VAPOR INTRUSION – DEFINING THE PROBLEM & MANAGING THE SOLUTION

DEFENSE SUPPLY CENTER RICHMOND

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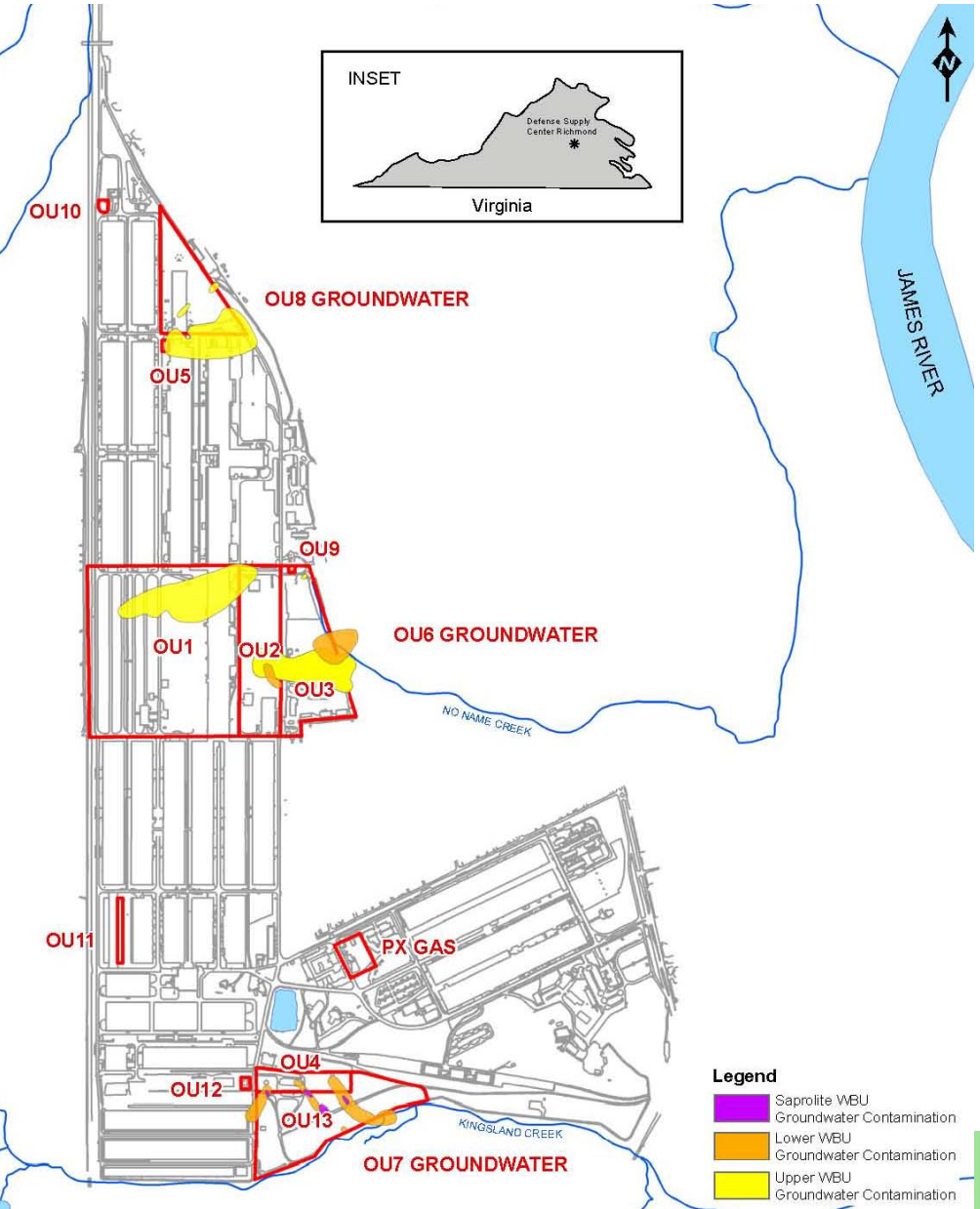
Installation Background

- Defense Supply Center Richmond's core mission is to supply products with a direct application to aviation
- Installation placed on National Priorities List (NPL) in 1987
- Primary Contaminants of Concern (COCs) include:
  - Volatile Organic Compounds (VOCs), Metals, and Semi-Volatile Organic Compounds (SVOCs)

OU Overview



OU 1- Open Storage Area Soil

OU 2- Area 50 Source Area Soil

OU 3- National Guard Source Area Soil

OU 4- Fire Training Source Area Soil

OU 5- Acid Neutralization Pits Source Area Soil

OU 6- Area 50/ Open Storage Area/ National Guard Area Groundwater

OU 7- Fire Training Area Groundwater

OU 8- Acid Neutralization Pits Groundwater

OU 9- Interim Action (OU 6 Groundwater)

OU 10- Former Building 68 Soil

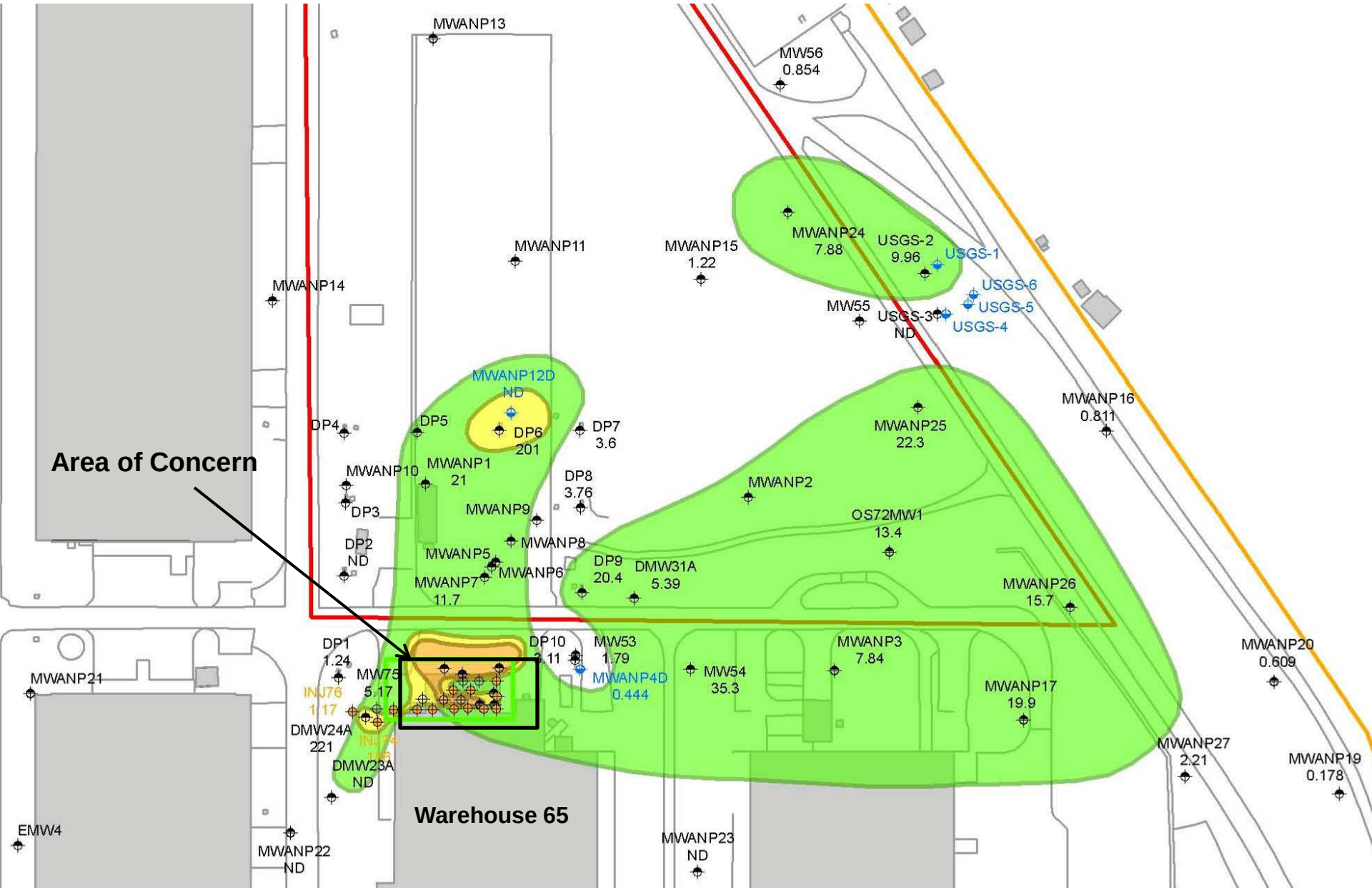
OU 11- Transitory Shelter 202 Soil

OU 12- Former Building 112 Soil

OU 13- PAH Area Soil

Vapor Intrusion - Defining the Problem

OU 8 PCE Plume (Sept 2010)



OU 8 - Warehouse 65 Site Map

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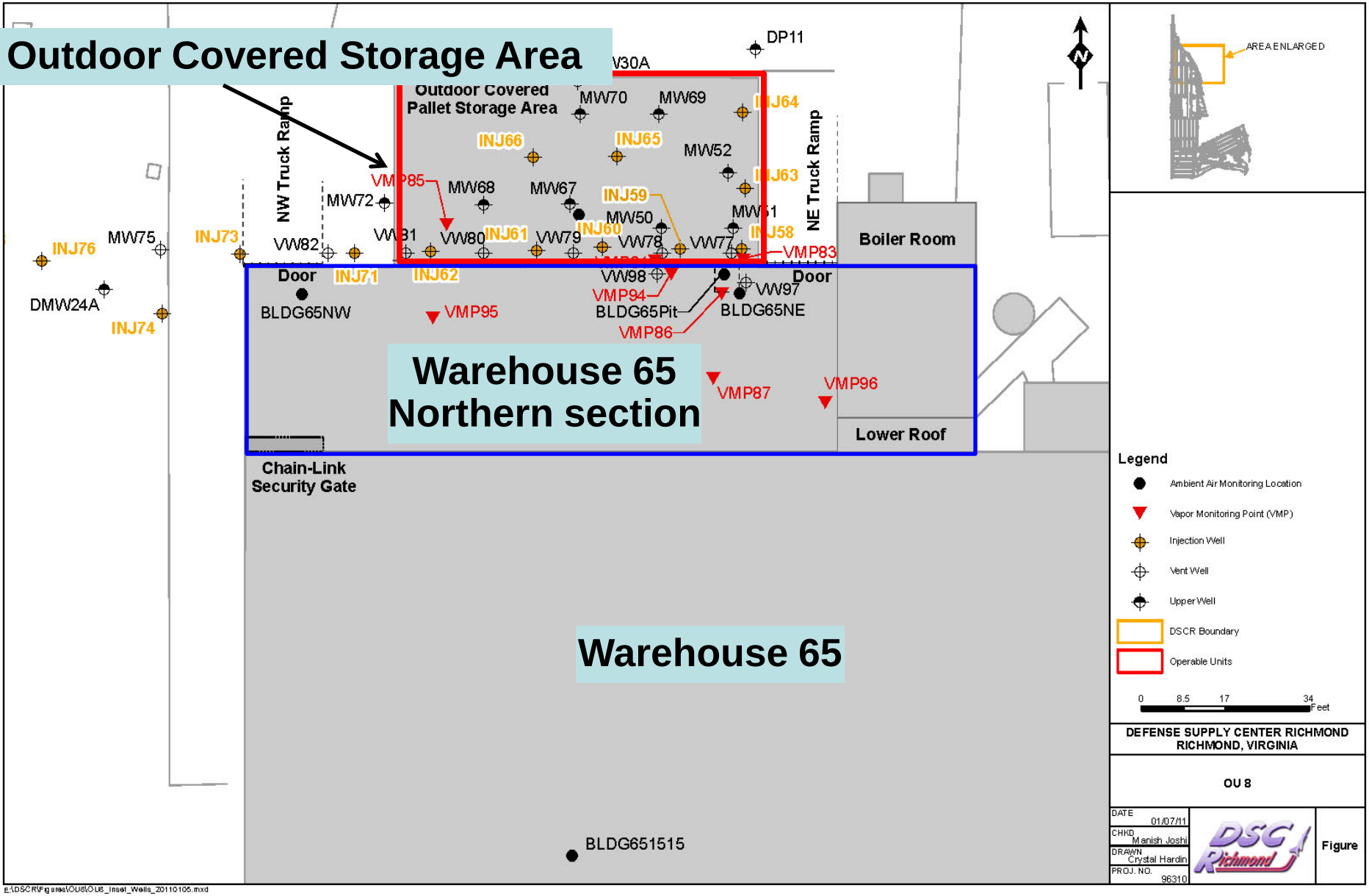


Conceptual Site Model

- **Past industrial operations in northern portion of Warehouse 65 resulted in groundwater contaminated with PCE and TCE**

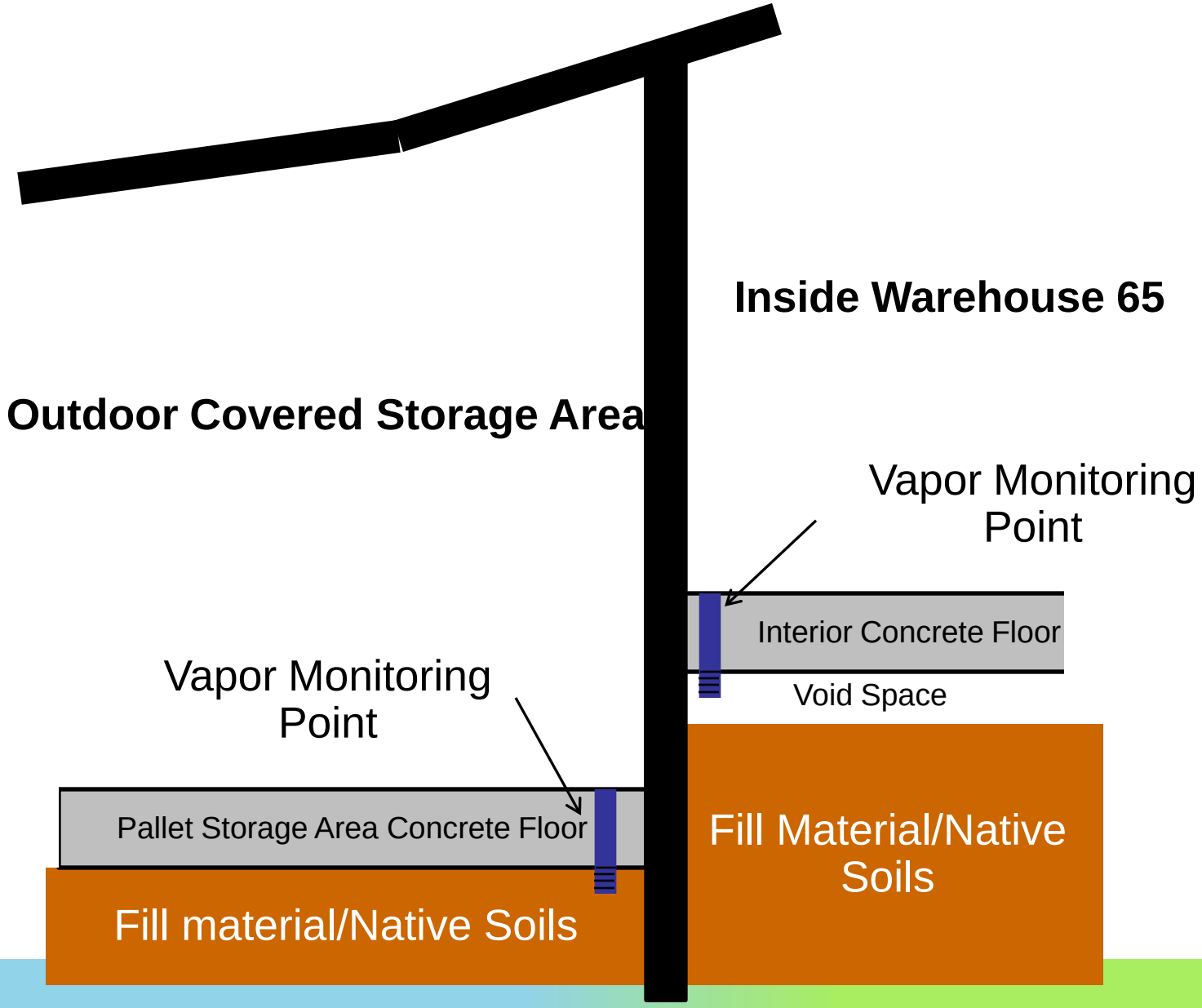
- **Northern section of Warehouse 65 currently used as storage area – no permanent occupancy**
- **Outdoor covered storage area used for storing pallets**

- **Vapor sampling conducted underneath outdoor covered storage area and Warehouse 65. Indoor air samples collected in Warehouse 65**
  - **PCE, TCE, cisDCE detected in subsurface vapors (200 to 3,900 ppbV)**
  - **PCE, TCE detected indoor air (ND to 2 ppbV)**
  - **PCE levels slightly above EPA indoor air screening levels (industrial)**


Exhaust Fan Stacks (Warehouse 65)
Northern Exterior Wall – Warehouse 65
VMP84
VW79
VW78
MW50
VMP83
VW77
MW51
Outdoor Covered Storage Area

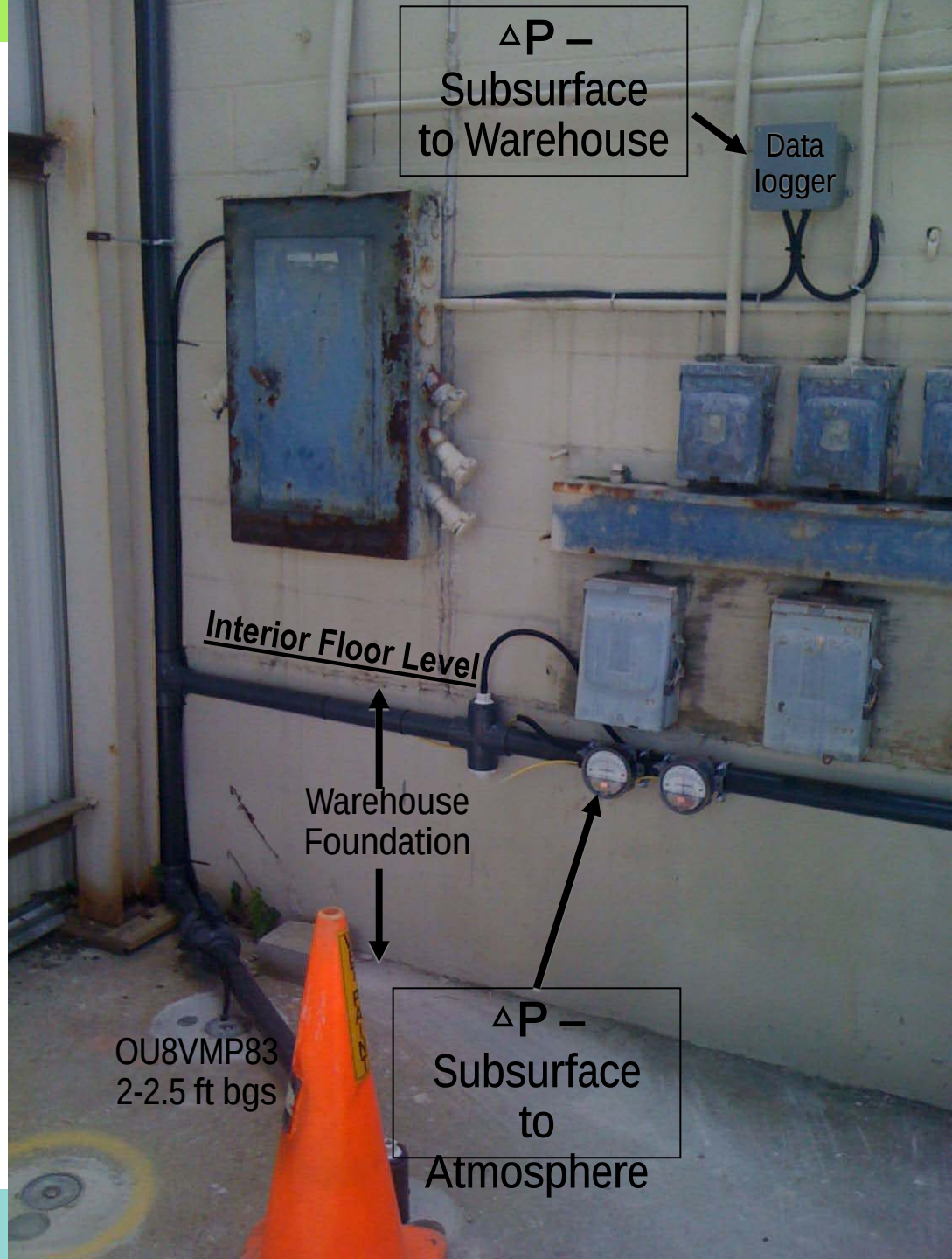
Warehouse 65 - northern section

Warehouse 65 Schematic



Vapor Intrusion – Managing the Solution

Pressure Differential monitoring used to evaluate potential for vapor migration into Warehouse 65



26Jun to 17Aug10 Pressure Profiles

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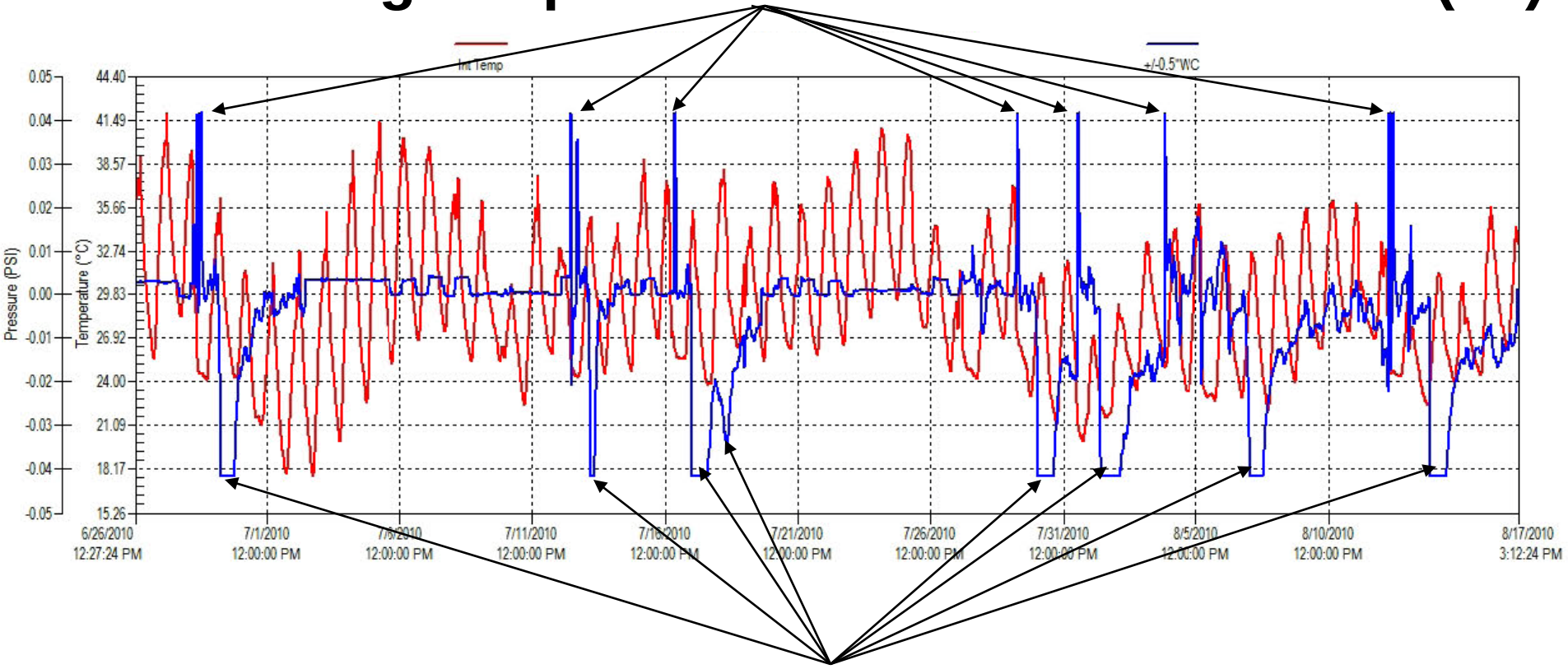
High Vapor Intrusion Potential Events (~8)



Low Vapor Intrusion Potential Events (~8)

Blue line – Pressure differential (Subsurface to Indoor)

Red line - Subsurface temperature

17Aug to 07Dec10 Pressure Profiles

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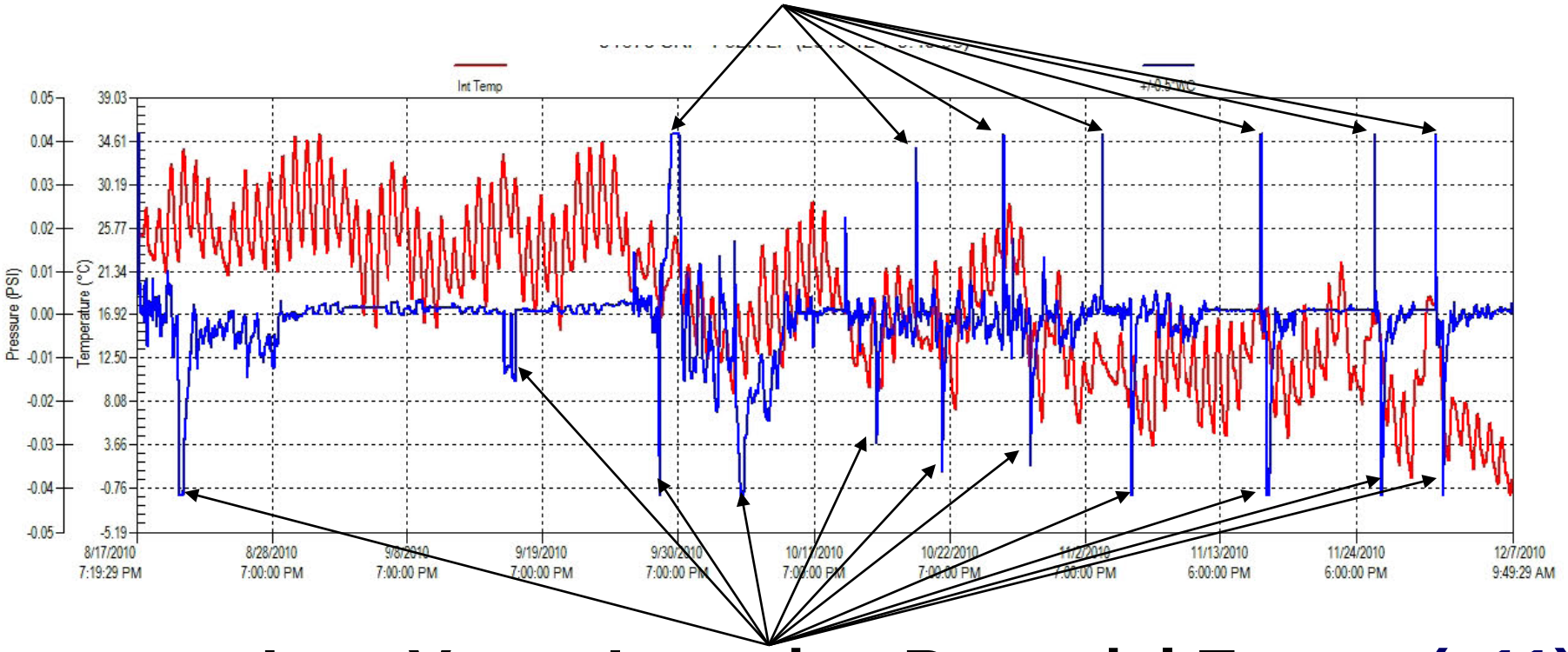
High Vapor Intrusion Potential Events (~8)



Low Vapor Intrusion Potential Events (~11)

Blue line – Pressure differential (Subsurface to Indoor)
Red line - Subsurface temperature

07Dec10 to 18Jan11 Pressure Profile

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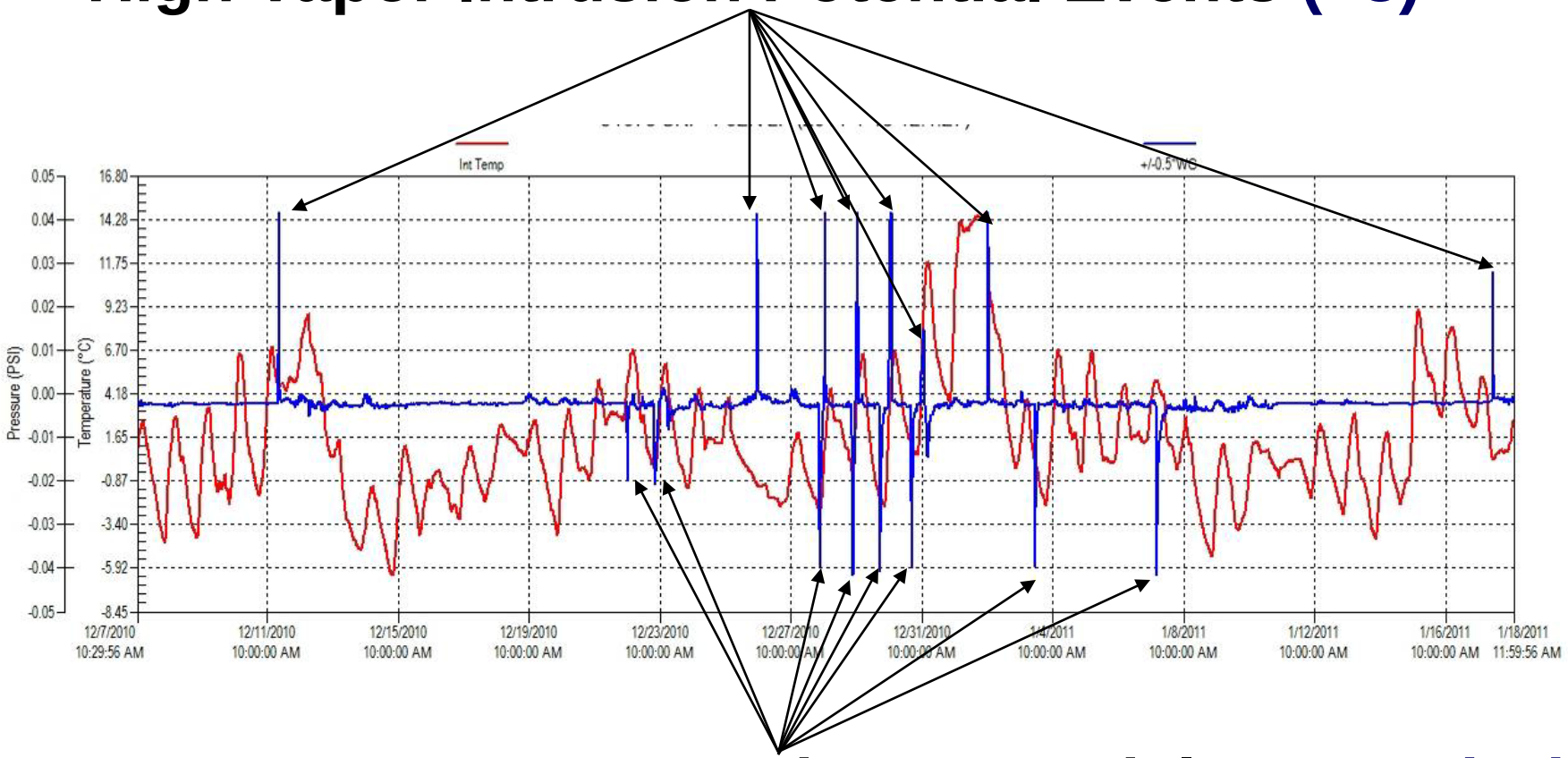
High Vapor Intrusion Potential Events (~8)



Low Vapor Intrusion Potential Events (~8)

Blue line – Pressure differential (Subsurface to Indoor)

Red line - Subsurface temperature

High vs. Low Vapor Intrusion Potential

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Condition	Percentage of Total Time	Percentage of Workday Time
Subsurface Pressure Positive $\Delta P \geq 0.01$ psi	4.1%	2.4%
Subsurface Pressure Positive $\Delta P \geq 0.02$ psi	0.84%	0.39%
Subsurface Pressure Negative $\Delta P \leq -0.01$ psi	13.5%	3.2%
Subsurface Pressure Negative $\Delta P \leq -0.02$ psi	4.3%	1.2%

Assumes Business Hours: Monday-Friday; 0730-1700

Concentration Comparisons

Chemical - Location	Maximum Concentration (ppbV)	Ratio to Industrial Indoor Air Screening Level (EPA, 2010)	Apparent Attenuation Factor (Indoor/Subsurf.)
PCE - Subsurface	3,900	12,600 times Screening Level	0.00036
PCE – Indoor Air	1.4	4.5 times Screening Level	Not Applicable
TCE- Subsurface	360	315 times Screening Level	0.00083
TCE – Indoor Air	0.3	0.26 times Screening Level	Not Applicable

EPA Screening Levels: PCE= 0.31 ppbV, TCE= 1.14 ppbV

Solar Depressurization System

40 watt photovoltaic system

Connected to vent wells in Outdoor Covered Storage Area

Interior Subslab Depressurization System

0.5 HP Regenerative Blower

Connected to vent wells inside Warehouse 65

Summary

- **Subsurface Vapors**
  - **PCE - Up to 12,600 times above Industrial Indoor Air Screening Levels (0.31 ppbV)**
  - **TCE – Up to 315 times above Industrial Indoor Air Screening Levels (1.14 ppbV)**
- **Indoor Air**
  - **Multiple VOCs detected**
    - **PCE - 4.5 times above Industrial Indoor Air Screening Level (0.31 ppbV)**
  - **Concentrations appear consistent despite**
    - **Adequate air exchange rates (e.g. Open overhead doors)**
    - **Stack effects – Wind, Heating, Roof vents, etc.**
  - **No permanent occupants in northern section of Warehouse 65 – minimal exposure**
  - **Risk assessment under preparation**

Summary

- **Subsurface to Warehouse Differential Pressure**
  - **Positive Pressure in subsurface 0.4 to 4% of time**
  - **Potential vapor intrusion events are short duration, transient events**
- **Subslab depressurization**
  - **Outdoor wells depressurization system (solar) operation ongoing**
  - **Indoor wells depressurization system (mechanical) operation ongoing**
  - **Radius of influence, pressure monitoring ongoing to evaluate effectiveness**
  - **Quarterly monitoring of subsurface vapor concentrations ongoing**

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DESIGNING MORE INTELLIGENTLY,
MANAGING MORE PRODUCTIVELY,
PARTNERING MORE POWERFULLY.