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Risk-Based Approaches

OCTOBER, 2019

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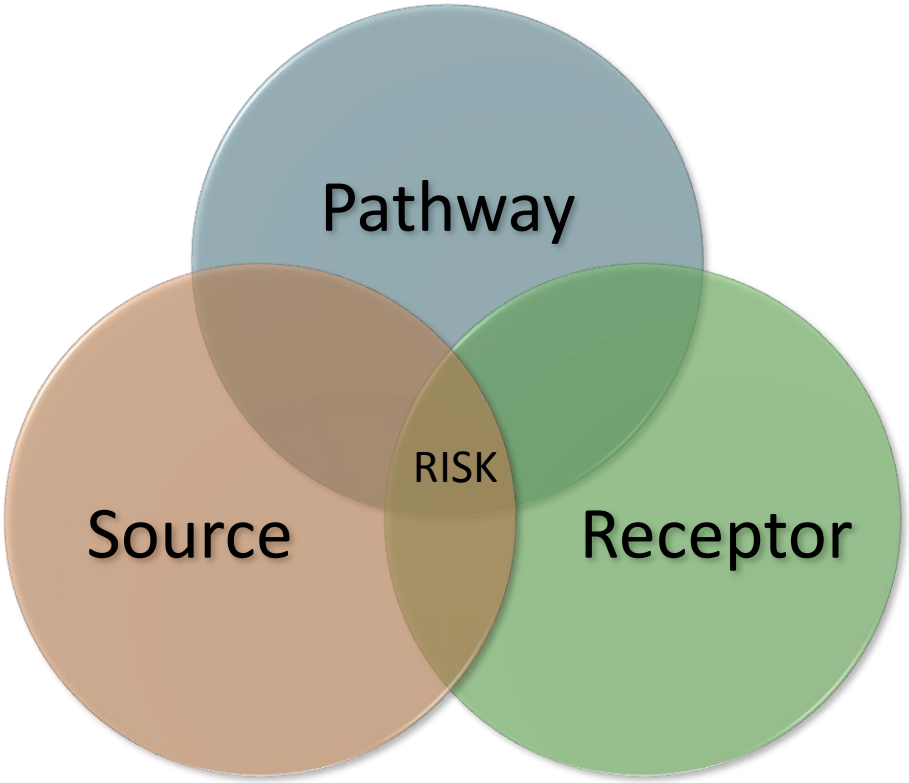
Exposure Pathway



- SSRA Tools

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Risk Tools

- Tier 2 guidelines include methods for pathway elimination, guideline re-calculation:
  - Many uses for these tools
  - Use of tools implicitly approved
  - Not always the right tools

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Risk Tools

- Could other tools get explicit regulatory approval?
- Project goal: document simple, inexpensive tools and present to regulators

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Risk Tools

- Tools evaluated:
  - Two-layer extension of groundwater model
  - Screening transport model for inorganics
  - Additional pathway elimination
  - Model parameters for peat

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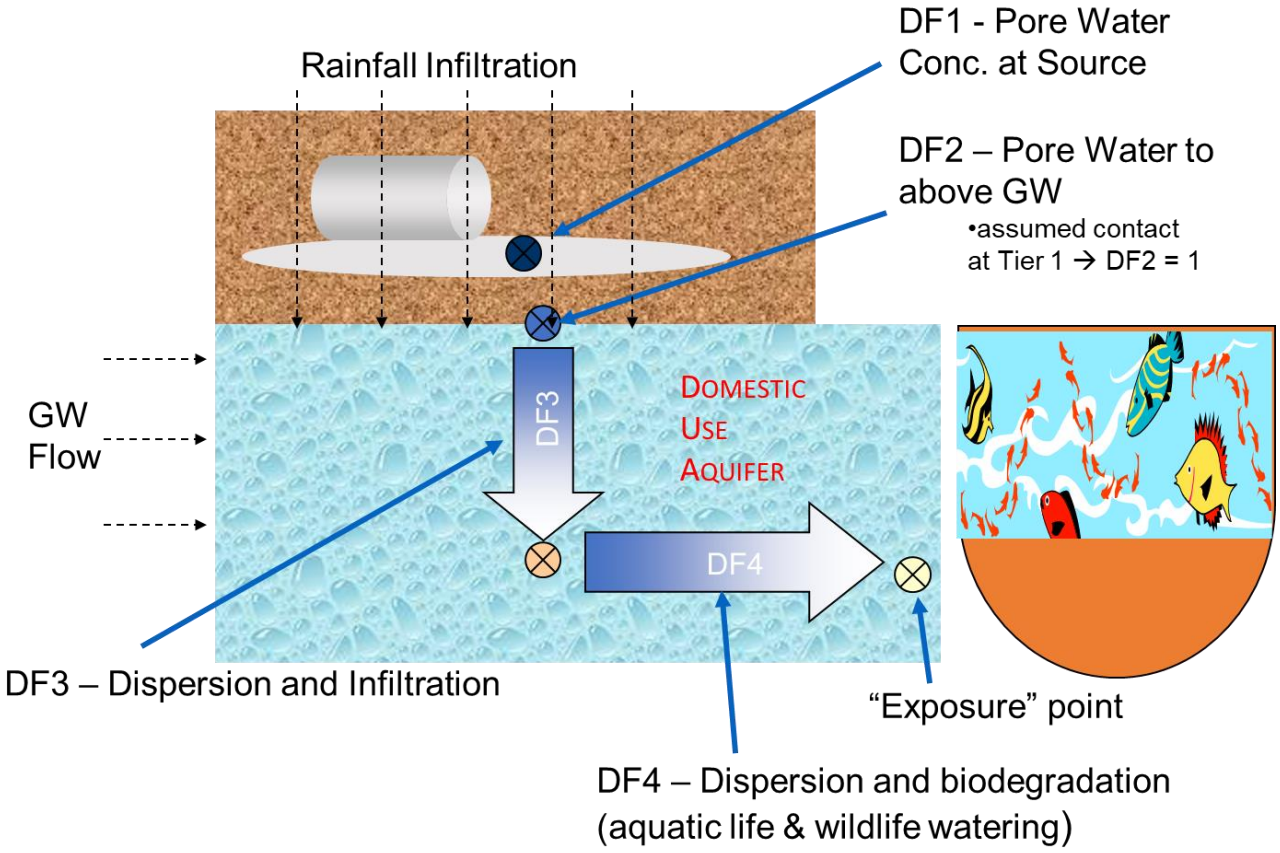
2-Layer Groundwater Model

- Tier 1/Tier 2 conceptual model:



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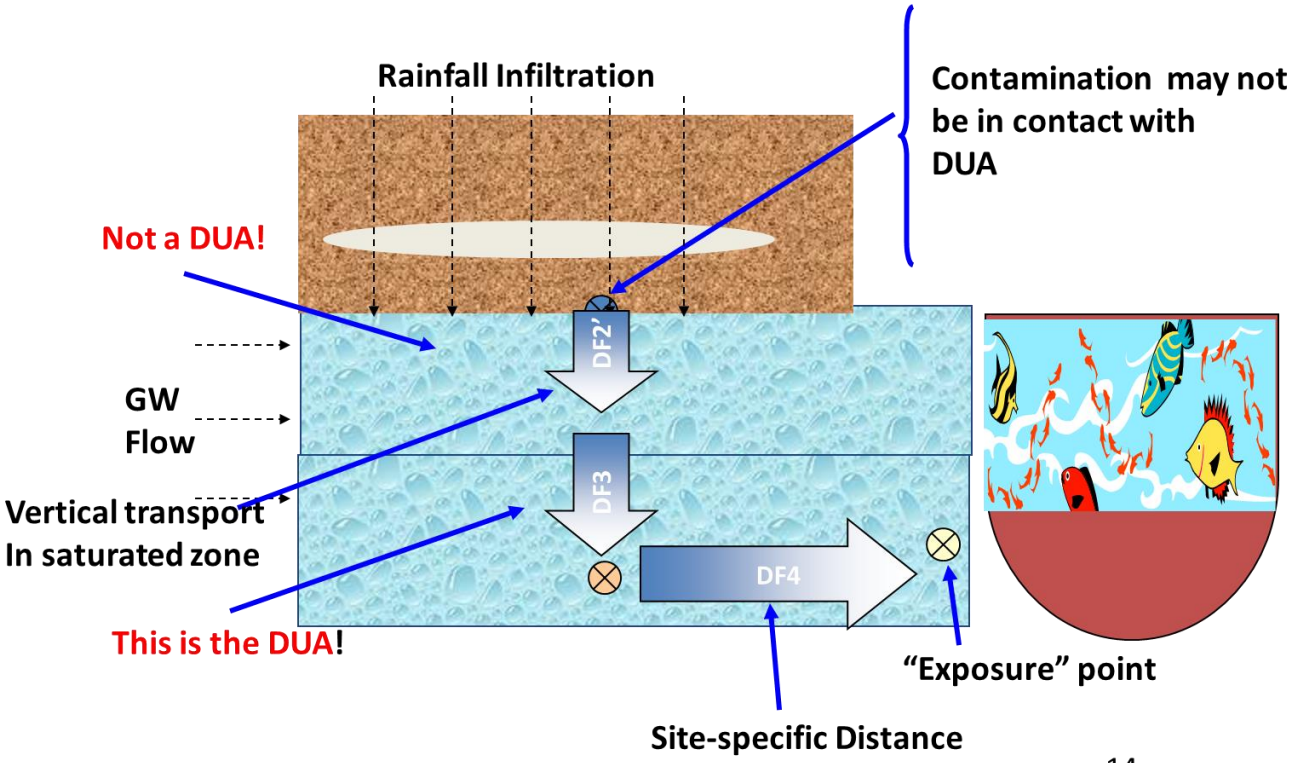
2-Layer Groundwater Model

- 2-Layer conceptual model



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2-Layer Groundwater Model

- Vertical transport in saturated zone (“DF2A”)
  - Model parameters adjusted for saturated zone
- Dilution of shallow groundwater in deeper DUA (“DF3A”)
- Lateral transport (DF4) through unit with highest groundwater velocity

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Challenges

- Does this model accurately represent vertical flow?
- Is it appropriate for all substances? DNAPL?
- Under what conditions do we have confidence it is conservative?

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Solutions

- Looking at approach similar to soil vapour
  - Factors applied to guidelines based on certain conditions being met
- Define conditions under which it can be applied
  - Biodegrading substance
  - No DNAPL
  - Stable/decreasing plume
  - Sufficient thickness of clean material

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Inorganics Screening Model

- Tier 1/Tier 2 groundwater model intended for organic chemicals
  - Based on Domenico (1987) model
- When metals or other inorganics exceed Tier 1 guidelines in groundwater, but receptor isn't close, what do we do?

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Inorganics Screening Model

- Other jurisdictions have applied Domenico model for inorganics
- Key considerations: complex soil-water partitioning; background concentrations
- → Tweak model to include background; conservative default background concentrations, Kd values
- Outstanding issue: what Kd values can we have confidence are conservative?

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Additional Pathway Exclusions

- Ideas considered:
  - DUA – aquifer is inherently unpotable
  - FAL – surface water at higher elevation than contamination; water bodies with no groundwater input
  - Wildlife soil & food ingestion: remote sites, deeper than burrowing depth

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Peat Properties

- AEP currently recommends coarse soil guidelines for organic chemicals in peat
- However, transport through peat may differ substantially from coarse soil
- → Research appropriate properties for peat

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Peat Properties

Table E1 Properties of Peat			
Property	**Fibric material**	**Mesic material**	**Humic material**
Bulk density (g/cm^3)	<0.075	0.075 – 0.195	>0.195
Total porosity (fraction)	>0.9	0.85-0.9	<0.85
Water content (fraction)	<0.48	0.48-0.7	>0.7
Hydraulic conductivity (m/y)	>530	8.8 – 530	<8.8

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Peat Properties

Table E3 Organic Matter Content of Peat[a]

Material	Organic Matter (g/kg)	Fibre Content (% by weight)	Estimated Organic Carbon (%)[b]
Canadian sphagnum	960	54	48 - 56
Michigan sphagnum	910	33	45.5 – 54
Dakota reed-sedge	860	12	43 – 50
Ohio muck peat	400	7	20 - 24

a – from McCoy (1992)

b – calculated based on OM/OC ratio of 1.7 to 2.0

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Outstanding challenges

- How does this fit within the broader issues of peat sites?

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Project Status

- Preliminary discussions with regulators have occurred
- Refining document for top priority (2-layer groundwater model)
- Seeking engagement from other industries