



# NRC Evaluation of the DOE Updated Performance Assessment for Salt Waste Disposal at the Savannah River Site

Details from the NRC Staff Technical Evaluation Report

A. Christianne Ridge

May 7, 2012

# Review Conclusions

- NRC staff does not have reasonable assurance the performance objective for an off-site member of the public is satisfied (§61.41)
- Conclusion based on DOE “Case K” results
- Conclusion supported by NRC independent sensitivity analyses

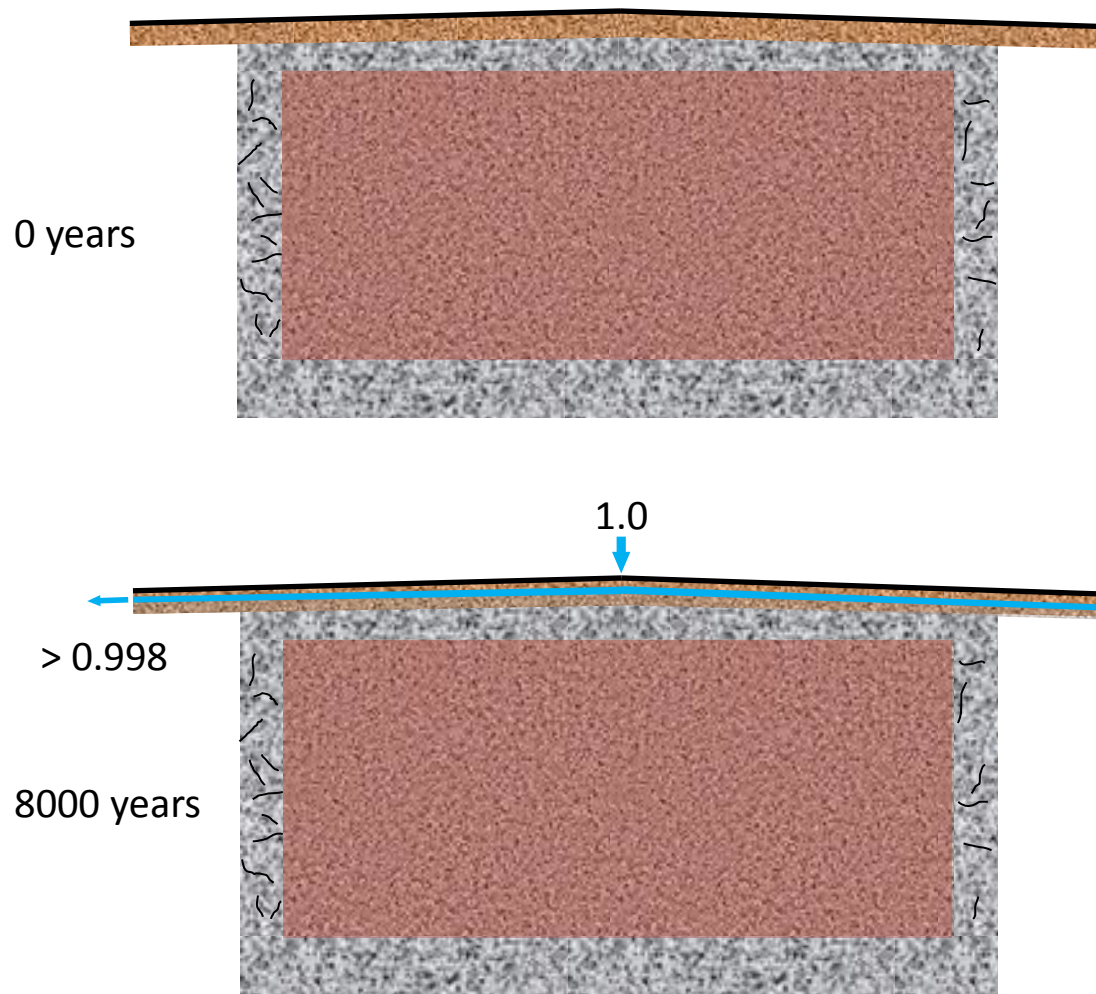


# DOE Performance Assessment

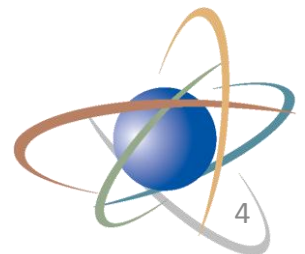
- Deterministic base case and sensitivity analyses
- Probabilistic analyses
  - Did not adequately consider uncertainty in flow
  - Multiple quality assurance problems
- Response to NRC request for revised base case
  - DOE supplied Case K but characterized it as a pessimistic sensitivity analysis. NRC staff disagrees case is overly pessimistic.



# DOE Base Case for the SDF



- No saltstone fracturing within 20,000 years (inconsistent with current conditions)
- Almost all water shed around the vault for the entire performance period (intermediate result not adequately supported)

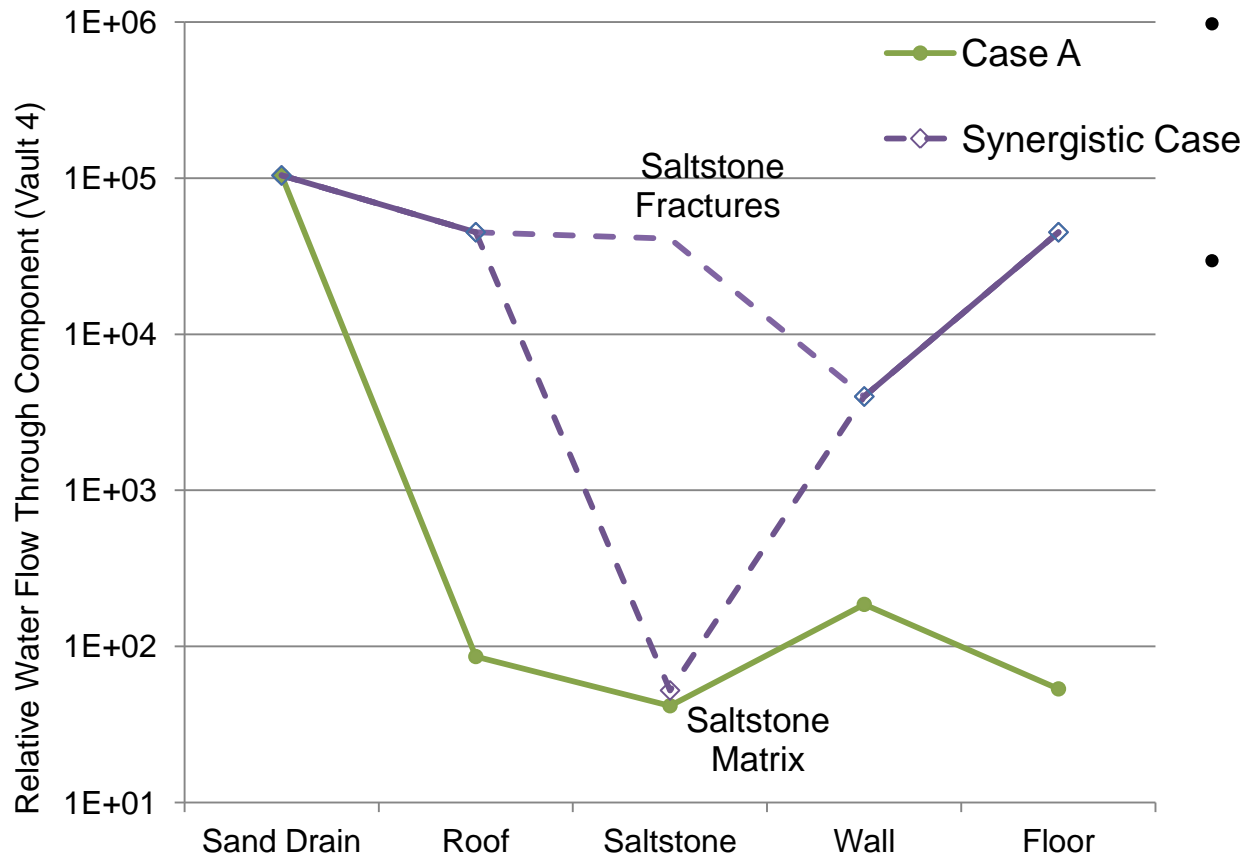


# DOE Base Case and PA Sensitivity Analyses

- DOE base case and sensitivity analyses rely on optimistic assumptions about water flow
- Synergistic Case
  - Evaluates degradation of multiple barriers
  - However - routes most water through inventory-free walls (FDCs)
- Importance of intermediate results



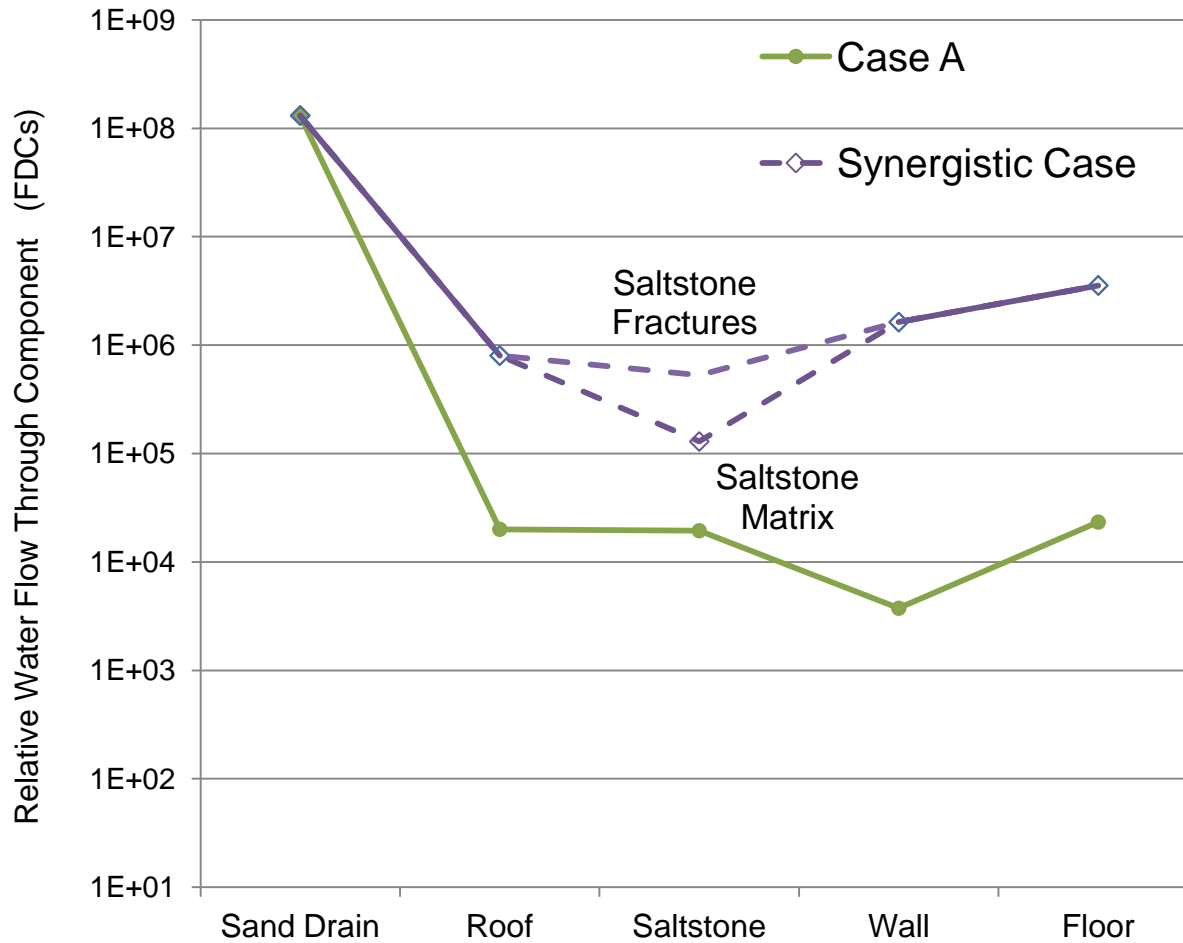
# DOE Intermediate Results: Synergistic Case



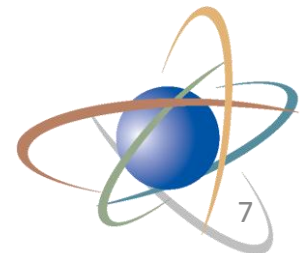
- Water flow through saltstone matrix similar to Case A
- Based on Case A hydraulic conductivity of saltstone matrix, which does not degrade with time



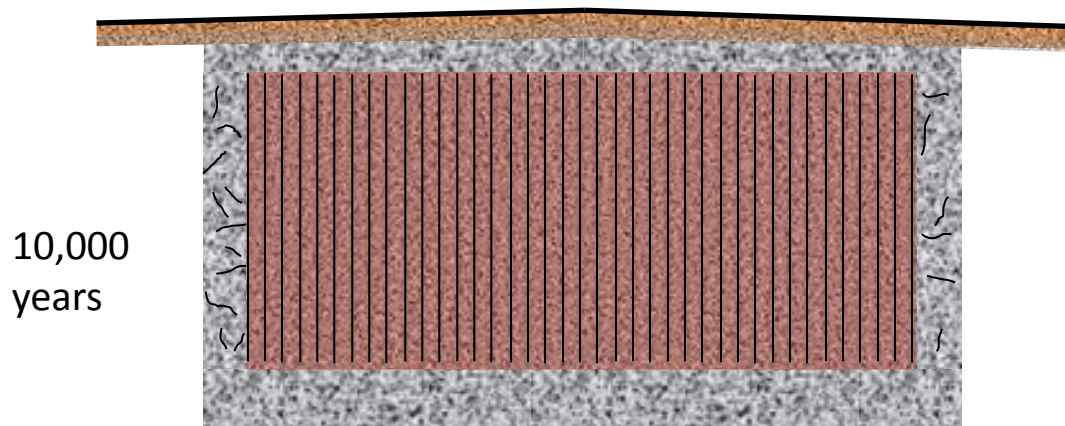
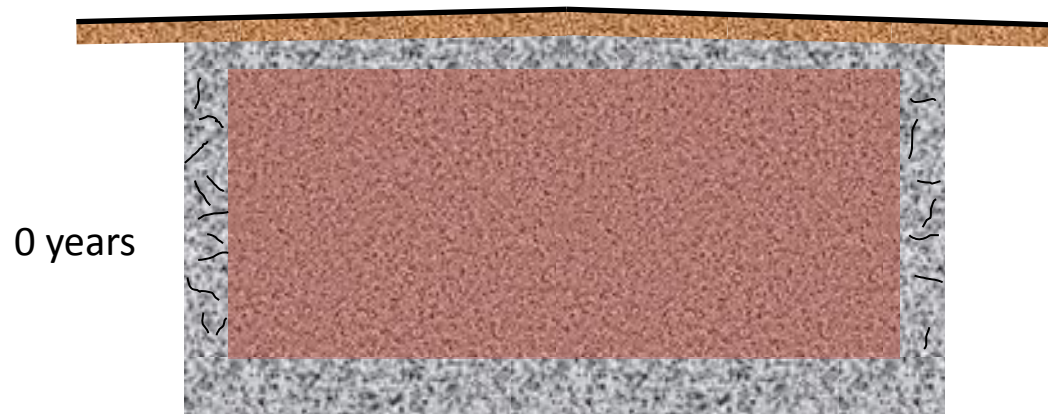
# DOE Intermediate Results: Synergistic Case



- An order of magnitude more water flows through the disposal unit walls than the saltstone matrix
- Unrealistic given material properties and geometry
- Lowers predicted dose



# Alternate Conceptual Model for the SDF (Case K)

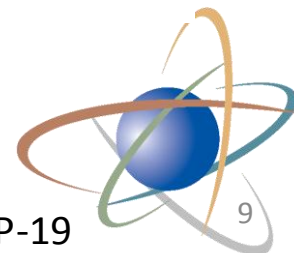
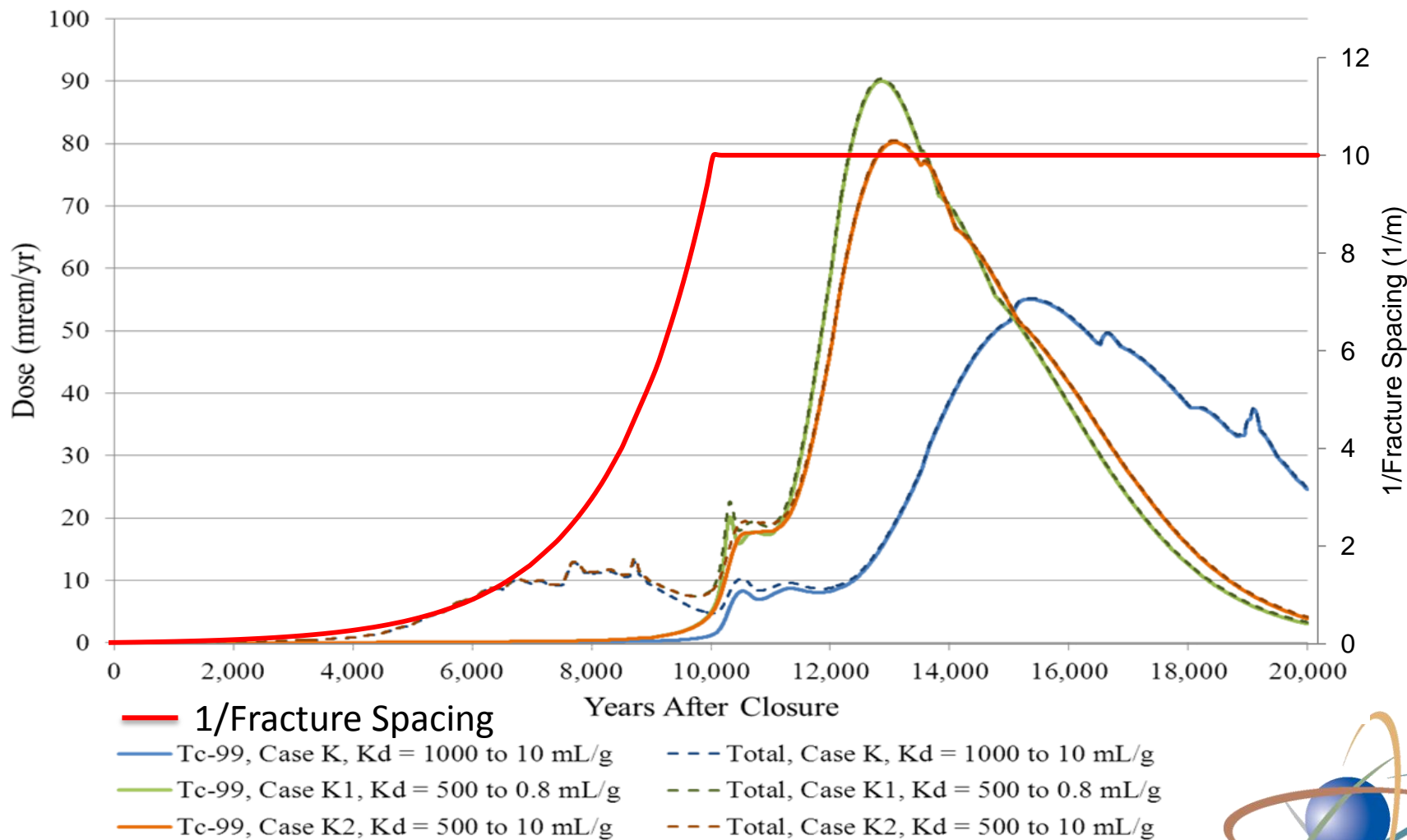


- Through-going fractures form every 10 cm in 10,000 years
- Oxidation proceeds from fracture faces and monolith edges
- Relative permeability assumed to be 1
- Additional differences from Case A

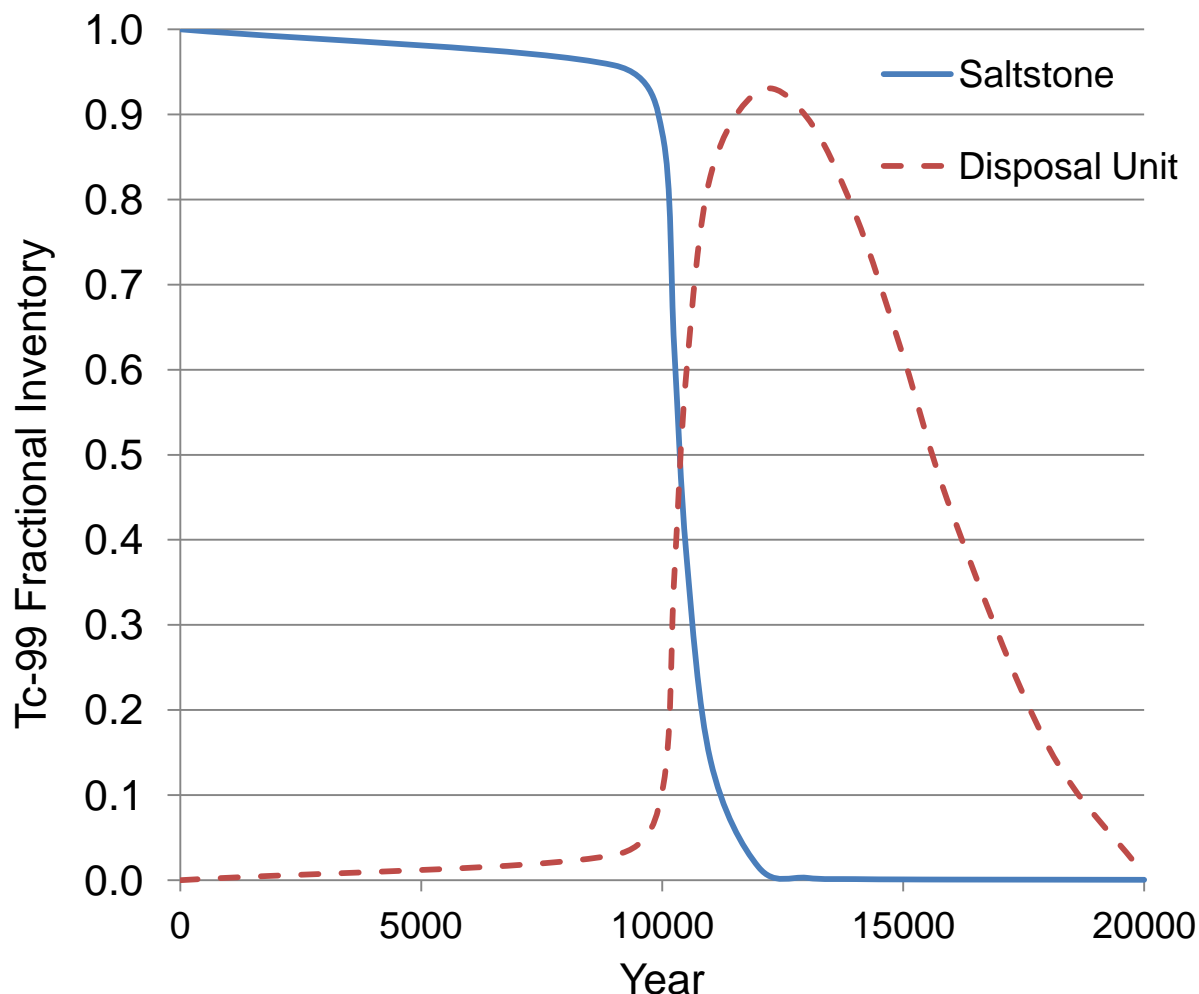




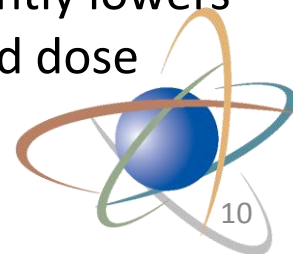
# SDF Time of Peak Dose Sensitivity to Fracturing



# Case K: DOE Intermediate Results



- Tc leaving saltstone nearly all retained in disposal unit concrete
- Reflects a 13X greater Tc concentration in disposal unit floor and walls than in original saltstone
- Unrealistic given material properties
- Significantly lowers predicted dose



# DOE Results & NRC Sensitivity Analyses

- Peak greater than 25 mrem/yr likely to occur within 10,000 years of closure (uncertain timing)
- Staff examines DOE intermediate model results to evaluate finding
- Staff performs sensitivity analyses to evaluate implications of anomalous DOE intermediate results



# NRC Modification of DOE Code

	Reduced Saltstone $K_d$ (mL/g)	Oxidized Saltstone $K_d$ (mL/g)	Disposal Unit $K_d$ (mL/g)	Fracturing Scheme	Final Fracture Spacing (m)	Time of Peak Release Rate (yr)	Dose Estimate* (mrem/yr)
DOE Case K1	500	0.8	500 to 217	Log	0.1	12,800	90
Test 1	500	0.8	500 to 217	<b>Quadratic</b>	0.1	12,100	86
Test 2	500	0.8	<b>0.8</b>	Quadratic	0.1	8730	680 <sup>†</sup>
Test 3	500	0.8	0.8	<b>Log</b>	0.1	10,300	930 <sup>†</sup>
Test 4	500	0.8	0.8	<b>Quadratic</b>	<b>1</b>	19,100	25
Test 5	<b>139</b>	0.8	0.8	Quadratic	1	10,100	35

\* Dose estimated based on the annual fraction Tc inventory released from the near-field domain in each case scaled by the ratio of the peak annual fractional Tc inventory released from the near-field domain in DOE's Case K1 to peak dose in Case K1

<sup>†</sup> NRC staff believes these doses are significant overestimates attributable to an artifact of DOE's "single-porosity" average- $K_d$  model that primarily affects cases with rapid oxidation



# Review Conclusions

- Predicted dose to off-site member of the public likely to exceed 25 mrem/yr within 10,000 years of closure
- NRC staff expects dose to be moderate (approximately 25 mrem/yr to 100 mrem/yr)
- NRC staff has discussed the importance of these issues with DOE since the 2005 review
  - Evaluating intermediate results
  - Assumptions about saltstone degradation and hydraulic performance
  - Assumptions about Tc chemical reduction and retention

