Updates to DEQ's Vapor Intrusion Guidance

Listening session focused on Heating Oil Tanks

Conrad Barry, Franziska Landes, Erin McDonnell, Mike Poulsen and Blair Paulik Aguilar

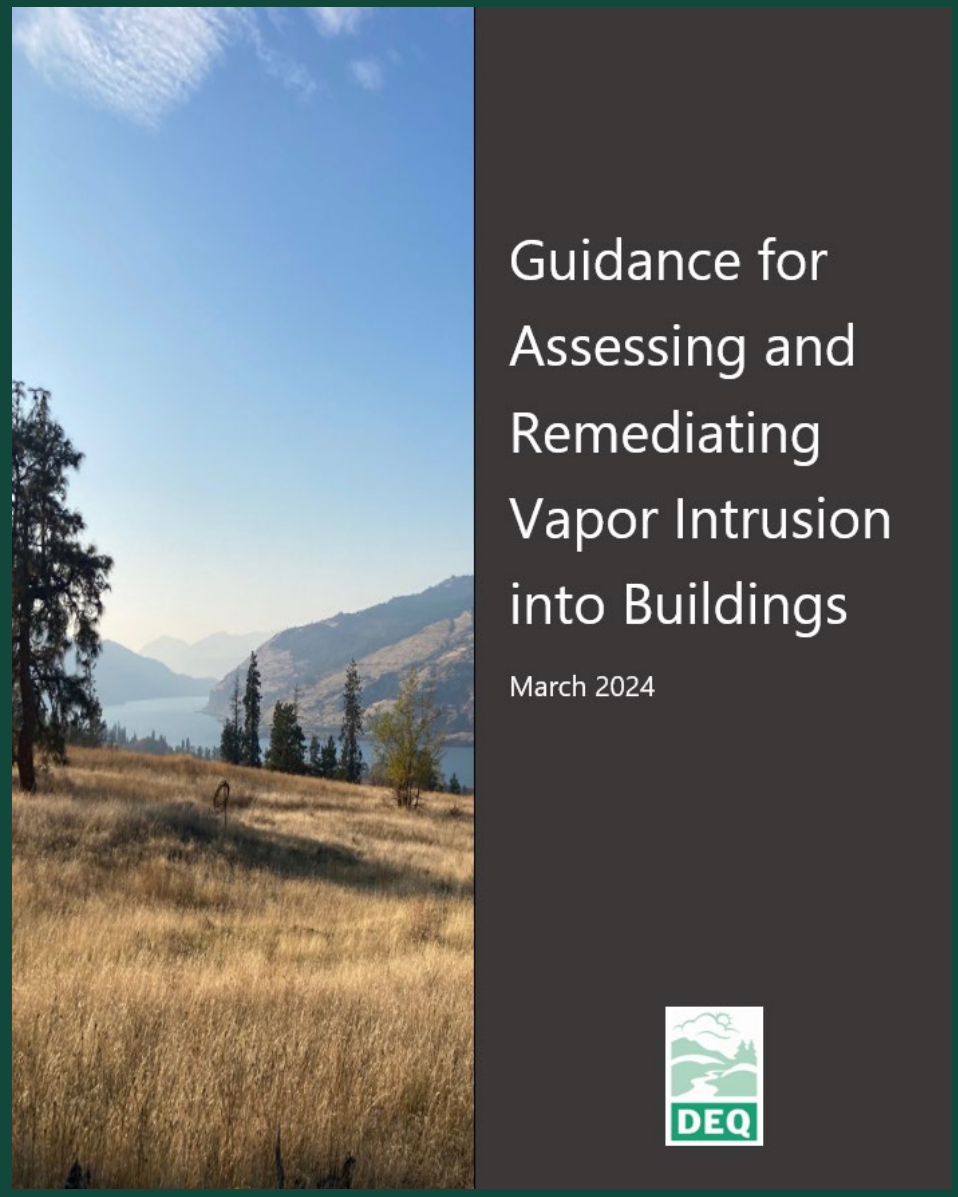
April 11, 2024

Welcome and Introductions

DEQ's mission: to be a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

Presentation Outline

- Housekeeping
- Overview of guidance updates
  - Background
  - HOT updates
  - VI acute and chronic risk-based concentrations (RBCs)
  - Remediation and performance monitoring
  - Public review period & future listening sessions
- Q&A



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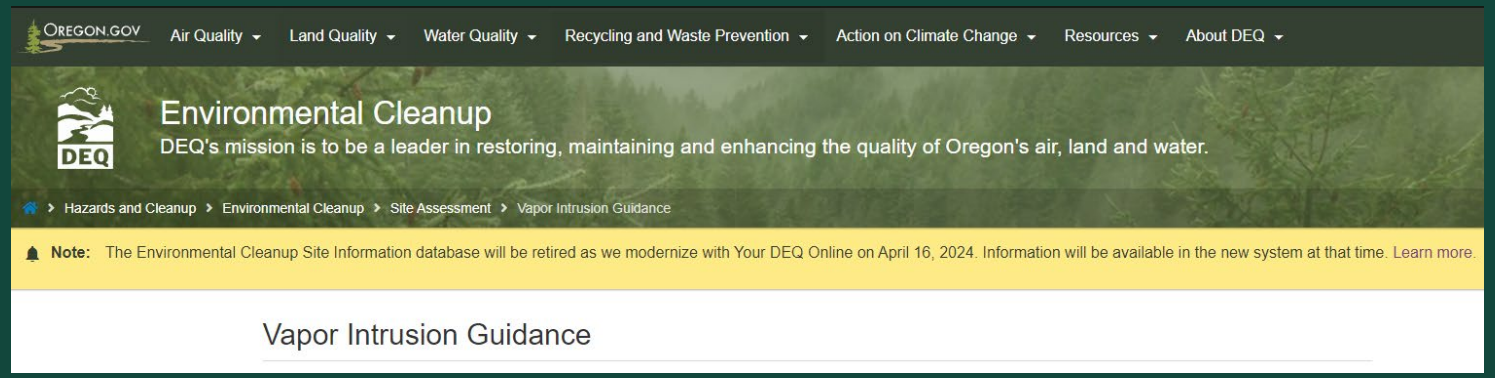
Housekeeping



- Thank you for attending
- Recording today
  - Slides will be posted on our website
  - More listening sessions focused on other groups (April 17th)
- Feedback and questions
  - Share questions in the chat
  - Time at the end today for listening and Q&A
  - To provide input after the presentation today: VIWorkGroup@deq.oregon.gov

Timeline for Final Guidance 2024

- Draft guidance and revised RBCs posted on website March 2024 – for immediate use
- 90-day public review period until May 31, 2024

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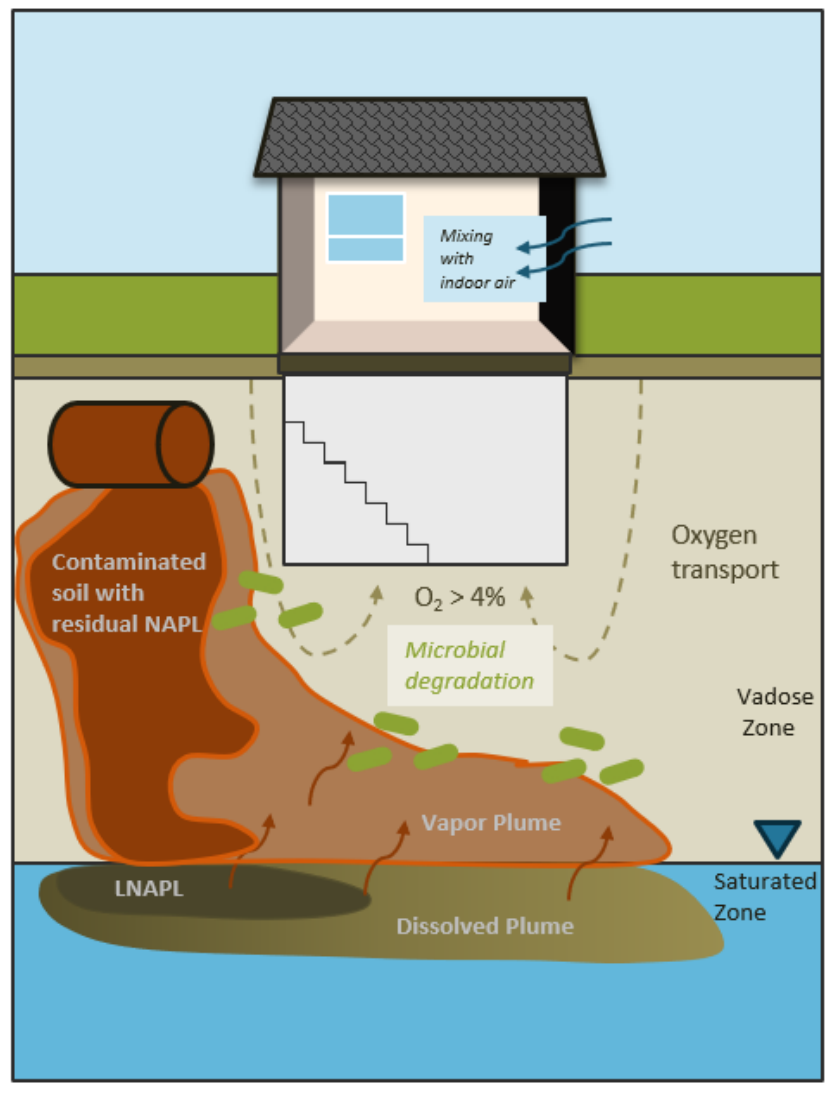
Significance of the VI Pathway



- One of the most commonly complete exposure pathways with building occupants frequently unaware of exposure
- Soil vapor contamination is difficult to reliably contain and is difficult to manage (i.e., inherently more difficult than soil or groundwater contamination)
- High variability in exposure due to seasonal changes and building-specific considerations

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Reasons for Updating Guidance

- Update with latest science since the 2010 VI guidance
- Ensure screening methods and RBCs are adequately protective
  - RBCs updated based on empirical data and derived attenuation factors (AF)
  - Consistent with EPA and other states

Media	Oregon	Washington
Soil Vapor / Soil Gas	33x (0.03)	0.03
Groundwater	1000x (0.001)	0.001

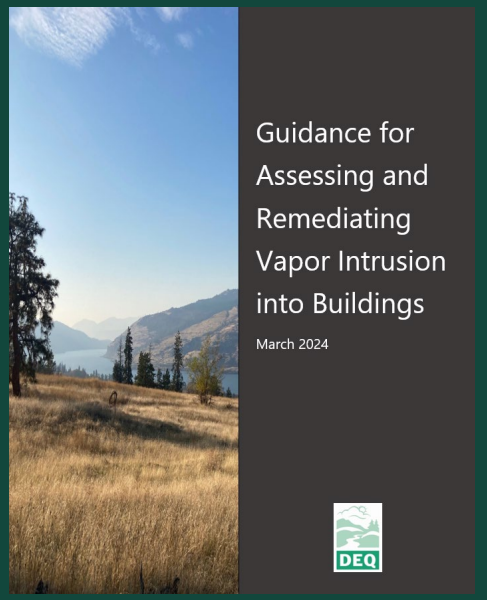
- Soil RBCs for the vapor intrusion pathway eliminated
- Improve quality and consistency of decision making at VI sites

Overview of VI Guidance

1. Introduction
2. VI Conceptual Site Model
3. VI Evaluation Process
   - Separate flow charts for chlorinated VI and petroleum VI
4. VI Sampling and Analysis
5. VI Risk-Based Concentrations
6. VI Remediation and Mitigation
7. Community Engagement

<u>Appendices</u>

A. Response Matrix for Indoor Air
B. Heating Oil Tank Sites
C. Development of RBCs
D. Other Agency Response to TCE
E. Managing Air Discharges from Remedial Systems
F. Engineering Review of VI Mitigation



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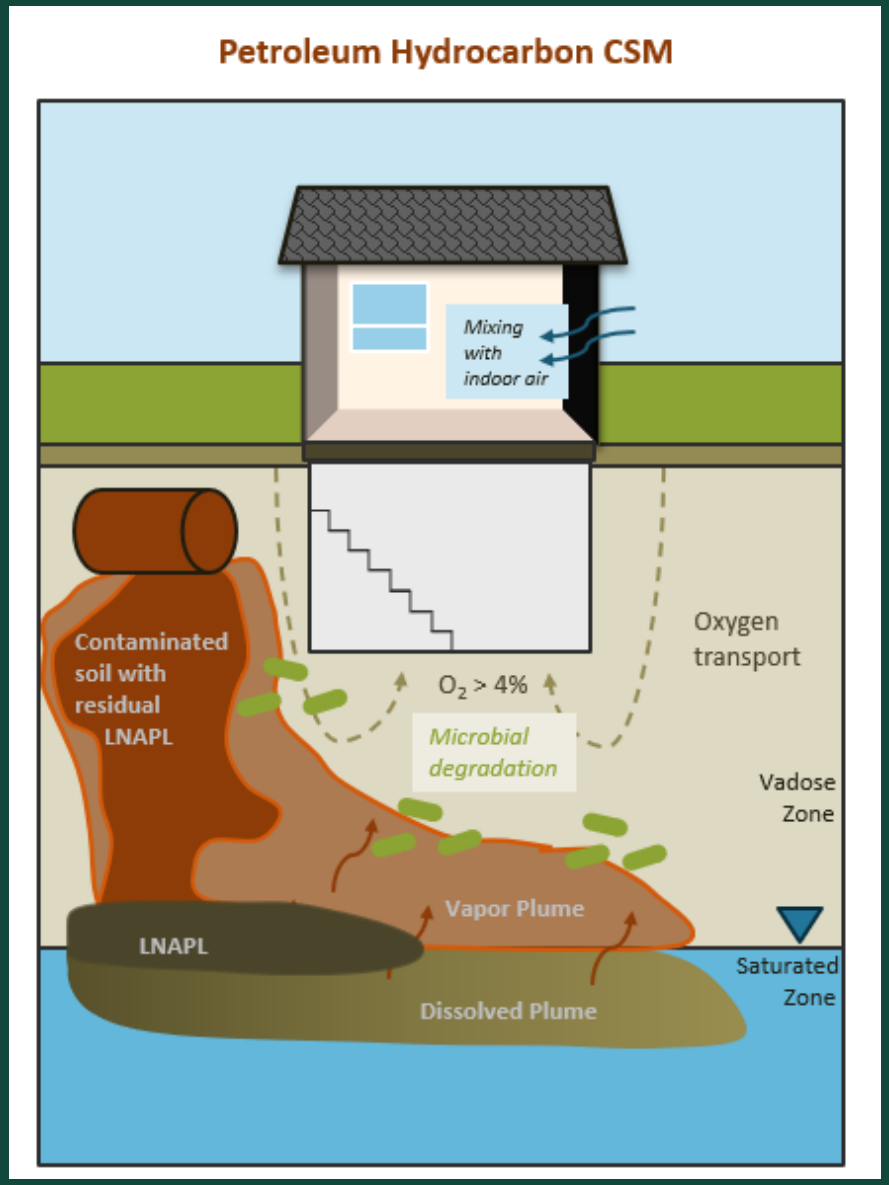
Major Updates impacting HOT sites

Already implemented

- Lower RBCs due to change in Attenuation Factors (AF)
- Updated and expanded RBCs
- Elimination of soil and urban residential RBCs; addition of acute RBCs

In revised VI Guidance

- Response-matrix for indoor air concentrations exceeding RBCs
- Greater emphasis on delineating subsurface vapor plumes
- Descriptions and expectations of mitigation systems and performance monitoring
- Additional tools for investigating VI sites
- Recommendations for community engagement
- Consideration of petroleum biodegradation



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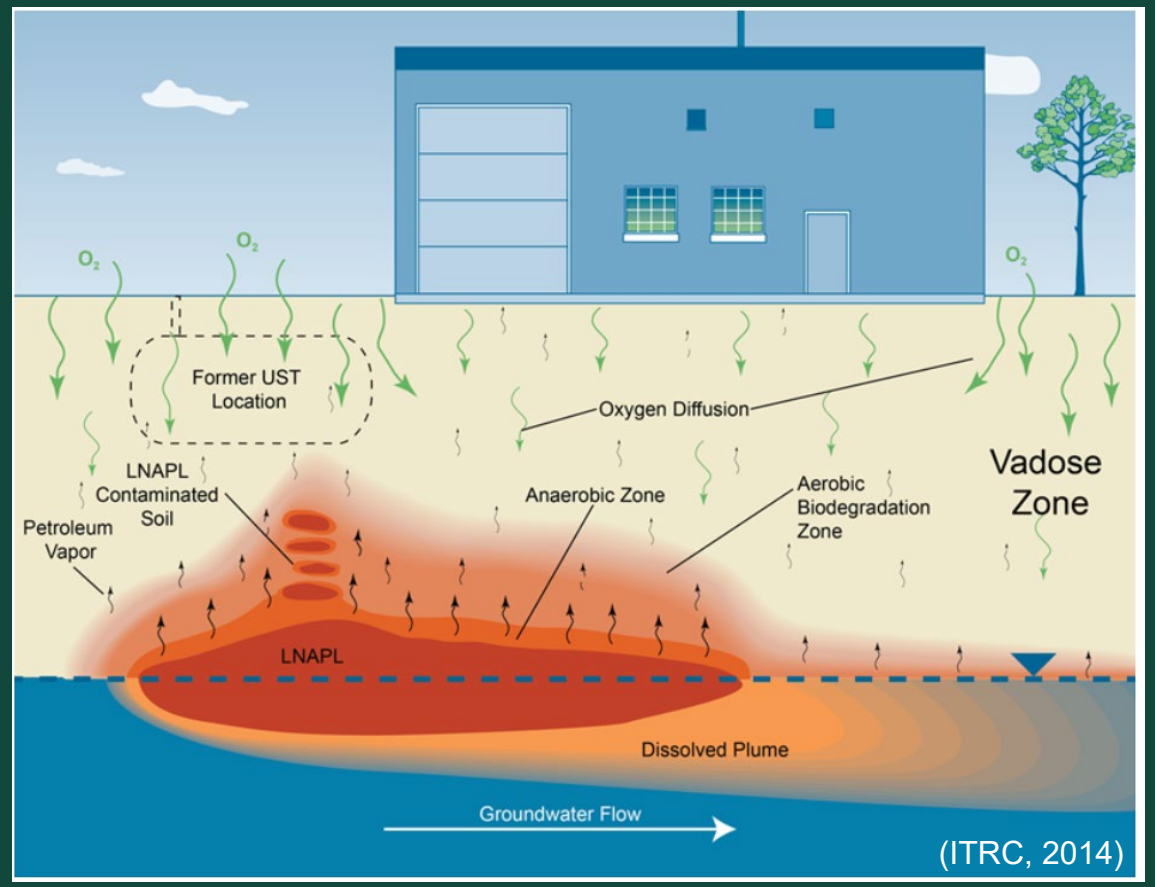
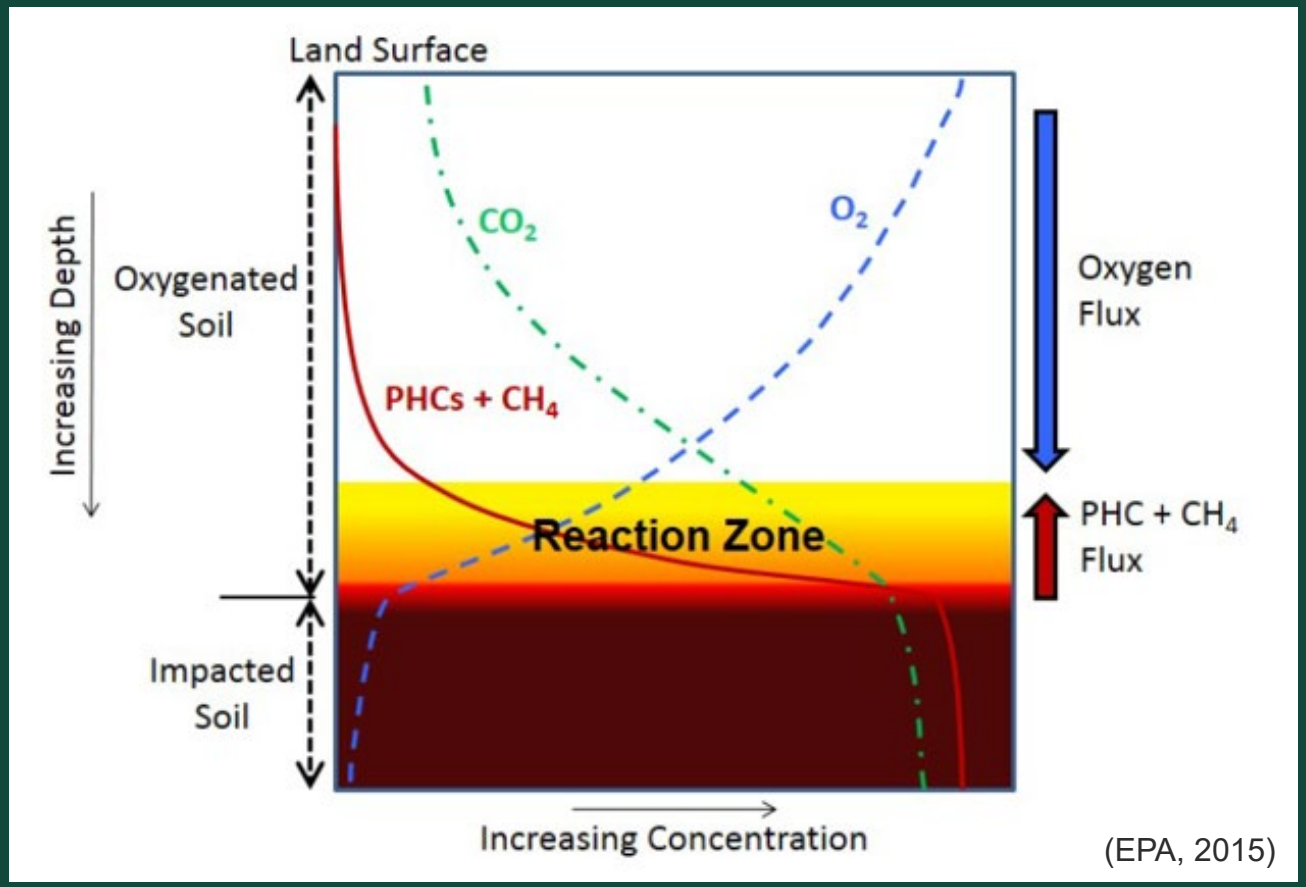
Petroleum hydrocarbon sites



Logging boreholes for conditions conducive to biodegradations



Developing vertical concentration profiles of contaminants and fixed gases (O_2, CO_2, CH_4)

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Soil Data and VI Pathway

Eliminated for VI Risk Screening

- Soil is generally an unreliable indicator of VI Risk due to:
  - Soil heterogeneities and distribution of contamination
  - Sample size/amount
  - Analytical detection limits for chlorinated compounds
  - Biodegradation of total petroleum hydrocarbons (TPH)

Continued Uses

- Delineating source areas to locate soil vapor sampling points
- Characterizing chemical composition of a source
- Evaluating source area treatment and remedial progress
- HOT generic remedy and Soil matrix certifications

Sampling and Analysis (Section 4 main guidance)

- Time, frequency, duration, analytical methods, and QA/QC
- Soil, groundwater, soil vapor sampling
- Indoor air sampling
  - Background sources of VOCs
  - Temporal variability
  - Barometric pressure changes

TO-15
TO-17

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Appendix B: Recommended Assessment Approach at Heating Oil Tanks (HOT) Sites

Table of Contents

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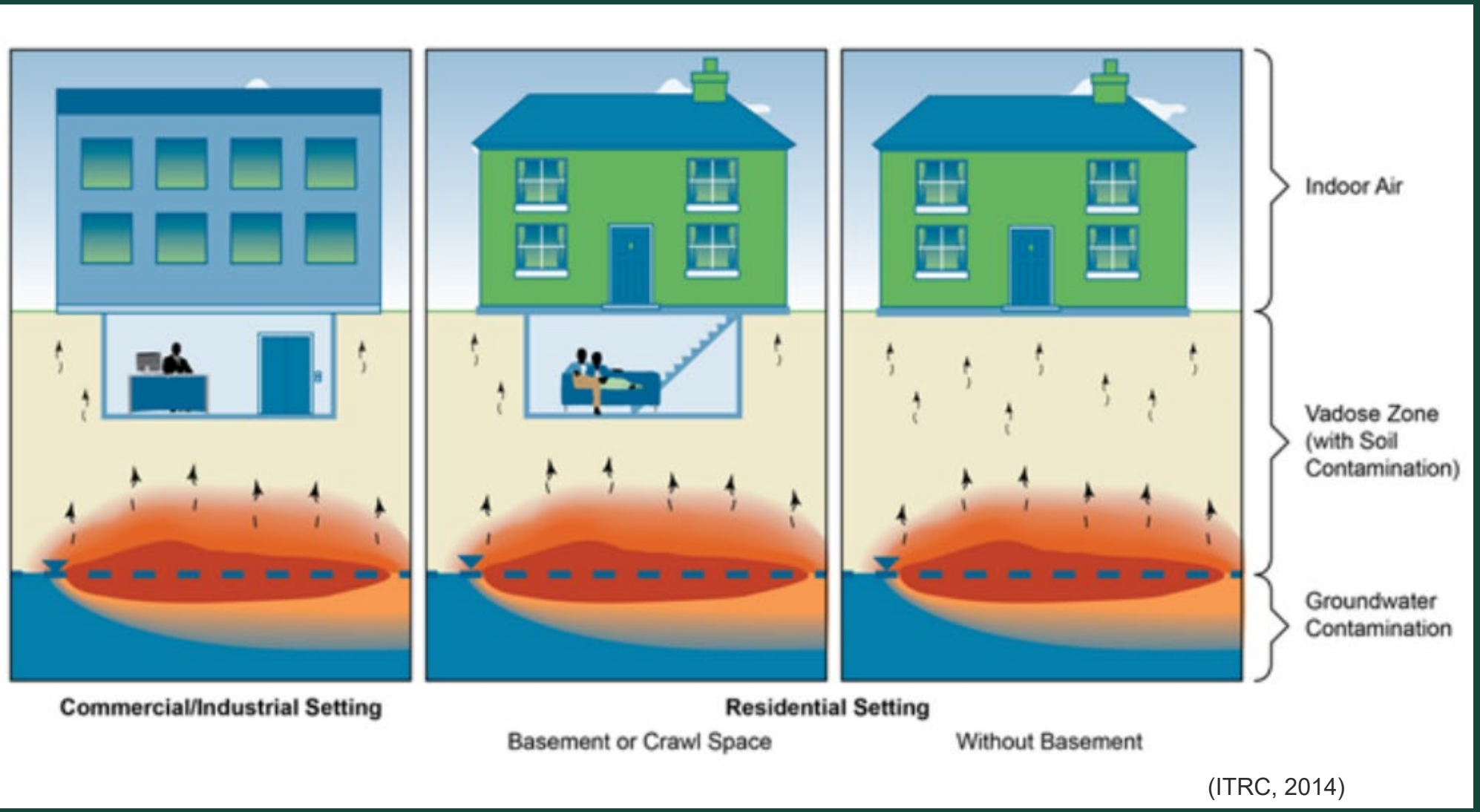
Heating Oil Tank appendix:

Heating Oil Tanks represent sites:

- With well known contamination sources - (diesel); usually not comingled
- With a lower VI risk than other sources (heavier hydrocarbons)
- With residential sources – smaller in volume but closer to the home
- With a soil plume that normally does not extend beneath the entire structure

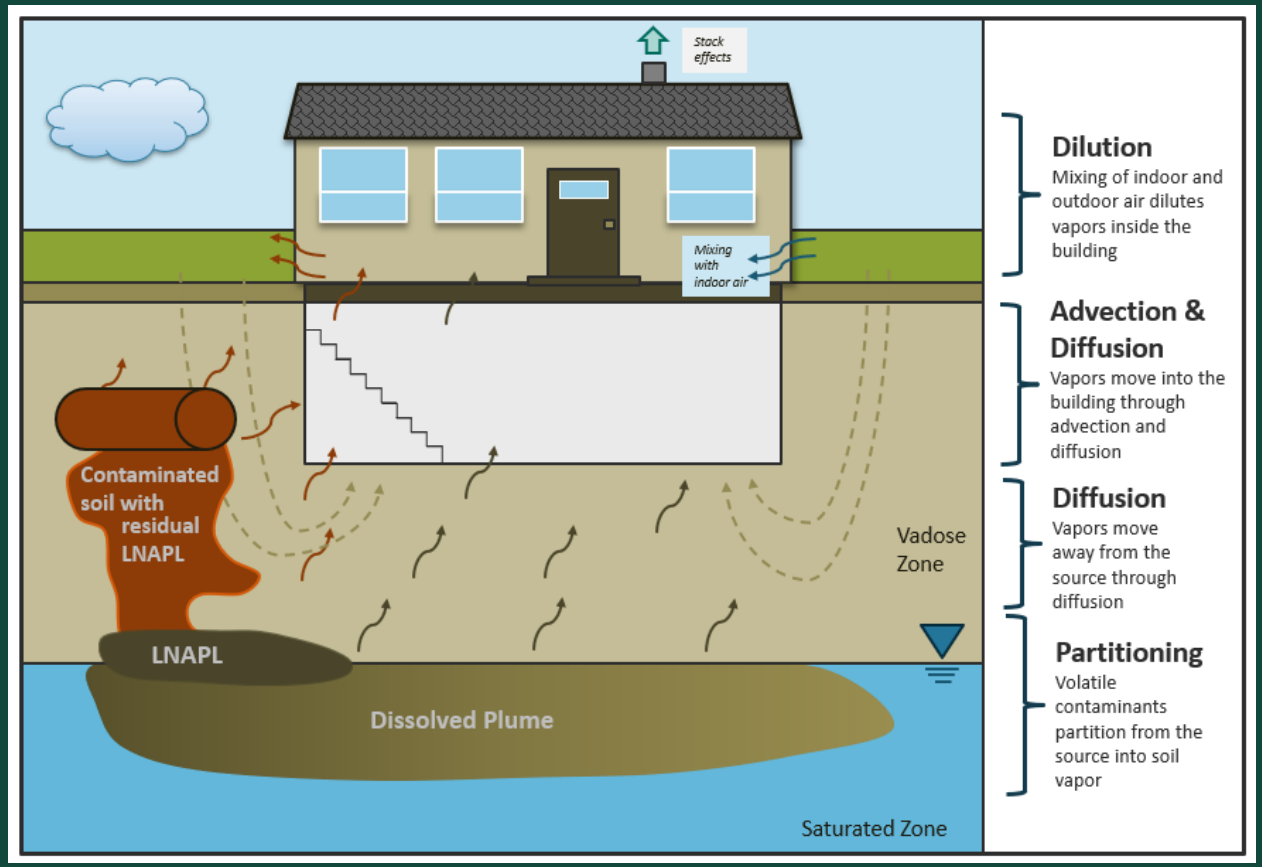
Soil vapor sampling: accounting for standard assumptions



(ITRC, 2014)

Background & Conceptual Site Models

- VI Conceptual Site Model – narrative and graphical with refinement
- Should include:
  - Site figure with building, tank, distance and basement depth
  - Location and depths of underground utilities / preferential pathways
  - Location and depth of samples
  - The extent of the contaminated soil (TPH Dx > 500 ppm)
  - The extent of contaminated groundwater, if present; and
  - A summary of key laboratory results at each sample location



Note: “soil vapor” = sub-slab and soil gas

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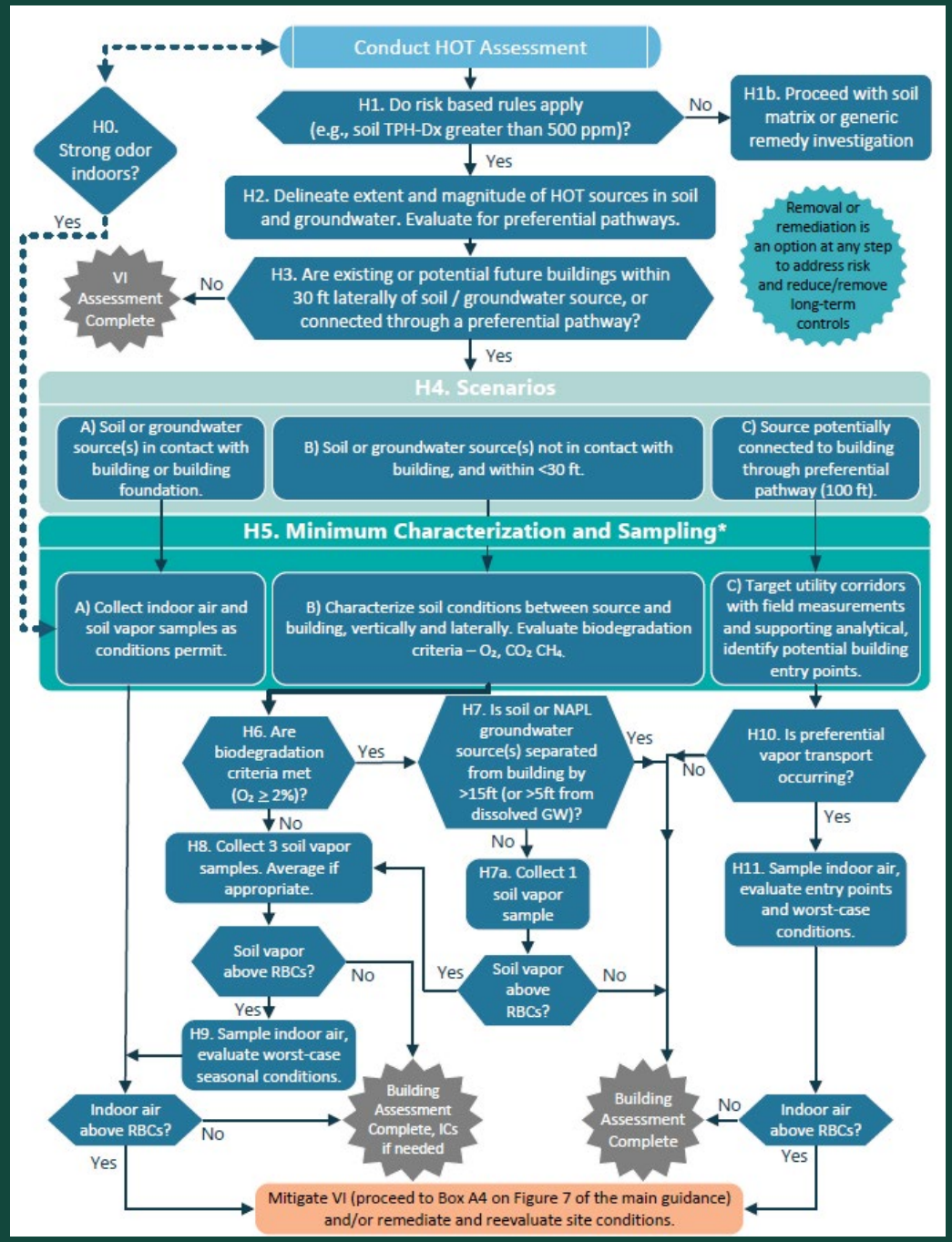
B.3 Heating Oil Tank Vapor Intrusion Evaluation Process



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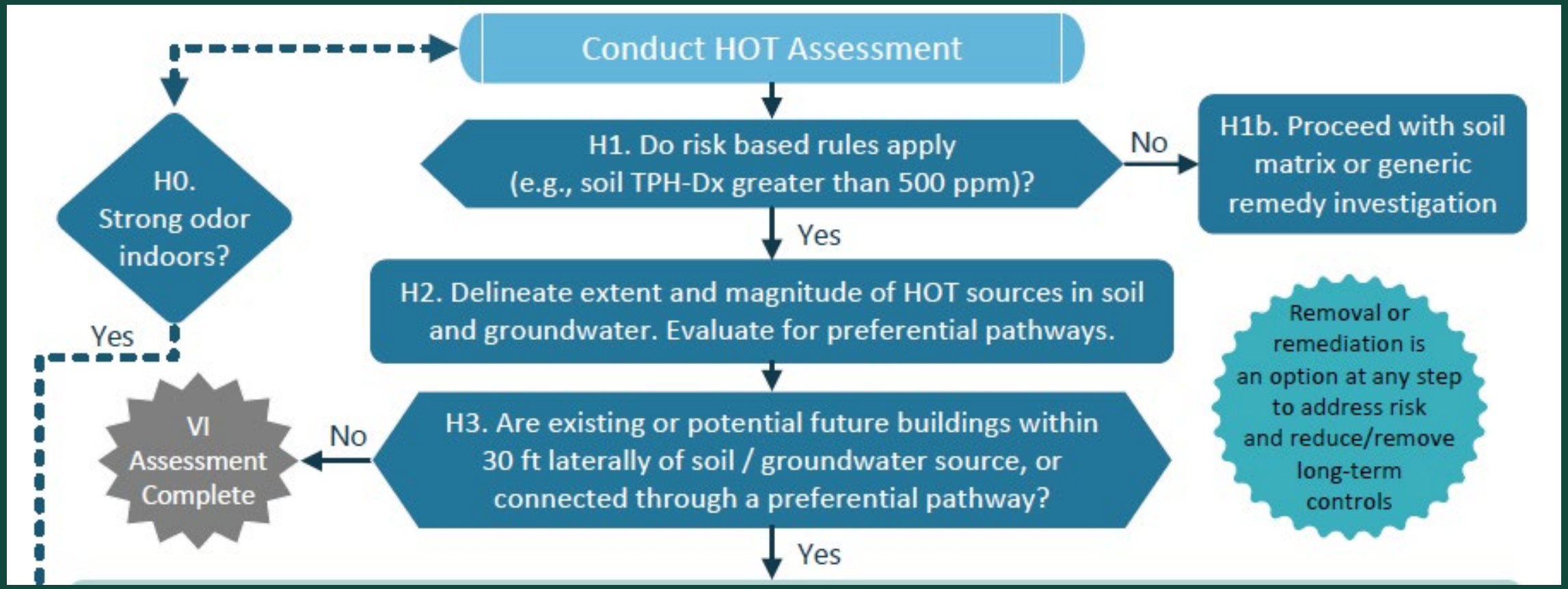
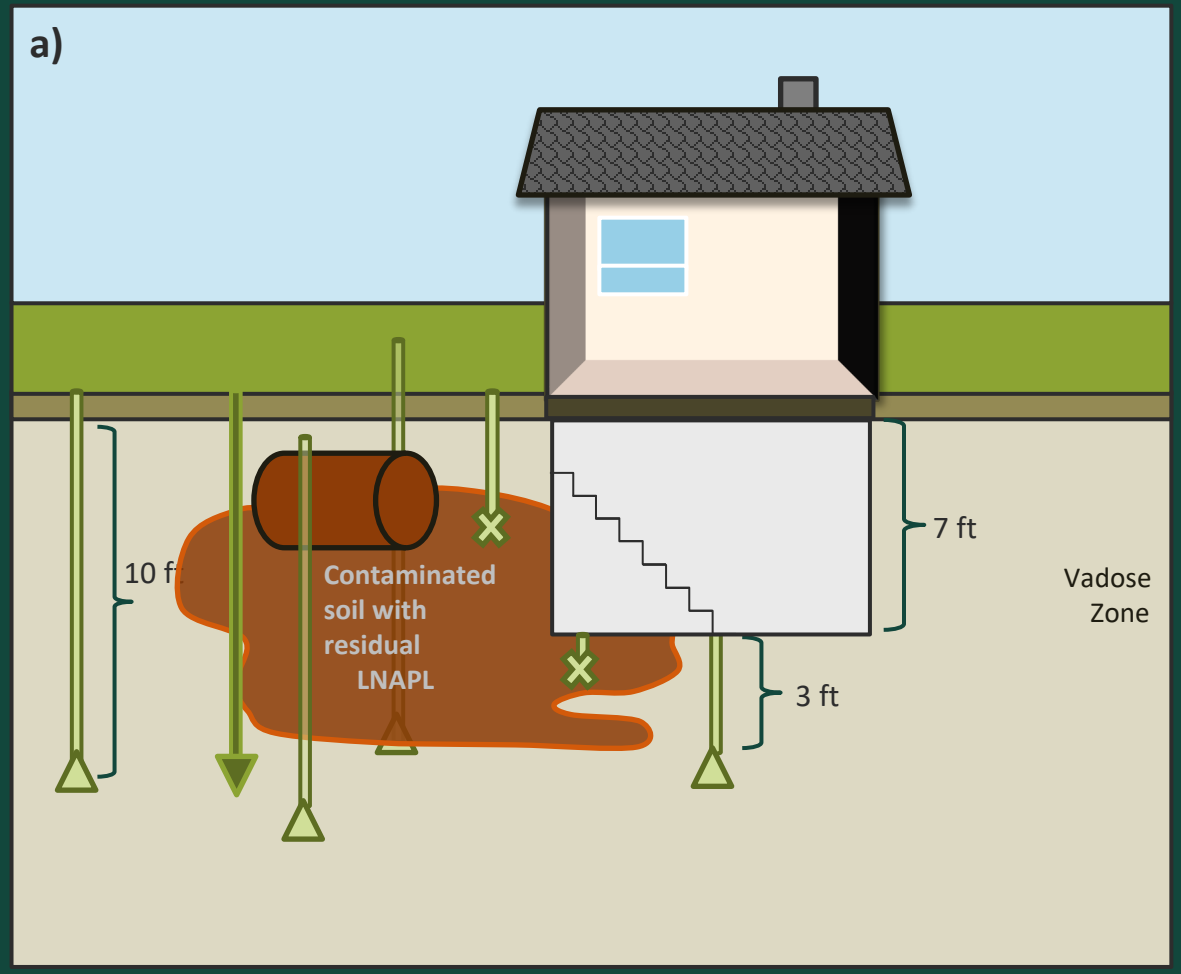
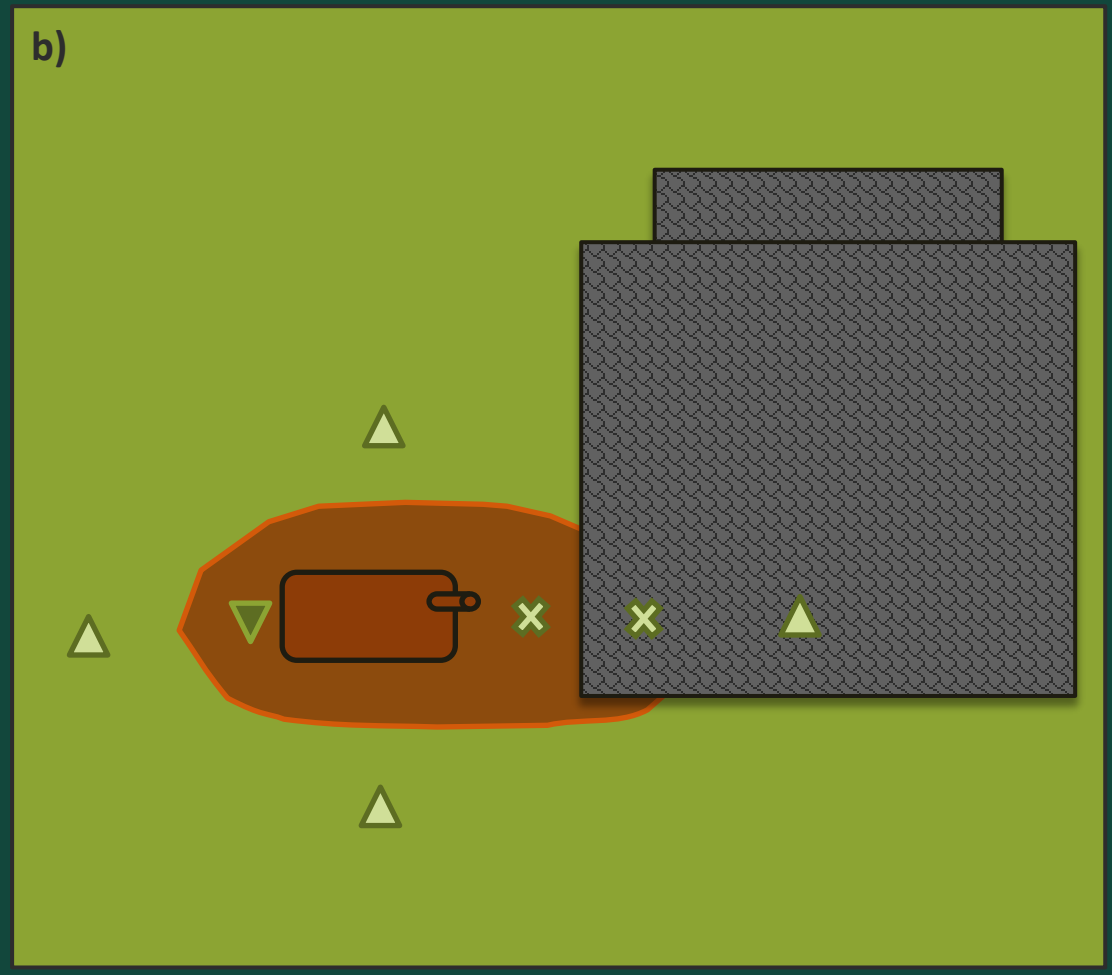


H2. Delineate extent and magnitude of HOT sources in soil and groundwater





Lateral Delineation
Vertical Delineation
Soil sample for lateral delineation
Soil sample for vertical delineation
Boring location that encountered soil visibly contaminated or strong odor

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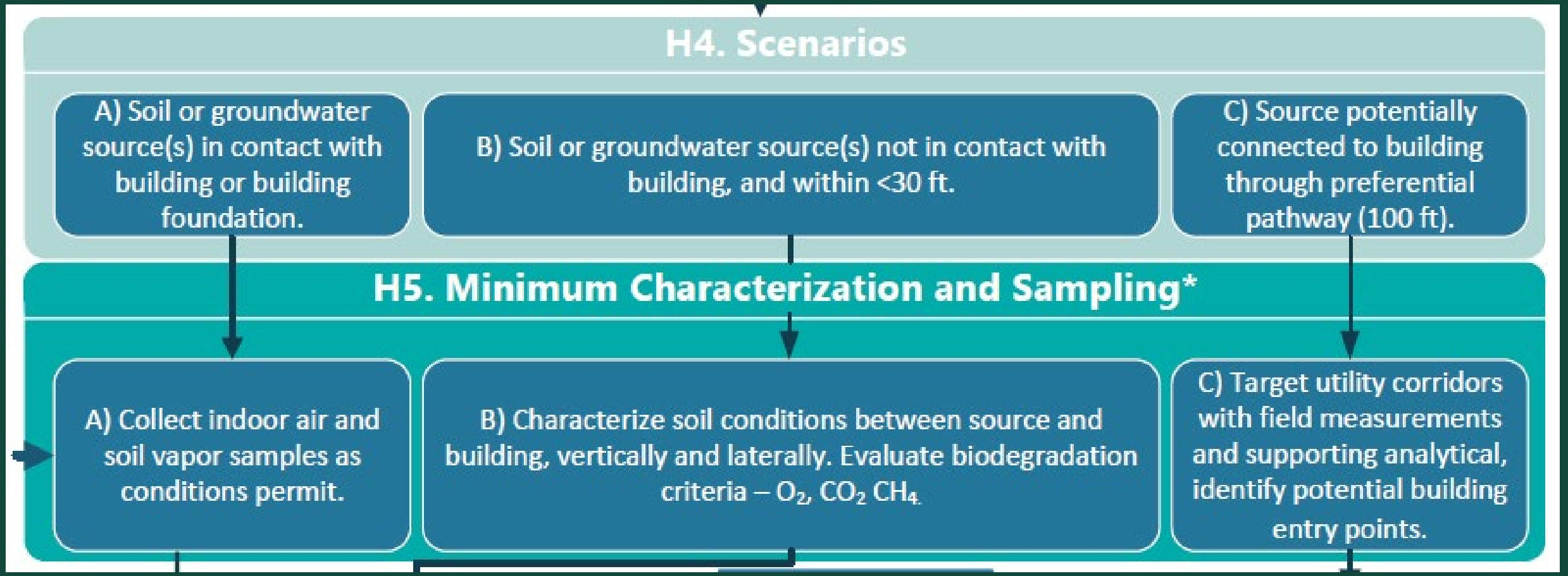

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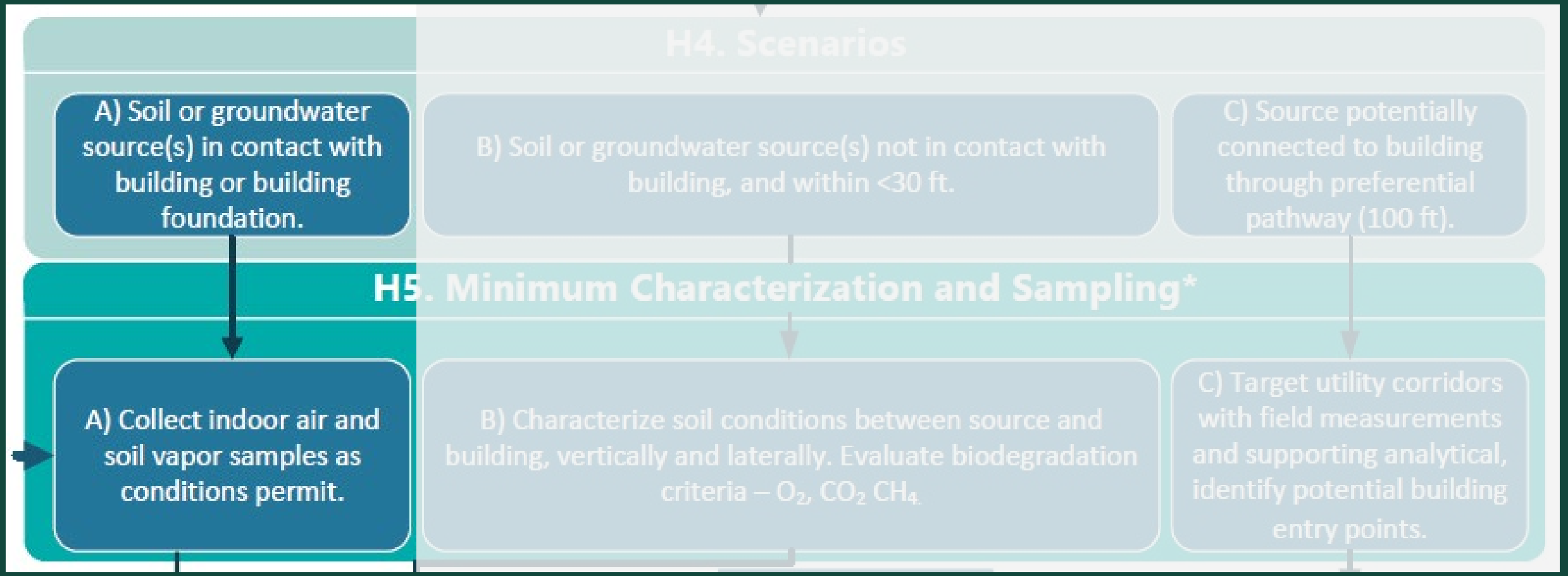
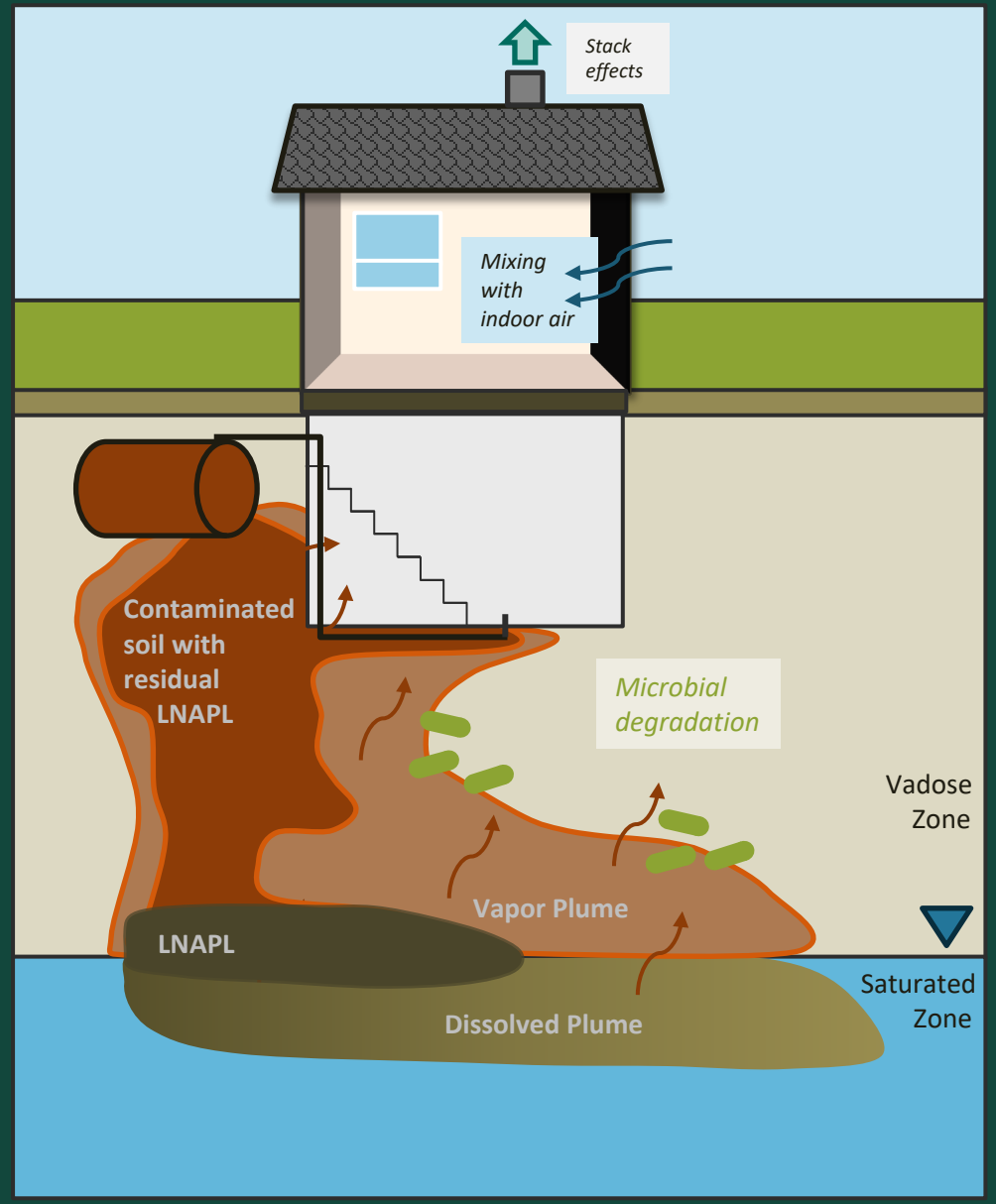


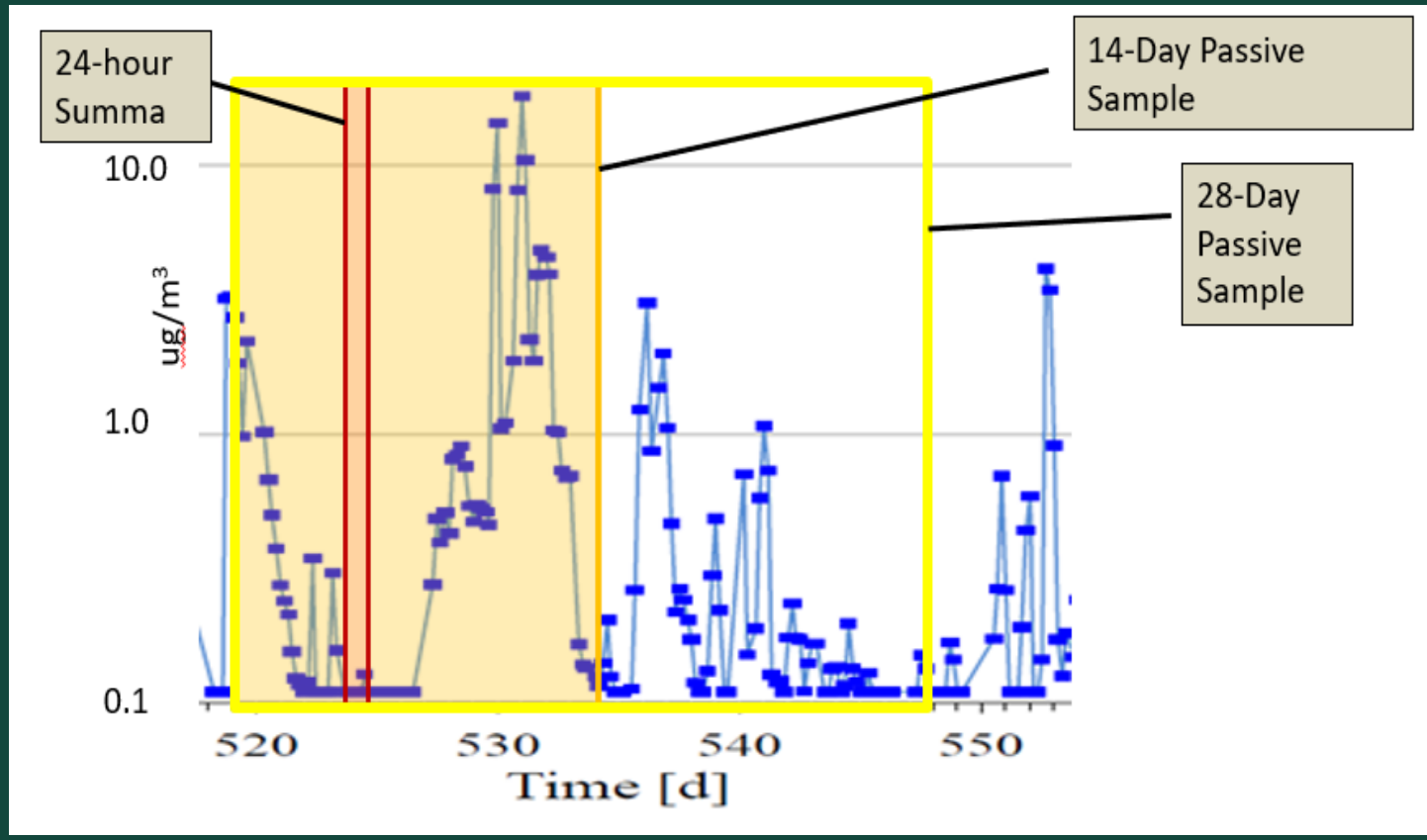
Scenario A: Sources in direct contact with building or foundation

- Collect indoor air and soil vapor samples
  - When contamination is in direct contact, soil vapor samples alone do not do a good job for assessing risk.
  - Indoor air samples plus soil vapor samples will help describe what is in the home and what is below the slab
- Line leaks are also of particular concern as they can produce strong VI impacts.
- Remember that targeted removal is always an option



Indoor Air Sampling (Section 4.2 main guidance)

- Greater reliance on long-term passive sampling for characterizing indoor air levels
- Consideration of acute exposure
- Response matrix for indoor air exceedances – time-frame expectations for addressing unacceptable risk
- Inclusion of TPH as a routine indoor air contaminant of interest at petroleum VI sites



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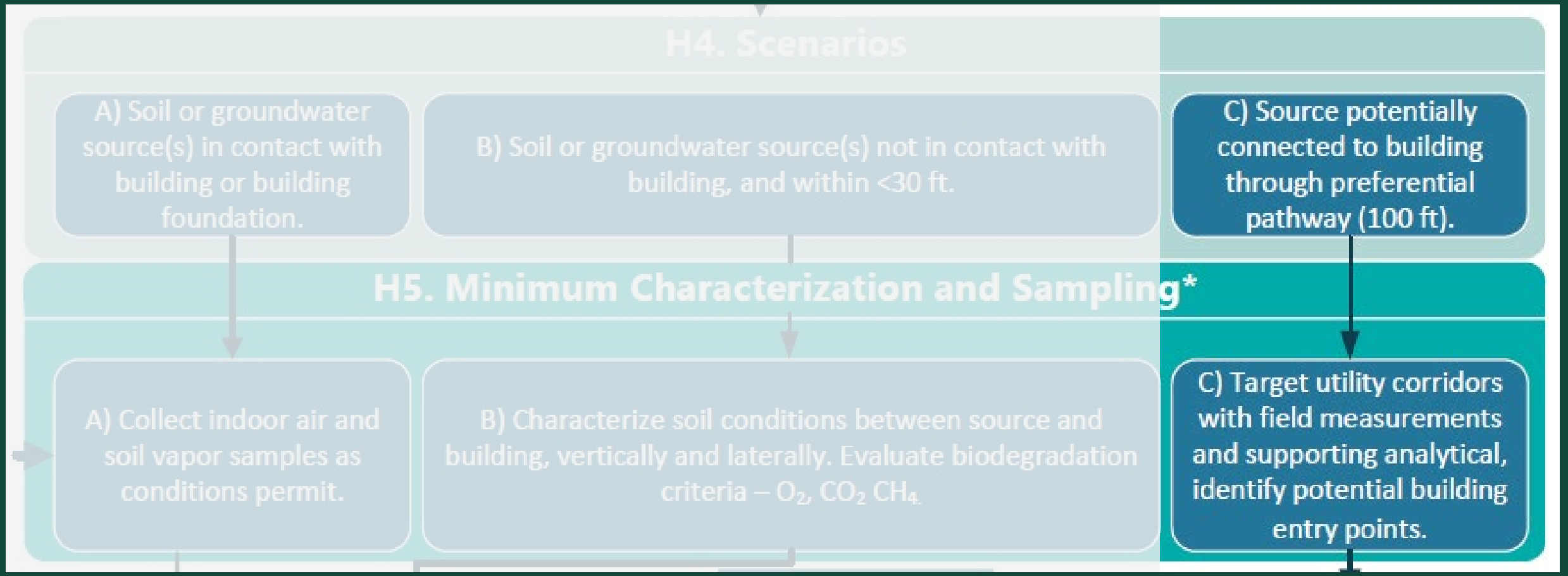
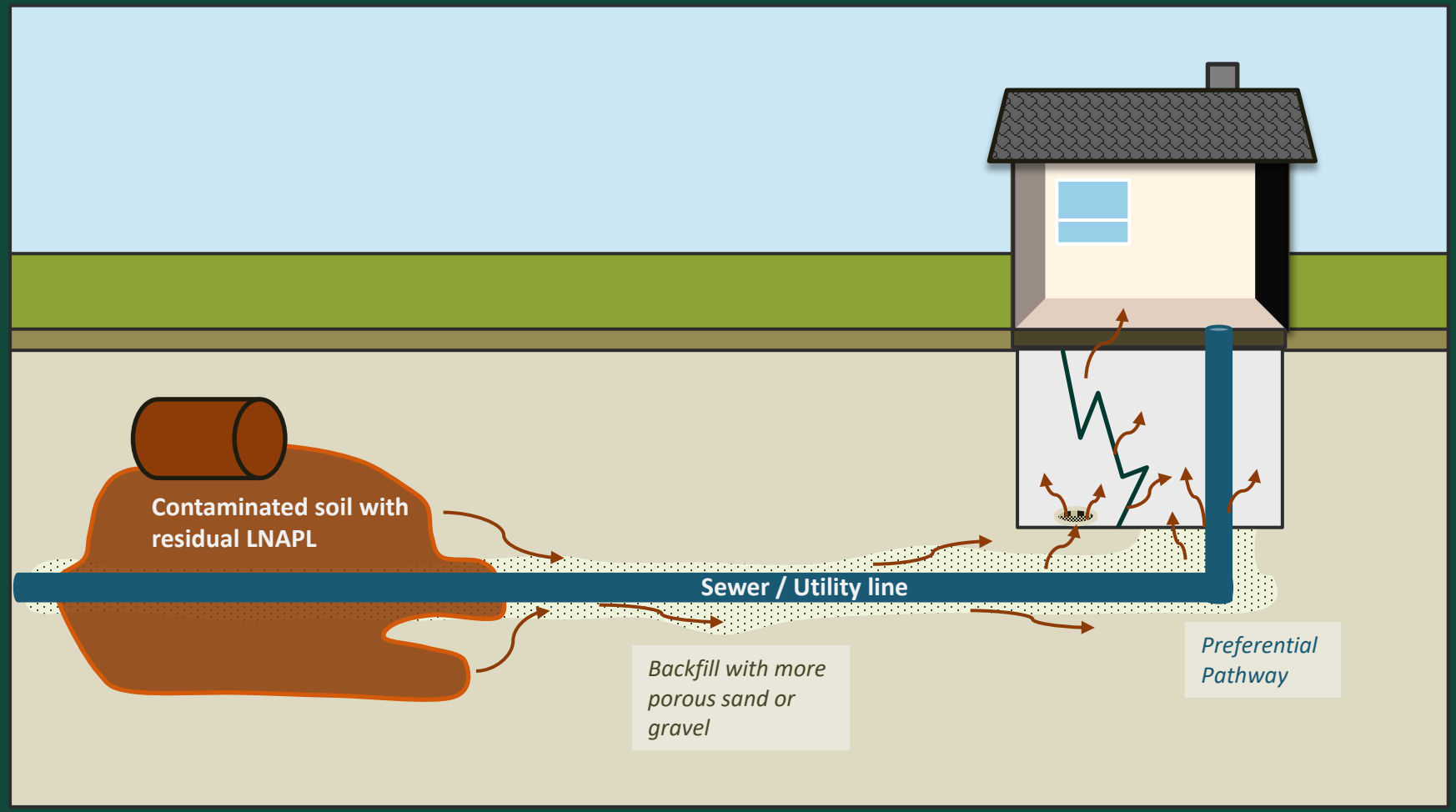


Scenario C: Sources potentially connected to building through preferential pathway (100 ft)



- Identify building entry points
- Target utility corridors with field measurements and analytical to evaluate whether vapor transport is occurring
- Consider worst-case conditions

- If vapor transport is occurring, sample indoor air

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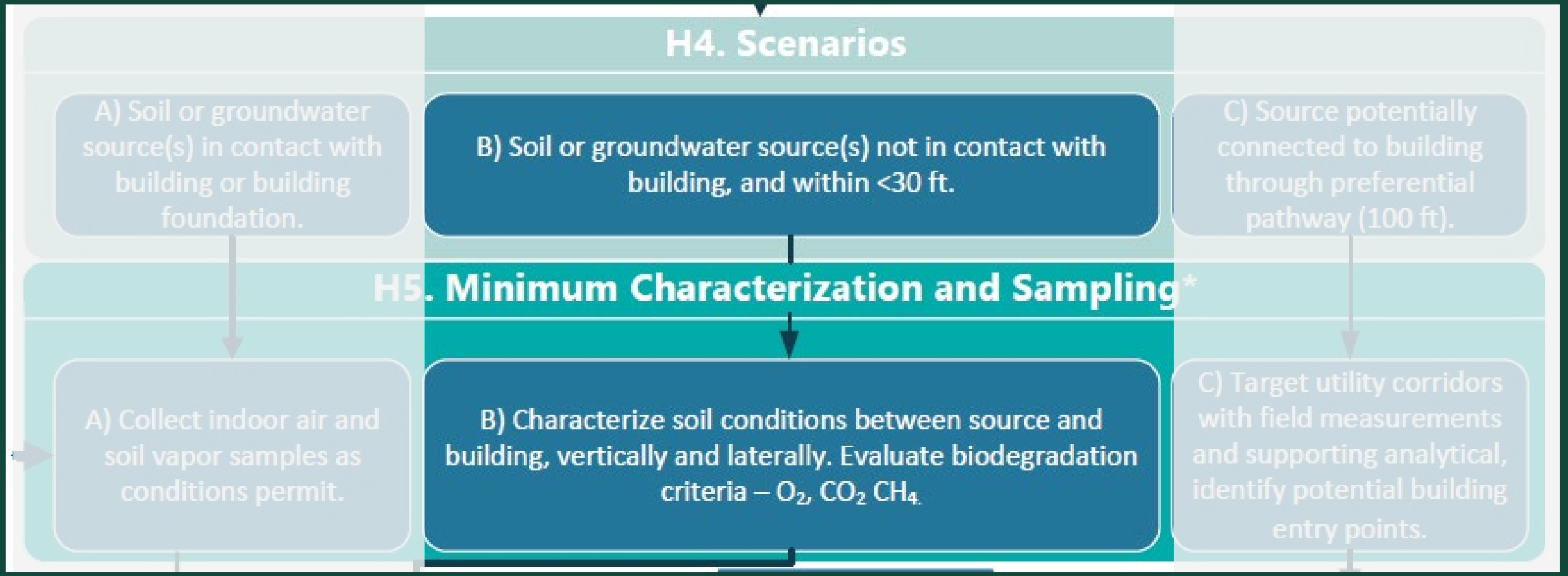
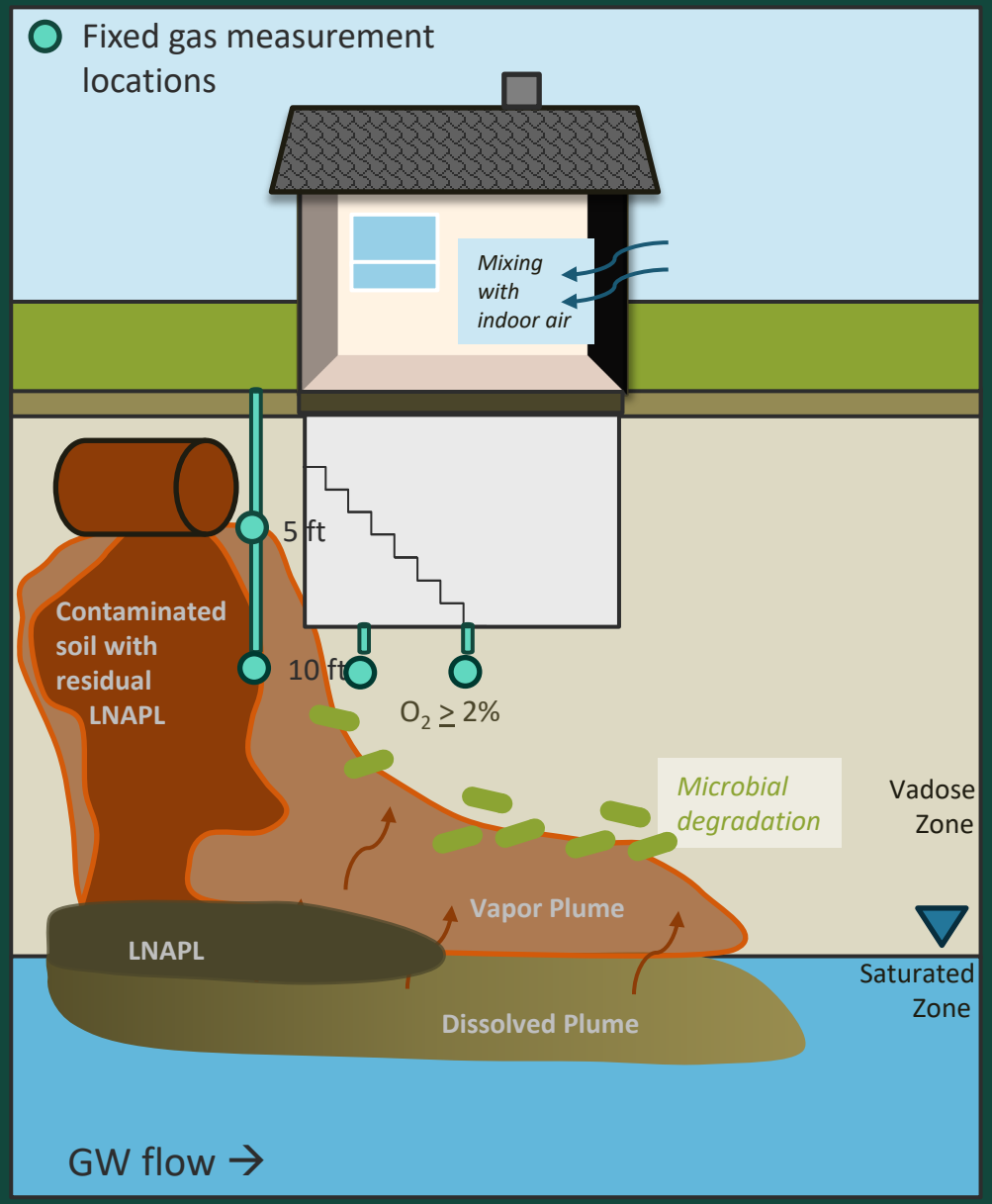
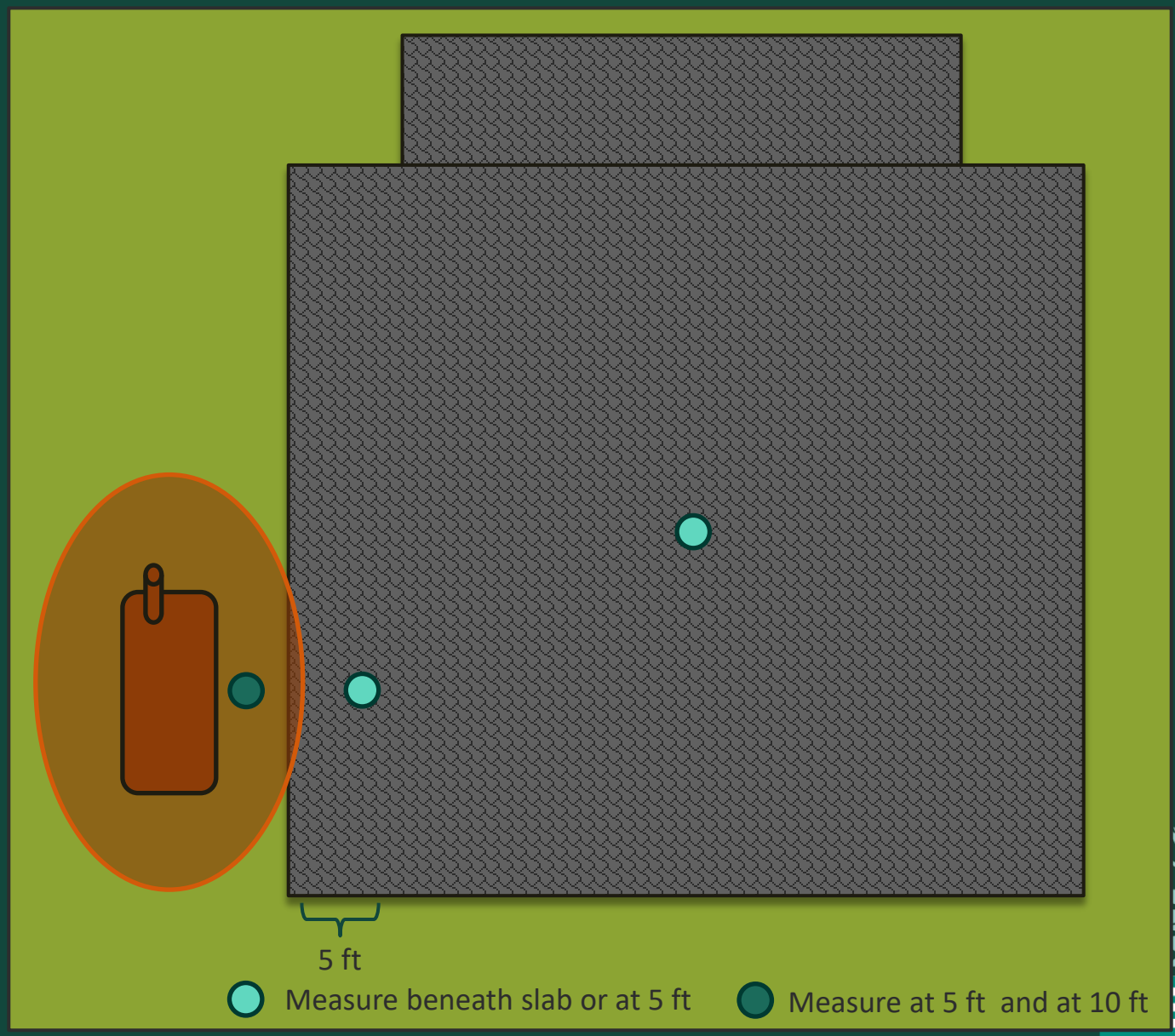
B.3 Heating Oil Tank Vapor Intrusion Evaluation Process



Evaluate biodegradation criteria (O_2, CO_2, CH_4) using fixed gas field measurements

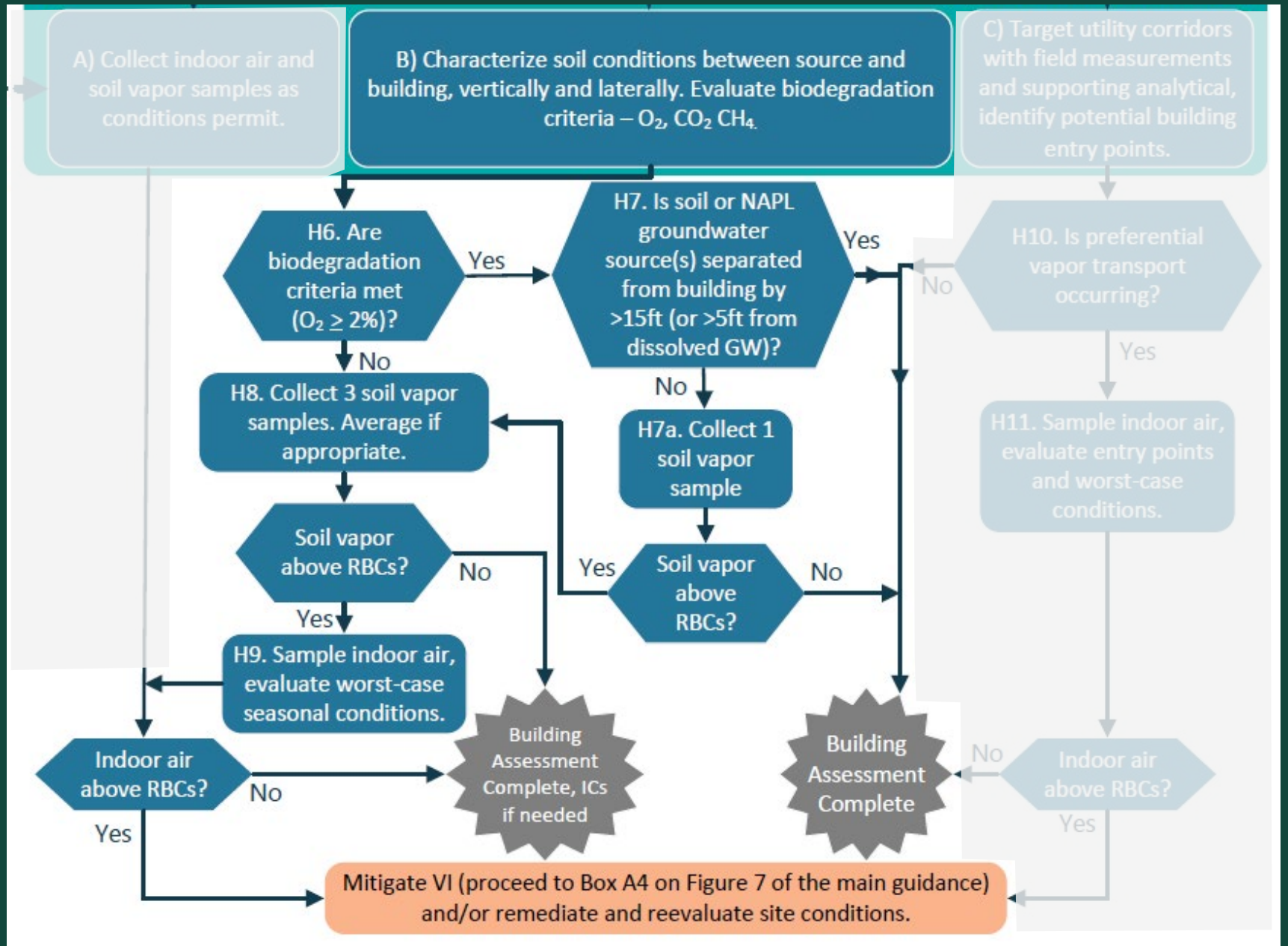




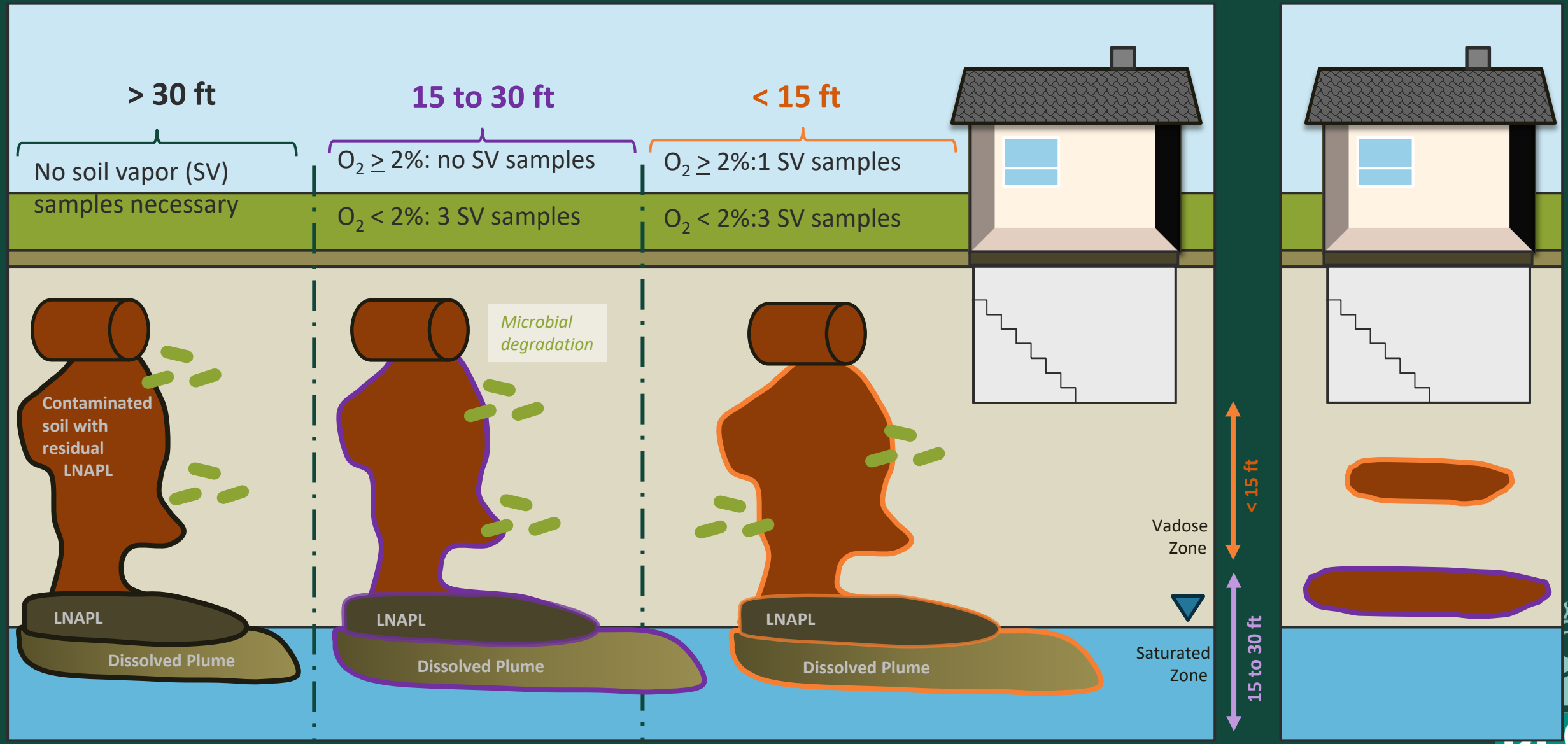
Tools for fixed gas measurements

- Landfill gas – GEM analyzers for fixed gasses (O_2, CO_2, CH_4) to establish biodegradation
- Sampling set up can be the same as your soil vapor set up, just make sure you purge volume before taking the sample

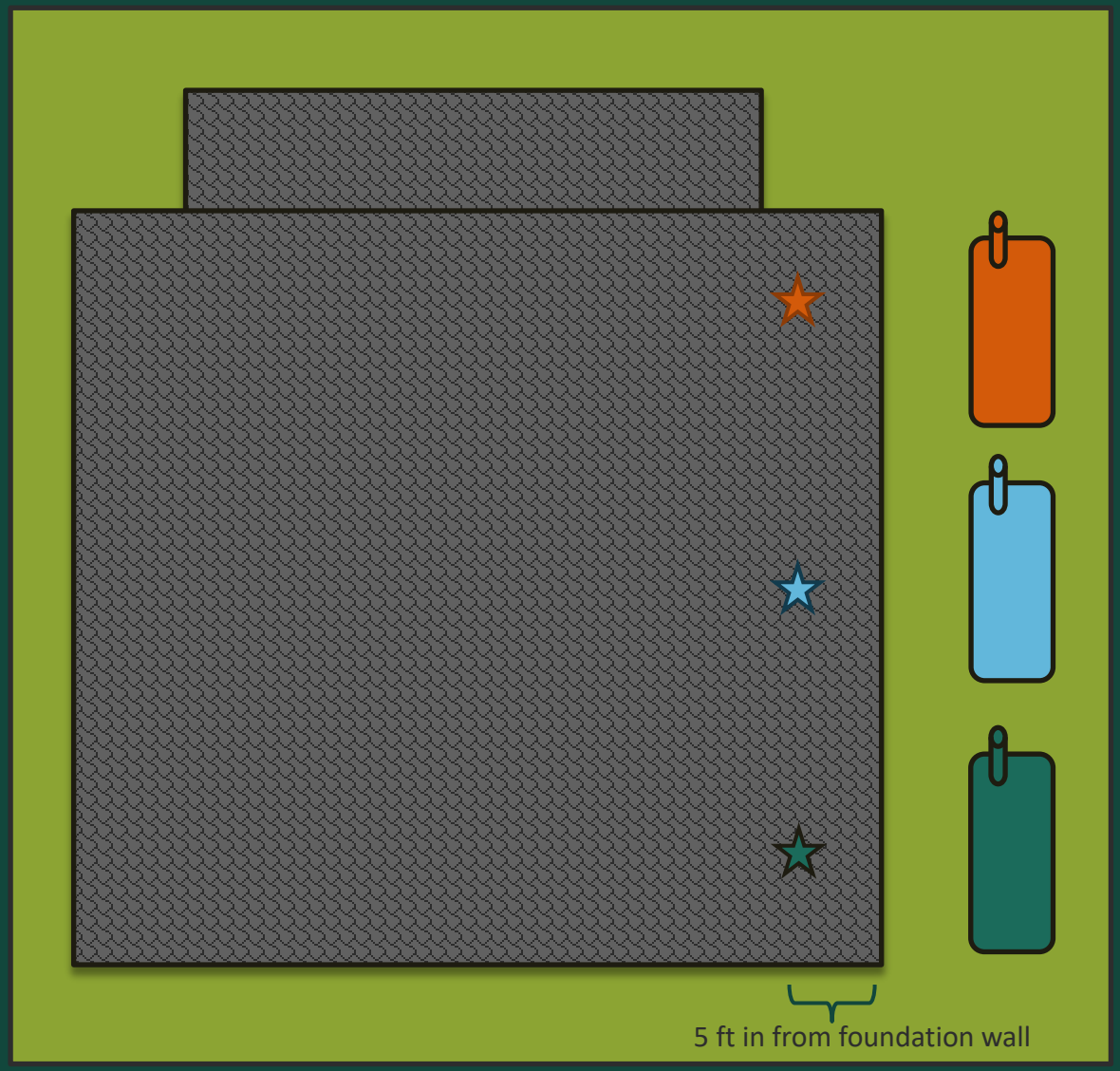
B.3 Heating Oil Tank Vapor Intrusion Evaluation Process



Soil vapor (SV) sampling with lateral distance to soil source



Soil vapor sampling: collecting one sample



Collecting one sample: Happens only when the house is close but O2 is at 2% or above

2010 Guidance – you collected the sample halfway between the plume and middle of the structure

2024 Guidance – take the one sample 5ft in from the foundation wall, next to the tank

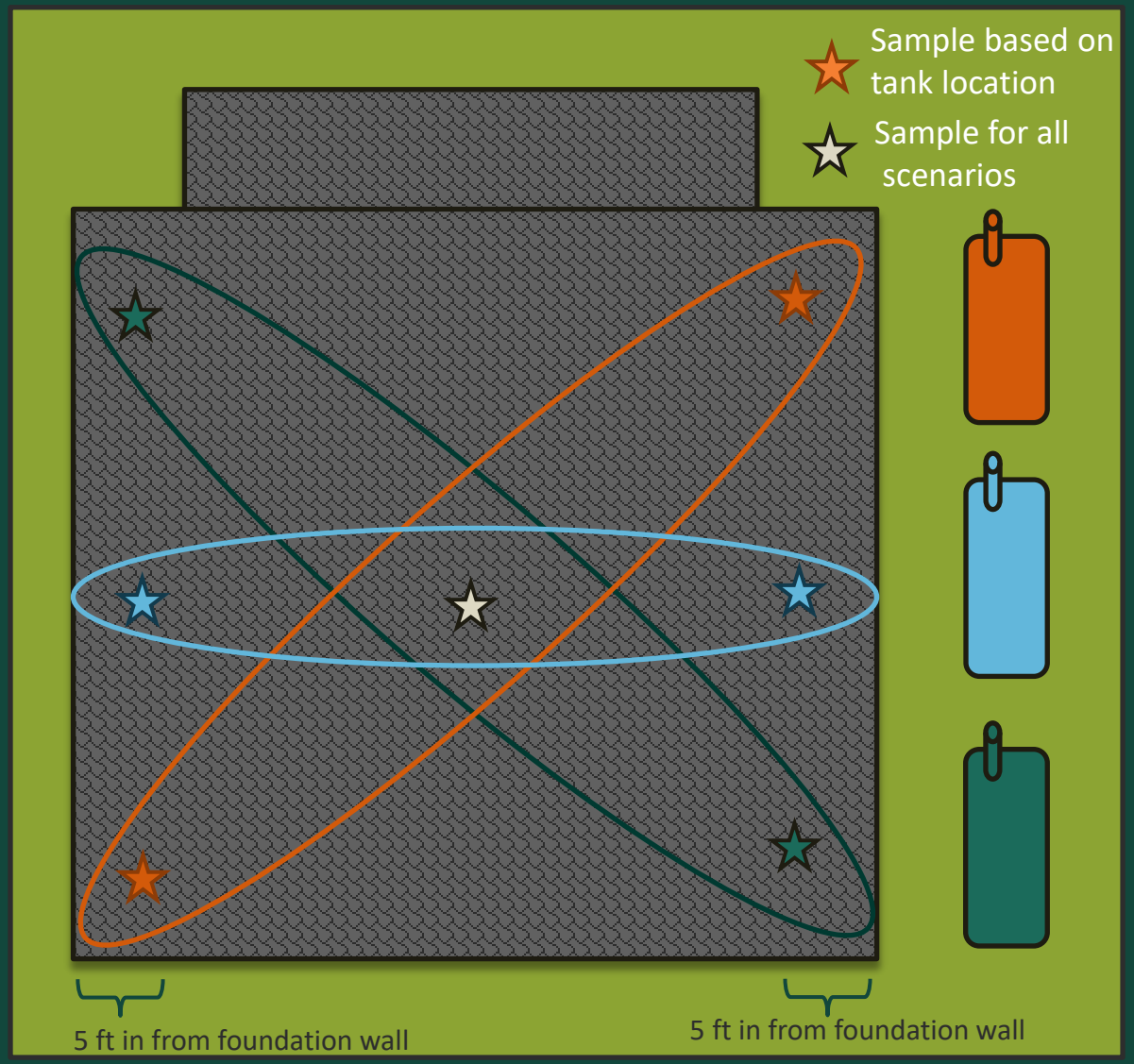
Soil vapor sampling: 3 samples

When can I average the three samples?

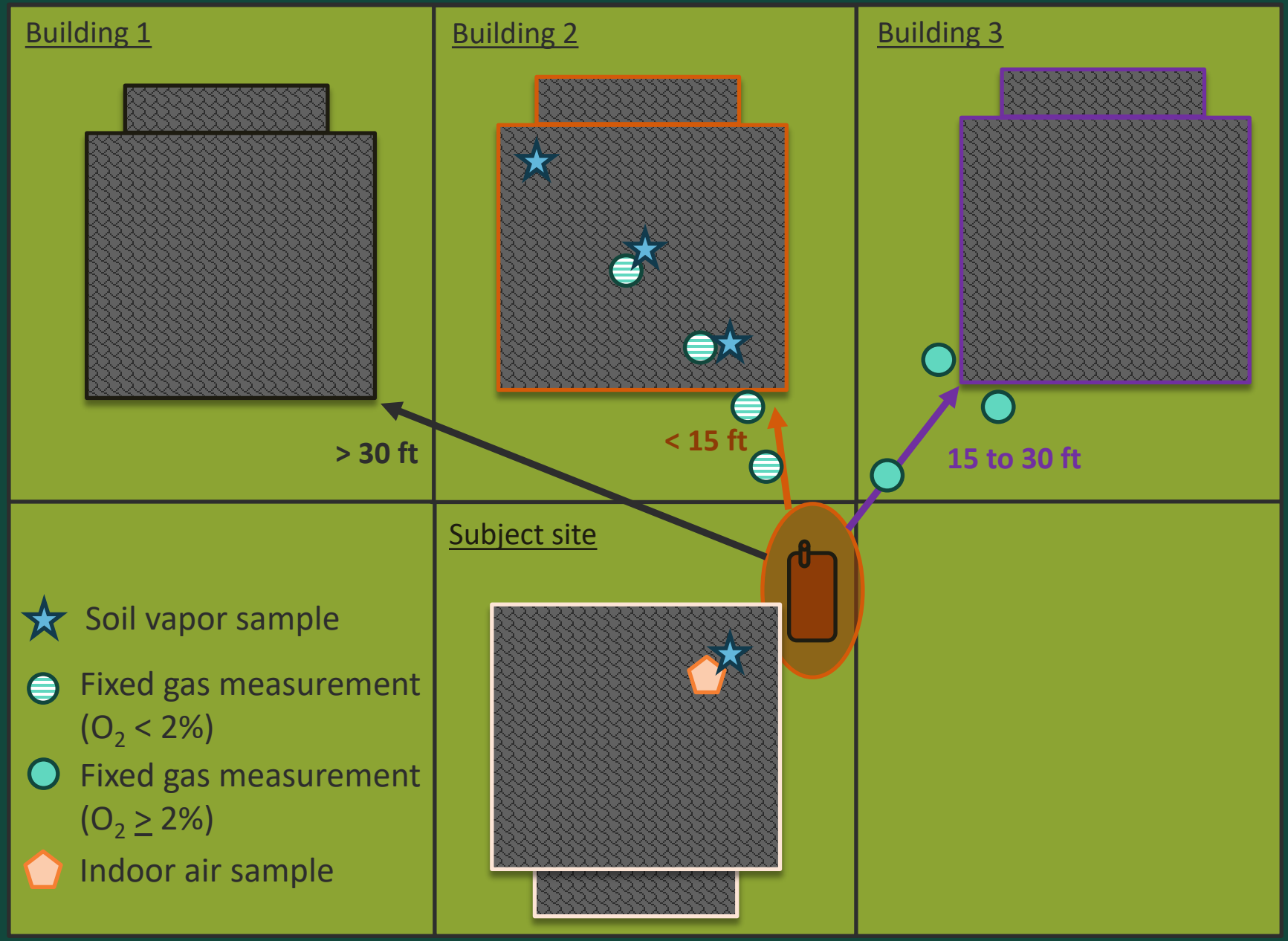
- When your soil vapor results show the plume is under only part of the structure, not the whole structure

When I can't average what do I do?

- You compare the highest soil vapor result direct to the RBCs



Sampling at neighboring properties based on distance



Vapor Intrusion Risk-Based Evaluation (Section 5)

VI Risk-Based Concentrations

- Published on DEQ website in June 2023
  - RBCair → RBCsv and RBCwi using attenuation factors
  - Not a conceptual change for RBCsv; new AFs
  - Bigger impact for RBCwi because of different approach for groundwater and new AFs
  - No more RBCsi; No more default urban residential
  - Acute RBCs for short-term exposure
- March 2024 updates based on EPA's Nov. 2023 RSLs
  - To be updated annually in January

Risk-Based Concentrations Spreadsheet

Residential Vapor Intrusion RBCs			
Chemical	RBCair ($\mu g/m^3$)	RBCsv ($\mu g/m^3$)	RBCwi ($\mu g/L$)
Benzene	0.36	12	2.8
Benzo[a]pyrene	0.0017	NV	NV
Ethylbenzene	1.1	37	7.1
Naphthalene	0.083	2.8	11
Toluene	5200	170000	36000
Xylenes	100	3500	780
Generic TPH			
Gasoline	300	10,000	120
Diesel/Heating Oil	100	3300	400
Mineral Insulating Oil	140	4700	360

Most chronic RBC_{sv} values lower by a factor of 6

Bigger impact for RBC_{wi} because of different approach for groundwater and new AFs (lower by factors of 50 to 1000)

Interactive VI RBC spreadsheet (based on EPA VISL)

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Acute RBCs

Cleanup Program Acute Risk-Based Concentrations						
	RBCair		RBCsv		RBCwi	
Chemical	Residential Acute RBC ($\mu g/m^3$)	Occupational Acute RBC ($\mu g/m^3$)	Residential Acute RBC ($\mu g/m^3$)	Occupational Acute RBC ($\mu g/m^3$)	Residential Acute RBC ($\mu g/L$)	Occupational Acute RBC ($\mu g/L$)
Benzene	29	87	970	2,900	230	650
Ethyl benzene	22,000	66,000	730,000	2,200,000	140,000	420,000
Naphthalene	200	600	6,700	20,000	27,000	83,000
Benzo[a]pyrene	0.0020	0.006	NV	NV	NV	NV
Toluene	7,500	23,000	250,000	770,000	52,000	160,000
Xylene (mixture), including m-xylene, o-xylene, p-xylene	8,700	26,000	290,000	870,000	68,000	200,000

- Acute RBC_{air} based on Cleaner Air Oregon
- Very important for chemicals with developmental effects

Responses to Acute and Chronic Exceedances

Indoor Air Concentration (Attributed to VI)[a] – Acute Exposure[1]			
No Data	**≤ acute RBCair**	**> acute RBCair to ≤ 3 x acute RBCair[e]**	**> 3 x acute RBCair[e]**
Monitor Initiate sub-slab and/or indoor air sampling if vapor intrusion is suspected.	**Monitor/ No Action** Use LOEs to determine need for additional sampling.	**Accelerated Response** • Evaluate and implement interim mitigation measures[b] within a few weeks. • Confirm effectiveness through monitoring. • Public outreach recommended.[d]	**Urgent Response** • Evaluate and implement interim mitigation measures[b,c] within a few days. • Confirm effectiveness through monitoring. • Public outreach recommended.[d]
Indoor Air Concentration (Attributed to VI)[a] – Chronic Exposure			
No Data	**≤ chronic RBCair**	**Noncancer:** **> chronic RBCair to ≤ 3x chronic RBCair[e]** **Cancer:** **> chronic RBCair to ≤ 10x chronic RBCair[e]**	**Noncancer:** **> 3x chronic RBCair[e]** **Cancer:** **> 10 x chronic RBCair[e]**
Monitor Initiate sub-slab and/or indoor air sampling if vapor intrusion is suspected.	**Monitor/ NoAction** Use LOEs to determine need for additional sampling.	**Accelerated Response** • Evaluate and implement interim mitigation measures[b] in a reasonable timeframe (e.g., 6 months). • Confirm effectiveness through monitoring. • Public outreach recommended.[d]	**Urgent Response** • Evaluate and implement interim mitigation measures[a,b] within a month. • Confirm effectiveness through monitoring. • Public outreach recommended.[d]

Appendix A

Based on recommendations from EPA Region 10, EPA Region 9, and Washington Ecology

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Mitigation, Remediation, and Performance Monitoring (Section 6)

Remedial Methods and Performance Monitoring

- Remediation and/or Mitigation
- Prompt, Early/Interim or Final Remedies
- Technologies and Design Considerations
- Performance Monitoring
- Plans and Documentation
- Definition of ECs and ICs
- Professional Registrants and Certifications

Engage your Engineer!

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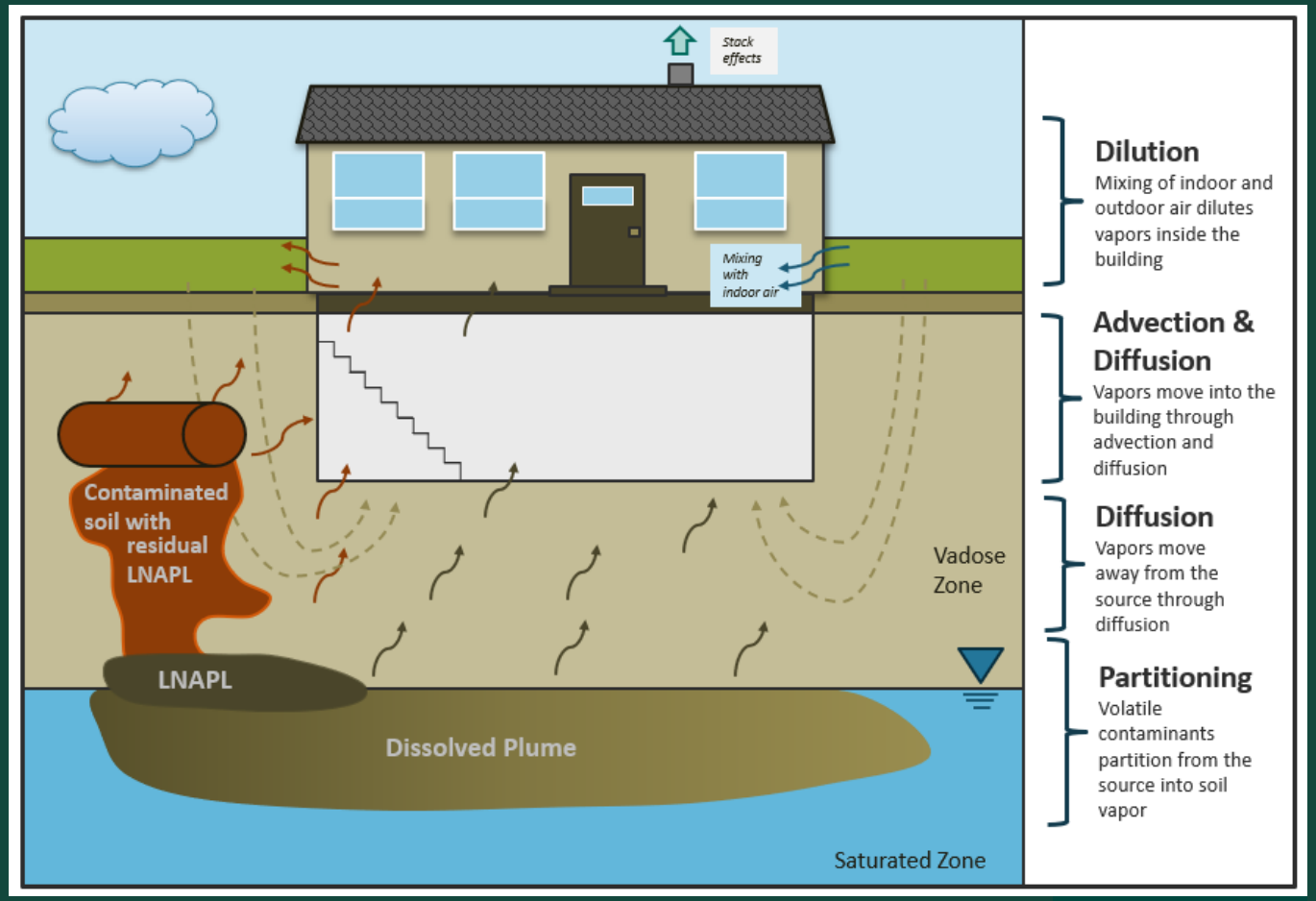
VI Remediation and Mitigation

- Engineer Controls to Protect Human Health
- Address unacceptable VI risk
- Or mitigate inferred current risk until additional data available
- VI sources may require remediation
- Strategy often a combination of technologies
- Plans (e.g., FS/CAP) provided to DEQ in advance for review/approval
- Adequate characterization of problem and good CSM is still important!



VI Remediation and Mitigation*

Remediation reduces/removes VI sources

- Excavation, SVE, groundwater remediation, etc.
- Preference to remove/treat hot spots
- Minimize the need to manage sources long-term to protect public health

Mitigation can provide immediate protection to building occupants

- Interrupts VI pathway at/near building
- No source depletion
- May be necessary for many years

***DEQ does not require specific mitigation or remedial techniques, but instead asks for an appropriate evaluation (CAP or FS) and a remedy proposal for its review and approval**

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Mitigation Technologies

Immediate	Typically Target Building Interior: Increase Ventilation, **Building Pressurization** (e.g., HVAC), Indoor Air Treatment, Preferential Pathway Sealing, Administrative
Passive	**Vapor Barrier**, Sub-Slab Venting, Building Design, Interceptor Trench, Preferential Pathway Prevention (Coatings/Sealants, Utility Collars), Aerated Floors
Active	**Sub-Slab Depressurization (SSD)**, Sub-Membrane Depressurization (SMD), Sub-Slab Ventilation (SSV), Vapor Pits, Aerated Floors

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Strong Lines of Evidence of VI Mitigation

Indoor Air	Indoor concentrations are below RBCs
Differential Pressure	Negative pressure (e.g., < indoor air) and sustained across the building sub-slab (or lateral extent vapor plume)
Sub-Slab	Reduction of sub-slab concentrations below RBCs

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Community Engagement (Section 7)

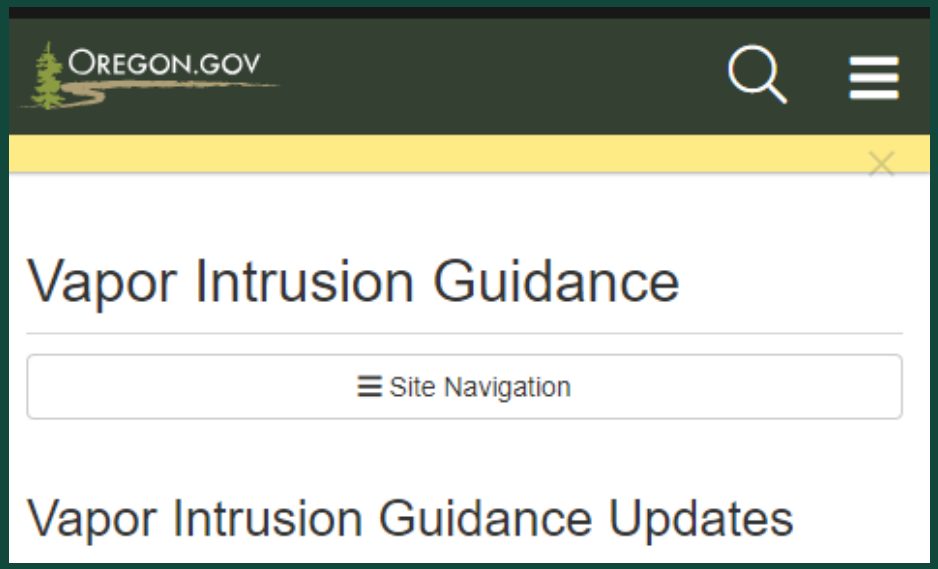
- Proactively and effectively engaging communities impacted by VI risks early on and throughout the process
  - VI is one of the most often complete exposure pathways and can represent imminent risk to human health
  - Engaging impacted communities is a public health issue
- Clear and open communication is key to establishing trust and collaborative working relationships
  - Set expectations, openly answer questions and respond to concerns
- Multiple references by EPA, ITRC, Washington Dept of Ecology

Public Review Period & Next Steps

Public Review Period

Informal public review period – ends May 31, 2024

- Informal public review period
- Not a public comment period
  - No written comment responses



Additional Listening Sessions: Please share!

Agencies & Consultants:

April 17, 12-1:30pm

Community Partners:

April 17, 6-7:30pm

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Where to find help during transition?

- DEQ: *https://www.oregon.gov/deq/hazards-and-cleanup/env-cleanup/pages/vapor-intrusion.aspx*
- EPA: *https://www.epa.gov/vaporintrusion*
- ITRC: https://itrcweb.org/teams/training/vapor-intrusion-mitigation-training
- Your DEQ Team and *VIworkgroup@deq.oregon.gov*

Thank You!

Feedback? Questions? Comments? Please reach out to the VI team at *VIworkgroup@deq.oregon.gov*

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