OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SPECIAL INSTRUCTION SHEET

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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
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Attachment II is the electronic media (CD) for this document.

Revision History

10. Revision No.	11. Description of Revision
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TABLES

1. PURPOSE

The purpose of this calculation is to perform a parametric study to determine the effects of fission product leaching, assembly collapse, and iron oxide loss (ΔFe_2O_3) on the reactivity of a waste package (WP) containing mixed oxide (MOX) spent nuclear fuel (SNF). Previous calculations (CRWMS M&O 1998a) have shown that the criticality control features of the WP are adequate to prevent criticality of a flooded WP for all the enrichment/ burnup pairs expected for the MOX SNF. Therefore, the objective of this calculation is to determine the increase in reactivity that might result from possible degradation of the WP criticality control features. Specifically, this calculation tests the sensitivity of effective neutron multiplication factor (k_{eff}) to loss (from the WP) of the following: (1) fission product neutron absorbers, or (2) moderator displacement material (principally, the iron oxide that results from the corrosion of carbon steel).

This calculation, prepared in accordance with the Procedure AP-3.12Q/Rev. 0/ICN 0, supports the activity outlined in CRWMS M&O (1999).

2. METHOD

The calculational method used to perform the reactivity calculations consisted of using the MCNP code (Section 4.1.1) to calculate k_{eff} for the various WP configurations. The calculations were performed using continuous energy cross-section libraries from the Evaluated Nuclear Data File, ENDF/B-V. The results reported from the MCNP calculations were the combined average values of k_{eff} from the three estimates (collision, absorption, and track length) listed in the final generation summary in the MCNP output. The base MCNP input is taken from CRWMS M&O (1998a, Attachment IV).

3. ASSUMPTIONS

3.1 All fission products and actinides, other than U and Pu, are assumed to have the same average solubility, whereas U and Pu isotopes are assumed to be insoluble. The basis for this assumption is that it is conservative. This assumption is used in Section 5.

4. USE OF COMPUTER SOFTWARE AND MODELS

4.1 SOFTWARE APPROVED FOR QUALITY ASSURANCE (QA) WORK

4.1.1 MCNP

The MCNP code was used to calculate the k_{eff} of the various WP configurations. The software specifications are as follows:

- Program Name: MCNP
- Version/Revision Number: Version 4B2
- Computer Software Configuration Item (CSCI) Number: 30033 V4B2LV
- Computer Type: Hewlett Packard (HP) 9000 Series Workstations

The input and output files for the various MCNP calculations are documented in Attachment II of this calculation, as described in Section 7, such that an independent repetition of the MCNP calculations may be performed. CRWMS M&O (1998b) provides the software qualification report. The MCNP software used was: (a) appropriate for the WP k_{eff} calculations, (b) used only within the range of validation documented throughout CRWMS M&O (1998b), and (c) obtained from the Software Configuration Manager in accordance with appropriate procedures.

4.2 SOFTWARE ROUTINES

None used.

4.3 MODELS

None used.

5. CALCULATION

The reactivity calculations are detailed calculations of the k_{eff} for MOX SNF configurations, as shown in Figure 5-1 for the nominal pitch and fully collapsed cases. The MCNP input and output files are presented in Attachment II. The k_{eff} results for the reactivity calculations are presented in Section 6.1. These results include the AENCF value (average energy of a neutron causing fission), which is calculated using Equation 5-1 (Eq. 5-1).

Eq. 5-1 AENCF (MeV) = energy per source particle/ weight per source particle

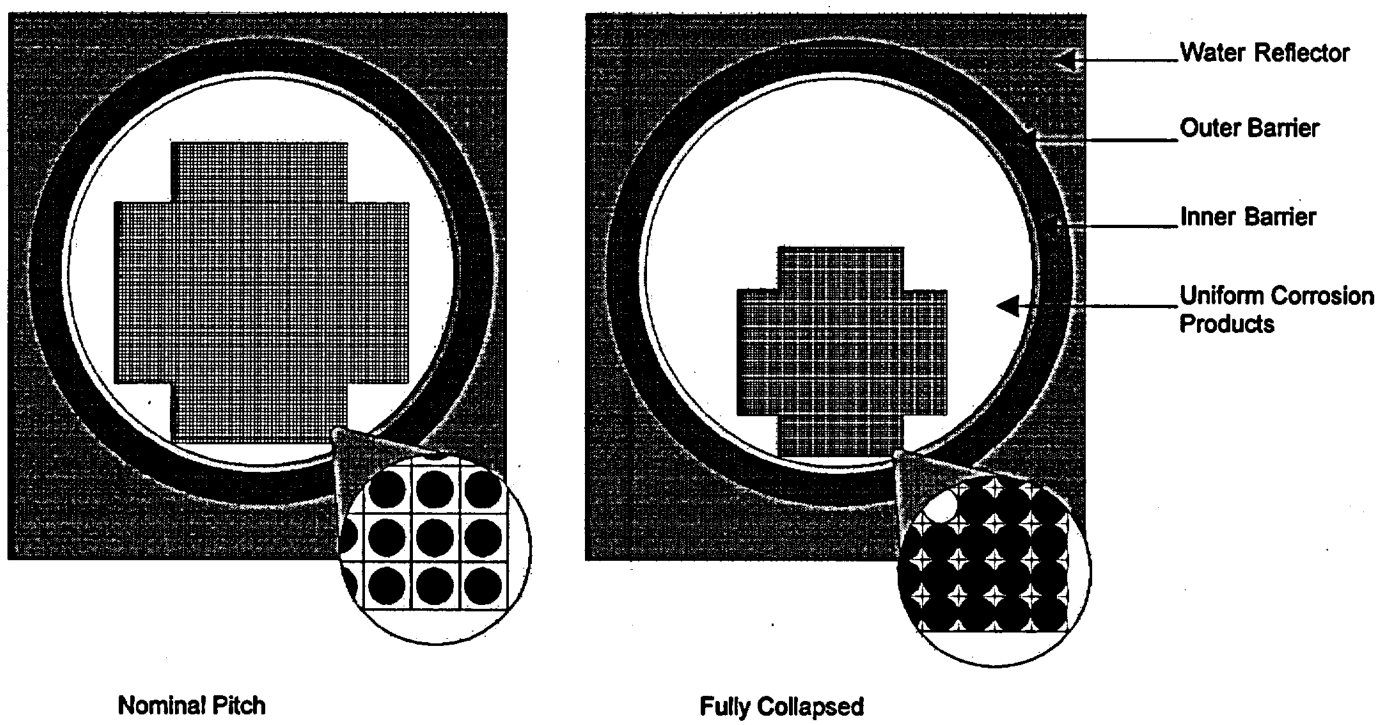

Figure 5-1. Degraded 21 PWR Fuel Waste Package with Uniform Corrosion Product Distribution

5.1 SOURCE INFORMATION

This calculation uses information retrieved from source documentation. This calculation is based on source information taken from a published report (CRWMS M&O 1998a) prepared under the Office of Civilian Radioactive Waste Management (OCRWM) QA program. Because the source information is based on the assumptions listed in CRWMS M&O (1998a, pp. 6-7), and because the fuel represented in the MCNP input files taken from CRWMS M&O (1998a, Attachment IV) is based on assumed enrichments and burnup curves, the source information should be considered unqualified data. Because of this, the results reported in Section 6 must be verified prior to use in quality affecting activities, or use in analyses affecting procurement, fabrication, or construction.

The base MCNP input and number densities are taken from CRWMS M&O (1998a, Attachment IV), which was developed under the OCRWM QA program. Table 5-1 lists the number densities taken from the reference for the 4.0 weight percent (wt%) of fissile Pu/35.6 gigawatt-days per metric ton of heavy metal (GWd/MTHM) cases and Table 5-2 lists the number densities taken from the reference for the 4.5 wt% fissile Pu/39.3 GWd/MTHM cases. These are the base values used for decreasing the fission product content in the fuel.

Table 5-1. Base-case Atom Densities (atom/b·cm) for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel

Isotope	10,000-y Decay	25,000-y Decay	45,000-y Decay	100,000-y Decay
^{16}O	4.600149×10^{-2}	4.600149×10^{-2}	4.600149×10^{-2}	4.600149×10^{-2}
^{95}Mo	3.876421×10^{-5}	3.876421×10^{-5}	3.876421×10^{-5}	3.876421×10^{-5}
^{99}Tc	4.476610×10^{-5}	4.720524×10^{-5}	4.720524×10^{-5}	4.720524×10^{-5}
^{101}Ru	4.720524×10^{-5}	4.254737×10^{-5}	3.993711×10^{-5}	3.328092×10^{-5}
^{103}Rh	4.214826×10^{-5}	4.214826×10^{-5}	4.214826×10^{-5}	4.214826×10^{-5}
^{109}Ag	1.040703×10^{-5}	1.040703×10^{-5}	1.040703×10^{-5}	1.040703×10^{-5}
^{143}Nd	3.224670×10^{-5}	3.224670×10^{-5}	3.224670×10^{-5}	3.224670×10^{-5}
^{145}Nd	2.342765×10^{-5}	2.342765×10^{-5}	2.342765×10^{-5}	2.342765×10^{-5}
^{147}Sm	1.001655×10^{-5}	1.001655×10^{-5}	1.001655×10^{-5}	1.001655×10^{-5}
^{149}Sm	1.898359×10^{-7}	1.898359×10^{-7}	1.898359×10^{-7}	1.898359×10^{-7}
^{150}Sm	1.291572×10^{-5}	1.291572×10^{-5}	1.291572×10^{-5}	1.291572×10^{-5}
^{151}Sm	4.216759×10^{-40}	N/A	N/A	N/A
^{152}Sm	6.372738×10^{-6}	6.372738×10^{-6}	6.372738×10^{-6}	6.372738×10^{-6}
^{151}Eu	1.197459×10^{-6}	1.197459×10^{-6}	1.197459×10^{-6}	1.197459×10^{-6}
^{153}Eu	5.824521×10^{-6}	5.824521×10^{-6}	5.824521×10^{-6}	5.824521×10^{-6}
^{155}Gd	2.891302×10^{-7}	2.891302×10^{-7}	2.891302×10^{-7}	2.891302×10^{-7}
^{233}U	3.312460×10^{-7}	8.308846×10^{-7}	1.445739×10^{-6}	2.863782×10^{-6}
^{234}U	3.480299×10^{-6}	3.386535×10^{-6}	3.265194×10^{-6}	2.961840×10^{-6}
^{235}U	1.164303×10^{-4}	2.169337×10^{-4}	2.987644×10^{-4}	3.822427×10^{-4}
^{236}U	1.312485×10^{-4}	1.848416×10^{-4}	1.968727×10^{-4}	1.979665×10^{-4}
^{238}U	2.136514×10^{-2}	2.136514×10^{-2}	2.136514×10^{-2}	2.136514×10^{-2}
^{237}Np	1.110894×10^{-4}	1.105449×10^{-4}	1.100003×10^{-4}	1.078221×10^{-4}
^{238}Pu	9.760772×10^{-29}	N/A	N/A	N/A
^{239}Pu	2.851152×10^{-4}	1.868368×10^{-4}	1.052982×10^{-4}	2.170763×10^{-5}
^{240}Pu	6.721718×10^{-5}	1.381985×10^{-5}	1.672364×10^{-6}	5.011713×10^{-9}
^{241}Pu	7.122154×10^{-11}	2.099161×10^{-11}	4.101933×10^{-12}	4.621368×10^{-14}
^{242}Pu	2.559761×10^{-5}	2.490435×10^{-5}	2.399776×10^{-5}	2.165132×10^{-5}
^{241}Am	2.254457×10^{-9}	6.586654×10^{-10}	1.237006×10^{-10}	1.392301×10^{-12}
^{242}Am	7.145978×10^{-29}	N/A	N/A	N/A
^{243}Am	2.294282×10^{-6}	5.576380×10^{-7}	8.550450×10^{-8}	4.843484×10^{-10}
Total	6.838521×10^{-2}	6.838284×10^{-2}	6.837897×10^{-2}	6.836814×10^{-2}

NOTE: N/A = not applicable

Table 5-2. Base-case Atom Densities (atom/b·cm) for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel

Isotope	10,000-y Decay	25,000-y Decay	45,000-y Decay	100,000-y Decay
^{16}O	4.600149×10^{-2}	4.600149×10^{-2}	4.600149×10^{-2}	4.600149×10^{-2}
^{95}Mo	4.270864×10^{-5}	4.270864×10^{-5}	4.270864×10^{-5}	4.270864×10^{-5}
^{99}Tc	5.219441×10^{-5}	5.219441×10^{-5}	5.219441×10^{-5}	5.219441×10^{-5}
^{101}Ru	4.933407×10^{-5}	4.698483×10^{-5}	4.398302×10^{-5}	3.667427×10^{-5}
^{103}Rh	4.591150×10^{-5}	4.591150×10^{-5}	4.591150×10^{-5}	4.591150×10^{-5}
^{109}Ag	1.141454×10^{-5}	1.141454×10^{-5}	1.141454×10^{-5}	1.141454×10^{-5}
^{143}Nd	3.549847×10^{-5}	3.549847×10^{-5}	3.549847×10^{-5}	3.549847×10^{-5}
^{145}Nd	2.583277×10^{-5}	2.583277×10^{-5}	2.583277×10^{-5}	2.583277×10^{-5}
^{147}Sm	1.089519×10^{-5}	1.089519×10^{-5}	1.089519×10^{-5}	1.089519×10^{-5}
^{149}Sm	2.773858×10^{-7}	2.773858×10^{-7}	2.773858×10^{-7}	2.773858×10^{-7}
^{150}Sm	1.437950×10^{-5}	1.437950×10^{-5}	1.437950×10^{-5}	1.437950×10^{-5}
^{151}Sm	4.558900×10^{-40}	N/A	N/A	N/A
^{152}Sm	6.899550×10^{-6}	6.899550×10^{-6}	6.899550×10^{-6}	6.899550×10^{-6}
^{151}Eu	1.291545×10^{-6}	1.291545×10^{-6}	1.291545×10^{-6}	1.291545×10^{-6}
^{153}Eu	6.491387×10^{-6}	6.491387×10^{-6}	6.491387×10^{-6}	6.491387×10^{-6}
^{155}Gd	3.349578×10^{-7}	3.349578×10^{-7}	3.349578×10^{-7}	3.349578×10^{-7}
^{233}U	3.606039×10^{-7}	9.084338×10^{-7}	1.573141×10^{-6}	3.118587×10^{-6}
^{234}U	3.893964×10^{-6}	3.783653×10^{-6}	3.640250×10^{-6}	3.281740×10^{-6}
^{235}U	1.186271×10^{-4}	2.218765×10^{-4}	3.064532×10^{-4}	3.926775×10^{-4}
^{236}U	1.449202×10^{-4}	2.039820×10^{-4}	2.171068×10^{-4}	2.187475×10^{-4}
^{238}U	2.120246×10^{-2}	2.120246×10^{-2}	2.120246×10^{-2}	2.120246×10^{-2}
^{237}Np	1.208915×10^{-4}	1.203469×10^{-4}	1.198023×10^{-4}	1.176241×10^{-4}
^{238}Pu	7.320579×10^{-29}	N/A	N/A	N/A
^{239}Pu	2.942950×10^{-4}	1.927767×10^{-4}	1.085382×10^{-4}	2.240962×10^{-5}
^{240}Pu	7.474551×10^{-5}	1.527174×10^{-5}	1.849817×10^{-6}	5.538696×10^{-9}
^{241}Pu	8.942855×10^{-11}	2.623952×10^{-11}	5.135448×10^{-12}	5.783403×10^{-14}
^{242}Pu	2.879732×10^{-5}	2.799739×10^{-5}	2.698415×10^{-5}	2.437106×10^{-5}
^{241}Am	2.822087×10^{-9}	8.246706×10^{-10}	1.547596×10^{-10}	1.745731×10^{-12}
^{242}Am	5.332819×10^{-29}	N/A	N/A	N/A
^{243}Am	2.634176×10^{-6}	6.426114×10^{-7}	9.825051×10^{-8}	5.576380×10^{-10}
Total	6.829658×10^{-2}	6.829265×10^{-2}	6.828811×10^{-2}	6.827699×10^{-2}

5.2 PARAMETERS

This calculation involves varying five parameters: enrichment/burnup, decay time, rod spacing, fission product concentration, and iron oxide concentration. The first two parameters, enrichment/burnup and decay time, affect the atom densities of all of the isotopes in the fuel material. The enrichment is the initial wt% of ^{239}Pu in the plutonium. The burnup is measured in GWd/MTHM.

The third parameter, rod spacing, affects the neutron spectrum of the system, by varying the amount of moderator (water) interspersed through the lattice. The rod spacing is decreased in steps of 25% of the inital spacing. The new lattice pitch (P), adjusted for the spacing decrease, is calculated using Eq. 5-2.

Eq. 5-2 $$P = D_R + (P_o - D_R)\cdot(1-\Delta S)$$

where:
P = Adjusted lattice pitch, cm
P_o = Initial lattice pitch, 1.25984 cm (CRWMS M&O 1998a, p. 9)
D_R = Outer diameter of the fuel rod, 0.9144 cm (CRWMS M&O 1998a, p. 9)
Δs = Change in spacing as a percentage of the initial spacing

When the fuel rods around the guide tubes collapse, they are arranged into some irregular lattice because the guide tubes have a larger diameter than the fuel rods. Because the actual locations of the rods and tubes cannot be predicted, the random lattice was approximated with a rectangular one. It is then necessary to decrease the guide tube radius so that a square pitch lattice can be maintained. When this is done, the thickness of the cladding for the guide tube is maintained, as the outer and inner diameters are decreased. This decreases the guide tube volume and the volume of water it can contain. However, the total mass of water available for moderation must be preserved. Therefore, the density of the water in the guide tube cell is increased so that the mass of water is conservatively maintained as the volume of the cell is decreased.

For the water inside the guide tube, this increase in water density is accomplished using Eq. 5-3.

Eq. 5-3 $$\rho = \frac{\rho_o IR_o^2}{IR^2}$$

where:
ρ = Adjusted water density, g/cm^3
ρ_o = Initial water density, 1.000 g/cm^3 (CRWMS M&O 1998a, p. 11)
IR = Adjusted guide tube inner radius, cm
IR_o = Initial guide tube inner radius, 0.5715 cm (CRWMS M&O 1998a, p. 9)

For the water outside the guide tube, but inside the guide tube cell, this increase in water density is accomplished using Eq. 5-4.

Eq. 5-4 $$\rho = \frac{\rho_o((2OR_o)^2 - \pi OR_o^2)}{((2OR)^2 - \pi OR^2)}$$

where: ρ = Adjusted water density, g/cm^3
ρ_o = Initial water density, 0.10103 atom/b·cm (CRWMS M&O 1998a, Attachment IV)
OR = Adjusted guide tube outer radius, cm (= ½ P_i, from Eq. 5-2)
OR_o = Initial guide tube outer radius, 0.61214 cm (CRWMS M&O 1998a, p. 9)

The fourth parameter is fission product concentration. This parameter affects the amount of parasitic absorption occurring in the fuel material. All fission products are conservatively assumed to have the same average solubility while U and Pu isotopes are assumed to be insoluble. The amount (atom density) of fission products in the fuel is decreased in steps of 25% of the initial amount, while the atom densities for the actinides and for oxygen remain unchanged. This is intended to represent fission product leaching (FPL) over time. The new isotopic atom densities (N_i), adjusted for the FPL, are calculated using Eq. 5-5.

Eq. 5-5 $$N_i = N_i^o(1 - \Delta_f)$$

where: N_i = Adjusted fission product atom density for isotope "i", atom/b·cm
N_i^o = Initial fission product atom density for isotope "i", atom/b·cm
Δ_f = Change in fission product atom densities as a percentage of the initial fission product atom densities

The fifth parameter is iron oxide concentration. This parameter affects the amount of parasitic absorption and the moderator displacement occurring in the moderator material interspersed through the lattice. The amount (moles) of the iron oxide, in the form of hematite (Fe_2O_3) present in the water, is decreased by up to 75% in four steps (10%, 25%, 50%, and 75% of the initial amount). The hematite is replaced with water (H_2O). The new iron atom densities (N_{Fe}), adjusted for the iron oxide loss, are calculated using Eq. 5-6. The adjusted hydrogen atom densities (N_H) are calculated using Eq. 5-7. The adjusted oxygen atom densities (N_O) are calculated using Eq. 5-8.

Eq. 5-6 $$N_{Fe} = N_{Fe}^o - \frac{2 \cdot N_{AV} \cdot m_{Fe}^o \cdot \Delta_C}{V}$$

where: N_{Fe} = Adjusted atom density for iron, atom/b·cm
N_{Fe}^o = Initial atom density for iron, atom/b·cm
m_{Fe}^o = Initial number of moles of hematite, 58103.5 moles (CRWMS M&O 1998a, p. 14)
Δ_C = Change in iron atom densities as a percentage of the initial iron atom densities
N_{Av} = Avagadro's Number, 6.022 x 10^{23} atom/mole
V = Void volume in a loaded WP, 5530485.47 cm^3 (CRWMS M&O 1998a, Attachment I)

Eq. 5-7
$$N_H = N_H^o + \frac{2 \cdot C \cdot (V_{Hem}^o - V_{Hem})\, \rho_{Wat} \cdot N_{Av}}{V \cdot M_{Wat}}$$

where:

N_H = Adjusted atom density for hydrogen, atom/b·cm
N_H^o = Initial atom density for hydrogen, atom/b·cm
ρ_{Wat} = Density of water, 1.000 g/cm^3 (CRWMS M&O 1998a, p. 11)
V_{Hem}^o = Initial volume occupied by hematite, 1,770,700 cm^3 (CRWMS M&O 1998a, p. 14)
V_{Hem} = New volume occupied by hematite, cm^3 (CRWMS M&O 1998a, p. 14)
V = Void volume in a loaded WP, 5,530,485.47 cm^3 (CRWMS M&O 1998a, Attachment I)
N_{Av} = Avagadro's Number, 6.022 x 10^{23} atom/mole
M_{Wat} = Molecular weight of water
C = Factor for converting cm^2 to b, 1 x 10^{-24} cm^2/b

Eq. 5-8
$$N_O = N_O^o - \frac{3}{2}(N_{Fe}^o - N_{Fe}) + \frac{1}{2}(N_H^o - N_H)$$

where:

N_O = Adjusted atom density for oxygen, atom/b·cm
N_O^o = Initial atom density for oxygen, atom/b·cm
N_H = Adjusted atom density for hydrogen, atom/b·cm
N_H^o = Initial atom density for hydrogen, atom/b·cm
N_{Fe}^o = Initial atom density for iron, atom/b·cm
N_{Fe} = Adjusted atom density for iron, atom/b·cm

A naming system was established for naming the MCNP input and output files so that the calculation could be identifiable using only a short name. For the purposes of this calculation, four- or five-letter names are used for the files. In this naming system, the first letter identifies the enrichment/burnup, the second letter identifies the decay time, the third identifies the Δ_S, and the fourth letter identifies the Δ_f. For cases containing no change in the iron oxide, there is no fifth letter. Cases that do contain adjusted iron oxide do have a fifth letter in the file name. Table 5-3 lists the identifying letter used for each of the parametric values. As an example, the case involving 4.0 wt% fissile Pu/35.6 GWd/MTHM fuel decayed over 10,000 years, with a spacing between rods decreased by 50% and the fission products reduced by 25%, is named "aacb" for the purposes of this calculation. This naming system is used consistently throughout this calculation. An "o" as the sixth letter, or a ".out" suffix, indicates that the file is an "output" file.

Table 5-3. Parametric Identifiers

Identifier	Enrichment/Burnup (wt% of ^{239}Pu)	Enrichment/Burnup (GWd/MTHM)	Decay Time (y)	Δ_s (%)	Δ_f (%)	ΔFe_2O_3 (%)
a	4.0	35.6	10,000	0	0	10
b	4.5	39.3	25,000	25	25	25
c	N/A	N/A	45,000	50	50	50
d	N/A	N/A	100,000	75	75	75
e	N/A	N/A	N/A	100	100	N/A

5.3 WASTE PACKAGE PARAMETERS

The intact waste package geometry parameters used in this calculation, which represent the Viability Assessment design, are listed in Table 5-4 as taken from CRWMS M&O (1998a).

Table 5-4. Waste Package Dimensions

Component	21 PWR WP Dimensions (cm)	Material (CRWMS M&O 1998a, p. 10)
Outer barrier length (skirt edge to skirt edge)	533.50	A 516 Carbon Steel
Outer barrier skirt length (both ends)	22.50	
Outer barrier lid thickness	11.00	
Outer barrier inner radius	73.17	
Outer barrier outer radius	83.17	
Gap between inner and outer lids	3.00	N/A
Inner barrier length (overall)	463.50	Alloy 22 (UNS N06022)
Inner barrier lid thickness	2.50	
Inner barrier inner radius	71.17	
Inner barrier outer radius	73.17	

6. RESULTS

The presentation of results is arranged to emphasize the sensitivity of k_{eff} to the most relevant parameters associated with waste package degradation. The cases varying these degradation parameters are divided into two major sets. Tables 6-1 through 6-10 emphasize the variation of k_{eff} with fission product loss for a range of times since discharge and degree of assembly collapse (or interpin pitch). Tables 6-1 through 6-5 are for the 4.0 wt% fissile Pu/35.6 GWd/MTHM fuel; Tables 6-6 through 6-10 are for the 4.5 wt% fissile Pu/39.3 GWd/MTHM fuel. In each of these two table subsets, the individual tables correspond to different degrees of assembly collapse: 0%, 25%, 50%, 75%, and 100%. These correspond to a square lattice with the following interpin spacings (center to center, cm): 1.260, 1.173, 1.087, 1.001, and 0.914. Each of these tables is divided into four blocks according to the time since discharge: 10, 25, 45, and 100 thousand years. Within each block the lines cycle through the values of fission product loss: 0%, 25%, 50%, 75%, and 100%.

The second major table set, consisting of Tables 6-11 and 6-12, emphasizes the variation of k_{eff} with iron oxide loss for a range of times since discharge and degree of assembly collapse (or interpin pitch). Fewer cases were run for this set, corresponding to two bounding time values (25,000 years and 100,000 years) and two bounding degrees of collapse (0 and 100%), hence, fewer number of tables and fewer lines per table.

In both of these sets, the k_{eff} results represent the average combined collision, absorption, and track-length estimator from the MCNP calculations. The standard deviation (σ) represents the standard deviation of k_{eff} about the average combined collision, absorption, and track-length estimate due to the Monte Carlo calculation statistics. The AENCF values are calculated using Eq. 5-1.

Figure 6-1 is a plot of k_{eff} as a function of fission product loss at the two extreme collapse rates of 0 and 100% and at decay times of 25,000 and 100,000 years for the 4.0 wt% fissile Pu/35.6 GWd/MTHM fuel, which is the fuel with the higher reactivity. Figure 6-2 is a plot of k_{eff} as a function of iron oxide loss at the two extreme collapse rates of 0 and 100% and at decay times of 25,000 and 100,000 years for the same fuel type. Both figures show an increase in k_{eff} with increase in the independent degradation parameter, fission product loss, and iron oxide loss. There is, however, one significant distinction. All the curves in Figure 6-1 (which are approximately straight lines) are approximately parallel, indicating that the k_{eff} increase with increasing fission product loss is relatively independent of assembly collapse. Figure 6-2 shows that the slope of the lines decreases with increasing collapse. This is because the collapsed configuration has little room for iron oxide between the fuel pins, so the loss of iron oxide doesn't make much difference.

After the two major table presentations, which are divided according to fission product loss versus iron oxide loss, a summary tabulation of all the results together is given in Tables 6-13 and 6-14. These summarize the change in system reactivity (Δk_{eff}) in reference to the base case of 10,000 years decay, 0% decrease in spacing, 0% decrease in fission product concentrations, and 0% decrease in iron oxide concentration for the two fuel types 4.0 wt% fissile Pu/35.6 GWd/MTHM and 4.5 wt% fissile Pu/39.3 GWd/MTHM, respectively. The base cases are cases "aaaa" and "baaa" for the two fuel types, respectively. All the cases in these tables summarize the change in system reactivity (Δk_{eff}) in reference to the base case of 10,000-years decay, 0% decrease in spacing, 0% decrease in fission product concentrations, and 0% decrease in iron oxide concentration for the two fuel types 4.0 wt% fissile Pu/35.6 GWd/MTHM and 4.5 wt% fissile Pu/39.3 GWd/MTHM, respectively. The base cases are cases "aaaa" and "baaa" for the two fuel types, respectively.

Because the source information is based on the assumptions listed in CRWMS M&O (1998a, pp. 6-7), and because the fuel represented in the MCNP input files taken from CRWMS M&O (1998a, Attachment IV) is based on assumed enrichments and burnup curves, the source information should be considered unqualified data. Because of this, the results reported in Section 6 must be verified prior to use in quality affecting activities, or use in analyses affecting procurement, fabrication, or construction.

Table 6-1. Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel, 0% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
aaaa.out	10000	0	0.83855	0.00125	0.273282
aaab.out	10000	25	0.85792	0.00118	0.266935
aaac.out	10000	50	0.87967	0.00135	0.259826
aaad.out	10000	75	0.90477	0.00125	0.252454
aaae.out	10000	100	0.92546	0.00115	0.249141
abaa.out	25000	0	0.84689	0.00116	0.256209
abab.out	25000	25	0.86969	0.00116	0.249169
abac.out	25000	50	0.89478	0.00105	0.243963
abad.out	25000	75	0.92102	0.00155	0.238047
abae.out	25000	100	0.94725	0.00114	0.230749
acaa.out	45000	0	0.82322	0.00129	0.251909
acab.out	45000	25	0.85307	0.00119	0.24510
acac.out	45000	50	0.87607	0.00116	0.238006
acad.out	45000	75	0.90313	0.00110	0.229325
acae.out	45000	100	0.93413	0.00129	0.222779
adaa.out	100000	0	0.77119	0.00099	0.246030
adab.out	100000	25	0.80710	0.00106	0.252329
adac.out	100000	50	0.82493	0.00088	0.234285
adad.out	100000	75	0.85406	0.00122	0.224065
adae.out	100000	100	0.88775	0.00084	0.217058

Table 6-2. Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel, 25% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
aaba.out	10000	0	0.82454	0.00116	0.314828
aabb.out	10000	25	0.84092	0.00126	0.308582
aabc.out	10000	50	0.86199	0.00114	0.300378
aabd.out	10000	75	0.88537	0.00123	0.292885
aabe.out	10000	100	0.91032	0.00124	0.282760
abba.out	25000	0	0.83435	0.00122	0.295026
abbb.out	25000	25	0.85955	0.00123	0.287559
abbc.out	25000	50	0.88176	0.00131	0.280420
abbd.out	25000	75	0.90956	0.00118	0.271029
abbe.out	25000	100	0.93708	0.00118	0.260653
acba.out	45000	0	0.81886	0.00102	0.286026
acbb.out	45000	25	0.84284	0.00108	0.278161
acbc.out	45000	50	0.87086	0.00119	0.269130
acbd.out	45000	75	0.90064	0.00117	0.259508
acbe.out	45000	100	0.93458	0.00104	0.251434
adba.out	100000	0	0.76691	0.00116	0.284240
adbb.out	100000	25	0.80878	0.00115	0.283810
adbc.out	100000	50	0.82553	0.00112	0.263707
adbd.out	100000	75	0.85403	0.00121	0.255345
adbe.out	100000	100	0.88927	0.00110	0.244877

Table 6-3. Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel, 50% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
aaca.out	10000	0	0.79430	0.00125	0.369269
aacb.out	10000	25	0.81232	0.00136	0.360445
aacc.out	10000	50	0.83460	0.00127	0.351134
aacd.out	10000	75	0.85590	0.00133	0.341036
aace.out	10000	100	0.88350	0.00134	0.334921
abca.out	25000	0	0.81048	0.00124	0.345012
abcb.out	25000	25	0.83403	0.00140	0.332472
abcc.out	25000	50	0.86054	0.00142	0.326434
abcd.out	25000	75	0.88581	0.00110	0.318255
abce.out	25000	100	0.91862	0.00130	0.305876
acca.out	45000	0	0.79948	0.00125	0.336472
accb.out	45000	25	0.82622	0.00105	0.322033
accc.out	45000	50	0.85599	0.00112	0.310370
accd.out	45000	75	0.88447	0.00107	0.30245
acce.out	45000	100	0.91738	0.00137	0.291156
adca.out	100000	0	0.75335	0.00100	0.3297
adcb.out	100000	25	0.79546	0.00098	0.331082
adcc.out	100000	50	0.81195	0.00096	0.30454
adcd.out	100000	75	0.84380	0.00104	0.293553
adce.out	100000	100	0.87957	0.00096	0.280466

Table 6-4. Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel, 75% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
aada.out	10000	0	0.75244	0.00127	0.449438
aadb.out	10000	25	0.77058	0.00107	0.436800
aadc.out	10000	50	0.79091	0.00146	0.422159
aadd.out	10000	75	0.81550	0.00151	0.418345
aade.out	10000	100	0.84204	0.00148	0.402749
abda.out	25000	0	0.77559	0.00123	0.418364
abdb.out	25000	25	0.79788	0.00145	0.404682
abdc.out	25000	50	0.81985	0.00137	0.390852
abdd.out	25000	75	0.84708	0.00127	0.382089
abde.out	25000	100	0.87748	0.00120	0.366047
acda.out	45000	0	0.76796	0.00117	0.402268
acdb.out	45000	25	0.79340	0.00117	0.387657
acdc.out	45000	50	0.82122	0.00131	0.376175
acdd.out	45000	75	0.85183	0.00129	0.360937
acde.out	45000	100	0.88529	0.00131	0.351000
adda.out	100000	0	0.72904	0.00111	0.394942
addb.out	100000	25	0.76830	0.00088	0.393812
addc.out	100000	50	0.78670	0.00098	0.365278
addd.out	100000	75	0.81809	0.00098	0.351284
adde.out	100000	100	0.85660	0.00106	0.338571

Table 6-5. Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel, 100% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
aaea.out	10000	0	0.71093	0.00128	0.550114
aaeb.out	10000	25	0.72484	0.00128	0.538684
aaec.out	10000	50	0.74631	0.00115	0.524844
aaed.out	10000	75	0.76518	0.00146	0.511534
aaee.out	10000	100	0.78893	0.00137	0.500746
abea.out	25000	0	0.72547	0.00123	0.517965
abeb.out	25000	25	0.74631	0.00128	0.505014
abec.out	25000	50	0.76777	0.00138	0.490907
abed.out	25000	75	0.79567	0.00136	0.473923
abee.out	25000	100	0.82162	0.00135	0.459427
acea.out	45000	0	0.72511	0.00126	0.493645
aceb.out	45000	25	0.74918	0.00139	0.476697
acec.out	45000	50	0.77495	0.00109	0.464322
aced.out	45000	75	0.80146	0.00112	0.447331
acee.out	45000	100	0.83403	0.00149	0.433827
adea.out	100000	0	0.69360	0.00120	0.485228
adeb.out	100000	25	0.73466	0.00131	0.483467
adec.out	100000	50	0.74730	0.00118	0.451890
aded.out	100000	75	0.77665	0.00093	0.432442
adee.out	100000	100	0.81507	0.00113	0.416798

Table 6-6. Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel, 0% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
baaa.out	10000	0	0.82764	0.00111	0.275705
baab.out	10000	25	0.84925	0.00101	0.268049
baac.out	10000	50	0.87286	0.00129	0.263741
baad.out	10000	75	0.89758	0.00119	0.256064
baae.out	10000	100	0.92293	0.00128	0.248748
bbaa.out	25000	0	0.83466	0.00127	0.259694
bbab.out	25000	25	0.86027	0.00115	0.254974
bbac.out	25000	50	0.88643	0.00121	0.2465
bbad.out	25000	75	0.91894	0.00123	0.238605
bbae.out	25000	100	0.94949	0.00126	0.228553
bcaa.out	45000	0	0.81323	0.00118	0.253022
bcab.out	45000	25	0.84098	0.00114	0.247098
bcac.out	45000	50	0.86988	0.00123	0.239408
bcad.out	45000	75	0.90427	0.00120	0.232203
bcae.out	45000	100	0.93911	0.00120	0.221019
bdaa.out	100000	0	0.75896	0.00104	0.253505
bdab.out	100000	25	0.78903	0.00115	0.244246
bdac.out	100000	50	0.81876	0.00111	0.235811
bdad.out	100000	75	0.85261	0.00097	0.227056
bdae.out	100000	100	0.89318	0.00107	0.216246

Table 6-7. Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel, 25% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
baba.out	10000	0	0.80635	0.00124	0.316082
babb.out	10000	25	0.83117	0.00121	0.314000
babc.out	10000	50	0.85441	0.00136	0.301128
babd.out	10000	75	0.88039	0.00141	0.295333
babe.out	10000	100	0.90502	0.00125	0.285282
bbba.out	25000	0	0.82065	0.00144	0.296439
bbbb.out	25000	25	0.84552	0.00125	0.288497
bbbc.out	25000	50	0.87761	0.00131	0.280616
bbbd.out	25000	75	0.90506	0.00106	0.273708
bbbe.out	25000	100	0.93639	0.00131	0.264216
bcba.out	45000	0	0.80536	0.00121	0.291187
bcbb.out	45000	25	0.83539	0.00108	0.280217
bcbc.out	45000	50	0.86464	0.00120	0.269560
bcbd.out	45000	75	0.89739	0.00126	0.262135
bcbe.out	45000	100	0.93133	0.00124	0.249864
bdba.out	100000	0	0.75435	0.00110	0.289607
bdbb.out	100000	25	0.78447	0.00109	0.277974
bdbc.out	100000	50	0.81748	0.00102	0.263824
bdbd.out	100000	75	0.85176	0.00104	0.254043
bdbe.out	100000	100	0.89320	0.00103	0.245736

Table 6-8. Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel, 50% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
baca.out	10000	0	0.77908	0.00109	0.374814
bacb.out	10000	25	0.80015	0.00134	0.366391
bacc.out	10000	50	0.82333	0.00137	0.355605
bacd.out	10000	75	0.84910	0.00143	0.346158
bace.out	10000	100	0.87219	0.00130	0.336956
bbca.out	25000	0	0.79894	0.00130	0.349424
bbcb.out	25000	25	0.82340	0.00118	0.339549
bbcc.out	25000	50	0.84952	0.00115	0.329124
bbcd.out	25000	75	0.88166	0.00124	0.322090
bbce.out	25000	100	0.90860	0.00153	0.307616
bcca.out	45000	0	0.78605	0.00087	0.338260
bccb.out	45000	25	0.81538	0.00131	0.327375
bccc.out	45000	50	0.84630	0.00123	0.314977
bccd.out	45000	75	0.88002	0.00121	0.301270
bcce.out	45000	100	0.91417	0.00118	0.290970
bdca.out	100000	0	0.74212	0.00091	0.334978
bdcb.out	100000	25	0.76900	0.00099	0.323167
bdcc.out	100000	50	0.80580	0.00107	0.308563
bdcd.out	100000	75	0.84264	0.00122	0.296057
bdce.out	100000	100	0.87986	0.00130	0.284168

Table 6-9. Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel, 75% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
bada.out	10000	0	0.74188	0.00133	0.457153
badb.out	10000	25	0.76292	0.00146	0.443100
badc.out	10000	50	0.78512	0.00140	0.434538
badd.out	10000	75	0.80901	0.00136	0.419566
bade.out	10000	100	0.83378	0.00130	0.404787
bbda.out	25000	0	0.76122	0.00139	0.423970
bbdb.out	25000	25	0.78618	0.00109	0.410791
bbdc.out	25000	50	0.81140	0.00134	0.395474
bbdd.out	25000	75	0.84281	0.00115	0.379589
bbde.out	25000	100	0.86941	0.00145	0.371741
bcda.out	45000	0	0.75423	0.00116	0.406758
bcdb.out	45000	25	0.78322	0.00125	0.393659
bcdc.out	45000	50	0.81192	0.00122	0.378110
bcdd.out	45000	75	0.84610	0.00160	0.363644
bcde.out	45000	100	0.88349	0.00133	0.349325
bdda.out	100000	0	0.71589	0.00112	0.399859
bddb.out	100000	25	0.74552	0.00116	0.386365
bddc.out	100000	50	0.77783	0.00098	0.369266
bddd.out	100000	75	0.81583	0.00125	0.352192
bdde.out	100000	100	0.85371	0.00132	0.338867

Table 6-10. Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel, 100% Collapse

Output File Name	Decay Time (y)	Δ_f (%)	k_{eff}	σ	AENCF (MeV)
baea.out	10000	0	0.69801	0.00119	0.566127
baeb.out	10000	25	0.71664	0.00129	0.550029
baec.out	10000	50	0.73673	0.00104	0.533749
baed.out	10000	75	0.75894	0.00131	0.518611
baee.out	10000	100	0.78558	0.00118	0.502126
bbea.out	25000	0	0.71780	0.00105	0.521109
bbeb.out	25000	25	0.73943	0.00107	0.507009
bbec.out	25000	50	0.76116	0.00115	0.493690
bbed.out	25000	75	0.78999	0.00116	0.475701
bbee.out	25000	100	0.81695	0.00134	0.459295
bcea.out	45000	0	0.71549	0.00103	0.502648
bceb.out	45000	25	0.74075	0.00128	0.488640
bcec.out	45000	50	0.76739	0.00153	0.466876
bced.out	45000	75	0.79822	0.00129	0.452426
bcee.out	45000	100	0.83040	0.00156	0.436062
bdea.out	100000	0	0.68286	0.00115	0.495412
bdeb.out	100000	25	0.71017	0.00106	0.475416
bdec.out	100000	50	0.73768	0.00109	0.455390
bded.out	100000	75	0.77427	0.00131	0.435151
bdee.out	100000	100	0.81237	0.00121	0.416773

Table 6-11. Results of the Iron Oxide Loss for 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel

Output File Name	ΔFe_2O_3 (%)	Δ_S (%)	Decay Time (y)	k_{eff}	σ	AENCF (MeV)
abaa.out	0	0	25,000	0.84689	0.00116	0.256209
abaaao	10	0	25,000	0.86085	0.00140	0.25067
abaabo	25	0	25,000	0.88371	0.00107	0.24043
abaaco	50	0	25,000	0.91950	0.00106	0.22931
abaado	75	0	25,000	0.95234	0.0014	0.21355
abea.out	0	100	25,000	0.72547	0.00123	0.517965
abeaao	10	100	25,000	0.73440	0.00095	0.50408
abeabo	25	100	25,000	0.74537	0.00105	0.49549
abeaco	50	100	25,000	0.76436	0.00138	0.47981
abeado	75	100	25,000	0.78441	0.00131	0.46254
adaa.out	0	0	100,000	0.77119	0.00099	0.246030
adaaao	10	0	100,000	0.78719	0.00109	0.24089
adaabo	25	0	100,000	0.80619	0.00107	0.23345
adaaco	50	0	100,000	0.84332	0.00101	0.21779
adaado	75	0	100,000	0.88409	0.00106	0.20455
adea.out	0	100	100,000	0.69360	0.00120	0.485228
adeaao	10	100	100,000	0.70139	0.00107	0.48098
adeabo	25	100	100,000	0.71517	0.00108	0.46706
adeaco	50	100	100,000	0.72881	0.00127	0.44989
adeado	75	100	100,000	0.74765	0.00138	0.43277

Table 6-12. Results of the Iron Oxide Loss for 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel

Output File Name	ΔFe_2O_3 (%)	Δ_S (%)	Decay Time (y)	k_{eff}	σ	AENCF (MeV)
bbaa.out	0	0	25,000	0.83466	0.00127	0.259694
bbaaao	10	0	25,000	0.84967	0.00132	0.25118
bbaabo	25	0	25,000	0.87010	0.00128	0.24673
bbaaco	50	0	25,000	0.90608	0.00145	0.23099
bbaado	75	0	25,000	0.93809	0.00125	0.21598
bbea.out	0	100	25,000	0.71780	0.00105	0.521109
bbeaao	10	100	25,000	0.72529	0.00130	0.51744
bbeabo	25	100	25,000	0.73629	0.00128	0.50626
bbeaco	50	100	25,000	0.74972	0.00119	0.48999
bbeado	75	100	25,000	0.77257	0.00129	0.47094
bdaa.out	0	0	100,000	0.75896	0.00104	0.253505
bdaaao	10	0	100,000	0.77254	0.00111	0.24684
bdaabo	25	0	100,000	0.79500	0.00099	0.23629
bdaaco	50	0	100,000	0.83050	0.00120	0.22028
bdaado	75	0	100,000	0.86642	0.00111	0.20838
bdea.out	0	100	100,000	0.68286	0.00115	0.495412
bdeaao	10	100	100,000	0.68877	0.00127	0.48936
bdeabo	25	100	100,000	0.69930	0.00128	0.47625
bdeaco	50	100	100,000	0.71312	0.00122	0.45720
bdeado	75	100	100,000	0.73223	0.00113	0.44265

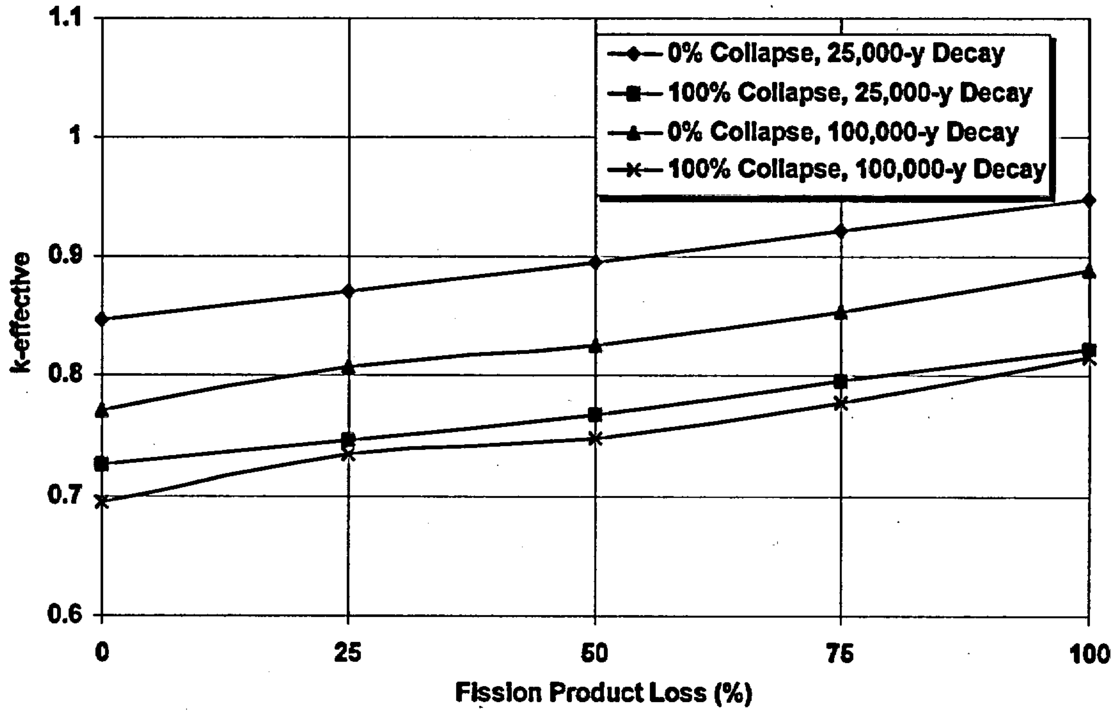

Figure 6-1. k_{eff} as a Function of Fission Product Loss (4.0 wt% fissile Pu/35.6 GWd/MTHM)

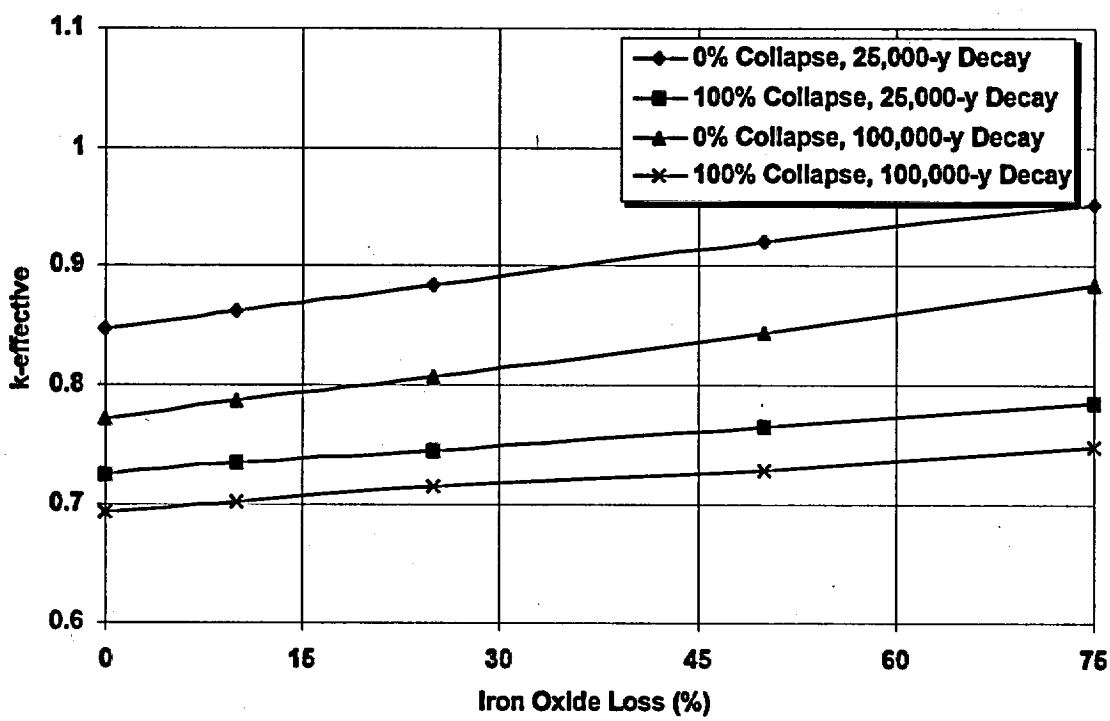

Figure 6-2. k_{eff} as a Function of Iron Oxide Loss (4.0 wt% fissile Pu/35.6 GWd/MTHM)

Table 6-13. Summary of Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_s (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
aaaa.out	10,000	0	0	0	0.00000
aaab.out	10,000	0	25	0	0.01937
aaac.out	10,000	0	50	0	0.04112
aaad.out	10,000	0	75	0	0.06622
aaae.out	10,000	0	100	0	0.08691
abaa.out	25,000	0	0	0	0.00834
abaaao	25,000	0	0	10	0.02230
abaabo	25,000	0	0	25	0.04516
abaaco	25,000	0	0	50	0.08095
abaado	25,000	0	0	75	0.11379
abab.out	25,000	0	25	0	0.03114
abac.out	25,000	0	50	0	0.05623
abad.out	25,000	0	75	0	0.08247
abae.out	25,000	0	100	0	0.10870
acaa.out	45,000	0	0	0	-0.01533
acab.out	45,000	0	25	0	0.01452
acac.out	45,000	0	50	0	0.03752
acad.out	45,000	0	75	0	0.06458
acae.out	45,000	0	100	0	0.09558
adaa.out	100,000	0	0	0	-0.06736
adaaao	100,000	0	0	10	-0.05136
adaabo	100,000	0	0	25	-0.03236
adaaco	100,000	0	0	50	0.00477
adaado	100,000	0	0	75	0.04554
adab.out	100,000	0	25	0	-0.03145
adac.out	100,000	0	50	0	-0.01362
adad.out	100,000	0	75	0	0.01551
adae.out	100,000	0	100	0	0.04920
aaba.out	10,000	25	0	0	-0.01401
aabb.out	10,000	25	25	0	0.00237
aabc.out	10,000	25	50	0	0.02344
aabd.out	10,000	25	75	0	0.04682
aabe.out	10,000	25	100	0	0.07177
abba.out	25,000	25	0	0	-0.00420
abbb.out	25,000	25	25	0	0.02100
abbc.out	25,000	25	50	0	0.04321
abbd.out	25,000	25	75	0	0.07101
abbe.out	25,000	25	100	0	0.09853
acba.out	45,000	25	0	0	-0.01969
acbb.out	45,000	25	25	0	0.00429
acbc.out	45,000	25	50	0	0.03231
acbd.out	45,000	25	75	0	0.06209
acbe.out	45,000	25	100	0	0.09603
adba.out	100,000	25	0	0	-0.07164
adbb.out	100,000	25	25	0	-0.02977
adbc.out	100,000	25	50	0	-0.01302
adbd.out	100,000	25	75	0	0.01548
adbe.out	100,000	25	100	0	0.05072
aaca.out	10,000	50	0	0	-0.04425
aacb.out	10,000	50	25	0	-0.02623
aacc.out	10,000	50	50	0	-0.00395

Table 6-13. Summary of Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_S (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
aacd.out	10,000	50	75	0	0.01735
aace.out	10,000	50	100	0	0.04495
abca.out	25,000	50	0	0	-0.02807
abcb.out	25,000	50	25	0	-0.00452
abcc.out	25,000	50	50	0	0.02199
abcd.out	25,000	50	75	0	0.04726
abce.out	25,000	50	100	0	0.08007
acca.out	45,000	50	0	0	-0.03907
accb.out	45,000	50	25	0	-0.01233
accc.out	45,000	50	50	0	0.01744
accd.out	45,000	50	75	0	0.04592
acce.out	45,000	50	100	0	0.07883
adca.out	100,000	50	0	0	-0.08520
adcb.out	100,000	50	25	0	-0.04309
adcc.out	100,000	50	50	0	-0.02660
adcd.out	100,000	50	75	0	0.00525
adce.out	100,000	50	100	0	0.04102
aada.out	10,000	75	0	0	-0.08611
aadb.out	10,000	75	25	0	-0.06797
aadc.out	10,000	75	50	0	-0.04764
aadd.out	10,000	75	75	0	-0.02305
aade.out	10,000	75	100	0	0.00349
abda.out	25,000	75	0	0	-0.06296
abdb.out	25,000	75	25	0	-0.04067
abdc.out	25,000	75	50	0	-0.01870
abdd.out	25,000	75	75	0	0.00853
abde.out	25,000	75	100	0	0.03893
acda.out	45,000	75	0	0	-0.07059
acdb.out	45,000	75	25	0	-0.04515
acdc.out	45,000	75	50	0	-0.01733
acdd.out	45,000	75	75	0	0.01328
acde.out	45,000	75	100	0	0.04674
adda.out	100,000	75	0	0	-0.10951
addb.out	100,000	75	25	0	-0.07025
addc.out	100,000	75	50	0	-0.05185
addd.out	100,000	75	75	0	-0.02046
adde.out	100,000	75	100	0	0.01805
aaea.out	10,000	100	0	0	-0.12762
aaeb.out	10,000	100	25	0	-0.11371
aaec.out	10,000	100	50	0	-0.09224
aaed.out	10,000	100	75	0	-0.07337
aaee.out	10,000	100	100	0	-0.04962
abea.out	25,000	0	0	0	-0.11308
abeaao	25,000	0	0	10	-0.10415
abeabo	25,000	0	0	25	-0.09318
abeaco	25,000	0	0	50	-0.07419
abeado	25,000	0	0	75	-0.05414
abeb.out	25,000	100	25	0	-0.09224
abec.out	25,000	100	50	0	-0.07078
abed.out	25,000	100	75	0	-0.04288
abee.out	25,000	100	100	0	-0.01693
acea.out	45,000	100	0	0	-0.11344

Table 6-13. Summary of Results for the 4.0 wt% Fissile Pu/35.6 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_s (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
aceb.out	45,000	100	25	0	-0.08937
acec.out	45,000	100	50	0	-0.06360
aced.out	45,000	100	75	0	-0.03709
acee.out	45,000	100	100	0	-0.00452
adea.out	100,000	0	0	0	-0.14495
adeaao	100,000	0	0	10	-0.13716
adeabo	100,000	0	0	25	-0.12338
adeaco	100,000	0	0	50	-0.10974
adeado	100,000	0	0	75	-0.09090
adeb.out	100,000	100	25	0	-0.10389
adec.out	100,000	100	50	0	-0.09125
aded.out	100,000	100	75	0	-0.06190
adee.out	100,000	100	100	0	-0.02348

Table 6-14. Summary of Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_S (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
baaa.out	10,000	0	0	0	0.00000
baab.out	10,000	0	25	0	0.02161
baac.out	10,000	0	50	0	0.04522
baad.out	10,000	0	75	0	0.06994
baae.out	10,000	0	100	0	0.09529
bbaa.out	25,000	0	0	0	0.00702
bbaaao	25,000	0	0	10	0.02203
bbaabo	25,000	0	0	25	0.04246
bbaaco	25,000	0	0	50	0.07844
bbaado	25,000	0	0	75	0.11045
bbab.out	25,000	0	25	0	0.03263
bbac.out	25,000	0	50	0	0.05879
bbad.out	25,000	0	75	0	0.09130
bbae.out	25,000	0	100	0	0.12185
bcaa.out	45,000	0	0	0	-0.01441
bcab.out	45,000	0	25	0	0.01334
bcac.out	45,000	0	50	0	0.04224
bcad.out	45,000	0	75	0	0.07663
bcae.out	45,000	0	100	0	0.11147
bdaa.out	100,000	0	0	0	-0.06868
bdaaao	100,000	0	0	10	-0.05510
bdaabo	100,000	0	0	25	-0.03264
bdaaco	100,000	0	0	50	0.00286
bdaado	100,000	0	0	75	0.03878
bdab.out	100,000	0	25	0	-0.03861
bdac.out	100,000	0	50	0	-0.00888
bdad.out	100,000	0	75	0	0.02497
bdae.out	100,000	0	100	0	0.06554
baba.out	10,000	25	0	0	-0.02129
babb.out	10,000	25	25	0	0.00353
babc.out	10,000	25	50	0	0.02677
babd.out	10,000	25	75	0	0.05275
babe.out	10,000	25	100	0	0.07738
bbba.out	25,000	25	0	0	-0.00699
bbbb.out	25,000	25	25	0	0.01788
bbbc.out	25,000	25	50	0	0.04997
bbbd.out	25,000	25	75	0	0.07742
bbbe.out	25,000	25	100	0	0.10875
bcba.out	45,000	25	0	0	-0.02228
bcbb.out	45,000	25	25	0	0.00775
bcbc.out	45,000	25	50	0	0.03700
bcbd.out	45,000	25	75	0	0.06975
bcbe.out	45,000	25	100	0	0.10369
bdba.out	100,000	25	0	0	-0.07329
bdbb.out	100,000	25	25	0	-0.04317
bdbc.out	100,000	25	50	0	-0.01016
bdbd.out	100,000	25	75	0	0.02412
bdbe.out	100,000	25	100	0	0.06556
baca.out	10,000	50	0	0	-0.04856
bacb.out	10,000	50	25	0	-0.02749
bacc.out	10,000	50	50	0	-0.00431

Table 6-14. Summary of Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_S (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
bacd.out	10,000	50	75	0	0.02146
bace.out	10,000	50	100	0	0.04455
bbca.out	25,000	50	0	0	-0.02870
bbcb.out	25,000	50	25	0	-0.00424
bbcc.out	25,000	50	50	0	0.02188
bbcd.out	25,000	50	75	0	0.05402
bbce.out	25,000	50	100	0	0.08096
bcca.out	45,000	50	0	0	-0.04159
bccb.out	45,000	50	25	0	-0.01226
bccc.out	45,000	50	50	0	0.01866
bccd.out	45,000	50	75	0	0.05238
bcce.out	45,000	50	100	0	0.08653
bdca.out	100,000	50	0	0	-0.08552
bdcb.out	100,000	50	25	0	-0.05864
bdcc.out	100,000	50	50	0	-0.02184
bdcd.out	100,000	50	75	0	0.01500
bdce.out	100,000	50	100	0	0.05222
bada.out	10,000	75	0	0	-0.08576
badb.out	10,000	75	25	0	-0.06472
badc.out	10,000	75	50	0	-0.04252
badd.out	10,000	75	75	0	-0.01863
bade.out	10,000	75	100	0	0.00614
bbda.out	25,000	75	0	0	-0.06642
bbdb.out	25,000	75	25	0	-0.04146
bbdc.out	25,000	75	50	0	-0.01624
bbdd.out	25,000	75	75	0	0.01517
bbde.out	25,000	75	100	0	0.04177
bcda.out	45,000	75	0	0	-0.07341
bcdb.out	45,000	75	25	0	-0.04442
bcdc.out	45,000	75	50	0	-0.01572
bcdd.out	45,000	75	75	0	0.01846
bcde.out	45,000	75	100	0	0.05585
bdda.out	100,000	75	0	0	-0.11175
bddb.out	100,000	75	25	0	-0.08212
bddc.out	100,000	75	50	0	-0.04981
bddd.out	100,000	75	75	0	-0.01181
bdde.out	100,000	75	100	0	0.02607
baea.out	10,000	100	0	0	-0.12963
baeb.out	10,000	100	25	0	-0.11100
baec.out	10,000	100	50	0	-0.09091
baed.out	10,000	100	75	0	-0.06870
baee.out	10,000	100	100	0	-0.04206
bbea.out	25,000	0	0	0	-0.10984
bbeaao	25,000	0	0	10	-0.10235
bbeabo	25,000	0	0	25	-0.09135
bbeaco	25,000	0	0	50	-0.07792
bbeado	25,000	0	0	75	-0.05507
bbeb.out	25,000	100	25	0	-0.08821
bbec.out	25,000	100	50	0	-0.06648
bbed.out	25,000	100	75	0	-0.03765
bbee.out	25,000	100	100	0	-0.01069
bcea.out	45,000	100	0	0	-0.11215

Table 6-14. Summary of Results for the 4.5 wt% Fissile Pu/39.3 GWd/MTHM Fuel

Output File Name	Decay Time (y)	Δ_S (%)	Δ_f (%)	ΔFe_2O_3 (%)	Δk_{eff}
bceb.out	45,000	100	25	0	-0.08689
bcec.out	45,000	100	50	0	-0.06025
bced.out	45,000	100	75	0	-0.02942
bcee.out	45,000	100	100	0	0.00276
bdea.out	100,000	0	0	0	-0.14478
bdeaao	100,000	0	0	10	-0.13887
bdeabo	100,000	0	0	25	-0.12834
bdeaco	100,000	0	0	50	-0.11452
bdeado	100,000	0	0	75	-0.09541
bdeb.out	100,000	100	25	0	-0.11747
bdec.out	100,000	100	50	0	-0.08996
bded.out	100,000	100	75	0	-0.05337
bdee.out	100,000	100	100	0	-0.01527

7. ATTACHMENTS

Table 7-1 contains a list of the attachments included in this calculation. Table 7-2 contains a description of the folders included in Attachment II. Table 7-2 presents a description of the contents of Attachment II.

Table 7-1. Attachment Listing

Attachment	Contents	Page
I	Document Input Reference Sheets (DIRS)	1
II	Compact Disc (CD) Containing the Input and Output Files for the MCNP Calculations.	N/A

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
aaaa	07/28/99	9:26	14,178
aaaa.out	07/28/99	9:37	288,941
aaab	07/28/99	9:27	14,178
aaab.out	07/28/99	9:37	289,638
aaac	07/28/99	9:27	14,180
aaac.out	07/28/99	9:37	288,884
aaad	07/28/99	9:27	14,180
aaad.out	07/28/99	9:37	288,871
aaae	07/28/99	9:27	13,714
aaae.out	07/28/99	9:37	279,887
aaba	07/29/99	8:36	14,055
aaba.out	07/29/99	9:46	284,872
aabb	07/29/99	8:36	14,054
aabb.out	07/29/99	10:51	284,778
aabc	07/29/99	8:36	14,056
aabc.out	07/29/99	11:52	284,778
aabd	07/29/99	8:36	14,056
aabd.out	07/29/99	12:53	284,778
aabe	07/29/99	8:36	13,590
aabe.out	07/29/99	13:58	275,555
aaca	07/29/99	8:36	14,053
aaca.out	07/29/99	9:20	281,890
aacb	07/29/99	8:36	14,052
aacb.out	07/29/99	9:55	282,108
aacc	07/29/99	8:36	14,054
aacc.out	07/29/99	10:31	282,108
aacd	07/29/99	8:36	14,054
aacd.out	07/29/99	11:08	282,108
aace	07/29/99	8:36	13,588
aace.out	07/29/99	11:39	272,373
aada	07/29/99	8:37	14,133
aada.out	07/29/99	15:56	281,133
aadb	07/29/99	8:37	14,132
aadb.out	07/29/99	19:51	281,411
aadc	07/29/99	8:37	14,134
aadc.out	07/29/99	21:04	281,422
aadd	07/29/99	8:37	14,134

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
aadd.out	07/29/99	22:20	281,409
aade	07/29/99	8:37	13,668
aade.out	07/30/99	2:13	272,183
aaea	07/29/99	8:37	14,183
aaea.out	07/30/99	7:45	291,105
aaeb	07/29/99	8:37	14,182
aaeb.out	07/30/99	8:31	290,885
aaec	07/29/99	8:37	14,184
aaec.out	07/30/99	9:16	290,942
aaed	07/29/99	8:37	14,184
aaed.out	07/30/99	10:02	290,942
aaee	07/29/99	8:37	13,718
aaee.out	07/30/99	11:42	280,889
abaa	07/28/99	9:27	15,477
abaa.out	07/28/99	9:37	287,637
abab	07/28/99	9:27	14,806
abab.out	07/28/99	9:37	288,290
abac	07/28/99	9:27	14,808
abac.out	07/28/99	9:37	287,666
abad	07/28/99	9:27	14,808
abad.out	07/28/99	9:37	287,478
abae	07/28/99	9:27	14,343
abae.out	07/28/99	9:37	278,957
abba	07/29/99	8:36	15,353
abba.out	07/29/99	16:59	282,850
abbb	07/29/99	8:36	14,682
abbb.out	07/29/99	18:54	283,433
abbc	07/29/99	8:36	14,684
abbc.out	07/29/99	19:55	283,446
abbd	07/29/99	8:36	14,684
abbd.out	07/29/99	20:55	283,420
abbe	07/29/99	8:36	14,219
abbe.out	07/29/99	21:50	273,600
abca	07/29/99	8:36	15,351
abca.out	07/29/99	12:15	279,798
abcb	07/29/99	8:36	14,680
abcb.out	07/29/99	12:50	280,833
abcc	07/29/99	8:36	14,682
abcc.out	07/29/99	13:52	280,193
abcd	07/29/99	8:36	14,682
abcd.out	07/29/99	15:28	280,772
abce	07/29/99	8:36	14,217
abce.out	07/29/99	16:04	271,118
abda	07/29/99	8:37	15,431
abda.out	07/30/99	6:56	279,413
abdb	07/29/99	8:37	14,760
abdb.out	07/30/99	12:33	280,066
abdc	07/29/99	8:37	14,762
abdc.out	07/30/99	18:32	280,009
abdd	07/29/99	8:37	14,762
abdd.out	07/30/99	19:47	280,075
abde	07/29/99	8:37	14,297
abde.out	07/30/99	20:53	270,744

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
abea	07/29/99	8:37	15,481
abea.out	07/30/99	14:59	288,957
abeb	07/29/99	8:37	14,810
abeb.out	07/30/99	16:54	289,651
abec	07/29/99	8:37	14,812
abec.out	07/30/99	18:44	289,610
abed	07/29/99	8:37	14,812
abed.out	07/30/99	20:45	289,029
abee	07/29/99	8:37	14,347
abee.out	07/30/99	22:30	280,327
acaa	07/28/99	9:27	14,086
acaa.out	07/28/99	9:37	287,013
acab	07/28/99	9:27	14,116
acab.out	07/28/99	9:37	286,982
acac	07/28/99	9:27	14,118
acac.out	07/28/99	9:37	287,666
acad	07/28/99	9:27	14,118
acad.out	07/28/99	9:37	288,274
acae	07/28/99	9:27	13,652
acae.out	07/28/99	9:37	278,333
acba	07/29/99	8:36	13,962
acba.out	07/29/99	22:52	282,780
acbb	07/29/99	8:36	13,992
acbb.out	07/29/99	23:53	282,933
acbc	07/29/99	8:36	13,994
acbc.out	07/30/99	0:56	283,446
acbd	07/29/99	8:36	13,994
acbd.out	07/30/99	1:57	283,503
acbe	07/29/99	8:36	13,528
acbe.out	07/30/99	2:54	274,218
acca	07/29/99	8:36	13,960
acca.out	07/29/99	16:40	280,123
accb	07/29/99	8:36	13,990
accb.out	07/29/99	18:39	280,833
accc	07/29/99	8:36	13,992
accc.out	07/30/99	0:05	280,149
accd	07/29/99	8:36	13,992
accd.out	07/30/99	0:42	280,706
acce	07/29/99	8:36	13,526
acce.out	07/30/99	1:15	271,118
acda	07/29/99	8:37	14,040
acda.out	07/30/99	22:05	278,911
acdb	07/29/99	8:37	14,070
acdb.out	07/30/99	23:19	280,204
acdc	07/29/99	8:37	14,072
acdc.out	07/31/99	0:32	280,114
acdd	07/29/99	8:37	14,072
acdd.out	07/31/99	1:50	280,079
acde	07/29/99	8:37	13,606
acde.out	07/31/99	2:59	270,801
acea	07/29/99	8:37	14,090
acea.out	07/31/99	0:28	288,957
aceb	07/29/99	8:37	14,120

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
aceb.out	07/31/99	2:28	289,667
acec	07/29/99	8:37	14,122
acec.out	07/31/99	4:31	289,667
aced	07/29/99	8:37	14,122
aced.out	07/31/99	6:36	289,667
acee	07/29/99	8:38	13,656
acee.out	07/31/99	8:23	280,334
adaa	07/28/99	9:27	14,087
adaa.out	07/28/99	9:37	287,013
adab	09/01/99	13:59	14,138
adab.out	09/01/99	13:58	287,325
adac	07/28/99	9:27	14,119
adac.out	07/28/99	9:37	287,844
adad	07/28/99	9:27	14,119
adad.out	07/28/99	9:37	288,220
adae	07/28/99	9:27	13,653
adae.out	07/28/99	9:37	278,263
adba	07/29/99	8:36	13,963
adba.out	07/30/99	3:56	282,793
adbb	09/01/99	13:59	14,014
adbb.out	09/01/99	13:58	281,898
adbc	07/29/99	8:36	13,995
adbc.out	07/30/99	6:04	283,503
adbd	07/29/99	8:36	13,995
adbd.out	07/30/99	7:09	283,503
adbe	07/29/99	8:36	13,531
adbe.out	07/30/99	8:12	274,170
adca	07/29/99	8:36	13,961
adca.out	07/30/99	1:51	280,180
adcb	09/01/99	13:59	14,012
adcb.out	09/01/99	13:58	280,492
adcc	07/29/99	8:36	13,993
adcc.out	07/30/99	3:07	280,833
adcd	07/29/99	8:36	13,993
adcd.out	07/30/99	3:44	280,833
adce	07/29/99	8:36	13,527
adce.out	07/30/99	4:18	270,596
adda	07/29/99	8:37	14,041
adda.out	07/31/99	4:22	278,827
addb	09/01/99	13:59	14,092
addb.out	09/01/99	13:58	279,239
addc	07/29/99	8:37	14,073
addc.out	07/31/99	7:02	280,578
addd	07/29/99	8:37	14,073
addd.out	07/31/99	8:28	279,808
adde	07/29/99	8:37	13,607
adde.out	07/31/99	10:01	270,733
adea	07/29/99	8:38	14,091
adea.out	07/31/99	10:28	288,174
adeb	09/01/99	13:59	14,142
adeb.out	09/01/99	13:58	289,638
adec	07/29/99	8:38	14,123
adec.out	07/31/99	14:34	289,667

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
aded	07/29/99	8:38	14,123
aded.out	07/31/99	16:39	288,827
adee	07/29/99	8:38	13,657
adee.out	07/31/99	18:27	279,634
baaa	07/28/99	9:31	14,176
baaa.out	07/28/99	9:30	289,156
baab	07/28/99	9:31	14,174
baab.out	07/28/99	9:30	289,160
baac	07/28/99	9:31	14,176
baac.out	07/28/99	9:30	288,403
baad	07/28/99	9:31	14,176
baad.out	07/28/99	9:30	289,160
baae	07/28/99	9:31	13,715
baae.out	07/28/99	9:30	279,612
baba	07/29/99	8:38	14,052
baba.out	07/30/99	9:42	284,745
babb	07/29/99	8:38	14,049
babb.out	07/30/99	11:13	284,903
babc	07/29/99	8:38	14,051
babc.out	07/30/99	13:02	284,776
babd	07/29/99	8:38	14,051
babd.out	07/30/99	14:54	284,903
babe	07/29/99	8:38	13,590
babe.out	07/30/99	16:33	275,482
baca	07/29/99	8:39	14,012
baca.out	07/30/99	12:02	282,569
bacb	07/29/99	8:39	13,996
bacb.out	07/30/99	14:03	282,582
bacc	07/29/99	8:39	13,996
bacc.out	07/30/99	16:06	282,639
bacd	07/29/99	8:39	13,964
bacd.out	07/30/99	18:05	282,639
bace	07/29/99	8:39	13,545
bace.out	07/30/99	19:49	273,447
bada	07/29/99	8:39	14,130
bada.out	07/30/99	11:50	280,892
badb	07/29/99	8:39	14,127
badb.out	07/30/99	14:43	280,910
badc	07/29/99	8:39	14,129
badc.out	07/30/99	16:36	281,037
badd	07/29/99	8:39	14,129
badd.out	07/30/99	18:06	280,910
bade	07/29/99	8:39	13,668
bade.out	07/30/99	19:39	271,247
baea	07/29/99	8:40	14,180
baea.out	07/30/99	12:07	289,512
baeb	07/29/99	8:40	14,177
baeb.out	07/30/99	17:27	291,067
baec	07/29/99	8:40	14,179
baec.out	07/30/99	19:27	291,010
baed	07/29/99	8:40	14,179
baed.out	07/30/99	21:31	291,067
baee	07/29/99	8:40	13,718

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
baee.out	07/30/99	23:20	281,589
bbaa	07/28/99	9:31	14,085
bbaa.out	07/28/99	9:30	287,232
bbab	07/28/99	9:31	14,081
bbab.out	07/28/99	9:30	287,301
bbac	07/28/99	9:31	14,165
bbac.out	07/28/99	9:31	287,256
bbad	07/28/99	9:31	14,083
bbad.out	07/28/99	9:31	287,280
bbae	07/28/99	9:31	13,654
bbae.out	07/28/99	9:31	278,552
bbba	07/29/99	8:38	13,960
bbba.out	07/30/99	18:18	282,911
bbbb	07/29/99	8:38	13,956
bbbb.out	07/30/99	20:02	282,959
bbbc	07/29/99	8:38	13,959
bbbc.out	07/30/99	21:49	282,905
bbbd	07/29/99	8:38	13,881
bbbd.out	07/30/99	23:36	283,012
bbbe	07/29/99	8:38	13,490
bbbe.out	07/31/99	1:14	274,366
bbca	07/29/99	8:39	13,921
bbca.out	07/30/99	21:44	280,641
bbcb	07/29/99	8:39	13,879
bbcb.out	07/30/99	23:41	280,711
bbcc	07/29/99	8:39	13,879
bbcc.out	07/31/99	1:37	280,711
bbcd	07/29/99	8:39	13,879
bbcd.out	07/31/99	3:32	280,711
bbce	07/29/99	8:39	13,488
bbce.out	07/31/99	5:16	272,008
bbda	07/29/99	8:39	14,038
bbda.out	07/30/99	21:23	278,995
bbdb	07/29/99	8:39	14,034
bbdb.out	07/30/99	23:07	278,482
bbdc	07/29/99	8:39	14,037
bbdc.out	07/31/99	0:54	278,982
bbdd	07/29/99	8:39	14,036
bbdd.out	07/31/99	2:40	279,052
bbde	07/29/99	8:39	13,607
bbde.out	07/31/99	4:14	270,037
bbea	07/29/99	8:40	14,088
bbea.out	07/31/99	1:20	289,139
bbeb	07/29/99	8:40	14,084
bbeb.out	07/31/99	3:20	288,299
bbec	07/29/99	8:40	14,087
bbec.out	07/31/99	5:18	289,139
bbed	07/29/99	8:40	14,086
bbed.out	07/31/99	7:19	289,139
bbee	07/29/99	8:40	13,657
bbee.out	07/31/99	9:05	280,547
bcaa	07/28/99	9:31	14,085
bcaa.out	07/28/99	9:31	287,232

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
bcab	07/28/99	9:31	14,081
bcab.out	07/28/99	9:31	287,232
bcac	07/28/99	9:31	14,083
bcac.out	07/28/99	9:31	287,225
bcad	07/28/99	9:31	14,083
bcad.out	07/28/99	9:31	287,105
bcae	07/28/99	9:31	13,653
bcae.out	07/28/99	9:31	278,552
bcba	07/29/99	8:38	13,925
bcba.out	07/31/99	3:03	283,060
bcbb	07/29/99	8:38	13,883
bcbb.out	07/31/99	4:53	283,069
bcbc	07/29/99	8:38	13,883
bcbc.out	07/31/99	6:44	282,999
bcbd	07/29/99	8:38	13,883
bcbd.out	07/31/99	8:39	282,942
bcbe	07/29/99	8:38	13,492
bcbe.out	07/31/99	10:22	274,436
bcca	07/29/99	8:39	13,923
bcca.out	07/31/99	7:12	280,210
bccb	07/29/99	8:39	13,881
bccb.out	07/31/99	9:09	280,654
bccc	07/29/99	8:39	13,881
bccc.out	07/31/99	11:13	280,743
bccd	07/29/99	8:39	13,881
bccd.out	07/31/99	13:13	280,584
bcce	07/29/99	8:39	13,490
bcce.out	07/31/99	15:00	272,135
bcda	07/29/99	8:39	14,038
bcda.out	07/31/99	5:59	278,412
bcdb	07/29/99	8:39	14,034
bcdb.out	07/31/99	7:47	279,052
bcdc	07/29/99	8:39	14,036
bcdc.out	07/31/99	9:34	278,995
bcdd	07/29/99	8:39	14,036
bcdd.out	07/31/99	11:24	279,052
bcde	07/29/99	8:39	13,606
bcde.out	07/31/99	13:01	270,406
bcea	07/29/99	8:40	14,088
bcea.out	07/31/99	11:06	289,139
bceb	07/29/99	8:40	14,084
bceb.out	07/31/99	13:09	289,139
bcec	07/29/99	8:40	14,086
bcec.out	07/31/99	15:10	289,082
bced	07/29/99	8:40	14,086
bced.out	07/31/99	17:09	288,299
bcee	07/29/99	8:40	13,656
bcee.out	07/31/99	18:49	280,563
bdaa	07/28/99	9:31	14,085
bdaa.out	07/28/99	9:31	287,162
bdab	07/28/99	9:31	14,082
bdab.out	07/28/99	9:31	287,232
bdac	07/28/99	9:31	14,084

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
bdac.out	07/28/99	9:31	287,296
bdad	07/28/99	9:31	14,084
bdad.out	07/28/99	9:31	286,548
bdae	07/28/99	9:31	13,653
bdae.out	07/28/99	9:31	278,425
bdba	07/29/99	8:38	13,924
bdba.out	07/31/99	12:13	282,369
bdbb	07/29/99	8:38	13,882
bdbb.out	07/31/99	14:06	282,999
bdbc	07/29/99	8:38	13,882
bdbc.out	07/31/99	16:04	283,069
bdbd	07/29/99	8:38	13,882
bdbd.out	07/31/99	18:04	282,385
bdbe	07/29/99	8:38	13,491
bdbe.out	07/31/99	19:50	274,493
bdca	07/29/99	8:39	13,922
bdca.out	07/31/99	17:07	280,711
bdcb	07/29/99	8:39	13,880
bdcb.out	07/31/99	19:08	280,711
bdcc	07/29/99	8:39	13,880
bdcc.out	07/31/99	20:35	280,641
bdcd	07/29/99	8:39	13,880
bdcd.out	07/31/99	21:43	280,743
bdce	07/29/99	8:39	13,489
bdce.out	07/31/99	22:44	271,495
bdda	07/29/99	8:39	14,038
bdda.out	07/31/99	14:53	279,052
bddb	07/29/99	8:39	14,035
bddb.out	07/31/99	16:47	278,982
bddc	07/29/99	8:39	14,037
bddc.out	07/31/99	18:36	278,925
bddd	07/29/99	8:39	14,037
bddd.out	07/31/99	19:50	279,052
bdde	07/29/99	8:39	13,606
bdde.out	07/31/99	20:56	270,419
bdea	07/29/99	8:40	14,088
bdea.out	07/31/99	20:12	289,139
bdeb	07/29/99	8:40	14,085
bdeb.out	07/31/99	21:17	288,455
bdec	07/29/99	8:40	14,087
bdec.out	07/31/99	22:04	289,139
bded	07/29/99	8:40	14,087
bded.out	07/31/99	22:50	289,139
bdee	07/29/99	8:40	13,656
bdee.out	07/31/99	23:32	280,506
abaaa	08/20/99	7:16	15525
abaaao	08/20/99	7:16	287066
abaab	08/20/99	7:16	15528
abaabo	08/20/99	7:16	287123
abaac	08/20/99	7:16	15528
abaaco	08/20/99	7:16	287123
abaad	08/25/99	8:38	15538
abaado	08/25/99	8:38	287029

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
abeaa	08/20/99	7:16	15531
abeaao	08/20/99	7:16	289269
abeab	08/20/99	7:16	15531
abeabo	08/20/99	7:16	288429
abeac	08/20/99	7:16	15531
abeaco	08/20/99	7:16	289262
abead	08/25/99	8:38	15542
abeado	08/25/99	8:38	289326
adaaa	08/20/99	7:16	14138
adaaao	08/20/99	7:16	286423
adaab	08/20/99	7:16	14138
adaabo	08/20/99	7:16	286996
adaac	08/20/99	7:16	14138
adaaco	08/20/99	7:16	287123
adaad	08/25/99	8:38	14149
adaado	08/25/99	8:38	287123
adeaa	08/20/99	7:16	14141
adeaao	08/20/99	7:16	288642
adeab	08/20/99	7:16	14141
adeabo	08/20/99	7:16	288626
adeac	08/20/99	7:16	14141
adeaco	08/20/99	7:17	288804
adead	08/25/99	8:38	14152
adeado	08/25/99	8:38	288626
bbaaa	08/20/99	7:17	14135
bbaaao	08/20/99	7:17	287467
bbaab	08/20/99	7:17	14135
bbaabo	08/20/99	7:17	287419
bbaac	08/20/99	7:17	14135
bbaaco	08/20/99	7:17	287419
bbaad	08/25/99	8:38	14146
bbaado	08/25/99	8:38	287349
bbeaa	08/20/99	7:17	14138
bbeaao	08/20/99	7:17	288554
bbeab	08/20/99	7:17	14138
bbeabo	08/20/99	7:17	289394
bbeac	08/20/99	7:17	14136
bbeaco	08/20/99	7:17	288611
bbead	08/25/99	8:38	14147
bbeado	08/25/99	8:38	289451
bdaaa	08/20/99	7:17	14135
bdaaao	08/20/99	7:17	287362
bdaab	08/20/99	7:17	14135
bdaabo	08/20/99	7:17	287362
bdaac	08/20/99	7:17	14135
bdaaco	08/20/99	7:17	287419
bdaad	08/25/99	8:38	14146
bdaado	08/25/99	8:38	287292
bdeaa	08/20/99	7:17	14138
bdeaao	08/20/99	7:17	288554
bdeab	08/20/99	7:17	14138
bdeabo	08/20/99	7:17	289581
bdeac	08/20/99	7:17	14138

Table 7-2. Files Contained in Attachment II

Name	Date	Time	Size (byte)
bdeaco	08/20/99	7:17	289451
bdead	08/25/99	8:38	14149
bdeado	08/25/99	8:38	289451

8. REFERENCES

CRWMS M&O (Civilian Radioactive Waste Management System Management and Operating Contractor) 1998a. *Criticality Evaluation of Intact and Degraded PWR WPs Containing MOX SNF.* A00000000-01717-0210-00002 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980701.0482.

CRWMS M&O 1998b. *Software Qualification Report for MCNP Version 4B2, A General Monte Carlo N-Particle Transport Code*. CSCI. 30033 V4B2LV. DI: 30033-2003 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980622.0637.

CRWMS M&O 1999. *FY 1999 Plutonium Disposition Waste Criticality Tasks.* 21019074M1. TDP-DDC-MD-000001 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990729.0059.

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
DOCUMENT INPUT REFERENCE SHEET

1. Document Identifier No./Rev.:	Change:	Title:
CAL-EBS-NU-000005 REV 00	N/A	Evaluation of Internal Criticality of the Plutonium Disposition MOX SNF Waste Form

Input Document			4. Input Status	5. Section Used in	6. Input Description	7. TBV/TBD Priority	8. TBV Due To		
2. Technical Product Input Source Title and Identifier(s) with Version		3. Section					Unqual.	From Uncontrolled Source	Un-confirmed
2a 1	CRWMS M&O 1998a. *Criticality Evaluation of Intact and Degraded PWR WPs Containing MOX SNF*. A00000000-01717-0210-00002 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980701.0482.	Attach-ment IV Section 5	TBV-3395	2 5.1 5.2	MCNP base input files, MCNP base input files, assembly parameters, waste package parameters, and corrosion product parameters based on unqualified data.	3	YES	N/A	N/A
2	CRWMS M&O 1998b. *Software Qualification Report for MCNP Version 4B2, A General Monte Carlo N-Particle Transport Code*. CSCI. 30033 V4B2LV. DI: 30033-2003 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980622.0637.	Entire	N/A	1	Not an input, reference only	N/A	N/A	N/A	N/A
3	CRWMS M&O 1999. *FY 1999 Plutonium Disposition Waste Criticality Tasks*. 21019074M1. TDP-DDC-MD-000001 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990729.0059.	Entire	N/A	1	Not an input, reference only	N/A	N/A	N/A	N/A