

1  **Generic Numerical Standards/
Property-Specific Risk Assessment**

OAC 3745-300-08
OAC 3745-300-09

Certified Professional
8-Hour Training

2  **Applicable Standards**

- Clean up values that are protective of human health and the environment.
- Concentrations of COCs within environmental media that are considered by the VAP to satisfy the above statement.

3  **Environmental Media**

- Soil, sediment, surface water, and ground water
- Also includes naturally occurring transitional zones such as bedrock, soil gas, and air

4  **Generic Standards**

- Standards for hazardous substances or petroleum derived for soil, indoor air, and ground water
- Generic numerical direct-contact soil standards
- Generic indoor air standards due to vapor intrusion
- Generic unrestricted potable use standards (UPUS)

5  **Phase I and Phase II assessments**

- Release history
- Selection of COCs
- Pathway analysis
- Exposure point concentration
- Demonstration of compliance with applicable standards

6  **Guidance documents**

- Risk Assessment Guidance for Superfund
- Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures
- Soil Screening Guidance, User's Guide and Technical Background Document
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites

7  **Soil direct-contact pathway**

- Incidental ingestion of contaminated soil
- Inhalation of contaminated soil particulates
- Inhalation of volatile COCs from soil
- Dermal contact with non-volatile COCs in soil



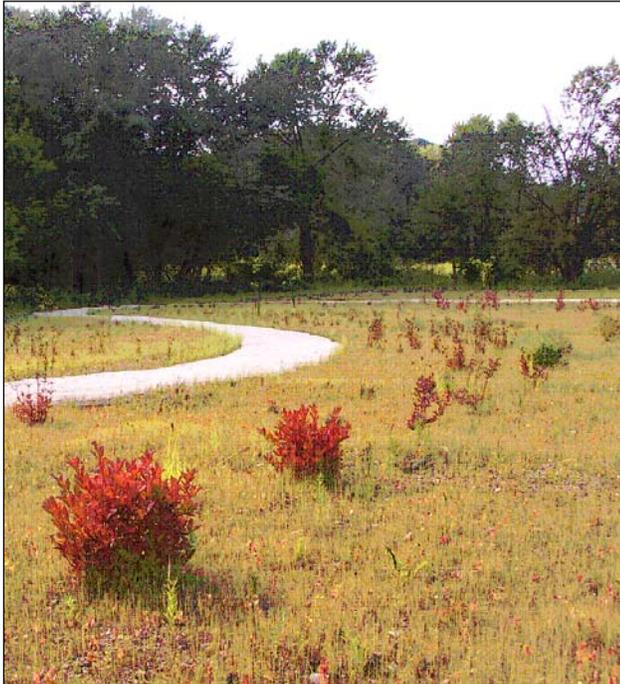
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- 12 **Property-specific risk assessment if:**
- Exposure pathways not considered in development of generic standards
 - Exposure scenarios are different than those listed in the tables
 - COCs are not listed in rule 08 tables
- 13 **PSRA if (cont.)**
- Complete exposure pathways to important ecological resources
 - Standards exceeded for sediment or surface water
- 14 **Petroleum Standards**
- GNS = BUSTR ORC 3737.882 (B)
- Pathways included in BUSTR standards do not have to be assessed separately in VAP
 - If BUSTR NFA has been issued the requirement to identify as an IA has been removed
- 15 **Free Product**
- Definition: a separate liquid hydrocarbon phase that has a measurable thickness of greater than one one-hundredth of a foot.
- 16 **Generic Standards for Soils**
- Table I - residential land use
- Direct contact is assumed from surface to 10 feet below surface
 - 10 foot point of compliance
 - Protective for, and may be applied to, all land use categories, without restriction
- 17 **Generic Standards for Soils**
- Table II – commercial/industrial land use
- Direct contact is assumed from surface to 2 feet below surface.
 - 2 foot point of compliance
 - Requires an environmental covenant as a remedy
- 18 **Generic Numerical Standards for Soils**
- Table III – construction/excavation activities
- Point of compliance is the anticipated depth of activity
- 19 **OAC 3745-300-08**
- Generic Numerical Standards**
- *Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures*
 - A transparent description of procedures used to derive generic standards
 - Describes PSRA procedures
- 20 **How are the standards generated?**
- Generic standards have historically been generated using a probabilistic method
- program runs 10,000 times, randomly selecting values from the distributions
 - The 90th percentile value selected as the cleanup standard
- 21 **How are the standards generated?**
- Point values - deterministic method uses one value for each input
 - Default US EPA assumptions already used within the RSLs, except:
 - Construction Worker standards; and
 - Ohio-specific Particulate Emission Factor and Volatilizations Factors

- 22 **US EPA Regional Screening Levels Default Inputs**
- Consistent with Remedial Response (RR) and RCRA
 - RSLs can be used as screening levels in RR & RCRA
 - VAP does not use RSLs as cleanup levels
 - The Ohio Risk Goal and Hazard Index at 1E-05 and HI of 1 remain the same
- 23 **Exposure Factors**
- Exposure Duration (years)
 - Exposure Frequency (days/year)
 - Exposure Time (hours/day)
 - Body Weight (kg)
 - Soil Ingestion Rate (mg/day)
 - Fraction Contaminated Soil (assume 50 percent)
 - Surface Area of exposed skin (cm²)
 - Soil Skin Adherence Factor (mg/ cm²)
- 24 **Standardized modeling assumptions for soil and climatic parameters**
- Fraction vegetative cover
 - Soil porosity
 - Soil bulk density
 - Fraction organic matter
 - Wind speed
 - Diffusion height...etc..
- 25 **COC parameters**
- Physical Properties
- molecular weight
 - Henry's Law constant
 - organic carbon adsorption coefficient
 - solubility
 - air and water diffusivity
 - melting point
- 26 **Use of appropriate toxicity criteria**
- U.S. EPA
 - IRIS
 - <http://www.epa.gov/iris/subst/index.html>
 - Ohio EPA
 - Provisional Peer-Reviewed Toxicity Values (PPRTVs)
 - ATSDR
 - California EPA and other states
- 27 **Toxicity Changes in 2014**
- Mutagenic mode of action in the chemical's toxicological profile in IRIS (Methylene Chloride and TCE are examples)
 - Arsenic and Vinyl chloride have new understandings adopted
- 28 **Generic Numeric Direct Contact Soil Standard**
- Single chemical standard is lowest of cancer, non-cancer, or soil saturation value

- Must account for the presence of multiple chemicals

29 **Soil Saturation**

$$C_{SAT} = S / \rho_b (K_d \rho_b + \theta_w + H' \theta_a)$$

Where:

S = solubility in water

ρ_b = dry soil bulk density

K_d = soil/water partition coefficient

θ_w = water – filled soil porosity

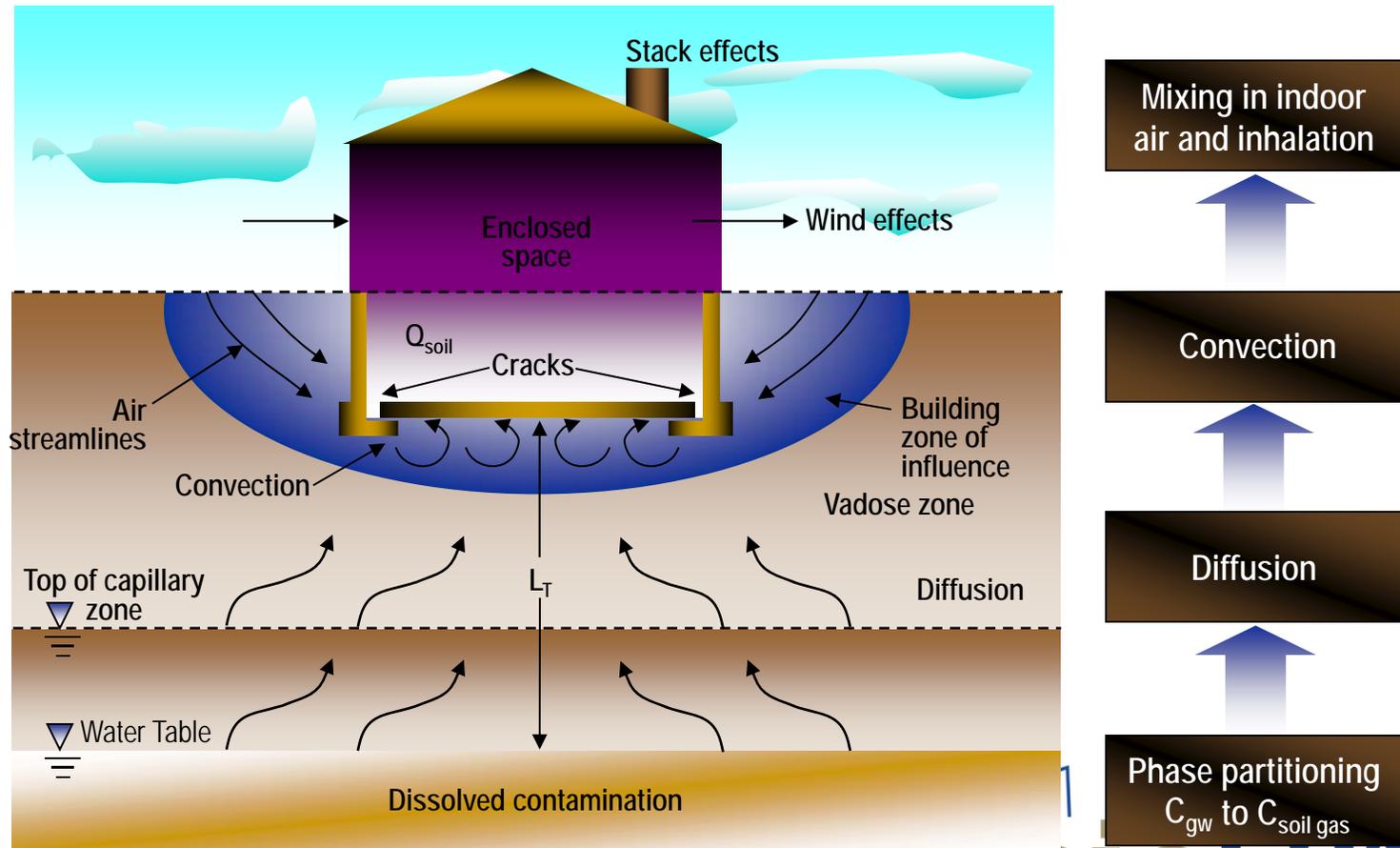
H' = Henry's Law constant (chemical specific)

θ_a = air – filled soil porosity

30 **Generic Numerical Standards for Indoor Air due to Vapor Intrusion**

- Table IV – Residential Land Use
- Table V – Commercial/Industrial Land Use
- These values can be used to evaluate volatile chemicals in ground water or soil gas with use of attenuation factors

Conceptual model of the vapor intrusion exposure pathway



- 32  **Unrestricted Potable Use Standards (UPUS)**
- Table VI – Maximum Contaminant Levels (MCLs)
 - Table VII – risk-derived
 - Ingestion
 - Inhalation
 - Dermal contact while showering
- 33  **Surface Water Generic Numerical Standards**
- Outside the Mixing Zone Average (OMZA) - OAC 3745-1
 - Compared to 30-day average value from:
 - Adjacent ground water monitoring wells
 - Surface water on the property
 - Off-property surface water locations
- 34  **Surface Water**
- All regulated point source discharges must comply with all permit requirements.
 - Includes general storm water permits.
 - VAP relies on permit limits as meeting applicable standards for point sources.
- 35  **Sediments**
- Complete exposure pathways on the property
 - Contaminated sediments migrating from the property
 - Ohio EPA “Sediment Sampling Guide and Methodology”
- 36  **Human Health Evaluation**
- COCs are persistent, bioaccumulative and toxic
 - Surface water produces edible-sized fish, supports wading, swimming, boating
 - Property-specific risk assessment
- 37  **Exposure of Important Ecological Resources to Sediments**
- Sample sediments directly
 - Compare to reference values in Ohio EPA “Guidance for Conducting Ecological Risk Assessment”
- 38  **Exposure of Important Ecological Resources to Sediments**
- If no SRVs, compare to consensus-based threshold effects concentration values in MacDonald, et al.
 - Conduct PSRA if COCs are persistent, bioaccumulative and toxic
- 39  **Exposure of Important Ecological Resources to Sediments**
- If sediments not compared to values, or COC concentrations exceed values, then bioassay or biocriteria surveys must be conducted.
- 40  **Multiple Chemical Adjustment**
- Technical Guidance Compendium document
- For all COCs listed in Tables I, II, III, IV, V and VII.
 - MCA for soil and ground water done separately – generic standards only
 - Inappropriate for Lead, Background, or MCLs (Table VI)
- 41  **Adjusting for Multiple Chemicals**
- Separate cancer/non cancer end points
 - Divide site concentration by single chemical standard

- Add ratios
- If cumulative ratio < 1.0, the soil concentrations meet the multiple chemical standard

42  **Adjusting for Multiple Chemicals**

- Alternatively, can divide the standard for each COC by number of COCs
- Compare adjusted value to site concentration

43  **Adjusting for Multiple Chemicals**

- If ratio sum > 1.0, then one or more COCs must be remedied until the ratio equals 1.0.
- Can derive a “flexible” multiple chemical standard by utilizing the buffer of risk from all COCs

44  **Example of MCA**

45  **Example of MCA**

- Noncancer ratio < 1
 - Acenaphthene: $90/3,500 = .03$
 - Anthracene: $500/18,000 = .03$
- Cancer ratio > 1
 - Benzo(a)anthracene: $12/11 = 1.09$
 - Benzo(a)pyrene: $8/1.1 = 7.27$

46  **MCA**

- Alternatively, can calculate MCA by dividing standard by the number of COCs.
- Determine if site concentration exceeds standard
- Can adjust the standard to make up for “extra risk” in other COCs

47  **Soil Standards - COC Concentrations From Soil to Ground Water**

- Concentrations that meet UPUS for GW when GW meets UPUS
- Any other pathway requirements that must be met when GW exceeds UPUS

48  **Property-Specific Risk Assessment**

- Based on same principles as generic numeric standards
- Elective or mandatory application
 - Use of property-specific information as algorithm inputs

49  **PSRA – Mandatory Applications**

- Exposure pathways not included in generic standards
- COC does not have a generic standard
- Concentrations of COCs exceed standards in surface water or sediment

50  **PSRA – Mandatory Applications**

- Complete exposure pathway to important ecological resource
- COCs are persistent, bioaccumulative and toxic

51  **PSRA – Risk Goals**

- Same as for generic numerical standards
- Industrial risk goal of 1E-04 for carcinogenic COCs
- Petroleum release assessment dependent on petroleum fraction of product

52  **Human Health Risk Assessment**

- Selection of COCs
- Exposure assessment

- Toxicity assessment
- Risk and Hazard Characterization
 - Incremental and cumulative risk from multiple pathways
 - Uncertainty analysis (optional)

53  **Human Health Risk Assessment**

- Exposure Assessment
 - Identify receptors
 - Evaluation of exposure pathways
 - Quantification of intake

54  **Human Health Risk Assessment**

- Toxicity Assessment
 - IRIS updates
- Risk Characterization
 - Calculation of incremental risk
 - For each cancer and non cancer COC and for each exposure pathway
 - Calculate cumulative risk across complete pathways for each receptor

55  **Calculation of Site-Wide Risk (cancer)**

56  **Important Ecological Resources**

- Excluding sediment and surface water
- Rare, endangered or threatened species
- Wildlife populations and their important nesting areas and food resources

57  **Aquatic Life Use Designation**

- Assessment of physical habitat
- Knowledge of what the habitat will support
- Ohio EPA sampled reference sites

58  **Aquatic Life Use Designations**

- Biological assessment of fish and macroinvertebrates
- Exceptional warm water habitat (EWH)
 - Warm water habitat (WWH)
 - Modified warm water habitat (MWH)
 - Coldwater habitat (CWH)
 - Seasonal salminid habitat (SSH)

59  **Biocriteria**

- Measure of attainment of designated use
- Habitat plays an important role
- Metrics provide an analysis of possible effects from site impacts

60  **Biological Surveys**

- Ohio biocriteria certification training
- Bioassessment under paid technical assistance

61  **Sediments - Ecological Risk Assessment**

- Demonstrate that COCs on the property are not contributing to the failure to meet, or
- Remedy source and/or sediment

62 **Applicable Standards From a PSRA**

- Concentration of COCs meeting human health risk goals;
- Concentration of COCs meeting ecological risk goals
- Sediment standards
- Surface water
- Soil saturation

63 **Risk Assessment Report**

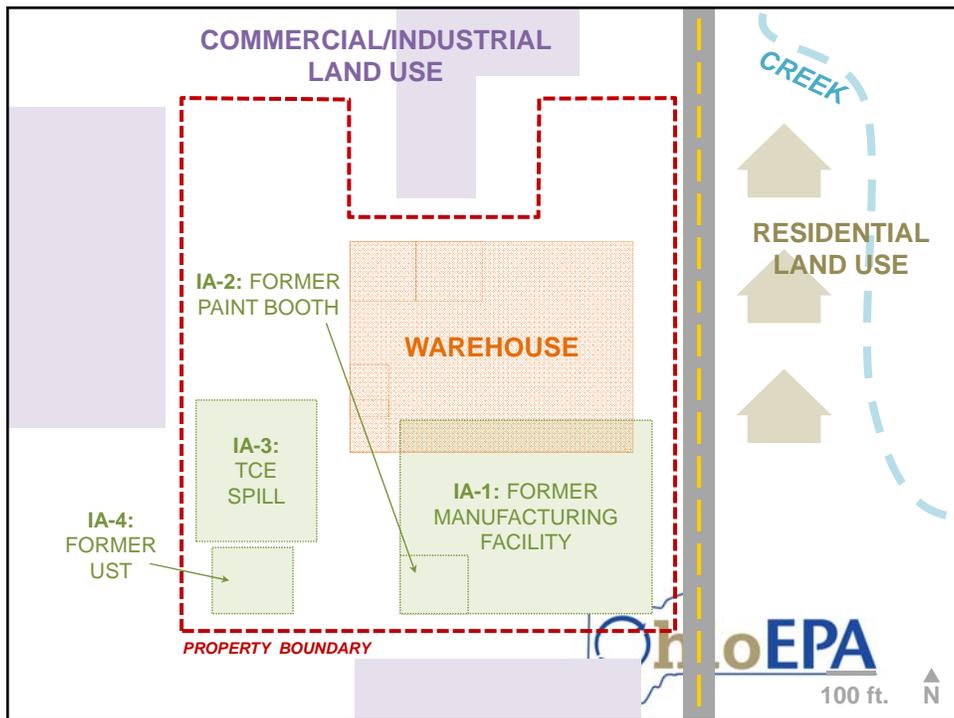
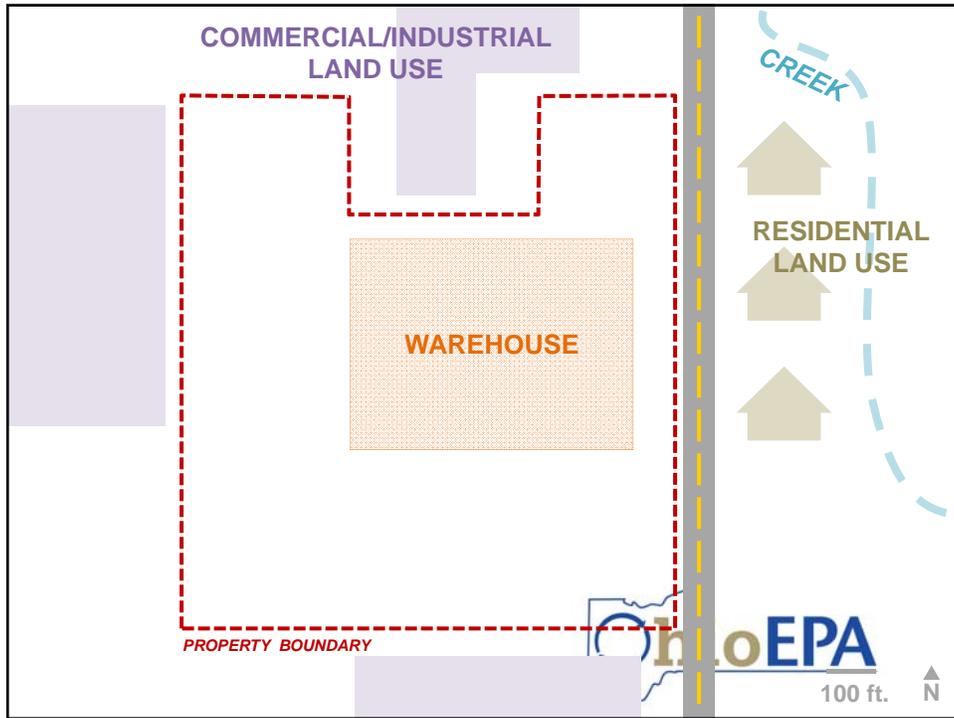
- Reason for PSRA
- List of institutional and/or engineering controls
- List of COCs not considered

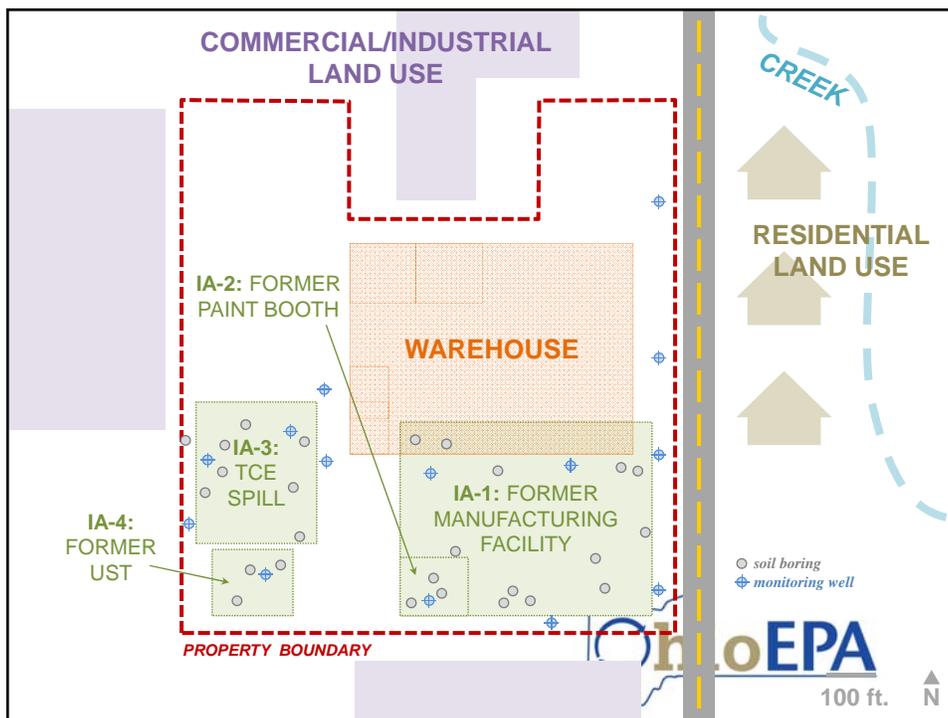
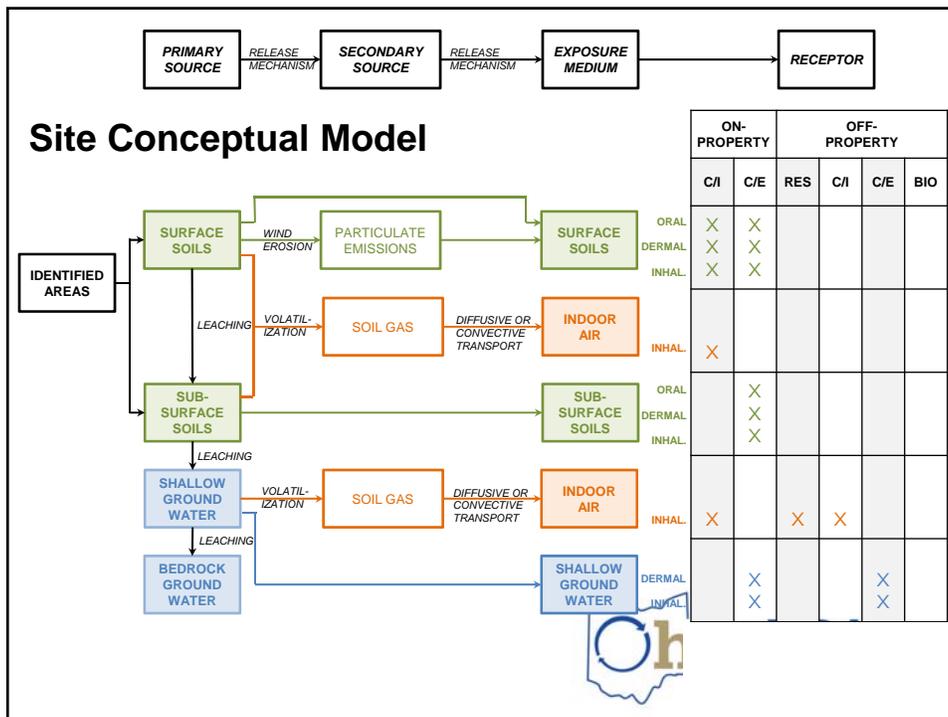
64 **Risk Assessment Report (cont.)**

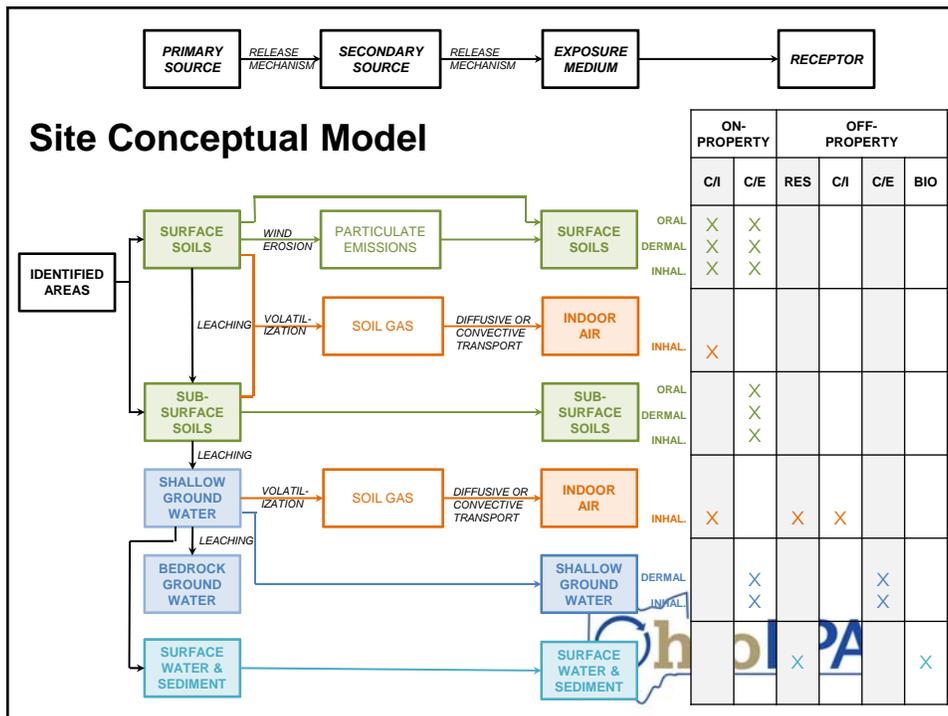
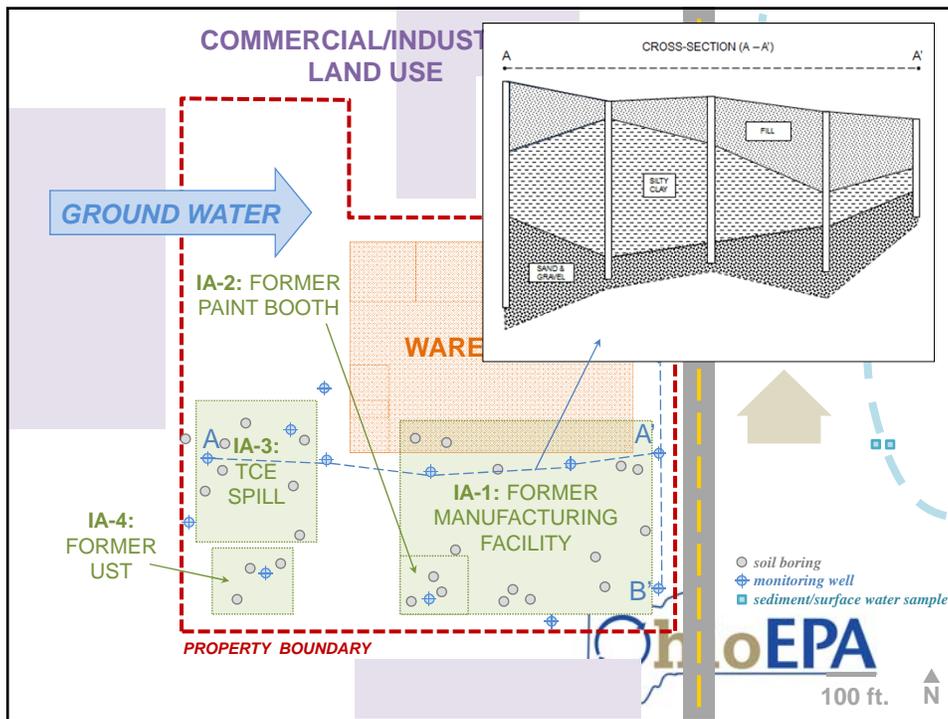
- List of receptor populations and exposure pathways
- Derivation and application of exposure factors used to quantify intake
- Toxicity values
- Risk characterization

65 **Risk Assessment Report (cont.)**

- Uncertainty analysis (if conducted)
- Ecological, sediment, surface water assessment
- Summary of compliance with applicable standards







SOIL DIRECT-CONTACT PATHWAY for commercial/industrial land use

COC	EPC (mg/kg)	STANDARD FOR A SINGLE CHEMICAL NON-CARCINOGEN (mg/kg)	HAZARD QUOTIENT	STANDARD FOR A SINGLE CHEMICAL CARCINOGEN (mg/kg)	RISK RATIO	SOIL SATURATION
B(a)P	4.1	NA	NA	5.8	0.707	NA
LEAD*	120	NA	NA	NA	NA	NA
TCE	50	170	0.294	690	0.072	51 ✓
VINYL CHLORIDE	ND	1,000	NA	50	NA	3,900 ✓
TOTAL			0.3		0.8 (8E-06)	

Table II of OAC 3745-300-08 Appendix A

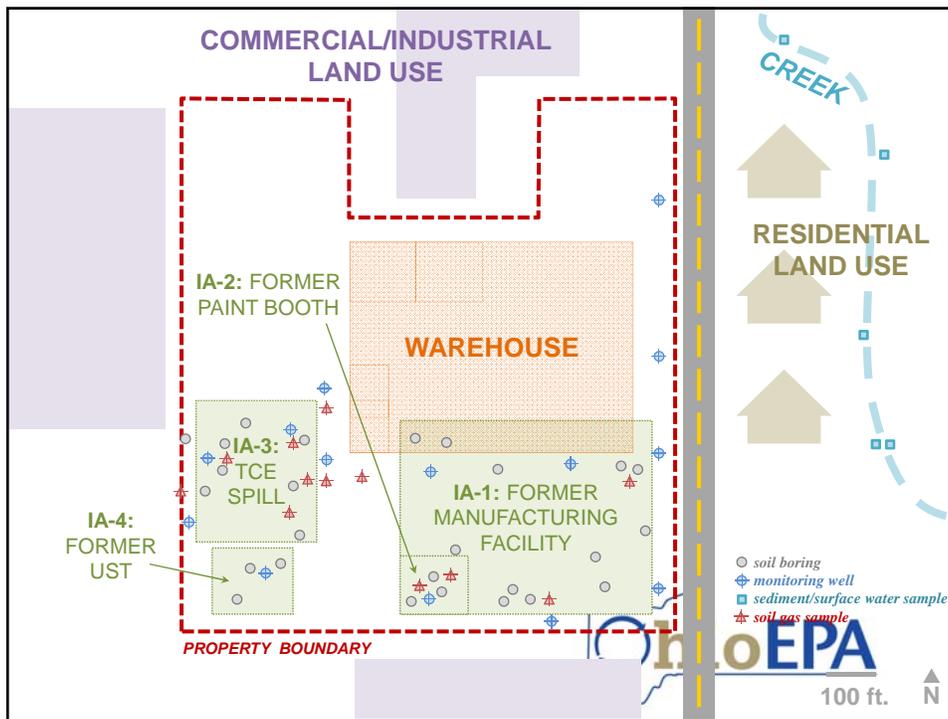


GROUNDWATER TO INDOOR AIR PATHWAY for commercial/industrial land use

COC	EPC (µg/L)	CALCULATED INDOOR AIR CONCENTRATION (µg/m³)	HAZARD QUOTIENT	RISK RATIO
TCE	42	8.3	0.95	0.28
VINYL CHLORIDE	110	82.5	0.19	3.0
TOTAL			1	3 (3E-05)

U.S. EPA'S VISL Calculator



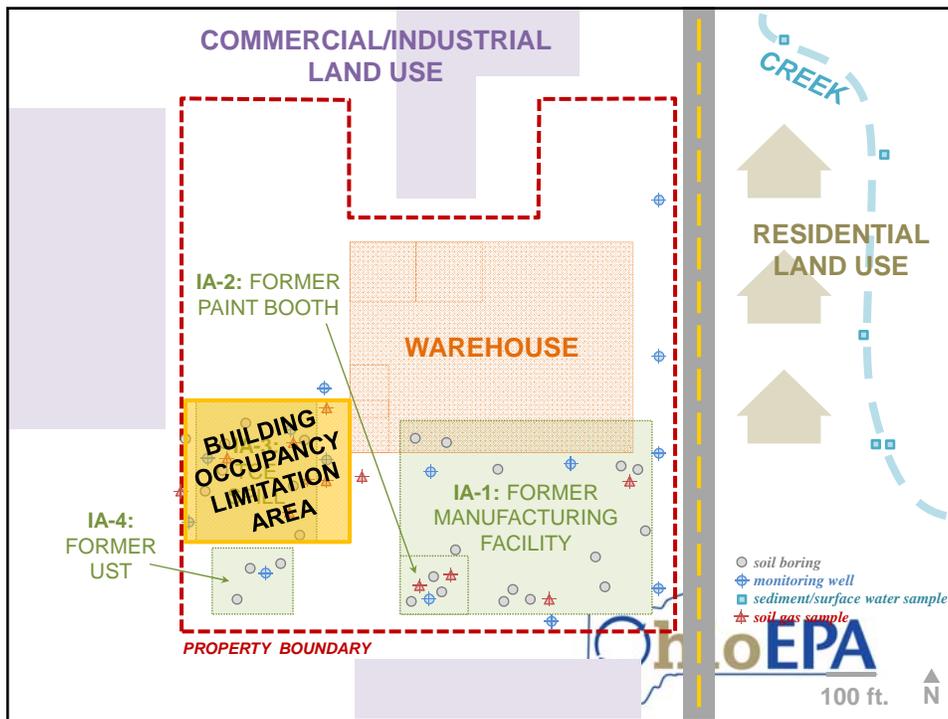


GROUNDWATER TO INDOOR AIR PATHWAY for commercial/industrial land use

COC	EPC ($\mu\text{g}/\text{m}^3$)	CALCULATED INDOOR AIR CONCENTRATION ($\mu\text{g}/\text{m}^3$)	HAZARD QUOTIENT	RISK RATIO
TCE	42	10.2	1.4	0.42
VINYL CHLORIDE	192	57.6	0.13	2.1
		TOTAL	2	3 (3E-05)

**U.S. EPA'S
VISL Calculator**





CUMULATIVE RISK for commercial/industrial land use

PATHWAY	HAZARD QUOTIENT	RISK RATIO
SOIL DIRECT-CONTACT	0.3	0.8
SOIL AND GROUNDWATER TO INDOOR AIR	0.2	0.1
TOTAL	0.5	0.9

