Result Summary for the Area 5 Radioactive Waste Management Site Performance Assessment Model Version 4.113

Preliminary results for Version 4.113 of the Nevada National Security Site (NNSS) Area 5 Radioactive Waste Management Site (RWMS) performance assessment (PA) model are summarized. Version 4.113 includes the Fiscal Year (FY) 2011 inventory estimate. Analyses are summarized in Table 1.

Table 1. Summary of analyses

Inventory	Analyses	Realizations
Post-1988	Member of Public, Intruder, Rn Flux	5,000
Pre- and Post-1988	Member of Public	5,000

Version 4.113 is implemented in GoldSim 10.5(SP2). The following changes have been implemented since the last baseline model, Version 4.110:

- Updated the inventory and disposal unit dimensions with data up through the end of FY 2011.
- Added a new nuclide, platinum-193 (Pt-193), to the model.
- Removed promethium-145 (Pm-145), Pm-146, samarium-146 (Sm-146), gadolinium-148 (Gd-148), hafnium-182 (Hf-182), osmium-194 (Os-194), and meta-stable iridium-192m (Ir-192m) from the model. The inventory of these radionuclides is negligible.
- Revised the fraction of cattle forage intake that is contaminated to scale with the area of disposal units.
- Conducted a comprehensive review of the model input documentation. Some input parameters were updated using new data.

Performance Assessment Results

Member of Public

Version 4.113 PA results comply with the air pathway annual total effective dose (TED) performance objective of 0.1 millisievert (mSv) (Tables 2 and 3, Figures 1 and 2). Air pathways results increase significantly for all scenarios. The increase is due to updated soil mass loading input distributions. The time of the maximum for the air pathway open rangeland scenario TED shifts from 1,000 to 100 years.

Table 2. Member of public annual TED through the air pathway

Exposure Scenario	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
Transient Visitor	8.3e-05	3.1E-04	1,000 years
Resident	1.6E-04	5.8E-04	1,000 years
Resident Farmer	4.5E-04	1.6E-03	1,000 years
Open Rangeland (Cane Spring)	6.9E-09	NA	100 years
Open Rangeland (NNSS Boundary)	1.0E-07	2.7E-07	1,000 years

NA – not available, insufficient realizations to calculate 95th percentile

The Version 4.113 results for the all-pathways annual TED are less than the 0.25 mSv performance objective for all scenarios. The all-pathways TED increases slightly for all scenarios. The maximum all-pathways TED occurs for the resident farmer scenario at 1,000 years. The resident farmer dose was predominantly due to technetium-99 (Tc-99) (79 percent), lead-210 (Pb-210) (13 percent), and uranium-238 (U-238) (3 percent). Pb-210 present at 1,000 years is produced predominantly by radioactive decay of U-234 present at the time of disposal.

Table 3. Member of public annual TED through all pathways

Exposure Scenario	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
Transient Visitor	4.7E-03	1.0E-02	1,000 years
Resident	7.8E-04	2.7E-03	1,000 years
Resident Farmer	1.9E-02	6.4E-02	1,000 years
Open Rangeland (Cane Spring)	3.7E-03	NA	100 years
Open Rangeland (NNSS Boundary)	4.0E-03	NA	100 years

NA – not available, insufficient realizations to calculate 95th percentile

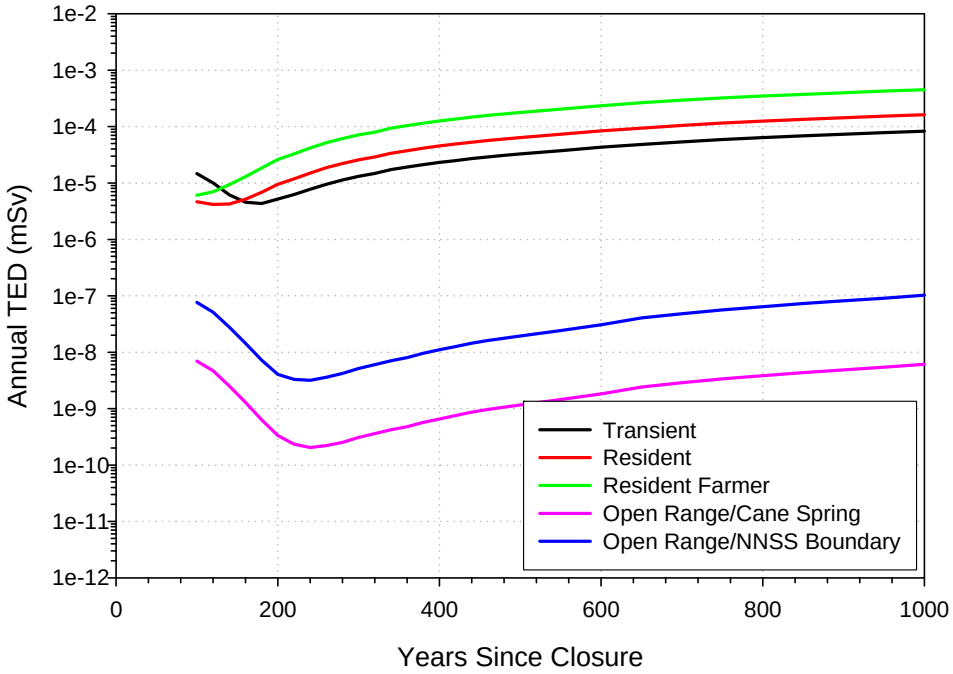

Figure 1. Member of public results for the air pathway

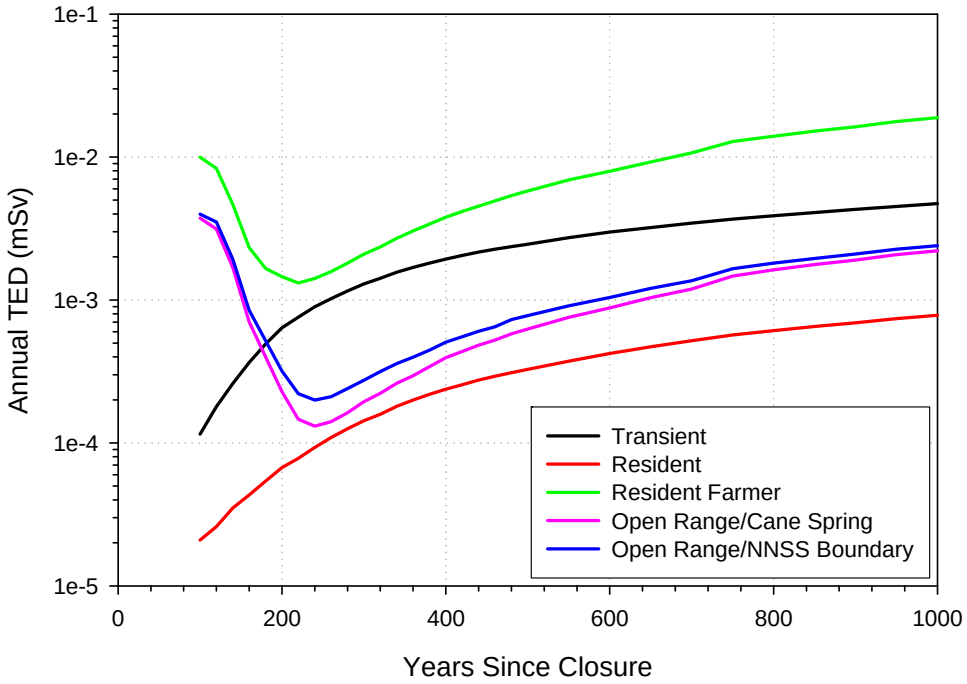

Figure 2. Member of public results for all pathways

Chronic Intrusion

All results for the post-drilling and intruder-agriculture chronic intruder scenarios comply with the performance objectives (Tables 4 and 5, Figures 3 and 4). The post-drilling and intruder-agriculture intruder results are similar to the Version 4.110 results. The intruder-agriculture result for the SLB disposal units is a significant fraction of the performance objective and exceeds the performance objective at the 95th percentile. The intruder-agriculture dose is due predominantly to Tc-99 (70 percent), U-238 (13 percent), and thorium-229 (Th-229) (5 percent).

Table 4. Post-drilling intruder TED weighted by the probability of occurrence

Disposal Unit	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
Shallow Land Burial (SLB)	8.9E-3	2.8E-2	1,000 years
Pit 6 Radium Disposal Unit (RaDU)	1.5E-3	4.1E-3	1,000 years
Pit 13 RaDU	1.2E-3	2.8E-3	1,000 years
Greater Confinement Disposal (GCD)	2.6E-7	8.1E-7	1,000 years

Table 5. Intruder-agriculture intruder TED weighted by the probability of occurrence

Disposal Unit	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
SLB	0.60	2.1	1,000 years
Pit 6 RaDU	8.6E-03	2.8E-02	1,000 years
Pit 13 RaDU	3.3E-04	1.1E-03	1,000 years
GCD	4.1E-10	NA	100 years

NA – not available, insufficient realizations to calculate 95th percentile

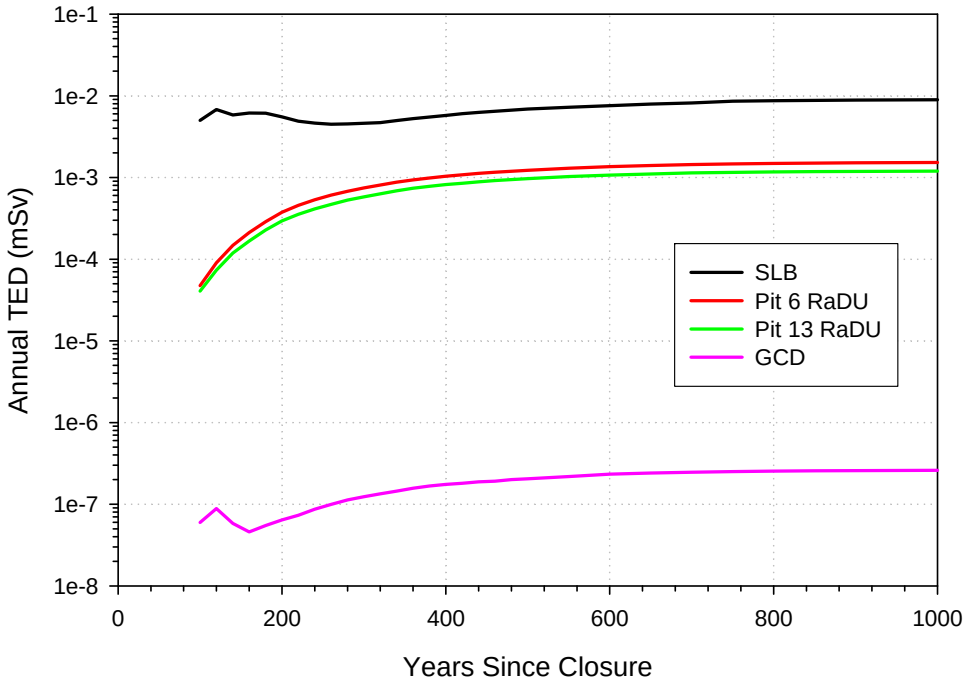

Figure 3. Intruder results for the post-drilling intruder scenario

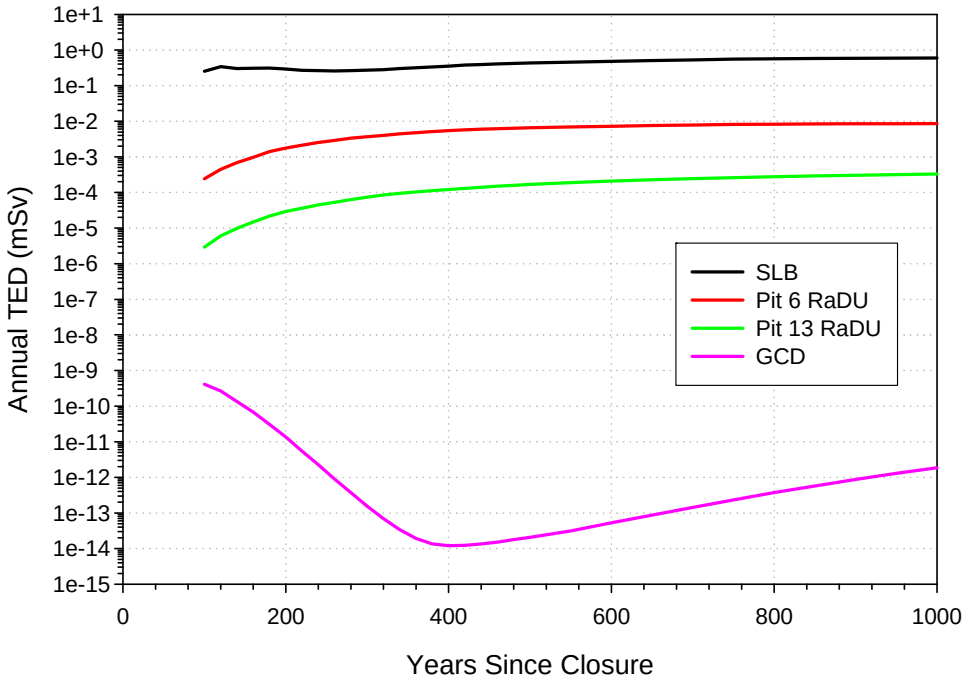

Figure 4. Intruder results for the intruder-agriculture scenario

Acute Intrusion

The acute intruder scenario results comply with all performance objectives (Tables 6 and 7, Figures 5 and 6). The acute intruder scenario results decrease for all scenarios with Version 4.113, except for the Pit 6 RaDU acute drilling scenario that increases slightly. The increase is due to increased inventory disposed in the upper cell of Pit 6 before its closure. The acute construction result for the SLB disposal units is a significant fraction of the 5 mSv limit. The acute construction intruder TED for the SLB disposal units is due to U-238 (36 percent), Th-229 (25 percent), plutonium-239 (Pu-239) (8 percent), U-233 (7 percent), and U-234 (7 percent).

Table 6. Acute drilling intruder TED

Disposal Unit	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
SLB	1.6E-3	2.7E-3	1,000 years
Pit 6 RaDU	0.034	0.062	1,000 years
Pit 13 RaDU	0.026	0.033	1,000 years
GCD	0.017	0.045	1,000 years

Table 7. Acute construction intruder TED

Disposal Unit	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
SLB	1.3	2.4	1,000 years
Pit 6 RaDU	0.85	2.1	1,000 years
Pit 13 RaDU	0.050	0.15	1,000 years
GCD	3.6E-06	NA	100 years

NA – not available, insufficient realizations to calculate 95th percentile

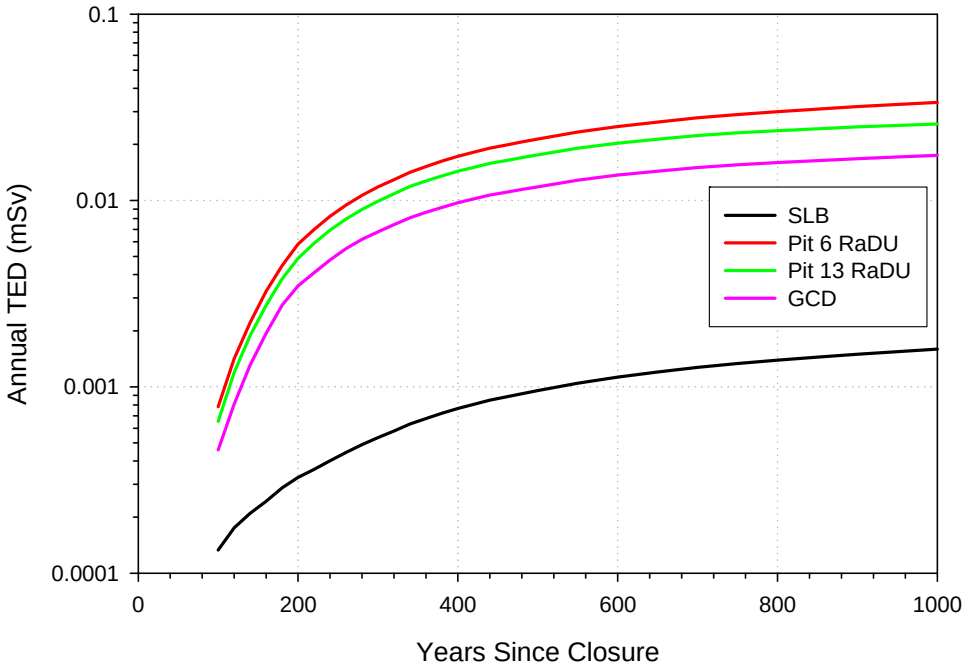

Figure 5. Intruder results for the acute drilling scenario

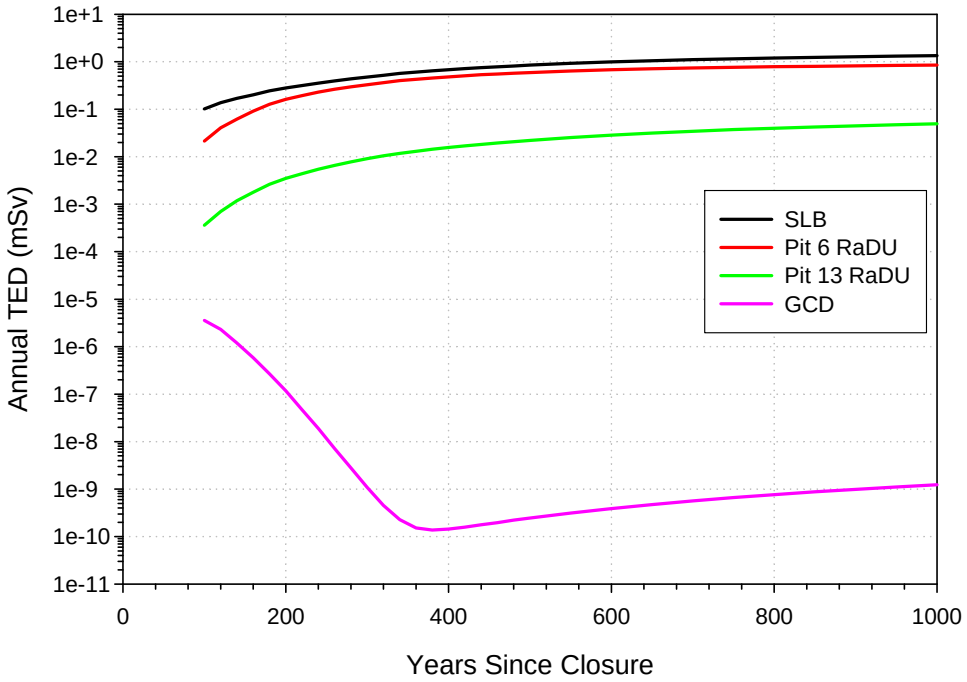

Figure 6. Intruder results for the acute construction scenario

Radon-222 Flux Density

All results for radon-222 (Rn-222) flux density comply with the performance objectives (Table 8, Figure 7). The Pit 13 RaDU flux density is close to the 0.74 becquerel per square meter per second (Bq m^{-2} s^{-1}) limit and exceeds the limit at the 95th percentile. The Pit 13 RaDU Rn-222 flux at 1,000 years is due predominantly to Th-230 present at the time of disposal.

Table 8. Rn-222 flux density results

Disposal Unit	Mean (Bq m^{-2} s^{-1})	95th Percentile (Bq m^{-2} s^{-1})	Time of Maximum
All	0.16	0.32	1,000 years
SLB	0.16	0.33	1,000 years
Pit 6 RaDU	0.083	0.17	1,000 years
Pit 13 RaDU	0.56	1.6	1,000 years
GCD	1.1E-08	2.9E-08	1,000 years

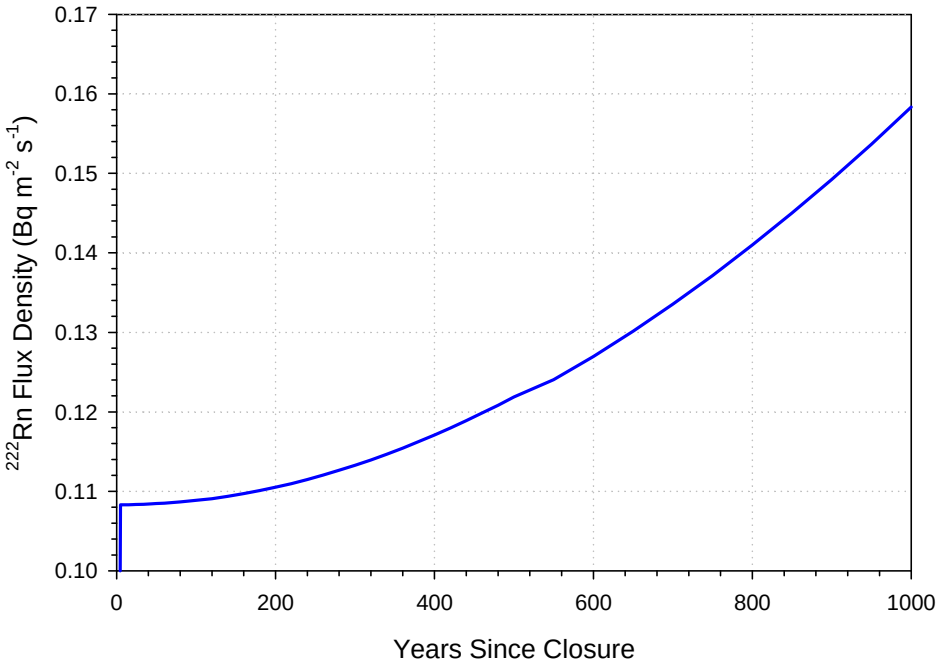

Figure 7. Rn-222 flux density averaged over all disposal units

Composite Analysis

The composite analysis results are less than the 0.3 mSv constraint (Table 9, Figure 8).

Table 9. Composite analysis results

Disposal Unit	Mean (mSv)	95th Percentile (mSv)	Time of Maximum
All	1.0E-3	3.2E-3	1,000 years

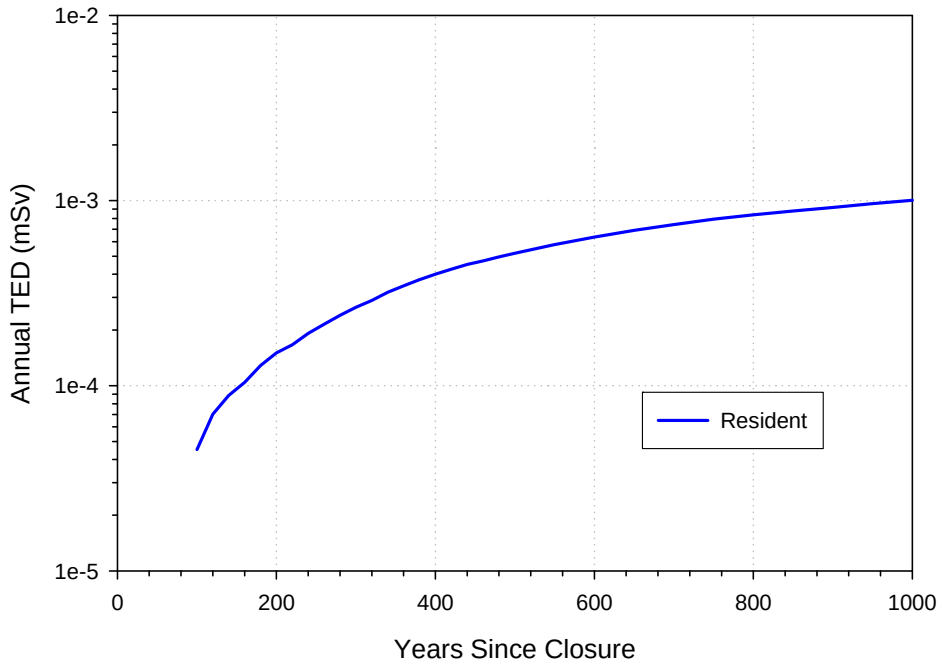

Figure 8. Composite analysis results

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