



Program Redesign: The Vapor Intrusion to Indoor Air Pathway

Amy Salisbury
Toxicologist Specialist
Remediation & Redevelopment Division
Dept. of Environmental Quality
Phone: 517-241-3584
salisburya@michigan.gov

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#	PATHWAY	CRITERIA			SCREENING LEVELS		
	Medium Sampled	Land Usage	Exposure Duration	Toxicity Basis	Land Usage	Exposure Duration	Toxicity Basis
1.	Indoor Air	Indoor Air Criteria (IAC)			Acute Indoor Air Screening Levels (AIIASLs)		
	Indoor Air	Residential (IAC _{res})	Chronic	IURF or ITSL	Same value for res and nr	Acute	MRL
		Non-Residential (IAC _{nr})	Chronic	IURF or ITSL			
2.	Soil Gas to Indoor Air	Soil Gas Criteria (SGC)			Acute Soil Gas Screening Levels (ASGSLs)		
	Soil Gas - Deep (5') and Sub-Slab	Deep (res)	Chronic	IURF or ITSL	Deep (same value for res & nr)	Acute	MRL
		Deep (nr)					
		Sub-slab (res)	Chronic	IURF or ITSL	Sub-Slab (same value for res & nr)	Acute	MRL
Sub-slab (nr)							
3.	Groundwater to Indoor Air	NA			Vapor Intrusion Groundwater Screening Levels (GWI _{VI} SLs)		
	Groundwater				Residential (GWI _{SLres})	Chronic	IURF or ITSL
					Non-Residential (GWI _{SLnr})	Chronic	IURF or ITSL
4.	Groundwater to Sump	NA			Sump Groundwater Screening Levels (GWI _{sump} SL)		
	Sump Water				Same value for res and nr	NA	IURF or ITSL
5.	Flammability/Explosivity	NA			Fire and Explosion Screening Levels (FE _{SL} s)		
	Groundwater				Same value for res and nr	Acute	LEL
6.	Excavation/Utility Worker	NA			Excavation Worker Screening Levels (EW _{SL} s)		
	Soil Gas - Deep (5')				Deep (same value for res & nr)	Acute	MRL

Nature of the VI Pathway

Contamination in Subsurface (Soil and/or groundwater)

Volatilization into pore space

Movement by Advection/diffusion through slab openings

Dispersion in indoor air due to air movement, openings (doors/windows), and HVAC

Office Building

Residence with Basement or Crawl Space

Residence on Slab



Ref: ITRC, January 2007, Vapor Intrusion Pathway: A Practical Guide

History of VI Pathway in MI

- MDEQ official recognition of the vapor intrusion (VI) pathway in 1998
- Indoor air criteria methodology based on a stakeholder process and supported by the MESB.
- Generic criteria were promulgated on December 21, 2002; however, the methodology has remained unchanged for over 10 years.
- Several guidance documents are available (EPA, Interstate Regulatory Training Council, American Petroleum Institute, individual State guidances, etc.)



Lecture 3: Data Analyses

Comparison to Screening Levels

Screening Values - PCE

Media	California	New Jersey	Michigan	Penn.
Groundwater ($\mu\text{g/L}$)	NA	1	25,000	42,000
Soil Gas ($\mu\text{g/m}^3$)	180	34	2,100	NA
Indoor Air ($\mu\text{g/m}^3$)	0.41	3	42	36

Ref: Eklund B. et al, Sep. 2006

Lecture 3: Data Analyses

Comparison to Screening Levels

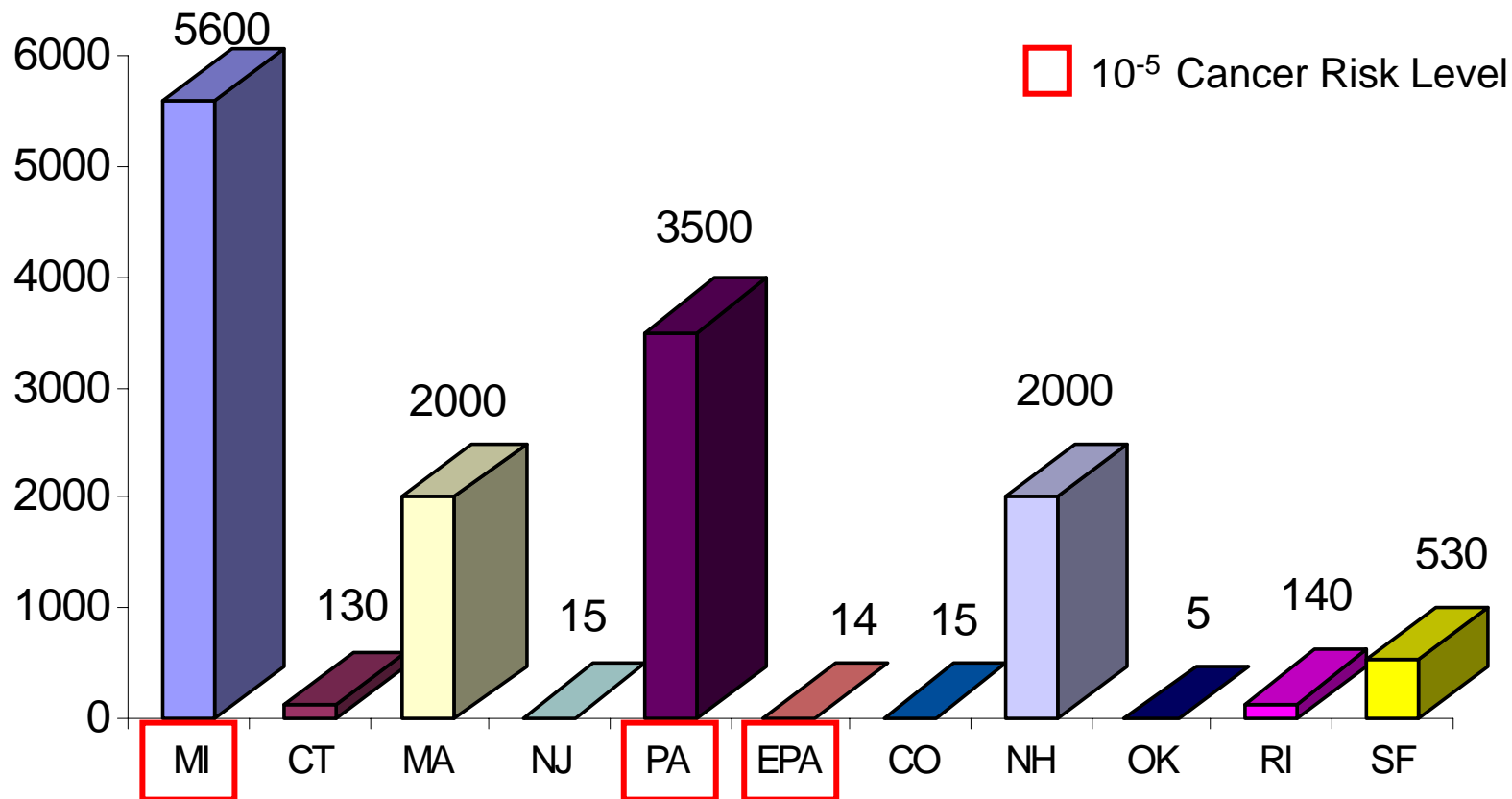
Screening Values - Benzene

Media	California	New Jersey	Michigan	Penn.
Groundwater ($\mu\text{g/L}$)	NA	15	5,600	3,500
Soil Gas ($\mu\text{g/m}^3$)	36	16	150	NA
Indoor Air ($\mu\text{g/m}^3$)	0.084	2	2.9	2.7

Ref: Eklund B. et al, Sep. 2006

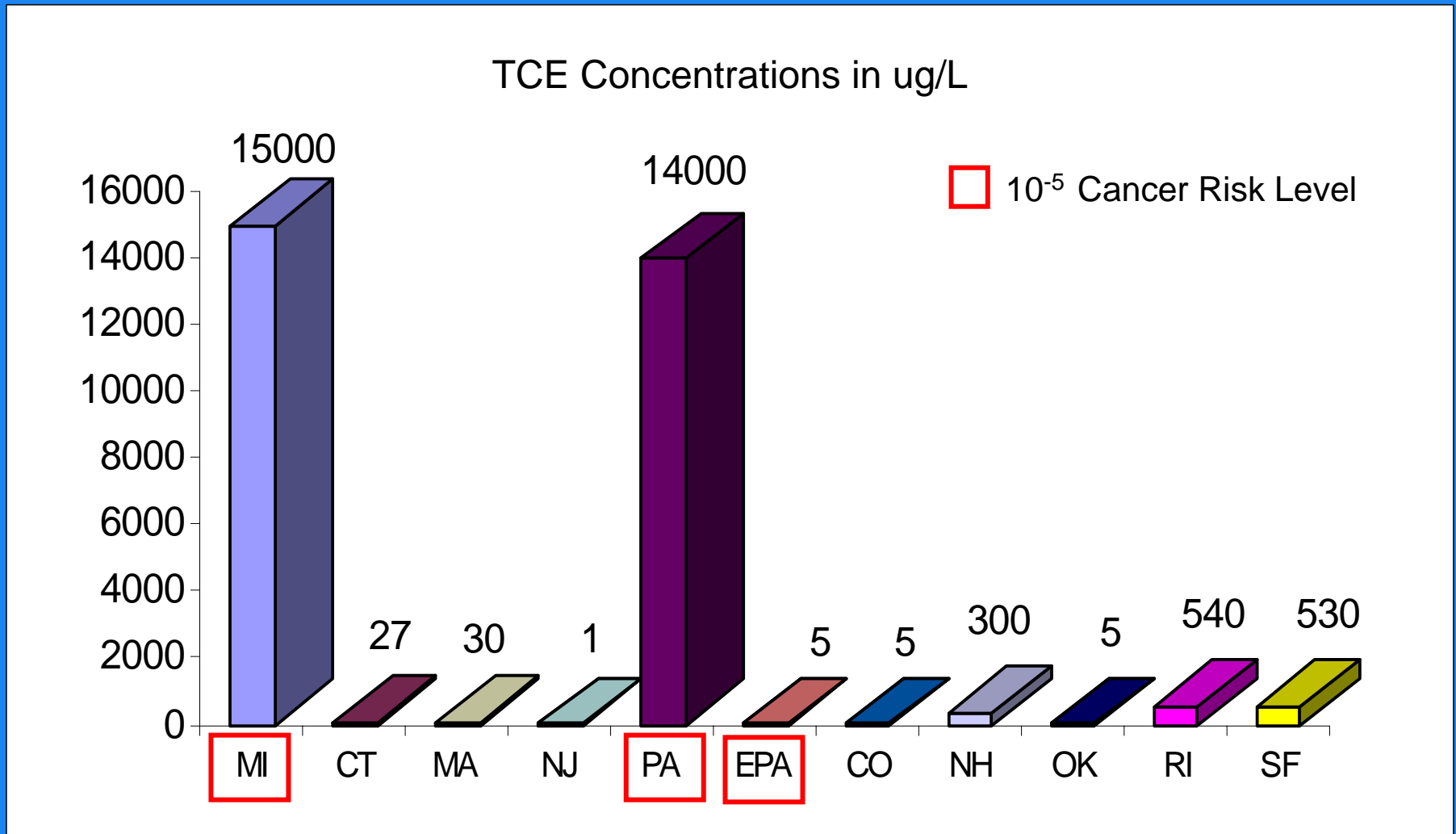
Benzene Screening Level Comparison by State

Benzene Concentrations in ug/L



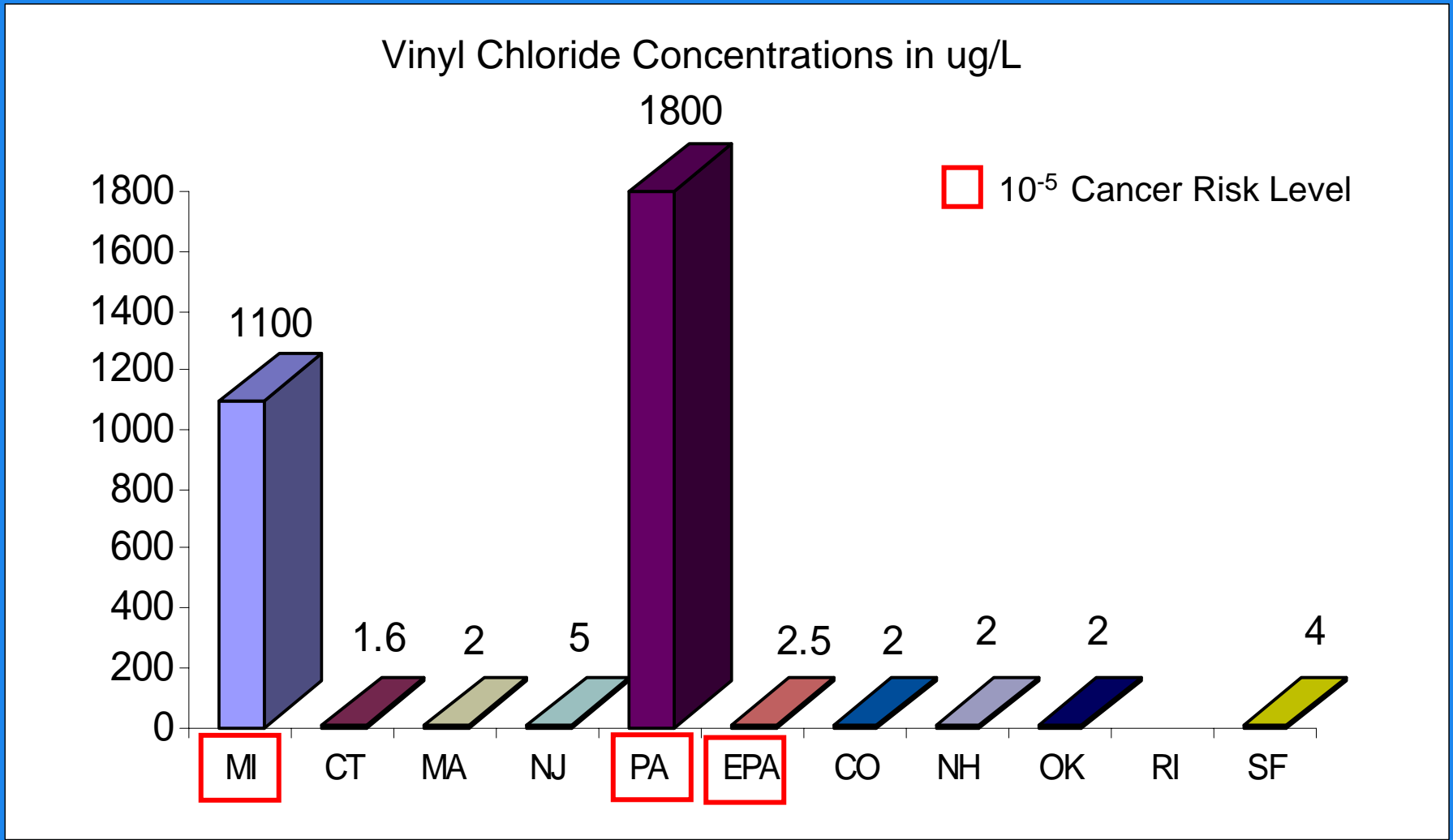
*SF = San Francisco Regional Water Quality Control Board

TCE Screening Level Comparison by State



*SF = San Francisco Regional Water Quality Control Board

Vinyl Chloride Screening Level Comparison by State



*SF = San Francisco Regional Water Quality Control Board

Why VI Redesign Proposal?

- The J&E represented the “state-of-the-art”, but VI science evolving rapidly
- J&E Model Limitations
 - Intended as a screening model
 - With limited site data, informed prediction of concentration levels not possible using J&E model
- Not suited for “generic” application in most cases – assumptions apply to very few sites
- Empirical evidence/EPA database
- Soil media no longer appropriate for predicting VI risk
- Other



Why VI Redesign Proposal?

Example:

- The J&E Model improperly screened out more than 300 homes at the Redfields Rifle Scope factory, a chlorinated solvent site, in southeast Denver.
- Indoor air tests indicated elevated exposure up to 200 times model predictions.
- Robbie Ettinger verified that the model under-predicted actual vapor intrusion in these Denver homes.
- EPA stated in 2002 Denver Post article that the J&E should not be used as a single line of evidence for determining VI risk.





New Proposal Includes...

Screening-Level Evaluation

- New Groundwater Screening Levels (GW_{VI}SLs)
 - Consistent with EPA's 2002 VI Guidance
 - Based on “generic” attenuation coefficient of 0.001 (1/1000 or 0.1%)
 - Not comparable to current GVIIC
 - Can provide means to certainty
- Soil Screening Criteria
- SGC and IAC

GW_{VI}SL

- Screening level for comparison to groundwater data
- Residential and non-residential screening levels
- Default to MCL
- Unlike GVIC, not dependant on modeling or consistency with a generic conceptual site model
- Applies to all groundwater beneath a structure (not in contact with a structure)
- Concentrations exceeding GW_{VI}SL will require “facility” determination

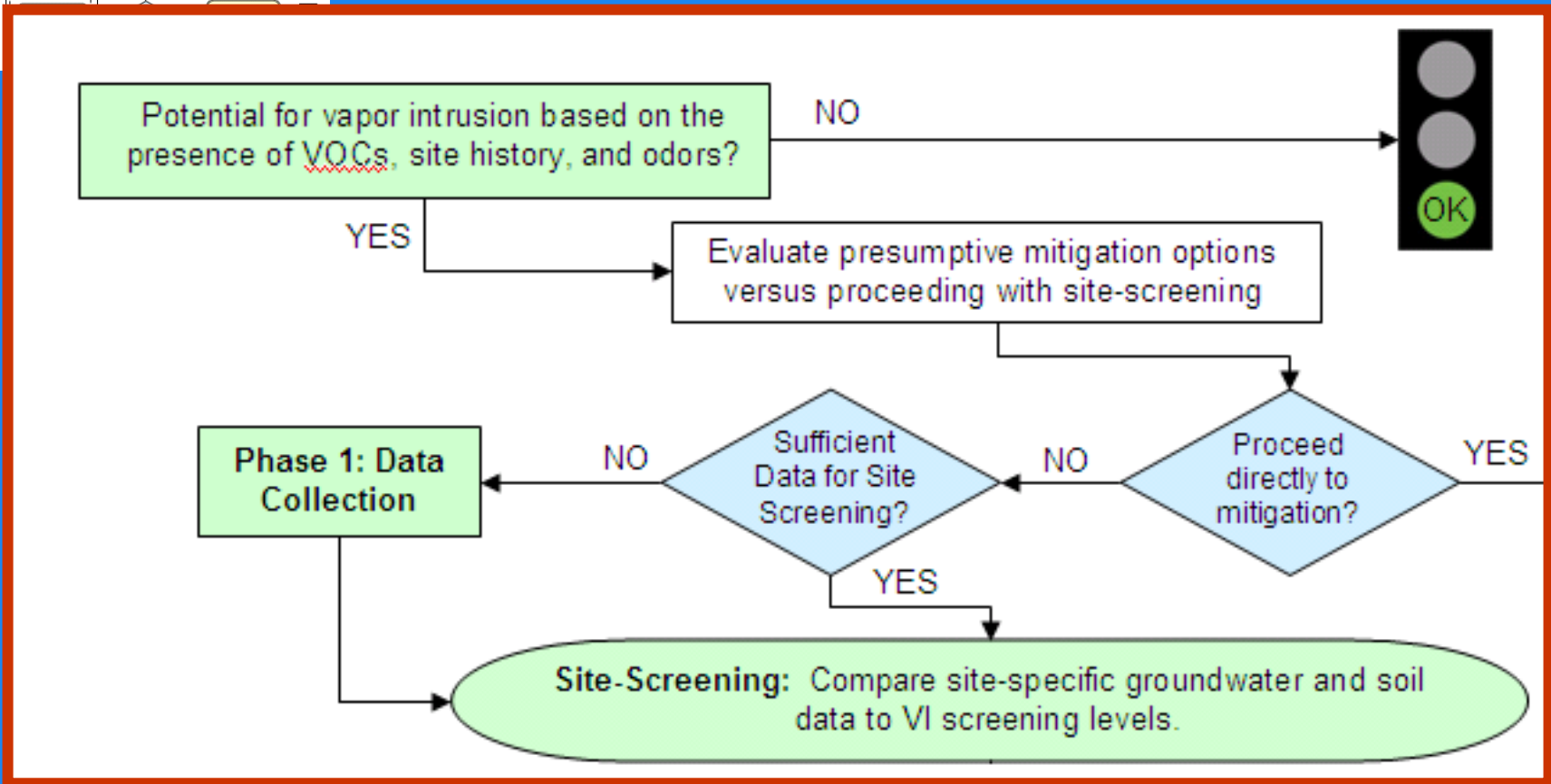
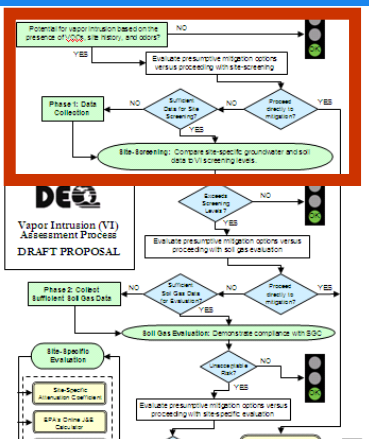


Soil Screening Levels

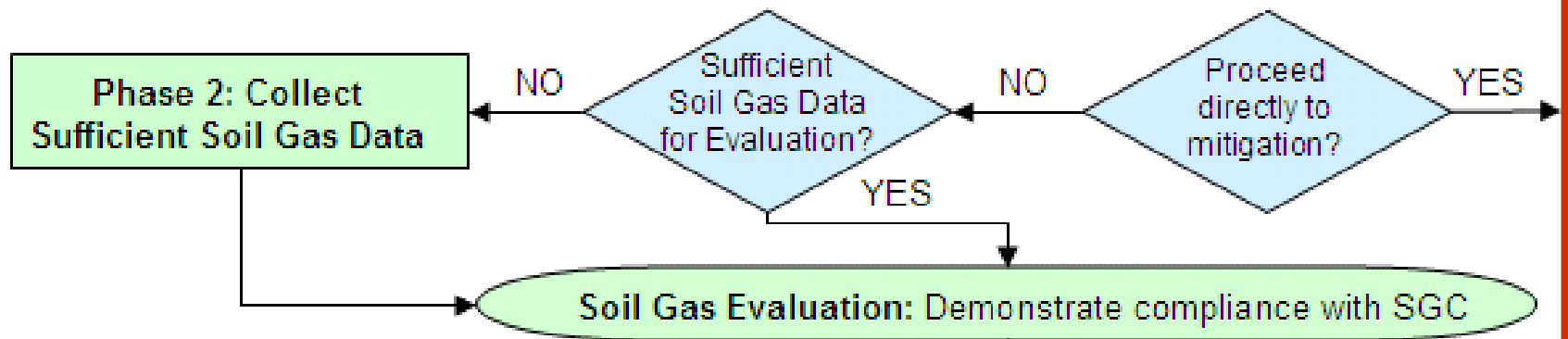
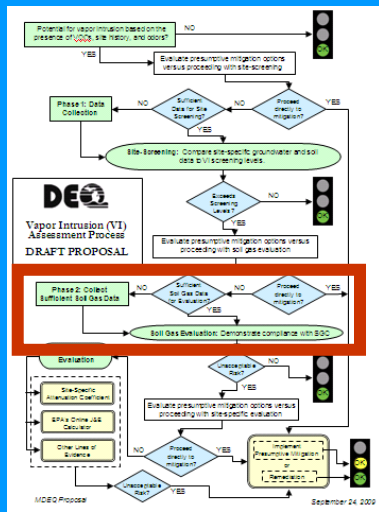
- One of only two states (Pennsylvania) with soil criteria, both promulgated
- Not currently recommended by EPA (2002)
- Not a reliable predictor of vapor intrusion risks
 - Large uncertainties introduced during sampling, preservation, and chemical analysis
 - Uncertainties associated with soil partitioning calculations in J&E Model
- VOCs detected (+) w/in distance from structure



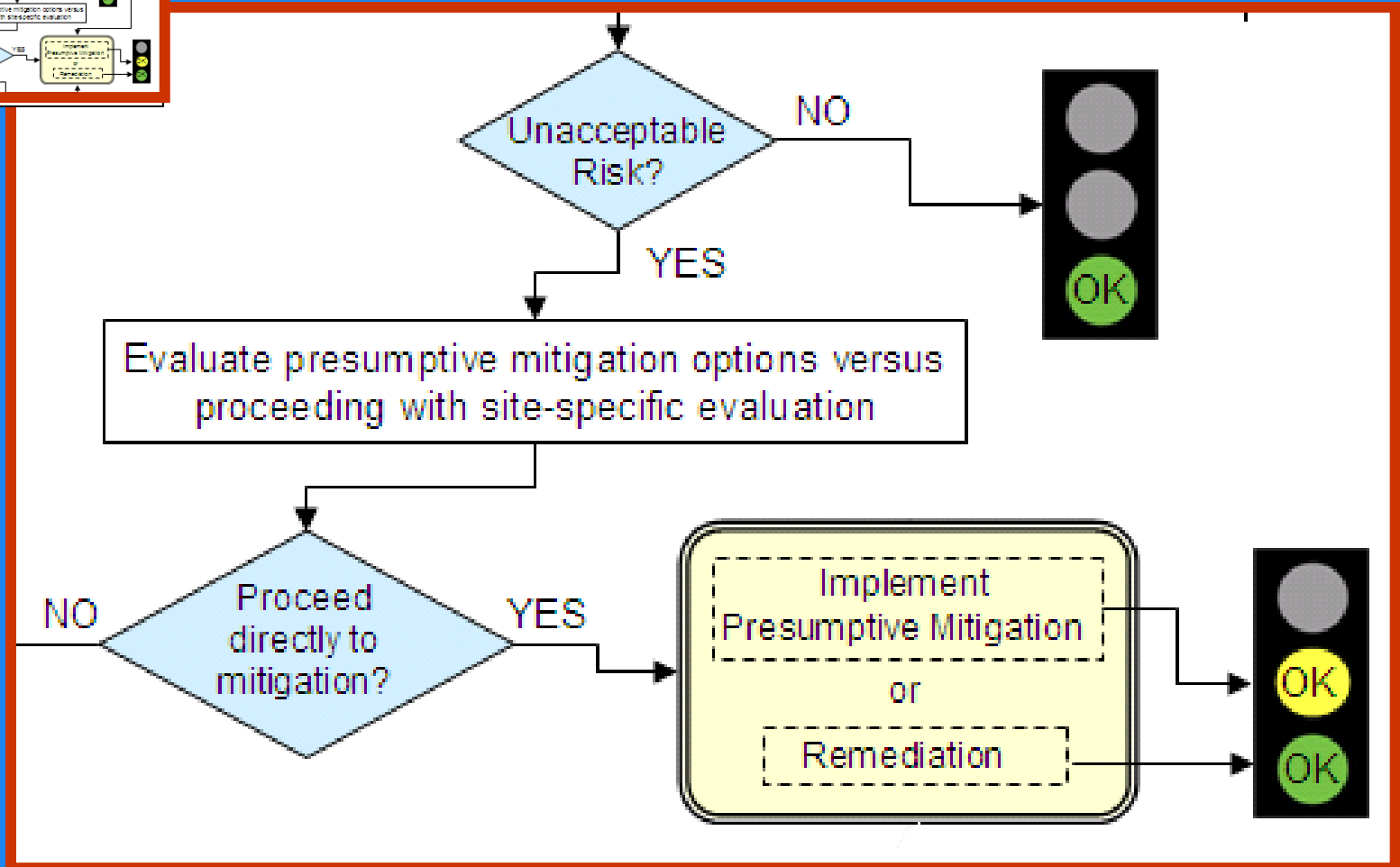
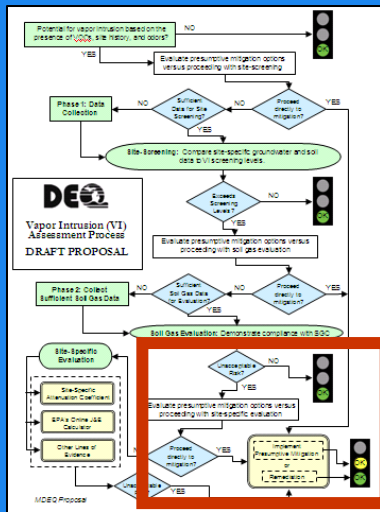
Proposed VI Assessment Flow Chart



Proposed VI Assessment Flow Chart



Proposed VI Assessment Flow Chart



Proposed VI Assessment Flow Chart

