

# Issues & Trends 2020

Wednesday, July 15

Zoom recording at [DNR.WI.GOV](https://dnr.wi.gov) (search: rr training)

Questions/Comments/Suggestions to:  
[DNRRRComments@wisconsin.gov](mailto:DNRRRComments@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

- January 2018 RR-800 Revised
- April 2018 Issues and Trends Webinar RR-800
- 2018-2019 VI Continuing Obligation (CO) Audits
- July 2019 DNR VI Personnel Changes & VI Updates
- July 15, 2020 Webinar: Preferential Pathways
- Oct. & Dec. 2020 Webinars TBD





# 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.



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## Remediation and Redevelopment Program training library

The Remediation and Redevelopment Program is committed to providing timely and quality training to our customers and colleagues. Recordings of recent presentations, webinars and teleconferences are available here for your convenience. If there is a topic you would like addressed in a future webinar or teleconference, please contact [Mick Skwarok](#).

[Issues and Trends](#)[Consultants' Day](#)[Local Government Days](#)

### 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.

Date	Presentation	Audio/Video
4/4/18	<a href="#">The DNR's Vapor Intrusion Guidance Summary [PDF]</a>	<a href="#">Audio [MP3 Length 55:31]</a>
10/4/17	<a href="#">An Alternative for Determining Soil RCLs for PAHs [PDF]</a>	<a href="#">Audio [MP3 Length 42:43]</a>
9/6/17	<a href="#">Vapor Intrusion: Action Criteria, Mitigation, and Long-term Monitoring [PDF]</a>	<a href="#">Audio [MP3 Length 01:01:20]</a>
8/9/17	<a href="#">A Preview and Discussion of the DNR's New Vapor Intrusion Guidance - RR-800 Revisions [PDF]</a>	<a href="#">Audio [MP3 Length 00:53:52]</a>
2/8/17	<a href="#">Asbestos Issues During Building Demolitions [PDF]</a>	<a href="#">Audio [MP3 Length 00:41:15]</a>
1/11/17	<a href="#">PCB Remediation in Wisconsin: How PCB Sample Results are Used, Cleanup Options and Steps [PDF]</a>	<a href="#">Audio [MP3 Length 00:51:32]</a>



### Cleanup & redevelopment

#### Read

and subscribe to the RR Report newsfeed.

#### Find

information on contaminated land activities.

#### Request

Green Team assistance.

#### Submit

forms and documents related to ch. NR 700, Wis. Adm. Code.

### Training resources

- [Upcoming conferences & workshops](#)

### Related links

- [Resources for environmental professionals](#)
- [Financial resources](#)
- [Cleanup overview](#)
- [Publications & forms](#)
- [Cleanup rules & laws](#)



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# Drycleaner and Vapor Intrusion Team (DVIT)

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

DERF = Drycleaner and Environmental Response Fund (Wis. Admin. Code ch. NR 169)



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# 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.

## 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 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.

A "sub-slab mitigation" system moves air from below to outside the house.



## 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](http://www.dhs.wisconsin.gov/chemical/trichloroethylene.htm): [www.dhs.wisconsin.gov/chemical/trichloroethylene.htm](http://www.dhs.wisconsin.gov/chemical/trichloroethylene.htm)
- [Vapor intrusion health concerns](http://www.dhs.wisconsin.gov/air/vi.htm): [www.dhs.wisconsin.gov/air/vi.htm](http://www.dhs.wisconsin.gov/air/vi.htm)
- [Vapor intrusion 101 video](https://www.youtube.com/watch?v=Izo0KqCToU): [www.youtube.com/watch?v=Izo0KqCToU](https://www.youtube.com/watch?v=Izo0KqCToU)



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- [Vapor intrusion health concerns](http://www.dhs.wisconsin.gov/air/vi.htm): [www.dhs.wisconsin.gov/air/vi.htm](http://www.dhs.wisconsin.gov/air/vi.htm)
- [Vapor intrusion 101 video](https://www.youtube.com/watch?v=Izo0QKqCToU): [www.youtube.com/watch?v=Izo0QKqCToU](https://www.youtube.com/watch?v=Izo0QKqCToU)



WISCONSIN DEPARTMENT  
of HEALTH SERVICES

Division of Public Health  
Bureau of Environmental and Occupational Health  
P-02480 (06/2019)

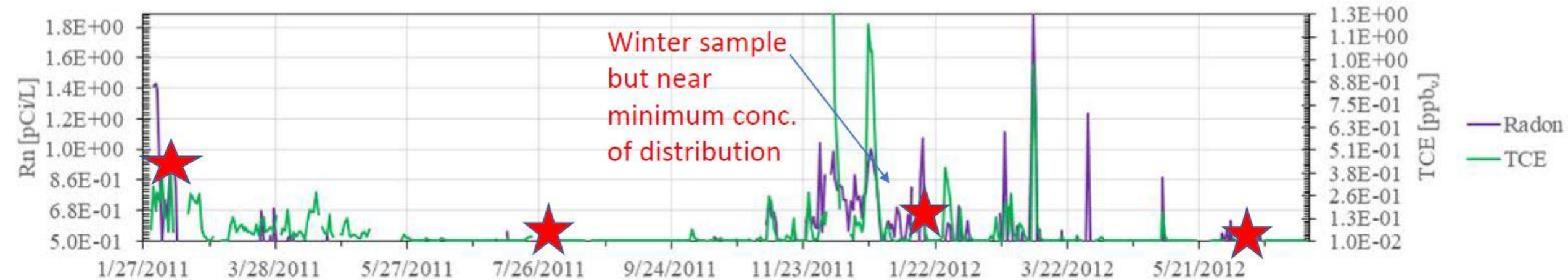


# RR-800 TCE Provisions

- Section 3.4.1
  - Quickly determine demographics
  - Quickly sample if developmental risk
- Section 7.1 Immediate Actions (Residential)
  - Developmental 1X VAL      2.1  $\mu\text{g}/\text{m}^3$
  - Non-carcinogens 3X VAL      6.2  $\mu\text{g}/\text{m}^3$



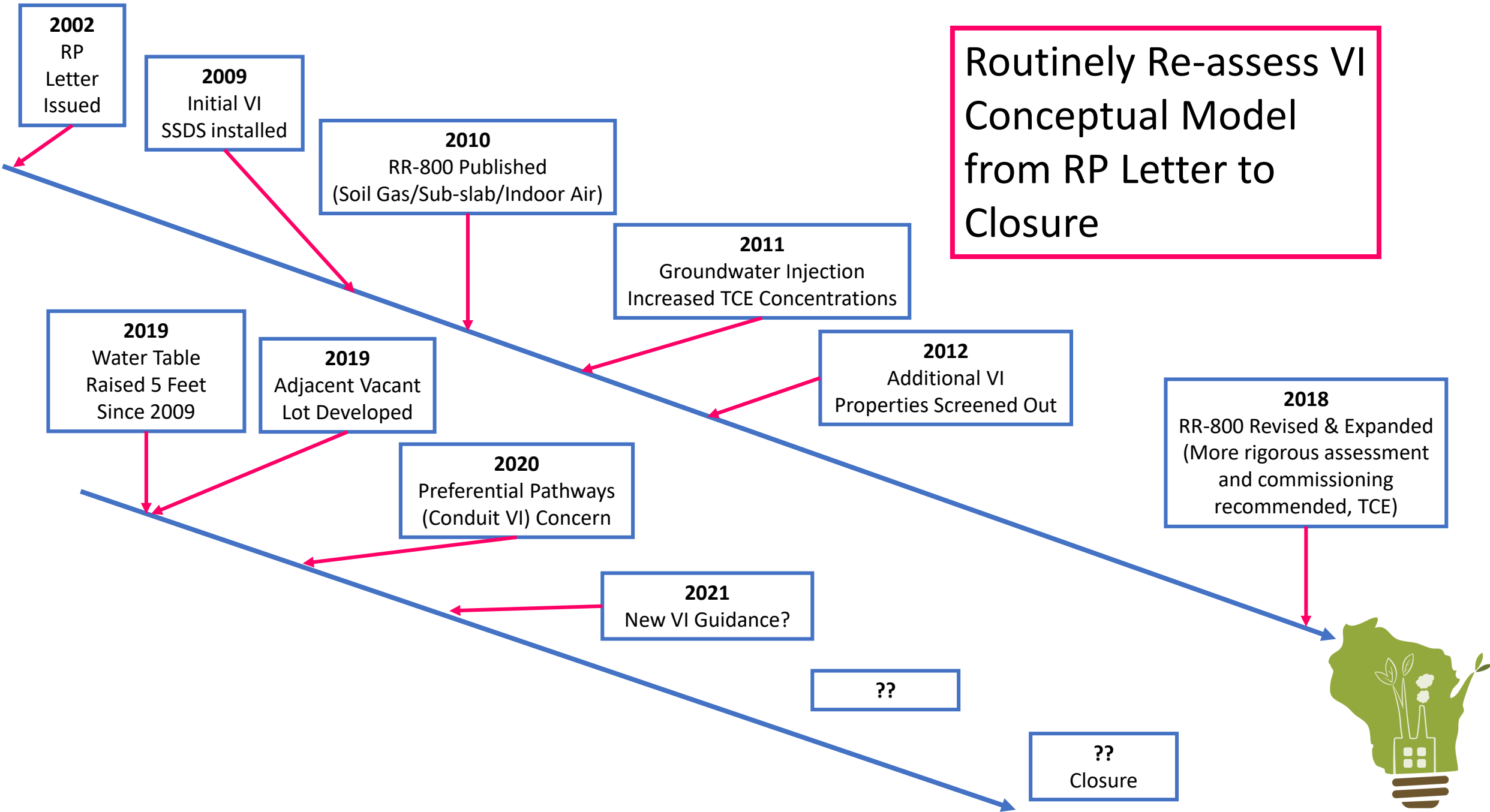
# Challenge of Vapor Data Variability – Indoor Air TCE, Utah Study House



Reference: Henry Schuver, U.S. EPA; EPA's 2020 Vapor Intrusion Workshop: Why You Should Monitor Indoor Radon, Differential Temperature, and Pressure During Chlorinated Vapor Intrusion Assessments, Tuesday, March 17, 2020



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





↓

**Jan. 2020 - Winter 2020/2021**

- [NRB scope approval](#)
- [Stakeholder group meetings](#) - open to public
- Preparation of proposed rule
- Solicitation of information for economic impact analysis (EIA)

← (We are here)

**DHS Recommended  
NR 140 Changes**

↓

**Winter 2020 - Spring 2021**

- Stakeholder group meetings complete
- EIA public comment period

↓

**Summer/Fall 2021**

- Public hearings on proposed rule
- Public comment period

↓

**Winter 2021/2022**

- NRB meeting for adoption
- Rule approved by governor
- Legislative review/hearings

↓


**Summer 2022**

- Rule signed by DNR Secretary
- Rule published and effective

	TCE	PCE
PAL (Current)	0.5	0.5
PAL (Proposed)	0.05	2
ES (Current)	5	5
ES (Proposed)	0.5	20

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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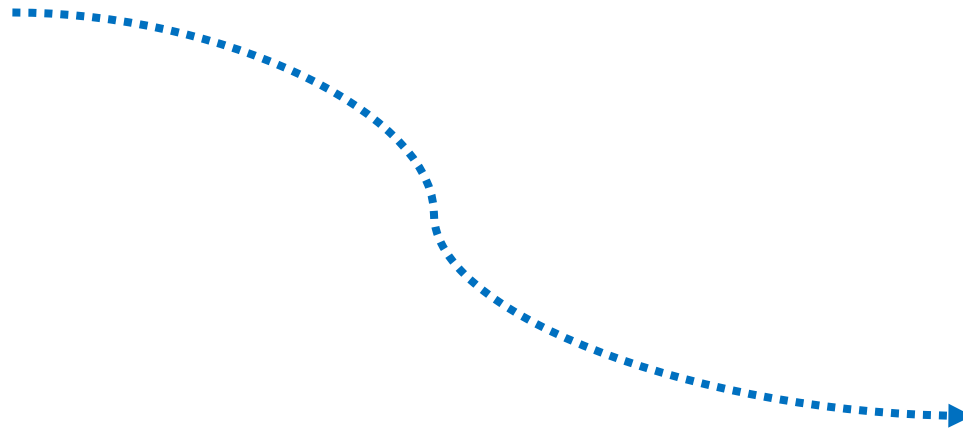
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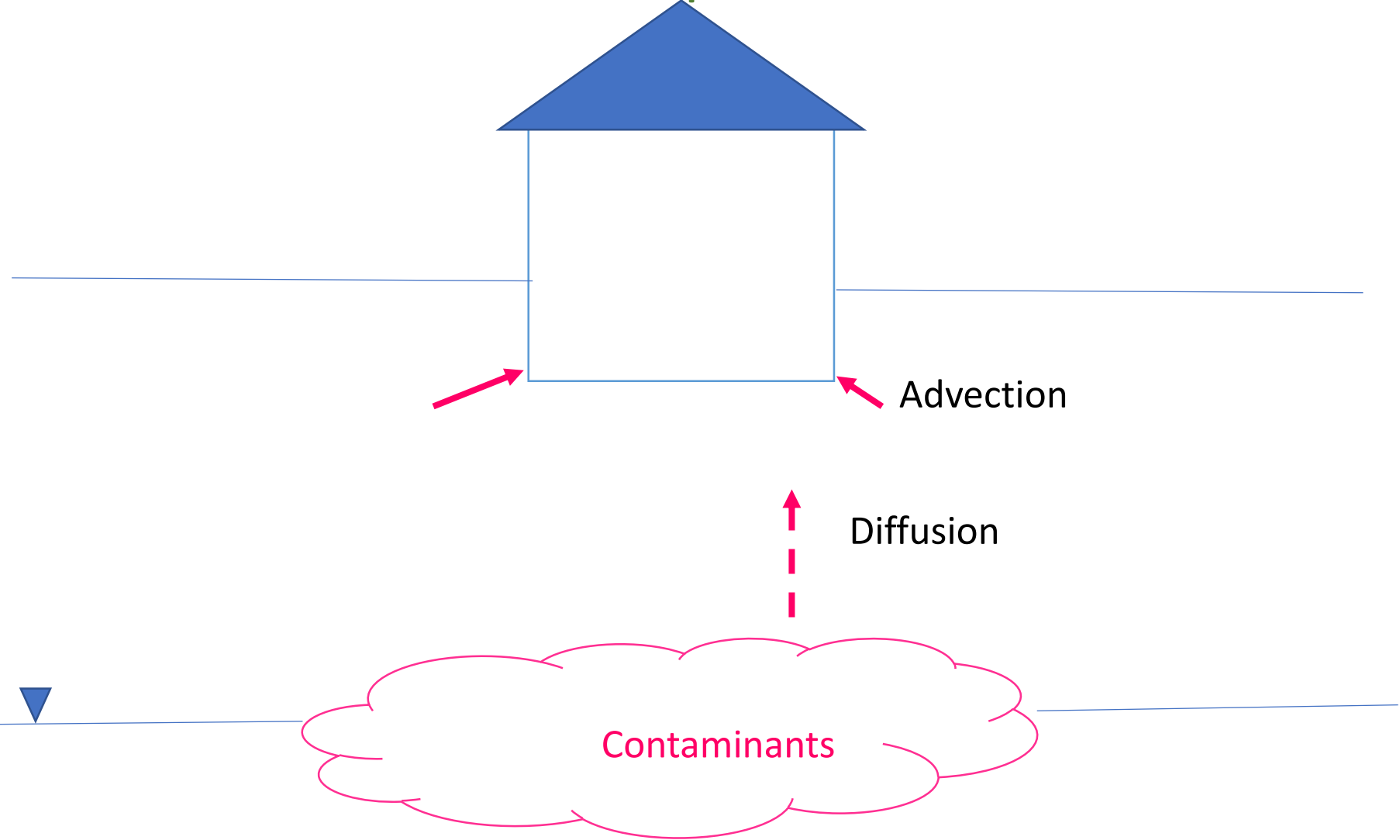
*Questions?*



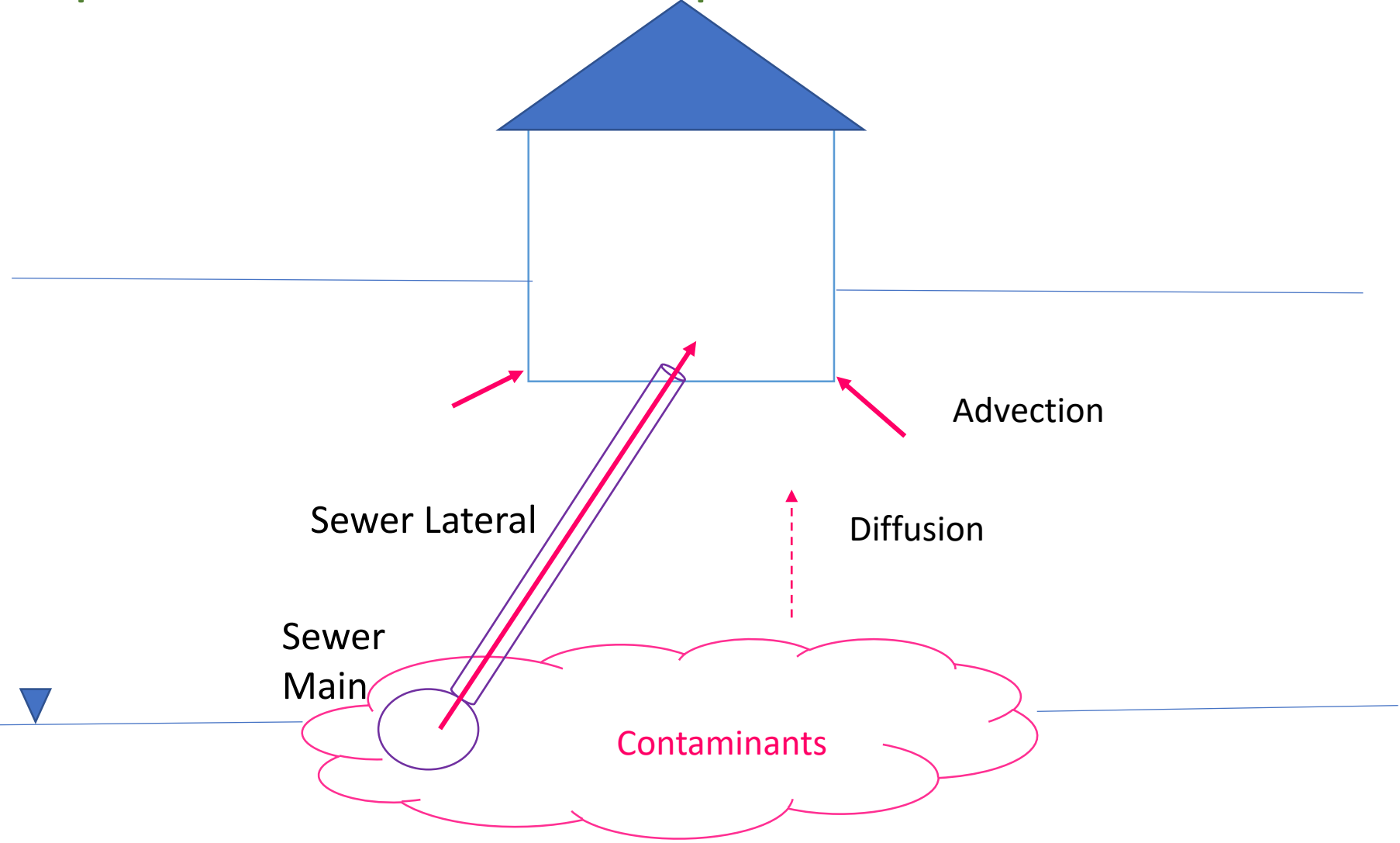
# Preferential Pathways



# Standard VI Conceptual Model



# Updated VI Conceptual Model





**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 <sup>7</sup>). 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.*

<sup>7</sup> See the DNR’s “Guidance for Documenting the Investigation of Utility Corridors”, <http://dnr.wi.gov/files/PDF/pubs/rr/RR649.pdf>



# Guidance for Documenting the Investigation of Utility Corridors

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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**

PCE ppb

CLEANER	CITY	DATE	RESULT in ppb	UNIT
Busy Bee	Lodi	9/11/90	60,699	Reclaimer
Turlock Cleaners	Turlock	4/29/91	62,755	Cooker
Snow White	Turlock	1/26/89	140 56	Reclaimer Cooker
Durite Cleaners	Turlock	1/30/89	15,000 150,000	Sniffer & Reclaimer II Reclaimer I
Brite Cleaners	Turlock	5/11/89	66,000	Reclaimer
Southgate Norge	Sacramento	3/20/91	247,000	Sniffer & Reclaimer
Tillet Cleaners	Roseville	4/11/89	74,000	Reclaimer
Merced Laundry	Merced	11/29/88	130,000	Sniffer
Modesto Steam	Modesto	4/30/91	1,119,300 139,087 8,120 52,618	Reclaimer Cooker Chiller Recalimer
			Median 64,000 Average 151,800	

Source: Drycleaners a Major Source of PCE in Groundwater, 1992, California Water Control Board



# Evidence of Sewer Breaches



Cracked Sewer Pipe (Riis)



Corroded Sewer Pipe



Rootlets in Sewer



Separated Sewer Pipe

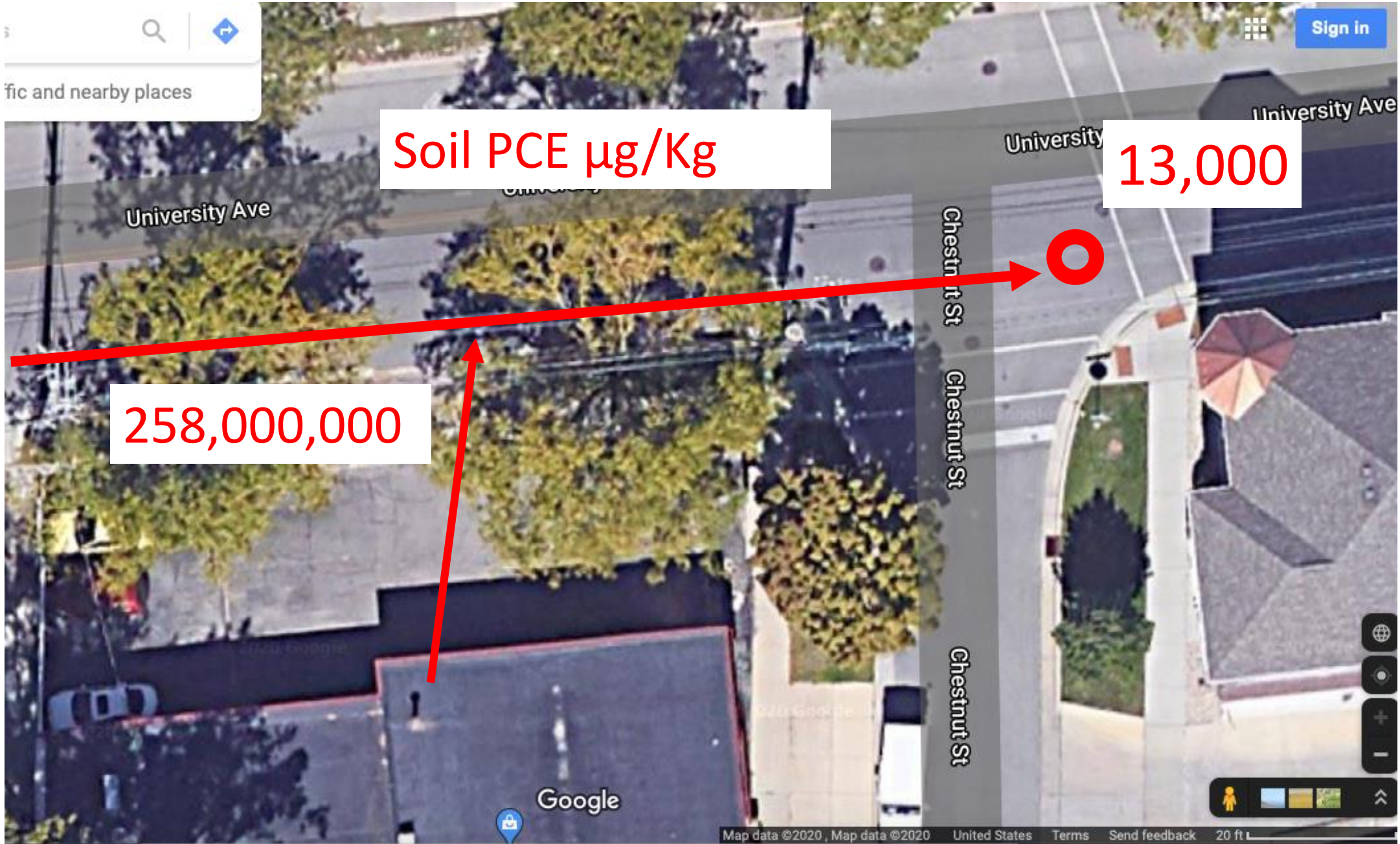


Cracked Sewer Pipes

Source: Jacobs, Jacobs, and Pennell, 2015







Soil PCE  $\mu\text{g}/\text{Kg}$

13,000

258,000,000



Former  
Manufacturing Plant

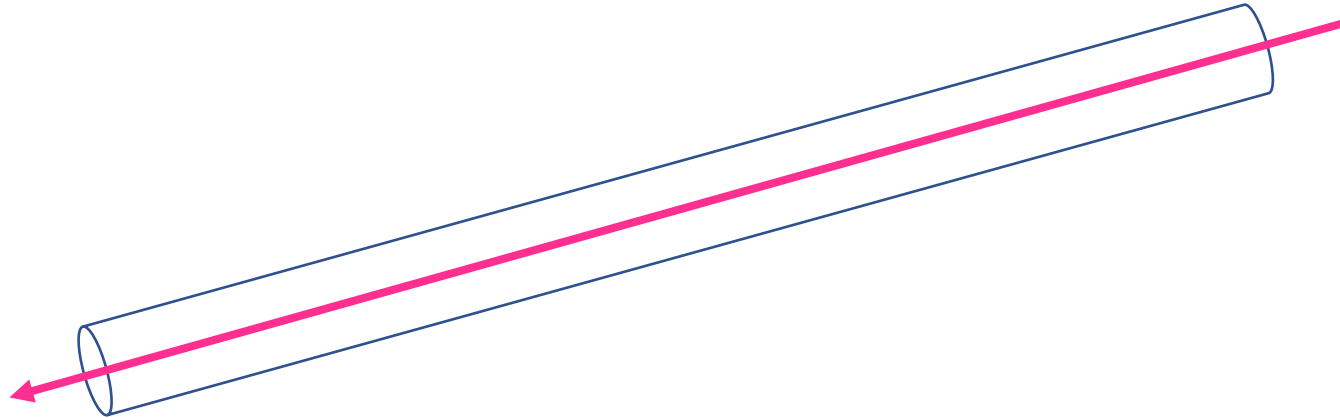
PCE in Soil Gas  
Around Sewers

Red > 10,000  $\mu\text{g}/\text{m}^3$

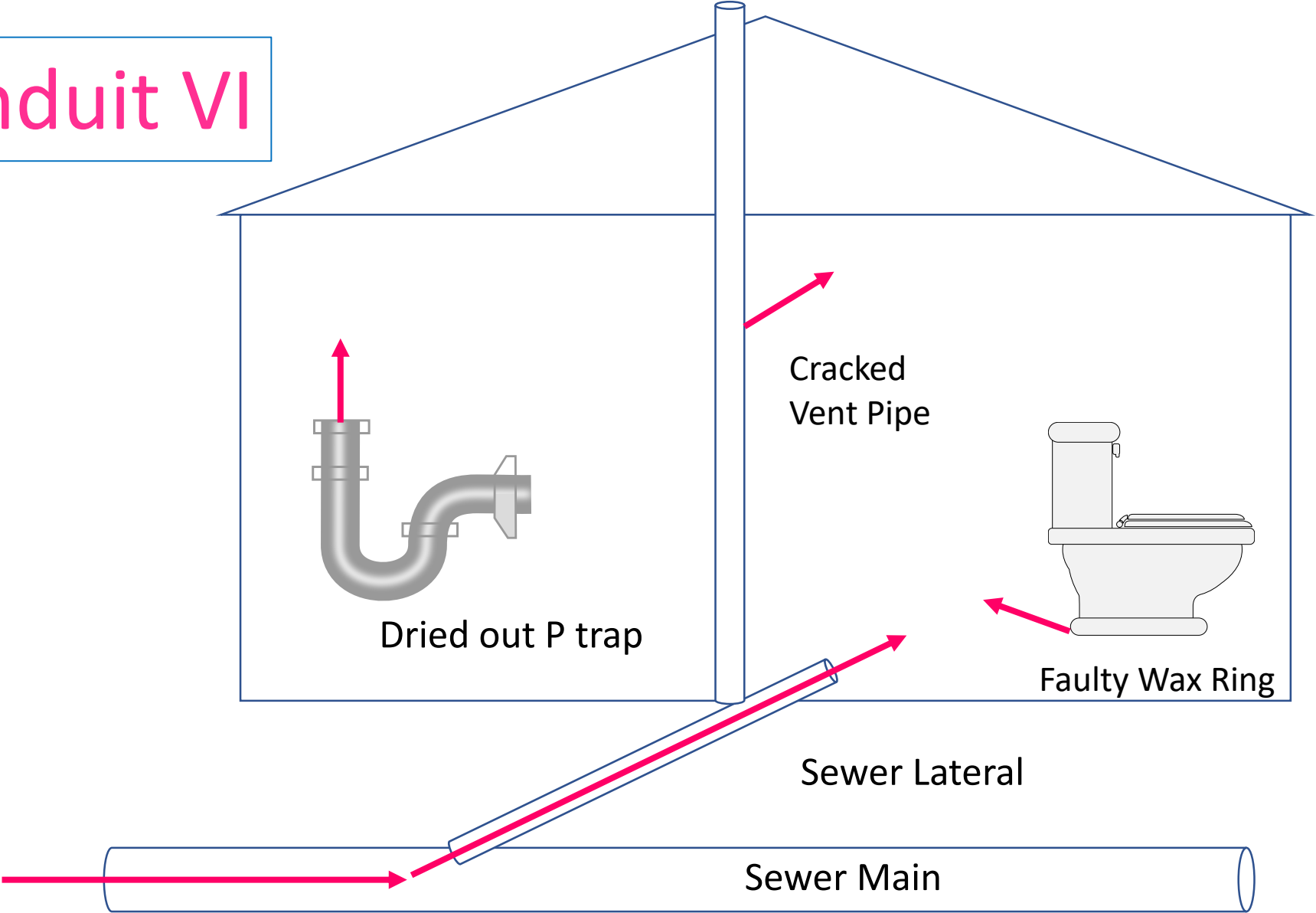
Source: <https://www.epa.gov/in/sewer-gas-documents-and-maps-former-amphenol-site-franklin-indiana>



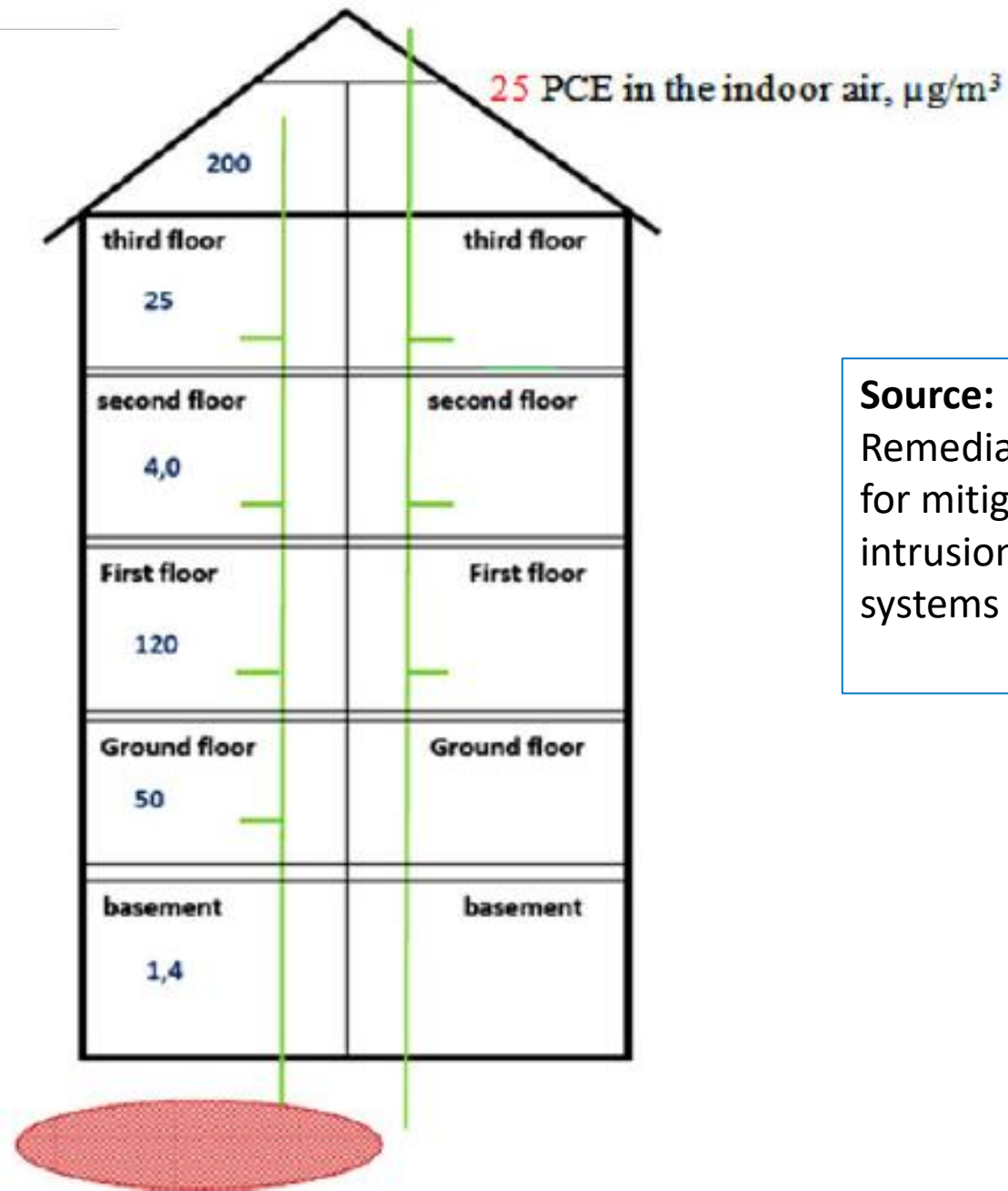
# Conduit VI



# 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 (or "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](#).

- [Guidance](#)
- [Screening levels](#)
- [Community outreach](#)
- [Training](#)
- [Other resources](#)**
- [Contacts](#)

### Websites

#### CLU-IN

- [CLU-IN Focus Website for Vapor Intrusion](#) [exit DNR] provides links to technical publications on sampling and analysis, and mitigation for vapor intrusion.

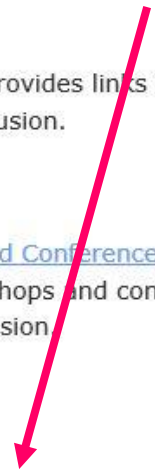
#### Workshops and Conferences

- [Indoor Air Vapor Intrusion Database Workshops and Conferences](#) [exit DNR] 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](#) [exit DNR] 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



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### Related links

- [Site Investigation Toolkit](#)
- [Vapor intrusion](#)
- [Cleanup resources for environmental professionals](#)
- [Soil residual contaminant levels](#)
- [Dry cleaner contamination](#)
- [Technical Focus Group](#)
- [Cleanup overview](#)

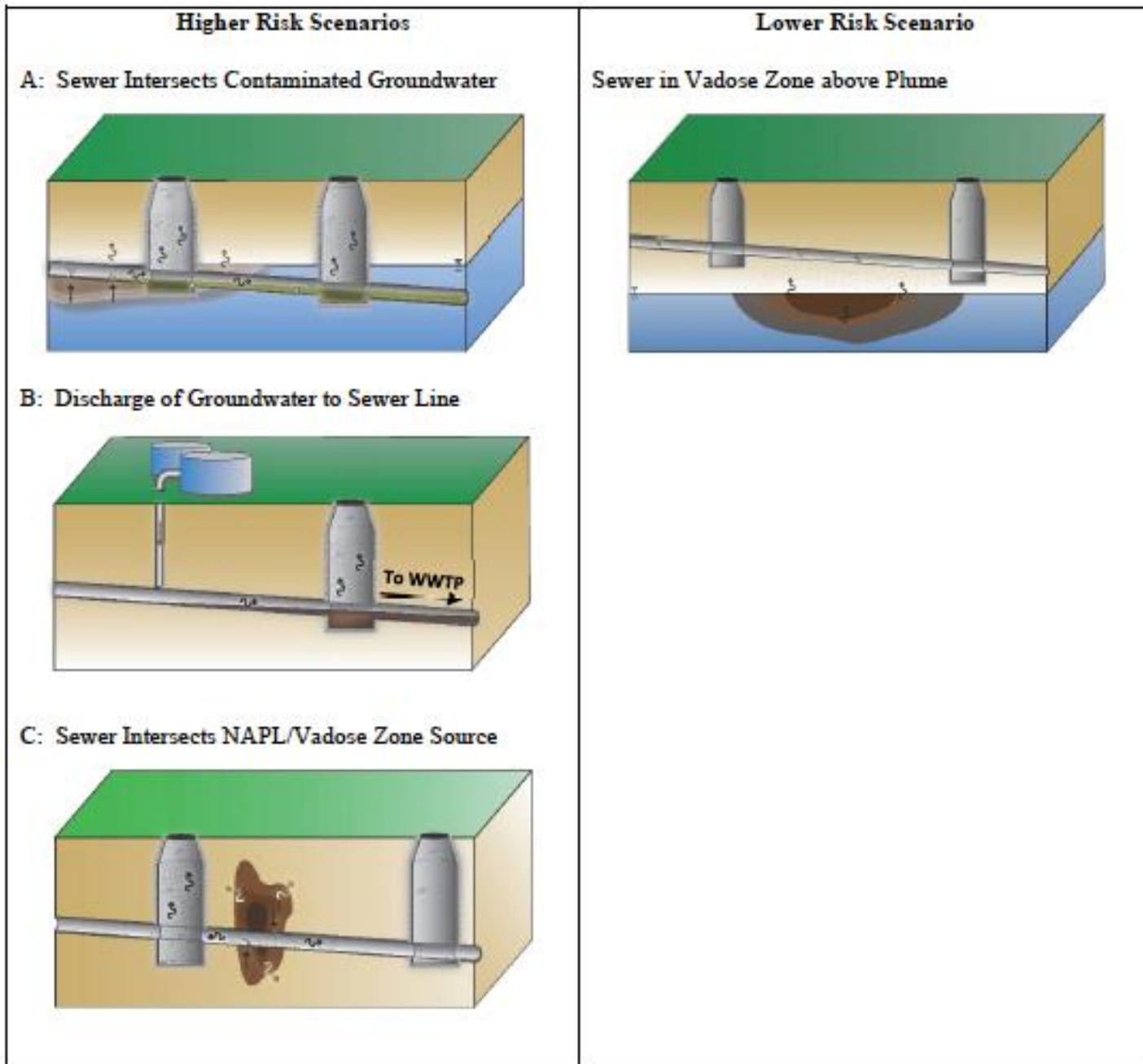


# Contributions of the DOD Study

- 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





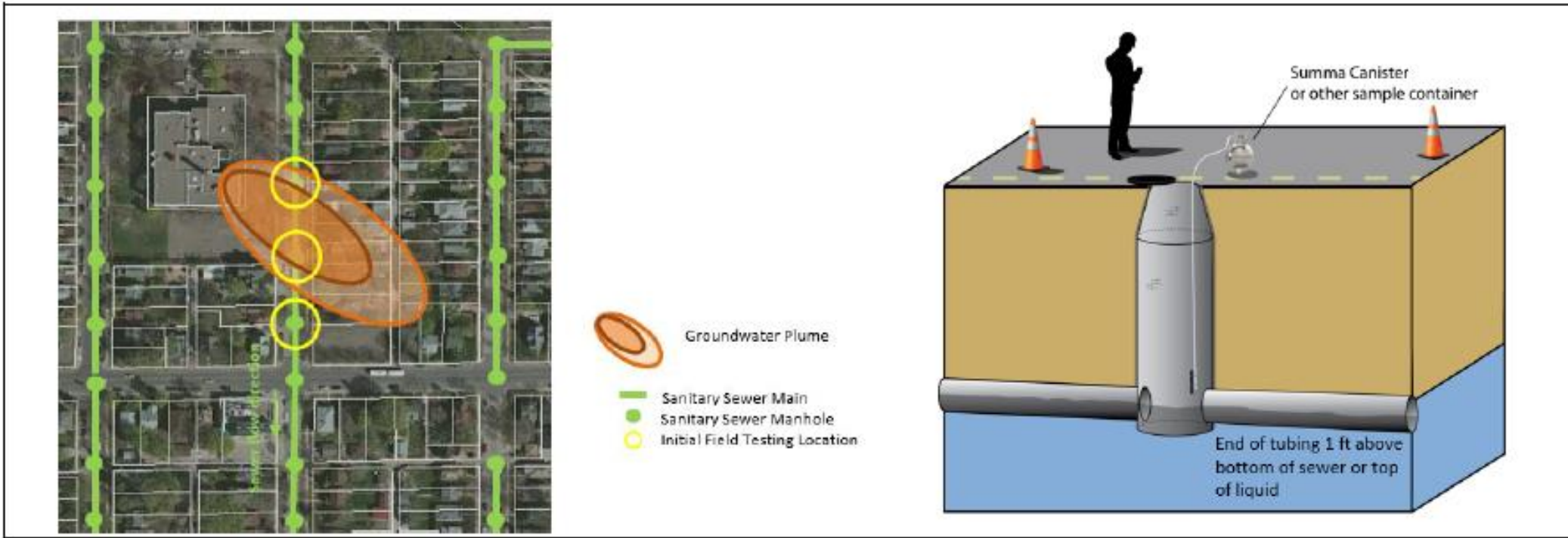


## High vs Low Risk Sites

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





**Figure ES.3 Example Initial Field Investigation Sample Locations**

Source: DOD ESTCP, ER-201505.

## Initial Sampling



# Sewer Vapor and Screening Levels

Parameter - PCE	Value $\mu\text{g}/\text{m}^3$	Parameter - TCE	Value $\mu\text{g}/\text{m}^3$
Background Average PCE (90% of samples)	3.2	Background Average TCE (70% of samples)	2.6
Sewer to Building Attenuation Factor (unitless)	0.03	Sewer to Building Attenuation Factor (unitless)	0.03
<b>PCE</b> Sewer Screening Concentration - Residential	1,400	<b>TCE</b> Sewer Screening Concentration - Residential	70
<b>PCE</b> Sewer Screening Concentration- Commercial/Industrial	6,000	<b>TCE</b> Sewer Screening Concentration - Commercial/Industrial	290



# 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

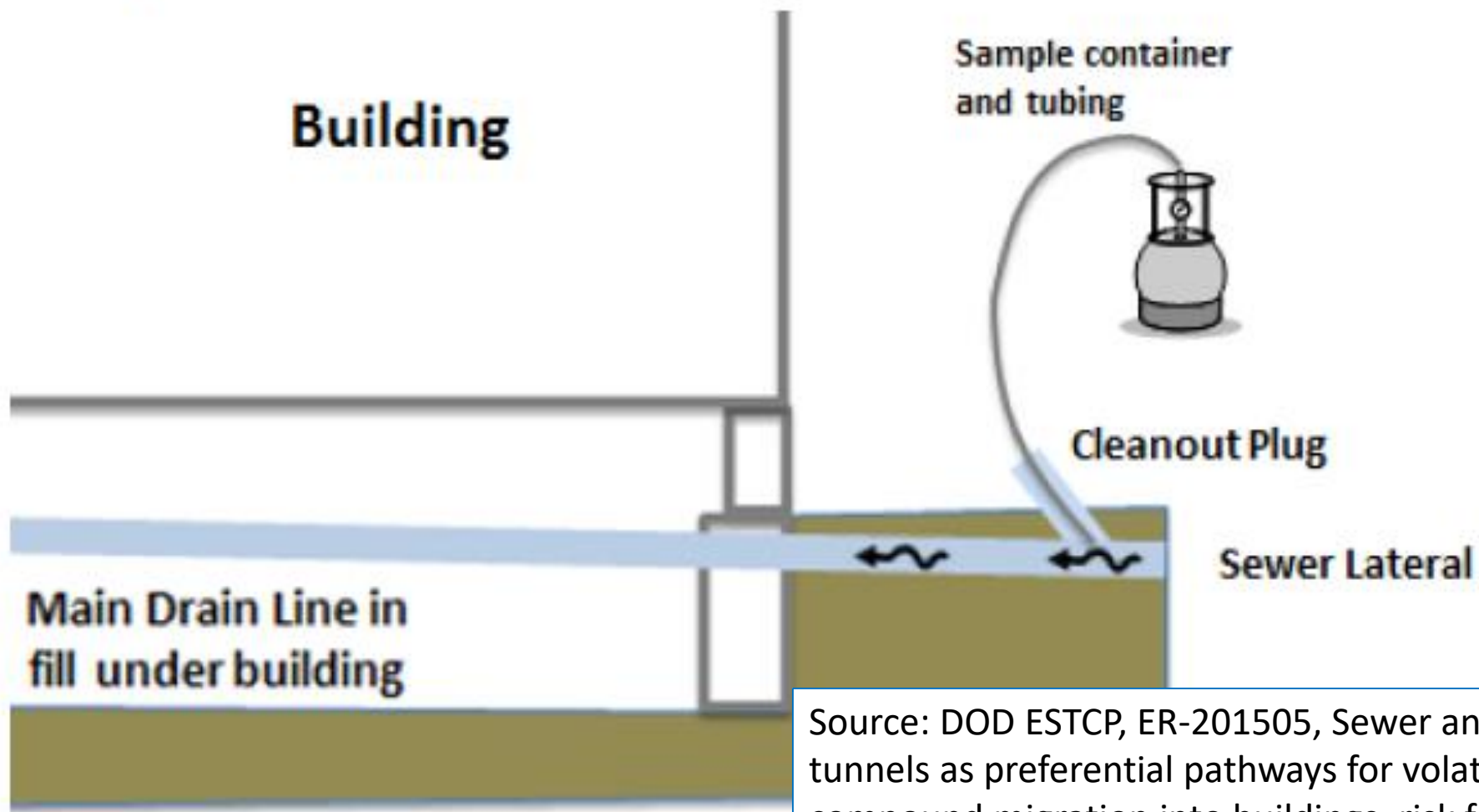


# Building Assessment

- 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.



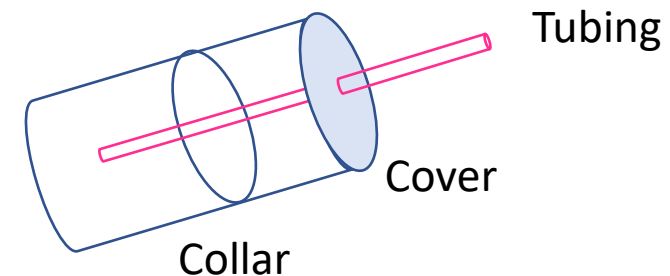
# Typical Household Cleanouts



## 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  $\mu\text{g}/\text{m}^3$ )

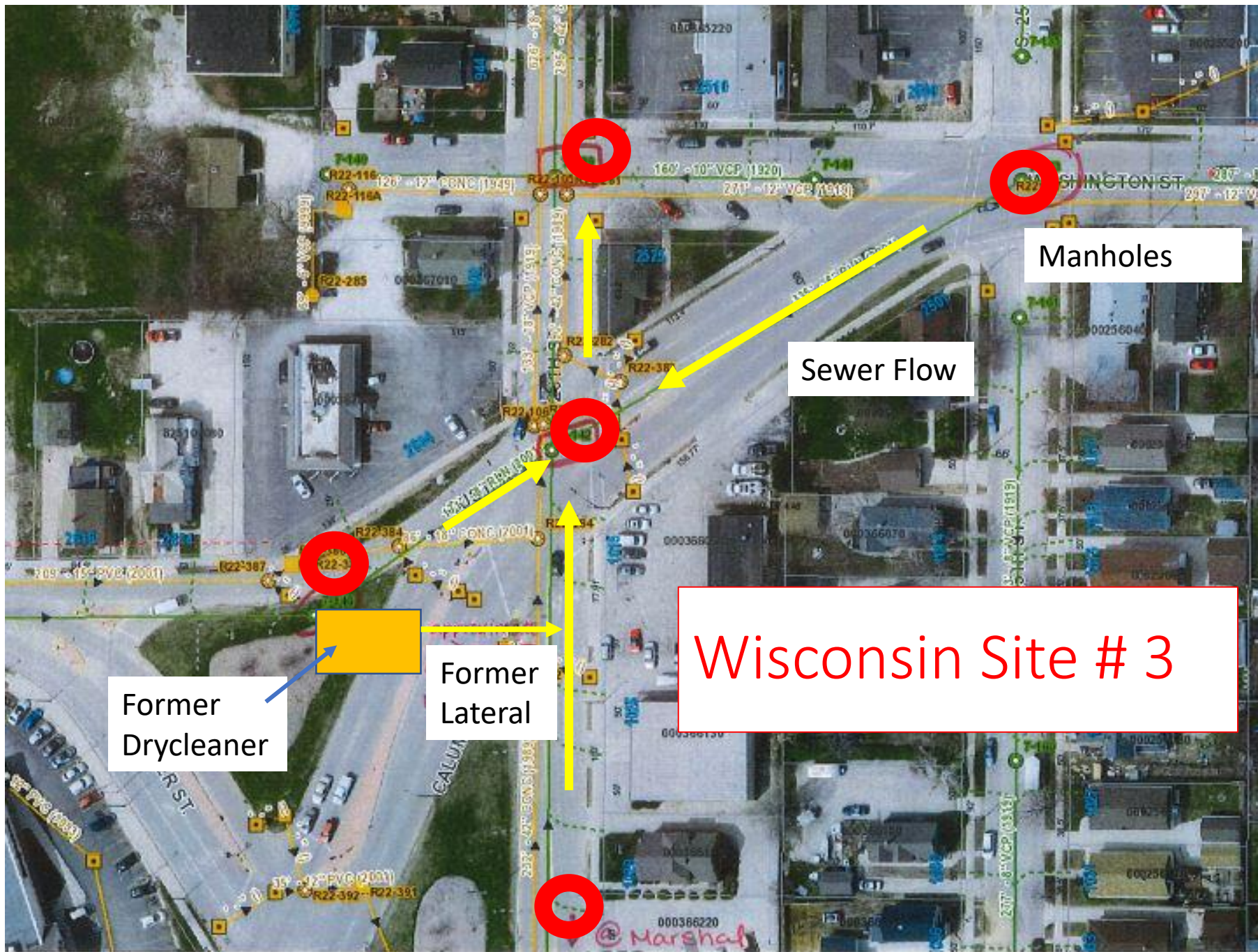
WI Site #1      Highest Concentration TCE      7,660

## WI Site #2

Manhole	PCE	TCE
Up-flow	4.2J	ND
Mid-site	5.9J	ND
Downflow	27	6.7J
Residential VRSL	1,400	70







Manholes

Sewer Flow

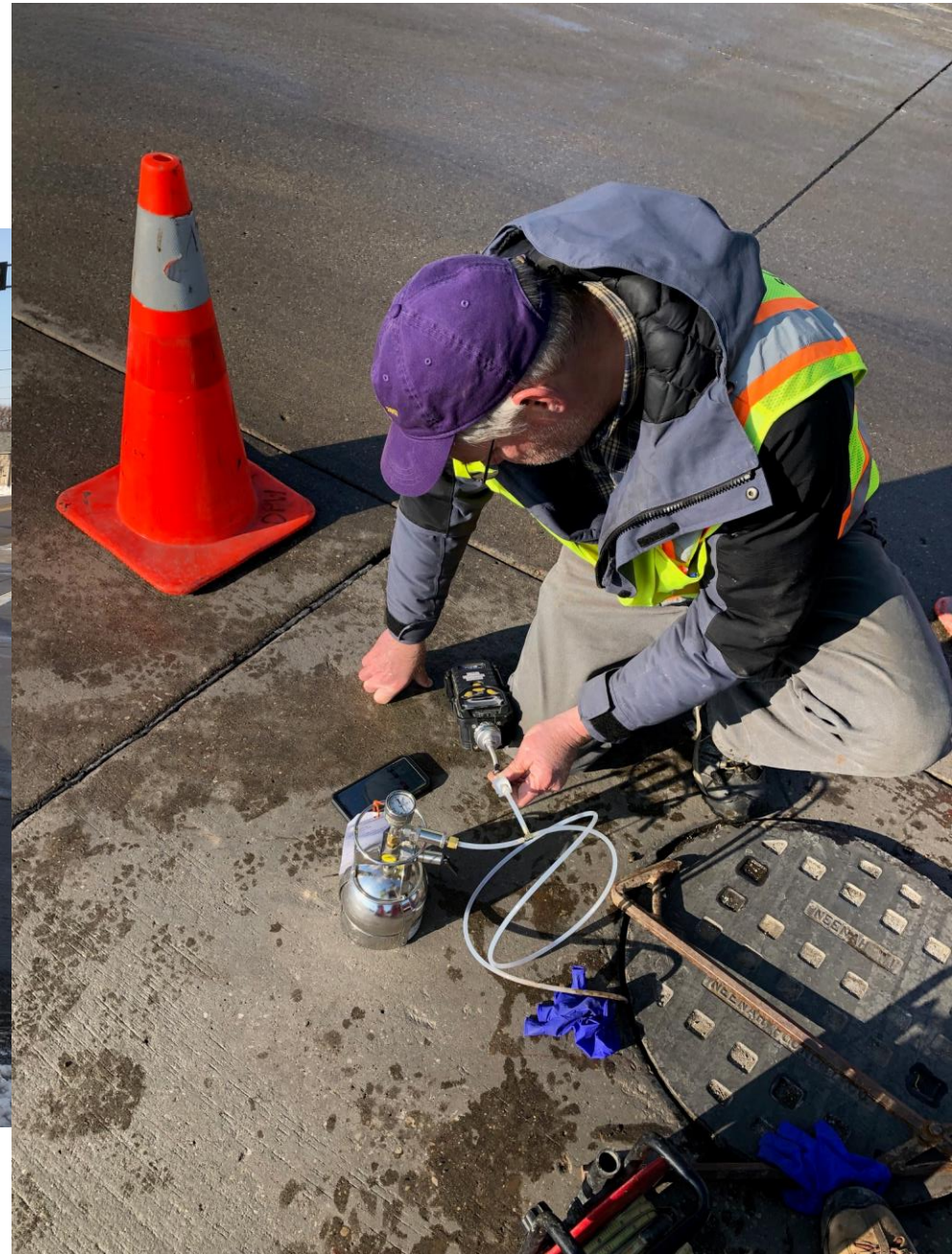
Wisconsin Site # 3

Former Drycleaner

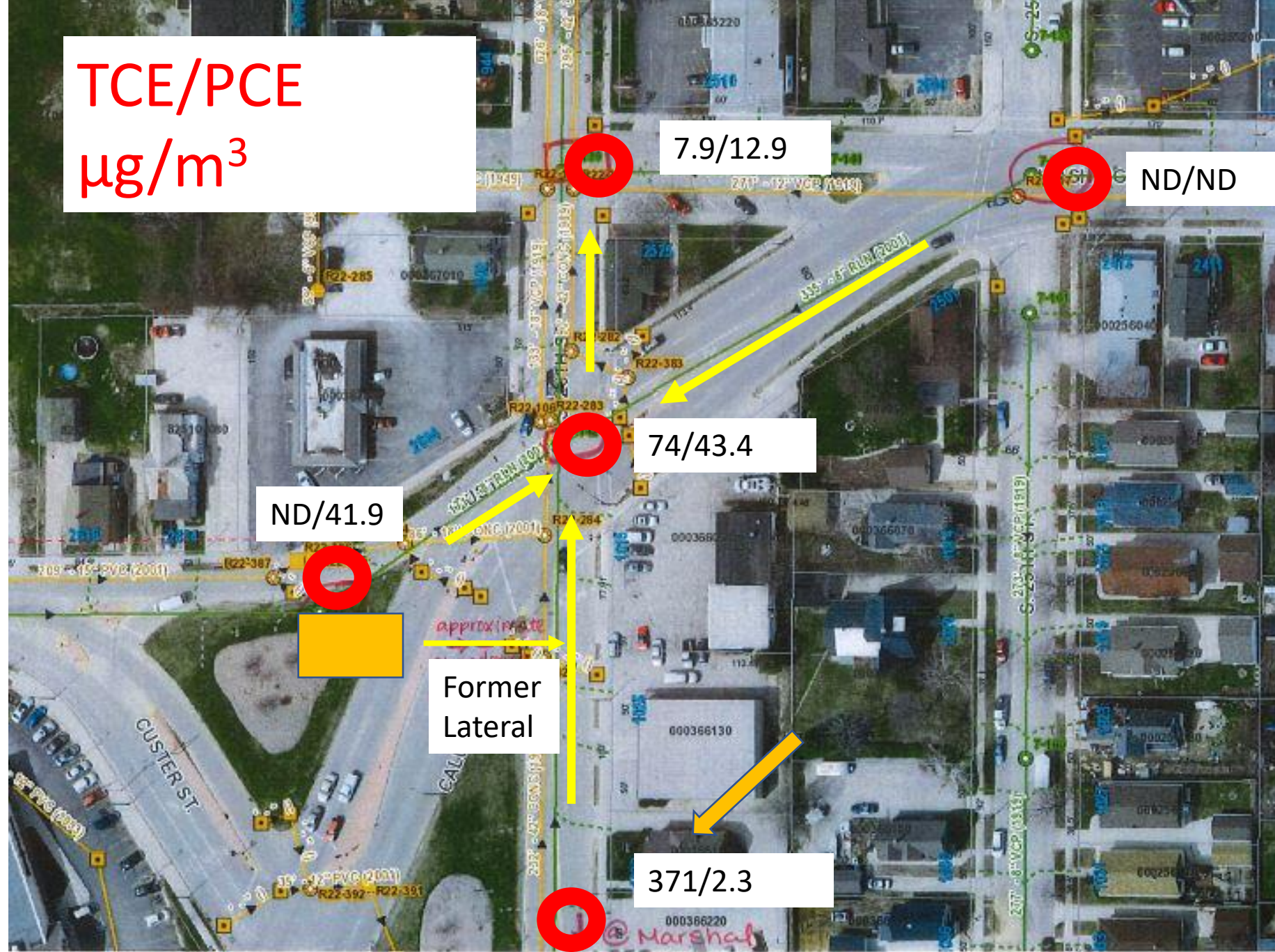
Former Lateral



# Photo of sewer sampling



TCE/PCE  
 $\mu\text{g}/\text{m}^3$



# Investigating Conduit VI Example: Dry Cleaner (DC)

Residence

Residence



Main Street

Ground water  
Flow



Retail

Retail

DC

Soil  
GW

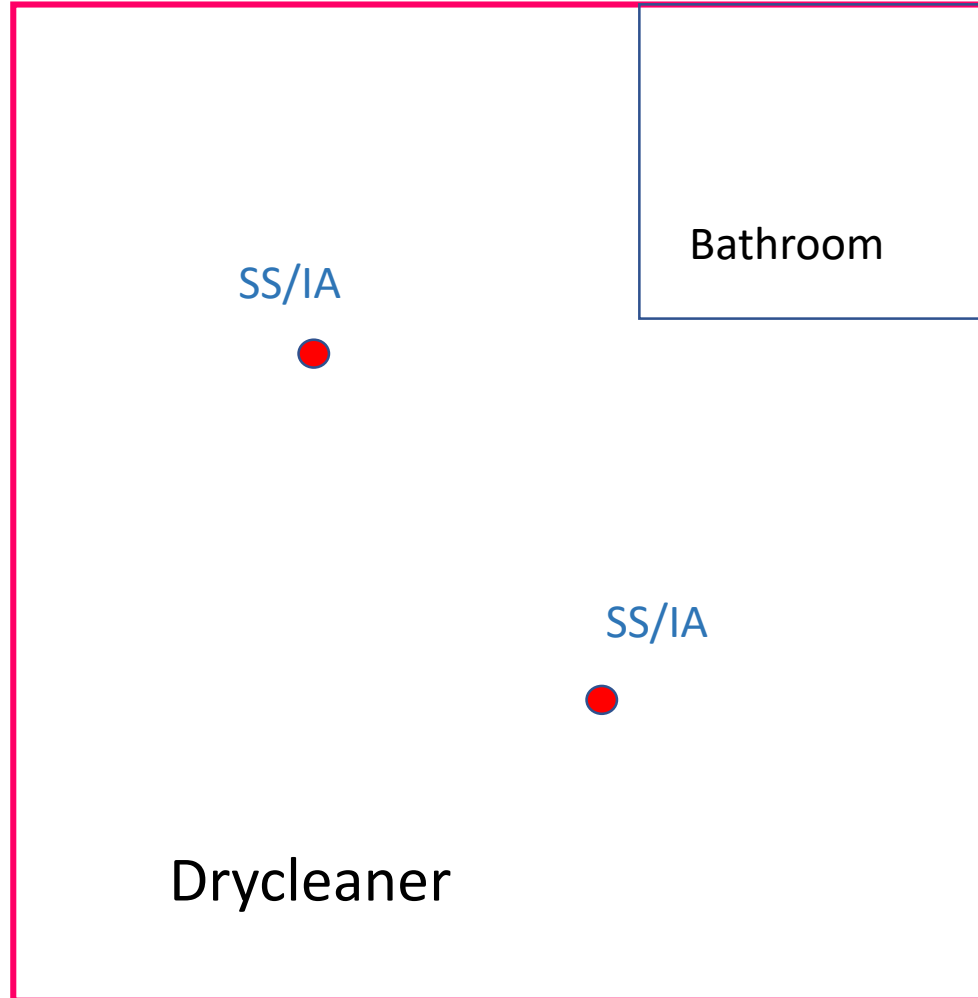
Soil  
GW

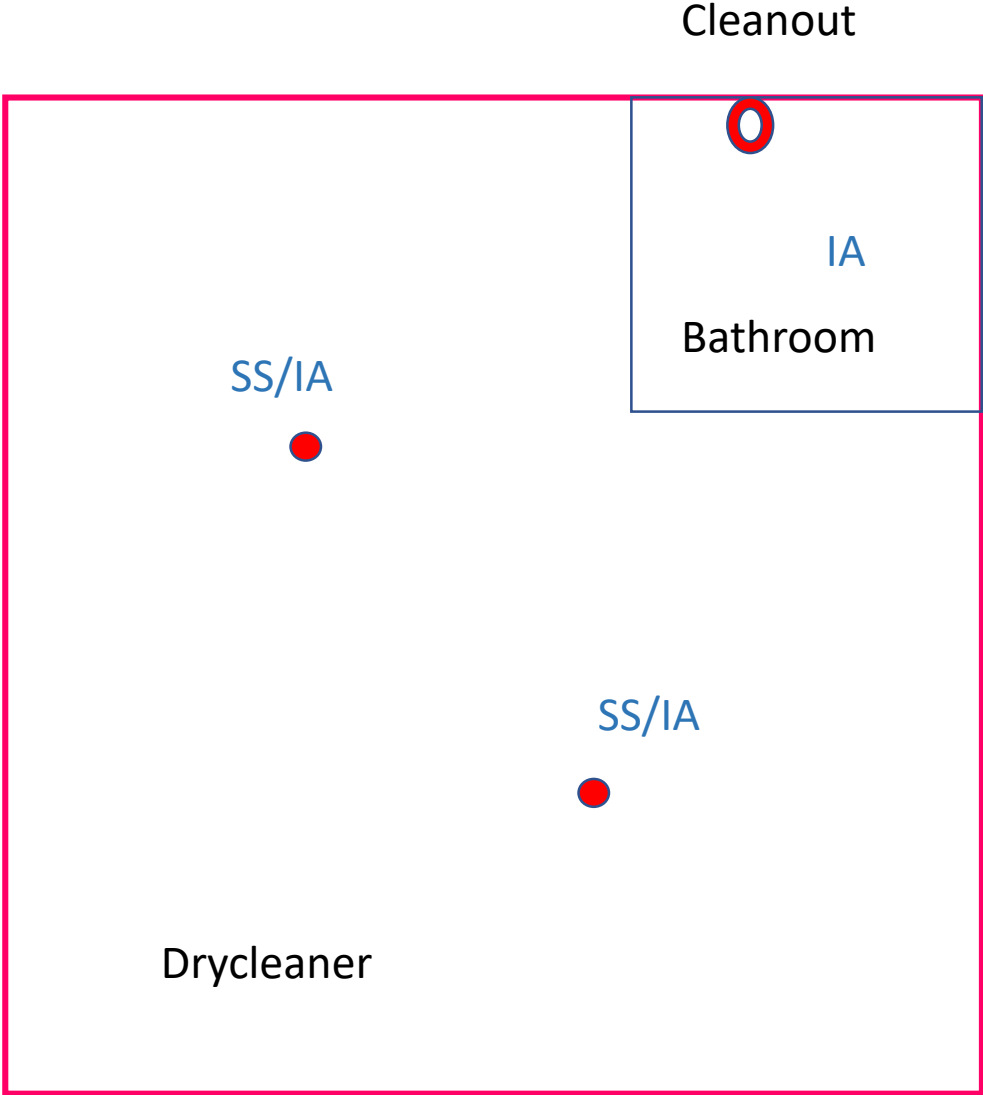
Soil  
GW





# Typical Initial Interior Vapor Sampling

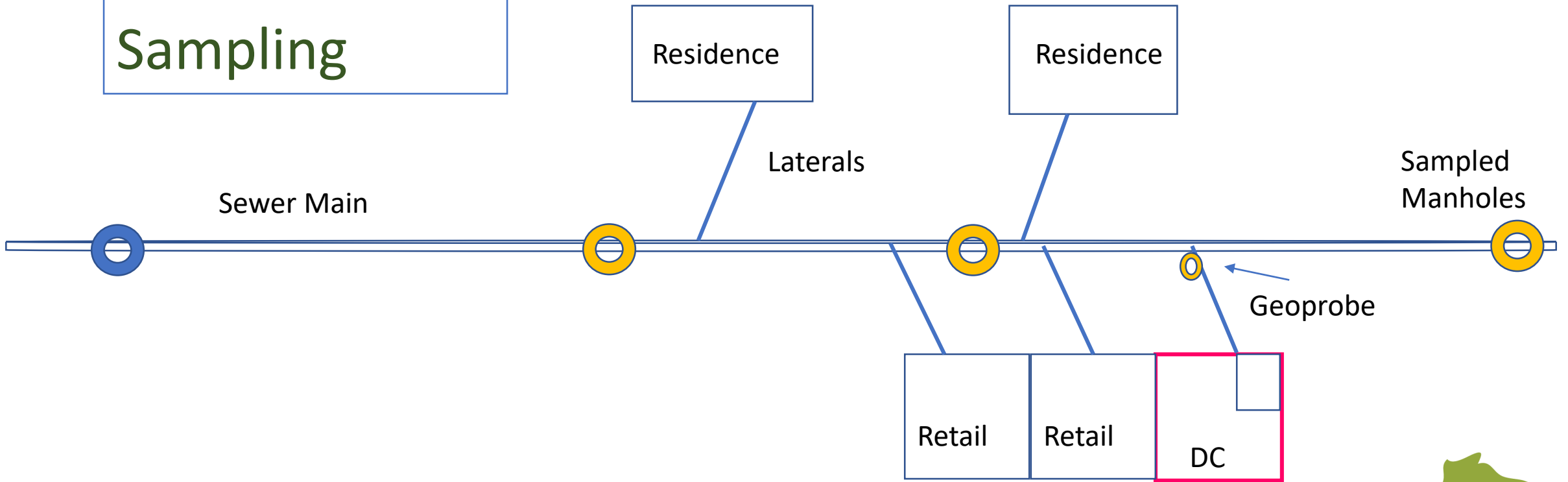




Additional  
Initial  
Conduit VI  
Sampling



# Exterior Initial Conduit VI Sampling

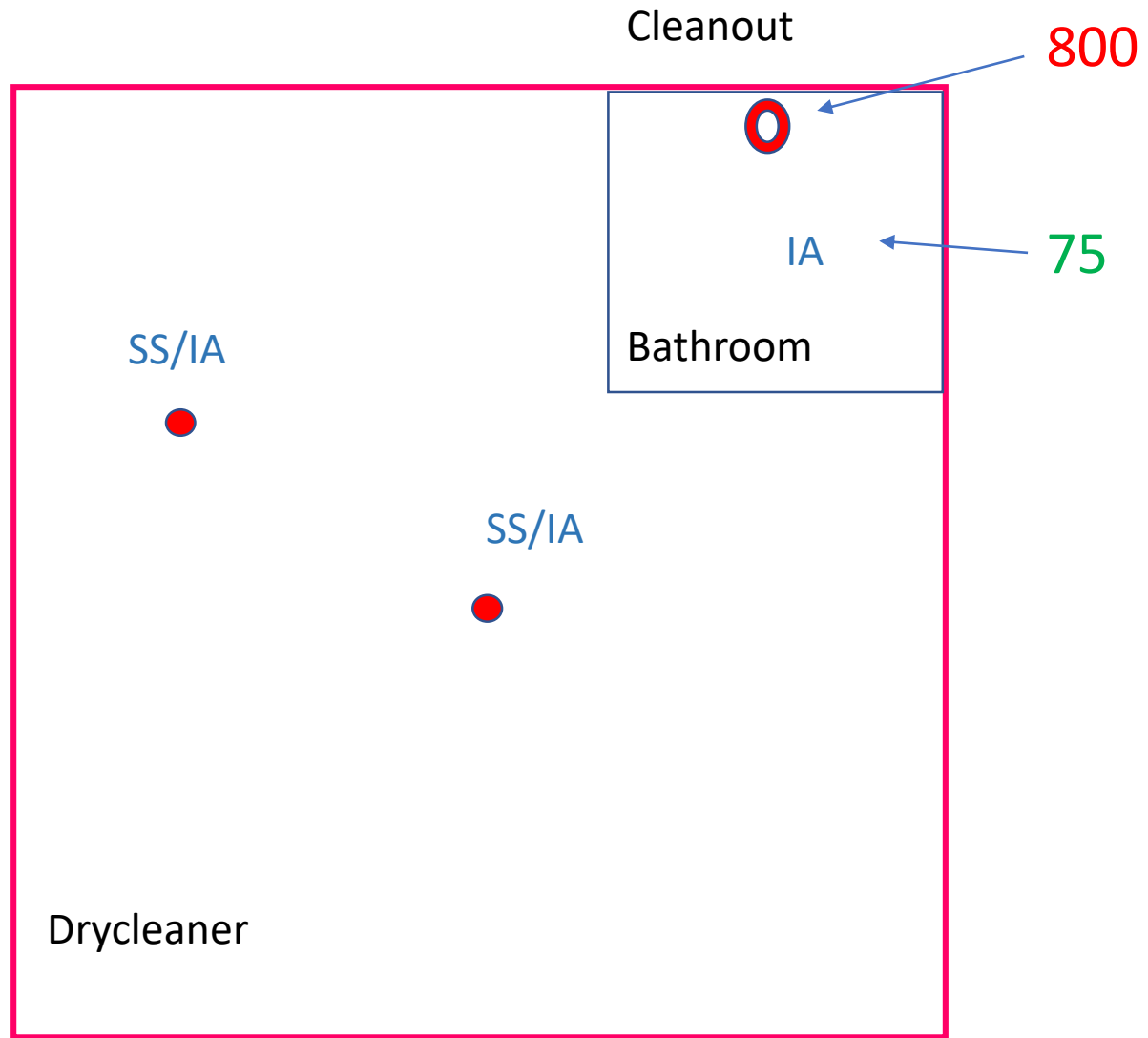


# Initial PCE Results $\mu\text{g}/\text{m}^3$

Small Commercial

VRSL 6,000

VAL 180

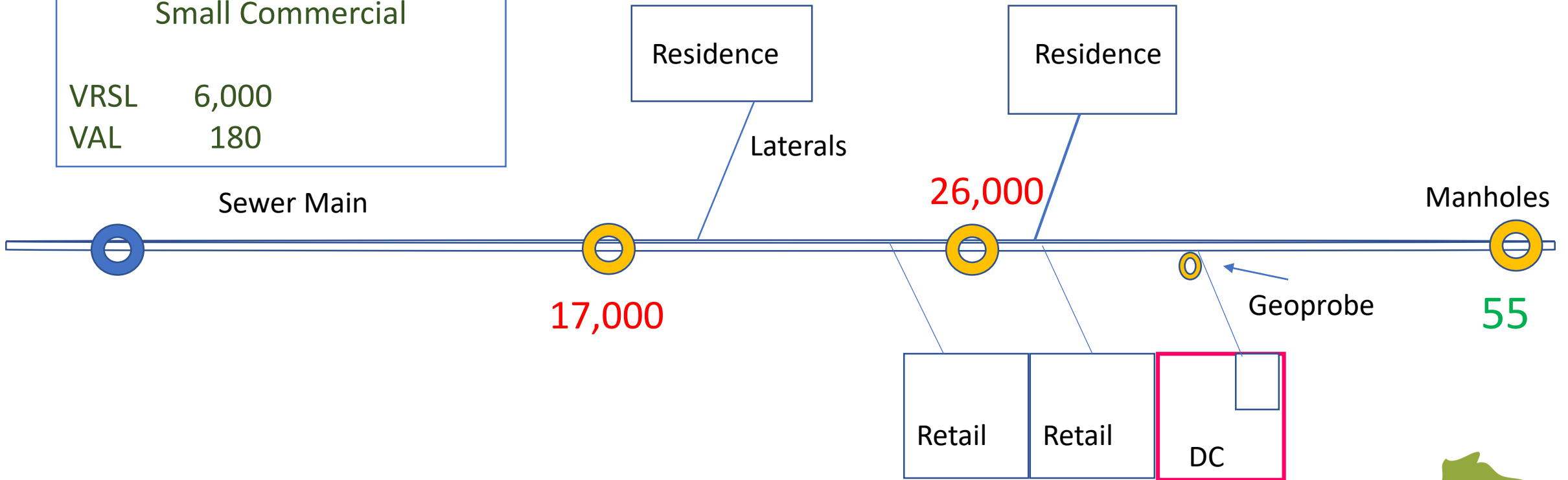


# Initial PCE Results

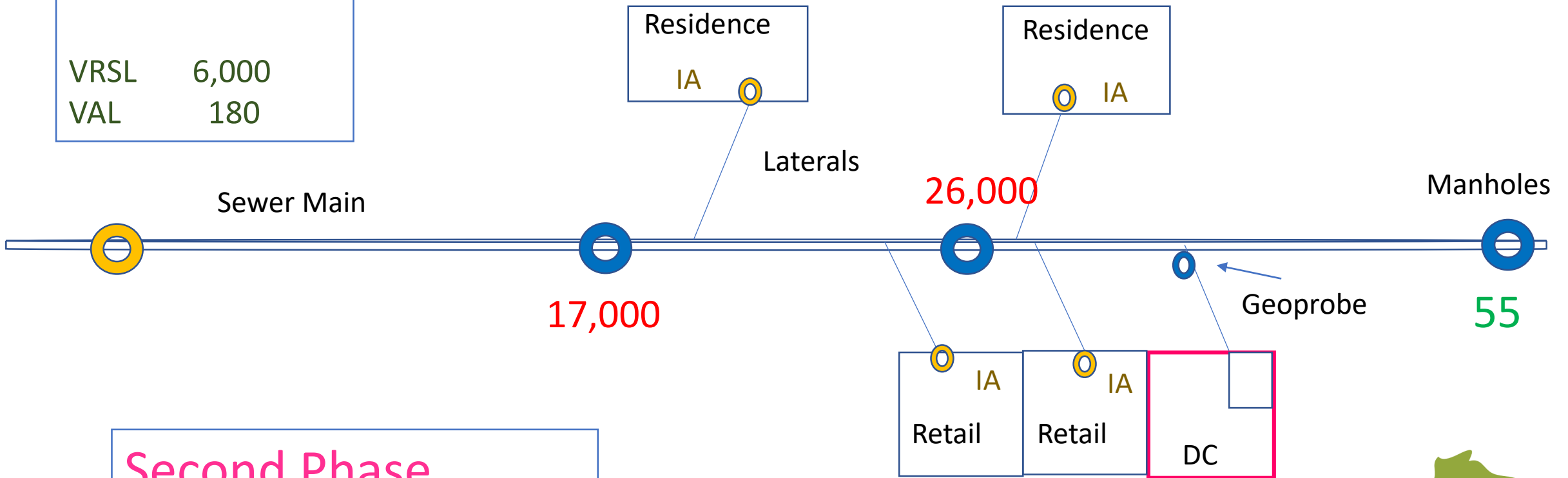
$\mu\text{g}/\text{m}^3$

Small Commercial

VRSL 6,000  
VAL 180



PCE Results	
$\mu\text{g}/\text{m}^3$	
Small Commercial	
VRSL	6,000
VAL	180



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>
- DOD report: <https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER-201505/ER-201505>
- Draft CA VI Guidance [https://dtsc.ca.gov/wp-content/uploads/sites/31/2020/02/Public-Draft-Supplemental-VI-Guidance\\_2020-02-14.pdf](https://dtsc.ca.gov/wp-content/uploads/sites/31/2020/02/Public-Draft-Supplemental-VI-Guidance_2020-02-14.pdf)
- Guo, Y., Dahlen, P., Johnson, P., 2020. Temporal variability of chlorinated volatile organic compound vapor concentration in a residential sewer and land drain system overlying a dilute groundwater plume, Sci. of the Total Environ. 702 (2020) 134756



# Questions ?

