



REGULATORY APPROVAL OF RISK  
TOOLS:  
**SHALLOW  
GROUNDWATER  
GUIDELINES TO  
PROTECT UNDERLYING  
DUA**

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OCTOBER 2023

# PROJECT BACKGROUND

- Tier 2 guidelines include methods for pathway elimination, guideline re-calculation
  - Many uses for these tools
  - Approaches are “approved”
  - Not always the right tools



# PROJECT BACKGROUND



Primary goal: document simple, inexpensive tools to supplement what is in Tier 2 guidelines document



Regulator approval of tools sought



3 tools initially considered

# ON THE BACKBURNER

- Generic Kd values for inorganic substances
  - To allow screening-level transport modelling of inorganics
  - Conservative values compiled based on other jurisdictions and technical documents
  - Limited interest from regulators without site-specific verification



# ON THE BACKBURNER

- Groundwater model parameters for peat
  - Would allow Tier 2 model to be used for transport in peat
  - Current policy: apply coarse soil guidelines for organic chemicals in peat
    - Peat parameters very different, but policy is not unreasonable for screening
  - Regulators did not want to consider as a stand-alone without broader framework for peat sites

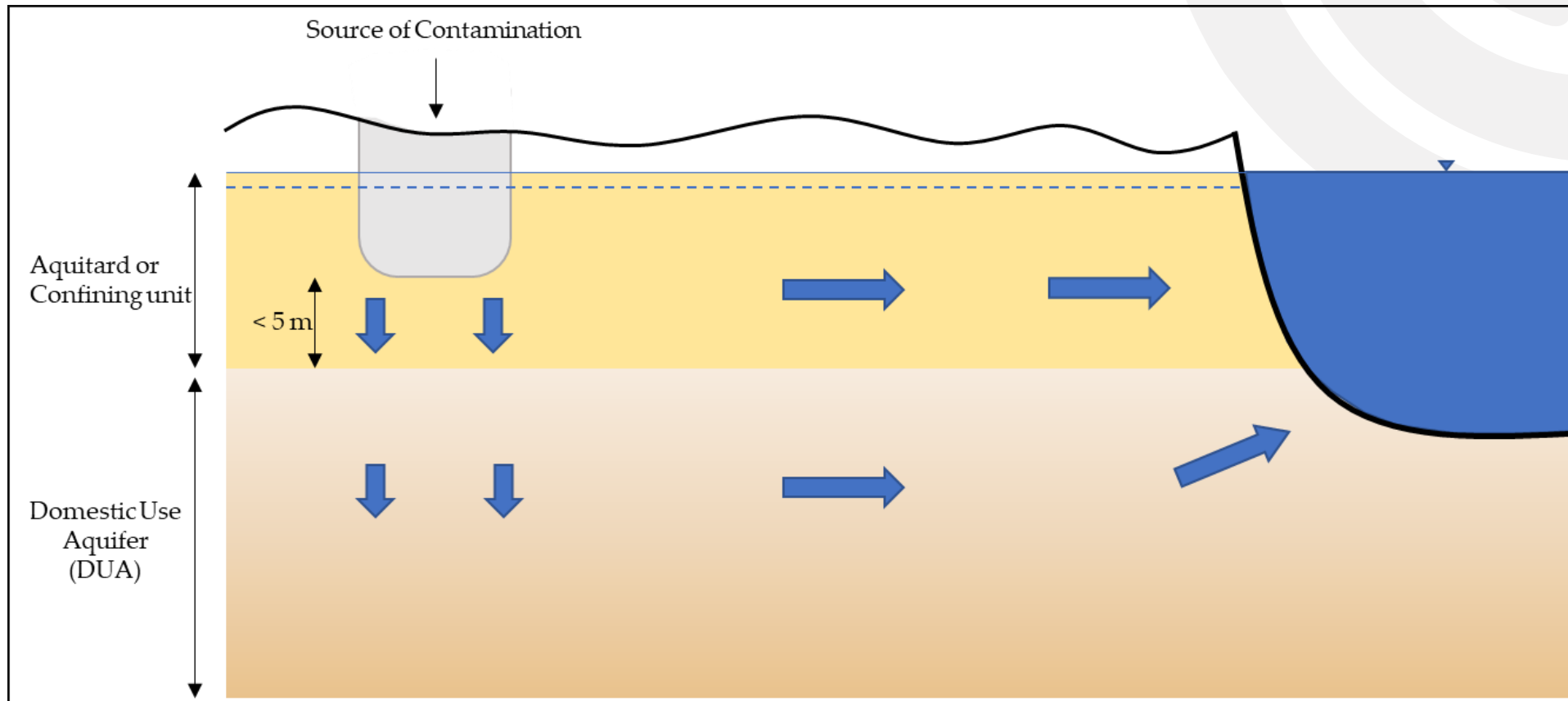


# CURRENT FOCUS

- Groundwater guidelines where shallow groundwater is not a DUA
  - Governing pathway for petroleum hydrocarbons, many other substances
  - Many sites where shallow groundwater is not a DUA, but pathway cannot be eliminated via current pathway elimination



# CONCEPTUAL MODEL



# INITIAL APPROACH

- 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





# 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?



# SOLUTIONS

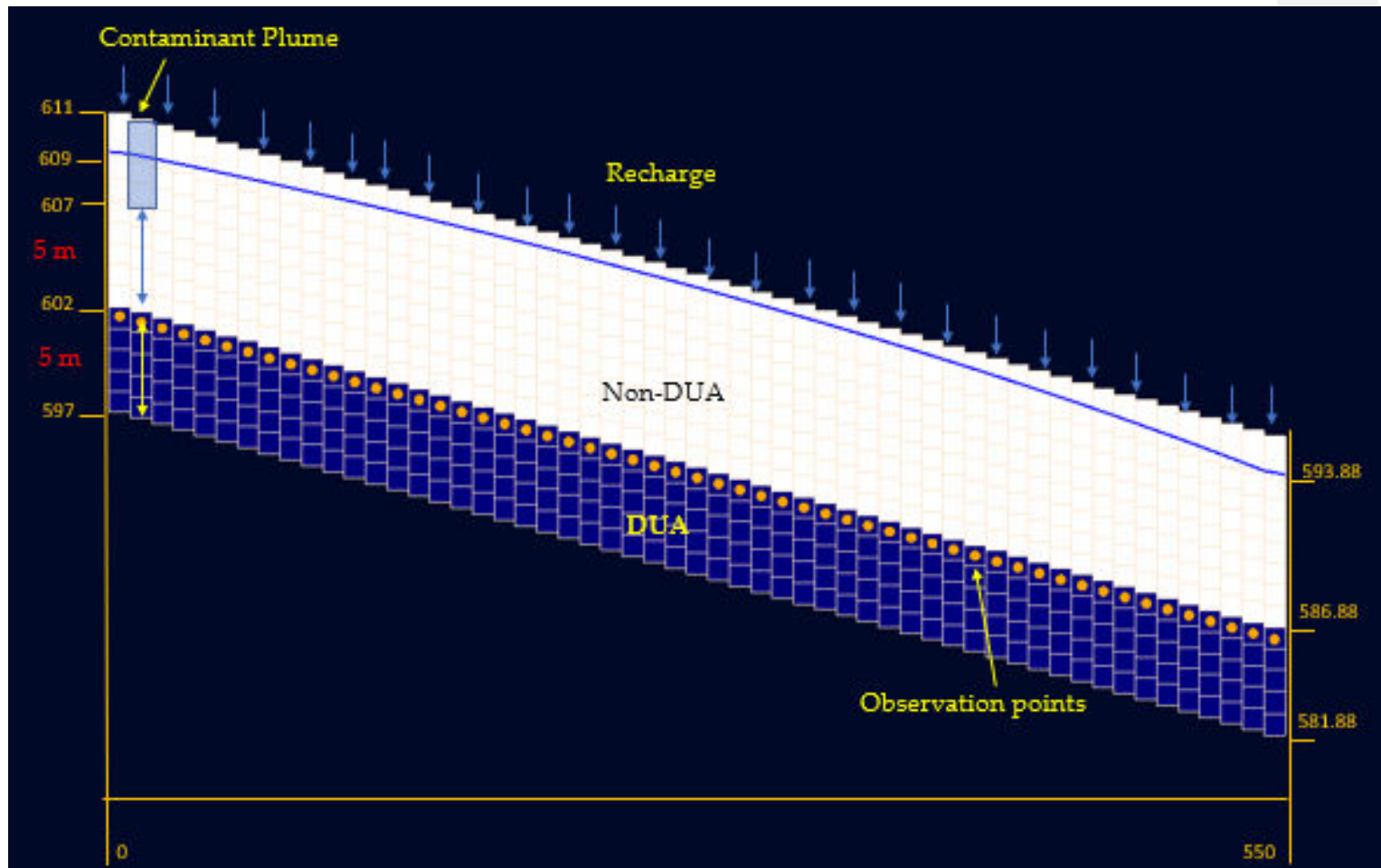
- Looking at approach similar to soil vapour
  - Factors applied to guidelines based on certain conditions being met
- Define conditions under which it can be applied

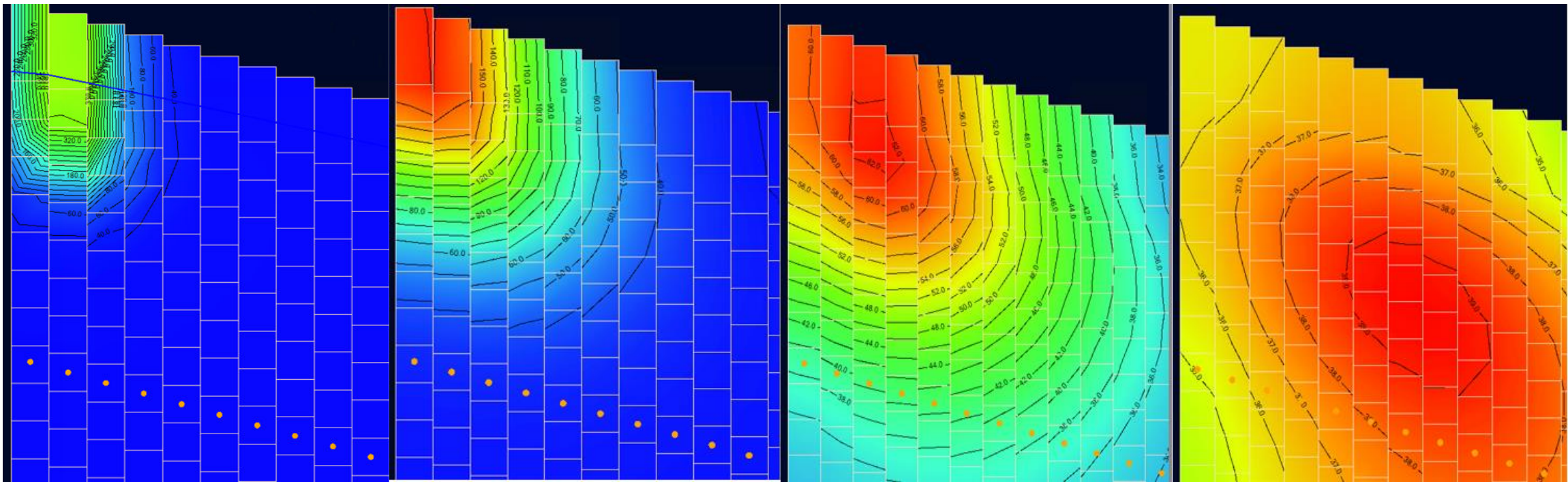


# APPROACH

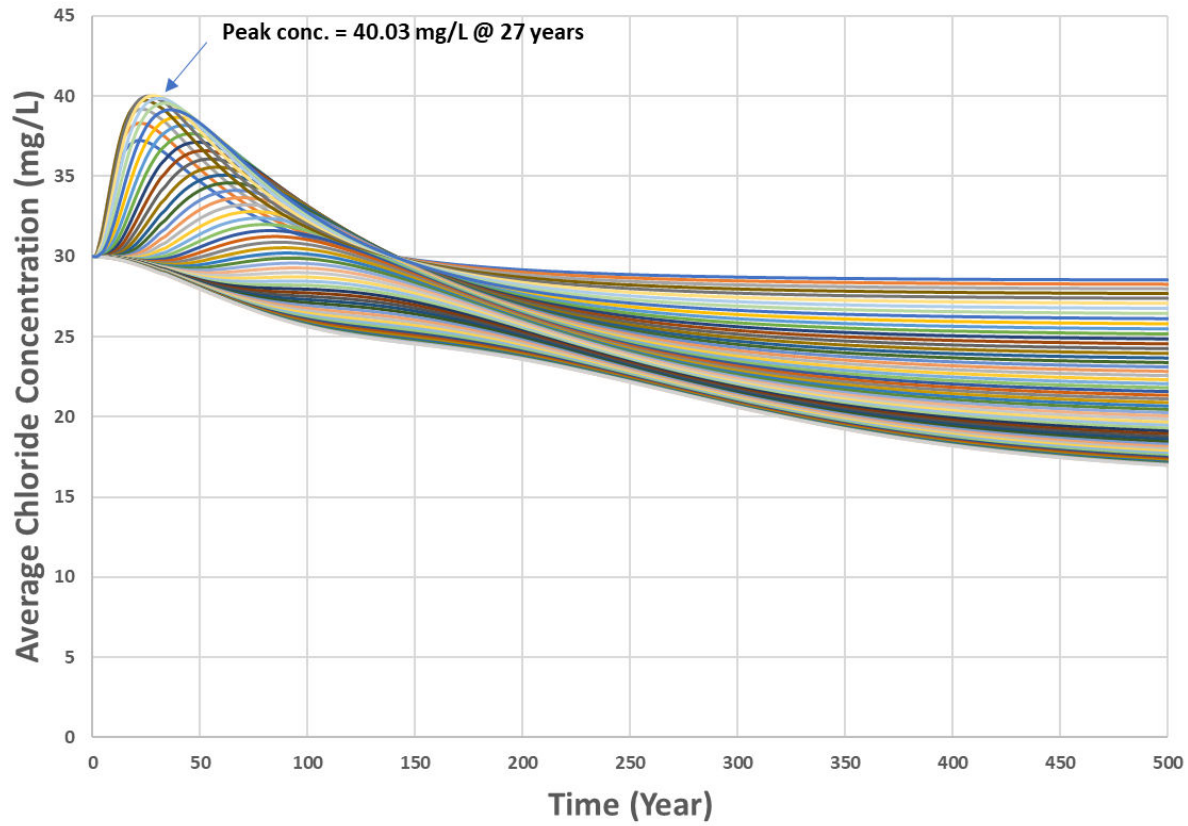
- Numeric mode (2-dimensional Modflow) used to represent conceptual model
- Base case – Alberta Tier 1 parameters
- Adjust key parameters over reasonable ranges
- Calculations done for chloride (conservative solute) and benzene (degrading chemical)
- Dilution factor: ratio between source area groundwater concentration and maximum concentration in DUA

# MODEL APPROACH

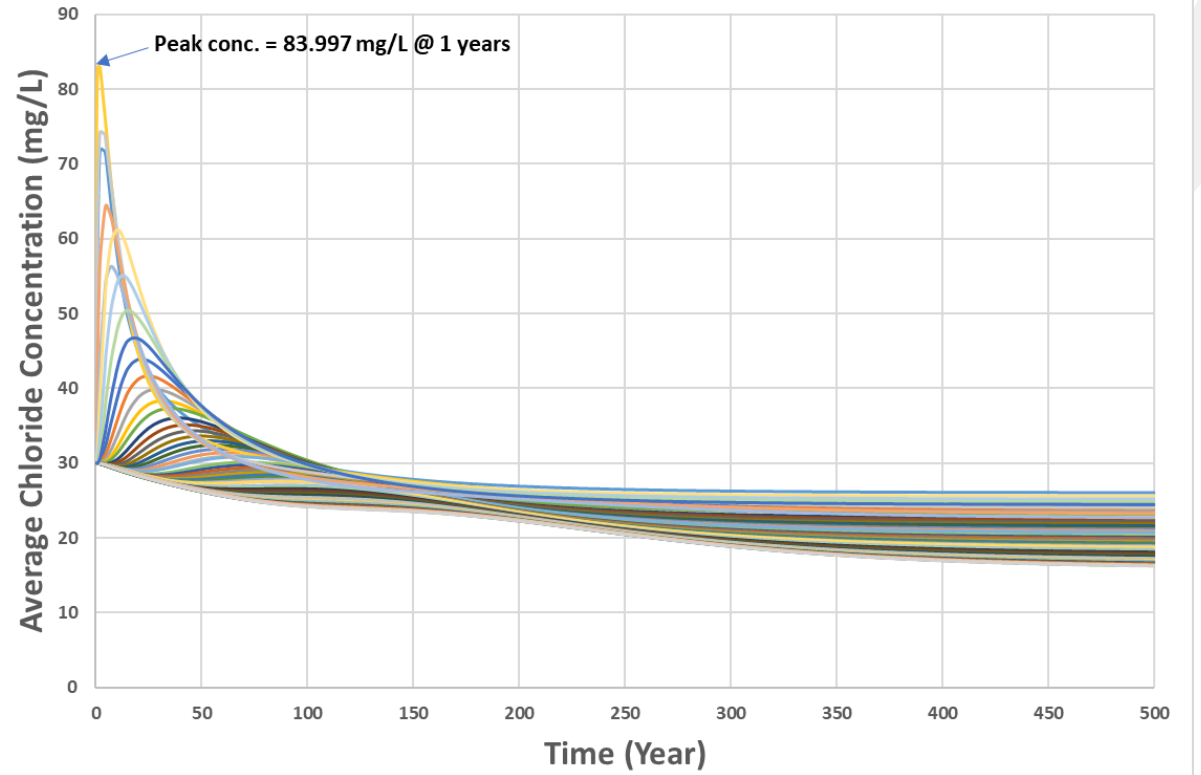




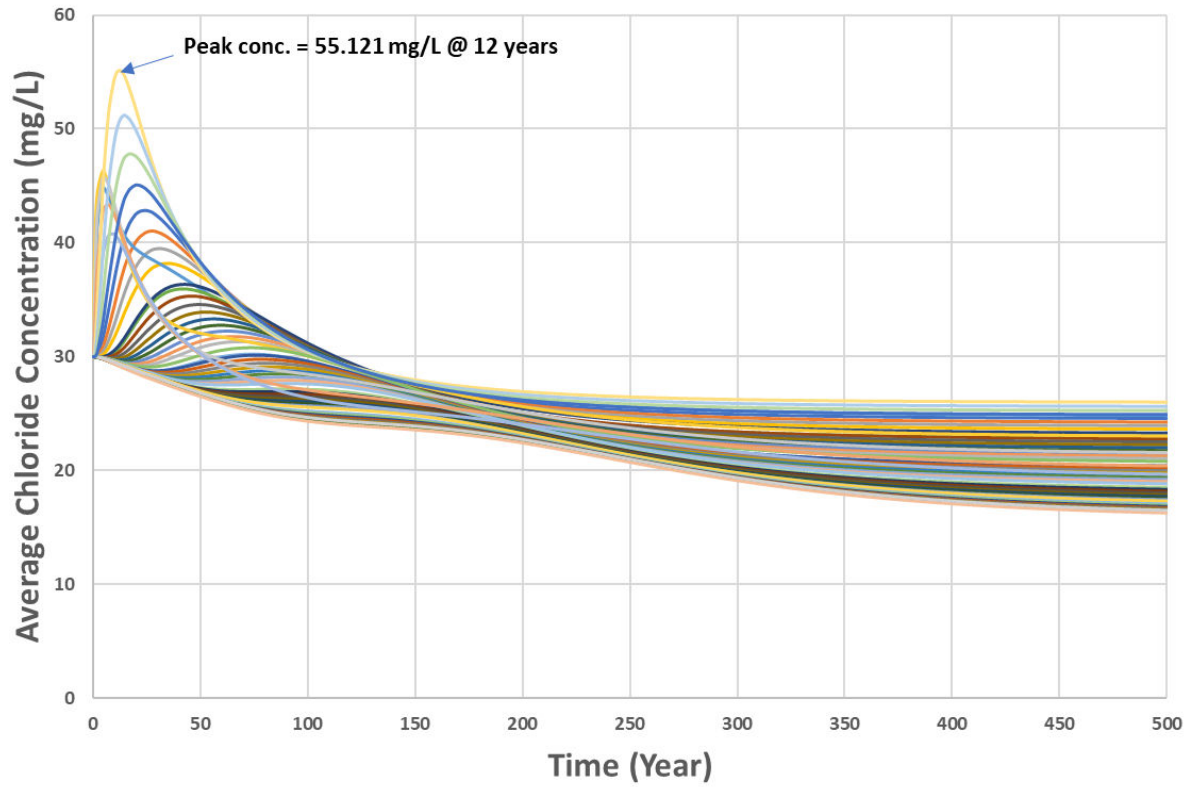
Base Model - DUA 2m Average Chloride Concentration



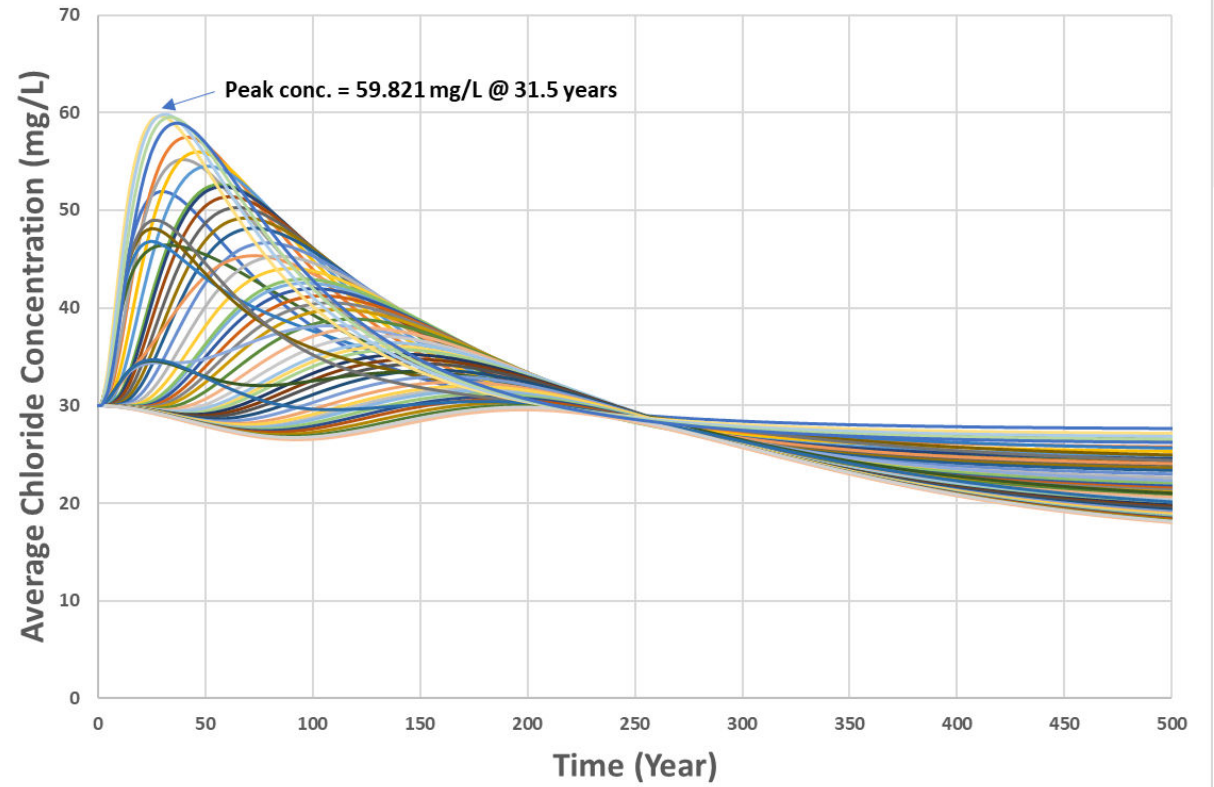
Model with 0 m separation to DUA  
- DUA 2m Average Chloride Concentration



Model with 1 m separation to DUA  
- DUA 2m Average Chloride Concentration



Model with 30m x 10m x 2m Source Volume  
- DUA 2m Average Chloride Concentration



# ADDITIONAL CHECKS



Calculation of generic dilution factors with SST



Calculations with modified Tier 2 model



Review of other jurisdictions



# RESULTS - CHLORIDE

- Site that meets Tier 1 conditions (source length  $\leq 10$  m) always had dilution factor  $>5$ 
  - Site-specific assessment needed for sites with source length  $> 10$  m

## Results - Benzene

Dilution factor  $>10$  for all scenarios

Minimum dilution factor with 1 m separation of 180

Recommendation: Dilution factor of 10, or 100 with  $>1$  m separation

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