VAPOR INTRUSION MITIGATION FUNDAMENTALS

DocAir

Barry C. Westbrook, CIH, PE (KY)

VAPOR EXTRACTION VS. VAPOR INTRUSION **MITIGATION**

Abatement vs. Isolation

WHAT IS VAPOR INTRUSION MITIGATION?

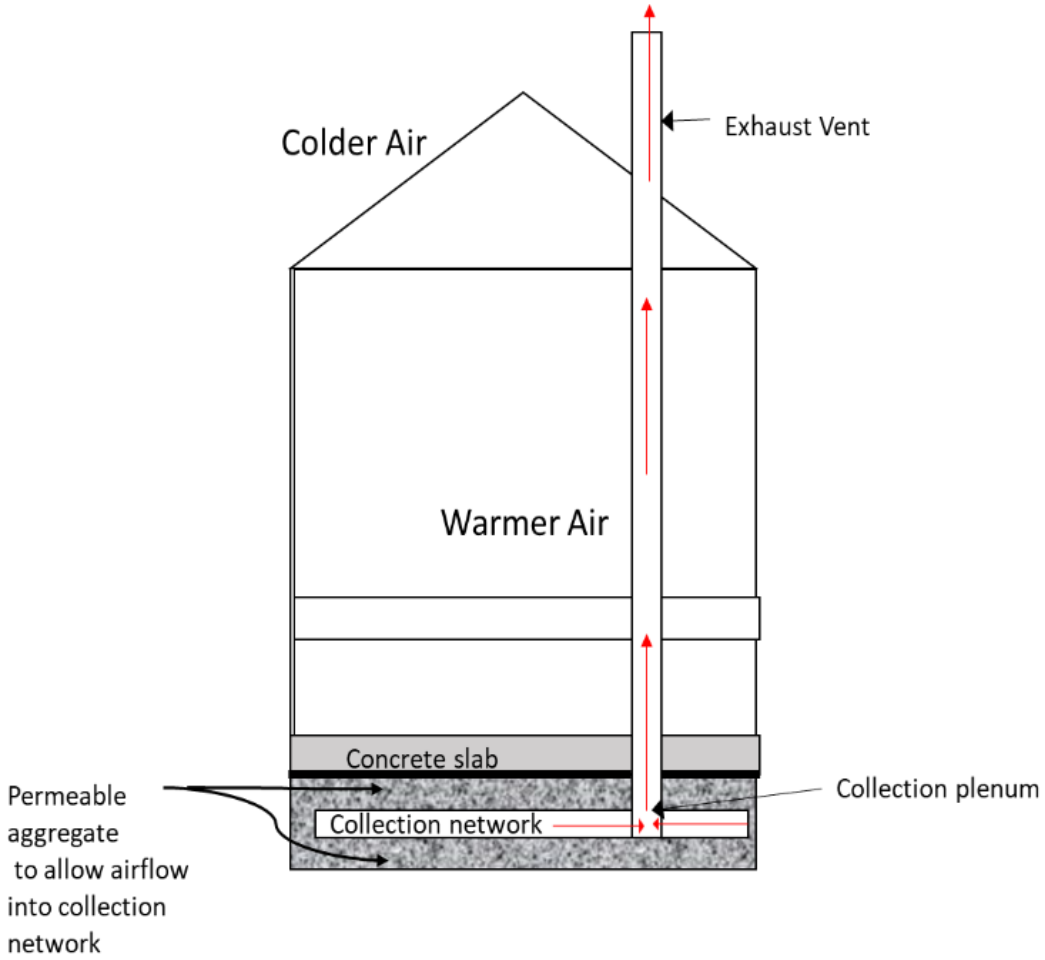
Passive Methods

- Sealing openings, gaps, and cracks
- Installing vapor barriers
- Passive venting

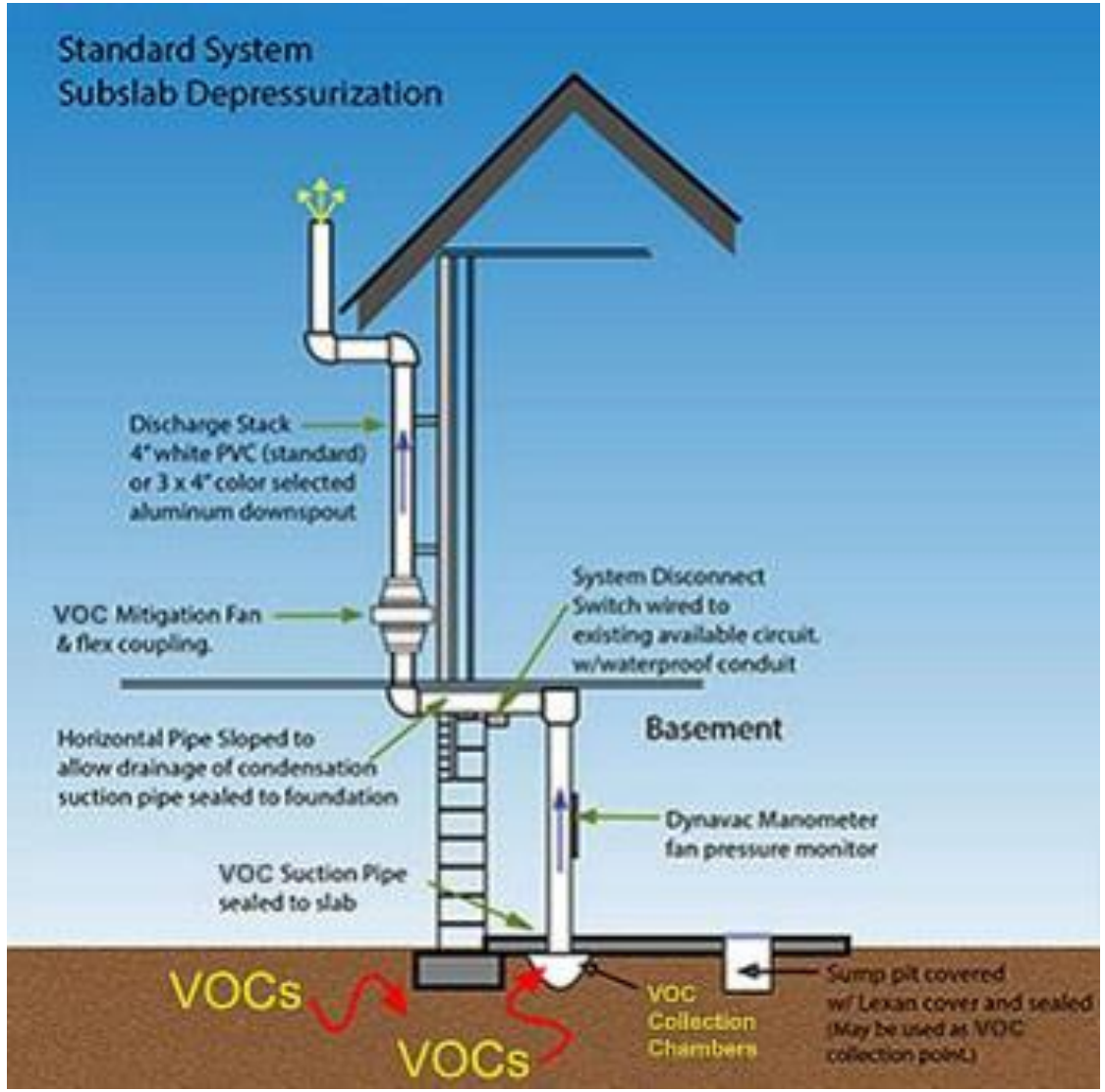
Active Methods

- Sub-slab or sub-membrane depressurization with fans
- Positive pressurization of the building interior

PASSIVE VAPOR INTRUSION MITIGATION

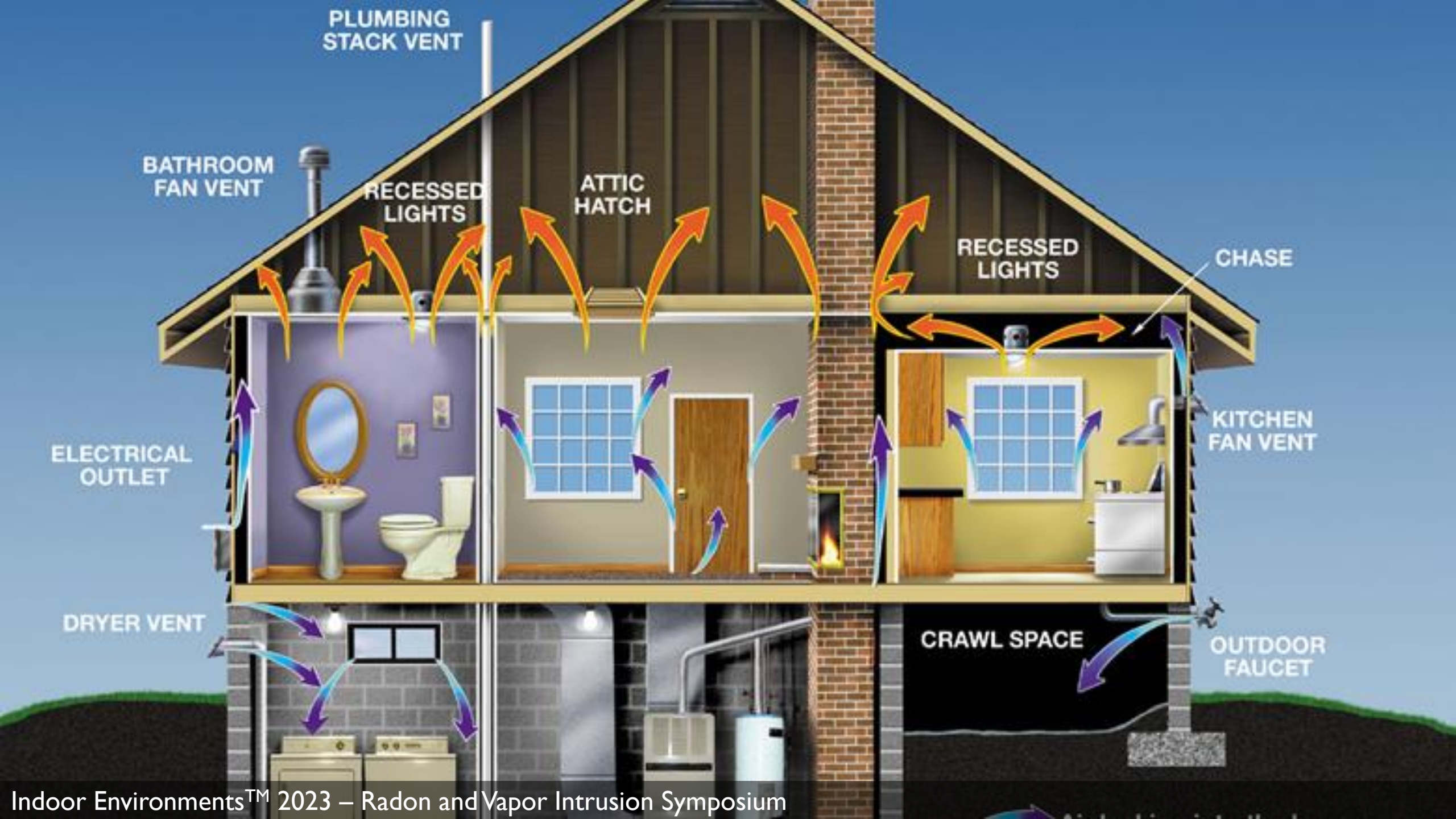


ACTIVE VAPOR INTRUSION MITIGATION

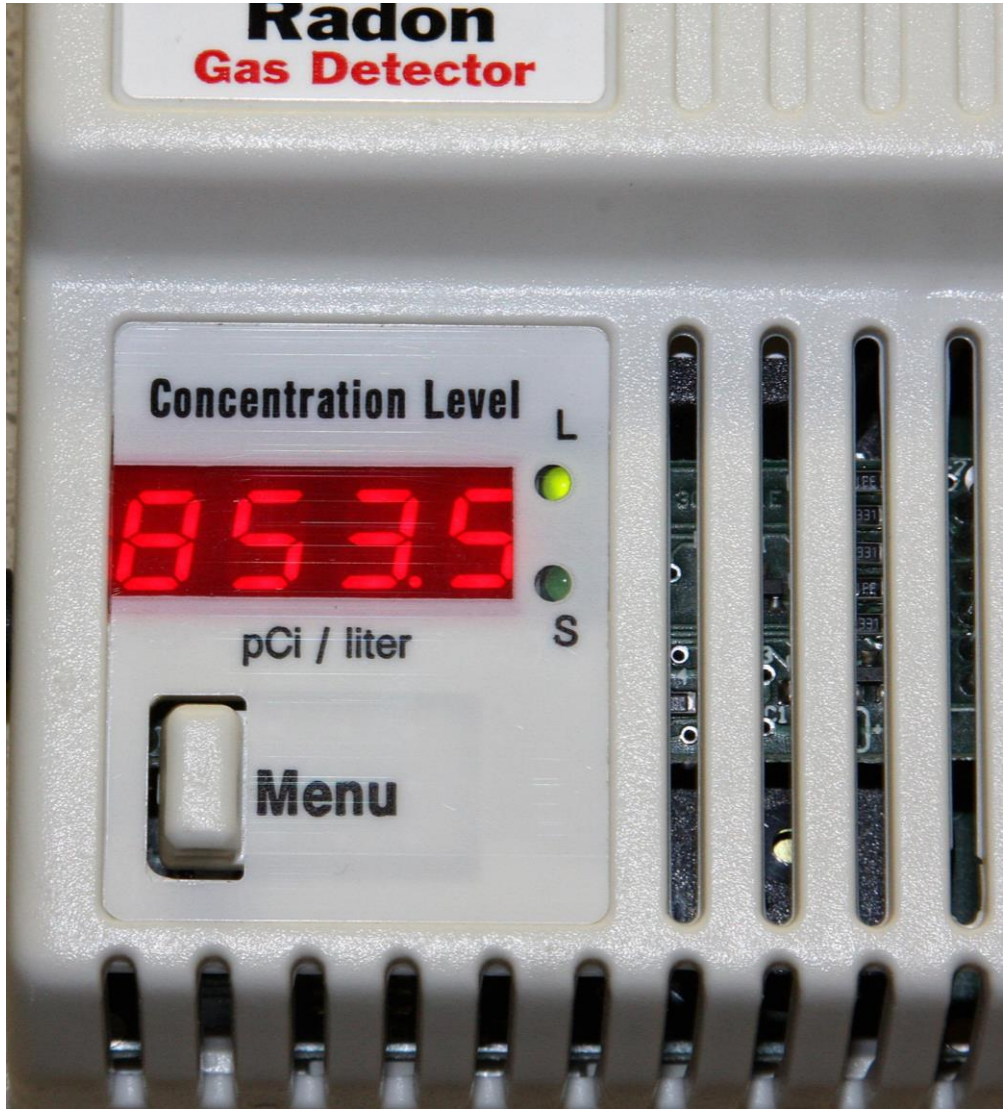


Where does our breathing air come from?

NEGATIVE BUILDING PRESSURE


PLUMBING STACK VENT
BATHROOM FAN VENT
RECESSED LIGHTS
ATTIC HATCH
RECESSED LIGHTS
CHASE
ELECTRICAL OUTLET
KITCHEN FAN VENT
DRYER VENT
CRAWL SPACE
OUTDOOR FAUCET

NASHVILLE RADON LEVELS (IN SOIL)



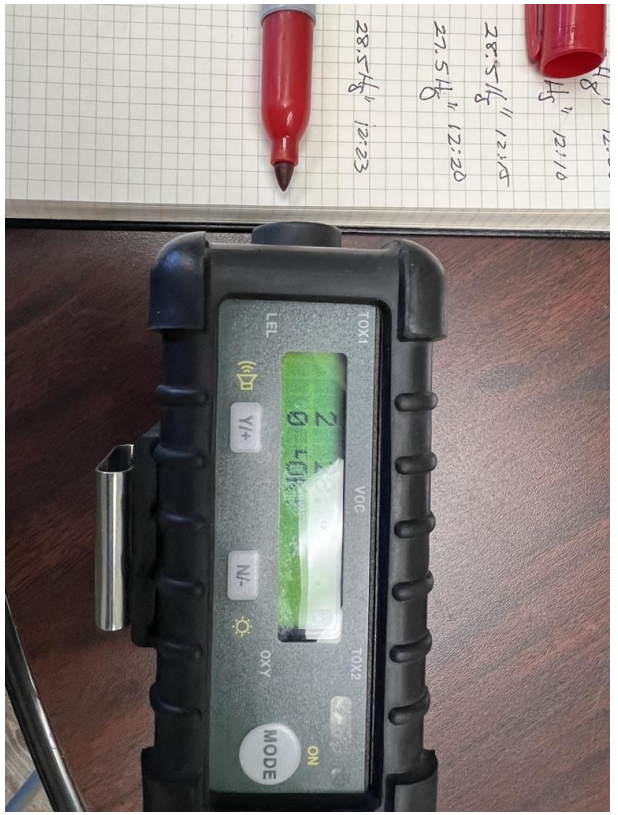
MAJOR SOURCE OF AIR EXFILTRATION/ INFILTRATION

BUILDING PRESSURE

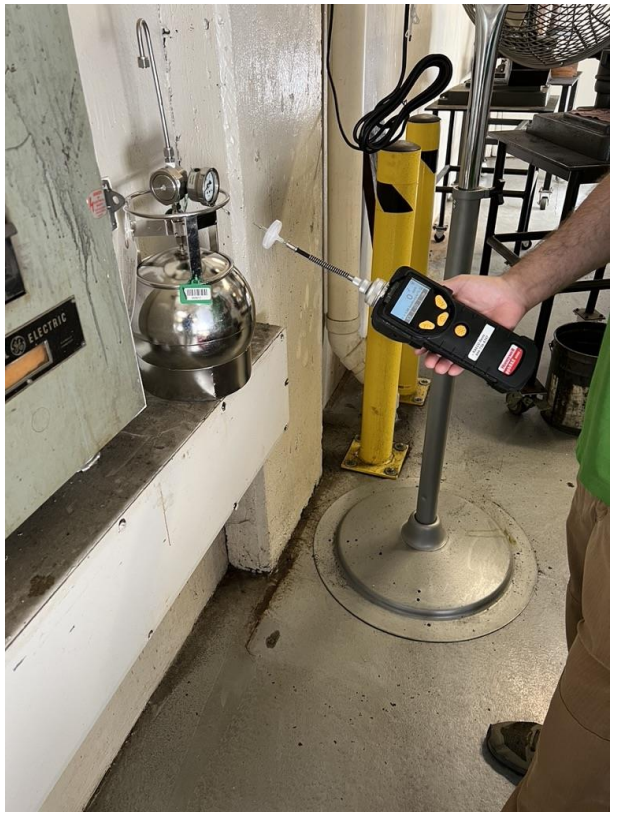
Sealing Leaks

Analyte	CAS #	Mol. Wt.	RDL1 ppbv	RDL2 ug/m3	Result ppbv	Result ug/m3	Qualifier	Dilution	Batch
Acetone	67-64-1	58.10	2.50	5.94	71.5	170		2	WG1616312
Allyl chloride	107-05-1	76.53	0.400	1.25	ND	ND		2	WG1616312
Benzene	71-43-2	78.10	0.400	1.28	ND	ND		2	WG1616312
Benzyl Chloride	100-44-7	127	0.400	2.08	ND	ND		2	WG1616312
Bromodichloromethane	75-27-4	164	0.400	2.68	ND	ND		2	WG1616312
Bromoform	75-25-2	253	1.20	12.4	ND	ND		2	WG1616312
Bromomethane	74-83-9	94.90	0.400	1.55	ND	ND		2	WG1616312
1,3-Butadiene	106-99-0	54.10	4.00	8.85	ND	ND		2	WG1616312
Carbon disulfide	75-15-0	76.10	0.400	1.24	ND	ND		2	WG1616312
Carbon tetrachloride	56-23-5	154	0.400	2.52	ND	ND		2	WG1616312
Chlorobenzene	108-90-7	113	0.400	1.85	ND	ND		2	WG1616312
Chloroethane	75-00-3	64.50	0.400	1.06	ND	ND		2	WG1616312
Chloroform	67-66-3	119	0.400	1.95	ND	ND		2	WG1616312
Chloromethane	74-87-3	50.50	0.400	0.826	0.729	1.51		2	WG1616312
2-Chlorotoluene	95-49-8	126	0.400	2.06	ND	ND		2	WG1616312
Cyclohexane	110-82-7	84.20	0.400	1.38	ND	ND		2	WG1616312
Dibromochloromethane	124-48-1	208	0.400	3.40	ND	ND		2	WG1616312
1,2-Dibromoethane	106-93-4	188	0.400	3.08	ND	ND		2	WG1616312
1,2-Dichlorobenzene	95-50-1	147	0.400	2.40	ND	ND		2	WG1616312
1,3-Dichlorobenzene	541-73-1	147	0.400	2.40	ND	ND		2	WG1616312
1,4-Dichlorobenzene	106-46-7	147	0.400	2.40	ND	ND		2	WG1616312
1,2-Dichloroethane	107-06-2	99	0.400	1.62	ND	ND		2	WG1616312
1,1-Dichloroethane	75-34-3	98	0.400	1.60	ND	ND		2	WG1616312
1,1-Dichloroethene	75-35-4	96.90	0.400	1.59	ND	ND		2	WG1616312
cis-1,2-Dichloroethene	156-59-2	96.90	0.400	1.59	ND	ND		2	WG1616312
trans-1,2-Dichloroethene	156-60-5	96.90	0.400	1.59	ND	ND		2	WG1616312
1,2-Dichloropropane	78-87-5	113	0.400	1.85	ND	ND		2	WG1616312
cis-1,3-Dichloropropene	10061-01-5	111	0.400	1.82	ND	ND		2	WG1616312
trans-1,3-Dichloropropene	10061-02-6	111	0.400	1.82	ND	ND		2	WG1616312
1,4-Dioxane	123-91-1	88.10	0.400	1.44	ND	ND		2	WG1616312
Ethanol	64-17-5	46.10	1.26	2.38	308	581	E	2	WG1616312
Ethylbenzene	100-41-4	106	0.400	1.73	ND	ND		2	WG1616312
4-Ethyltoluene	622-96-8	120	0.400	1.96	ND	ND		2	WG1616312
Trichlorofluoromethane	75-69-4	137.40	0.400	2.25	ND	ND		2	WG1616312
Dichlorodifluoromethane	75-71-8	120.92	0.400	1.98	0.584	2.89		2	WG1616312
1,1,2-Trichlorotrifluoroethane	76-13-1	187.40	0.400	3.07	ND	ND		2	WG1616312
1,2-Dichlorotetrafluoroethane	76-14-2	171	0.400	2.80	ND	ND		2	WG1616312
Heptane	142-82-5	100	0.400	1.64	0.457	1.87		2	WG1616312
Hexachloro-1,3-butadiene	87-68-3	261	1.26	13.5	ND	ND		2	WG1616312
n-Hexane	110-54-3	86.20	1.26	4.44	ND	ND		2	WG1616312
Isopropylbenzene	98-82-8	120.20	0.400	1.97	ND	ND		2	WG1616312
Methylene Chloride	75-09-2	84.90	0.400	1.39	ND	ND		2	WG1616312
Methyl Butyl Ketone	591-78-6	100	2.50	10.2	ND	ND		2	WG1616312
2-Butanone (MEK)	78-93-3	72.10	2.50	7.37	ND	ND		2	WG1616312
4-Methyl-2-pentanone (MIBK)	108-10-1	100.10	2.50	10.2	ND	ND		2	WG1616312
Methyl methacrylate	80-62-6	100.12	0.400	1.64	ND	ND		2	WG1616312
MTBE	1634-04-4	88.10	0.400	1.44	ND	ND		2	WG1616312
Naphthalene	91-20-3	128	1.26	6.60	ND	ND		2	WG1616312
2-Propanol	67-63-0	60.10	2.50	6.15	ND	ND		2	WG1616312
Propene	115-07-1	42.10	0.800	1.38	ND	ND		2	WG1616312
Styrene	100-42-5	104	0.400	1.70	ND	ND		2	WG1616312
1,1,2,2-Tetrachloroethane	79-34-5	168	0.400	2.75	ND	ND		2	WG1616312
Tetrachloroethylene	127-18-4	166	0.400	2.72	ND	ND		2	WG1616312
Toluene	108-88-3	92.10	1.00	3.77	1.12	4.22		2	WG1616312

VOLATILE ORGANIC COMPOUNDS


TOX1
LEL
VOC
Y/+
N/-
OXY
TOX2
MODE
ON

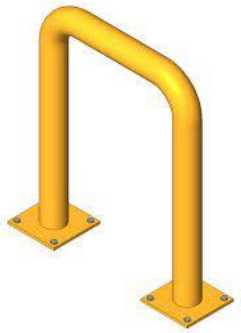

3799
ppb
CF = 1.00 Isobutyle


ELECTRIC

VAPOR MITIGATION COMPONENTS

Extraction Points: Four-inch floor penetrations were cored through the concrete slab floor and a void space of at least five gallons.

1-4 steel bollards to provide protection



BOLLARDS PROTECTING RISER PIPES

Typical 4-inch diameter hole through slab

Soil excavated at the slab/soil interface

1/4-INCH SAMPLING PORT

VELOCITY TESTING USING PITOT TUBE

PRESSURE MONITORING OF RISER

VAPOR PIN AND PROTECTIVE CAP

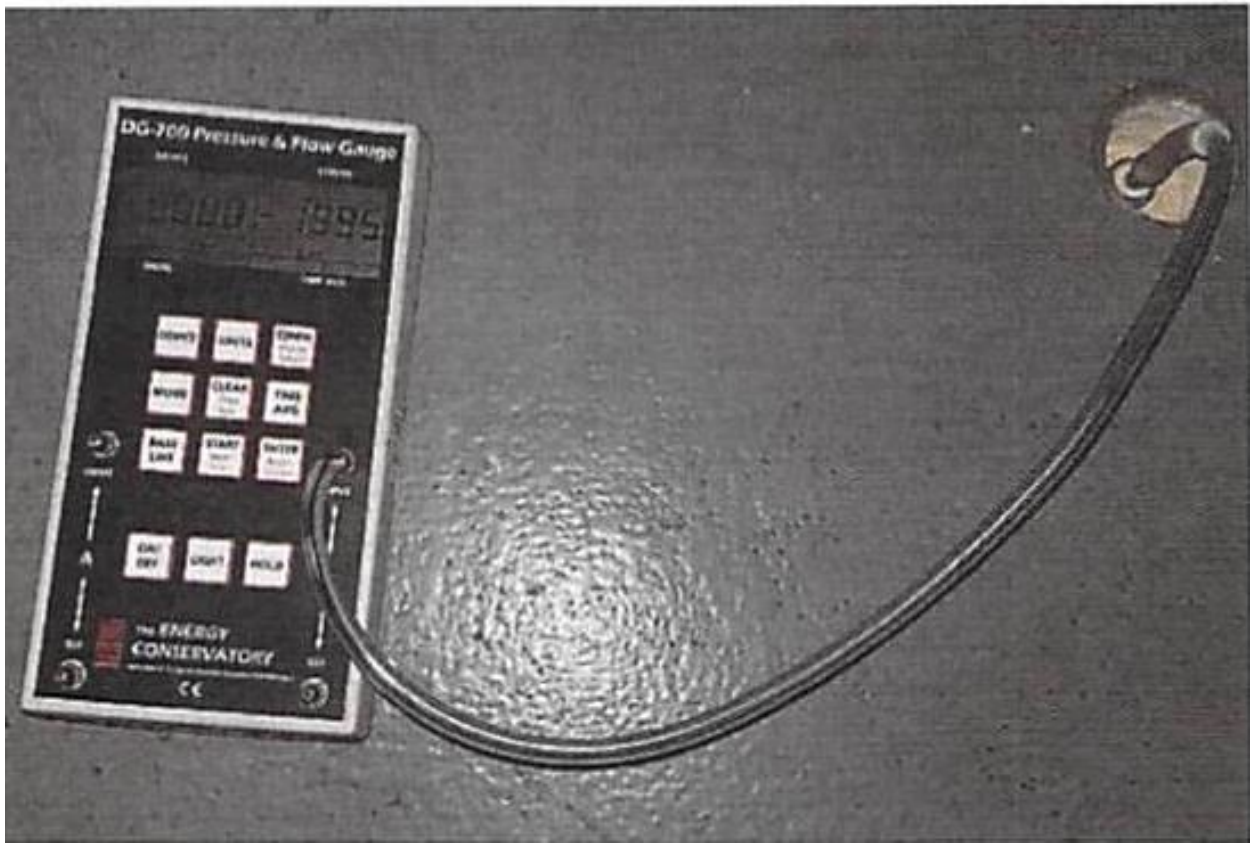
ROOF TOP BLOWER

VOC SAMPLING AT ROOF DISCHARGE

VACUUM BLOWER ASSESSMENT

Blower Number	Air Velocity	Vacuum (in WC)	Total VOC's (ppb)
1	>9200	>5	0
2	>9200	>5	0
3	>9200	>5	0

SUB-SLAB PRESSURE MONITORING



FINAL COMMENTS

- Vapor intrusion studies 20 years ago assumed buildings to be naturally ventilated and leaky. The focus was on the source of the vapors under the building.
- Many vapor intrusion problems are a symptom of poor building construction
- Vapors migrate into buildings under a pressure gradient. We suck them in.
- Properly constructed buildings are not as prone to vapor intrusion problems.
- Vapor intrusion prevention methods are effective and predictable.
- Vapor intrusion mitigation will allow us to safely return brownfield buildings to productive use.