Screening Levels vs. Remediation Standards

Vapor Intrusion Indoor Air

Presented to:

Remediation Standards Stakeholders

October 14, 2014

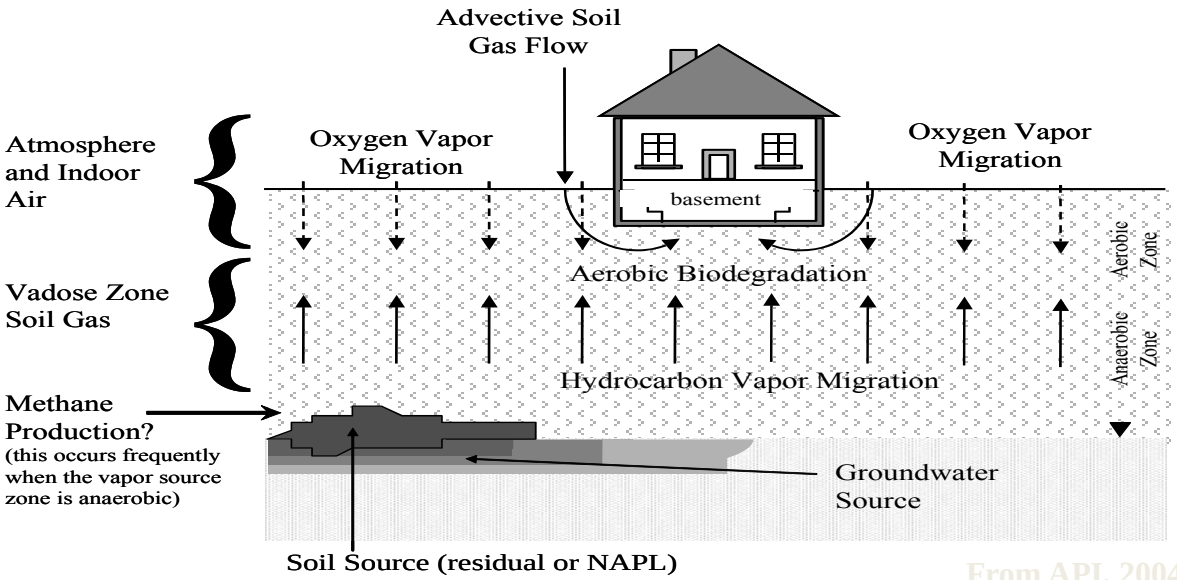
Vapor Intrusion: Indoor Air

- **Evaluation of the Vapor Intrusion Pathway**
  - Multiple Lines of Evidence/Conceptual Site Model
  - Factors affecting Indoor Air Measurements
  - Vapor Investigations: background, sampling and analysis
- **Review of Current Federal and State Policies**
- **Interpretation of Indoor Air Data**
  - Examples of data evaluation
  - Regulatory Action
  - Performance Standards/State of the Practice

Multiple Lines of Evidence/CSM

- Multiple Lines of Evidence (MLE) Approach
- Conceptual Site Model: sources, pathways, and receptors

(Key Elements for Professional Judgment)

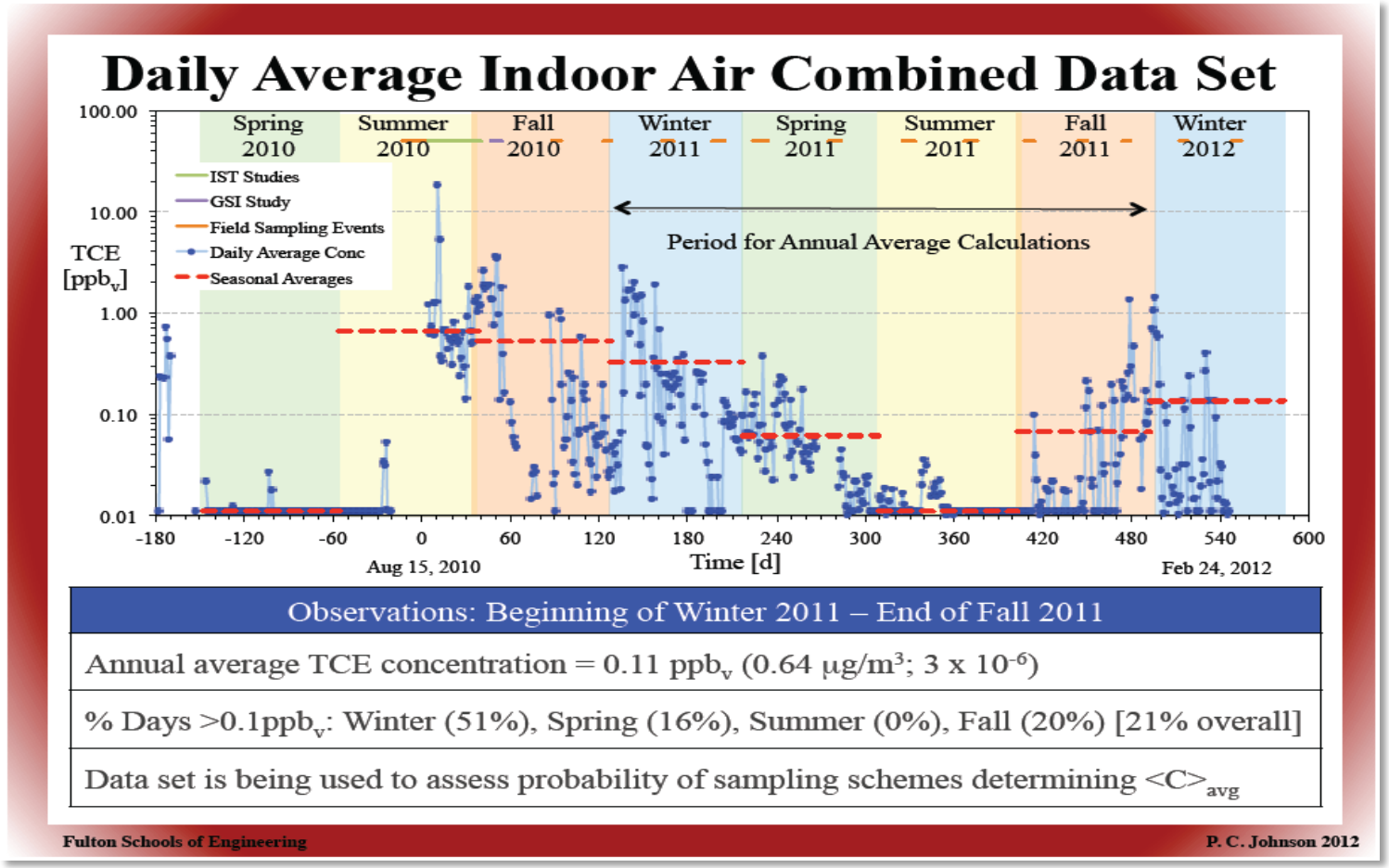


Factors Affecting Indoor Air Measurements

- Vapor Source: concentration, size, location, depth
- Subsurface Conditions: soil permeability, soil layers, moisture conditions, oxygen levels
- Building Characteristics: foundation type and condition, pressurization, air exchange rates
- General Site Conditions: wind, atmospheric pressure, temperature, ground cover, background and ambient concentrations
- Sampling and Analysis Factors

Temporal Variability in Indoor Air Concentrations

- **Johnson et al, 2012**



Example Background Indoor Air Concentrations

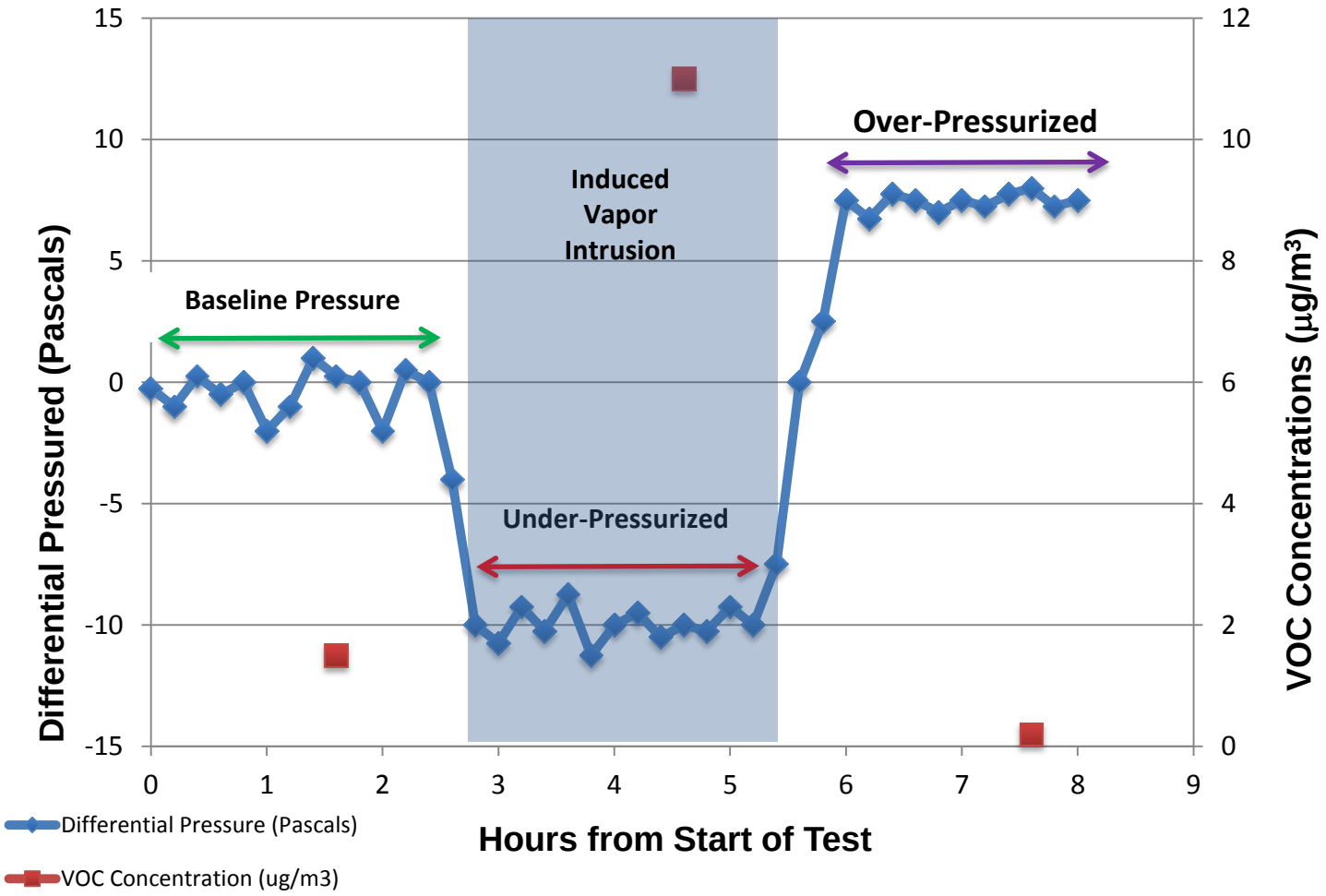
Table 2
Summary Statistics for Background Indoor Air Concentrations Measured in North American Residences Since 1990 (All concentrations in µg/m^3)

Compound	N Studies	N Samples	%Detect	RL Range	25%	N	50%	N	75%	N	90%	N	95%	N	Max	N
Benzene	14	2615	87	0.05 - 1.6	1.9	7	2.5	13	4.5	9	10	11	17	5	93	10
Carbon tetrachloride	5	873	88	0.15 - 0.25	0.3	2	0.5	5	0.7	2	0.8	4	1.1	1	2.7	3
Chloroform	10	2178	73	0.02 - 2.4	0.5	4	1.1	9	2.2	6	3.9	8	6.0	5	20.2	7
Dichloroethane,1,1-	5	1309	0.3	0.08 - 2.0	<RL	5	<RL	5	<RL	5	<RL	5	<RL	4	0.9	5
Dichloroethane,1,2-	4	950	12.6	0.02 - 0.25	<RL	2	<RL	4	<RL	3	0.15	4	0.20	2	1.8	4
Dichloroethene, 1,1-	5	957	10	0.01 - 2.0	<RL	4	<RL	5	<RL	5	<RL	5	<RL	3	86.8	5
Dichloroethene, cis 1,2-	4	975	3	0.25 - 2.0	<RL	4	<RL	4	<RL	4	<RL	4	<RL	3	3.7	4
Dichloroethene, trans 1,2-	3	575	0	0.8 - 2.0	<RL	3	<RL	3	<RL	3	<RL	3	<RL	2	<RL	3
Ethylbenzene	10	1484	81	0.01 - 2.2	0.8	4	2.0	9	3.0	5	8.6	7	14	3	126	8
Methyl tert-butyl ether (MTBE)	4	502	47	0.05 - 1.8	<RL	3	1.2	4	5.7	4	26	4	72	2	242	4
Methylene chloride	7	1,649	73	0.4 - 3.5	0.42	3	1.10	7	3.6	5	10	7	20	4	506	6
Tetrachloroethene	13	2312	64	0.03 - 3.4	<RL	7	0.9	10	1.8	6	4.0	9	7.4	5	171.2	8
Toluene	12	2065	96	0.03 - 1.9	9	5	13	12	27	7	51	9	106	4	547	9
Trichloro-1,2, 2-trifluoroethane, 1,1	1	400	56	0.25	<RL	1	0.5	1	1.1	1	1.8	1	3.4	1	7	1
Trichloroethane, 1,1,1-	9	1877	60	0.12 - 2.7	0.5	7	1.9	9	2.7	7	5.5	7	10.2	5	196	8
Trichloroethene	13	2403	44	0.02 - 2.7	<RL		0.3	10	0.3	6	0.9	8	1.6	5	84	10
Vinyl chloride	6	1684	7	0.01 - 1.3	<RL	6	<RL	6	<RL	6	0.03	2	0.05	2	0.8	6
Xylene, m/p-	10	1920	90	0.4 - 2.2	2.9	6	5.5	10	9.4	7	27	9	41	4	593	8
Xylene, o-	12	2004	85	0.11 - 2.2	1.4	6	2.2	11	3.9	7	10	9	16	4	196	10

Note: "N" indicates number of studies reporting a particular statistic.

From Dawson and McAlary, 2009

Building Pressure Cycling

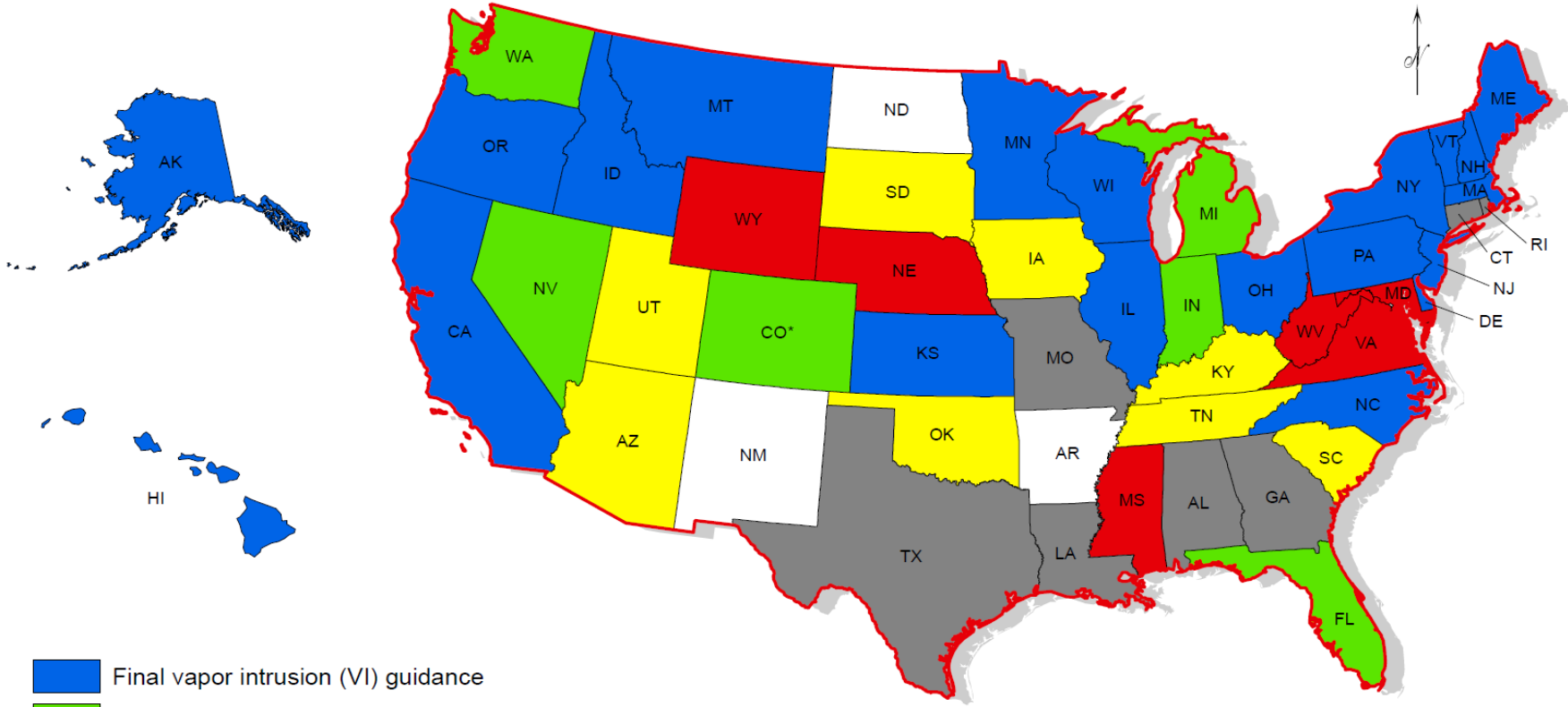


Indoor Air Sampling

- Indoor air sampling may seem to be a direct assessment approach, but is typically conducted during higher tier of investigation.
- Fundamentally, the process calls for measuring very small amounts of CoCs in a difficult matrix to sample (air).

- Challenges to indoor air sampling
  - Occupant disruption
  - Temporal and spatial variability
  - Background effects
    - PCE, carbon tetrachloride, chloroform, 1,2-dichloroethane, and BTEX are common

Status of State VI Guidance/Rules



Final vapor intrusion (VI) guidance

Draft VI guidance (NV and FL internal drafts)

VI pathway included in risk-based regulations but limited or no VI guidance

VI addressed through voluntary cleanup program guidance or fact sheets

Petroleum VI guidance through leaking UST program

No VI or PVI regulations or guidance

* Colorado has both draft VI guidance and petroleum VI guidance through leaking UST program

Federal/State Policy

> *"For many regulatory agencies, an exceedance of the state's vapor intrusion criteria simply identifies the need for further investigation (especially at the preliminary screening phase). In fact, 73% of the state agencies surveyed by ITRC in January 2006 acknowledged their criteria as "screening" rather than "action" levels."*

ITRC – Vapor Intrusion Pathway: A Practical Guideline (January 2007)

Federal/State Policy

"Exceedance of the applicable screening levels does not automatically mean that a remedial action is appropriate. A determination will have to be made whether additional data are necessary as part of the investigative phase."

ITRC – Vapor Intrusion Pathway: A Practical Guideline (January 2007)

"Exposure to a volatile chemical due to vapor intrusion does not necessarily mean that health effects will occur. Whether or not a person experiences health effects depends on several factors, including length of exposure, the amount of exposure, the frequency of exposure, the toxicity of the chemical and the individual's sensitivity to the chemical."

NYSDOH Soil Vapor Intrusion Guidance, October 2006

Data Interpretation: Professional Judgment

"*In applying technical guidance, the Department recognizes that professional judgment may result in a range of interpretations on the application of the guidance to* ***site conditions.*** *If the investigator does not consider this technical guidance appropriate or necessary, the investigator* ***must explain*** *why and provide adequate justification to document that the decisions made are still* ***protective of public health, safety and the environment****."*

(VITG 1.1)

Professional Judgment: Case Study

- Industrial Site with a long history of manufacturing
- CVOCs in impacted groundwater and sub-slab soil gas may represent a completed pathway.
- Sub-slab Soil Gas and Indoor Air Sampling initiated:
  - CVOCs in Soil Gas at 19,400 µg/m^3 (PCE) and 8,220 µg/m^3 (TCE)
  - CVOCs in Indoor Air: 18.7 µg/m^3 (PCE); 5.8 µg/m^3 (TCE);
  - Vapor Concern triggered by TCE Indoor Air Data
- Access was limited to impacted area; long term monitoring initiated.
- Monitoring in the adjacent occupied space over 18 months showed concentrations of TCE less than 2 ug/m^3 (Nonresidential IA screening level is 3 ug/m^3; reporting limit is 1 ug/m^3)
- Sample collected on 12 September 2014; TCE measured at 4 ug/m^3
- Resampled on 1 October 2014; TCE measured at 2 ug/m^3.

- Occupied space is 700 ft long and 75 feet high
- Building operated at a positive pressure

Case Study 2

- Residences downgradient of a cVOC plume from an Industrial Facility.
- Indoor Air measured 55 times in 2008, 2009, 2012.
- No TCE or PCE found in 31 of 55 samples.
- PCE was measured in one sample at a concentration above the March 2007 IASL, but below the subsequent January 2013 IASL.
- The residents sued the responsible party for alleged health effects and impact to property values.
- The judge found for the defendant and wrote:

"Screening levels set by the NJDEP dictate when certain concentrations of compounds require additional testing. The screening levels do not necessarily indicate levels at which compounds become hazardous to health."

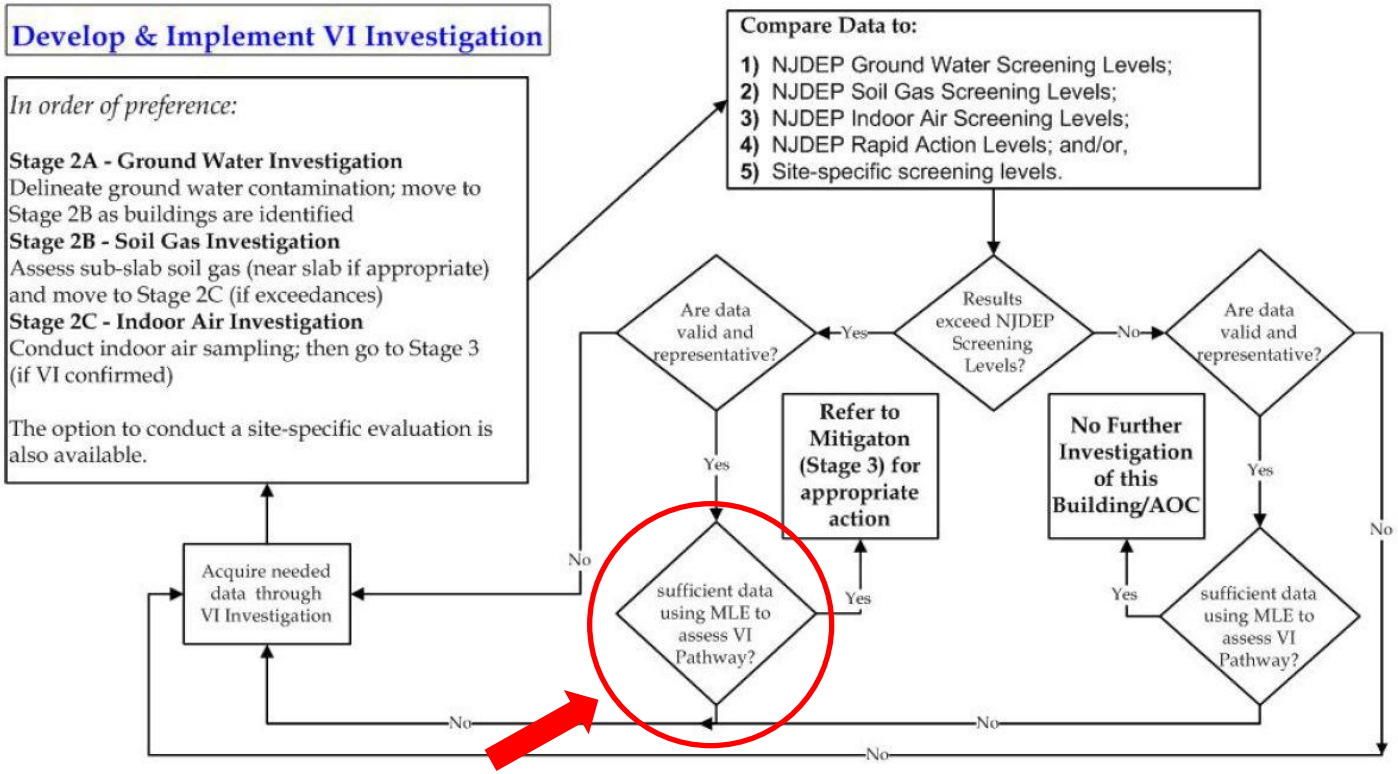
  - Judge Jerome Simandle in *Michael Leese, et.al. v. Lockheed Martin*, 09/30/13

- Would that conclusion have remained the same if the screening level was referred to as a "standard"?

Data Interpretation: Professional Judgment

Decision Flow Chart for Vapor Intrusion Pathway

VI Investigation (Stage 2)



Does this step stay the same without a VISL?

Standards vs. Screening Levels

Vapor Intrusion Indoor Air - Conclusions

1. IA measurements require a MLE approach.
2. Basic research is on-going in this field.
3. The EPA and the majority of States use a screening levels approach.
4. Current regulations and technical guidance allow for Professional Judgment, yet require mandatory action and timeframes.
5. Screening levels are appropriate for evaluating the VI Pathway.