



U.S. Department of Energy
Office of Civilian Radioactive Waste Management



Total System Performance Assessment Results

Presented to:

**NRC/DOE Technical Exchange on Total System Performance
Assessment (TSPA) for Yucca Mountain**

Presented by:

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**TSPA Modeling and Analysis Technical Lead
Sandia National Laboratories**

April 03, 2008

Las Vegas, Nevada

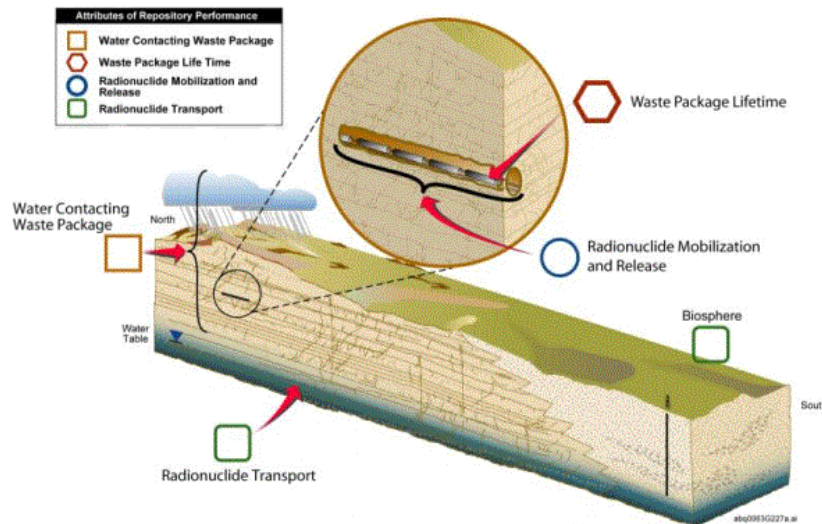
Outline

- **Scenarios and Modeling Cases**
- **Overview of Total System Performance Assessment- License Application (TSPA-LA) results**
 - **Total Dose (summed over scenarios)**
 - **Important Scenarios and Radionuclides**
 - **What determines**
 - ◆ **Shape of expected dose history**
 - ◆ **Magnitude of expected dose**
 - ◆ **Uncertainty in expected dose**
 - **Stability of total dose results**
- **Results are from TSPA AMR (MDL-WIS-PA-000005) Rev00 AD01**

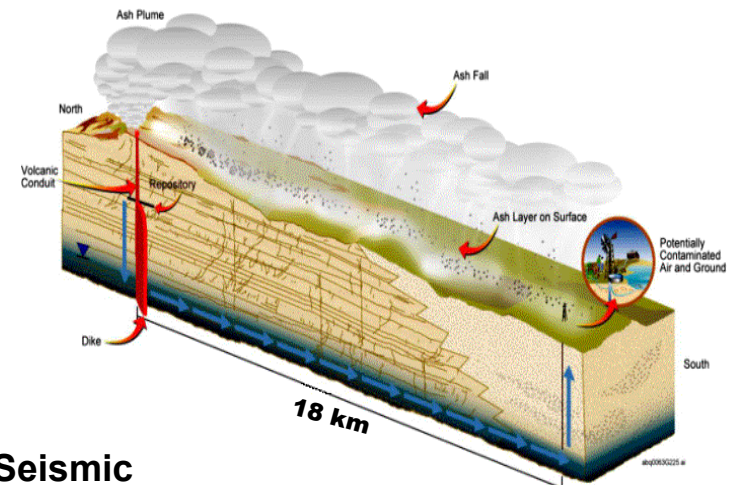


Future Scenarios for Yucca Mountain

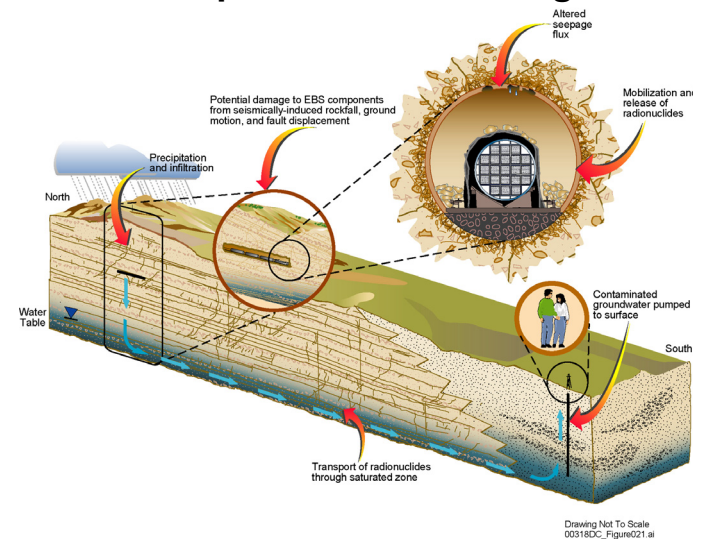
- **Nominal Scenario**
 - Nominal Modeling Case
- **Early Failure Scenario**
 - Waste Package Modeling Case
 - Drip Shield Modeling Case



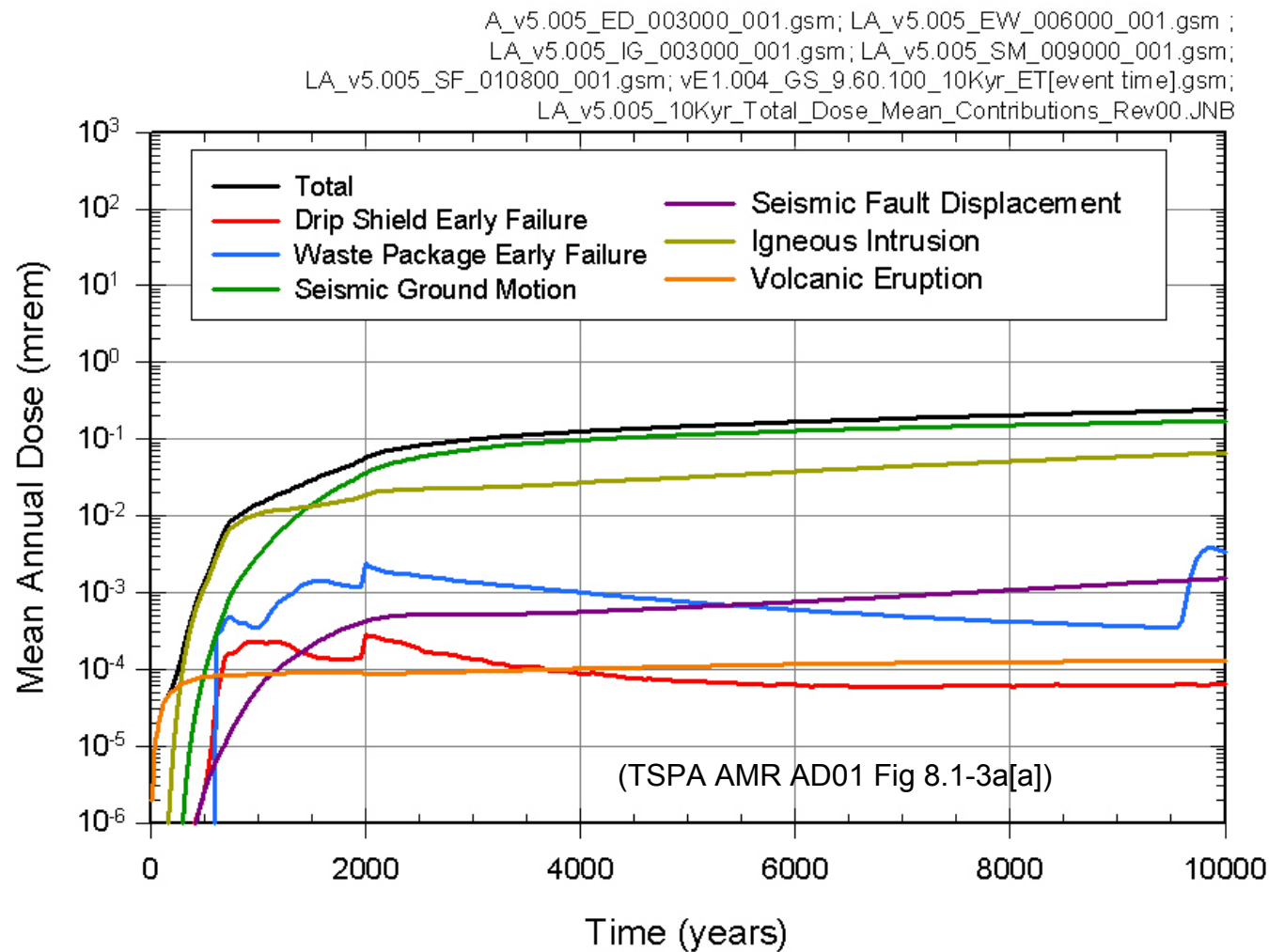
- **Igneous Scenario**
 - Intrusion Modeling Case
 - Eruption Modeling Case



- **Seismic**
 - Ground Motion Modeling Case
 - Fault Displacement Modeling Case



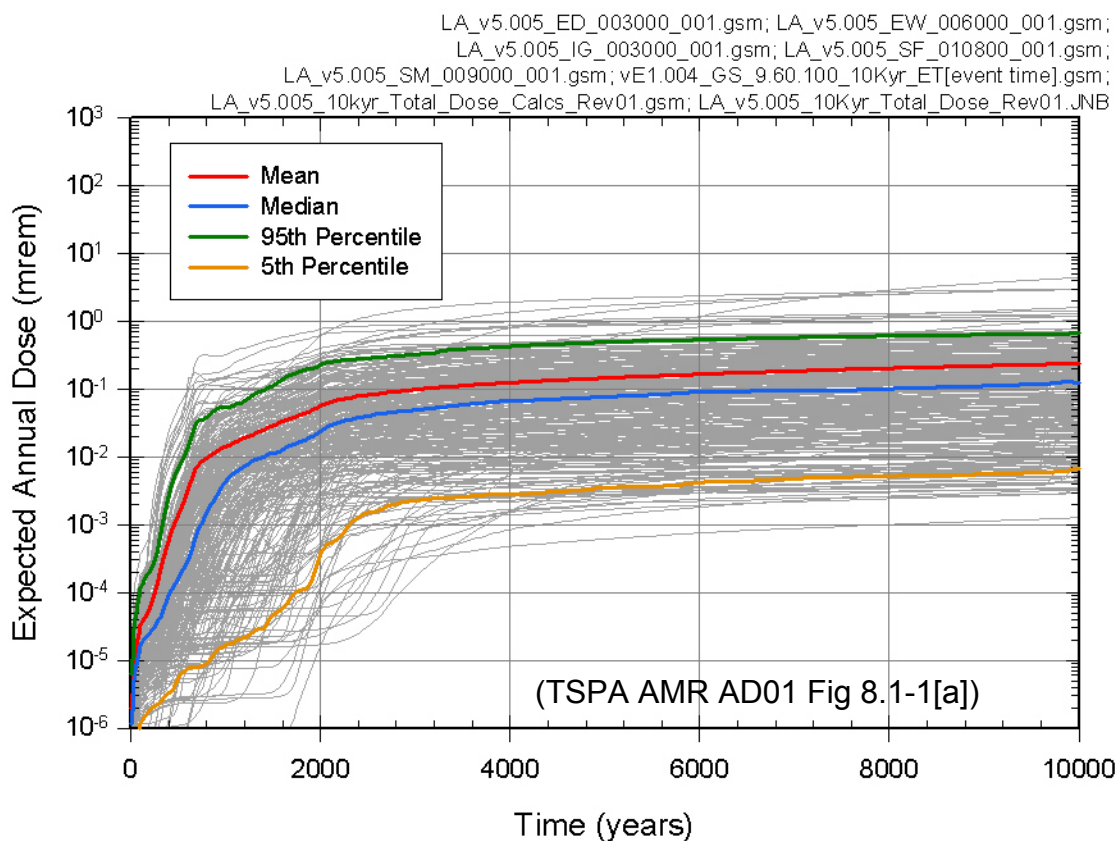
Total Mean Dose Contributions By Modeling Case



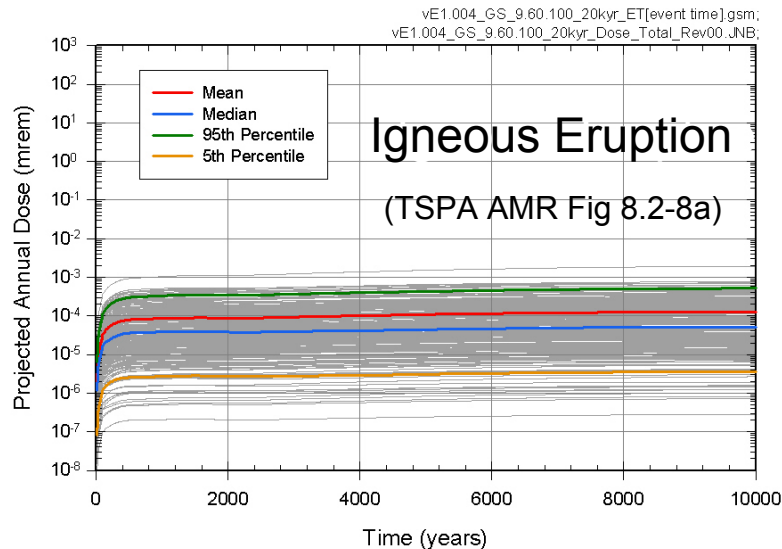
Uncertainty in Total Expected Dose (Summed over Modeling Cases)

Four questions:

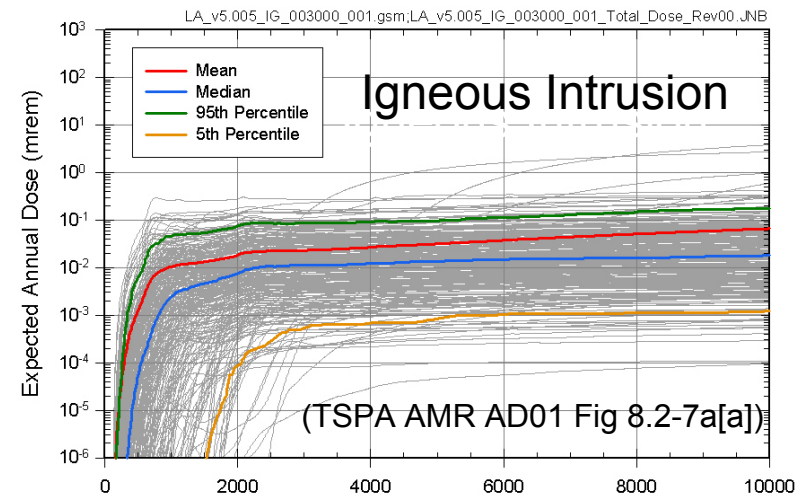
1. What determines the shape of these curves?
2. What determines the magnitude of total mean dose?
3. What determines the uncertainty in total expected dose?
4. Are these results stable?



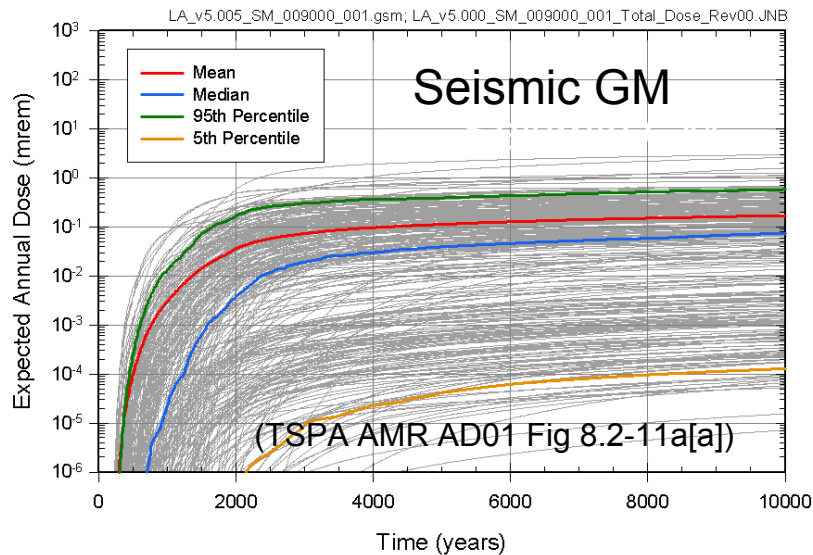
Shape of Total Expected Dose



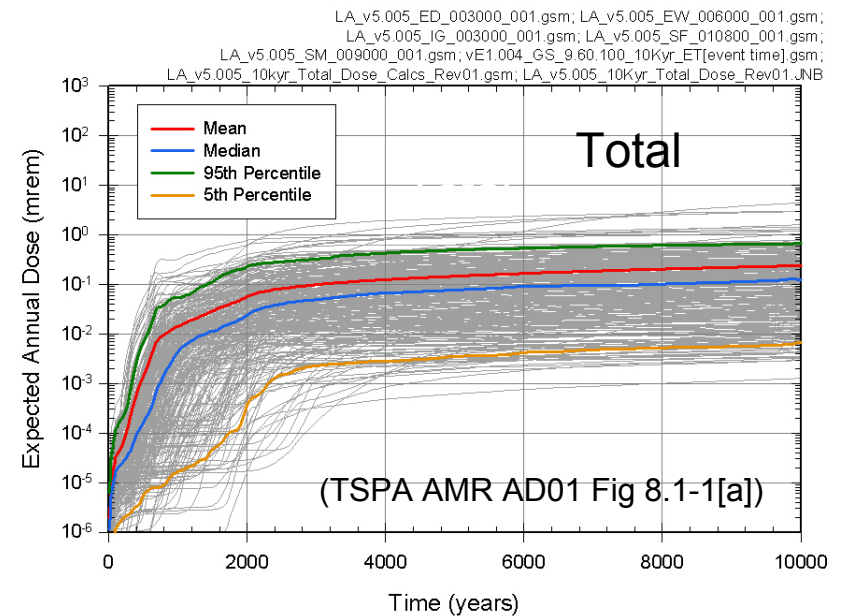
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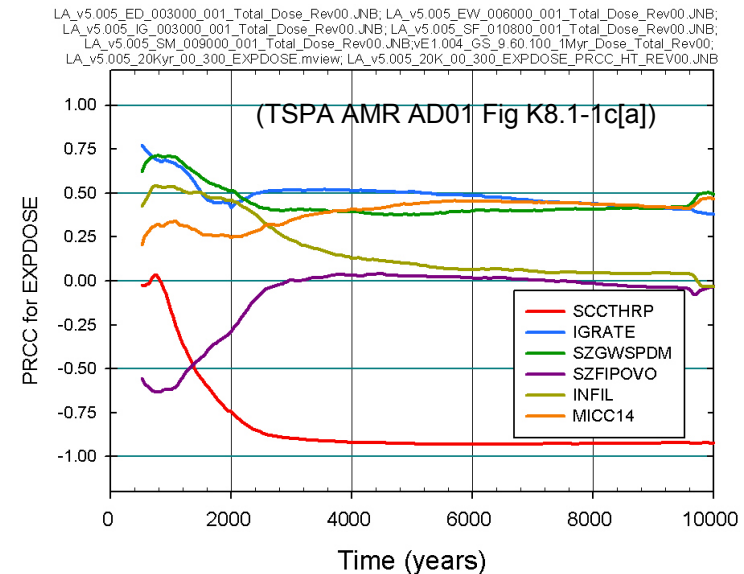
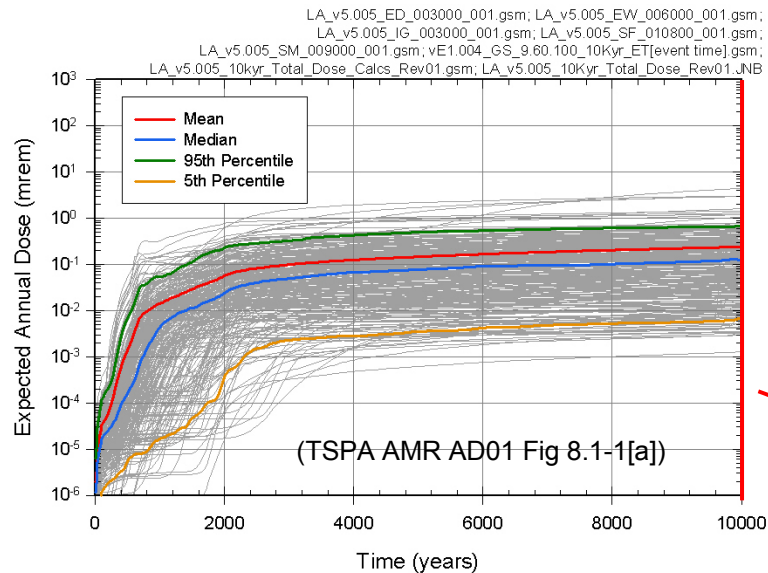
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Uncertainty in Total Expected Dose



SCCTHRP – stress threshold for SCC initiation (90 to 105, % of yield strength)

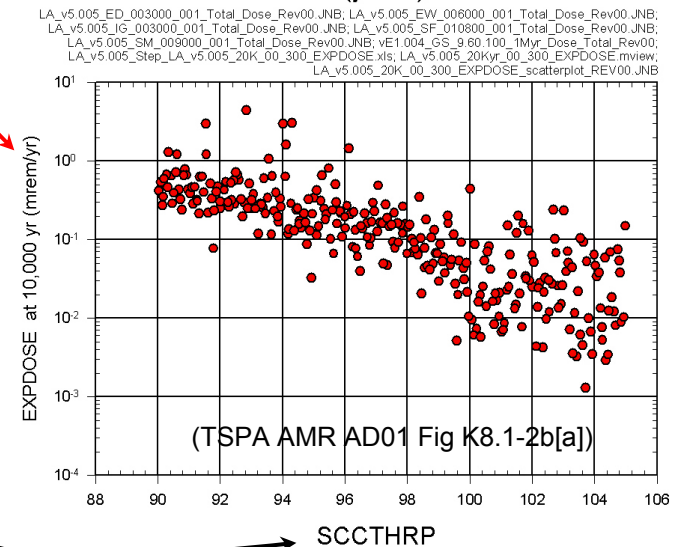
IGRATE – frequency of igneous events

SZGWSPDM – logarithm of uncertainty factor in groundwater specific discharge

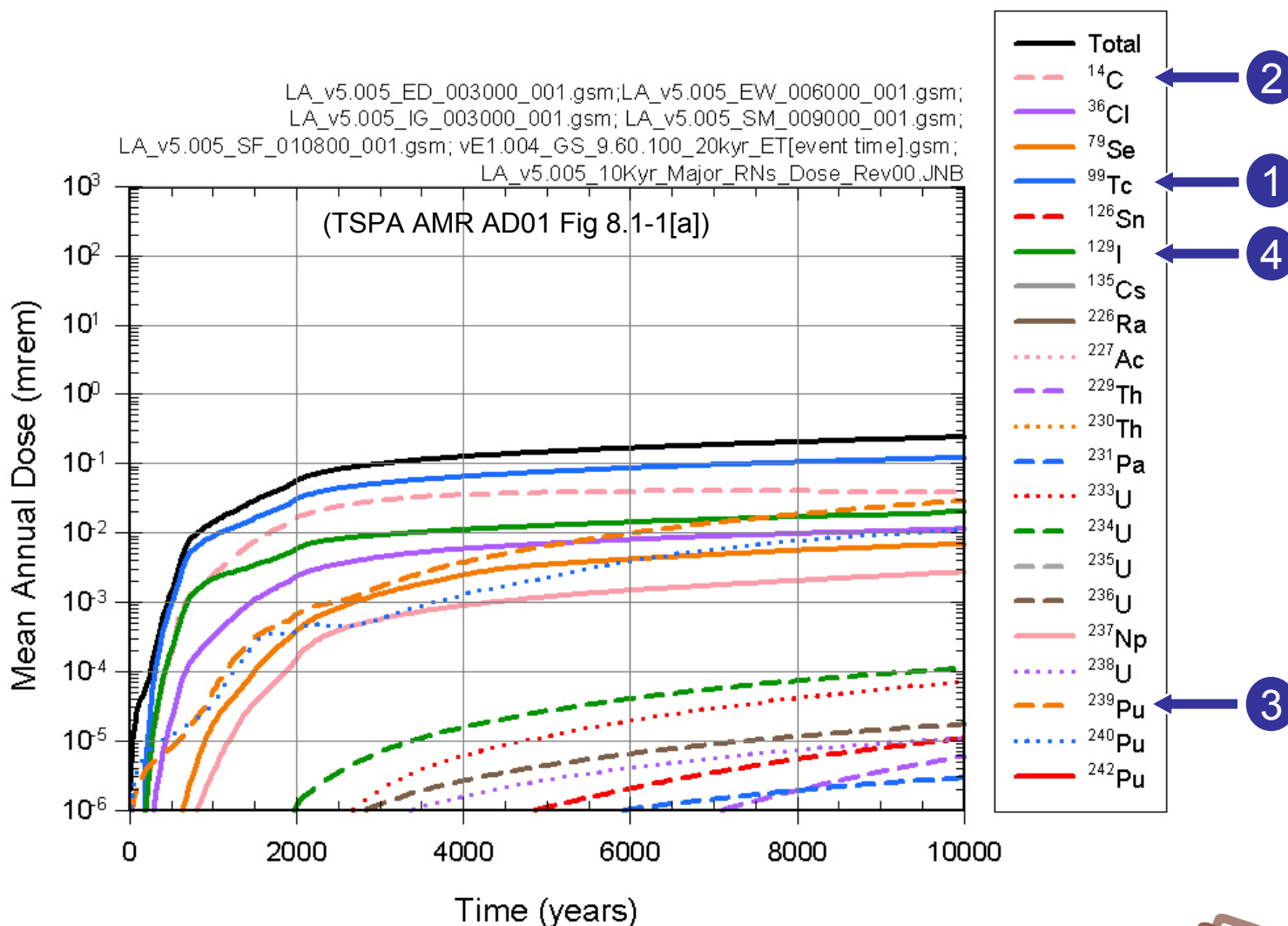
SZFIPOVO – flowing interval porosity in volcanic units

INFIL – infiltration case

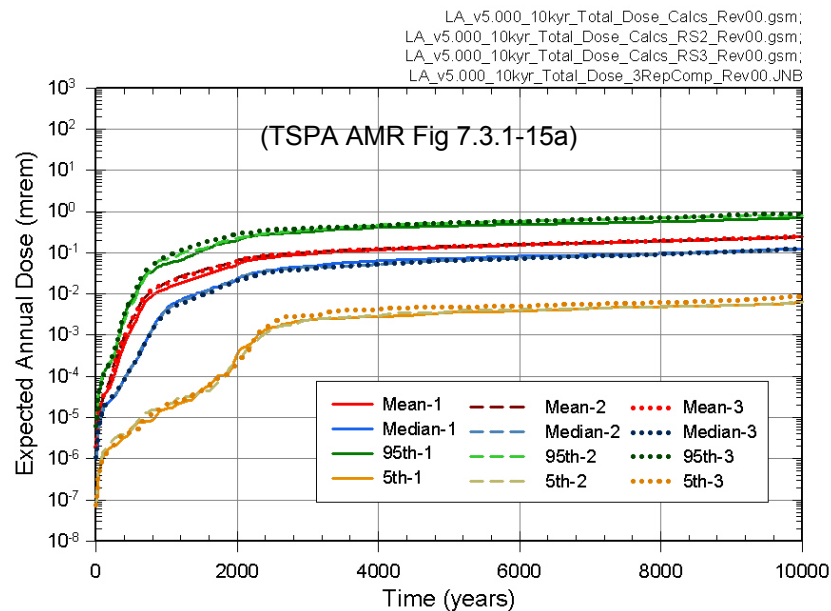
MICC14 – biosphere dose conversion factor for C14



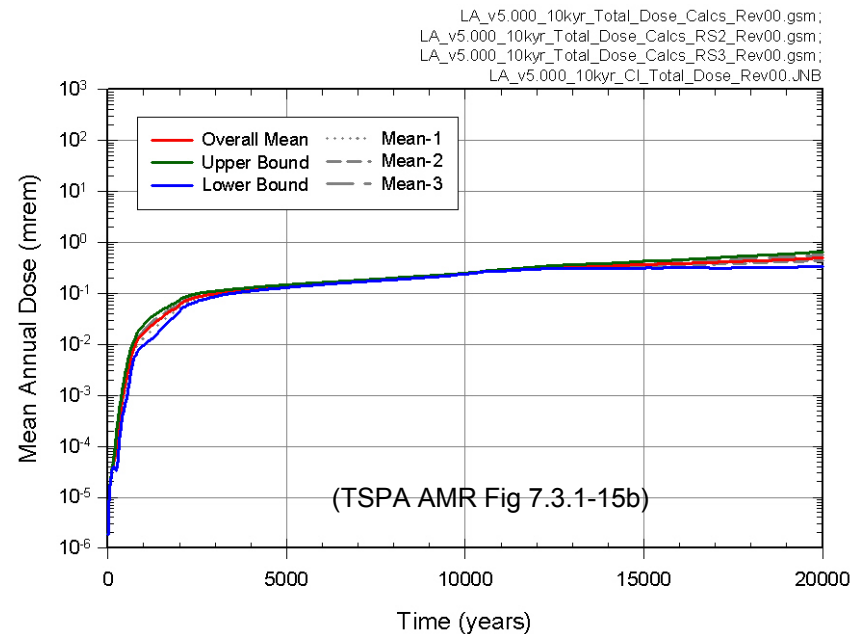
Radionuclides Contributing to Total Mean Dose at 10,000 Years



Stability of Total Dose



**Replicated sampling
demonstrates that sample
size is sufficient**



**Confidence interval
illustrates precision of
estimate of total mean dose**

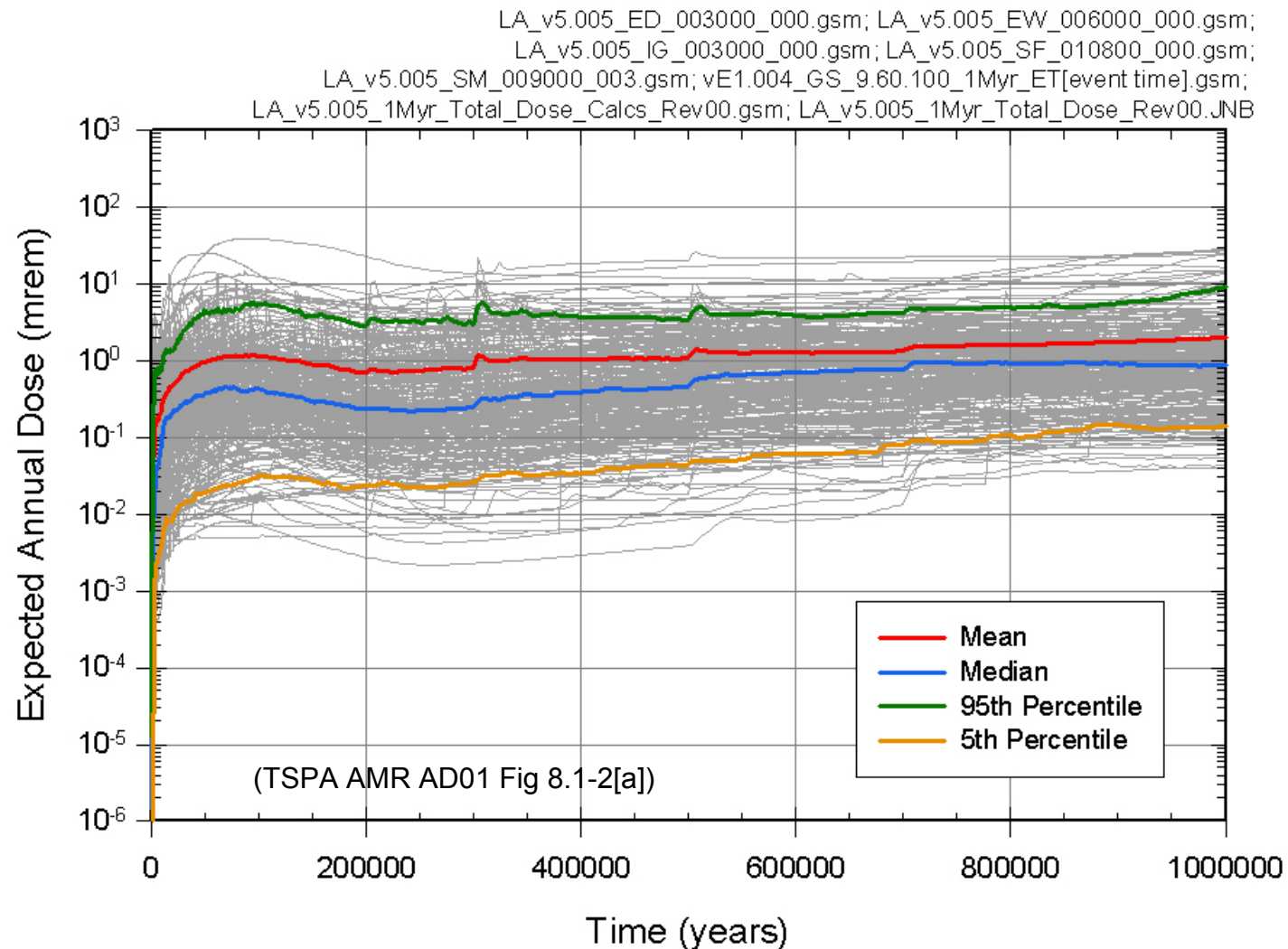


Summary of 10,000 Year Results

- **Total mean dose determined by contribution from seismic scenario class**
 - **Probability of damage to co-disposed waste packages within 10,000 yr < 0.2**
- **Largest contribution to mean dose from ^{99}Tc**
- **Magnitude of mean dose determined by**
 - **Probability of events (seismic, igneous)**
 - **Diffusion of radionuclides through cracks in waste package outer barrier**

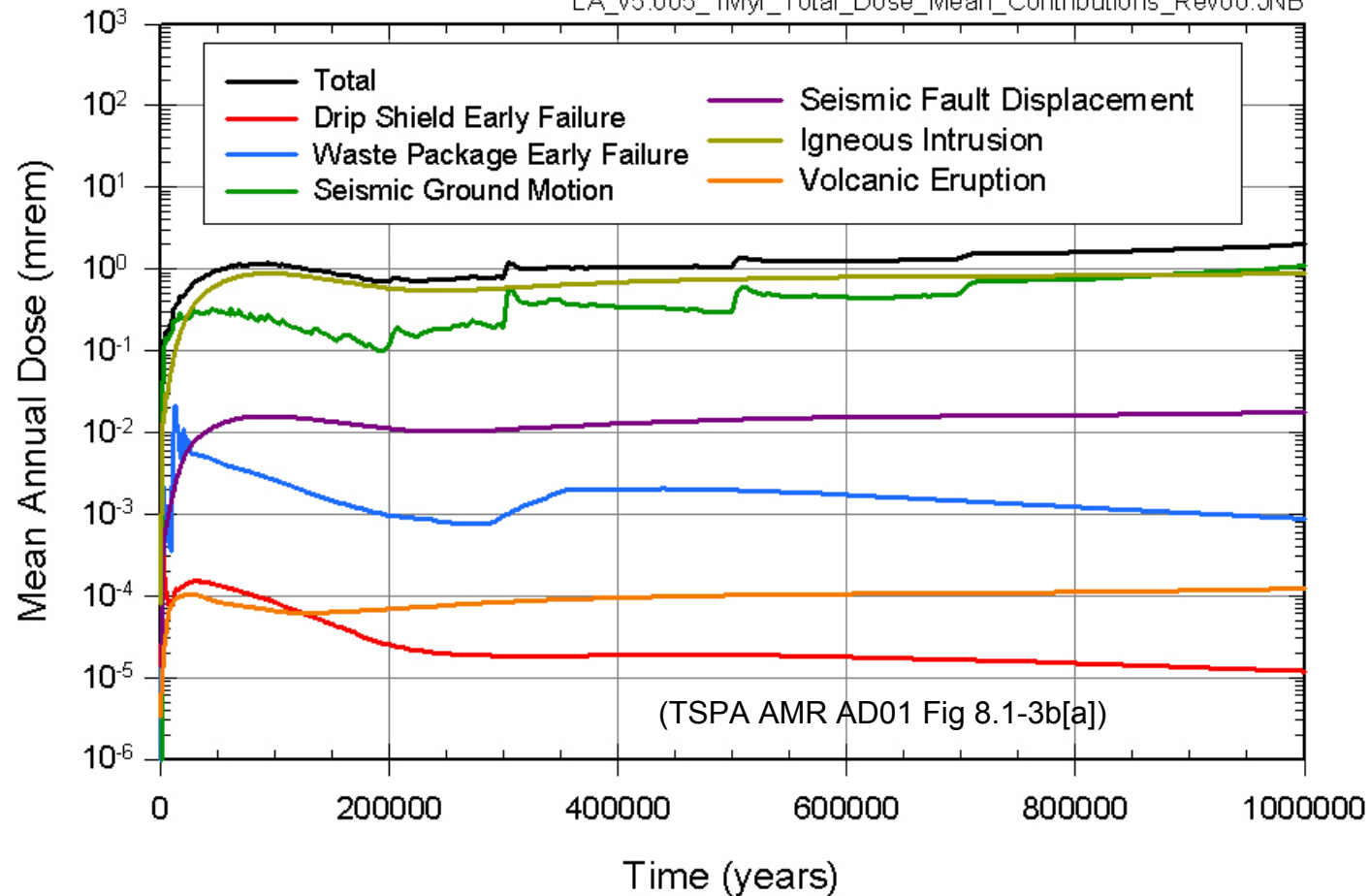


Uncertainty in Total Expected Dose (post-10,000-year period)

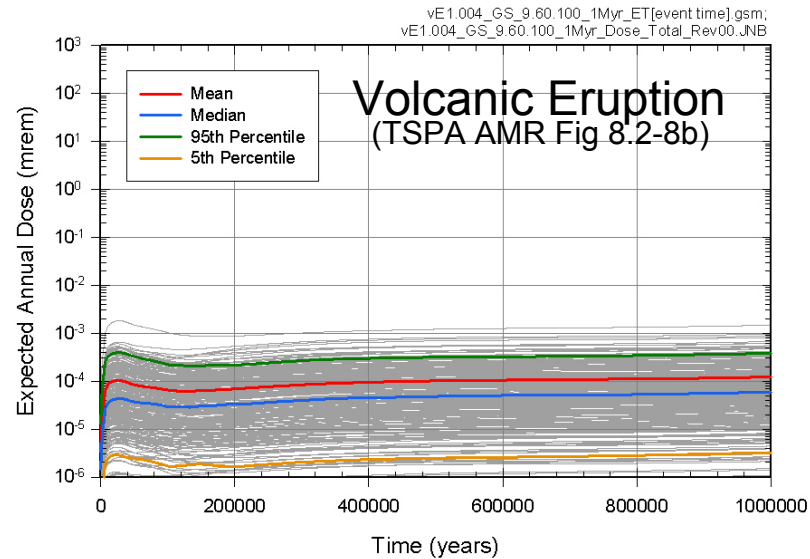


Total Mean Dose Contribution By Modeling Case

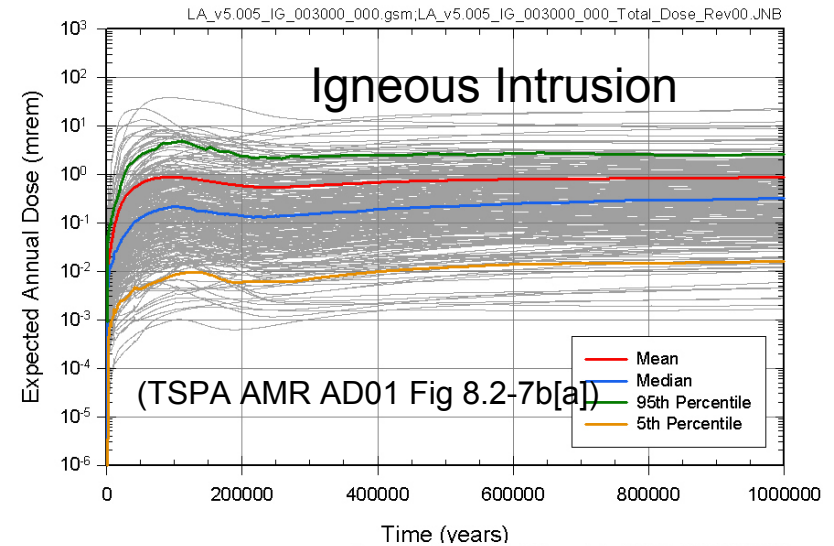
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LA_v5.005_SF_010800_000.gsm; vE1.004_GS_9.60.100_1Myr_ET[event time].gsm;
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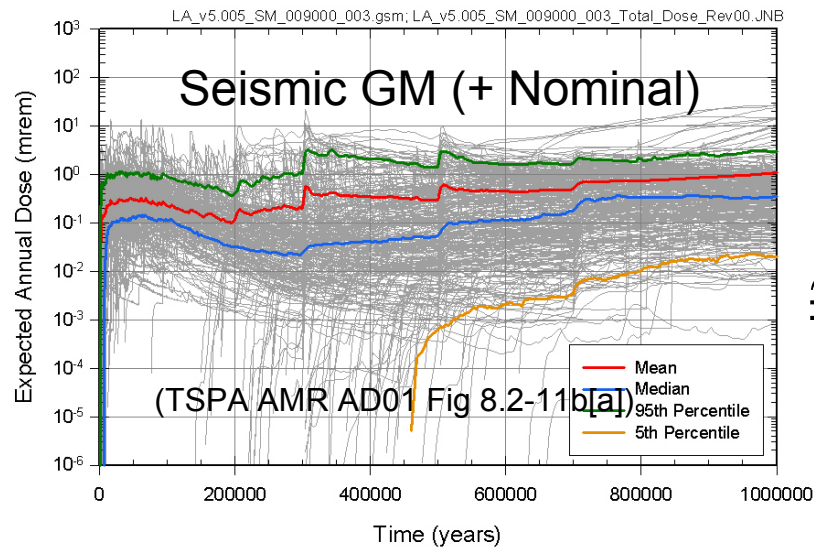
Construction of Total Dose



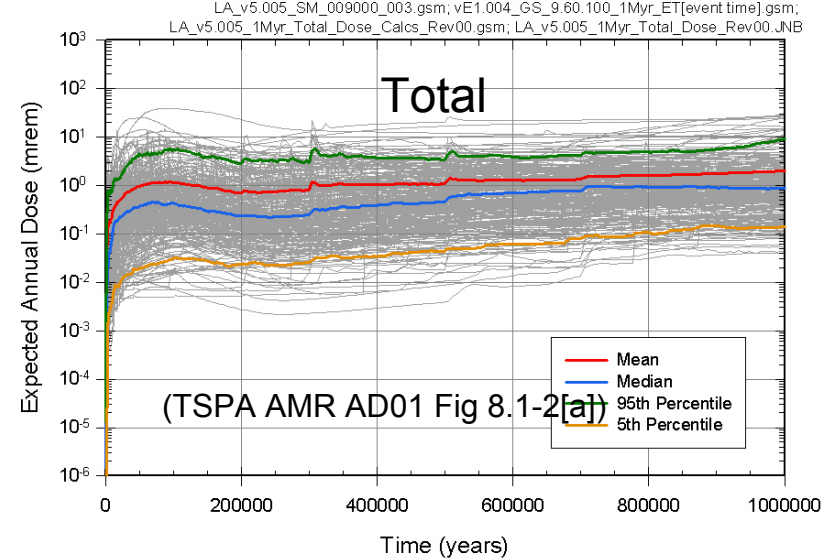
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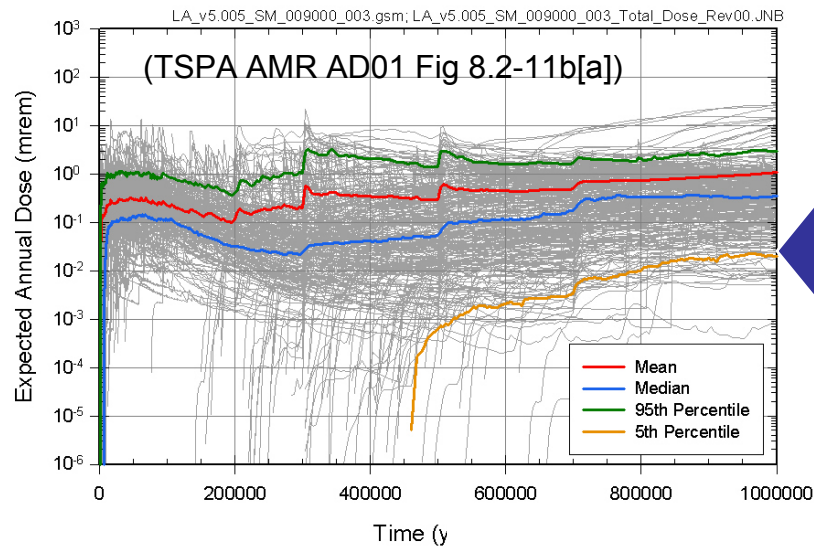
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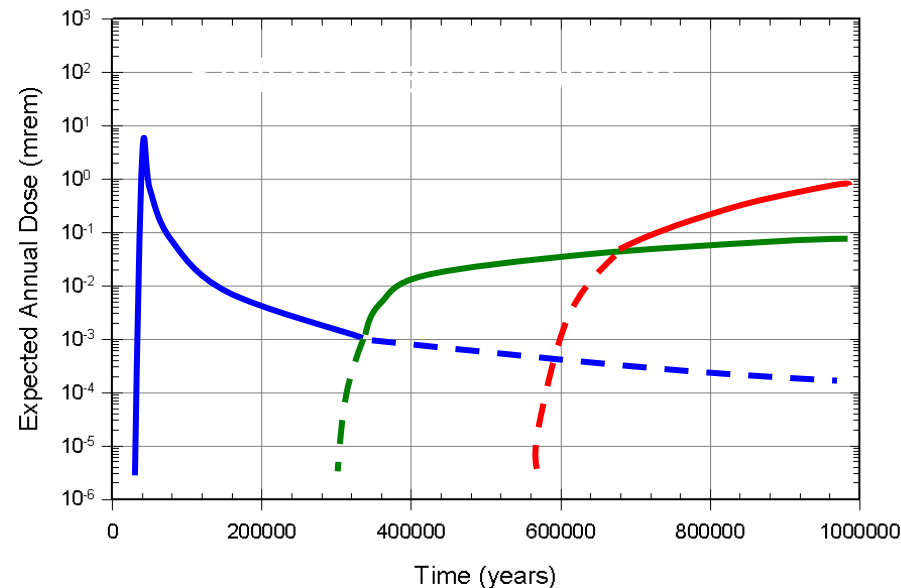
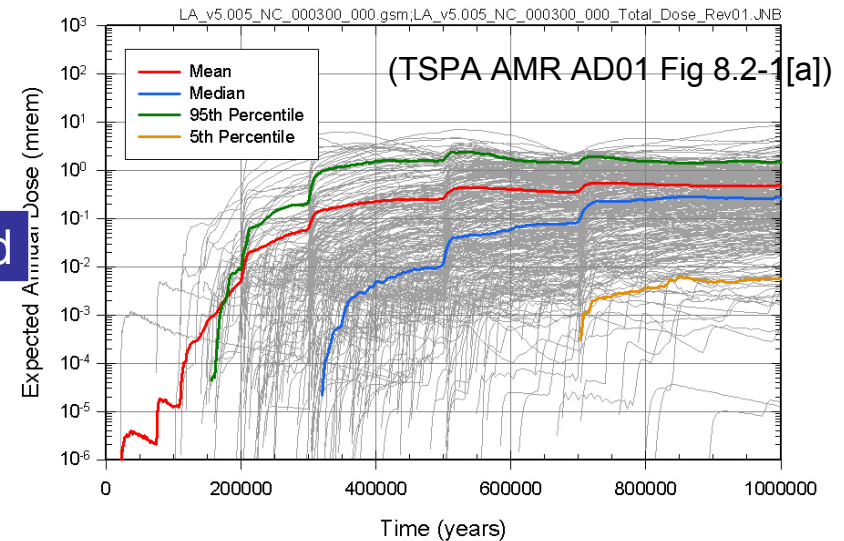
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Composition of Dose from Seismic GM



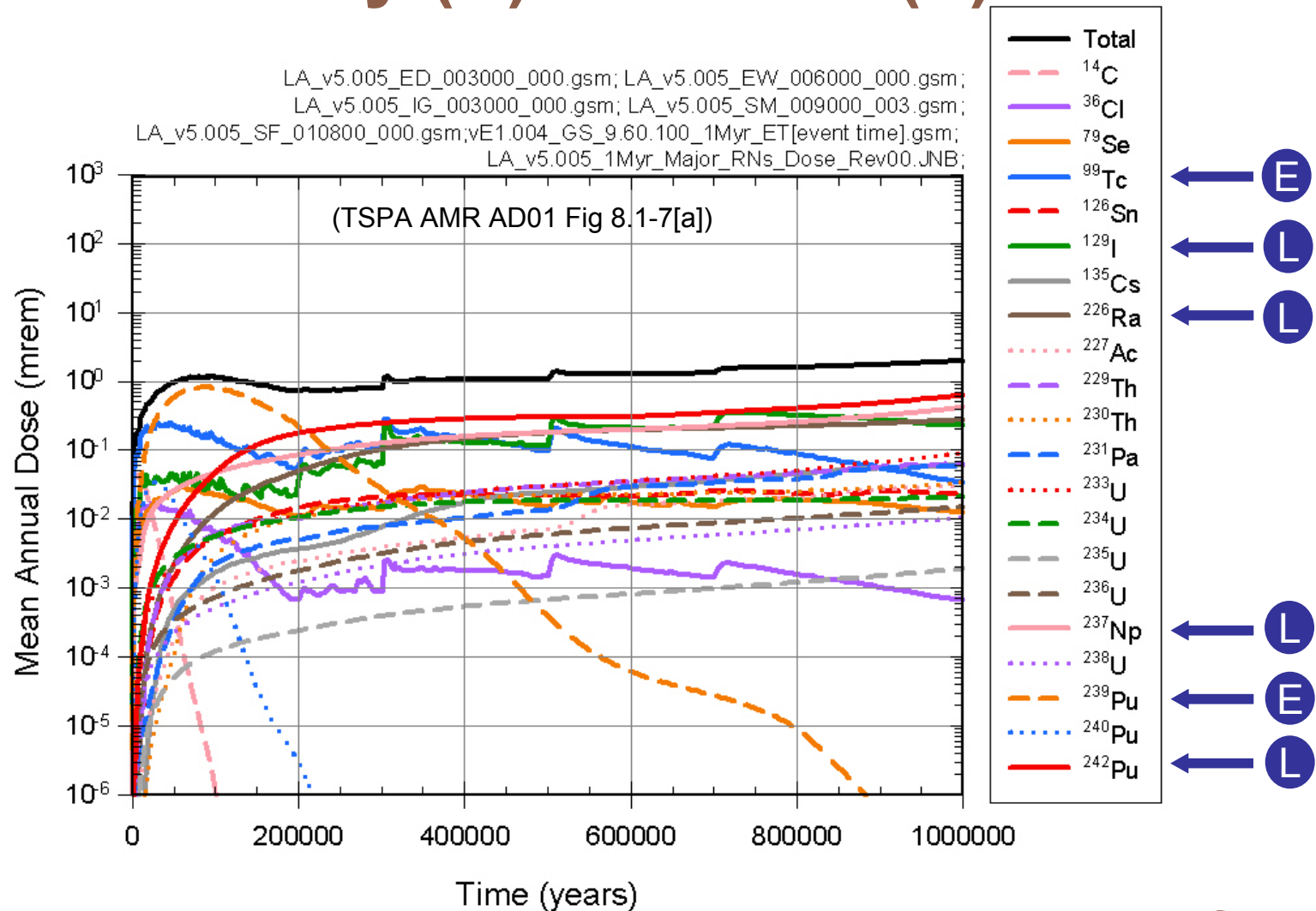
Included



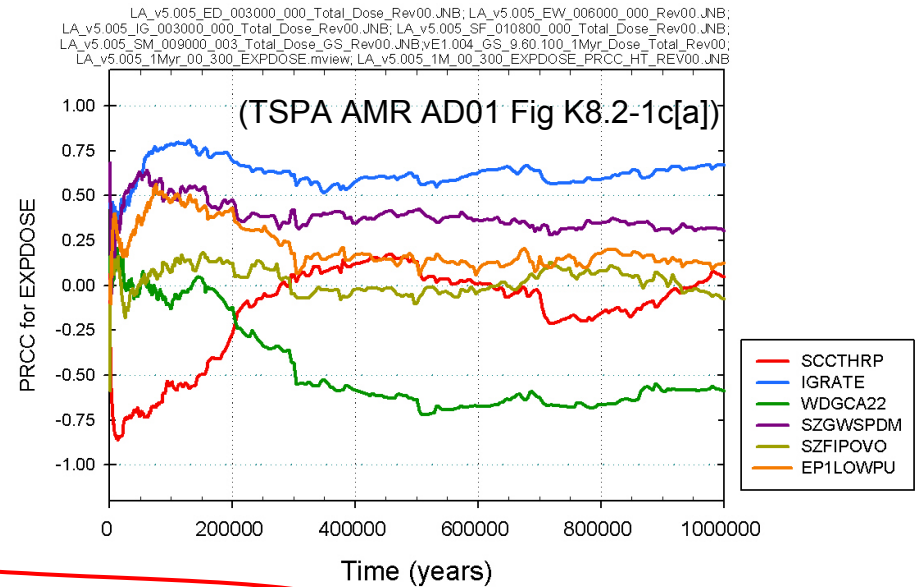
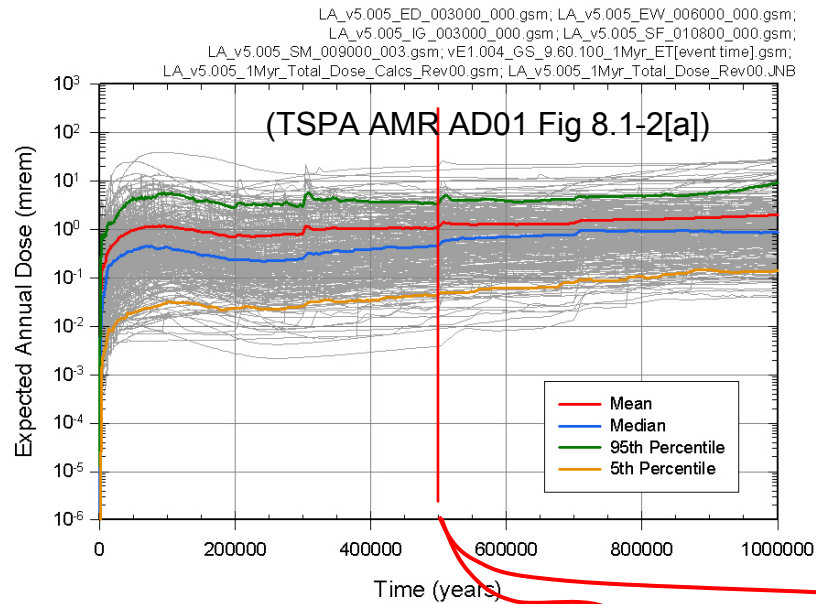
- From Seismic Damage to CDSP WP
- From SCC failure of CSNF WP
- From GC failure of both WPs (advection)



Radionuclides Important to Mean Dose Early (E) and Late (L)



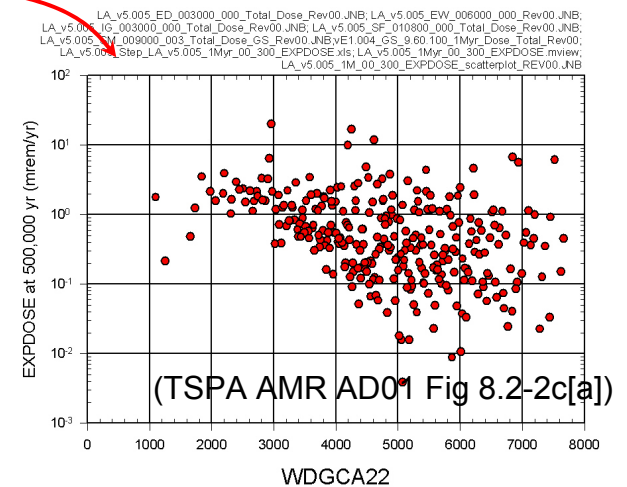
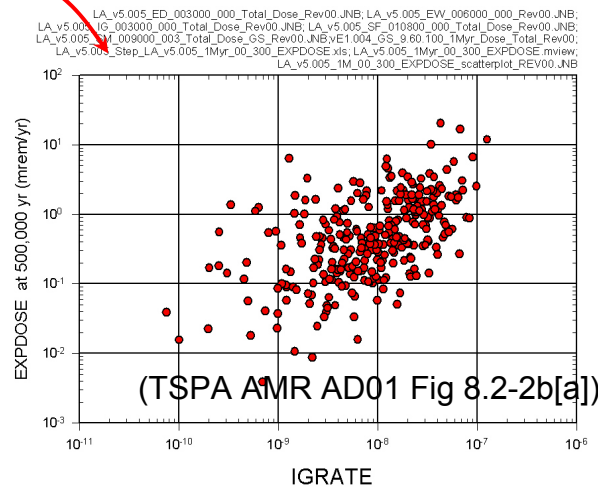
Uncertainty in Total Expected Dose



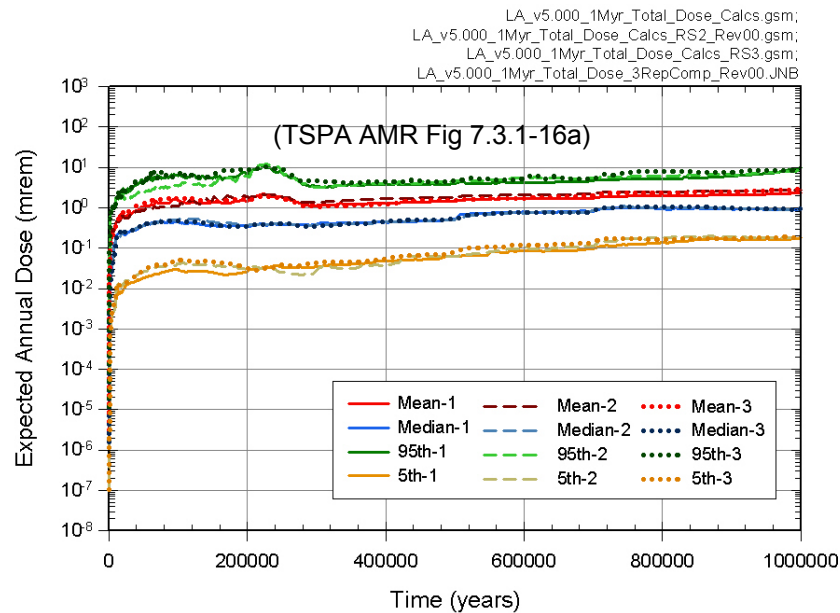
SCCTHRP – stress threshold for SCC initiation

IGRATE – frequency of igneous events

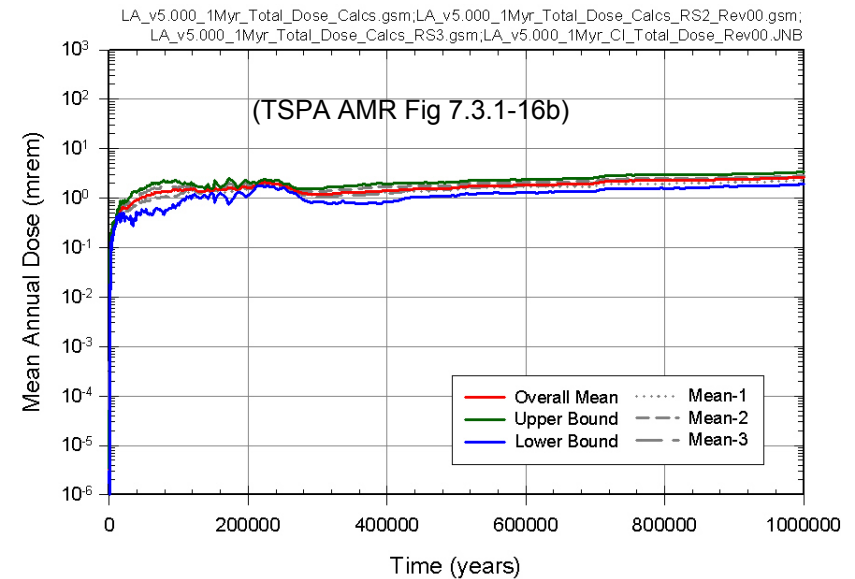
WDGCA22 – Temperature dependence in A22 corrosion rate



Stability of Total Dose



**Replicated sampling
demonstrates that sample
size is sufficient**



**Confidence interval
illustrates precision of
estimate of total mean dose**



Summary of 1 Million Year Results

- **Total mean dose determined by occurrence of igneous events, seismic damage and general corrosion**
- **Major contributors to dose are technetium, iodine, plutonium, neptunium, radium**
- **Waste package outer barrier governs releases of technetium and iodine**
- **Chemistry governs release of plutonium from waste package**

