

VAPOR INTRUSION – DEFINING THE PROBLEM & MANAGING THE SOLUTION

DEFENSE SUPPLY CENTER RICHMOND

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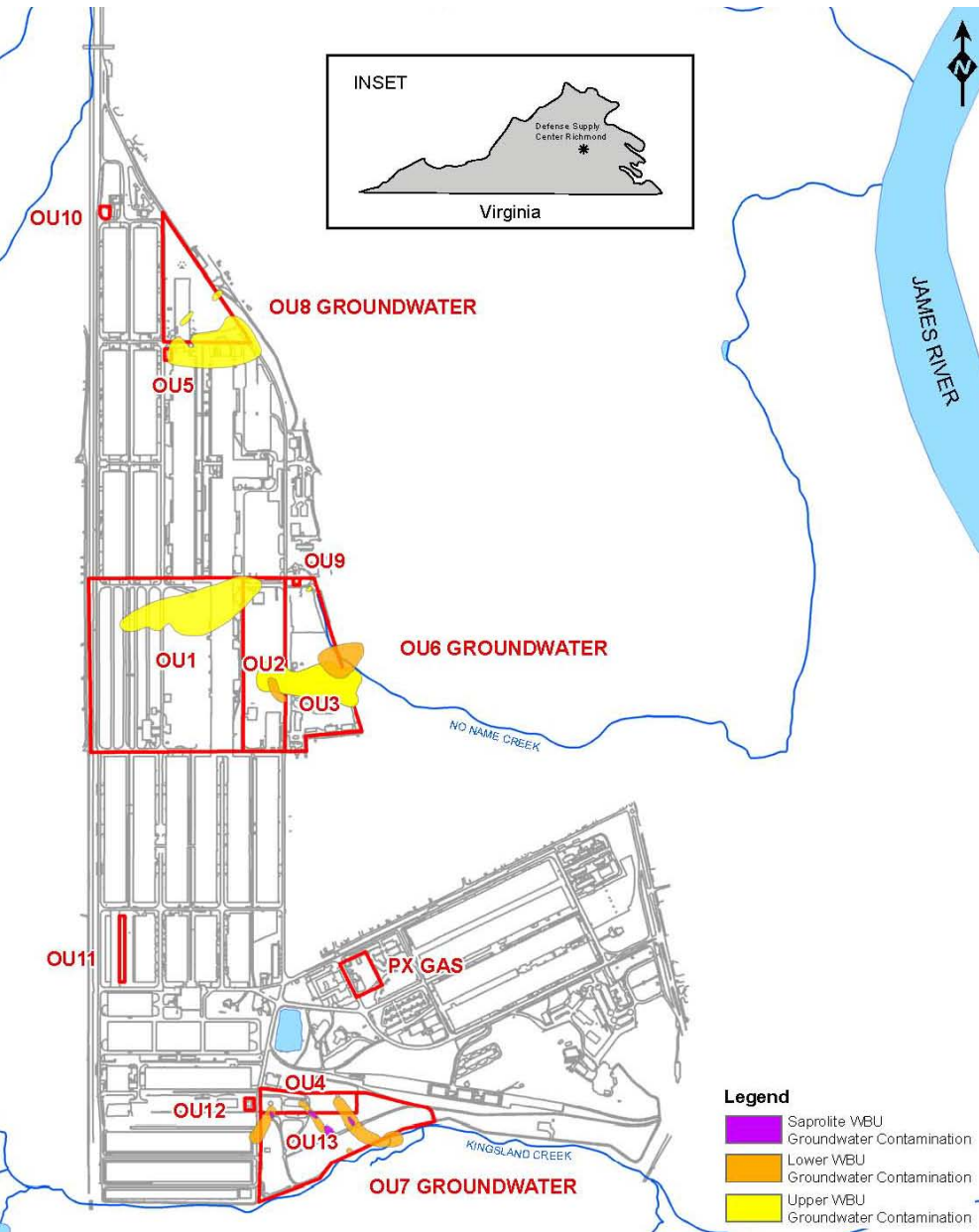
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Installation Background



- 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



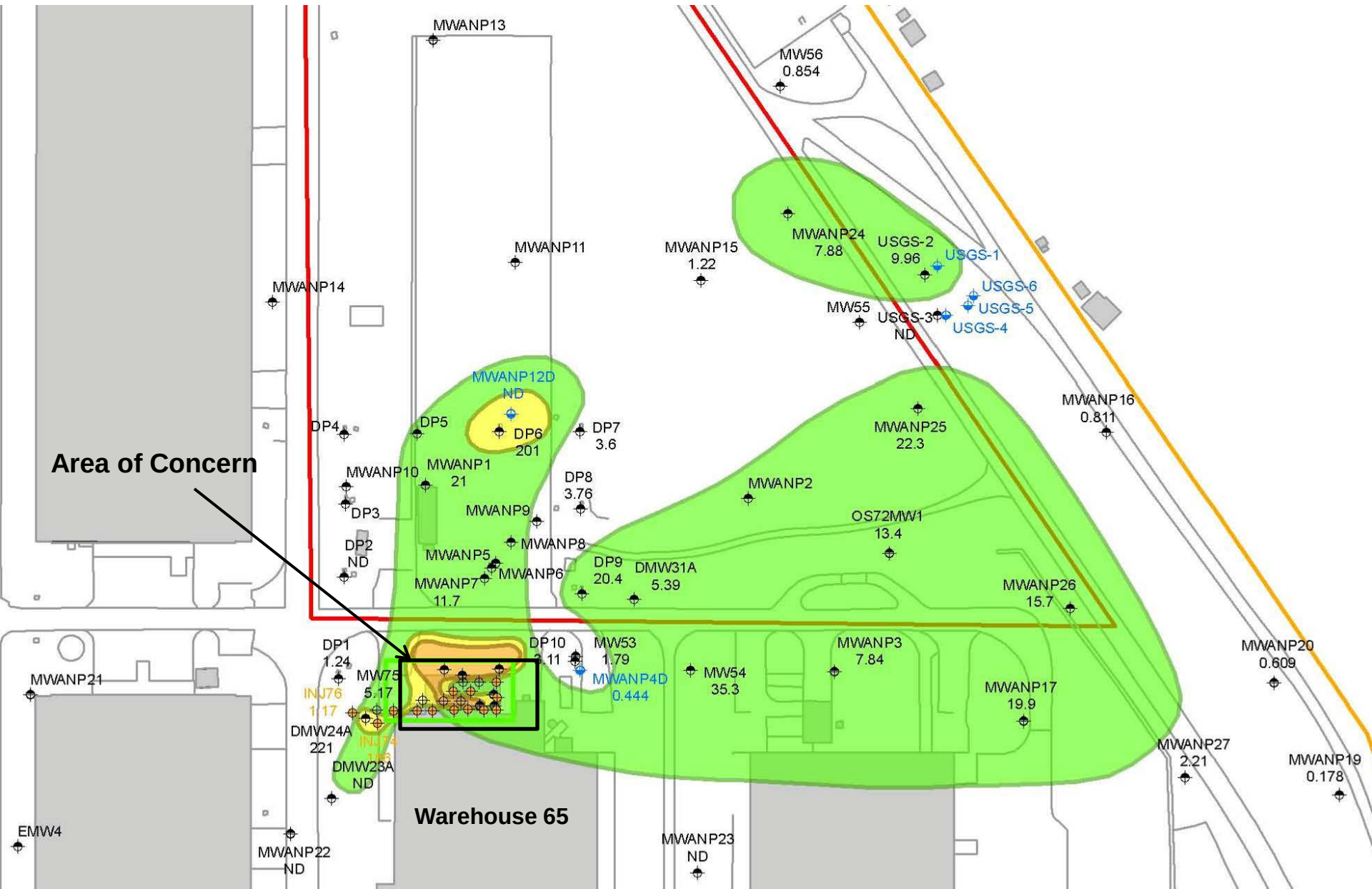
- OU 1- Open Storage Area Soil
- OU 2- Area 50 Source Area Soil
- OU 3- National Guard Source Area Soil
- OU 4- Fire Training Source Area Soil
- OU 5- Acid Neutralization Pits Source Area Soil
- OU 6- Area 50/ Open Storage Area/ National Guard Area Groundwater
- OU 7- Fire Training Area Groundwater
- 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

Legend

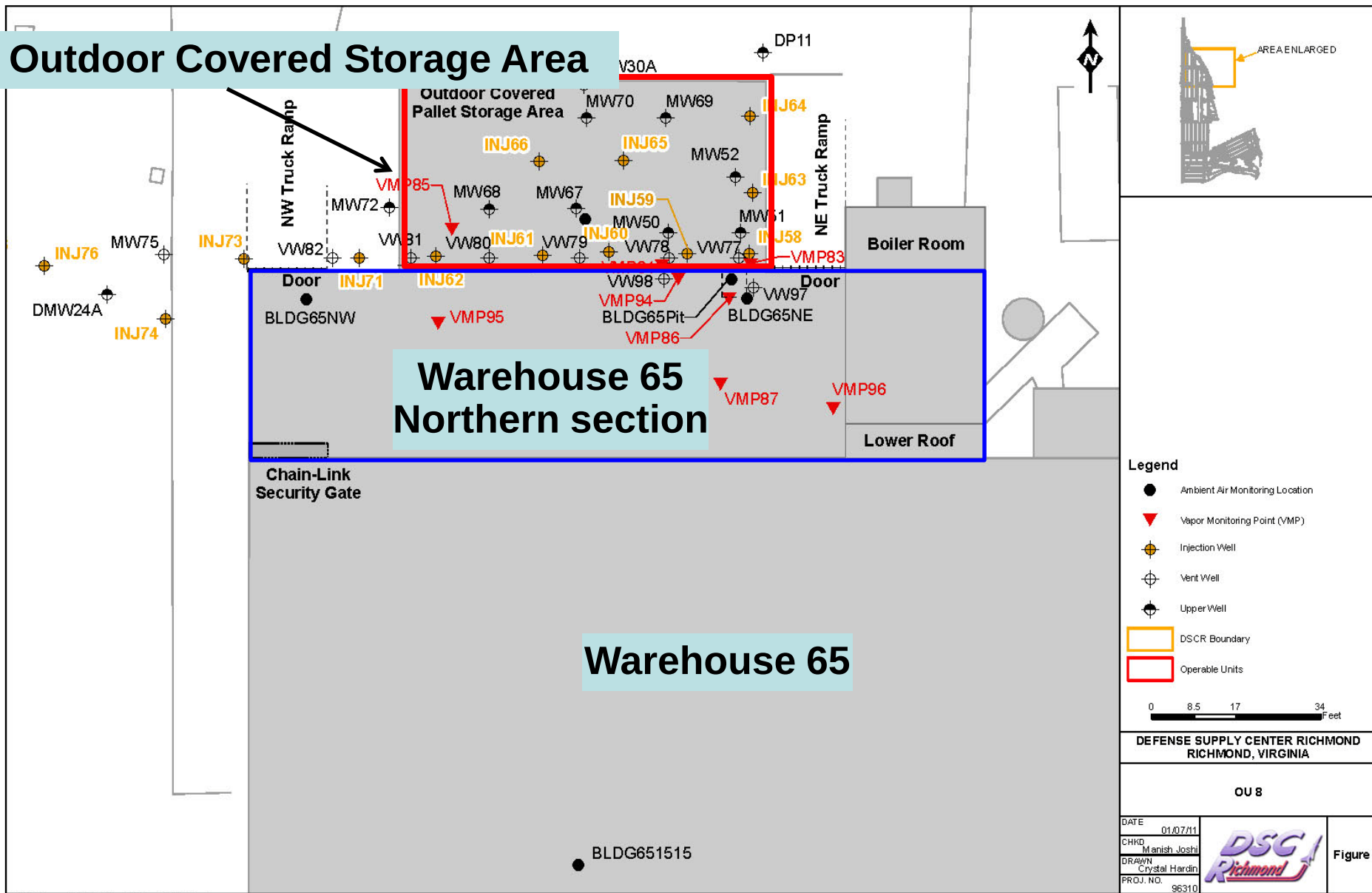
-  Saprolite WBU Groundwater Contamination
-  Lower WBU Groundwater Contamination
-  Upper WBU Groundwater Contamination

Vapor Intrusion - Defining the Problem

OU 8 PCE Plume (Sept 2010)



OU 8 - Warehouse 65 Site Map



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

VW78

VW79

VMP83

VW77

©
MW51

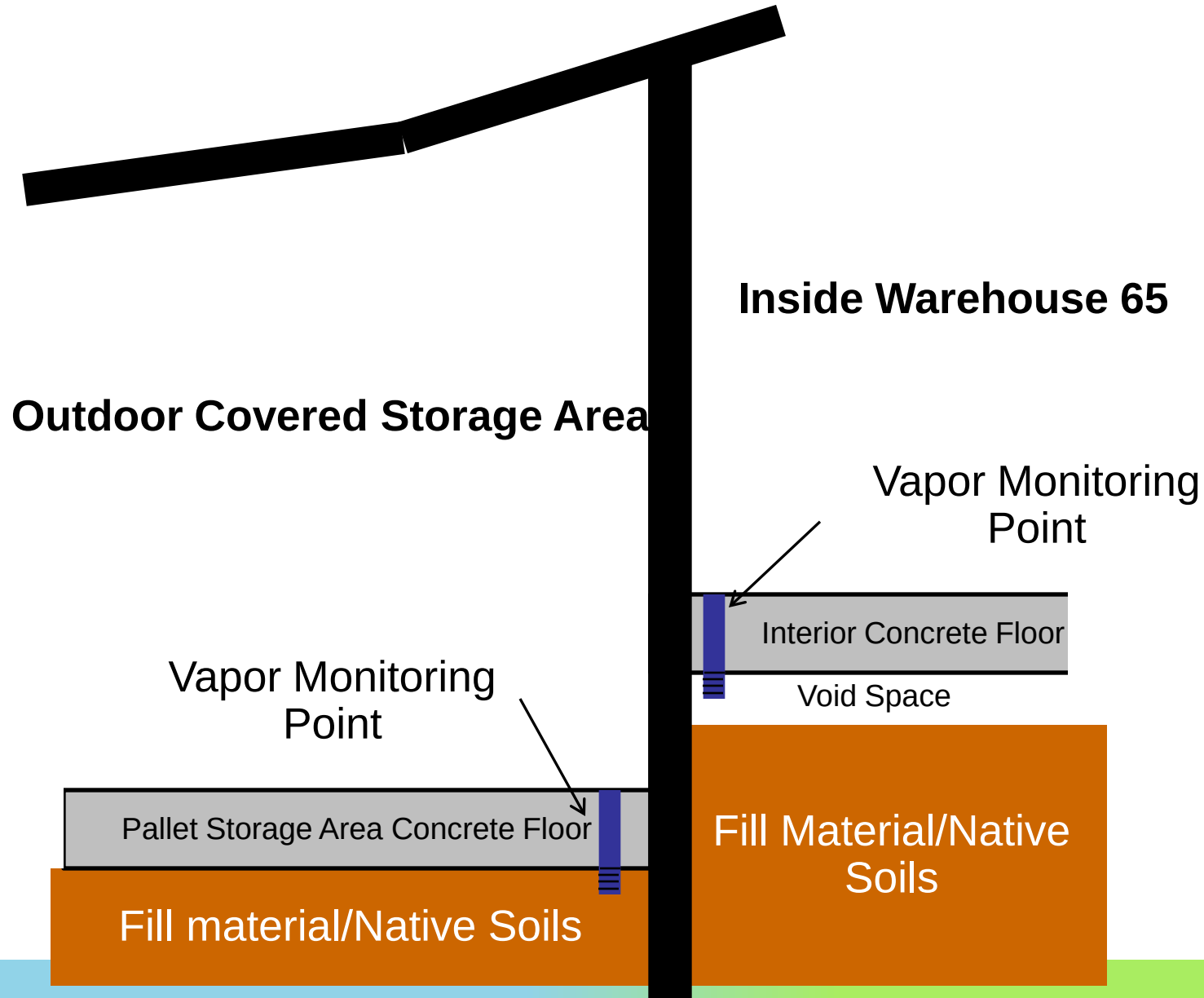
©
MW50

Outdoor Covered Storage
Area

Warehouse 65 - northern section

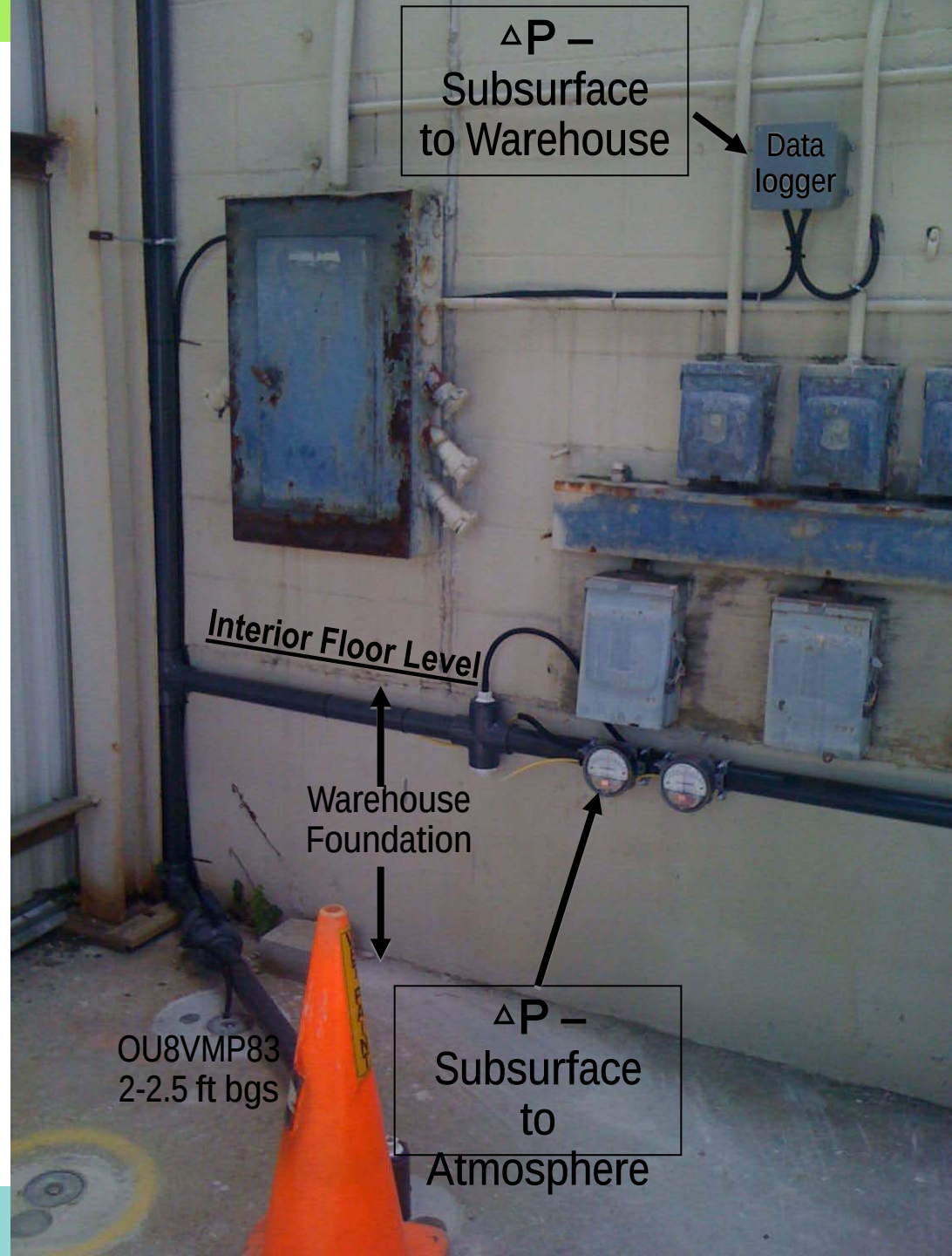


Warehouse 65 Schematic



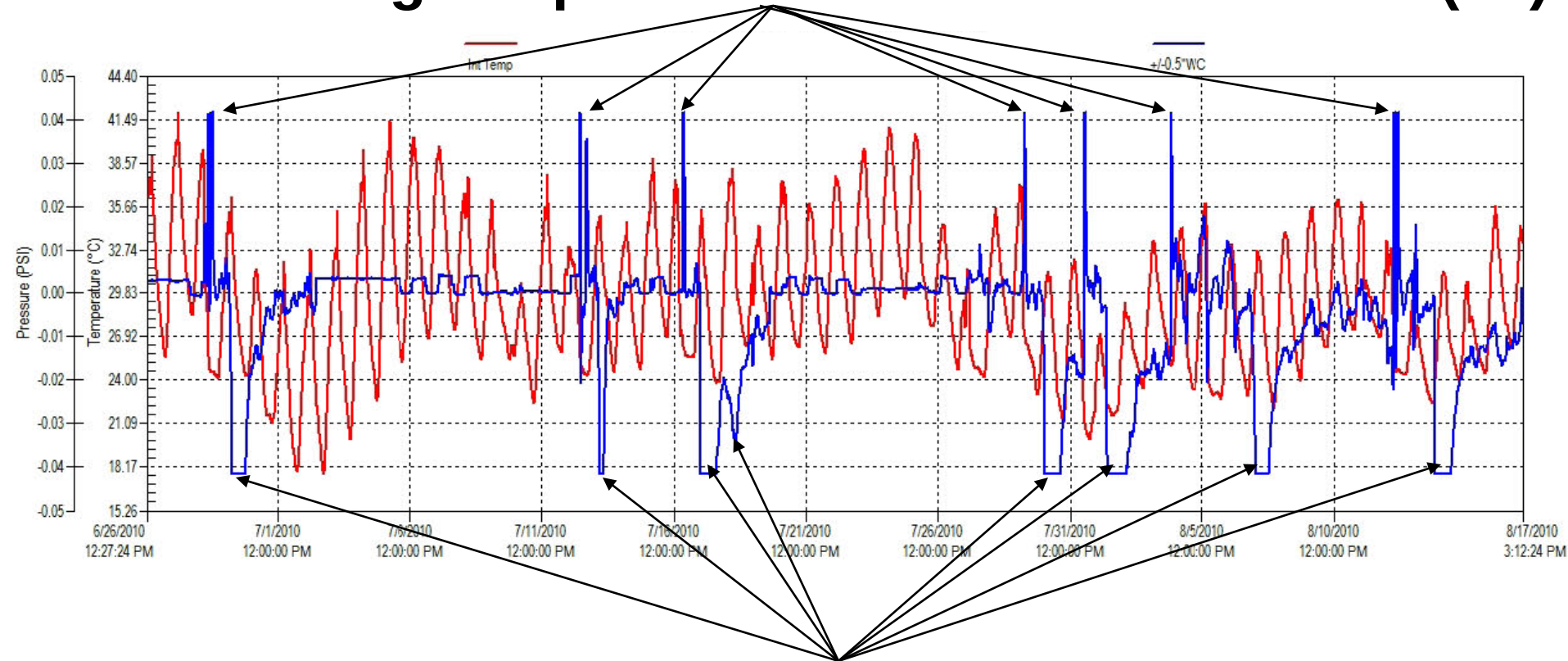
Vapor Intrusion – Managing the Solution

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



26Jun to 17Aug10 Pressure Profiles **AECOM**

High Vapor Intrusion Potential Events (~8)

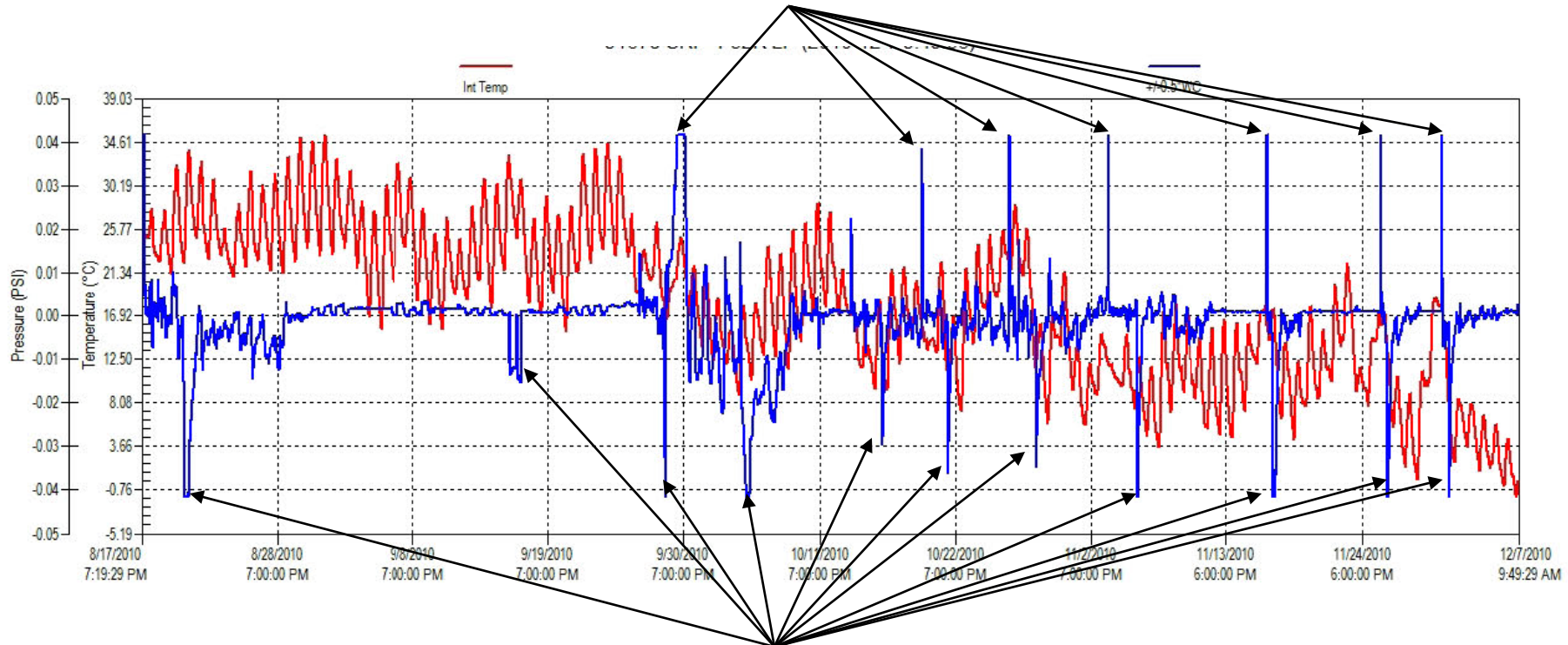


Low Vapor Intrusion Potential Events (~8)

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

17Aug to 07Dec10 Pressure Profiles

High Vapor Intrusion Potential Events (~8)

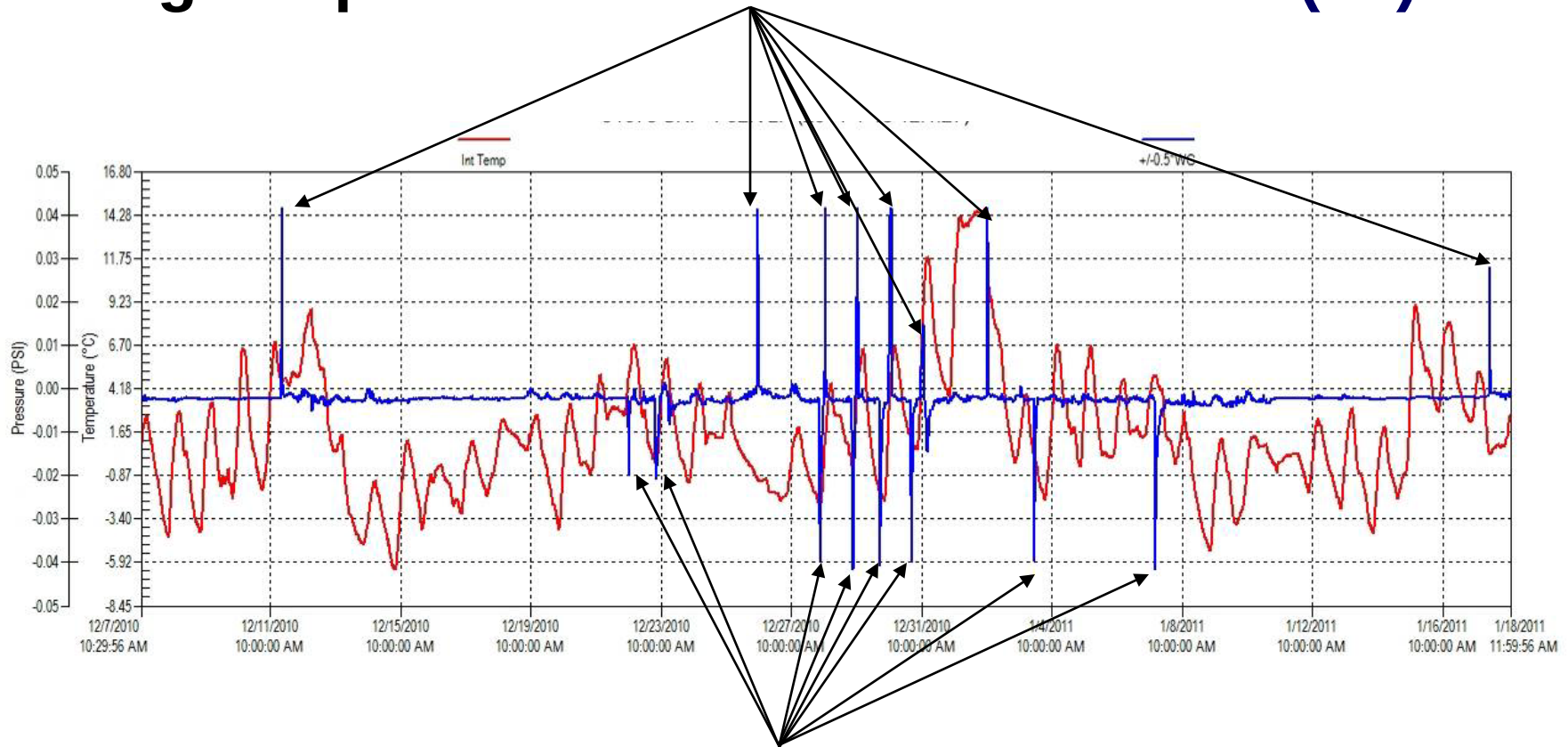


Low Vapor Intrusion Potential Events (~11)

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

07Dec10 to 18Jan11 Pressure Profile **AECOM**

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

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

- **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

MORE EXPERTS,
THINKING MORE INNOVATIVELY,
DESIGNING MORE INTELLIGENTLY,
MANAGING MORE PRODUCTIVELY,
PARTNERING MORE POWERFULLY.