg/m$^3$)*

| WI Site #1 | Highest Concentration TCE | 7,660 |

**WI Site #2**

<table>
<thead>
<tr>
<th>Manhole</th>
<th>PCE</th>
<th>TCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-flow</td>
<td>4.2J</td>
<td>ND</td>
</tr>
<tr>
<td>Mid-site</td>
<td>5.9J</td>
<td>ND</td>
</tr>
<tr>
<td>Downflow</td>
<td>27</td>
<td>6.7J</td>
</tr>
<tr>
<td>Residential VRSL</td>
<td>1,400</td>
<td>70</td>
</tr>
</tbody>
</table>
TCE/PCE µg/m3

Site #2
Former Drycleaner

Former Lateral

Manholes

Sewer Flow

Wisconsin Site #3
Photo of sewer sampling
TCE/PCE
µg/m³

- 74/43.4
- 7.9/12.9
- ND/ND
- ND/41.9

Former Lateral
Investigating Conduit VI
Example: Dry Cleaner (DC)
Exterior Initial Conduit VI Sampling

Sewer Main

Residence

Laterals

Residence

Geoprobe

Retail

Retail

DC

Sampled Manholes
Initial PCE Results
µg/m³

Small Commercial
VRSL  6,000
VAL    180

Cleanout  800
Bathroom  75
SS/IA

Drycleaner

IA
Initial PCE Results
\(\mu g/m^3\)

Small Commercial

- VRSL: 6,000
- VAL: 180

Diagram:
- Sewer Main
- Residence
- Laterals
- Retail
- Manholes
- Geoprobe
- DC

Values:
- 17,000
- 26,000
- 55
Second Phase
Conduit VI Sampling
Takeaways

• NR 716.11(5)(a) requires the investigation of all vapor paths

• In-pipe or “conduit VI” is more common

• Conduit VI requires atypical assessment strategies

• DOD Report Useful – Recommend Reviewing
Takeaways

• Mitigation options exist and will evolve

• Revising RR-649 – Vapor Assessment

• Re-assess VI pathway conceptual model

• Site specific questions – contact DNR Project Manager
References

- RR training page: https://dnr.wi.gov/topic/Brownfields/TrainingLibrary.html
- DHS TCE Fact Sheet: https://www.dhs.wisconsin.gov/publications/p02480.pdf
Questions ?