MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan Petroleum Storage Tank Conference
Volatilization to the Indoor Air Pathway (VIAP)

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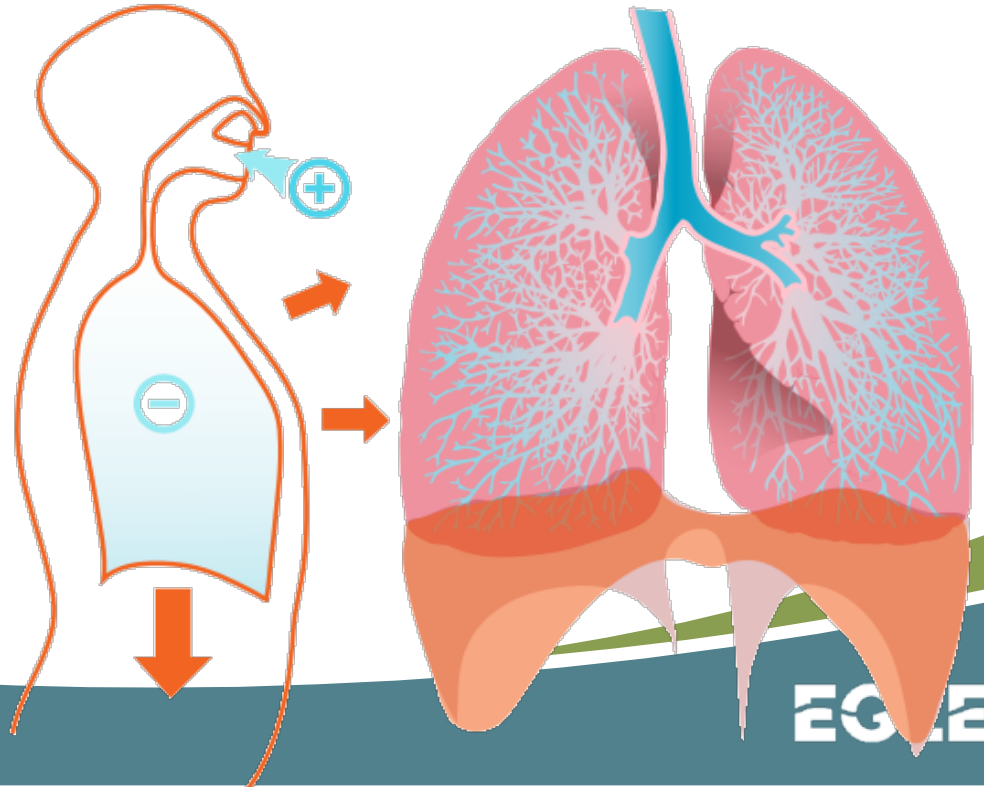
EGLE

Key Terms for the Volatilization to the Indoor Air Pathway (VIAP)

- Volatilization to the Indoor Air Pathway (VIAP)
- Vapor Intrusion vs Direct Volatilization to the Indoor Air
- Vapor Source or Source of Vapors

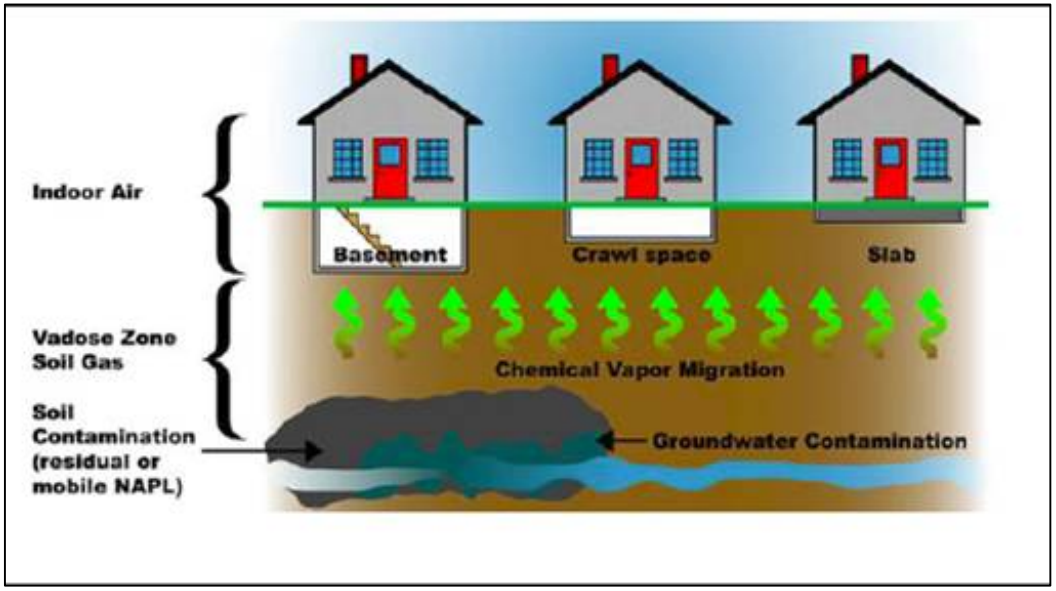
What is the Volatilization to the Indoor Air Pathway (VIAP)?

- Pathway describing the inhalation of hazardous substance vapors volatilizing from a ***vapor source*** to indoor air



Vapor Source

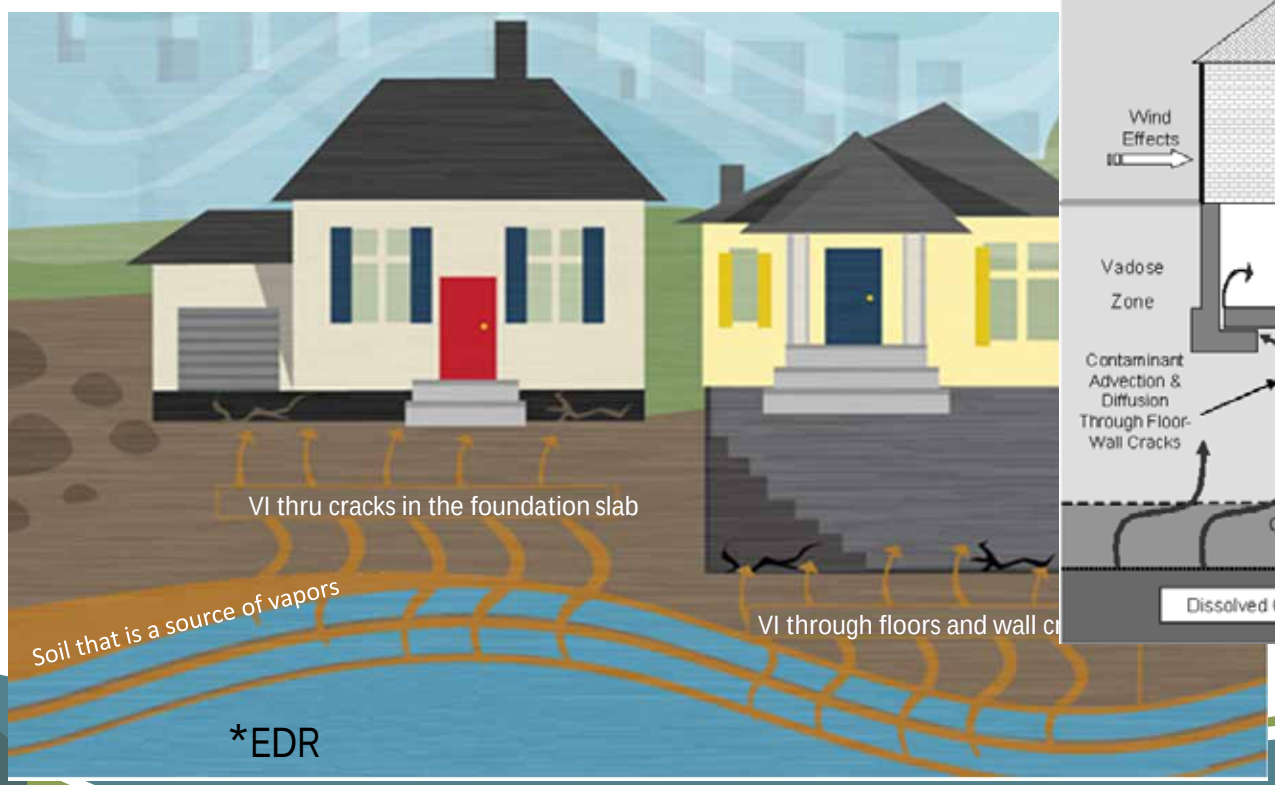
- A concentration that above which a hazardous substance may form vapors that have the potential to migrate to a structure and cause an unacceptable human health risk.
  - Groundwater
  - Soil contamination
  - NAPL (at or above the water table surface)

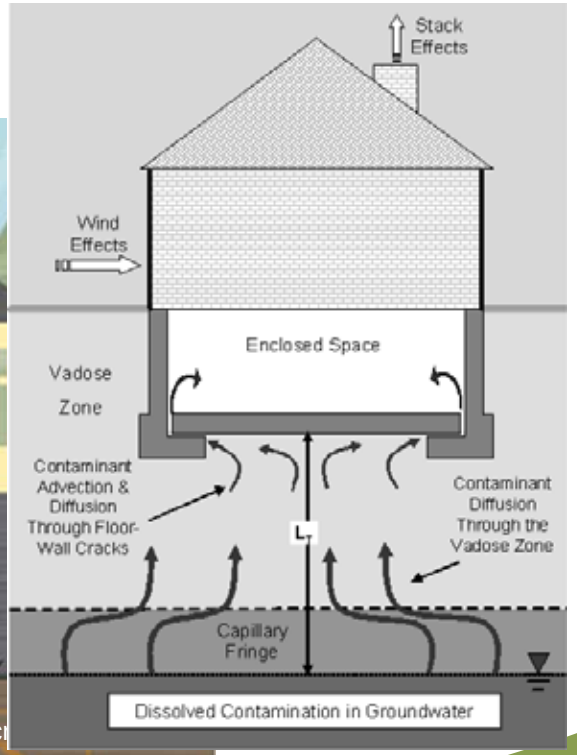


*USEPA, 2012

Vapor Intrusion (VI)
Vapor Source Outside Structure

- Vapor Intrusion (VI) is the process by which chemicals in soil or groundwater migrate to the indoor air





Direct Volatilization

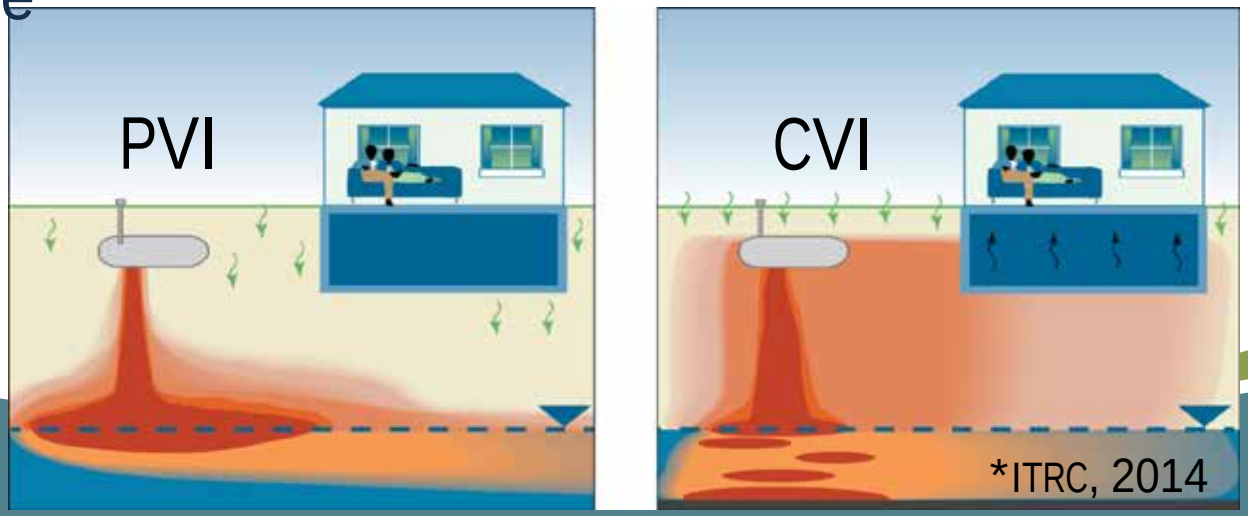
Vapor Source Inside Structure

- Hazardous substances that based on their location will volatilize directly into the structure without migrating through soil

Petroleum vs. Chlorinated Vapor Intrusion

PVI vs. CVI

- Both are types of VI
  - Petroleum vapor intrusion (PVI) is a subset of VI that deals exclusively with releases from a petroleum source
  - Chlorinated vapor intrusion (CVI) is a subset of VI that deals with chlorinated hydrocarbons and includes mixed releases that may also contain a petroleum source

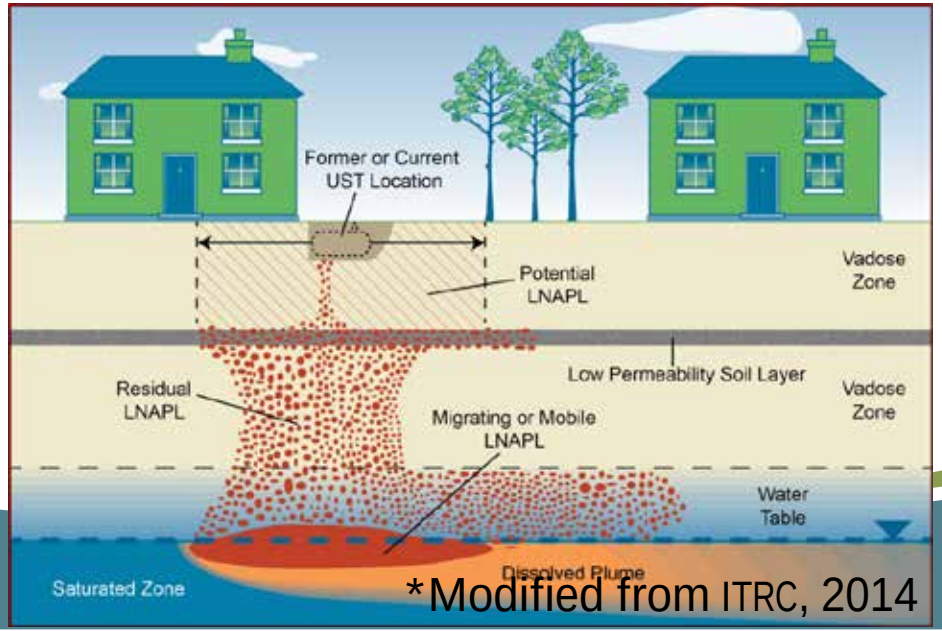


Part 213, the Risk-Based Corrective Action (RBCA) Process and the VIAP

- Assessing the VIAP will likely impact:
  - How you categorize a site
  - Where or how you allocate resources
  - The level and urgency of response required at a site

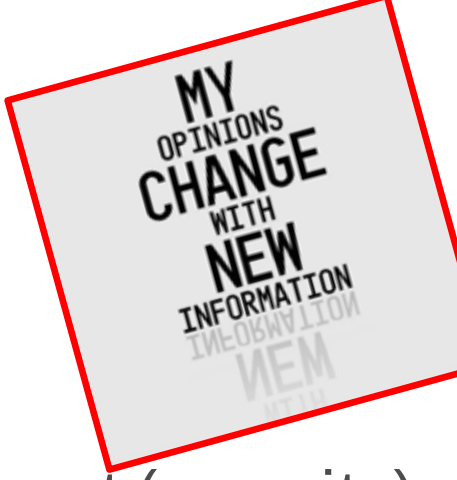
Part 213, RBCA, and the VIAP
Conceptual Site Model

- RBCA is incorporated in Part 213
  - Sec. 21303(g)
- Part 213 requires a conceptual site model (CSM)
  - Sec. 21303(g)/ASTM E 2531-06
- CSMs are considered a critical element for assessing the VIAP

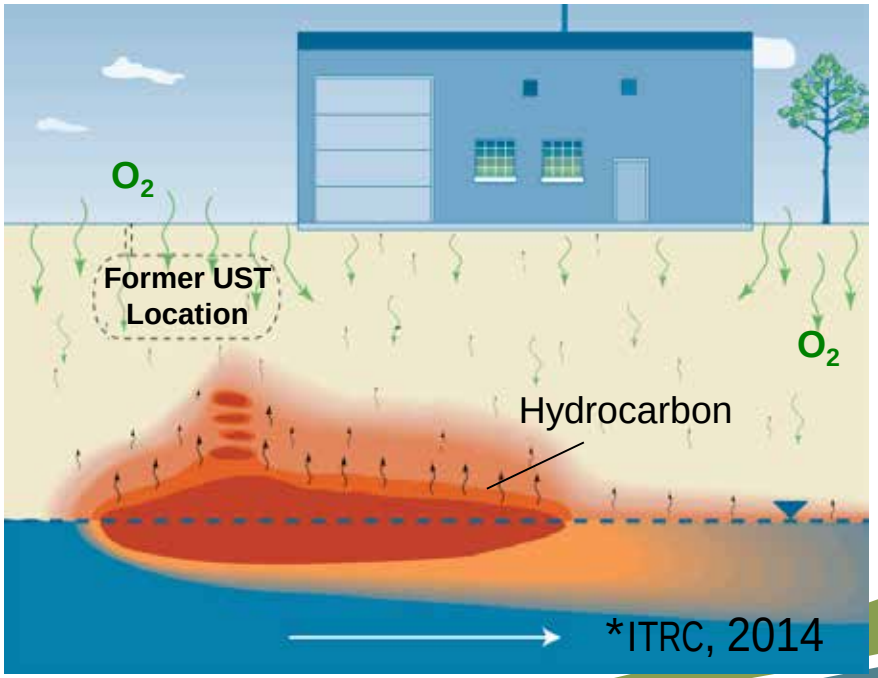


*Modified from ITRC, 2014

Conceptual Site Model
CSM



- Preliminary CSM based on available data
  - Pre-existing data (existing site)
  - Data collected during an initial site assessment (new site)
- Gather sufficient info on:
  - Sources
  - Pathways
  - Receptors
- Identify gaps in the
  - Data
  - Update as necessary



Part 213, RBCA, and the VIAP
Need to Immediately Address Vapor Hazards

- Sec 21307 requires the owner or operator that is liable identify and mitigate immediate fire, explosion hazards, and acute vapor hazards
  - Hazard needs to be mitigated, confirmation of the risk is not required
- Sec. 21326(1)(b) requires past or present contents of the underground storage tank system
  - Contents of petroleum are known to contain short term hazardous substances like toluene and ethanol

Part 213, RBCA, and the VIAP

Need to Immediately Address Vapor Hazards

- Focus must be the mitigation of the potential exposure to the acute vapor hazard
  - Mitigation may include measures to minimize exposures or the contamination may be remediated
- Additional assessment and/or long-term remediation may be proposed after the hazard is mitigated
  - Additional assessment (not mitigation or remediation) may not be good cause for an extension
- More information will follow

Recommended Parameters

Sec. 21326(1)(b)

Appendix B

Recommended Parameters For Common Petroleum Products

Parameters	Leaded Gasoline[1]	Unleaded Gasoline[2]	Petro. Solv[3]	Light Distillate Oils[4]	Residual Oils[5]	Used Motor	Waste Oils[7]	Unknown
BTEX	X	X	X	X		X	X	X
Trimethylbenzene Isomers (TMB)[8]	X	X	X	X	X	X	X	X
MTBE		X						X
1,2-Dibromoethane[1] (ethylene dibromide)	X					X	X	X
1,2-Dichloroethane[1]	X					X	X	X
PNAs[9]			X	X	X	X		X
Naphthalene/ 2-methylnaphthalene	X	X						X
Cadmium[10]						X	X	X
Chromium[10]						X	X	X
Lead[10]	X					X	X	X
Volatile Halocarbons[11]						X	X	X
PCBs							X	X
Diesel Range Organics (DRO)[12]			X	X	X	X	X	X
Gasoline Range Organics (GRO)[12]	X	X	X					X
Oil Range Organics (ORO)[12]					X	X	X	X

Application of Target Detection Limits and Designated Analytical Methods

Remediation and Redevelopment Division Resource Materials

*Under Evaluation

Unacceptable Risks Associated with the VIAP

- Typically unavoidable and involuntary (inhalation)
- High “intake” rates lead to low acceptable levels
  - 20,000 L/day of air compared to 2 L/day of water
- Typically below odor thresholds
  - Benzene – 1,000x less
  - TCE – 2,500x less
- Low concentrations in soil and groundwater may pose a risk
- Risk level is established by statute across all pathway at 10-5 and hazard quotient of 1

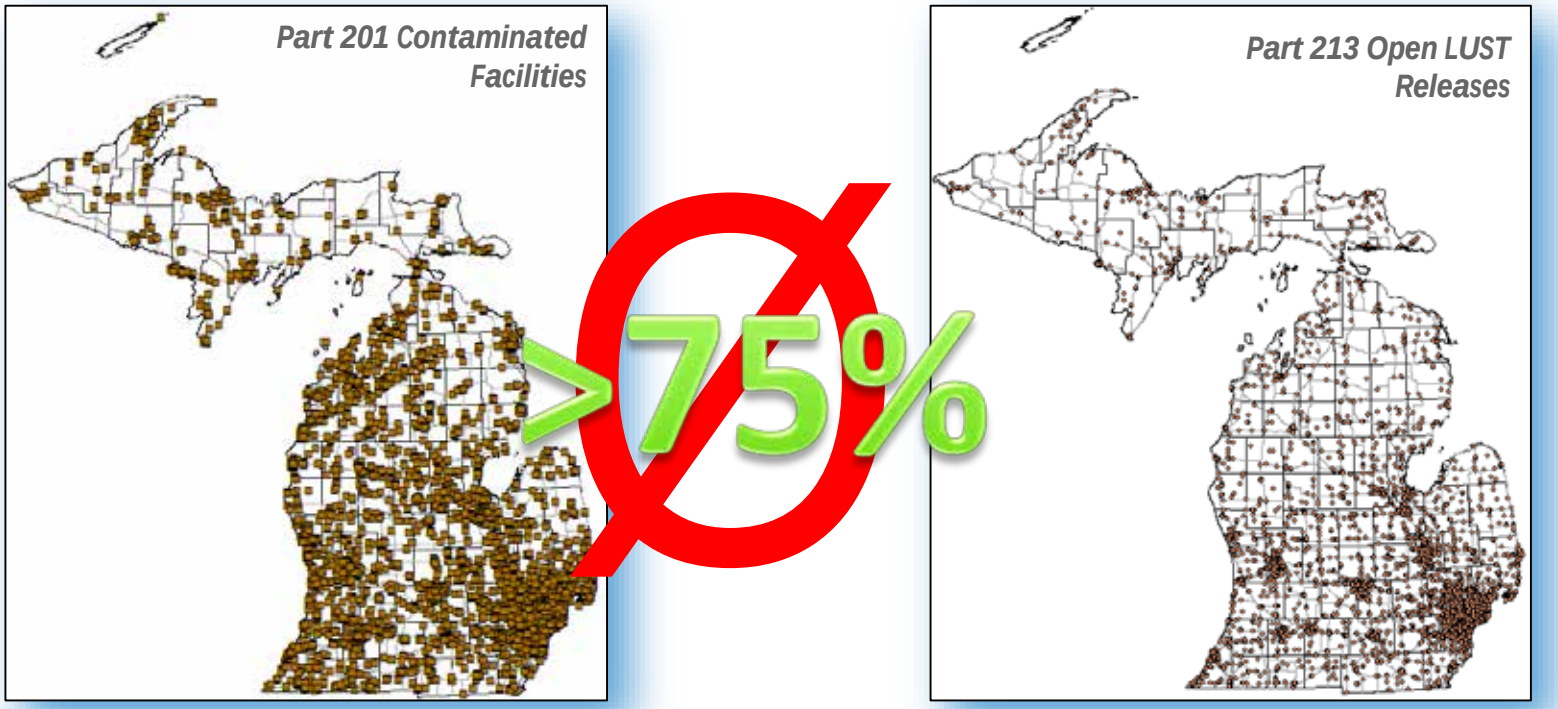
Documented Risks to the VIAP

- Documented risks are most often commonly associated with:
  - Nonaqueous Phase Liquids (NAPL) close to a structure
  - Preferential pathway that directly connects a vapor source to a structure
  - Dissolved petroleum source within 5’ of a structure
  - NAPL or a dissolved source of petroleum directly in contact or within a structure

What Criteria Do I Use?
VIAP

- Risk Based Screening Levels (RBSLs)
- Key Assumptions in the Development of RBSLs
  - Groundwater (R 299.14)
    - Water table is greater than 3 meters below ground surface
    - Concrete block or poured concrete floor and walls
    - Presence of a sump not isolated from the soil
  - Soil (R 299.24)
    - Concrete block or poured concrete floor and walls
    - Presence of a sump not isolated from the soil
  - Development of the RBSLS does not account for the presence of NAPL

Application of RBSLs



Application limiting factors:

- Depth to groundwater < 3m
- Presence of a sump
- Presence of NAPL
- Building construction

What Criteria Do I Use?

RBSLs use when NAPL is present

- Total petroleum hydrocarbons (TPH), gasoline range organics (GRO), diesel range organics (DRO), and/or oil range organics (ORO), can be used to estimate the degree of NAPL saturation
  - NAPL Not Present
    - Gasoline – GRO ≤ 250 mg/kg in the soil
    - Diesel – DRO ≤ 250 mg/kg in the soil
- Generic RBSLs for the VIAP may be used when:
  - The site has been appropriately characterized
  - Gasoline – GRO ≤ 350 mg/kg in the soil
  - Diesel – DRO ≤ 500 mg/kg in the soil

What Criteria Do I Use?

VIAP

- For more information on NAPL or ways NAPL can be identified please see:
  - June 2014 Non-Aqueous Phase Liquid (NAPL) Characterization, Remediation, and Management for Petroleum Releases
  - Available at: https://www.michigan.gov/documents/deq/deq-rrd-NAPLResourceDocument_464472_7.pdf

What Criteria Do I Use?
Site-Specific Target Level (SSTL)

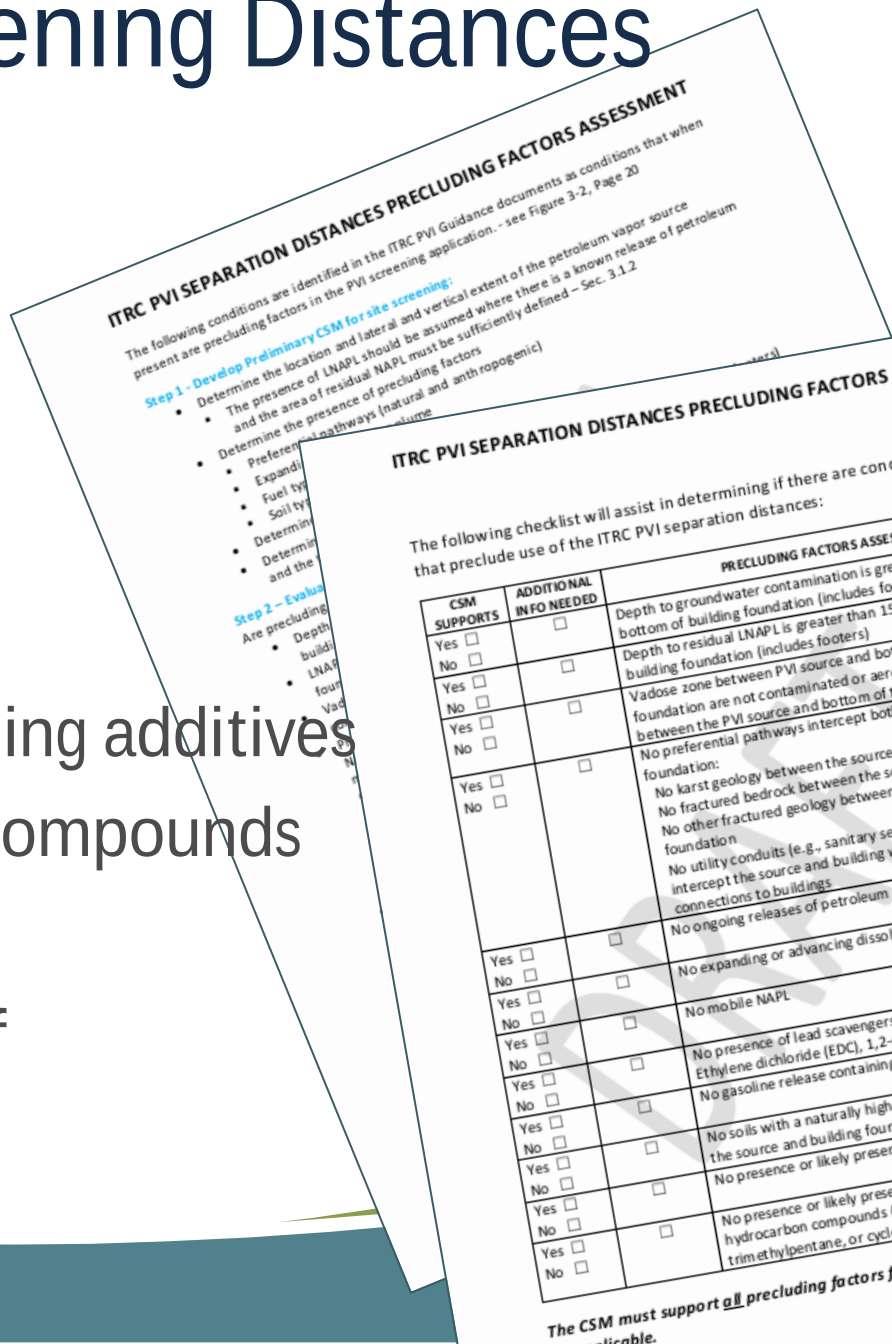
- SSTL – Restricted and Unrestricted
- Concentrations below an *unrestricted residential* criteria is not a source of vapors
- SSTLs are required under statute to be developed by the party proposing the response action!
  - Party may elect to use or propose their own
  - EGLE has been assisting in their development
  - All SSTLs must be approved by EGLE
- EGLE's SSTLs are for soil, groundwater and vapor
  - Party must demonstrate compliance with all 3 media

What Criteria Do I Use?
What's on the horizon for SSTLs

- Under Part 213 EGLE can only review a FAR or a CAP
  - No way to get preapproval of SSTLs
- Working on a process to get SSTLs
  - Will realign with Part 213 and allow for the values to be audited in a FAR or CAP
  - On-line calculator will identify the values for a party
  - The submitted FAR and CAP will contain the information necessary to support the values and to complete the audit

Use of ITRC's Screening Distances

- Limiting factors
  - On-going releases
  - Mobile NAPL
  - Depth to groundwater
  - Preferential pathways
  - Presence of non-biodegrading additives
  - …Presence of chlorinated compounds
  - More…
- Checklist distributed to staff


ITRC PVI SEPARATION DISTANCES PRECLUDING FACTORS ASSESSMENT

The following conditions are identified in the ITRC PVI Guidance documents as conditions that when present are precluding factors in the PVI screening application. - see Figure 3-2, Page 20

Step 1 - Develop Preliminary CSM for site screening:

- Determine the location and lateral and vertical extent of the petroleum vapor source and the area of residual NAPL should be assumed where there is a known release of petroleum
- Determine the presence of residual NAPL must be sufficiently defined – Sec. 3.1.2
- Preferential pathways (natural and anthropogenic)
- Expandi
- Fuel typ
- Soil typ
- Determin
- Determin and the

Step 2 – Evalua

Are precluding

- Depth
- build
- LNAP
- four
- Vad

ITRC PVI SEPARATION DISTANCES PRECLUDING FACTORS

The following checklist will assist in determining if there are con
that preclude use of the ITRC PVI separation distances:

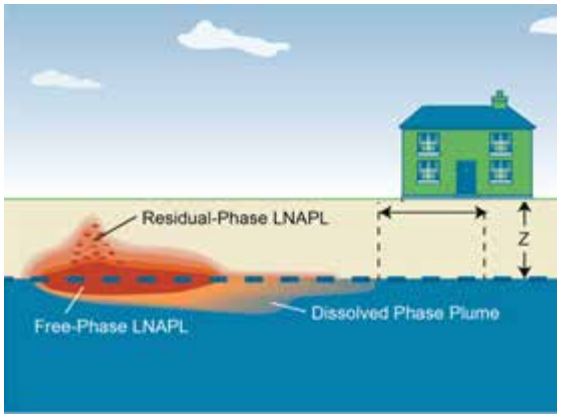
CSM SUPPORTS	ADDITIONAL INFO NEEDED	PRECLUDING FACTORS ASSE
Yes ☐ No ☐	☐	Depth to groundwater contamination is gre bottom of building foundation (includes fo
Yes ☐ No ☐	☐	Depth to residual LNAPL is greater than 15 building foundation (includes footers)
Yes ☐ No ☐	☐	Vadose zone between PVI source and bo foundation are not contaminated or aer between the PVI source and bottom of
Yes ☐ No ☐	☐	No preferential pathways intercept bot foundation: No karst geology between the source No fractured bedrock between the s No other fractured geology between foundation No utility conduits (e.g., sanitary se intercept the source and building connections to buildings
Yes ☐ No ☐	☐	No ongoing releases of petroleum
Yes ☐ No ☐	☐	No expanding or advancing dissol
Yes ☐ No ☐	☐	No mobile NAPL
Yes ☐ No ☐	☐	No presence of lead scavengers Ethylene dichloride (EDC), 1,2-
Yes ☐ No ☐	☐	No gasoline release containin
Yes ☐ No ☐	☐	No soils with a naturally high the source and building foun
Yes ☐ No ☐	☐	No presence or likely prese
Yes ☐ No ☐	☐	No presence or likely prese hydrocarbon compounds trimethylpentane, or cycl

The CSM must support all precluding factors

Distance Vapors Will Travel

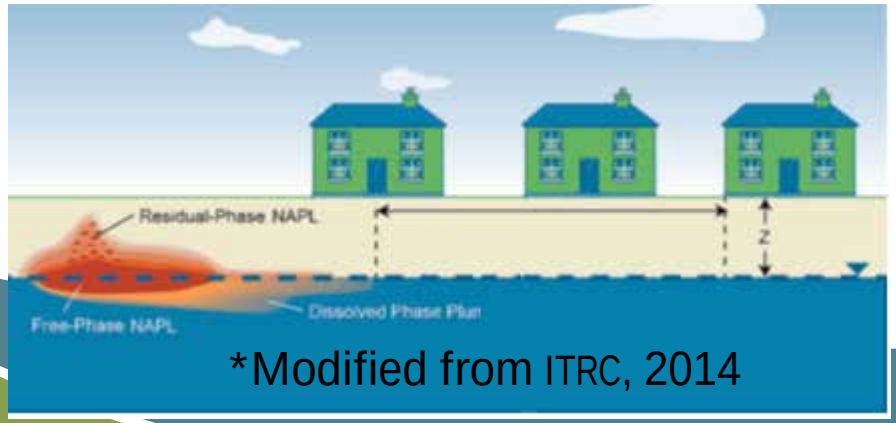
Lateral Inclusion Zone

PVI – 30’



- The horizontal distance beyond a vapor source that may make a property or structure vulnerable to the migration of vapors

CVI – 100’



*Modified from ITRC, 2014

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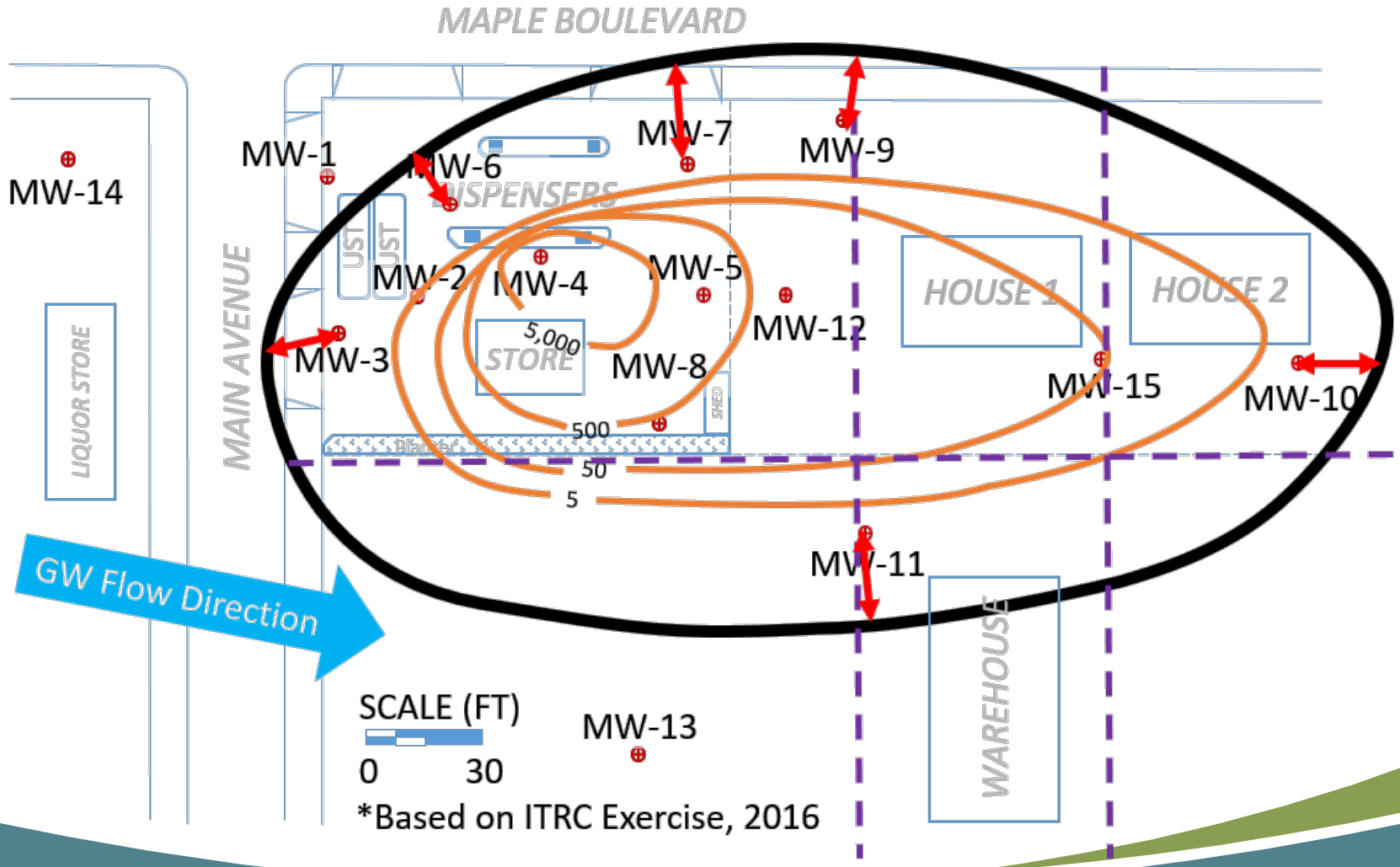
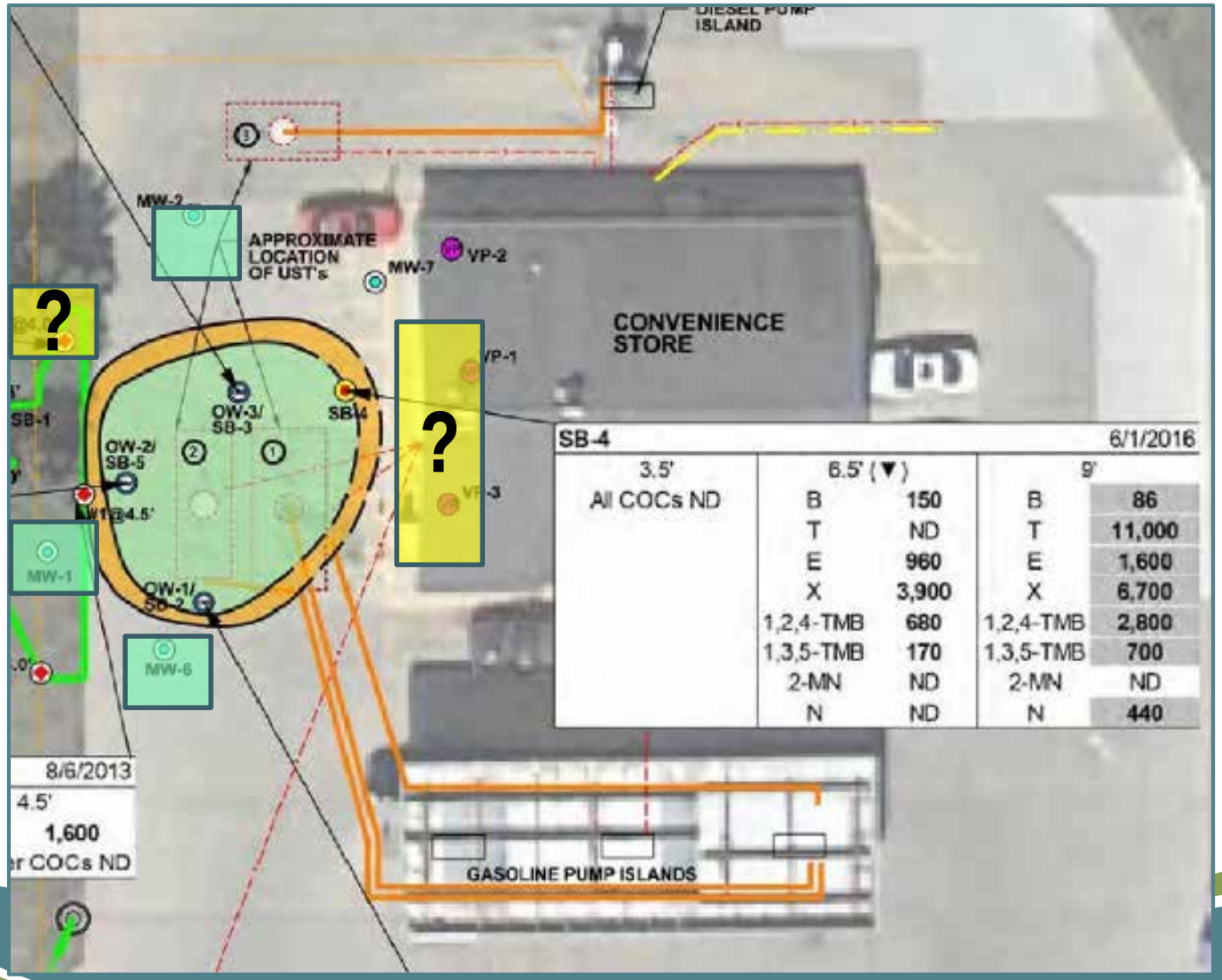
Lateral Inclusion Zone

Appropriate Characterization is Key



Lateral Inclusion Zone

Appropriate Characterization



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Mitigations System's and Closures Under Part 213

- On-going discussions with the AG, MPA and other key stakeholders
- Stay tuned…

VIAP Point of Contact (POCs)

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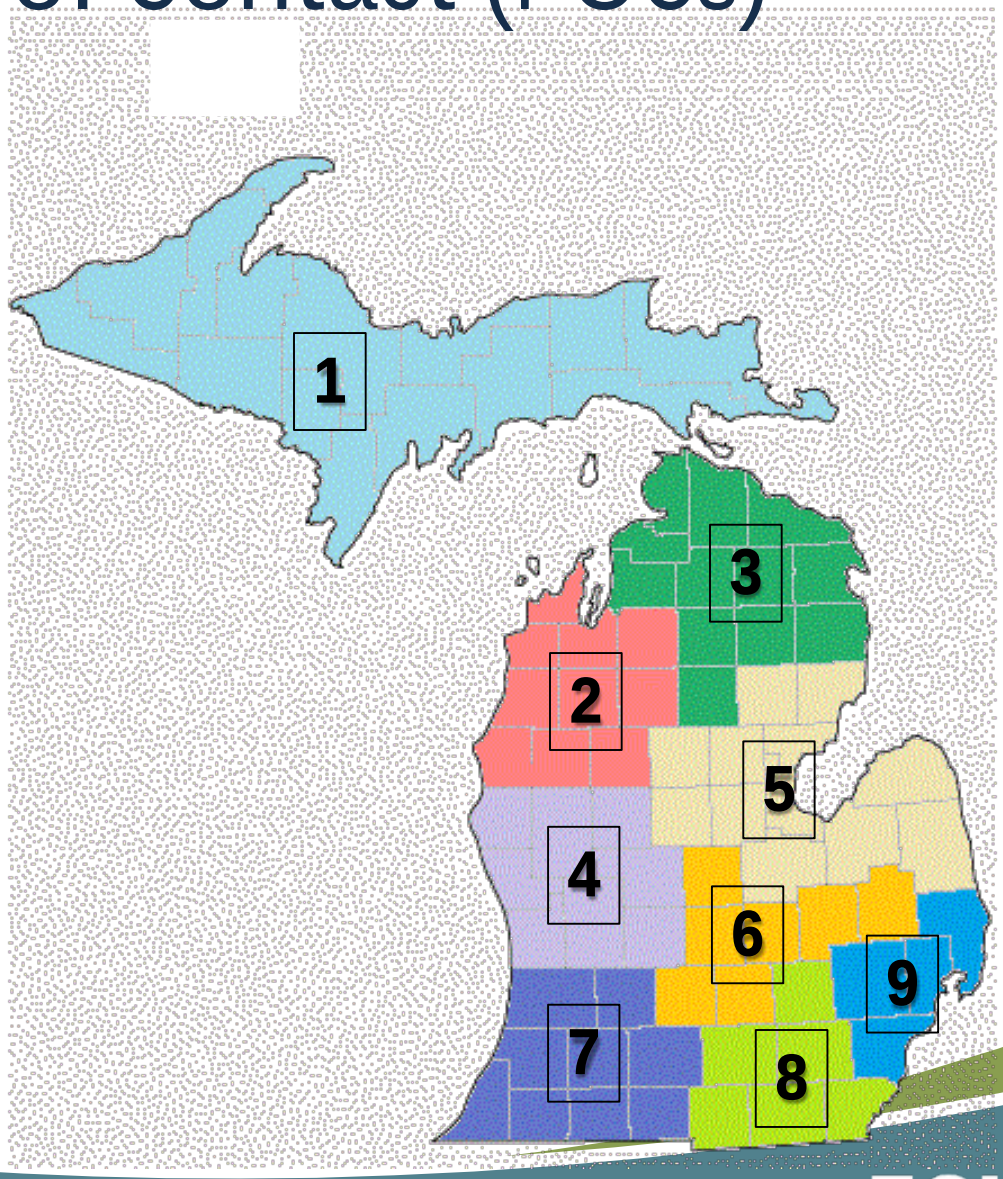

Additional Resources

Technical Resources	
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