Calculation of the Waste Unit Factor
For the Performance Assessment Baseline Calculation
Revision 0

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1. INTRODUCTION

In 1996 the Department of Energy (DOE) completed a performance assessment (PA) calculation for the Waste Isolation Pilot Plant (WIPP). The PA was part of the Compliance Certification Application (CCA) submitted to the Environmental Protection Agency (EPA) to demonstrate compliance with the radiation protection regulations of 40 CFR 191 and 40 CFR 194 (DOE 1996). As required by the WIPP Land Withdrawal Act (Public Law 102-579), DOE is required to submit documentation to EPA for the recertification of the WIPP every five years in order to continue operating the site. This required that a Compliance Recertification Application (CRA) be prepared, and CRA-2004 was submitted to the EPA in March 2004 (DOE 2004).

EPA is currently performing a completeness review of CRA-2004 and will soon start a final evaluation to determine if CRA-2004 demonstrates continued compliance with the disposal regulations governing WIPP. It is expected that as part of their final evaluation, the EPA will require that another PA, the Performance Assessment Baseline Calculation (PABC), is performed.

During the final preparation of CRA-2004, Mr. P.E. Shoemaker (Shoemaker 2003) of Sandia National Laboratories (SNL) requested a review of the waste stream profiles that form the basis of the inventory estimates for CRA-2004 (DOE 2004). The review was performed by Mr. J.P. Harvill (2004) of Washington TRU Solutions LLC (WTS). Mr. Harvill (2004) found a number of inconsistencies and possible omissions in the reporting of TRU waste inventories for CRA-2004. In response to Mr. Harvill's review, Los Alamos National Laboratory – Carlsbad Operations (LANL-CO) and SNL investigated the noted inconsistencies and possible omissions. The results of the laboratories investigations are documented in Leigh and Crawford (2004).

In addition, the EPA as part of its completeness review for CRA-2004 thoroughly examined the CRA-2004 inventory and visited several of the TRU waste sites to review information about the TRU waste inventory. The EPA review highlighted the need for inventory updates that should be incorporated in the PABC.

An update to the CRA-2004 inventory, governed by AP-113, *Analysis Plan For Inventory Reconciliation: Compliance Recertification Application,* has been completed. This inventory update is the basis for the PA inventory for the PABC.

This analysis is governed by AP-119, *Analysis Plan For Deriving Radionuclide Inventory Information for Performance Assessment Calculations: Post CRA Performance Assessment Baseline Calculation* which discusses the methodology that will be used by Sandia National Laboratories (SNL) to determine the WIPP repository radionuclide inventory information for use in the PA calculation for the PABC. In particular, the waste unit factor at 2033 and EPA units at 2033, 2133, 2383, 3033, 7033 and 12,033 is information needed to address Section 2.2 of AP-119, "Identification of Radionuclides That Dominate Release," and its associated tasks.

This analysis was performed in accordance with the SNL Quality Assurance Program and was prepared as prescribed by the SNL Nuclear Waste Management Program (NWMP) Procedure (NP), NP 9-1, *Analyses*. Entry of the Waste Unit Factor (WUF) into the WIPP PABC Parameter

Database is to be managed in accordance with the specific procedure SP 9-5, *Parameter Data Entry*.

1.1 ACRONYMS

AP	Analysis Plan
CCA	Compliance Certification Application
CCDF	Complimentary Cumulative Distribution Function Code
CFR	Code of Federal Regulations
CH	Contact Handled
CRA	Compliance Recertification Application
DOE	Department of Energy
EPA	Environmental Protection Agency
EPAUNI	EPA Units Code
ERMS	Electronic Records Management System
LANL-CO	Los Alamos National Laboratory – Carlsbad Operations
MTHM	Metric Tons of Heavy Metal
MWd	Megawatt-days
NP	NWMP Procedure
NWMP	Nuclear Waste Management Program
NWPA	Nuclear Waste Policy Act
ORIGEN	Oak Ridge Isotope Generation and Depletion Code
PA	Performance Assessment
PABC	Performance Assessment Baseline Calculation
RH	Remote Handled
SNF	Spent Nuclear Fuel
SNL	Sandia National Laboratory
TRU	Transuranic
TWBID	Transuranic Waste Baseline Inventory Database
TWBIR	Transuranic Waste Baseline Inventory Report
WIPP	Waste Isolation Pilot Plant
WTS	Westinghouse TRU Solutions
WUF	Waste Unit Factor

2. PROBLEM DESCRIPTION

The WUF, also referred to as the "Unit of Waste," is defined in the CCA as the number of millions of curies of alpha-emitting transuranic radionuclides with half-lives longer than 20 years destined for disposal in the WIPP repository (DOE 1996). Computation of a new waste unit factor based on the updated inventory information provided in *Radionuclide Activities in TRU Waste Stream from TWBID Revision 2.1 Version 3.13, Data Version D.4.15* (LANL 2005), is required for the PABC. This computation is performed using the following equation (Sanchez et al.1997):

$$f_w = \frac{\sum W_i}{10^6 Ci} \qquad (1)$$

Where:

f_w is the Waste Unit Factor, and

W_i is the WIPP-scale activity in curies (Ci), for α –emitting TRU repository wastes having half-lives greater than or equal to 20 years.

This calculation uses the WIPP-scale inventory provided in LANL (2005) for 2001 and the decayed radionuclide inventory provided in Leigh and Fox (2005a – f) for 2033, 2133, 2383, 3033, 7033, and 12,033.

3. ANALYSIS

In order to understand which radionuclides are considered important, with respect to WIPP PA, one must become familiar with Table 1, which identifies the release limits per 40CFR191. These release limits are normalized to a "Unit of Waste" (also called a "waste unit factor," f_w). For the TRU waste to be disposed of in the WIPP, the unit of waste is "An amount of TRU wastes containing one million curies of alpha-emitting transuranic radionuclides with half lives greater than 20 years." The unit of waste is determined in Table 2. From this table it can be seen that of the 138 radionuclides in the current inventory report (LANL 2005), there are reported data for 17 transuranic waste radionuclides that contribute to the unit of waste. In total there are only 18 possible radionuclides that fall into the "transuranic waste" category. The one that was not identified in LANL (2005) is Bk247. Since this radionuclide is proton rich, it is expected that this is very difficult to generate and should not exist in appreciable quantities. The overall quantity of transuranic waste radionuclides from Table 2 that apply to the unit of waste at 2033 is 2.32E+06 curies, thus the value for the unit of waste is **2.32**. From this table it is easily identified that the plutonium and americium radionuclides dominate the unit of waste. For release to the accessible environment that involves a mix of radionuclides, the limits in Table 1 are used to define normalized releases for comparison with the release limits. Now the unit of waste and the specific release limits are used to determine release limits and cumulative normalized release limits. To help describe the 40CFR191 containment requirements, the following two paragraphs were taken as is from *An Introduction to the Mechanics of Performance Assessment Using Examples of Calculations Done for the Waste Isolation Pilot Plant Between 1990 and 1992* (Rechard 1995). This reference gives a very thorough introduction to the mechanics of the WIPP PA process and is considered a must for reading if a person wants to be able to understand the CCA results or any comparable performance assessment.

"Containment Requirements in 40CFR191.13 specify general limits on the release of transuranic (TRU) waste, high-level waste, or spent nuclear fuel (SNF) from a geological repository. Environmental Protection Agency (EPA) release limits are defined as the normalizing factors for various radionuclides listed in Table 1 of Appendix A of EPA regulation 40CFR191 (see Table 1). According to the Containment Requirements, there must be a reasonable expectation, based on a performance assessment that includes all significant processes and events, that the cumulative release of any one radionuclide over 10,000 years to the accessible environment shall have (these two points alone determine the EPA limits drawn on all WIPP Complimentary Cumulative Distribution Function Codes (CCDFs):

- less than 1 chance in 10 of exceeding the promulgated EPA radionuclides limits (L_i), and
- less than 1 chance in 1000 of exceeding 10 times those quantities.

For a mix of radionuclides, the sum of all releases, where each radionuclide is normalized with respect to its L_i, shall have:

- Less than 1 chance in 10 of exceeding 1, and
- Less than 1 chance in 1000 of exceeding 10.

Where the sum of all releases is expressed by:

$$R_j = \frac{1}{f_w}\left\{\frac{Q_{1j}}{L_1} + \frac{Q_{2j}}{L_2} + \ldots\ldots + \frac{Q_{nRj}}{L_{nR}}\right\} = \sum_{i=1}^{nR} \frac{Q_{ij}}{f_w L_i} \leq 1 (or\ 10) \qquad [1\text{-}1]$$

Where:

f_w = waste unit factor = $\dfrac{\sum W_i}{10^6\ Ci}$

W_i = activity in Curies (Ci) for α-emitting TRU repository wastes having half-lives ($\tau_{1/2}$) ≥ 20 years

L_i = the EPA release limit for radionuclide i (see Table 1 for examples of units)

nR = number of radionuclides contributing to the release

R_j = total normalized release (EPA sum) for the *j*th scenario

Q_{ij} = cumulative release for radionuclide q_{ij} beyond a specified boundary, $\int_0^{10{,}000\,yr} q_{ij}dt$

q_{ij} = release rate into accessible environment at time *t* for radionuclide *i* and scenario *j* calculated from consequence model(s) (see Chapter 5.0 of Rechard 1995)"

Table 1: 40CFR191 Release Limits for Containment Requirements[a]

[Cumulative releases to the accessible environment for 10,000 years after disposal]	
Radionuclide	**Release Limit per 1,000 MTHM or other unit of waste (b) (see notes) (c) (curies)**
Americium-241 or –243	100
Carbon-14	100
Cesium-135 or –137	1,000
Iodine-129	100
Neptunium-237	100
Plutonium-238, -239, -240, or –242	100
Radium-226	100
Strontium-90	1,000
Technetium-99	10,000
Thorium-230 or –232	10
Tin-126	1,000
Uranium-233, -234, -235, -236, or –238	100
Any other alpha-emitting radionuclide with a half-life greater than 20 years	100
Any other radionuclide with a half-life greater than 20 years that does not emit alpha particles	1,000

Application of Table 1 {Appendix A to Part 191 for Subpart B} 40 CFR 191.

Note 1: Units of Waste. The Release Limits in Table 1 apply to the amount of wastes in any one of the following:

a) An amount of spent nuclear fuel containing 1,000 metric tons of heavy metal (MTHM) exposed to a burnup between 25,000 megawatt-days per metric ton of heavy metal (MWd/MTHM) and 40,000 MWd/MTHM;
b) The high-level radioactive wastes generated from reprocessing each 1,000 MTHM exposed to a burnup between 25,000 MWd/MTHM and 40,000 MWd/MTHM;
c) Each 100,000,000 curies of gamma or beta-emitting radionuclides with half-lives greater than 20 years but less than 100 years (for use as discussed in Note 5 or with materials that are identified by the Commission as high-level radioactive waste in accordance with part B of the definition of high-level waste in the NWPA);
d) Each 1,000,000 curies of other radionuclides (i.e., gamma or beta-emitters with half-lives greater than 100 years or any alpha-emitters with half-lives greater than 20 years)(for use as discussed in Note 5 or with materials that are identified by the Commission as high-level radioactive waste in accordance with part B of the definition of high-level waste in the NWPA); or
e) An amount of transuranic wastes containing one million curies of alpha-emitting transuranic radionuclides with half-lives greater than 20 years.

(a) Based on Table 1 of Appendix A of 40 CFR 191.
(b) **Note!!! The categories of notes 1(a) through 1(e) are organized according to the waste type and not the radiation emission type. Only TRU wastes are allowed in the WIPP facility, thus only Note 1(e) should be used for identification of the "unit of waste" value. Also, alpha, beta and gamma emitting radionuclides with half-lives greater than 20 years all contribute to the "release limits".**
(c) Notes 2 through 6 of Table 1 from Appendix A of 40 CFR191 are not shown here.

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste

Nuclide			WIPP TRU Waste													
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][i]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
Ac-225	α, γ	10.0 d	1.54E+00	5.21E+00	1.66E+01	4.46E+01	1.14E+02	4.56E+02	7.28E+02	----	----	----	----	----	----	----	----
Ac-227	α, β⁻, γ	21.77 a	3.62E-01	6.86E-01	8.68E-01	9.01E-01	9.63E-01	1.42E+00	2.17E+00	----	----	----	----	----	----	----	----
Ac-228	α, β⁻, γ	6.15 h	2.51E+00	3.34E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	----	----	----	----	----	----	----	----
Ag-109m	*ITe⁻*	39.8 s	1.26E-04	3.30E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Ag-110	β⁻, γ, ε	24.6 s	1.28E-10	1.06E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Ag-110m	β⁻, γ, *ITe⁻*	249.8 d	9.70E-09	8.06E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Am-241	**α, γ, *SF***	**432.7 a**	**4.89E+05**	**5.17E+05**	**4.54E+05**	**3.04E+05**	**1.07E+05**	**1.75E+02**	**6.65E-02**	**4.89E+05**	**5.17E+05**	**4.54E+05**	**3.04E+05**	**1.07E+05**	**1.75E+02**	**6.65E-02**	**2.23E+01**
Am-242	β⁻, γ, ε *e⁻*	16.02 h	5.12E-02	2.15E-01	1.36E-01	4.36E-02	2.25E-03	2.69E-11	3.38E-21	----	----	----	----	----	----	----	----
Am-242m	**α, *ITe⁻*, γ, *SF***	**141.0 a**	**2.53E-01**	**2.19E-01**	**1.39E-01**	**4.43E-02**	**2.29E-03**	**2.74E-11**	**3.43E-21**	**2.53E-01**	**2.19E-01**	**1.39E-01**	**4.43E-02**	**2.29E-03**	**2.74E-11**	**3.43E-21**	**9.41E-06**
Am-243	**α, γ, *SF***	**7.37E+03 a**	**7.88E+01**	**7.87E+01**	**7.84E+01**	**7.77E+01**	**7.59E+01**	**6.70E+01**	**5.97E+01**	**7.88E+01**	**7.87E+01**	**7.84E+01**	**7.77E+01**	**7.59E+01**	**6.70E+01**	**5.97E+01**	**3.39E-03**
Am-245	β⁻, γ	2.05 h	9.35E-11	9.47E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
At-217	α, β⁻, γ	32 ms	1.54E+00	5.21E+00	1.66E+01	4.46E+01	1.14E+02	4.57E+02	7.29E+02	----	----	----	----	----	----	----	----
Ba-137m	*IT*	2.552 m	4.00E+05	1.94E+05	1.92E+04	5.95E+01	1.79E-05	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Bi-210	α, β⁻, γ	5.01 d	1.87E+00	3.55E+00	4.34E+00	4.02E+00	4.28E+00	2.01E+01	4.95E+01	----	----	----	----	----	----	----	----
Bi-211	α, β⁻, γ	2.14 m	3.57E-01	6.77E-01	8.57E-01	8.90E-01	9.51E-01	1.41E+00	2.15E+00	----	----	----	----	----	----	----	----
Bi-212	α, β⁻, γ	1.009 h	1.64E+01	1.38E+01	7.37E+00	3.75E+00	3.39E+00	3.39E+00	3.39E+00	----	----	----	----	----	----	----	----
Bi-213	α, β⁻, γ	45.6 m	1.54E+00	5.20E+00	1.66E+01	4.45E+01	1.14E+02	4.55E+02	7.28E+02	----	----	----	----	----	----	----	----
Bi-214	α, β⁻, γ	19.9 m	4.57E+00	4.51E+00	4.33E+00	4.02E+00	4.28E+00	2.01E+01	4.95E+01	----	----	----	----	----	----	----	----
Bk-249	α, β⁻, γ, *SF*	3.2E+02 d	6.47E-06	6.55E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Bk-250	β⁻, γ	3.217 h	2.60E-12	2.60E-12	2.59E-12	2.56E-12	2.50E-12	2.13E-12	1.74E-12	----	----	----	----	----	----	----	----
C-14	β⁻	5730 a	2.42E+00	2.41E+00	2.38E+00	2.31E+00	2.14E+00	1.32E+00	7.19E-01	----	----	----	----	----	----	----	----
Cd-109	γ, ε	462.0 d	1.28E-04	3.34E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Cd-113m	β⁻, *IT*	14.1 a	5.20E-01	1.14E-01	9.83E-04	6.82E-09	2.64E-22	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----
Ce-141	β⁻	32.501 d	4.20E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	----	----	----	----	----	----	----	----

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste (continued)

Nuclide			WIPP TRU Waste													
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][l]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
Ce-144	β^-, γ	284.6 d	6.40E+00	2.68E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Cf-249	**α, γ, *SF***	**351 a**	**6.19E-02**	**5.81E-02**	**4.77E-02**	**2.91E-02**	**8.03E-03**	**2.95E-06**	**1.49E-10**	**6.19E-02**	**5.81E-02**	**4.77E-02**	**2.91E-02**	**8.03E-03**	**2.95E-06**	**1.49E-10**	**2.50E-06**
Cf-250	α, γ, *SF*	13.1 a	2.46E-01	4.51E-02	2.25E-04	4.00E-10	2.53E-12	2.15E-12	1.77E-12	--------	--------	--------	--------	--------	--------	--------	--------
Cf-251	**α, γ**	**9.0E+02 a**	**1.06E-03**	**1.03E-03**	**9.55E-04**	**7.87E-04**	**4.76E-04**	**2.17E-05**	**4.58E-07**	**1.06E-03**	**1.03E-03**	**9.55E-04**	**7.87E-04**	**4.76E-04**	**2.17E-05**	**4.58E-07**	**4.44E-08**
Cf-252	α, γ, *SF*	2.638 a	2.61E-01	5.83E-05	2.26E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Cm-242	α, γ, *SF*	162.8 d	4.30E-02	1.80E-01	1.14E-01	3.65E-02	1.88E-03	2.26E-11	2.84E-21	--------	--------	--------	--------	--------	--------	--------	--------
Cm-243	**α, γ, *SF*, ε**	**29.1 a**	**9.02E-01**	**4.14E-01**	**3.64E-02**	**8.32E-05**	**1.13E-11**	**0.00E+00**	**0.00E+00**	**9.02E-01**	**4.14E-01**	**3.64E-02**	**8.32E-05**	**1.13E-11**	**0.00E+00**	**0.00E+00**	**1.78E-05**
Cm-244	α, γ, *SF*	18.1 a	7.26E+03	2.13E+03	4.64E+01	3.24E-03	5.09E-14	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Cm-245	**α, γ, *SF***	**8.5E+03 a**	**1.70E-02**	**1.71E-02**	**1.74E-02**	**1.78E-02**	**1.77E-02**	**1.31E-02**	**8.68E-03**	**1.70E-02**	**1.71E-02**	**1.74E-02**	**1.78E-02**	**1.77E-02**	**1.31E-02**	**8.68E-03**	**7.37E-07**
Cm-246	**α, γ, *SF***	**4.76E+03 a**	**4.49E+00**	**4.47E+00**	**4.40E+00**	**4.24E+00**	**3.86E+00**	**2.15E+00**	**1.03E+00**	**4.49E+00**	**4.47E+00**	**4.40E+00**	**4.24E+00**	**3.86E+00**	**2.15E+00**	**1.03E+00**	**1.92E-04**
Cm-247	**α, γ**	**1.56 E+07 a**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.73E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.74E+01**	**4.73E+01**	**2.04E-03**
Cm-248	**α, *SF***	**3.48E+05 a**	**7.43E-02**	**7.43E-02**	**7.43E-02**	**7.43E-02**	**7.42E-02**	**7.35E-02**	**7.28E-02**	**7.43E-02**	**7.43E-02**	**7.43E-02**	**7.43E-02**	**7.42E-02**	**7.35E-02**	**7.28E-02**	**3.20E-06**
Cm-250	**α, β^-, *SF***	**9700 a**	**4.73E-11**	**4.73E-11**	**4.71E-11**	**4.66E-11**	**4.54E-11**	**3.87E-11**	**3.17E-11**	**4.73E-11**	**4.73E-11**	**4.71E-11**	**4.66E-11**	**4.54E-11**	**3.87E-11**	**3.17E-11**	**4.73E-11**
Co-60	β^-, γ	5.271 a	1.82E+03	2.71E+01	5.25E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Cs-134	$\beta^-, \gamma, \varepsilon$	2.065 a	1.09E+02	2.33E-03	5.86E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Cs-135	β^-	2.3E+06 a	3.46E-04	3.46E-04	3.46E-04	3.46E-04	3.46E-04	3.45E-04	3.45E-04	--------	--------	--------	--------	--------	--------	--------	--------
Cs-137	β^-, γ	30.17 a	4.33E+05	2.07E+05	2.05E+04	6.36E+01	1.91E-05	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Eu-152	$\beta^-, \gamma, \varepsilon\beta^+$	13.48 a	2.36E+03	4.63E+02	2.83E+00	8.29E-06	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Eu-154	$\beta^-, \gamma, \varepsilon\gamma$	8.59 a	1.13E+03	8.56E+01	2.71E-02	4.80E-11	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Eu-155	β^-, γ	4.71 a	3.49E+02	3.98E+00	3.39E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Fe-55	ε	2.73 a	1.33E-01	2.63E-05	6.95E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Fr-221	α, γ	4.8 m	1.54E+00	5.20E+00	1.66E+01	4.45E+01	1.14E+02	4.56E+02	7.28E+02	--------	--------	--------	--------	--------	--------	--------	--------
Fr-223	α, β^-, γ	21.8 m	4.94E-03	9.35E-03	1.18E-02	1.23E-02	1.31E-02	1.94E-02	2.96E-02	--------	--------	--------	--------	--------	--------	--------	--------
Gd-152	α	1.1E+14 a	9.80E-11	1.63E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	--------	--------	--------	--------	--------	--------	--------	--------
H-3	β^-	12.3 a	2.18E+02	3.61E+01	1.32E-01	1.06E-07	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
I-129	β^-, γ	1.57E+07 a	8.23E-02	8.23E-02	8.23E-02	8.23E-02	8.22E-02	8.22E-02	8.22E-02	--------	--------	--------	--------	--------	--------	--------	--------
Kr-85	β^-, γ	10.73 a	8.19E-01	1.03E-01	1.61E-04	1.54E-11	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste (continued)

Nuclide			WIPP TRU Waste													
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][i]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
Mn-54	ε, γ	312.2 d	2.03E+00	1.12E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Na-22	ε	2.6019 a	3.28E-01	6.52E-05	1.76E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Nb-93m	*ITe*	16.1 a	9.11E-04	2.62E-01	3.26E-01	3.26E-01	3.26E-01	3.25E-01	3.25E-01	-------	-------	-------	-------	-------	-------	-------	-------
Nb-95	β, γ	34.97 d	2.15E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Nb-95m	β, γ, *IT*	3.61 d	7.19E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Nd-144	α	2.1E+15 a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Ni-59	ε	7.6E+04 a	2.31E+01	2.31E+01	2.30E+01	2.30E+01	2.29E+01	2.21E+01	2.12E+01	-------	-------	-------	-------	-------	-------	-------	-------
Ni-63	β	100 a	1.12E+03	8.83E+02	4.16E+02	6.32E+01	4.72E-01	3.85E-14	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Np-237	α, γ	**2.14E+06 a**	**6.89E+00**	**1.22E+01**	**2.80E+01**	**5.88E+01**	**9.86E+01**	**1.20E+02**	**1.19E+02**	**6.89E+00**	**1.22E+01**	**2.80E+01**	**5.88E+01**	**9.86E+01**	**1.20E+02**	**1.19E+02**	**5.24E-04**
Np-238	β, γ	2.117 d	2.57E-04	1.08E-03	6.84E-04	2.19E-04	1.13E-05	1.35E-13	1.70E-23	-------	-------	-------	-------	-------	-------	-------	-------
Np-239	β, γ	2.355 d	7.70E+01	7.76E+01	7.73E+01	7.67E+01	7.49E+01	6.61E+01	5.89E+01	-------	-------	-------	-------	-------	-------	-------	-------
Np-240m	β, γ, *IT*	7.22 m	5.58E-03	5.58E-03	5.58E-03	5.58E-03	5.58E-03	5.58E-03	5.59E-03	-------	-------	-------	-------	-------	-------	-------	-------
Pa-231	α, γ	3.28E+04 a	8.67E-01	8.69E-01	8.78E-01	9.01E-01	9.62E-01	1.42E+00	2.17E+00	-------	-------	-------	-------	-------	-------	-------	-------
Pa-233	β, γ	27.0 d	6.17E+00	1.21E+01	2.78E+01	5.83E+01	9.76E+01	1.18E+02	1.18E+02	-------	-------	-------	-------	-------	-------	-------	-------
Pa-234	β, γ	6.69 h	9.37E-02	2.79E-01	2.79E-01	2.79E-01	2.79E-01	2.79E-01	2.79E-01	-------	-------	-------	-------	-------	-------	-------	-------
Pa-234m	β, γ, *IT*	1.17 m	7.20E+01	2.15E+02	2.15E+02	2.15E+02	2.15E+02	2.15E+02	2.15E+02	-------	-------	-------	-------	-------	-------	-------	-------
Pb-209	β	3.25 h	1.54E+00	5.20E+00	1.66E+01	4.45E+01	1.14E+02	4.56E+02	7.28E+02	-------	-------	-------	-------	-------	-------	-------	-------
Pb-210	α, β, γ	22.3 a	1.89E+00	3.59E+00	4.39E+00	4.07E+00	4.33E+00	2.03E+01	5.01E+01	-------	-------	-------	-------	-------	-------	-------	-------
Pb-211	β, γ	36.1 m	3.58E-01	6.78E-01	8.58E-01	8.91E-01	9.52E-01	1.41E+00	2.15E+00	-------	-------	-------	-------	-------	-------	-------	-------
Pb-212	β, γ	10.64 h	1.63E+01	1.37E+01	7.35E+00	3.73E+00	3.38E+00	3.38E+00	3.38E+00	-------	-------	-------	-------	-------	-------	-------	-------
Pb-214	β, γ	27 m	4.58E+00	4.51E+00	4.34E+00	4.03E+00	4.29E+00	2.01E+01	4.96E+01	-------	-------	-------	-------	-------	-------	-------	-------
Pd-107	β	6.5E+06 a	1.45E-05	1.45E-05	1.45E-05	1.45E-05	1.45E-05	1.44E-05	1.44E-05	-------	-------	-------	-------	-------	-------	-------	-------
Pm-147	β, γ	2.6234 *a*	6.10E+02	1.30E-01	4.36E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-------	-------	-------	-------	-------	-------	-------	-------
Po-210	α, γ	138.38 d	1.89E+00	3.59E+00	4.39E+00	4.07E+00	4.33E+00	2.03E+01	5.00E+01	-------	-------	-------	-------	-------	-------	-------	-------
Po-211	α, γ	0.516 s	1.09E-03	2.07E-03	2.62E-03	2.72E-03	2.90E-03	4.29E-03	6.55E-03	-------	-------	-------	-------	-------	-------	-------	-------
Po-212	α	0.298 μs	1.04E+01	8.78E+00	4.70E+00	2.39E+00	2.16E+00	2.16E+00	2.16E+00	-------	-------	-------	-------	-------	-------	-------	-------
Po-213	α	4 μs	1.51E+00	5.09E+00	1.62E+01	4.36E+01	1.12E+02	4.46E+02	7.13E+02	-------	-------	-------	-------	-------	-------	-------	-------

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste (continued)

Nuclide			WIPP TRU Waste														
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][i]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
Po-214	α, γ	163.7 µs	4.58E+00	4.51E+00	4.34E+00	4.03E+00	4.28E+00	2.01E+01	4.95E+01	---------	---------	---------	---------	---------	---------	---------	---------
Po-215	α, β-, γ	1.780 ms	3.58E-01	6.78E-01	8.58E-01	8.91E-01	9.52E-01	1.41E+00	2.15E+00	---------	---------	---------	---------	---------	---------	---------	---------
Po-216	α, γ	0.145 s	1.63E+01	1.37E+01	7.34E+00	3.73E+00	3.37E+00	3.37E+00	3.37E+00	---------	---------	---------	---------	---------	---------	---------	---------
Po-218	α, β-, γ	3.10 m	4.50E+00	4.44E+00	4.26E+00	3.96E+00	4.21E+00	1.97E+01	4.87E+01	---------	---------	---------	---------	---------	---------	---------	---------
Pr-144	β-, γ	17.28 m	6.27E+00	2.63E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	---------	---------	---------	---------	---------	---------	---------	---------
Pu-236	α, γ, *SF*	2.87 a	3.30E-03	1.38E-06	3.81E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	---------	---------	---------	---------	---------	---------	---------	---------
Pu-238	**α, γ, *SF***	**87.7 a**	**1.45E+06**	**1.13E+06**	**5.12E+05**	**7.10E+04**	**4.18E+02**	**6.17E-11**	**6.74E-21**	**1.45E+06**	**1.13E+06**	**5.12E+05**	**7.10E+04**	**4.18E+02**	**6.17E-11**	**6.74E-21**	**4.86E+01**
Pu-239	**α, γ, *SF***	**2.41E+04 a**	**5.83E+05**	**5.82E+05**	**5.81E+05**	**5.77E+05**	**5.66E+05**	**5.04E+05**	**4.37E+05**	**5.83E+05**	**5.82E+05**	**5.81E+05**	**5.77E+05**	**5.66E+05**	**5.04E+05**	**4.37E+05**	**2.51E+01**
Pu-240	**α, γ, *SF***	**6.56E+03 a**	**9.57E+04**	**9.54E+04**	**9.44E+04**	**9.19E+04**	**8.58E+04**	**5.61E+04**	**3.30E+04**	**9.57E+04**	**9.54E+04**	**9.44E+04**	**9.19E+04**	**8.58E+04**	**5.61E+04**	**3.30E+04**	**4.11E+00**
Pu-241	α, β-, γ	14.4 a	2.09E+06	4.48E+05	3.64E+03	3.94E-02	1.77E-02	1.30E-02	8.66E-03	---------	---------	---------	---------	---------	---------	---------	---------
Pu-242	**α, γ, *SF***	**3.75E+05 a**	**1.27E+01**	**1.27E+01**	**1.27E+01**	**1.27E+01**	**1.26E+01**	**1.26E+01**	**1.25E+01**	**1.27E+01**	**1.27E+01**	**1.27E+01**	**1.27E+01**	**1.26E+01**	**1.26E+01**	**1.25E+01**	**5.45E-04**
Pu-243	β-, γ	4.956 h	4.68E+01	4.68E+01	4.68E+01	4.68E+01	4.68E+01	4.68E+01	4.68E+01	---------	---------	---------	---------	---------	---------	---------	---------
Pu-244	**α, *SF***	**8.0E+07 a**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**5.53E-03**	**2.38E-07**
Ra-223	α, γ	11.435 d	3.62E-01	6.86E-01	8.67E-01	9.01E-01	9.62E-01	1.42E+00	2.17E+00	---------	---------	---------	---------	---------	---------	---------	---------
Ra-224	α, γ	3.66 d	1.63E+01	1.37E+01	7.33E+00	3.73E+00	3.37E+00	3.37E+00	3.37E+00	---------	---------	---------	---------	---------	---------	---------	---------
Ra-225	β-, γ	14.9 d	1.54E+00	5.21E+00	1.66E+01	4.46E+01	1.14E+02	4.56E+02	7.29E+02	---------	---------	---------	---------	---------	---------	---------	---------
Ra-226	α, γ	1.60E+03 a	4.63E+00	4.56E+00	4.39E+00	4.07E+00	4.33E+00	2.03E+01	5.01E+01	---------	---------	---------	---------	---------	---------	---------	---------
Ra-228	β-, γ	5.76 a	2.96E+00	3.94E+00	3.98E+00	3.98E+00	3.98E+00	3.98E+00	3.98E+00	---------	---------	---------	---------	---------	---------	---------	---------
Rh-106	β-, γ	29.9 s	2.07E-03	5.73E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	---------	---------	---------	---------	---------	---------	---------	---------
Rn-219	α, γ	3.96 s	3.58E-01	6.77E-01	8.57E-01	8.90E-01	9.51E-01	1.41E+00	2.15E+00	---------	---------	---------	---------	---------	---------	---------	---------
Rn-220	α, γ	55.6 s	1.63E+01	1.37E+01	7.34E+00	3.73E+00	3.37E+00	3.37E+00	3.37E+00	---------	---------	---------	---------	---------	---------	---------	---------
Rn-222	α, γ	3.8235 d	4.58E+00	4.52E+00	4.34E+00	4.03E+00	4.29E+00	2.01E+01	4.96E+01	---------	---------	---------	---------	---------	---------	---------	---------
Ru-106	β-	1.02 a	2.09E-03	5.79E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	---------	---------	---------	---------	---------	---------	---------	---------
Sb-125	β-, γ	2.758 a	4.88E+00	1.63E-03	2.20E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	---------	---------	---------	---------	---------	---------	---------	---------
Sb-126	β-, γ	12.4 d	1.47E-04	1.47E-04	1.47E-04	1.47E-04	1.46E-04	1.42E-04	1.37E-04	---------	---------	---------	---------	---------	---------	---------	---------
Sb-126m	γ, *ITe*-	11.0 s	1.05E-03	1.05E-03	1.05E-03	1.05E-03	1.04E-03	1.02E-03	9.80E-04	---------	---------	---------	---------	---------	---------	---------	---------
Se-79	β-	6.5E+04 a	4.00E-02	4.00E-02	4.00E-02	3.99E-02	3.96E-02	3.79E-02	3.60E-02	---------	---------	---------	---------	---------	---------	---------	---------

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste (continued)

Nuclide			WIPP TRU Waste													
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][i]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
Sm-147	α	1.06E+11 a	3.24E-08	4.73E-08	4.74E-08	4.74E-08	4.74E-08	4.74E-08	4.74E-08	------	------	------	------	------	------	------	------
Sm-148	α	7.0E+15 a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	------	------	------	------	------	------	------	------
Sm-151	β⁻, γ	90 a	6.54E+02	5.11E+02	2.37E+02	3.45E+01	2.31E-01	9.63E-15	0.00E+00	------	------	------	------	------	------	------	------
Sn-121m	β⁻, γ, *IT*e⁻	55 a	2.58E-03	1.66E-03	4.14E-04	1.29E-05	1.57E-09	0.00E+00	0.00E+00	------	------	------	------	------	------	------	------
Sn-126	β⁻, γ	1.0E+05 a	1.05E-03	1.05E-03	1.05E-03	1.05E-03	1.05E-03	1.02E-03	9.82E-04	------	------	------	------	------	------	------	------
Sr-90	β⁻	29.1 a	3.78E+05	1.76E+05	1.63E+04	4.25E+01	8.12E-06	0.00E+00	0.00E+00	------	------	------	------	------	------	------	------
Tc-99	β⁻, γ	2.13E+05 a	3.06E+02	3.06E+02	3.05E+02	3.05E+02	3.05E+02	3.01E+02	2.96E+02	------	------	------	------	------	------	------	------
Te-123	ε	1.0E+13 a	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	------	------	------	------	------	------	------	------
Te-123m	*IT*	119.7 d	3.55E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	------	------	------	------	------	------	------	------
Te-125m	γ, *IT*e⁻	58 d	1.18E+00	3.94E-04	5.33E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	------	------	------	------	------	------	------	------
Th-227	α, γ	18.72 d	3.53E-01	6.68E-01	8.45E-01	8.77E-01	9.37E-01	1.39E+00	2.12E+00	------	------	------	------	------	------	------	------
Th-228	α, γ	1.913 a	1.65E+01	1.39E+01	7.43E+00	3.78E+00	3.41E+00	3.41E+00	3.41E+00	------	------	------	------	------	------	------	------
Th-229	α, γ	7.3E+03 a	1.54E+00	5.21E+00	1.66E+01	4.46E+01	1.14E+02	4.57E+02	7.30E+02	------	------	------	------	------	------	------	------
Th-230	α, γ	7.54e+04 a	9.72E-02	1.80E-01	6.01E-01	2.10E+00	7.01E+00	3.31E+01	6.41E+01	------	------	------	------	------	------	------	------
Th-231	β⁻, γ	1.063 d	3.14E+00	4.95E+00	5.01E+00	5.15E+00	5.51E+00	7.59E+00	9.88E+00	------	------	------	------	------	------	------	------
Th-232	α, γ	1.4E+10 a	3.42E+00	3.42E+00	3.42E+00	3.42E+00	3.42E+00	3.42E+00	3.42E+00	------	------	------	------	------	------	------	------
Th-234	β⁻, γ	24.10 d	7.21E+01	2.15E+02	2.15E+02	2.15E+02	2.15E+02	2.15E+02	2.15E+02	------	------	------	------	------	------	------	------
Tl-207	β⁻, γ	4.77 m	3.56E-01	6.74E-01	8.53E-01	8.86E-01	9.46E-01	1.40E+00	2.14E+00	------	------	------	------	------	------	------	------
Tl-208	β⁻, γ	3.053 m	5.88E+00	4.95E+00	2.64E+00	1.34E+00	1.21E+00	1.21E+00	1.21E+00	------	------	------	------	------	------	------	------
Tl-209	β⁻, γ	2.2 m	3.38E-02	1.14E-01	3.65E-01	9.80E-01	2.51E+00	1.00E+01	1.60E+01	------	------	------	------	------	------	------	------
U-232	α, γ, *SF*	70 a	1.39E+01	1.02E+01	3.90E+00	3.51E-01	6.73E-04	1.27E-20	0.00E+00	------	------	------	------	------	------	------	------
U-233	α, γ, *SF*	1.592E+05 a	1.23E+03	1.23E+03	1.23E+03	1.22E+03	1.22E+03	1.20E+03	1.18E+03	------	------	------	------	------	------	------	------
U-234	α, γ, *SF*	2.46E+05 a	2.27E+02	3.44E+02	5.65E+02	7.23E+02	7.48E+02	7.42E+02	7.34E+02	------	------	------	------	------	------	------	------
U-235	α, γ, *SF*	7.04E+08 a	4.99E+00	5.01E+00	5.07E+00	5.21E+00	5.58E+00	7.69E+00	1.00E+01	------	------	------	------	------	------	------	------
U-236	α, γ, *SF*	2.342E+07 a	2.78E+00	2.87E+00	3.16E+00	3.85E+00	5.56E+00	1.38E+01	2.03E+01	------	------	------	------	------	------	------	------
U-237	β⁻, γ	6.75 d	2.06E+01	1.10E+01	8.94E-02	9.66E-07	4.34E-07	3.19E-07	2.12E-07	------	------	------	------	------	------	------	------

Table 2: 40CFR191 Unit of Waste for WIPP-Scale TRU Waste (continued)

Nuclide			WIPP TRU Waste													
ID	Decay Mode[a]	Half-life[a]	Total Inventory [Curies]							Transuranic Inventory [α-curies][i]							% of Unit of Waste
			2001[b]	2033[c]	2133[d]	2383[e]	3033[f]	7033[g]	12,033[h]	2001	2033	2133	2383	3033	7033	12,033	2033
U-238	α, γ, *SF*	4.47E+09 a	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	--------	--------	--------	--------	--------	--------	--------	--------
U-240	β⁻, γ	14.1 h	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.48E-03	--------	--------	--------	--------	--------	--------	--------	--------
Y-90	β⁻, γ	2.67 d	3.73E+05	1.74E+05	1.61E+04	4.20E+01	8.03E-06	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Y-91	*IT*, β⁻	49.71 m	4.07E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Zn-65	β⁺, γ, ε	243.8 d	1.65E-10	6.18E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
Zr-93	β⁻, γ	1.5E+06 a	3.42E-01	3.42E-01	3.42E-01	3.42E-01	3.42E-01	3.42E-01	3.41E-01	--------	--------	--------	--------	--------	--------	--------	--------
Zr-95	β⁻, γ	64.02 d	9.78E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--------	--------	--------	--------	--------	--------	--------	--------
		Total: WUF	6.31E+06	3.53E+06	1.72E+06	1.05E+06	7.64E+05	5.68E+05	4.80E+05	2.62E+06	2.32E+06 **2.32**	1.64E+06	1.04E+06	7.60E+05	5.61E+05	4.70E+05	100

(a) Decay mode and half-life information taken from *Nuclides and Isotopes* (also called the "Chart of the Nuclides"), 14th Ed. (General Electric 1989).

(b) Radionuclide inventory information taken from *Radionuclide Activities in TRU Waste Stream from TWBID Revision 2.1 Version 3.13 Data Version D.4.15.* (LANL 2005). The inventory information given in LANL (2005) has been decayed through 2001. The total curies are "WIPP-Scale" estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

(c) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 2033 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005a). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(d) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 2133 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005b). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(e) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 2383 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005c). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(f) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 3033 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005d). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(g) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 7033 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005e). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(h) Decayed radionuclide inventory information taken from *Unit Conversion and Data Transfer for Decay to 12033 Using ORIGEN, Version 2.2:Post CRA Performance Assessment Baseline Calculation, Revision 0* (Leigh and Fox 2005f). Radionuclide decay was performed using ORIGEN2 Version 2.2.

(i) Transuranic inventory data corresponds to the activity (curie) data only for radionuclides that are categorized as "transuranic waste" per definitions in 40CFR191.

4. RELEVANT PROCEDURES AND REFERENCES

4.1 PROCEDURES

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4.2 REFERENCES

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