EVALUATING THE EFFECT OF BUILDING PRESSURES ON 3-DIMENSIONAL SUB SLAB VACUUM FIELDS

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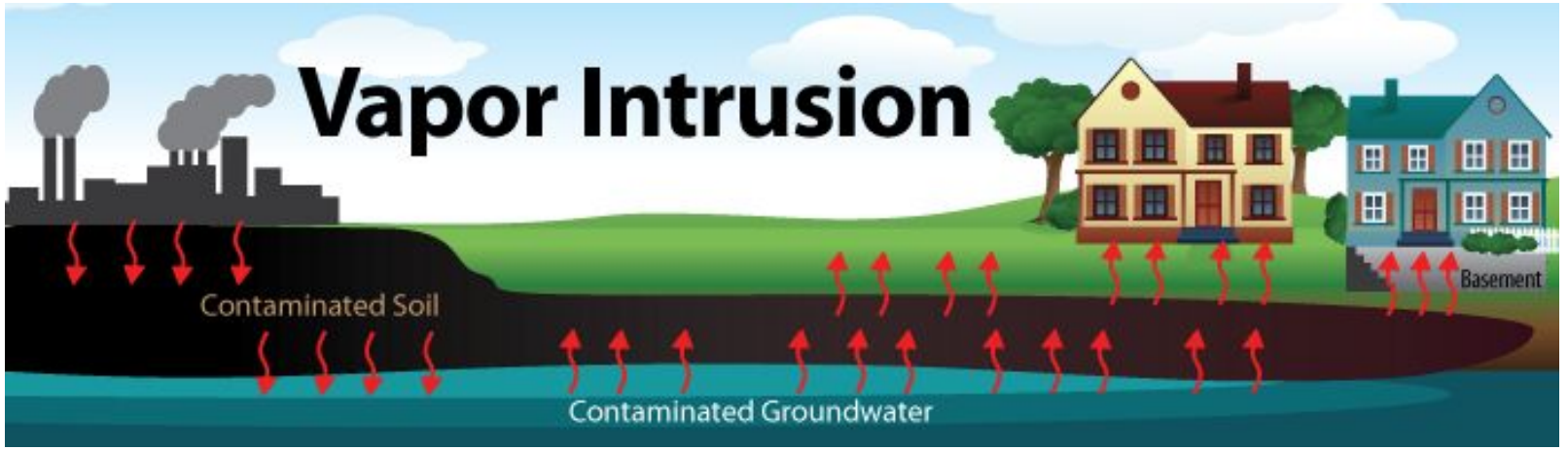
TO BE DISCUSSED

- ✔ What is vapor intrusion?
- ✔ Basic concepts of mitigation
- ✔ Mitigation system design
  - ✔ Sub Slab Depressurization
- ✔ How do buildings effect mitigation systems?
- ✔ The experiment
- ✔ Overlapping ROIs
- ✔ 3-Dimensional analysis of ROIs
- ✔ Lessons learned

WHAT IS VAPOR INTRUSION?

"Vapor intrusion occurs when volatile chemicals migrate from contaminated groundwater or soil into an overlying building in ways similar to that of radon gas seeping into homes." –EPA.gov



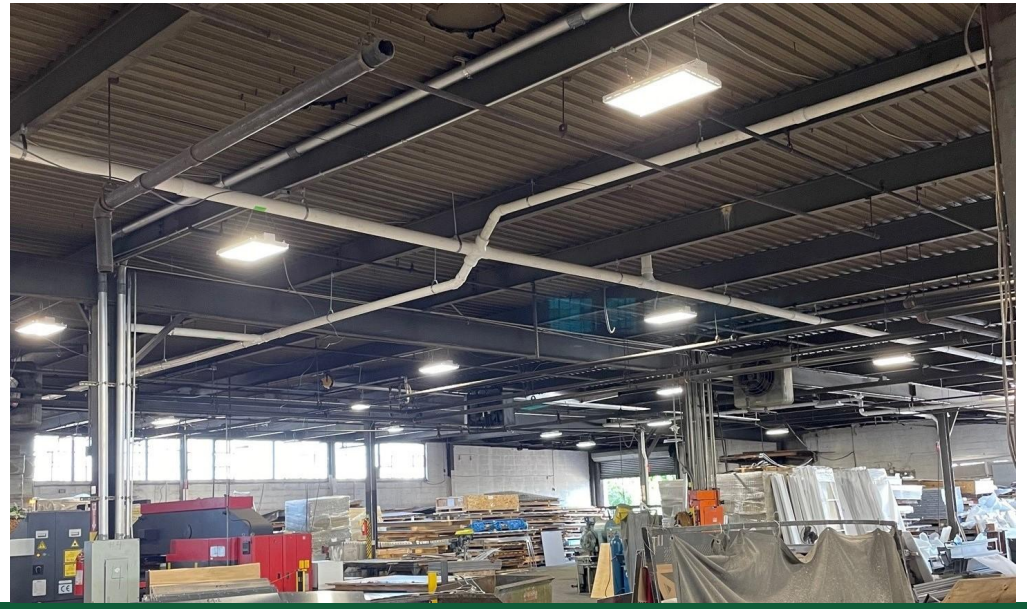
CONCEPTS OF MITIGATION

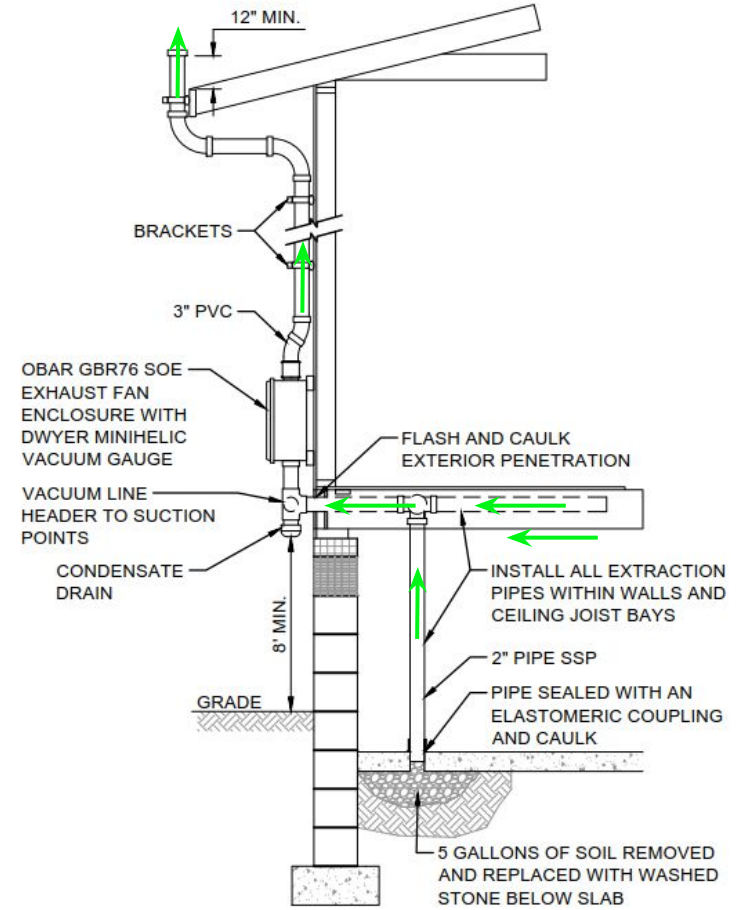
- ✔ Mitigation vs remediation
  - ✔ Not focused on source removal
  - ✔ Run continually
  - ✔ Designed to maintain a sub slab pressure differential
    - ✔ Typically -0.004 "w.c. to -0.010 "w.c. *
- ✔ Sub slab depressurization is most common method

* "w.c. – inches of water column

SUB SLAB DEPRESSURIZATION SYSTEMS (SSDS)

- ✔ Apply vacuum:
  - ✔ To the soil beneath the building
  - ✔ Through a network of pipes
  - ✔ From externally mounted mitigation fans
- ✔ Exhaust soil gas above the roofline



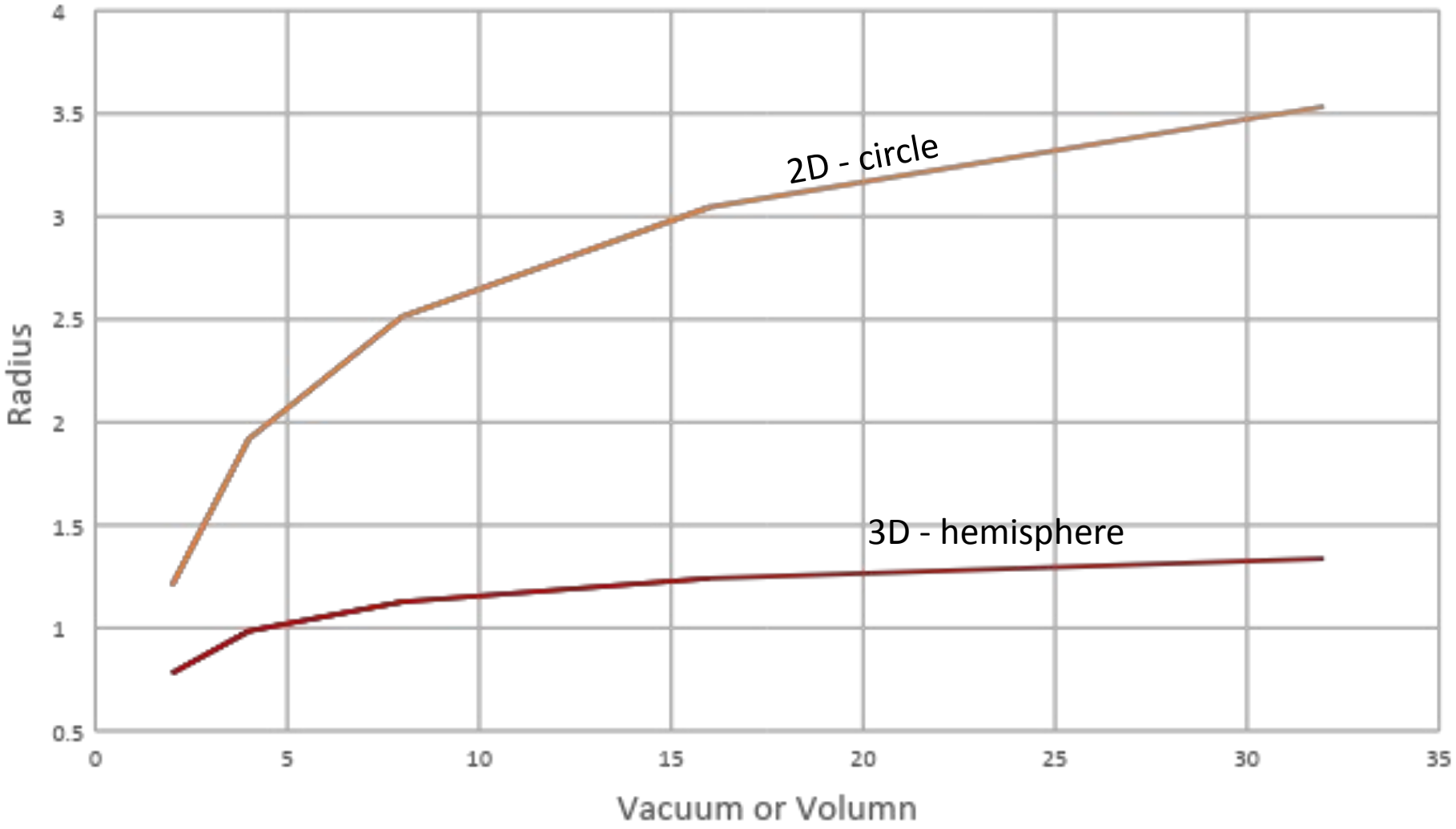


4 / 1001 TYPICAL SUCTION POINT AND BLOWER ASSEMBLY
NOT TO SCALE

VACUUM FIELDS

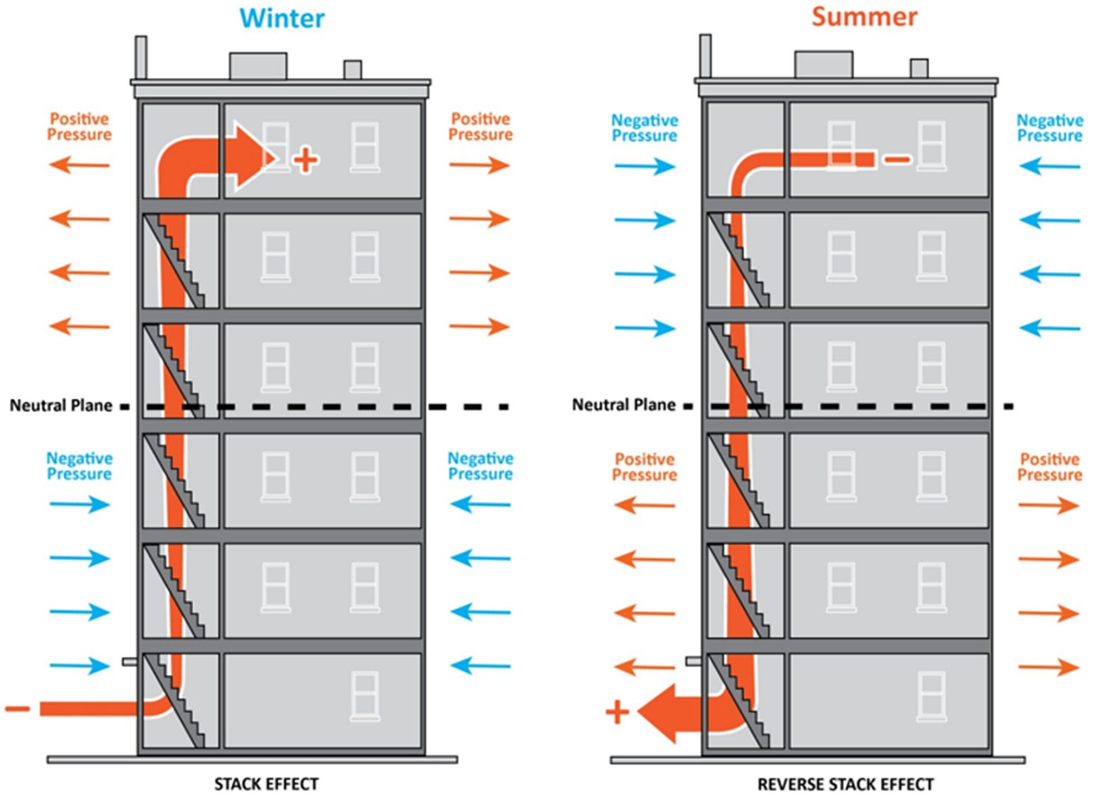
✔ Radius of Influence (ROI) vs. Area of Influence (AOI)

VACUUM FIELDS



HOW DO BUILDINGS EFFECT MITIGATION SYSTEMS

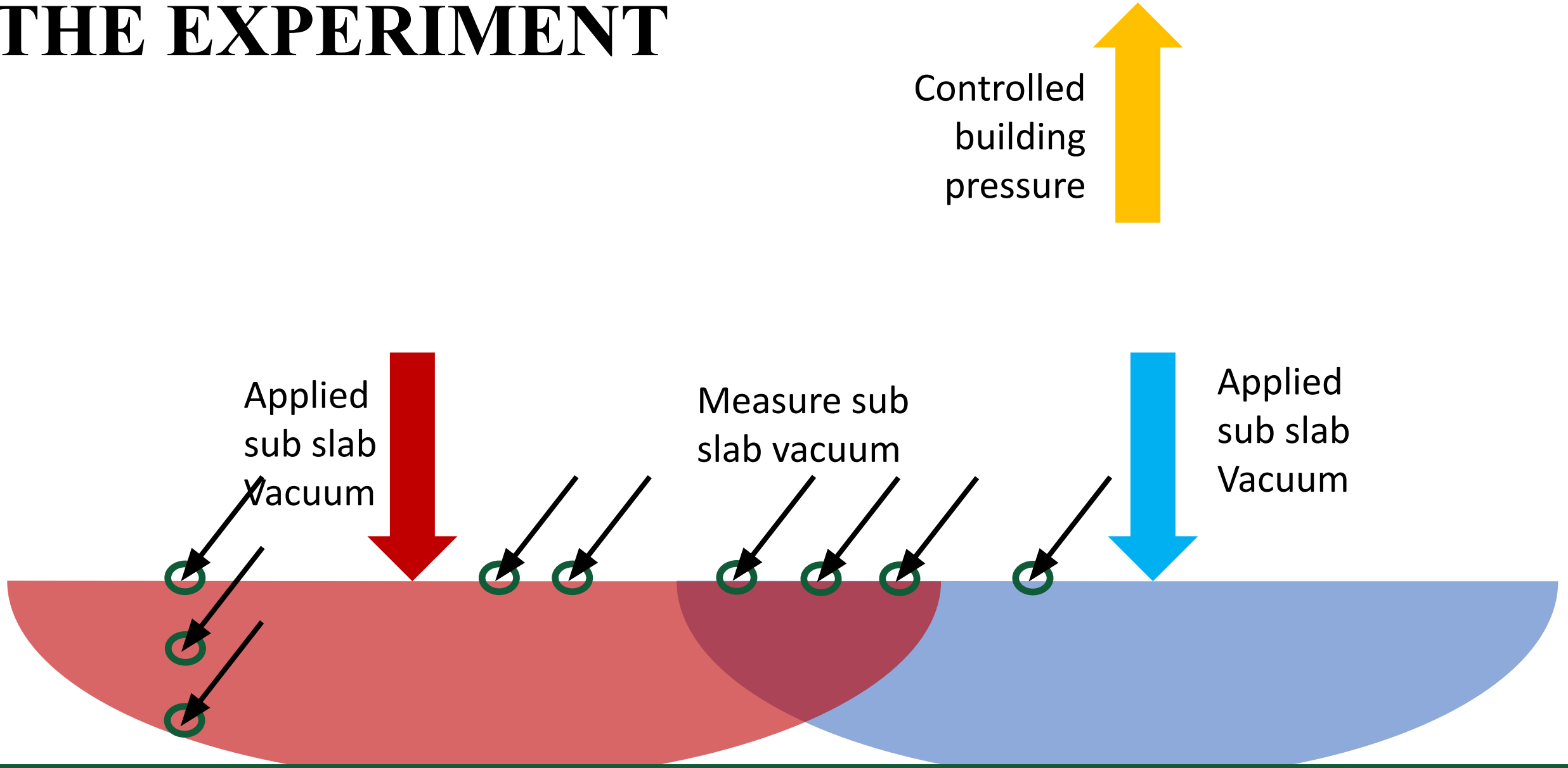
- ✔ Summer vs. Winter
  - ✔ Effects vary based on building location
  - ✔ Effect vary based on building type
- ✔ Stack effect larger contributor in residential
- ✔ HVAC controls, return type, setbacks
- ✔ Industrial vs. office building HVAC
- ✔ Typical building pressures
  - ✔ Neutral to 0.015 “w.c.



THE EXPERIMENT

- ✔ Goals:
  - ✔ Evaluate the depth of sub slab soil effected by building pressures
  - ✔ Evaluate the overlapping effect of ROIs from multiple suction points
- ✔ The Set Up
  - ✔ Apply vacuum at two different locations
  - ✔ Measure pressure differential at multiple soil depths and distances from applied
  - ✔ Modulate building pressure and applied vacuums
    - ✔ Blower door
    - ✔ Variable speed mitigation fan

THE EXPERIMENT



THE EXPERIMENT

1. Apply

2. Measure

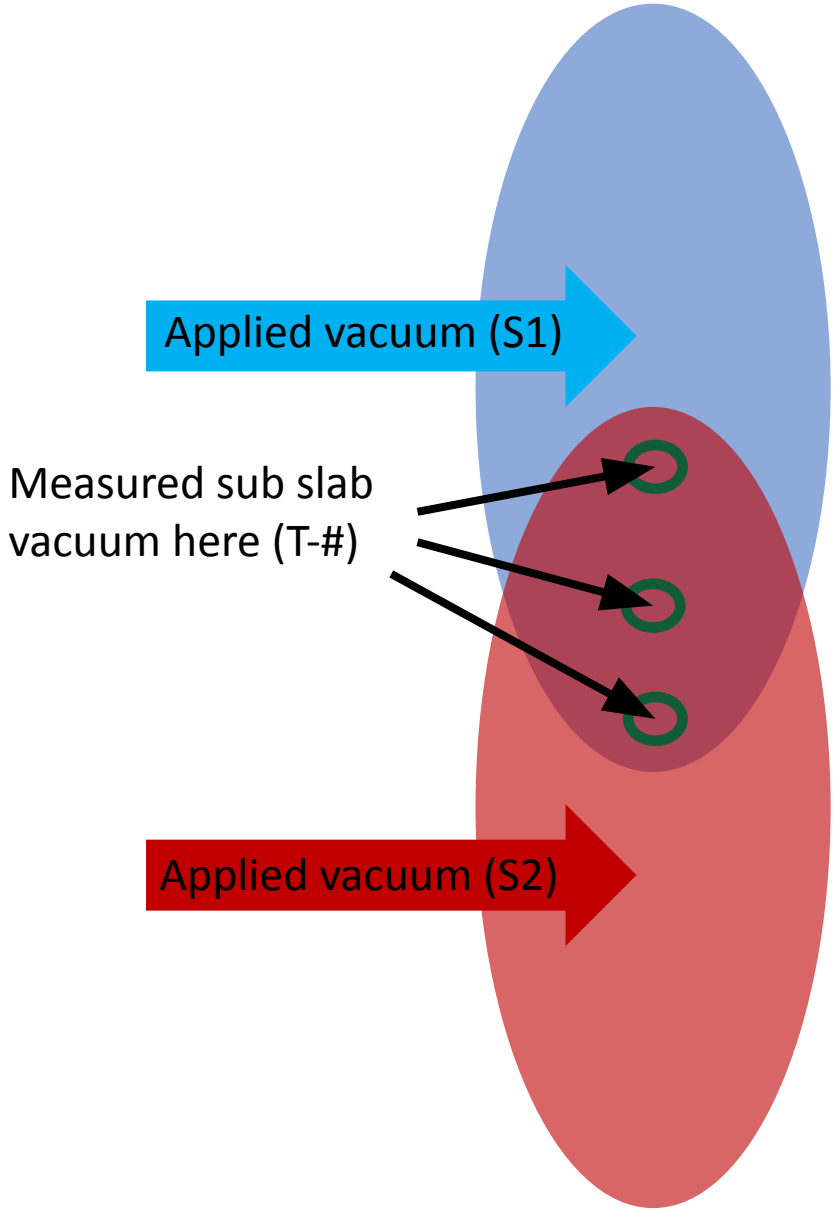
3. Control

OVERLAPPING ROIS

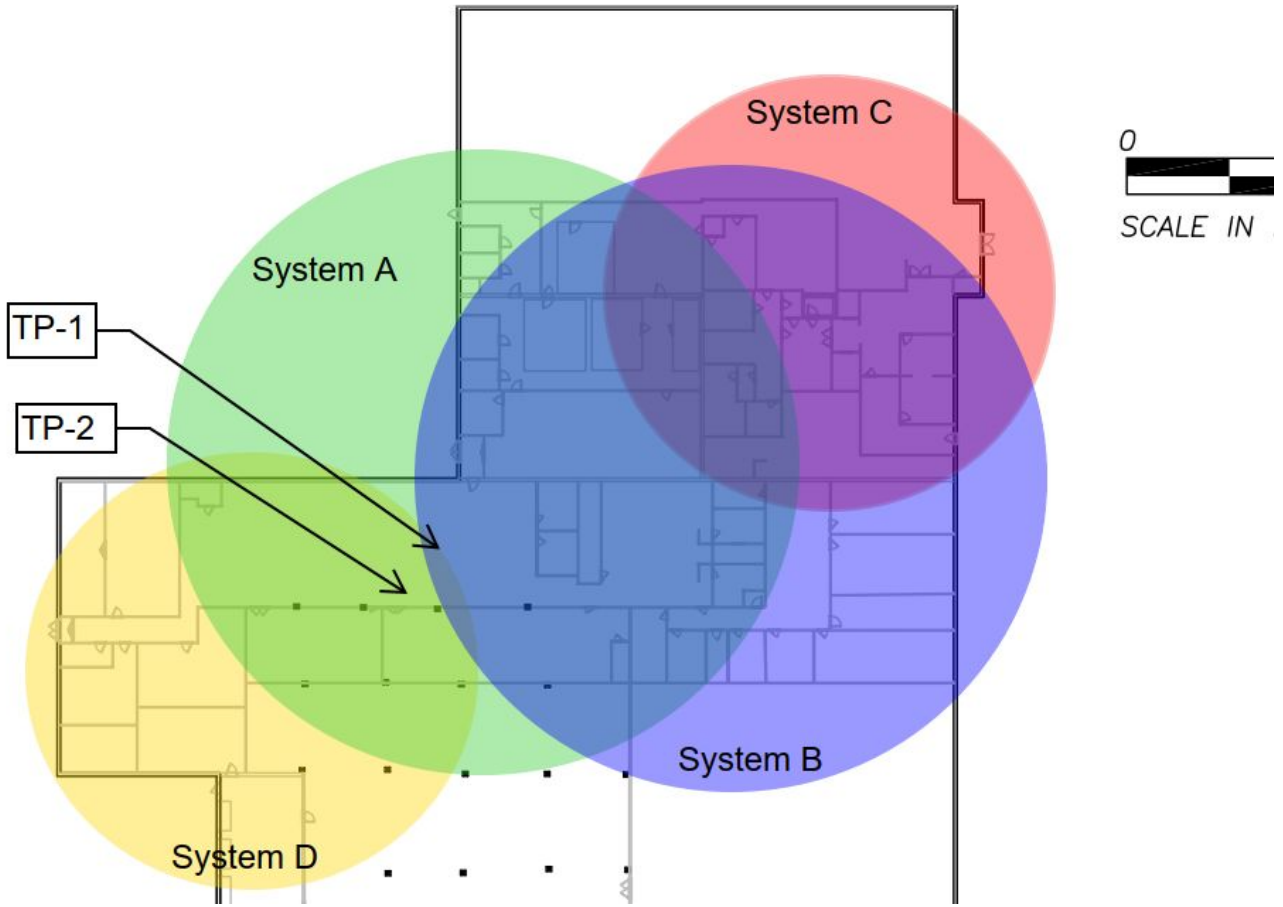
✔ Overlapping ROIs are ADDITIVE

Test Point	Distance from S1	Distance from S2	S1 Only	S2 Only	S1 & S2 Theoretical	S1 & S2 Actual
TP- 1	6	19	0.134	0.008	0.142	0.157
TP-2	7	18	0.058	0.009	0.067	0.063
TP-3	8	17	0.046	0.014	0.060	0.056
TP-4	9	16	0.033	0.014	0.047	0.052
TP-5	10	15	0.024	0.018	0.042	0.048
TP-6	11	14	0.014	0.021	0.035	0.042
TP-7	12	13	0.014	0.032	0.046	0.048
TP-8	13	14	0.010	0.037	0.047	0.052
TP-9	14	11	0.009	0.042	0.051	0.054

12 "w.c. applied
(all measurements in "w.c.)



OVERLAPPING ROIS



	ABCD Theoretical
	0.078
	0.059

	AB Theoretical	ABC Theoretical	AD Theoretical	ABD Theoretical
	0.038	0.048	0.055	0.068
	0.036	0.042	0.042	0.053

(all measurements in "w.c.)

3- DIMENSIONAL ROIS

✔ 6’ from vacuum source

(all measurements in "w.c.)

THE EFFECT OF BUILDING PRESSURES

✔ Neutral Building

✔ 0.01 Building Pressure

(all measurements in "w.c.)

THE EFFECT OF BUILDING PRESSURES

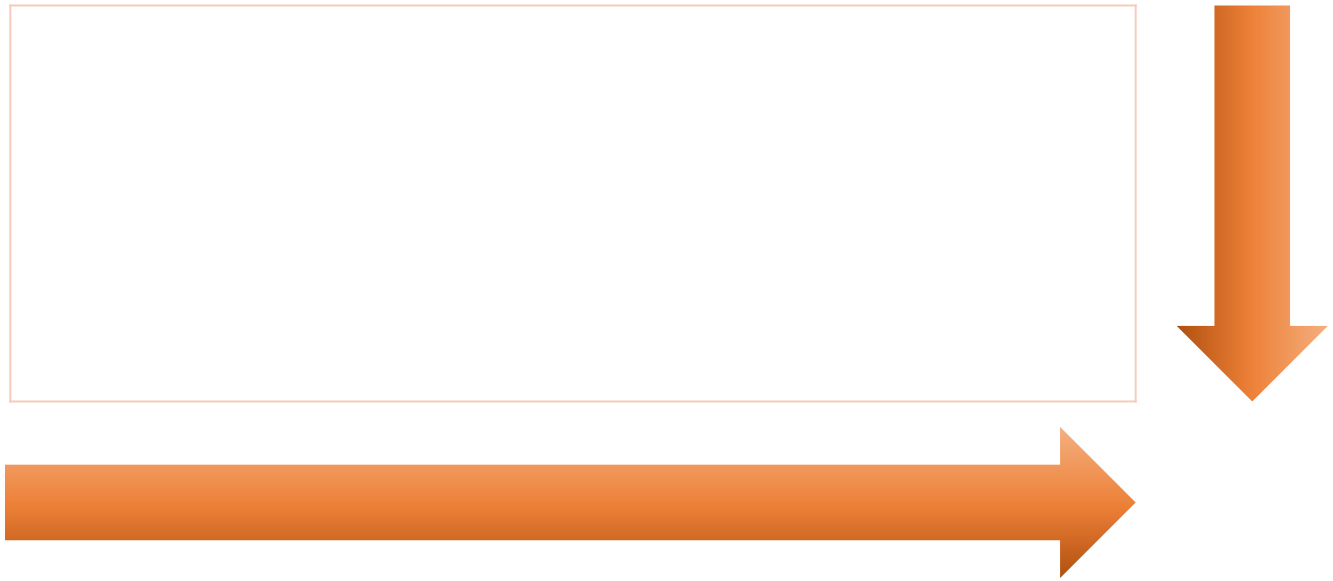
- ✔ 0.03 Building

- ✔ 0.05 Building Pressure

(all measurements in "w.c.)

THE EFFECT OF BUILDING PRESSURES

- ✔ 8” of applied vacuum



(all measurements in "w.c.)

LESSONS LEARNED

- ✔ ROIs are 3-dimensional
- ✔ More applied vacuum is not the answer
- ✔ Overlapping ROIs are additive
- ✔ Building ΔP between outside and the slab are not the same
  - ✔ Determined by porosity and leakage rate of the slab (barrier)
- ✔ Building ΔP has diminishing effects as the depth of measurement increases