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Lessons Learned and Best Practices in Savannah River Site Saltstone and Tank Farm Performance Assessments

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- **Community of Practice Technical Exchange**

Las Vegas, NV
December 12, 2014

Perspective

- **Over the past 9 years Savannah River Remediation has issued three Performance Assessments (F-Tank Farm, Saltstone Disposal Facility, H-Tank Farm) and four Special Analyses**
- **Reviewers have included**
  - Department of Energy (DOE) oversight personnel
  - South Carolina Department of Health and Environmental Control
  - Nuclear Regulatory Commission
  - Environmental Protection Agency
  - Other DOE contractors
  - Members of academia
  - SRS Citizens Advisory Board
  - Members of the public
- **This presentation reflects the lessons learned and best practices gleaned from our experiences**

Model Development

- **Given the long time periods considered in modeling, there can be significant variability in possible future conditions**
  - It is not reasonable to model everything
- **A Base Case (or Evaluation Case) provides a single conceptual model as a foundation for communicating results**
- **Base Case serves as a comparison or reference case**
- **Base Case captures best knowledge available - most probable and defensible conditions**
  - Base Case model provides foundation, but has inherent uncertainty
- **No ONE model provides a complete understanding of the system**
  - Alternative conceptual models can then be used to improve understanding and build confidence

Challenges in Base Case Development

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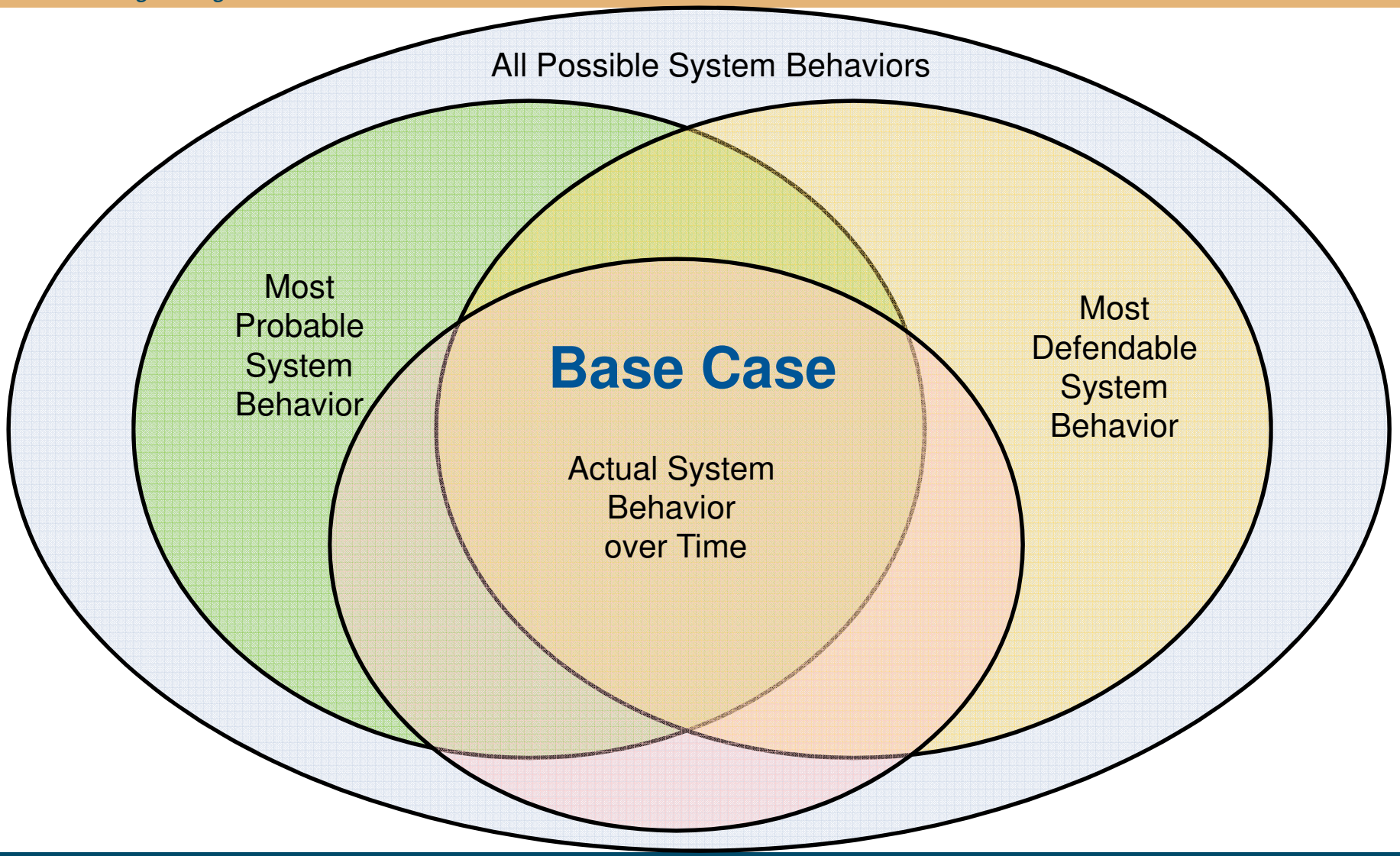

The Rest of the Story

- Base Case
- Benchmark Model or Alternate Method
- Alternative Conceptual Models
- Parameter Sensitivity Models
- Barrier Sensitivity Models
- Uncertainty Analyses
- Sensitivity Analyses
- Base Case Revision

More Modeling

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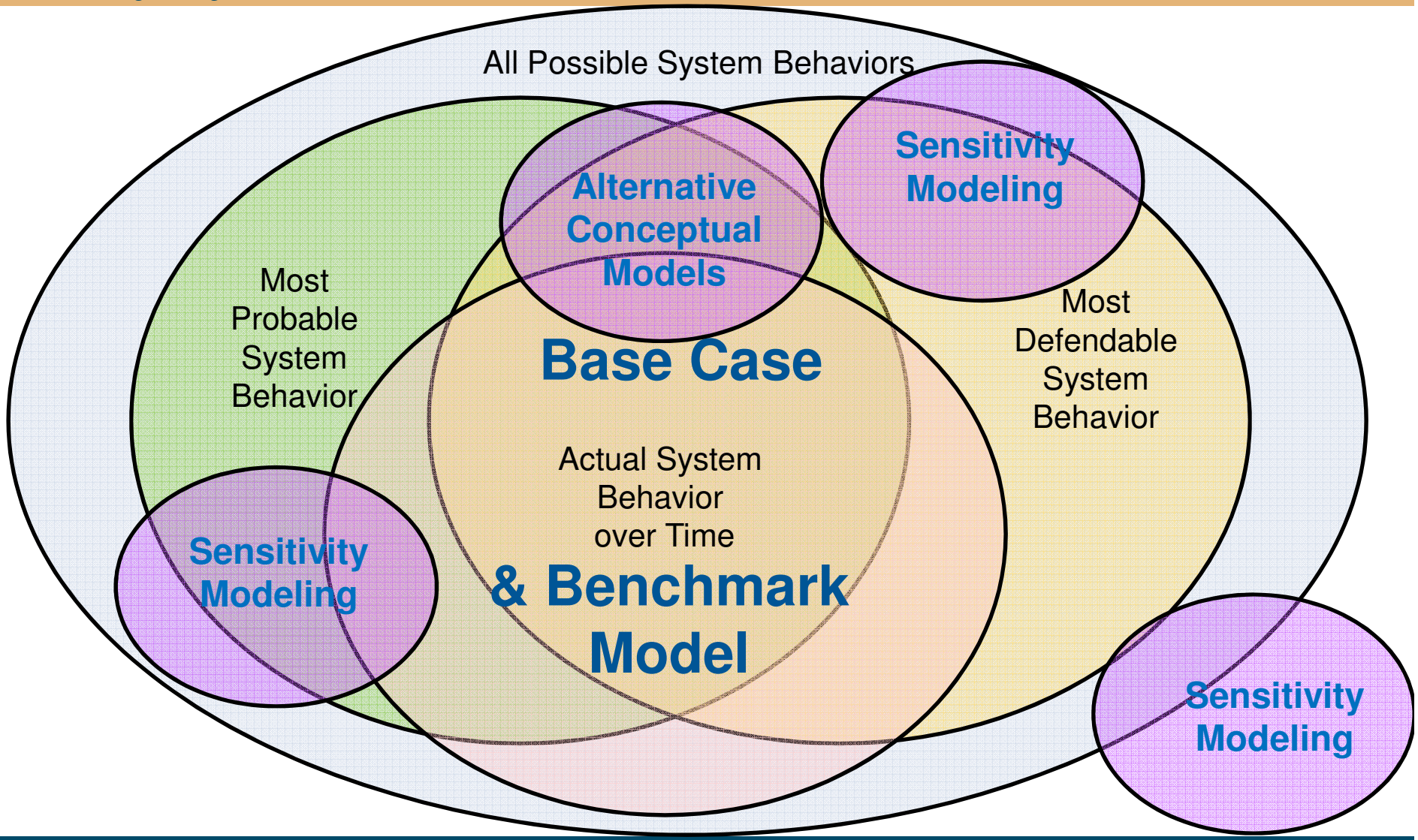


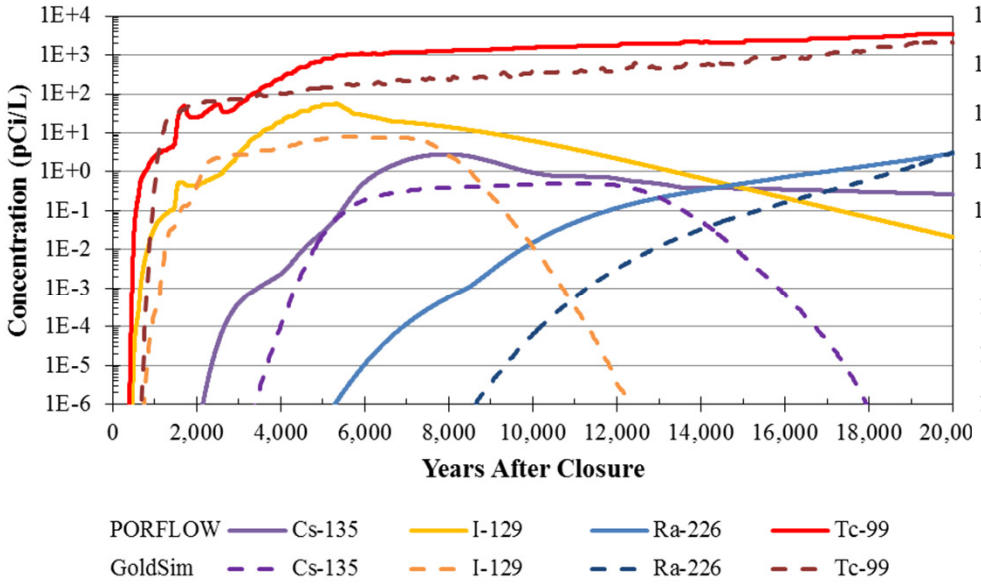
Benchmarking/Alternate Methods

- **Benefits**
  - Builds confidence
  - Provides additional modeling outlet
  - Helps identify weaknesses or errors in models
- **Lessons Learned**
  - Which model is which?
    - Requires very clear documentation to avoid confusion as both models can be very similar
  - Which model is “right”?
    - Even minor differences can cause stakeholders to question the validity of both models
  - Why aren’t they exactly the same?
    - Requires in-depth understanding and description of the differences between the models

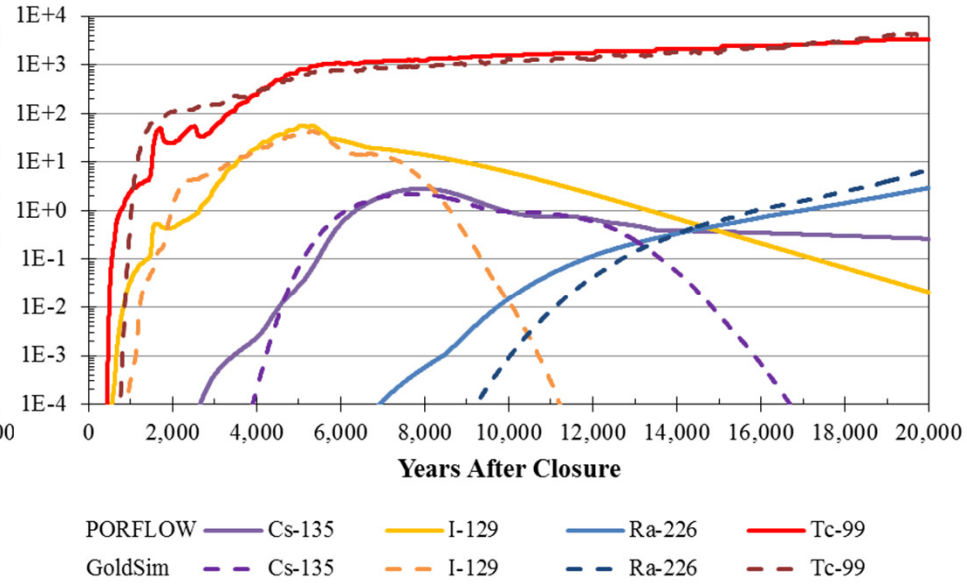
Benefits from Benchmarking

- **Example of Using Benchmarking to Identify Weakness**

Before

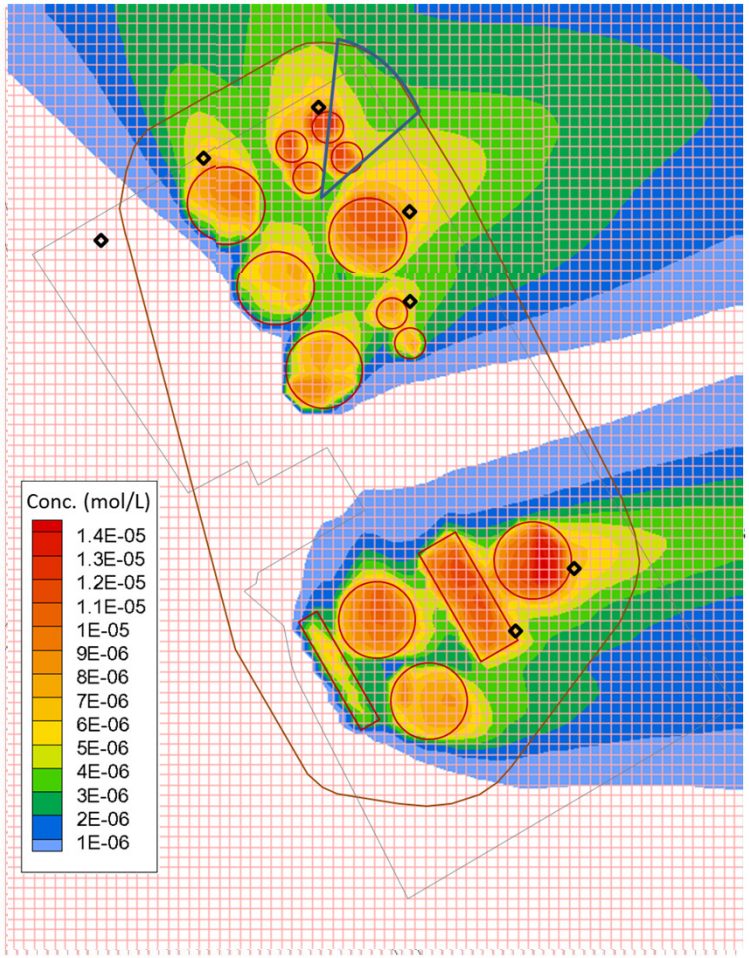


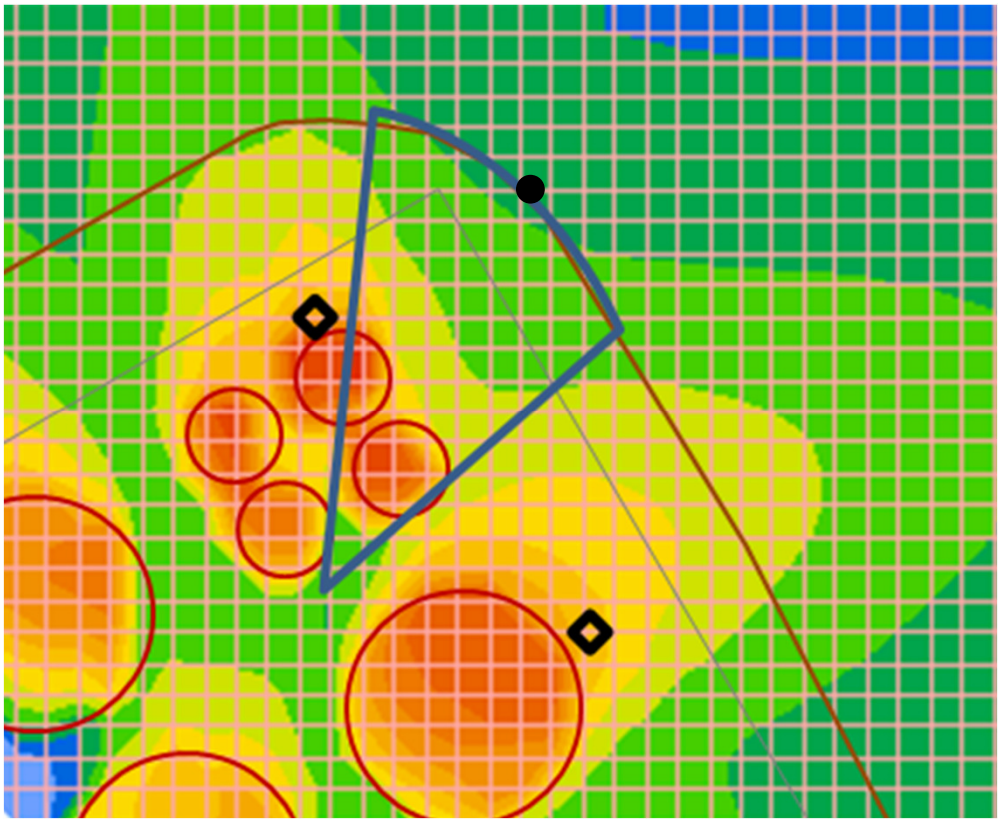
After



Benefits from Benchmarking

- **Example of Using Benchmarking to Identify Weakness**



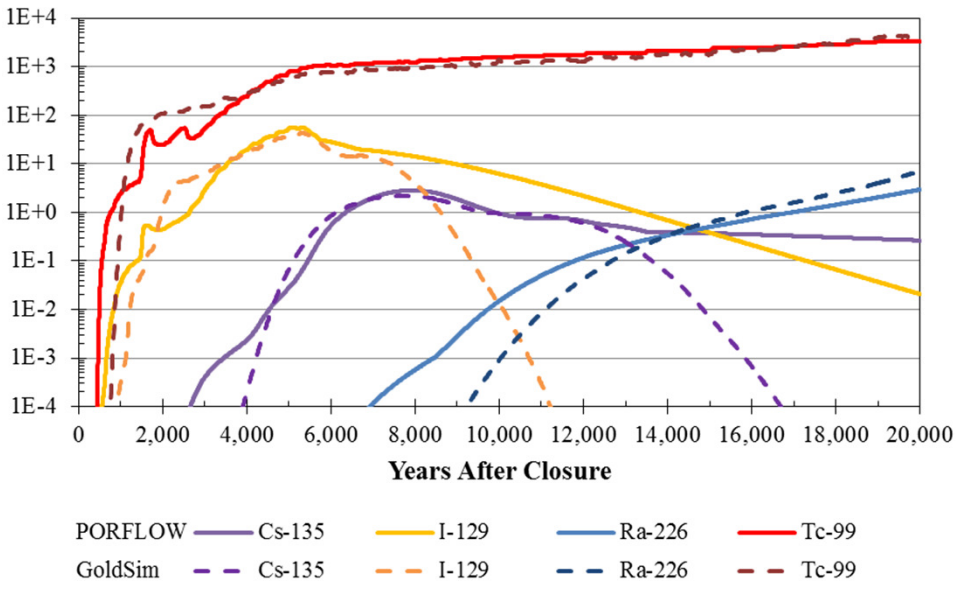


Lessons Learned from Benchmarking

- **Example of the Need to Understand the Differences between the Base Case and the Benchmark Model**

- **After the concentrations peak, mass quickly depletes in the GoldSim model while PORFLOW shows gradual decreases over thousands of years**
- **The PORFLOW model is a three-dimensional representation of the system**
  - PORFLOW includes an additional clay layer within the saturated zone which provides a storage zone for sorptive radionuclides

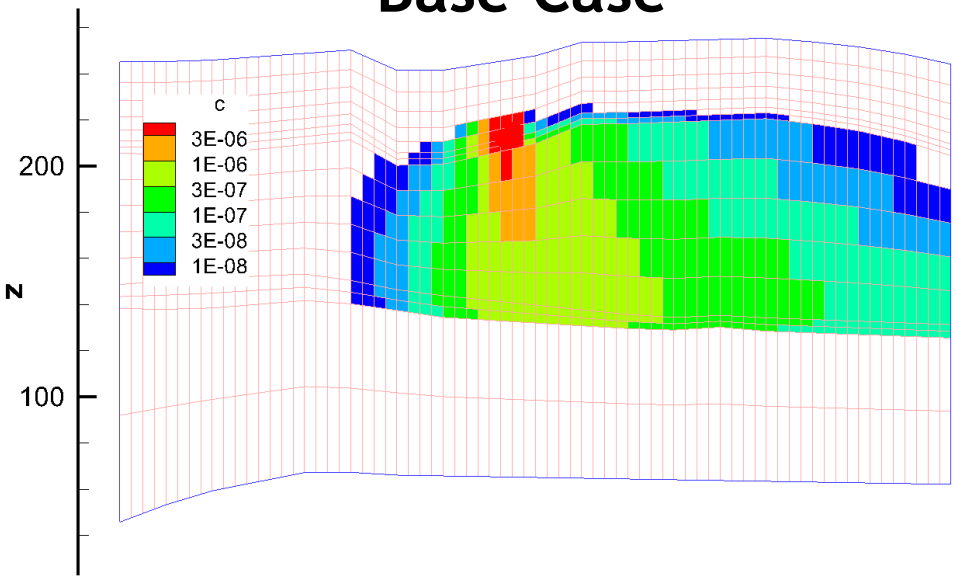
After



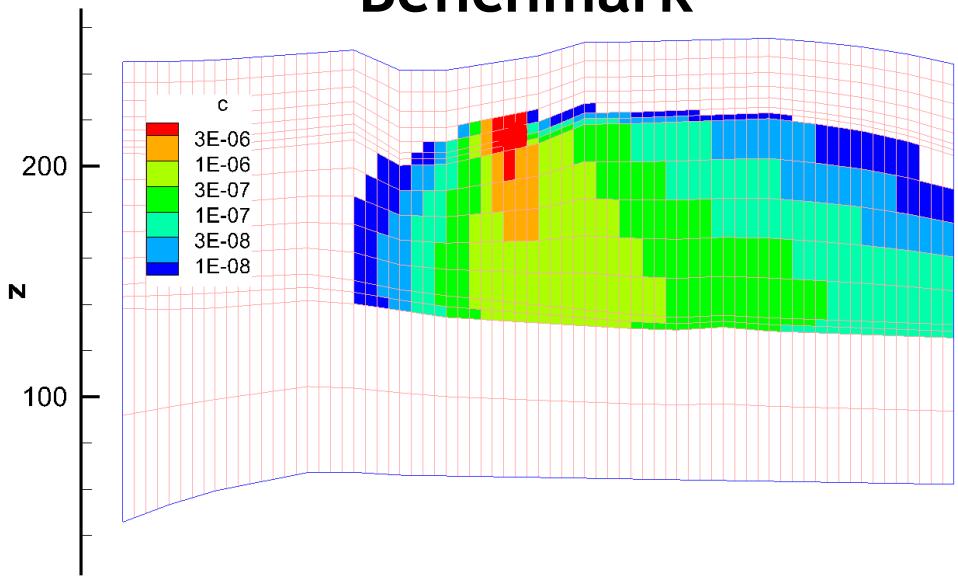
Lessons Learned from Benchmarking

- **Example of the Need to Understand the Differences between the Base Case and the Benchmark Model**

Base Case

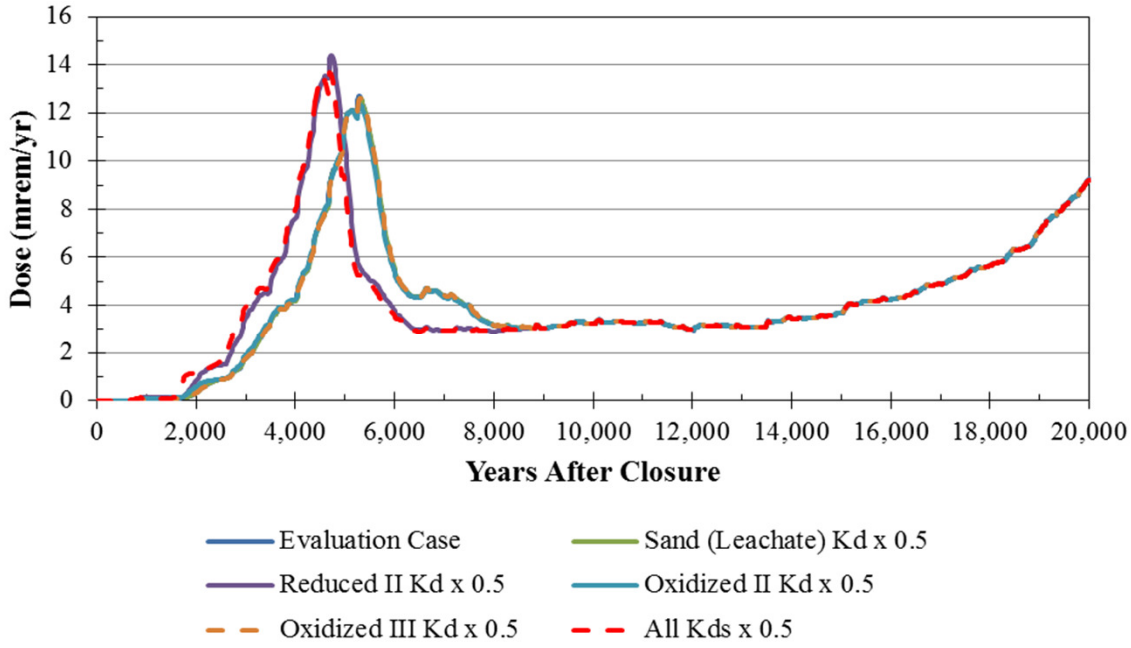


Benchmark



Lessons from Sensitivity Modeling

- Multiple single-parameter Sensitivity Models provide clear and useful understanding of how parameter variability influences model behavior
- Varying too many parameters simultaneously makes interpretation of results difficult



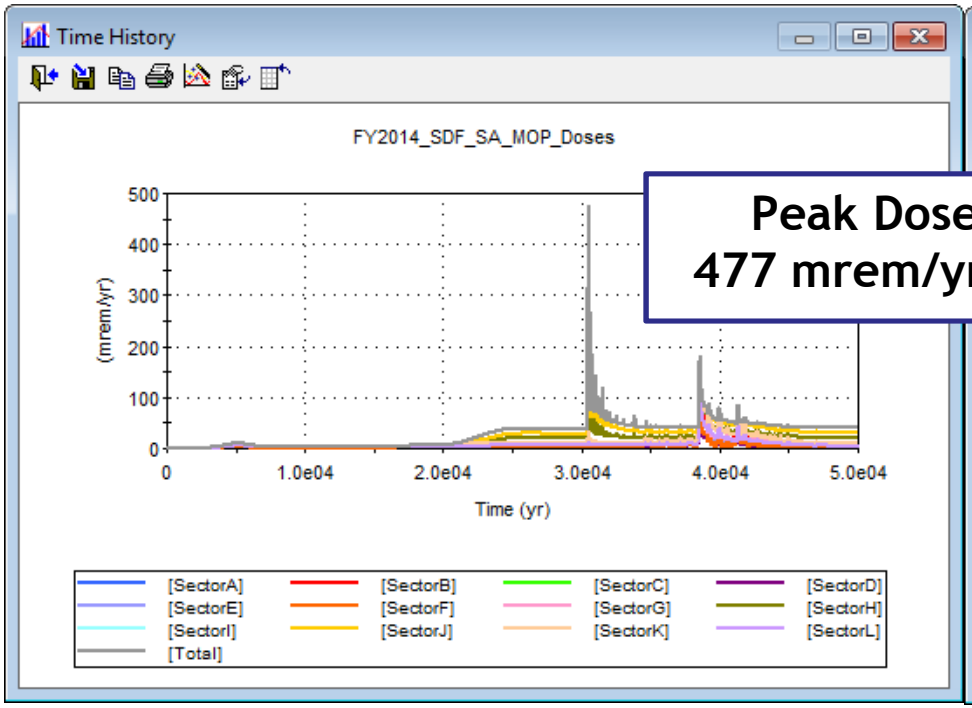
Temporal and Spatial Variability

- **Model discretization can be challenging**
- **More discrete (e.g., more time steps or more nodes or 3-D)**
  - Model takes a LONG time to run
  - Result files take up a LOT of disk space
  - Analyzing results becomes time consuming
  - File management issues
  - Model better captures extreme events
  - Easier to defend
- **Less discrete (e.g., fewer time steps or fewer nodes or 1-D)**
  - Model finishes quickly
  - Files sizes are smaller and more manageable
  - Analysis can be quicker and easier
  - Results show less accuracy
  - Harder to defend

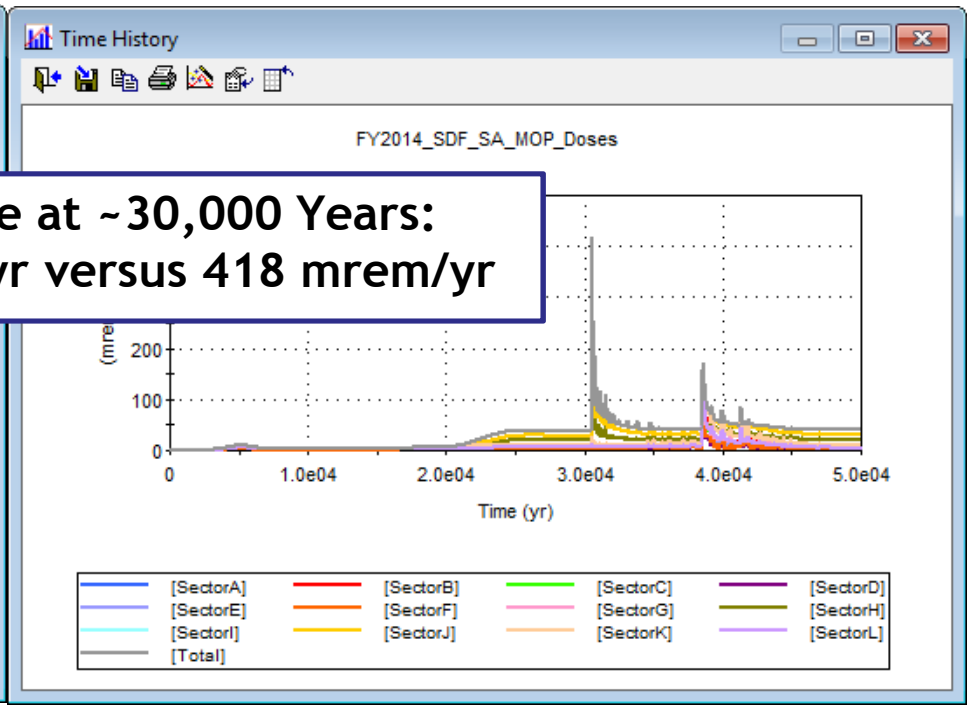
Temporal and Spatial Variability

- **Example 1: Timestep Discretization can Change Results**

More Discrete (2-yr Timesteps)



Less Discrete (50-yr Timesteps)

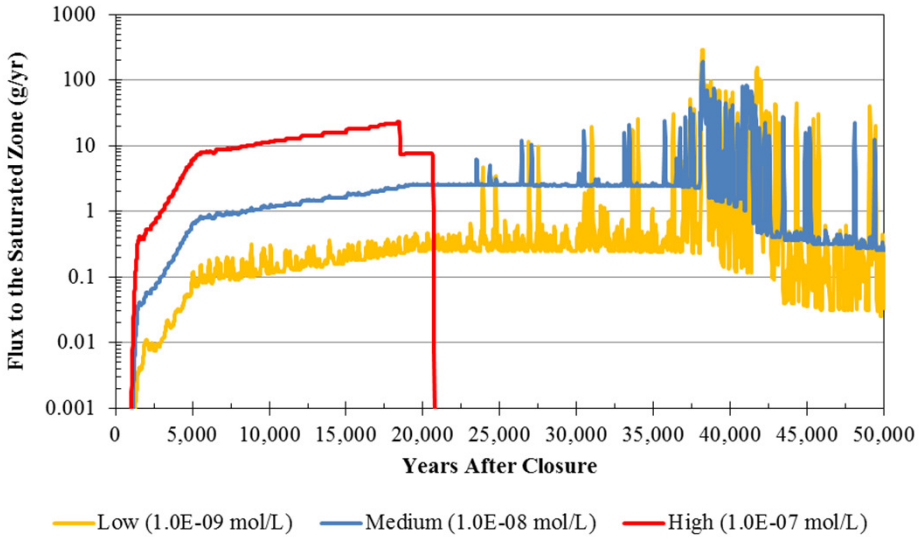


Peak Dose at ~30,000 Years:
477 mrem/yr versus 418 mrem/yr

Temporal and Spatial Variability

- **Example 2: Conservative versus Non-Conservative Assumptions Change with Respect to Time Period Considered**

- **Effects of Solubility on Tc-99 Flux from SDU 6**
  - Assuming high solubility is conservative for the first 20,000 years
  - Assuming nominal solubility is conservative between about 20,000 and 30,000 years
  - Assuming low solubility is conservative after 30,000 years



Challenges in Presenting the Results

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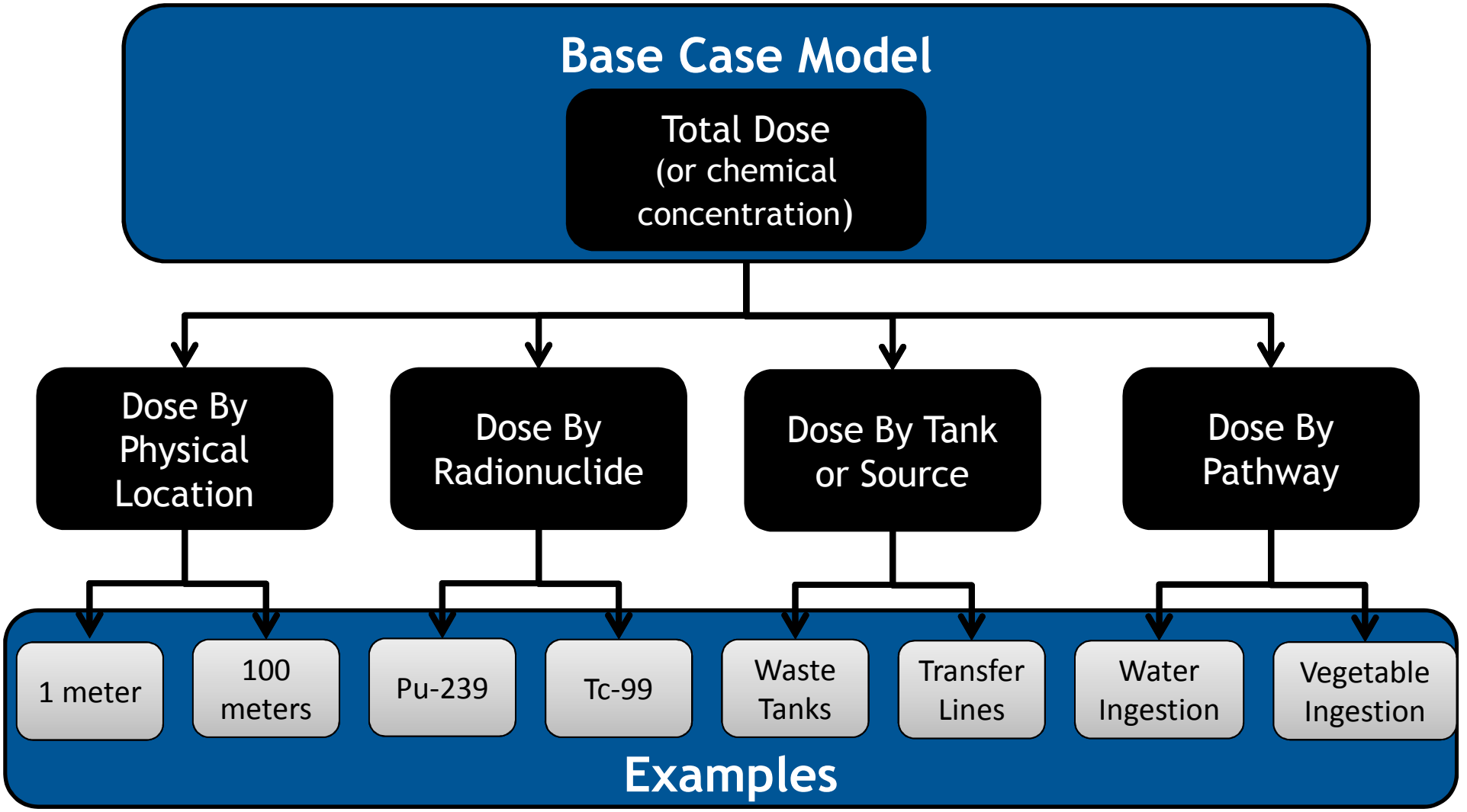
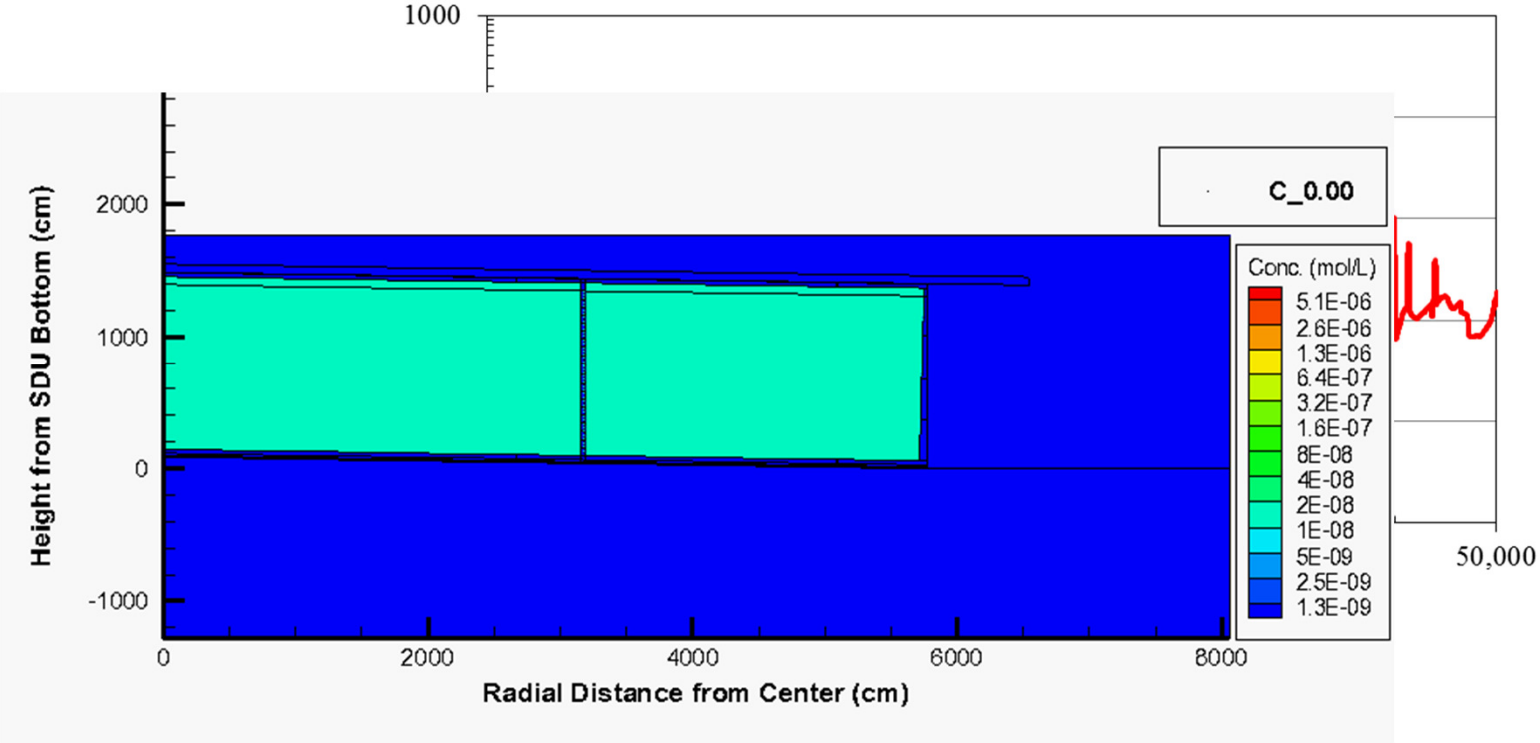


Challenges in Presenting the Results

- If a picture is worth 1,000 words…
- Then a Video is Priceless



Understanding Roles

- Practitioners must remember that they will interface with oversight organizations, regulators, consultants, stakeholders, and members of the public.
- They all have a role to play so you should not be surprised when they perform that role - do not get emotional about your work product.
- Stakeholders may want to see results before all analyses are complete but there must be a balance between getting ahead of the reviews and understanding of results.
- Reviews and comments from varied perspectives will make a better finished product.
- Need to balance reviewers new to the facility/modeling versus experienced reviewers when looking at document revisions. There are pluses and minuses of each.

Prepare for Reviews

- **You should know during the model development and analysis of results where the uncertainties lie and anticipate the questions. "What if …"**
- **Exercise the model early and you can try to answer the what ifs within the original documentation rather than as responses to reviews.**
- **Get clarification to comments before expending significant efforts to answer what you "think" is the concern.**
- **If there are tools such as figures and videos that help you interpret results, they will probably help those reviewing your work so be prepared to share them.**
  - Intermediate results
  - Movies
  - Model files

Conclusions

- Applying lessons learned and best practices will make the development of your documents and the review process less painful than figuring it out as you go.

- If you have any questions please feel free to contact me.

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