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FY01 Supplemental Science and Performance Analyses, Volume 2: Performance Analyses

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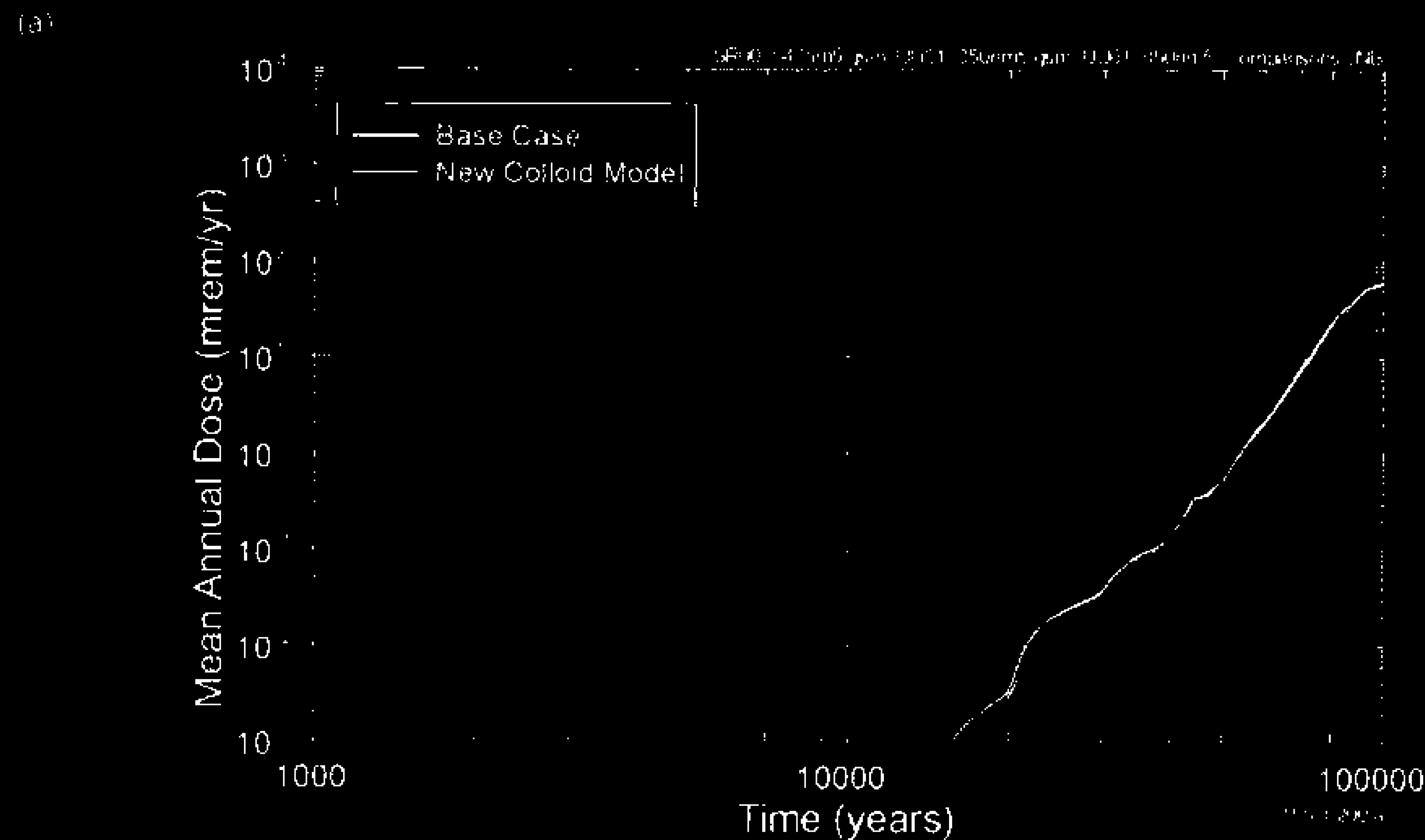
The conditional eruptive annual dose analyses conducted for the SSPA and described previously in this section provide useful insights into an upper bound on the possible consequences of ash redistribution following an eruption. Specifically, the no-soil removal case (Figure 3.3.1.2.4-3) provides an upper bound on conditional annual doses that might result if surficial redistribution processes cause deposition of contaminated sediment at the location of the receptor, as long as concentrations of radionuclides in the redeposited sediments are equal to or less than concentrations in the initial ash layer. This conclusion applies to redeposition by aeolian and fluvial processes, and it is not affected if the rate of redeposition at the location of the receptor exceeds the rate of soil removal by agricultural processes. Even if the layer of contaminated sediment grew in thickness through time, doses still would be derived from the upper 15 cm of the contaminated layer. The thin-layer transition-phase BDCFs used in this calculation result in greater annual doses than would be derived from layers of contaminated ash 15 cm or greater in thickness, because all radionuclides in the thin layer are assumed to be concentrated in the upper 1 cm where they are available for resuspension and inhalation (CRWMS M&O 2000 [DIRS 153246], Sections 5.2.9.10 and 3.10.3.3). Thus, regardless of the rate of redeposition of contaminated ash at the location of the receptor, the eruptive-pathway conditional annual dose calculated using the TSPA-SR model and parameters (CRWMS M&O 2000 [DIRS 153246], Sections 3.10.2 through 3.10.4) will not exceed the annual doses for the no-soil removal case (Figure 3.3.1.2.4-3) as long as surficial processes do not concentrate radionuclides within the sediment to levels above those calculated for the initial ashfall.

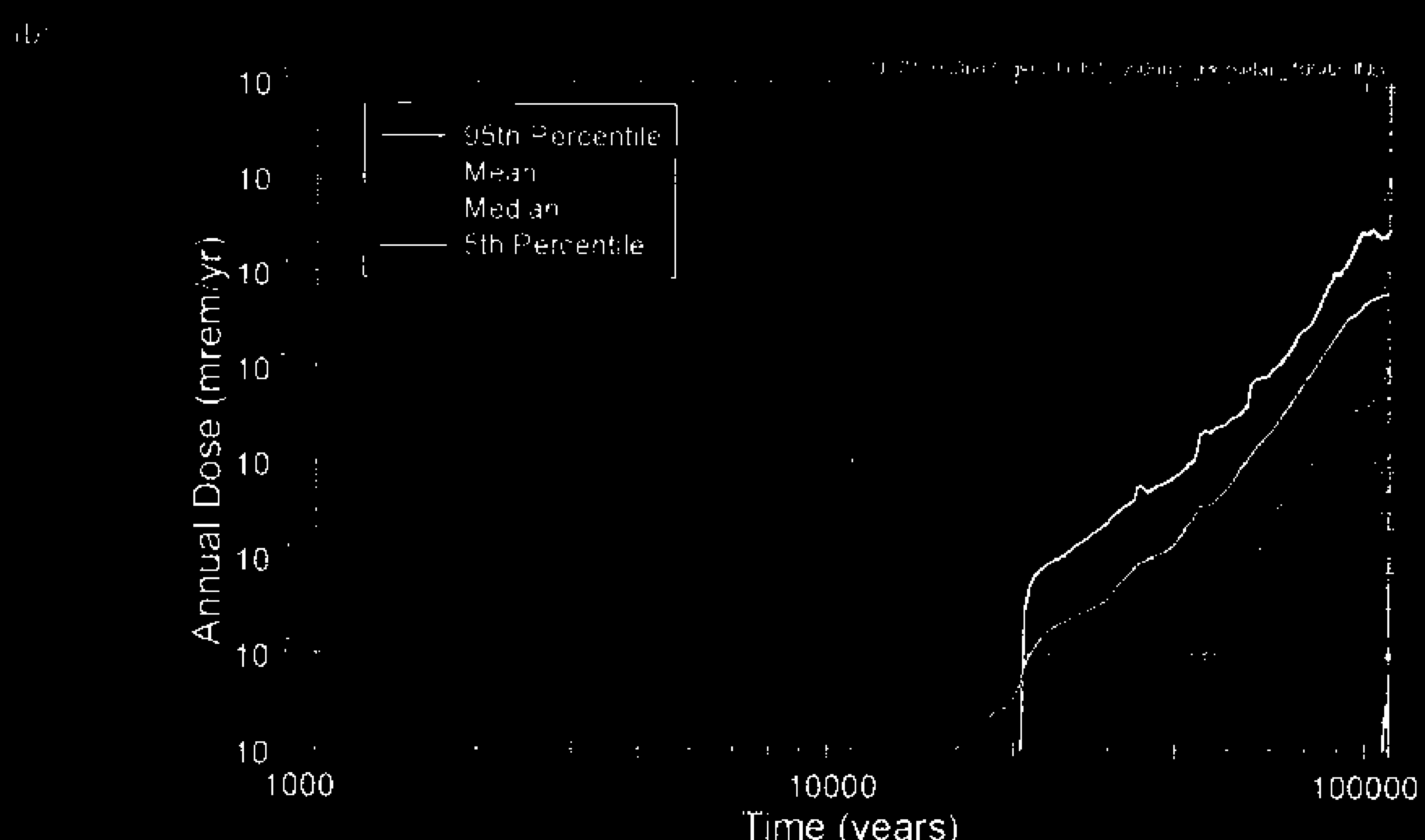
3.3.2 Seismic Activity Analyses

No new analyses of seismic events were conducted in SSPA Volume 1 (BSC 2001 [DIRS 154657]). Consequently, supplemental analyses of direct, disruptive effects of seismic events on the estimate of mean annual dose are not provided here. However, potential effects of seismic activity can be inferred from supplemental TSPA analyses regarding drift degradation, rock fall, and damage to CSNF cladding (which may be exacerbated by seismic activity).

Drift degradation and rock fall are considered in SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 6.3.4), and effects of the additional considerations on the estimate of annual dose are discussed in this volume (see Section 3.2.4.1). These analyses do not indicate any significant effect on drip shield or waste package performance.

The effect of vibratory ground motion on CSNF cladding is considered in SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 9.3.3), which notes that the TSPA-SR base-case model addresses this effect in terms of a discrete event in which cladding is damaged due to seismic activity. The frequency assumed for this event in the base-case model is 1.1×10^{-6} per year. Such a seismic event would occur randomly and is sampled in the TSPA-SR base-case analysis. When the vibratory ground motion event occurs, all CSNF cladding in the potential repository is assumed to fail by perforation, and further cladding degradation (i.e., unzipping) is calculated according to the cladding degradation model. Analyses in the TSPA-SR (CRWMS M&O 2000 [DIRS 153246], Section 3.3.1) indicate no effect on the estimate of mean annual dose as long as waste packages remain unbreached, and only minor effects at later times.

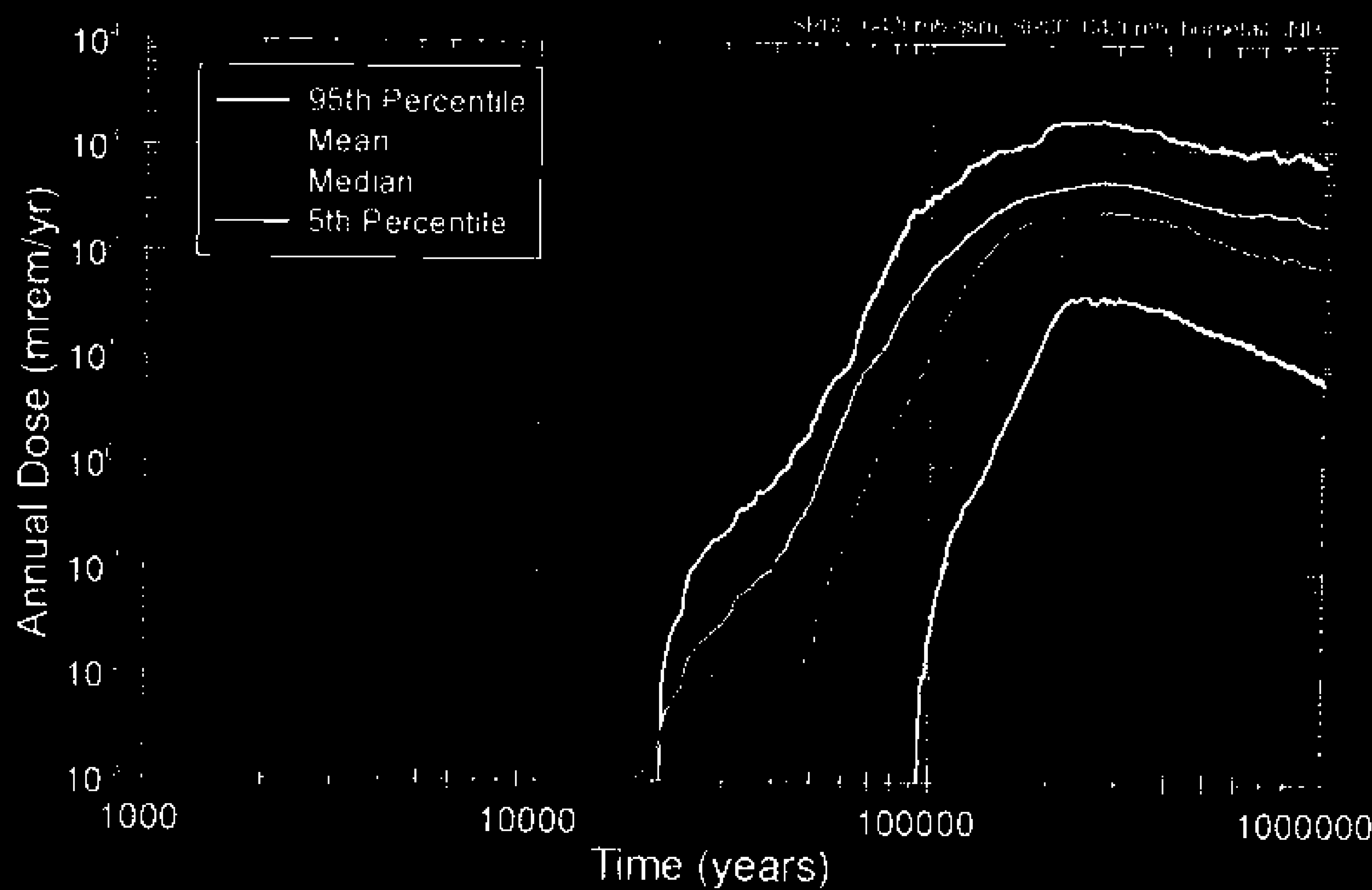




Source: TSPA-SR (CRWMS M&O 2000 [DIRS 153246]).

NOTE: (a) Mean annual dose for the TSPA-SR base-case and for the increased uncertainty in colloid-facilitated transport case for SZ flow and transport (changes in the EBS, UZ, and SZ transport model). (b) Simulated annual dose for the increased uncertainty in colloid-facilitated-transport case for SZ flow and transport (changes in the EBS, UZ, and SZ transport model).

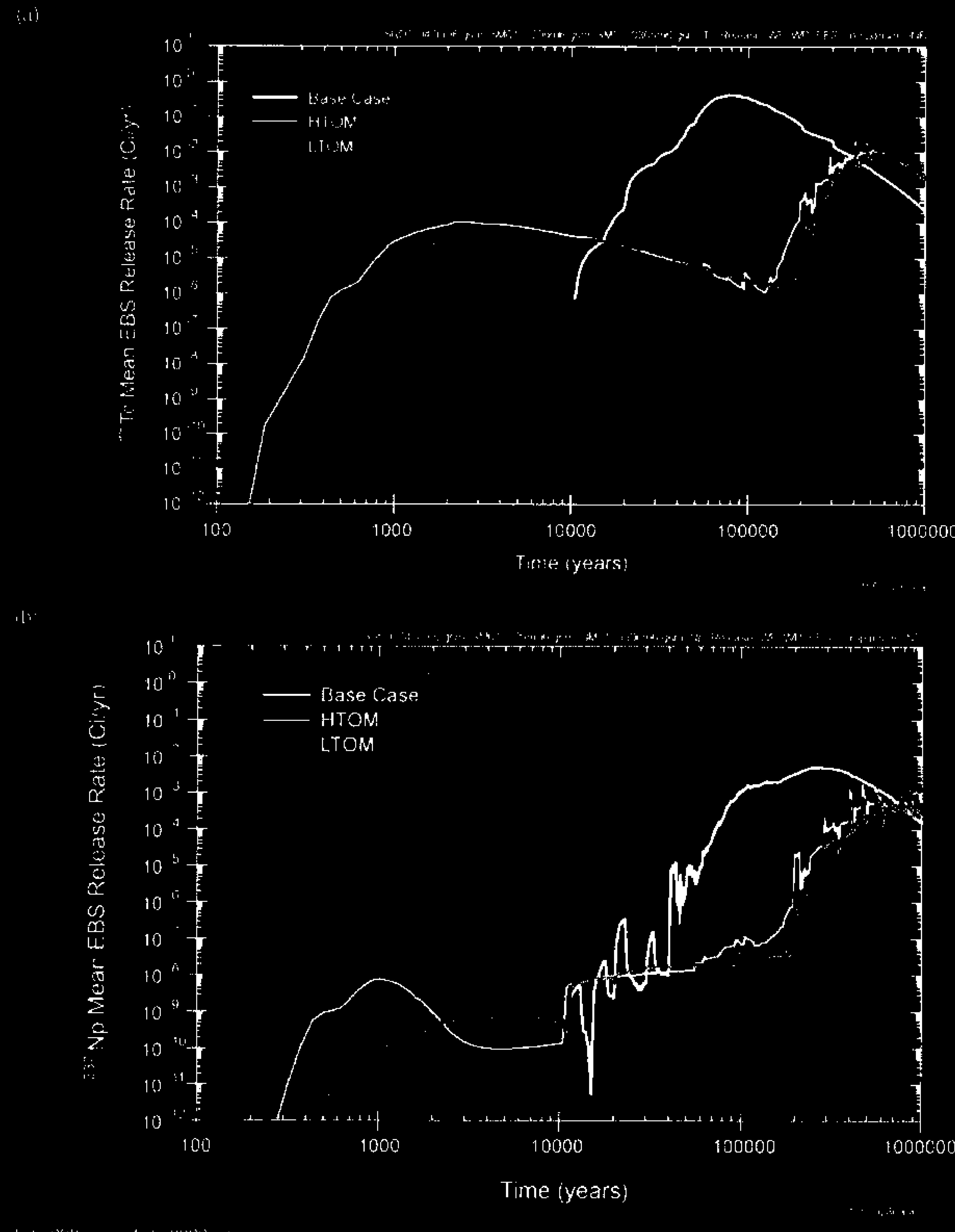
Figure 3.2.10-6 Simulated Total System Performance Assessment Dose Rates for the Base Case and the Increased Uncertainty in Colloid-Facilitated-Transport Case for Saturated Zone Flow and Transport



Source: TSPA-SR (CRWMS M&O 2000 [DIRS 153246], Figure 4.1-19a)

NOTE: Summary curves show the 95th, 50th (median), and 5th percentiles, as well as the mean. Results based on the TSPA-SR base-case model.

Figure 4.1-4. TSPA-SR Base-Case Model: 300 Realizations of Million-Year Annual Dose Histories for Nominal Performance



NOTE: Comparison of the mean HLW EBS release of (a) technetium-99 and (b) neptunium-237 for the three cases: TSPA-SR base-case HTOM, supplemental TSPA model HTOM, and supplemental TSPA model LTOM.

Figure 4.2.8-3. High-Level Waste Engineered Barrier System Release Rate Calculated with the TSPA-SR Base-Case Model and the Supplemental TSPA Model

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