



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

Biosphere Process Model Assumptions, Comparison to VA, and Sensitivities

Presented to:
Nuclear Waste Technical Review Board

Presented by:
John F. Schmitt
Manager, Biosphere Analysis Section
Civilian Radioactive Waste Management System
Management and Operating Contractor

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YUCCA
MOUNTAIN
PROJECT

Biosphere Inputs to TSPA-SR

- Process Model Factors Affecting Radionuclide Transport Away from Engineered Barriers

Key Attributes of Performance	Process Model Factor	TSPA-SR Input Parameters
Transport Away from the Engineered Barrier System	UZ Radionuclide Transport	<ul style="list-style-type: none"> Fracture aperture and spacing in different units Flow fields for different infiltration scenarios and climate states K_d for all elements included in TSPA Matrix diffusion coefficients – f (isotopes, units) K_c and/or kinetic colloid parameters for Pu , Am, Th etc. Colloid filtration factor
	SZ Radionuclide Transport	<ul style="list-style-type: none"> Breakthrough curves – f (radionuclide, region) Climate change flux multiplication factor Capture zones and release locations within each zone. Flow fields Flowing interval spacing Effective porosity for all units except the volcanic units Dispersivity (longitudinal, horizontal transverse, vertical transverse) Boundary definition of the alluvium K_d for isotopes included in TSPA Flowing interval porosity Matrix porosity Effective diffusion coefficient K_c colloid parameters Colloid filtration factor
	Wellhead dilution	<ul style="list-style-type: none"> Annual groundwater usage
	Biosphere Dose Conversion Factor	<ul style="list-style-type: none"> Biosphere dose conversion factor – f (radionuclide, irrigation time)

Biosphere Inputs to TSPA-SR

- Process Model Factors for Disruptive Events Scenario

Key Attributes of Performance	Process Model Factor	TSPA-SR Input Parameters
Effects of Potentially Disruptive Processes and Events	Seismic Activity	<ul style="list-style-type: none"> Probability of seismicity/structural deformation
	Volcanic Direct Release	<ul style="list-style-type: none"> Annual probability of igneous intrusion Atmospheric transport parameters Probability that an intrusion will result in one or more eruptive vents Number of vents through the waste Wind direction factor Wind speed Biosphere dose conversion factors - f (radionuclide) Factor to account for radionuclide removal from soil
	Intrusive Indirect Release	<ul style="list-style-type: none"> Annual probability of igneous intrusion Number of Waste Packages damaged by intrusion (for groundwater transport source term)

Key Biosphere Assumptions and Their Bases

- **Biosphere work is performed to comply with DOE Guidance, and proposed EPA and NRC regulations**
- **These documents provide substantial biosphere definition**

Key Biosphere Assumptions and Their Bases

(Continued)

- **Critical receptor and environment are partially prescribed in proposed regulations**
 - **NRC: “...to limit speculation by specifying the assumptions to be used...”**
 - **EPA: “...speculation concerning some characteristics of the future should not be the focus of the compliance determination...”**

Key Biosphere Assumptions and Their Bases

(Continued)

- **Values representing the behaviors and characteristics of the receptor of interest are developed based upon demographic survey information for Amargosa Valley residents**
 - **EPA and NRC specify the Amargosa Valley location, and use of current diet and life style for compliance demonstration**

Key Biosphere Assumptions and Their Bases

(Continued)

- **Post-closure assessment for nominal case assumes potential contamination to the reference Biosphere is from groundwater via water well**
 - **No other significant release pathways for licensed material are identified in other process models**

Key Biosphere Assumptions and Their Bases

(Continued)

- **Volcanic eruptive scenario assumes exposure during volcanic event, and increased dust concentrations in air afterwards**
 - Reasonably conservative approach

Principal Biosphere Differences - VA to PMR

- **Critical receptor**

- **VA: rural residential farmer in Amargosa Valley**
- **PMR: average member of the critical group located in Amargosa Valley, and RMEI**

- **Food ingestion**

- **VA: rural resident: assumes 50% of diet is locally grown food**
- **PMR: AMCG, RMEI: based on survey results for people who eat locally grown food and have a garden**

Principal Biosphere Differences - VA to PMR

(Continued)

- **Radionuclide buildup in soil and soil removal**
 - VA: not included
 - PMR: modeled and incorporated
- **Annual rainfall**
 - VA: calculated for current rainfall, and for 2x and 3x more
 - PMR: current rainfall

Biosphere Related Sensitivity Tests

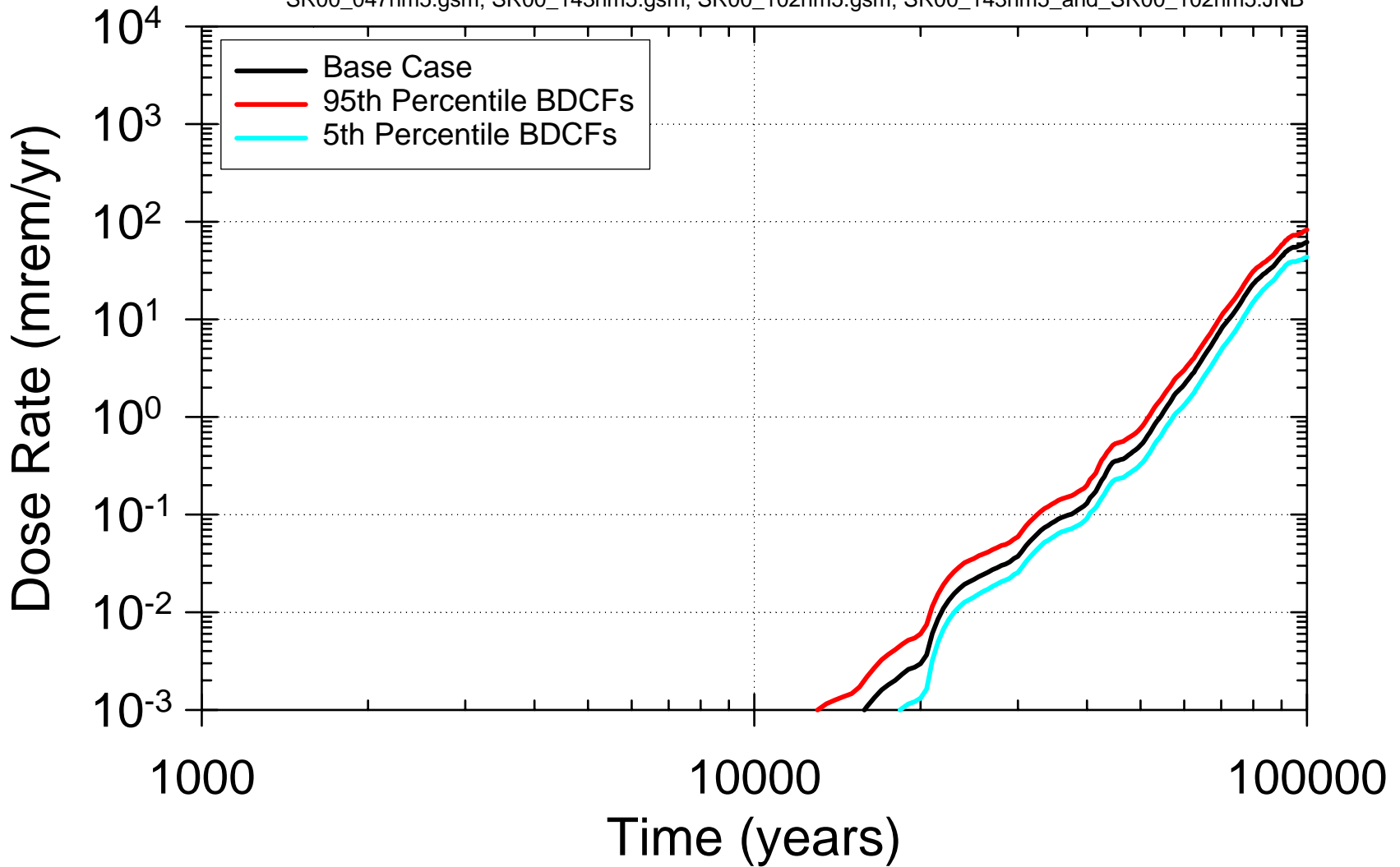
- **Nominal case sensitivity analysis results**
 - ingestion accounts for essentially all of the Biosphere Dose Conversion Factors (BDCF)
 - drinking water, followed by leafy vegetables
 - inhalation and external exposure are not significant
- **Volcanic eruptive scenario sensitivity results**
 - soil ingestion and inhalation dominate for most radionuclides

Biosphere BDCF Sensitivity

- **Degraded Barrier**
 - 95th %tile BDCFs for all radionuclides
- **Enhanced Barrier**
 - 5th %tile BDCFs for all radionuclides

Preliminary Biosphere BDCF Sensitivity Analysis

SR00_047nm5.gsm; SR00_143nm5.gsm; SR00_102nm5.gsm; SR00_143nm5_and_SR00_102nm5.JNB



This information was prepared for the 8/00 NWTRB meeting for illustrative purposes only and is subject to revision; not appropriate for assessing regulatory compliance.