# Measuring the Last Mile for Vapor Mitigation

## Real-Time Remote Monitoring of the Sub-slab Pressure Field

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Vapor Intrusion Track – Monday October 30, 2023 – 2:40 pm

# Overview

- Current standards in Operation, Maintenance, and Monitoring (OM&M) for active Vapor Mitigation systems
- Why use Telemetry?
- Case study examples for current telemetry monitoring
- Benefits of real-time monitoring of the sub-slab pressure field
- Q&A

# Current OM&M standards for active Vapor Mitigation systems

## Typical OM&M Schedule

- Annual inspection of system components and sub-slab pressure field with periodic (quarterly / semi-annual) system pressure gauge monitoring.

**Positives:**

- Predictable Schedule for building occupants and field operations
- Easy to budget with Clients
- Can be scheduled for convenience

**Negatives:**

- No defensible proof of system operation outside of the documented inspection windows
- Data points cluster around normal business hours (M-F, 8:00am – 5:00pm) regardless of building occupancy schedules
- Responsible parties rarely notified of changes to the structure that can impact system function and occupant safety

# Mitigation System Operational Challenges

- Seasonal Variability during design and monitoring
- Building Maintenance and Modification
- Soil and Fill Material Condition Changes
- Onsite Inspection Requirements

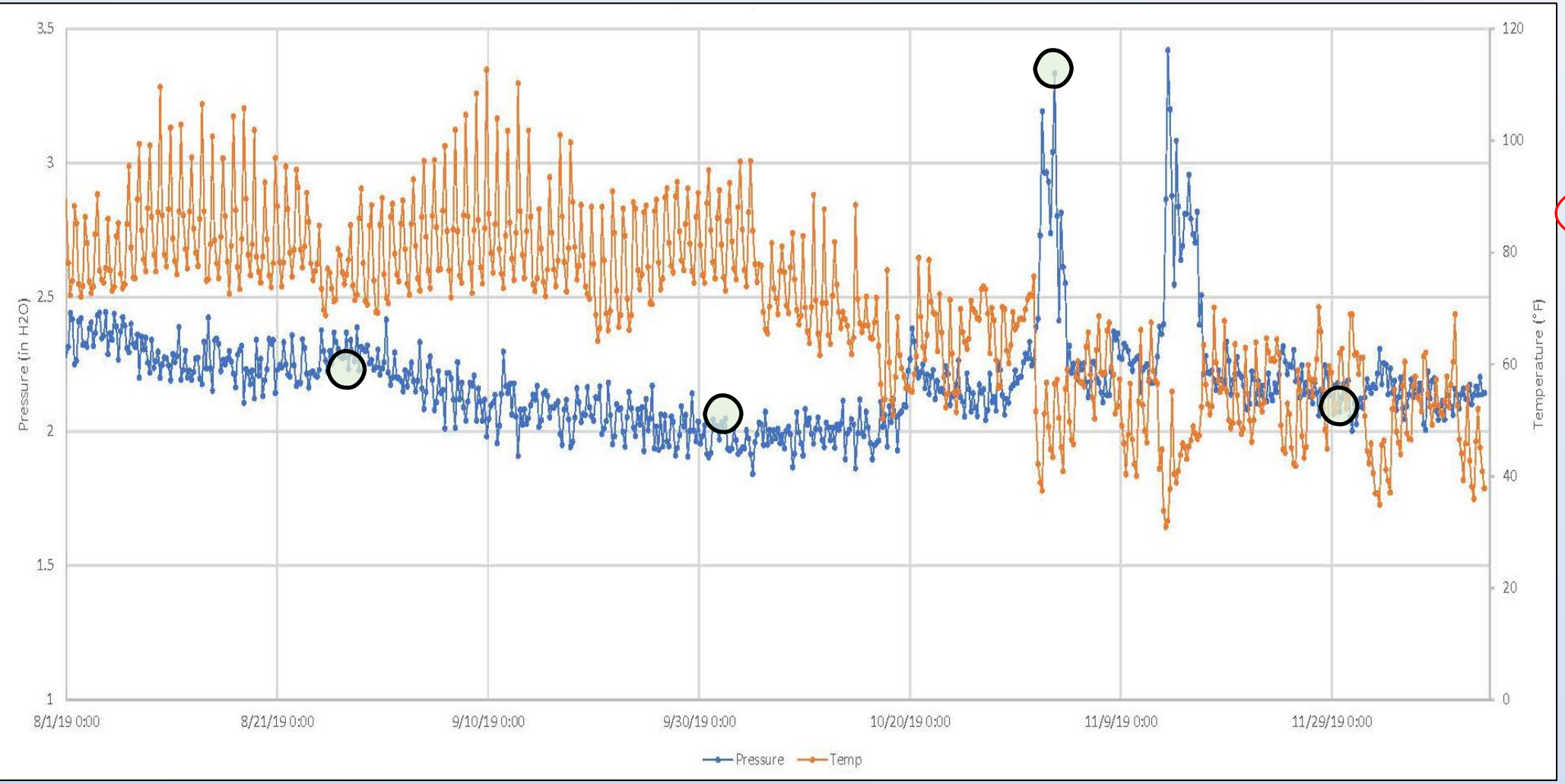
# Why Use Telemetry?

- Provides actionable, real-time data on the mitigation
- Is an effective liability management tool for occupant exposure
- Creates an opportunity for long-term service engagement with the project

# Telemetry Case Study Comparisons

- Case Study #1 – Environmental Condition Interference
- Case Study #2 – Building Modification Interference

# Case Study #1: No Information on the Root Cause




Datapoints

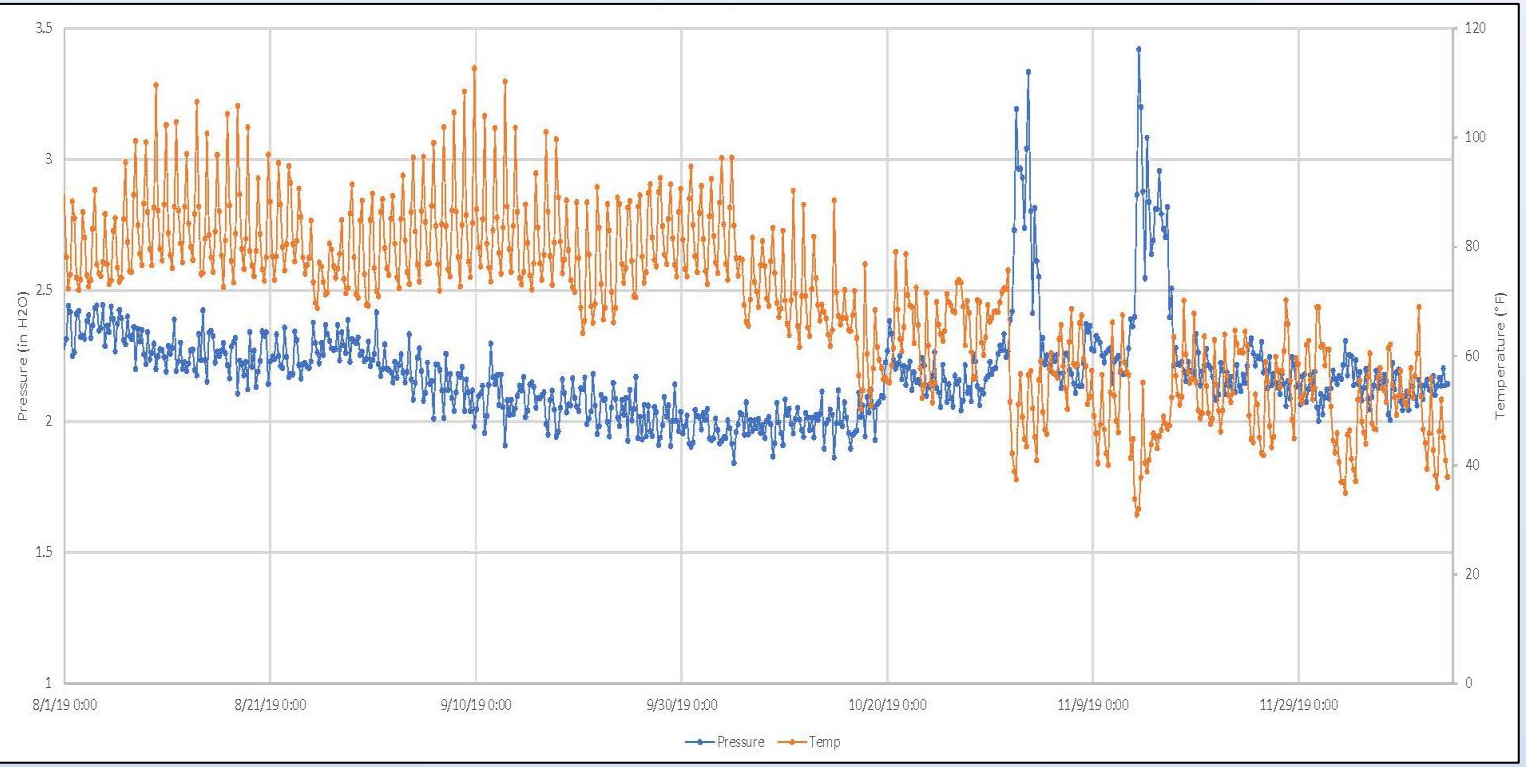
8/30: 2.3" w.c.

9/30: 2.1" w.c.

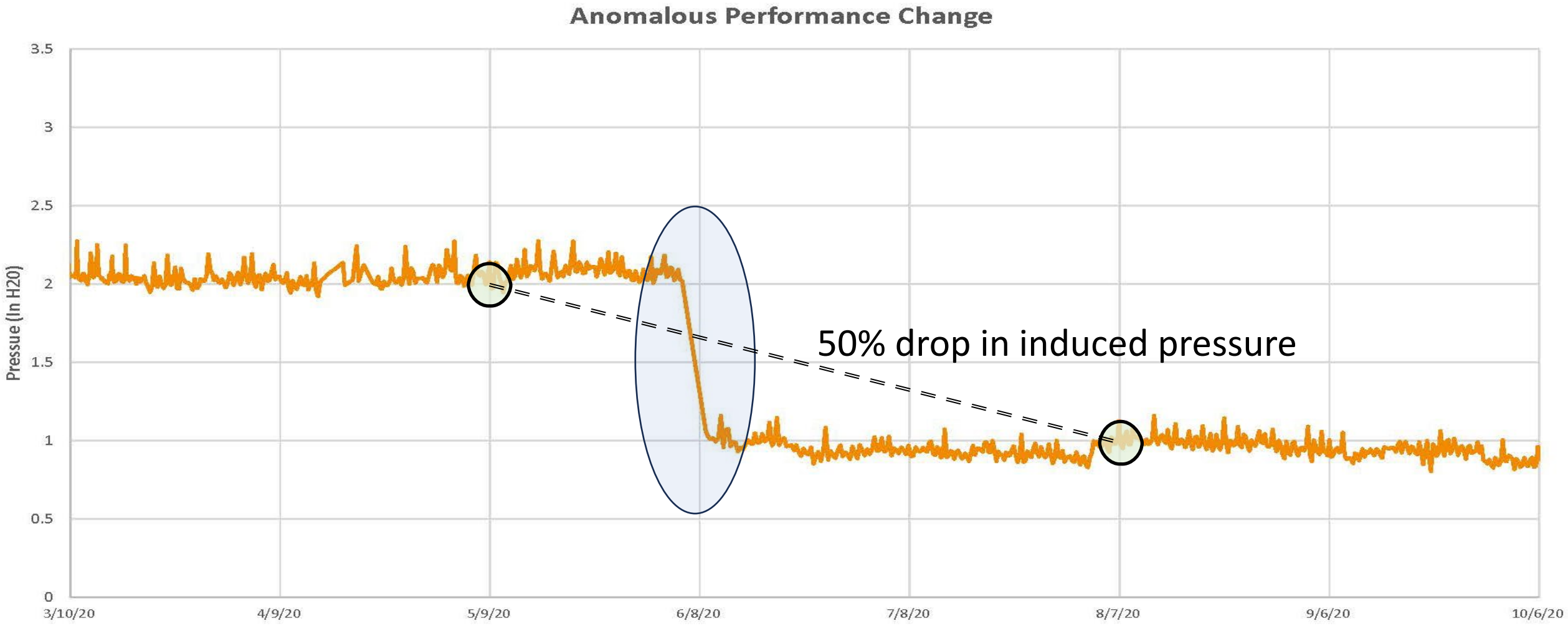
10/30: 3.3" w.c.

11/30: 2.1" w.c.

# Case Study #1: Root Cause – Short term precipitation event impacts




# Case Study #2: Building Modification Interference



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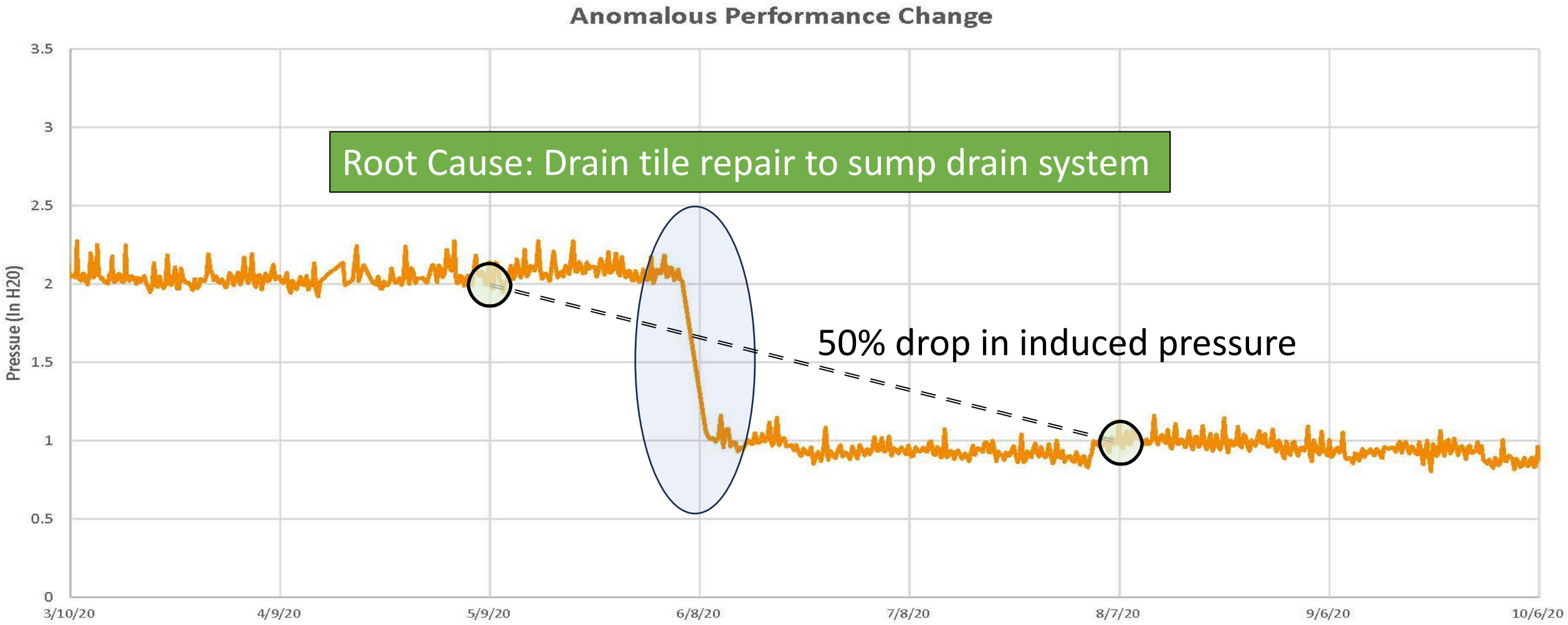


# Mitigation System Telemetry – Missing Pieces

- No data on building sub-slab pressure field
- Anomalies still require on-site personnel to verify conditions
- Building and HVAC modifications not always visible in induced pressure data
- “It should be fine…”

# Sub-Slab Pressure Field Telemetry: The Missing Piece

- Definitive, defensible proof of mitigation system effectiveness
- Identify seasonal anomalies that may not have been detectible due to system design and access limitations
- Know when building and HVAC modifications put occupants at risk

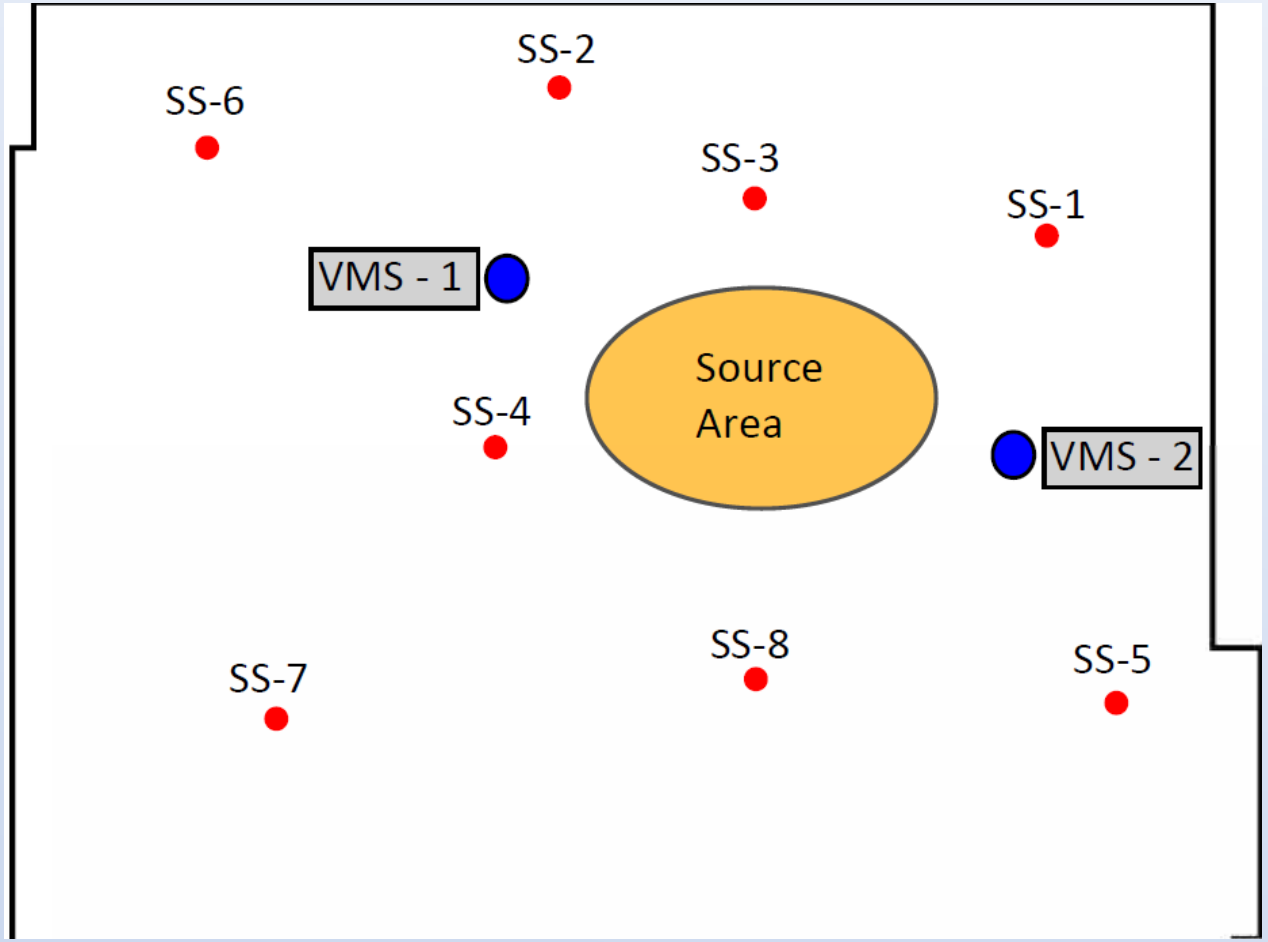
# Sub-Slab Pressure Field Telemetry: Key Concepts

- Points of Compliance
  - The area or areas of the building slab where pressure measurements are most relevant to system function
- Hot Spot vs. Whole Building Mitigation
- Data Density

# Example Scenario #1: Former Drycleaner

- Property now used as commercial office space
- Hot-spot mitigation system design
- Point of Compliance Method: Pressure field perimeter monitoring

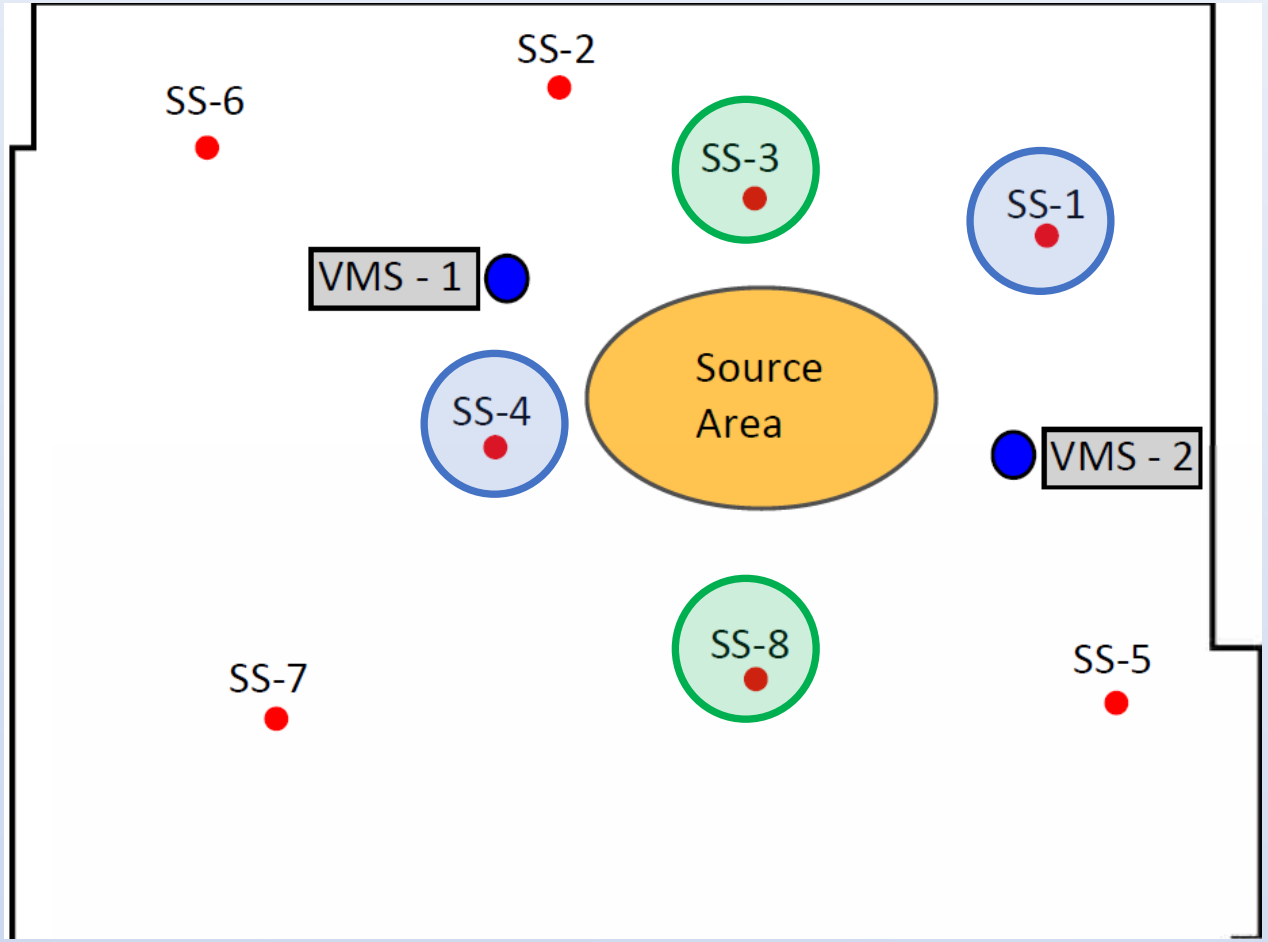
# Example Scenario #1: Former Drycleaner




- Known PCE and TCE impacts
- Array of sub-slab vapor pins installed to define PFE
- Post-mitigation indoor air results are non-detect for CoCs.

**Where do we monitor?**

# Example Scenario #1: Former Drycleaner



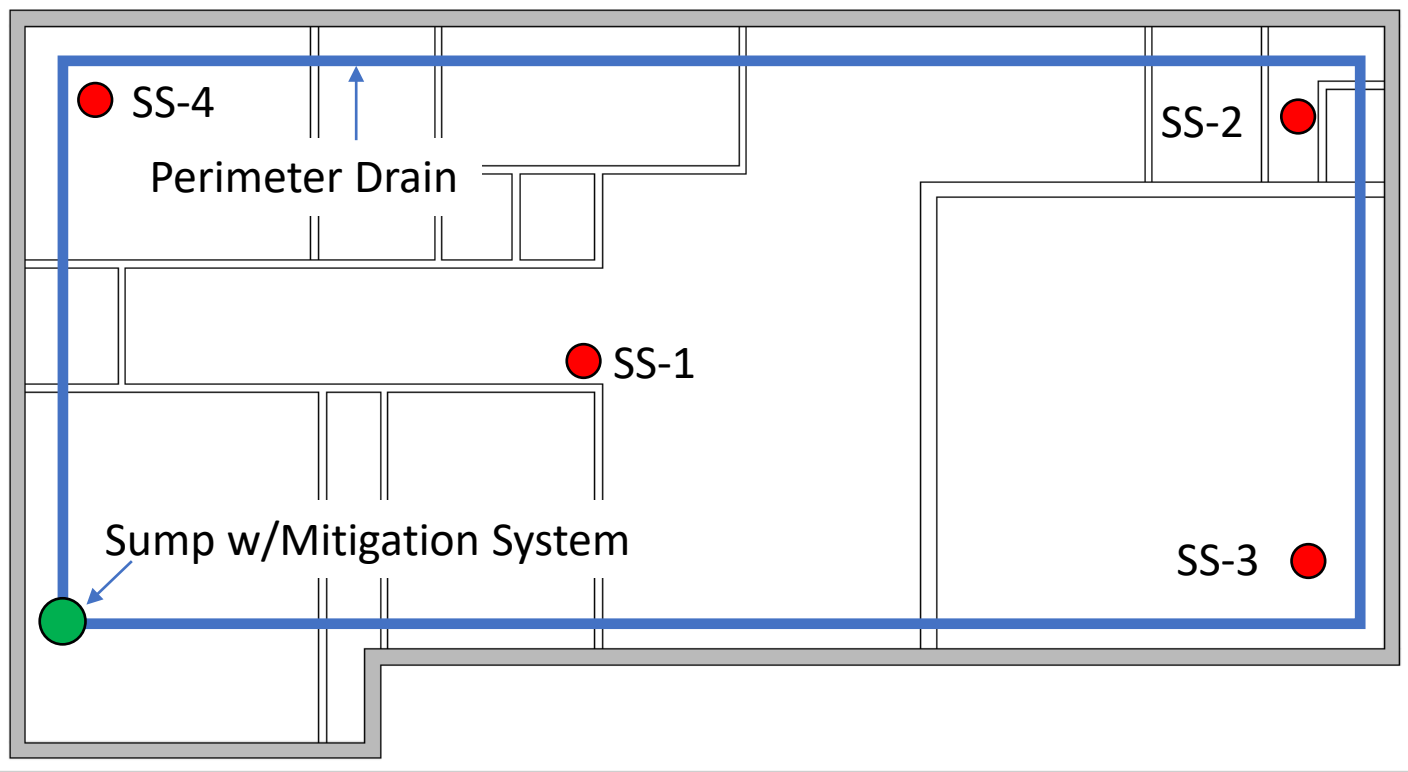

- Critical Points of Compliance:
  - **SS-3 and SS-8**
- Secondary Points of Compliance:
  - **SS-1 and SS-4**
- Target SSD Pressure: -0.10” w.c.

**Maintenance of Target SSD pressure field at points of compliance ensures protectiveness of mitigation design**

# Example Scenario #2: Residential Home

- Basement Construction with drain tile depressurization system installed
- Known vapor intrusion impacts from off-site source
- Point of Compliance Method: Far wall and center of slab PFE monitoring

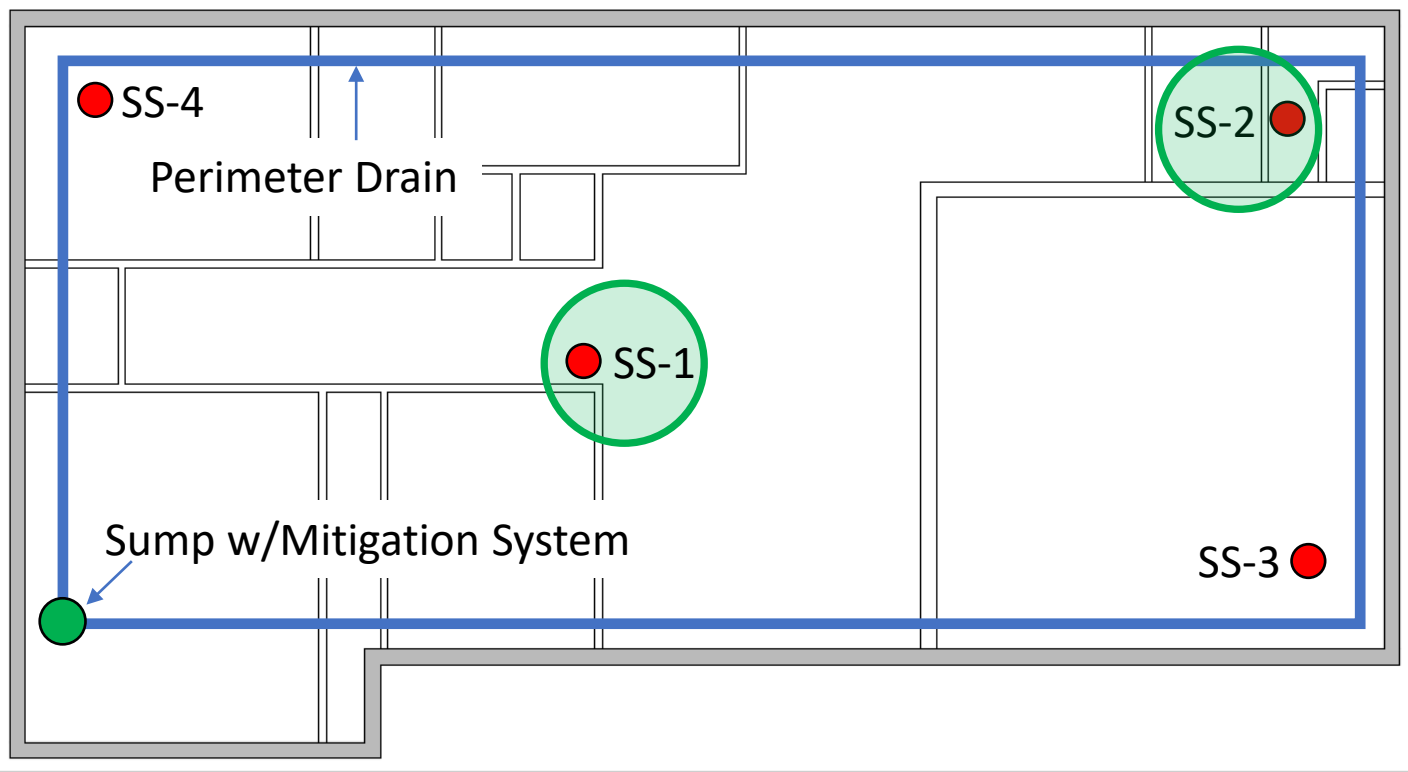
# Example Scenario #2: Residential Home




- Property adjacent to contaminated groundwater plume
- Whole-house mitigation with activation of the sump and drain tile system
- Post mitigation indoor air results are non-detect

**Where do we monitor?**

# Example Scenario #2: Residential Home




- Critical Points of Compliance:
  - **SS-1 and SS-2**
- Monitoring of additional points optional
- Target SSD Pressure: -0.10” w.c.

**Maintenance of Target SSD pressure field at points of compliance ensures protectiveness of mitigation design**

# Increased Data Density: Pros and Cons

## Pros

- 24/7/365 monitoring of the building pressure field
- Provides alerts if mitigation system is disrupted
- Can be utilized as a mitigation system design tool
- Can remotely study the building dynamics in real-time over weeks, months, or years
- Ensures effective mitigation regardless of seasonality of initial design and installation

# Increased Data Density: Pros and Cons

## Cons

- How much is too much data?
- Building operations can damage sensors, leading to increased monitoring costs
- Ensures effective mitigation regardless of seasonality of initial design and installation, which can lead to additional mobilizations should the initial mitigation design not be sufficient.

# The Big Question:

**How long can a mitigation system be out of compliance with the established parameters before triggering additional action by the responsible party?**

- Acceptable risk windows can vary greatly depending on contaminates of concern and impacted occupants

# Final Notes

- Technological advancements are making real time sub-slab pressure monitoring cost effective
- Expect regulators to strongly favor real time telemetry data when making No Further Action (NFA) or Operation Maintenance and Monitoring (OM&M) decisions
- Better data leads to better designs and greater occupant safety

# Questions?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# Thank you

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