CRWMS/M&O

Calculation Cover Sheet

Complete only applicable items.

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10. Remarks

Attachments I through IX are contained on Disc (CD ROM). For Attachments I and II, the page numbers shown in box 6 refer to the number of pages in the hard-copy listing of each files content on disc.

Attachment X is an electronic attachment and has been moved to reference 7.14

Revision History

11. Revision No.	12. Description of Revision
REV 00	Initial Issue.
REV 01	Sections 5.5 and 6.4 were added to evaluate the effects of plutonium decay. List of Figures and List of Tables were also added. Editorial changes were made to the attachments. Editorial changes were also made to the body of the document to comply with the procedure.

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1. PURPOSE

The objective of this calculation is to characterize the criticality aspect of a Department of Energy Spent Nuclear Fuel (DOE SNF) canister containing 5 Fast Flux Test Facility (FFTF) assemblies in a Five-Pack defense High-Level Waste (HLW) waste package. The purpose of this calculation is to investigate the criticality issues for the waste package (WP) containing HLW and DOE SNF canisters in various stages of degradation.

2. METHOD

The calculational method used to perform the criticality calculations consisted of using the MCNP Version 4B2 code (Ref. 7.1) to calculate the effective neutron multiplication factor (k_{eff}) of the system. The calculations were performed using continuous energy cross section libraries from Evaluated Nuclear Data File (ENDF). All calculations were performed with the fresh fuel isotopics (Assumption 3.1). The HLW degraded composition was given in Table 5-14 of Reference 7.2.

3. ASSUMPTIONS

3.1 It is assumed that all fuel is fresh and unburned for the criticality calculations; i.e., there is no credit for burnup. The basis for this assumption is that it is conservative, because fresh fuel is more neutronically reactive than spent fuel. This assumption is used throughout Section 5.

3.2 It is assumed that various amounts of mixing of HLW clayey material and degraded DOE SNF, and various degrees of hydration (i.e., water fraction) of the resulting mixtures, are possible up to a point that the available volume is filled (DOE SNF canister or codisposal waste package depending on the configuration being evaluated). The basis for this assumption is that there is a great deal of uncertainty in these parameters, and therefore, it is conservative to evaluate the entire range to find the set of parameters that produce the peak k_{eff} for a given configuration. This assumption is used throughout Section 5.

3.3 It is assumed that the mass of gadolinium (Gd) present in the WP is 2% of the mass of the basket. The basis of this assumption is that up to 6% of Gd may be included in the basket as a result of intact criticality calculation. It is conservative to underestimate the amount of Gd in the WP. This assumption is used throughout Section 5.

3.4 It is assumed that after two half lives ($T_{½}$) of Pu-239 (48,200 years), the Pu-240 (half life 6560 years) has all decayed. The basis of this assumption is that it is conservative since the Pu-240 will decay to U-236 and that the absorption cross of Pu-240 is higher than the absorption cross section of U-236. This assumption is used in Section 5.5.

4. USE OF COMPUTER SOFTWARE AND MODELS

4.1 SOFTWARE APPROVED FOR QA WORK

4.1.1 MCNP

The MCNP code was used to calculate the k_{eff} of the codisposal waste package. The software specifications are as follow:

- Program Name: MCNP
- Version/Revision Number: Version 4B2
- CSCI Number: 30033 V4B2LV
- Computer Type: Hewlett Packard (HP) 9000 Series Workstations
- Software is installed on the Civilian Radioactive Waste Management System (CRWMS) Management and Operating (M&O) workstation "bloom" whose CRWMS M&O Tag number is 700887

The input and output files for the various MCNP calculations are documented in Attachments I and II (the electronic Attachment has been moved to Reference 7.14). The calculation files described in Sections 5 and 6 are such that an independent repetition of the software use may be performed. The MCNP software used was: (a) appropriate for the application of research reactor k_{eff} calculations, (b) used only within the range of validation as documented in Reference 7.3, (c) obtained from the Software Configuration Manager in accordance with appropriate procedures.

4.2 SOFTWARE ROUTINES

4.2.1 Excel

- Title: Excel
- Version/Revision Number: Microsoft® Excel 97

The Excel spreadsheet programs were used to calculate the isotopic composition of the materials in the WP as documented in Section 5 of this calculation file, (see Attachments III through IX). The user-defined formulas, inputs, and results were documented in sufficient detail in Section 5 or in relevant attachments to allow an independent repetition of computations. This software is installed on a personal computer running Microsoft Windows 95 with CRMWS M&O Tag number 115769.

5. CALCULATION

This section describes the calculations performed to calculate the k_{eff} of a degraded WP that contains HLW clayey material and FFTF SNF enclosed in a DOE SNF canister. The criticality calculations are detailed calculations of the neutron multiplication factor (k_{eff}). Section 5.1 gives a description of the intact WP. The k_{eff} of different configurations of a degraded WP is investigated in Sections 5.2, 5.3, and 5.4. Section 5.2 describes calculations performed assuming the HLW glass and the FFTF fuel, enclosed in the DOE SNF canister, degraded. In Section 5.2, the DOE SNF canister remains intact. In Section 5.3, the DOE SNF canister is fully degraded and the FFTF fuel is above the HLW clayey layer. Section 5.4 describes calculations assuming that the degraded FFTF fuel is settled on the bottom of the WP with the HLW clayey material above. In Section 5.5, effect of plutonium is calculated. The MCNP input decks are presented in Attachment I (the electronic Attachment has been moved to Reference 7.14). The MCNP output decks are presented in Attachment II (the electronic Attachment has been moved to Reference 7.14). The results (k_{eff}) for each calculation are presented in Section 6.

The description of the FFTF fuel is from the FFTF description document, Ref. 7.6 (pp. 1-5). All fuel related information is from this reference unless otherwise noted. Compositions for structural and other nonfuel related materials are from References 7.7 through 7.11. The material compositions that were obtained from References 7.7 through 7.11 are considered accepted data. These references are standard handbooks, and due to the nature of these sources, the data in it are established fact and are therefore considered accepted. The high-level waste degraded composition is from Ref. 7.2 (TBV). Avogadro's number and atomic weights are from Ref. 7.13, and are considered accepted due to the nature of the references cited therein. The data from References 7.4, 7.5 and 7.6 are considered qualified data. The number of digits cited for values converted from English to metric units does not indicate the accuracy; it is an artifact of the conversion process. This calculation is based in part on existing data; therefore, use of any results from this calculation for input into document supporting procurement, fabrication, or construction is required to be identified and tracked as TBV (to be verified) in accordance with appropriate procedures.

5.1 INTACT WP

This section provides the dimensions of the intact WP. The WP is composed of:

- A codisposal waste package,
- 5 HLW glass canisters,
- A DOE SNF canister.

5.1.1 Co-disposal Waste Package

The codisposal waste package contains 5 HLW canisters surrounding a DOE SNF codisposal canister. The waste container barrier materials are typical of those used for commercial SNF

waste packages. The inner barrier is composed of 20 mm of high-nickel alloy ASTM B 575 (Alloy 22) and serves as a corrosion resistant material. The outer barrier is composed of a 100 mm of carbon steel (ASTM A 516 Grade 70) and serves as a corrosion allowance material (Ref. 7.4, pages 56 and 72). The outside diameter of the waste package is 2120 mm and the inside cavity length is 4617 mm. The inner barrier lids are 25 mm thick and the outer barrier lids are 110 mm thick. There is a 30 mm closure lid gap between the upper inner and outer barrier lids. There is a 225 mm skirt at each end of the container.

The codisposal canister is placed in a 31.75 mm thick carbon steel (ASTM A 516 Grade 70) support tube with 565 mm nominal outer diameter. The support tube is connected to the inside wall of the waste package by web-like carbon steel (ASTM A 516 Grade 70) plates to allow emplacement of five equally spaced HLW canisters as shown in Figure 5.1.1-1. The support tube and plates are each 4597 mm long.

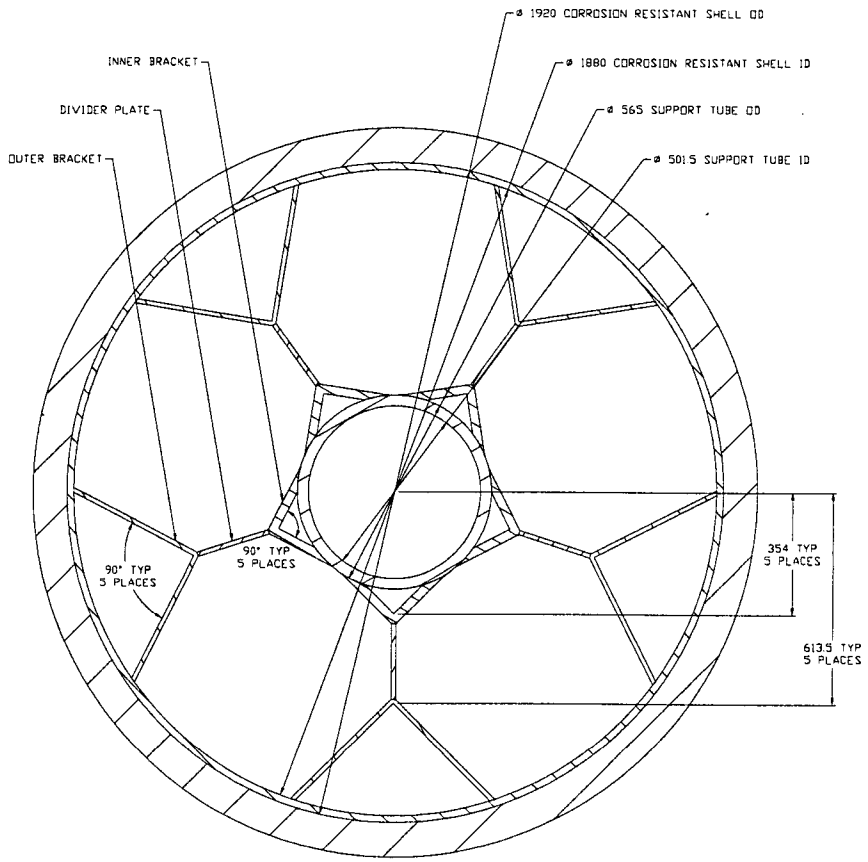

Figure 5.1.1-1. 5-DHLW/DOE Spent Fuel-Long Disposal Container

5.1.2 HLW Glass Pour Canisters

The Hanford fifteen feet HLW canister is a cylindrical stainless steel (Type 304L) shell with an outer diameter of approximately 610 mm (24.00 in.) (Ref. 7.5, p. 3.3-4), a wall thickness of 10.5 mm, and a nominal length of 4572 mm (15 ft). HLW glass occupies 87% of the canister's volume. The maximum loaded canister weight is 4200 kg. The nominal dimensions of the canister are used for analyses. In this calculation, the HLW canisters are degraded. The composition of the clayey material resulting from this degradation is given in Table 5.1.5-6 (Ref. 7.2, Table 5.14). The composition of the clayey material used in this calculation is given in Table 5.1.5-7. As shown in Table 6.1-4, k_{eff} is not affected by the fact that the atomic densities of sodium, calcium, and potassium used are different from the ones that are given in the geochemistry calculation (Ref. 7.2, Table 5.14).

5.1.3 DOE SNF Canister

The following information is taken from Reference 7.6, pages 5, 6, and 7. The DOE SNF canister is a right circular cylinder of stainless steel (Type 316L) that contains a stainless steel (Type 316L) basket. The basket serves as a criticality control material and a guide for assemblies during loading. The dimensions for the DOE SNF canister are a 457.2 mm (18.00 in.) outer diameter with a 9.525 mm (0.375 in.) wall thickness. The nominal internal length of the canister is 4145 mm and the nominal overall length is 4569 mm (179.87 in.). There is a curved bottom carbon steel rupture disk that varies in thickness from 15.24 mm to 50.8 mm at the top and bottom boundaries of the canister. In addition, there is a 12.7 mm thick curved plate and a 12.7 mm flat plate in each end of the canister. The plan view of the canister is shown in Figure 5.1.3-1. The DOE SNF canister contains basket locations for 5 Fast Flux Test Facility (FFTF) assemblies surrounding one Ident-69 pin container. Maximum loaded weight of the canister is 3400 kg. The DOE SNF canister containing 5 FFTF assemblies and an Ident-69 pin container is shown in Figure 5.1.3-2.

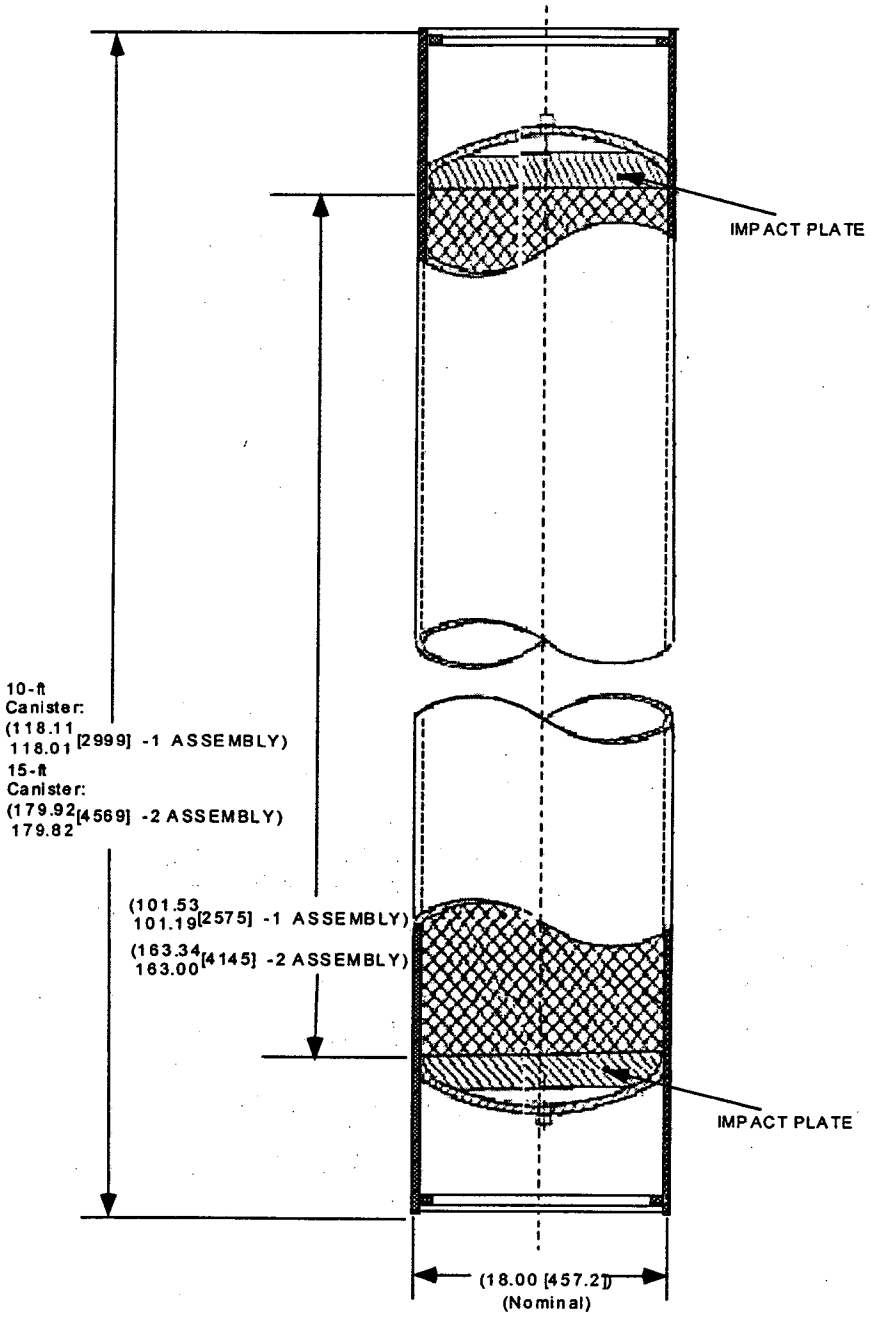

Figure 5.1.3-1. Plan View of the Proposed 18 in. DOE SNF Canister

The basket assembly consists of a cylindrical center tube and 5 divider plates extending radially from center tube to the DOE SNF canister wall. The center tube is stainless steel (Type 316L)

with 153.0 mm inside diameter and 10 mm wall thickness. The divider plates are also stainless steel (Type 316L) with a 10 mm thickness. The basket length is 4125 mm.

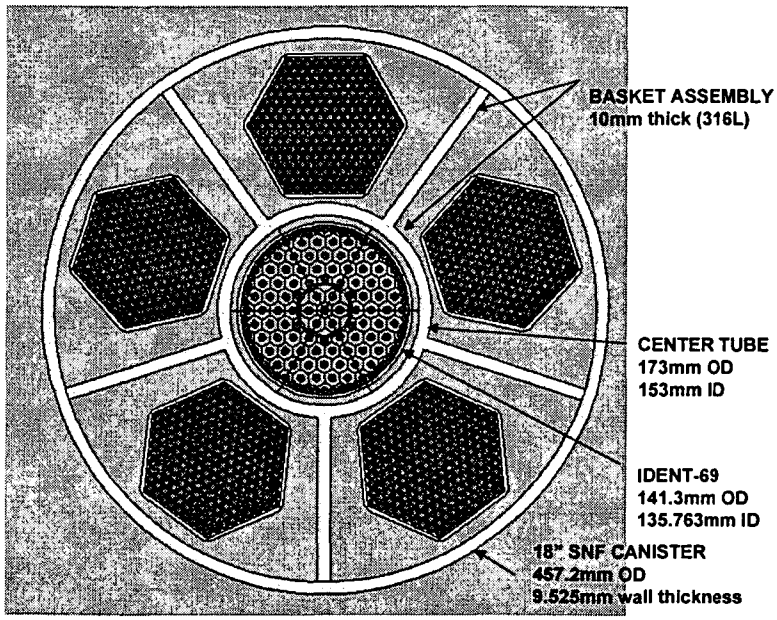

Figure 5.1.3-2. Cross-sectional View of the FFTF DOE SNF Canister

5.1.4 DOE FFTF SNF

The following dimensions are from Reference 7.6, pages 1 through 5. The FFTF standard driver fuel assembly is hexagonally shaped and contains 217 cylindrical fuel pins. The assembly is 3657.6 mm long. The overall length of a fuel pin is 2372.36 mm for Type 3.1 and 4.1 fuels, and 2377.44 mm for Type 3.2 and 4.2 fuels. The cladding is 0.381 mm (0.015 in.) thick stainless steel (Type 316). The inner and outer diameters of the cladding are 5.08 mm (0.200 in.) and 5.842 mm (0.230 in.), respectively. Each fuel pin has 914.4 mm (36.0 in.) long fuel region with fuel pellet outer diameter of 4.9403 mm (0.1945 in.). The fuel region is centered 1663.7 mm (65.5 in.) from the bottom of the assembly. Each fuel pin is helically wrapped with a 1.4224 mm (0.056 in.) diameter Type 316 stainless steel wire to provide lateral spacing along its length. The wire pitch is 304.8 mm (12.0 in.). The fuel pins are arranged in a triangular pitch within the hexagonal duct. The fuel density is reported as 90.4% of the theoretical density. This corresponds to 10.02 g/cm^3 fuel meat density. The mixed oxide (MOX – $UO_{1.96}$ and $PuO_{1.96}$) fuel region is followed by 20.32 mm (0.80 in.) of natural UO_2 insulator pellets and 144.78 mm (5.70 in.) of Inconel 600 reflector on each end. The density of natural uranium insulator pellets is 10.42 ± 0.22 g/cm^3. The reflector outer diameter is 4.8133 mm (0.1895 in.). Above the top reflector is a 125.5 mm long region with a 0.8052 mm diameter Type 302 stainless steel spring

and 862.1 mm long stainless steel plenum (Type 316) with 4.9022 mm outer diameter and 0.1397 mm wall thickness. The maximum stainless steel spring volume is 2.7264 cm^3. The fuel pin is closed with 5.842 mm diameter 104.6 mm and 35.6 mm long top and bottom caps, respectively. The bottom cap length for Type 3.2 and 4.2 fuels is 40.6 mm. Each fuel pin weighs 0.455 kg (1.0 lb). The fuel enrichments and isotopic fractions for all four types of fuel are given in Table 5.1.4-1.

The driver fuel assembly consists of a hexagonal duct that surrounds the fuel pins, discriminator, inlet nozzle, neutron shield and flow orifice region, load pads, and handling socket. The duct is Type 316 stainless steel with a wall thickness of 3.048 mm (0.12 in.). The duct tube outer dimension is 116.205 mm (4.575 in.) across the hexagon flats, and 131.064 mm (5.16 in.) across the opposite hexagon points. The fuel pin pitch is 7.2644 mm (0.286 in.). The maximum assembly width is determined by the load pads, which are 138.1125 mm (5.4375 in.), wide across the opposite hexagon points. The assembly length is 3657.6 mm (144 in.). Total weight of a Driver Fuel Assembly (DFA) is 172.819 kg (381 lb).

Some of the fuel assemblies have been disassembled and the fuel pins were placed in pin containers named Ident-69. Although there are several types of pins container, the most reactive pin container has been found to be the compartmented model, which can contain up to 217 fuel pins. The total container length is 3657.6 mm (144 in.). The Ident-69's are made with a 5 in. stainless steel Type 304L pipe (actual outer diameter is 5.563 in., or 141.30 mm) with a transition to 2.5 in. pipe (actual outer diameter is 2.875 in., or 73.02 mm) at 431.8 mm (17.0 in.) from the bottom. Inside diameter of the pin container is 135.763 mm (5.345 in.). The fuel pins are supported on a grid plate with 1.5875 mm (1/16 in.) holes. The central compartment has inside and outside radius of 20.701 mm (0.815 in.) and 22.225 mm (0.875 in.), respectively. Empty weight of an Ident-69 container is 59.09 kg (130 lb). The pin container inventory shows that the highest loading for an Ident-69 pin container is 154 pins of Type 4.2, 109 pins of Type 3.1, and 131 pins of Type 4.1 and 4.2 mixed together.

In this calculation, materials inside the DOE SNF canister are homogenized.

Table 5.1.4-1. Uranium and Plutonium Content of a Fresh DFA (Ref. 7.6, p. 5)

			Driver Fuel Type			
			3.1	3.2	4.1	4.2
Plutonium						
	Enrichment %Pu/(Pu+U)		27.37	22.43	29.28	25.14
	Assembly content (kg)		9.071	7.421	9.722	8.333
	Fuel pin content (g)		41.8	34.2	44.8	38.4
	Isotopic fraction					
		Pu-239	0.8696	0.8696	0.8711	0.8711
		Pu-240	0.1173	0.1173	0.1163	0.1163
		Pu-241	0.0104	0.0104	0.0102	0.0102
Uranium						
	Enrichment %U/(Pu+U)		72.63	77.57	70.72	74.86
	Assembly content (kg)		24.070	25.666	23.481	24.813
	Fuel pin content (g)		110.9	118.3	108.2	114.3
	Isotopic fraction					
		U-235	0.007	0.007	0.002	0.002
		U-238	0.993	0.993	0.998	0.998

Note: Each assembly contains nominally 1.5 kg of uranium in insulator pellets.

5.1.5 Materials

Table 5.1.5-1. Chemical Composition of Alloy 22 (Ref. 7.7, p. 10)

Element	Weight Percent Range	Value Used
Carbon	0.010 (max)	0.010
Manganese	0.50 (max)	0.50
Silicon	0.08 (max)	0.08
Chromium	22.00	22.00
Nickel	56.00	56.00
Molybdenum	13.00	13.00
Cobalt	2.50 (max)	2.060
Tungsten	3.00	3.00
Vanadium	0.35 (max)	0.35
Iron	3.00	3.00
Density = 8.69 g/cm^3		

Table 5.1.5-2. Chemical Composition of ASTM A 516 Grade 70 (Ref. 7.8, p. 2)

Element	Weight Percent Range	Value Used
Carbon	0.30 (max)	0.30
Manganese	0.85 - 1.20	1.025
Phosphorus	0.035 (max)	0.035
Sulfur	0.035 (max)	0.035
Silicon	0.15 - 0.40	0.275
Iron	Balance	98.33
Density = 7.832 g/cm^3		

Density of this material is given as 7.850 g/cm^3 in Reference 7.9, page 7.

Table 5.1.5-3. Chemical Composition of Inconel Alloy 600 (Ref. 7.10, p. 9)

Element	Weight Percent Range	Value Used
Nickel	72.00 (min)	74.335
Chromium	14.0 - 17.0	15.5
Iron	6.0 - 10.0	8.0
Carbon	0.15 (max)	0.15
Manganese	1.0 (max)	1.0
Sulfur	0.015 (max)	0.015
Silicon	0.5 (max)	0.5
Copper	0.5 (max)	0.5
Density = 8.47 g/cm^3		

Table 5.1.5-4. Chemical Composition of Type 304L Stainless Steel (Ref. 7.7, p. 13)

Element	Weight Percent Range	Value Used
Carbon	0.03 (max)	0.03
Manganese	2.00 (max)	2.00
Phosphorus	0.045 (max)	0.045
Sulfur	0.03 (max)	0.03
Silicon	0.75 (max)	0.75
Chromium	18.00 - 20.00	19.00
Nickel	8.00 - 12.00	10.00
Nitrogen	0.10 (max)	0.10
Iron	Balance	68.045
Density = 7.90 g/cm^3		

Density of this material is given as 7.94 g/cm^3 in Reference 7.9, page 7 and as 8.0 g/cm^3 in Reference 7.11, page 871.

Table 5.1.5-5. Chemical Composition of Type 316L Stainless Steel (Ref. 7.7, p. 14)

Element	Weight Percent Range	Value Used
Carbon	0.03 (max)	0.03
Manganese	2.00 (max)	2.00
Phosphorus	0.045 (max)	0.045
Sulfur	0.03 (max)	0.03
Silicon	0.75 (max)	0.75
Chromium	16.00 - 18.00	17.00
Nickel	10.00 - 14.00	12.00
Molybdenum	2.00 - 3.00	2.50
Nitrogen	0.10 (max)	0.10
Iron	Balance	65.545
Density = 7.9497 g/cm^3		

Density of this material is given as 7.98 g/cm^3 in Reference 7.9, page 7 and as 8.0 g/cm^3 in Reference 7.11, page 871.

Table 5.1.5-6. Chemical Composition of Degraded HLW Glass (Ref. 7.2, Table 5.14)

Element	Mole Percent	Element	Mole Percent
H	6.455	K	0.105
C	0.0002	Ti	0.1819
O	59.80	Mn	0.7144
Na	0.0291	Fe	18.84
Al	1.139	Ni	0.3249
Si	11.89	Cu	0.0123
Ca	0.1994	Gd	0.0020
Density at 25°C = 3.892 g/cm^3		Mg	0.2597

Table 5.1.5-7. Chemical Composition of Degraded HLW Glass Used in this Calculation

Element	Mole Percent	Element	Mole Percent
H	6.4551	K	0.3872
C	0.0002	Ti	0.1819
O	59.7993	Mn	0.7144
Na	0.0761	Fe	18.8429
Al	1.1394	Ni	0.2200
Si	11.8930	Cu	0.0123
Ca	0.2762	Gd	0.0020
Density at 25°C = 3.892 g/cm^3			

5.2 DEGRADED FFTF FUEL INSIDE AN INTACT DOE SNF CANISTER SURROUNDED BY DEGRADED HLW

This section describes the calculation performed assuming a DOE SNF canister either located among 5 degraded HLW canisters or against the inner barrier of the waste package surrounded by the remnants of the HLW glass (HLW clayey material). These configurations are shown in Figures 5.2-1 and 5.2-2, respectively. The degraded FFTF fuel either sits on the bottom of the DOE SNF canister (in this case the DOE SNF canister is flooded with water – see Figure 5.2-3) or is homogenized within the DOE SNF canister volume as shown in Figure 5.2-4. The dimensions used to represent the WP and the DOE SNF canister are shown in Figure 5.2-5. Material volumes and densities used to generate the number densities are provided in the spreadsheet scenario1.xls (see Attachments III) for the degraded FFTF SNF and for the HLW clayey material. The equation used to calculate the number density values throughout Section 5.4 is shown below:

$$N = (m/V) \times N_a / M$$

where: m is the mass in grams
V is the volume
N_a is Avogadro's number (6.022 E+23 atoms/mole, Ref. 7.13, p. 59)
M is the atomic weight in gram/mole.

The volume of a cylinder segment is also calculated in the spreadsheet named x% water in clay and "snfhomo0" in the Excel file scenario1.xls (Attachments III). The equation for the volume of a cylinder segment is shown below (Ref. 7.12, p. 19):

$$\text{Cylinder Segment Volume} = L\left(R^2 \cos^{-1}\left(\frac{R-h}{R}\right) - (R-h)\sqrt{2Rh-h^2} \right)$$

where: L is the cylinder length
R is the cylinder radius
h is the height of the segment.

The MCNP input decks developed for this section are presented in Attachment I (the electronic Attachment has been moved to Reference 7.14). The MCNP output decks are presented in Attachment III (the electronic Attachment has been moved to Reference 7.14).

In this calculation, the terms "fraction of water" or "percent of water" refer to a volume fraction or to a percentage of volume.

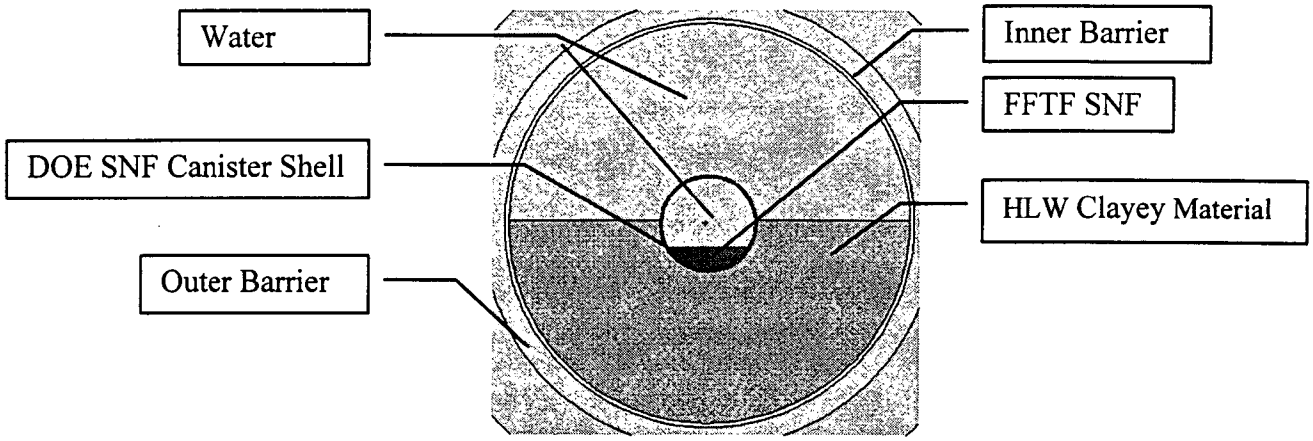

Figure 5.2-1. Cross-sectional View of the DOE SNF Canister Settled in the Middle of the WP

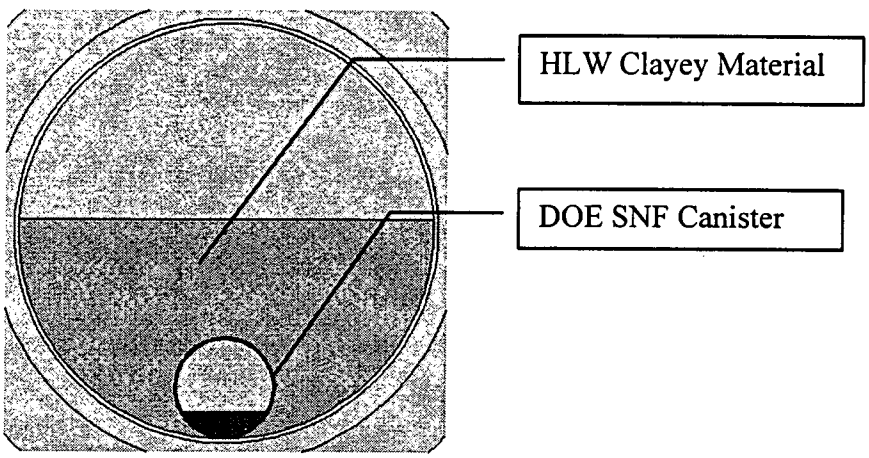

Figure 5.2-2. Cross-sectional View of the DOE SNF Canister on the Bottom of the WP

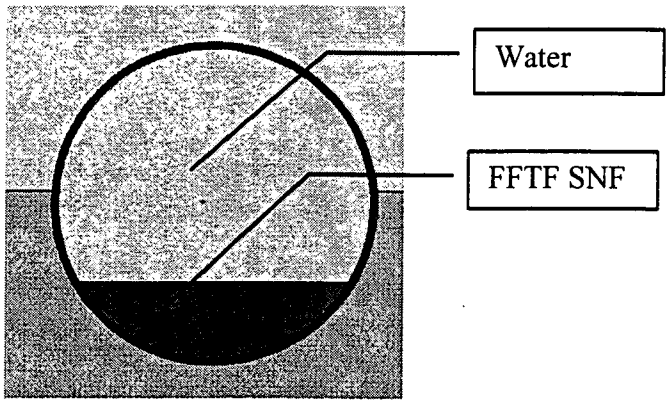

Figure 5.2-3. Cross-sectional View of the DOE SNF Canister with FFTF SNF Settled on the Bottom

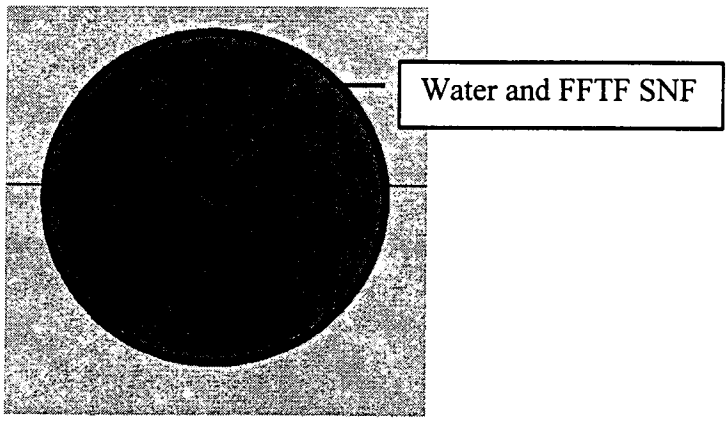

Figure 5.2-4. Cross-sectional View of the DOE SNF Canister with FFTF SNF Homogenized over the Entire Volume

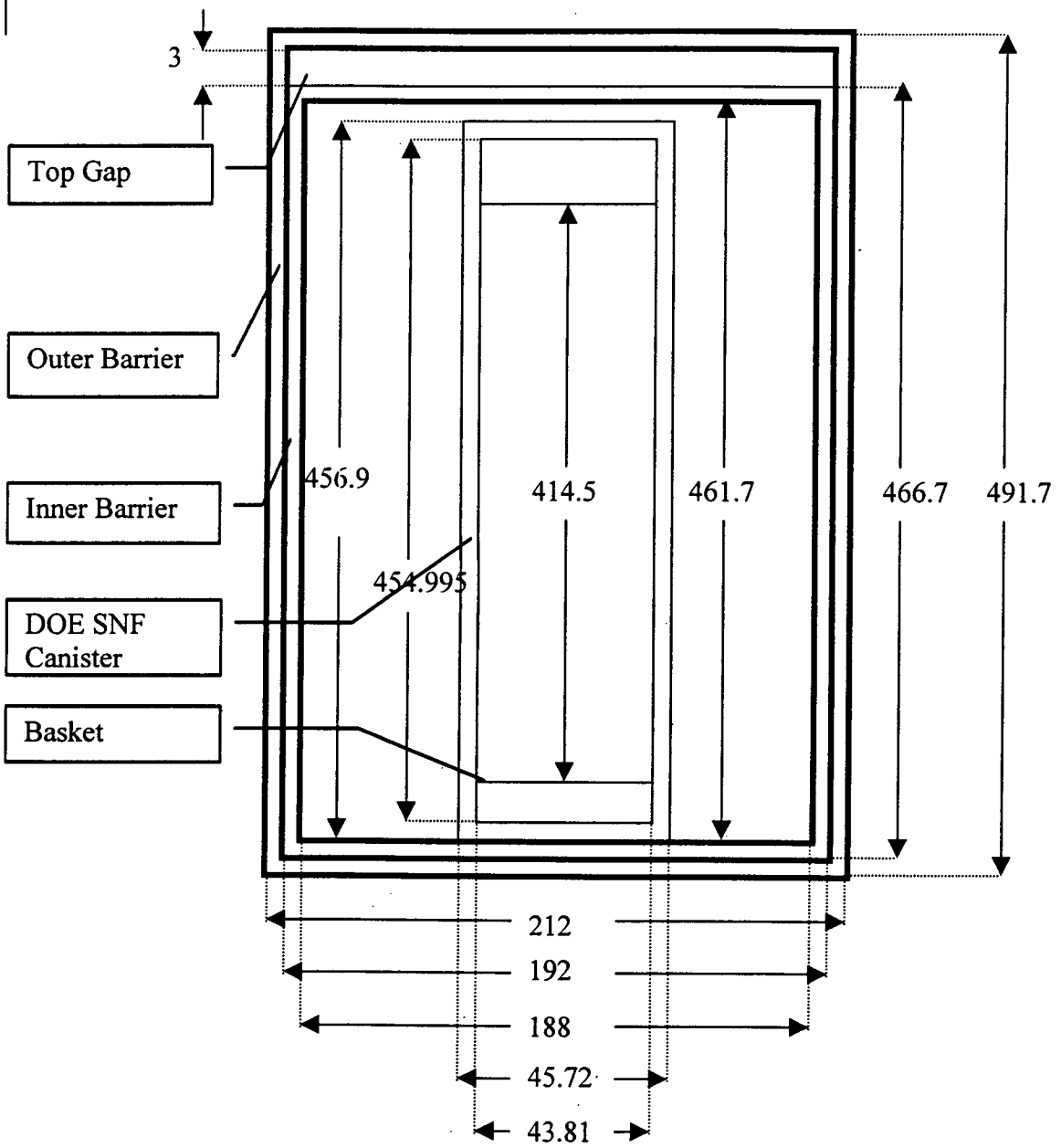

Figure 5.2-5. Dimensions of the WP and the DOE SNF Canister in cm (not to scale)

5.2.1 FFTF Mixture in a Flooded DOE SNF Canister

This scenario is based on an intact DOE SNF canister with the FFTF fuel settled on the bottom of this flooded canister (Figure 5.2-3). The volume and the atomic density of the FFTF mixture enclosed in the DOE SNF canister is calculated in the spreadsheet "clay" in the Excel file

scenario1.xls (Attachment III). Variations of this scenario are listed in Table 5.2.1-1. First the percentage of water in the clay is increased (along with the volume of clay). Then the position of the DOE SNF canister is varied in the WP (see Figures 5.2-1 and 5.2-2).

Table 5.2.1-1. Degraded Dry FFTF SNF in an Intact DOE SNF Canister Surrounded by HLW Clayey Material

Case Name	y_1* (cm)	y_2** (cm)	Description
m00f0c	1.710471	-12.138	DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. Dry clay. WP and DOE SNF void spaces are flooded with water.
m00f20	23.57083	-12.138	DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. 20% water in the clay. WP and DOE SNF void spaces are flooded with water.
m00f49	94 (1 inner radius)	-12.138	DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. Mixture of clay and water flooding the WP. DOE SNF void space is flooded with water.
t00f0c	5.62338	-12.138	DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. Dry clay. WP and DOE SNF void spaces are flooded with water.
t00f20	23.57083	-12.138	DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. 20% water in the clay. WP and DOE SNF void spaces are flooded with water.
t00f49	94 (1 inner radius)	-12.138	DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. Mixture of clay and water flooding the WP. DOE SNF void space is flooded with water.

* y_1 is the distance from the WP centerline to the top of the clay layer.

** y_2 is the distance from the DOE SNF canister centerline to the top of the fuel layer.

5.2.2 FFTF Fuel Mixed with Different Volume of Water in a Flooded DOE SNF Canister

This scenario is based on an intact DOE SNF canister located in the center of the WP. The FFTF fuel is mixed with different volumes of water. Variations of this scenario are listed in Table 5.2.2-1. The hematite (product resulting from the iron degradation) is a porous media and therefore can retain an unknown volume of water. The k_{eff} of a degraded WP as a function of the amount of water trapped in the hematite (which is also noted as Fe_2O_3 in this calculation) is also investigated (Table 5.2.2-1). In all of these cases, the clay was not diluted.

Table 5.2.2-1. Degraded FFTF Fuel Mixed with Water in an Intact DOE SNF Canister Surrounded by Dry HLW Clay

Case Name	% of the Fe_2O_3 Volume Occupied by Water	% of Water in the Fuel	y_1* (cm)	y_2** (cm)
m50f0c	0	50	1.710	-5.833
m80f0c	0	83.374	1.710	21.901 (1 inner radius)
m53f0c	30	50	1.710	-5.833
m83f0c	30	83.374	1.710	21.901 (1 inner radius)
m56f0c	60	50	1.710	-5.833***
m86f0c	60	83.374	1.710	21.901 (1 inner radius)
m60f0c	0	65	1.710	-0.860
m63f0c	30	65	1.710	-0.860
m66f0c	60	65	1.710	-0.86
m20f0c	0	25	1.710	-9.929
m23f0c	30	25	1.710	-9.929
m26f0c	60	25	1.710	-9.929
m03f0c	30	0	1.710	-12.138
m06f0c	60	0	1.710	-12.138

* y_1 is the distance from the WP centerline to the top of the clay layer.

** y_2 is the distance from the DOE SNF canister centerline to the top of the fuel layer.

*** A similar case (called n_clay) was developed using the clay composition given in Table 5.1.5-6 (the atomic densities are calculated in the spreadsheet n_clay.xls, Attachment VIII).

5.2.3 Change in k_{eff} Due to the Absorber

If the main absorbers (Gd and Fe_2O_3) are lost, k_{eff} of the WP will increase. Cases reflecting such events are described in Table 5.2.3-1. The total mass of Gd in the canister is assumed to be 7.7353 kg (see Assumption 3.3 and spreadsheet "gd" of Attachment III).

Table 5.2.3-1. Cases Considering the Loss of Absorber

Cases Name	Mass of Gd (kg) in the DOE SNF Canister	% of Fe_2O_3 Removed from the Canister	Description
nogd56	0	0	DOE SNF canister shell intact in the middle, fuel degraded, dry clay, 60% of the hematite volume is occupied by clay, 50% of water in the fuel. WP and DOE SNF void spaces are flooded. All Gd removed from the FFTF fuel.*
10gd56	0.77353	0	DOE SNF canister shell intact in the middle, fuel degraded, dry clay, 60% of the hematite volume is occupied by clay, 50% of water in the fuel. WP and DOE SNF void spaces are flooded. 90% of the volume of Gd has been removed.
05gd56	0.3868	0	DOE SNF canister shell intact in the middle, fuel degraded, dry clay, 60% of the hematite volume is occupied by clay, 50% of water in the fuel. WP and DOE SNF void spaces are flooded. 95% of the volume of Gd has been removed.
nofe56	7.7353	100	DOE SNF canister shell intact in the middle, fuel degraded, dry clay, 60% of the hematite volume is occupied by clay, 50% of water in the fuel. WP and DOE SNF void spaces are flooded. 100% of the hematite has been removed from the canister.
06gd56	0.4641	0	DOE SNF canister shell intact in the middle, fuel degraded, dry clay, 60% of the hematite volume is occupied by clay, 50% of water in the fuel. WP and DOE SNF void spaces are flooded. 94% of the Gd has been removed from the canister.

* A similar case (called nogdcl) was developed using the clay composition given in Table 5.1.5-6 (the atomic densities are calculated in the spreadsheet n_clay.xls, Attachment VIII).

5.3 DEGRADED SNF CANISTER SETTLED ABOVE THE HLW GLASS CLAY

This section describes the calculations performed assuming the HLW canister degrades before the DOE SNF canister. The degraded HLW clayey material is assumed to be collected at the bottom of the WP, and the degraded FFTF SNF settles at the top of the clayey material as shown

in Figure 5.3-1. Material volumes and densities used to generate the number densities for the MCNP cases are provided in the spreadsheets scenario2a.xls and scenario2b.xls (see Attachments IV and V). The water density used is 1 g/cm^3 unless otherwise specified. The k_{eff} of the WP for different degrees of hydration of both the FFTF SNF and the HLW clayey material layers is investigated in this section. Descriptions of such configurations are given in Table 5.3-1 through Table 5.3-5. The cases described in Table 5.3-6 were developed to investigate the impact of a loss of absorber. The MCNP input decks developed for this section are presented in Attachment I (the electronic Attachment has been moved to Reference 7.14. The MCNP output decks are presented in Attachment II (the electronic Attachment has been moved to Reference 7.14).

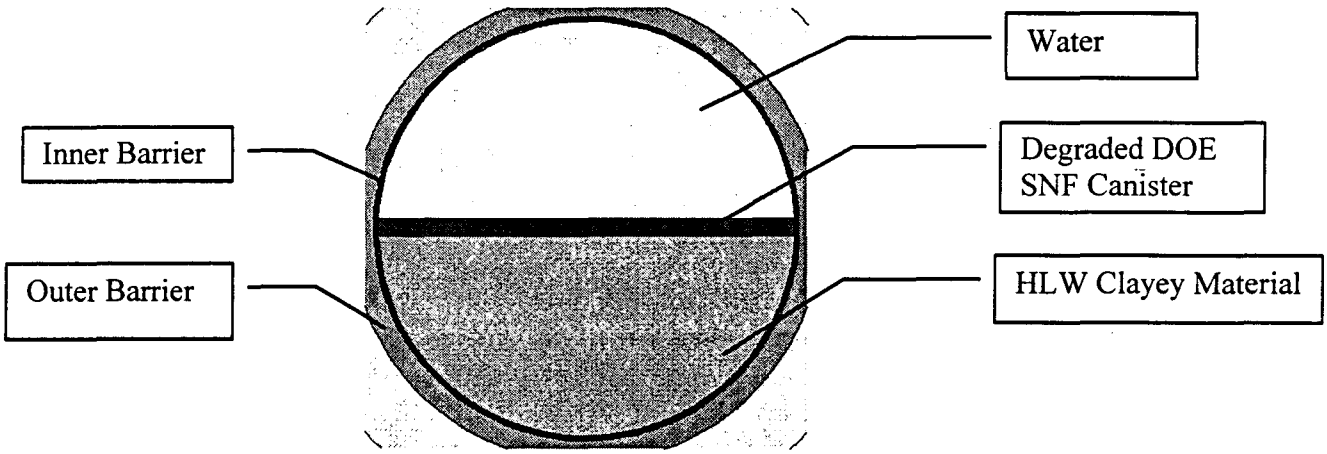

Figure 5.3-1. Degraded DOE SNF on Top of the Degraded HLW Glass Clay

The atomic densities of the clay and of the fuel used for the calculations presented in the two following tables are described in the Excel file scenario2a.xls in the spreadsheets named "clay" and "fuel", respectively.

Table 5.3-1. Stratified Layer of Degraded Dry FFTF SNF on Top of the HLW Glass Clay

Case Name	y_1* (cm)	y_2** (cm)	Fraction of Water in the HLW Clay	Description
ft00	-3.022	-1.087	0	Dry clay. Dry FFTF fuel sits on the top of the clay. The void space in the WP is flooded with water.
ft25	20.750	22.739	0.25	25% of water in the clay. Dry FFTF fuel sits on the top of the clay. The void space in the WP is flooded with water.

Table 5.3-1. Stratified Layer of Degraded Dry FFTF SNF on Top of the HLW Glass Clay

Case Name	y_1* (cm)	y_2** (cm)	Fraction of Water in the HLW Clay	Description
ft50	86.597	94 (1 inner radius)	0.5141	51.41% of water in the clay. Dry FFTF fuel sits on the top of the clay.

* y_1 is the distance from the centerline of the WP to the top of the HLW clay layer.
** y_2 is the distance from the centerline of the WP to the top of the FFTF SNF layer.

In the calculations described in Table 5.3-2, the amount of water in the FFTF SNF layer varies. The HLW clayey material is modeled with no free water fraction (however, it contains some hydrogen in the form of hydrates) in order to maximize the potential volume of the degraded FFTF fuel in the layer above the HLW glass clay.

Table 5.3-2. Stratified Layers with Degraded FFTF Fuel on the Top of Dry Clay

Case Name	y_1* (cm)	y_2** (cm)	Fraction of Water in FFTF Fuel	% of Fe_2O_3 Filled with Water	Description
f25t00	-3.022	-0.441	0.25	0	Dry clay. 25% of water in the FFTF fuel layer. Void space of the WP filled with water.
f50t00	-3.022	0.849	0.50	0	Dry clay. 50% of water in the FFTF fuel layer. Void space of the WP filled with water.
f75t00	-3.022	4.721	0.75	0	Dry clay. 75% of water in the FFTF fuel layer. Void space of the WP filled with water.
f97t00	-3.022	94 (1 inner radius)	0.975	0	Dry clay. 97.48% of water in the FFTF fuel layer (entire space filled with a mixture of water and fuel except the clay layer).
f75t30	-3.022	4.721	0.75	30	Dry clay. 75% of water in the FFTF fuel layer. Void space of the WP filled with water.

Table 5.3-2. Stratified Layers with Degraded FFTF Fuel on the Top of Dry Clay

Case Name	y_1* (cm)	y_2** (cm)	Fraction of Water in FFTF Fuel	% of Fe_2O_3 Filled with Water	Description
f75t60	-3.022	4.721	0.75	60	Dry clay. 75% of water in the FFTF fuel layer. Void space of the WP filled with water.

* y_1 is the distance from the centerline of the WP to the top of the HLW clay layer.

** y_2 is the distance from the centerline of the WP to the top of the FFTF SNF layer.

In the previous configuration, the WP was flooded with water. In the next configuration, the HLW glass clay and the fuel layer fill the entire WP, there is no void space (see Figure 5.3-2). Table 5.3-3 lists the different cases developed. To find the most reactive case, the density of the water mixed with the clay and/or the fuel is varied.

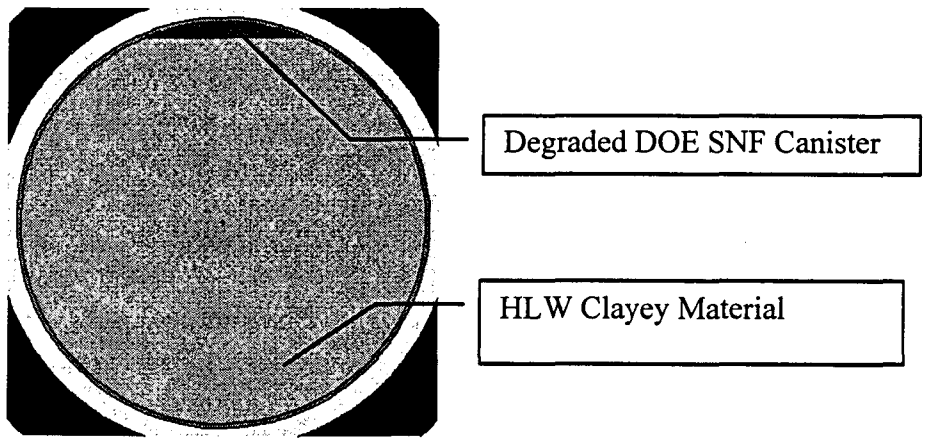

Figure 5.3-2. WP Filled with HLW Clay Material Layer and FFTF SNF Layer

The atomic densities of the clay and of the fuel used for the calculations presented in the two following tables are described in the Excel file scenario2b00.xls in the spreadsheets named "clay" and "fuel", respectively.

Table 5.3-3. Stratified Layer with Degraded FFTF SNF Diluted with Different Density of Water

Case Name	y* (cm)	Density of the Water in the FFTF SNF (g/cm^3)	Density of the Water in the HLW Clayey Material (g/cm^3)
51.41% of Water in the HLW Clayey Material, Dry FFTF SNF			
01ft50	86.597	N/A**	0.1
05ft50	86.597	N/A	0.5
08ft50	86.597	N/A	0.8
ft50***	86.597	N/A	1.0
Dry HLW Clayey Material, 97.48% of Water in the FFTF SNF			
f97t01	-3.022	0.1	N/A
f97t05	-3.022	0.5	N/A
f97t08	-3.022	0.8	N/A
f97t00****	-3.022	1.0	N/A
25% of Water in the HLW Clayey Material, 96.37% of Water in the FFTF SNF			
01ft25	20.750	1.0	0.1
05ft25	20.750	1.0	0.5
08ft25	20.750	1.0	0.8
10ft25	20.750	1.0	1.0
960125	20.750	0.1	1.0
960525	20.750	0.5	1.0
960825	20.750	0.8	1.0
45% of Water in the HLW Clayey Material, 89.77% of Water in the FFTF SNF			
894501	59.068	1.0	0.1
894505	59.068	1.0	0.5
894508	59.068	1.0	0.8
894510	59.068	1.0	1.0
49.39% of Water in the HLW Clayey Material, 75% of Water in the FFTF SNF			
754901	75.106	1.0	0.1
754905	75.106	1.0	0.5
754908	75.106	1.0	0.8
754910	75.106	1.0	1.0
750149	75.106	0.1	1.0
750549	75.106	0.5	1.0
750849	75.106	0.8	1.0
750105	75.106	0.1	0.5
750505	75.106	0.5	0.5
750805	75.106	0.8	0.5

Table 5.3-3. Stratified Layer with Degraded FFTF SNF Diluted with Different Density of Water

Case Name	y* (cm)	Density of the Water in the FFTF SNF (g/cm^3)	Density of the Water in the HLW Clayey Material (g/cm^3)
50% of Water in the HLW Clayey Material, 67.98% of Water in the FFTF SNF			
695001	78.033	1.0	0.1
695005	78.033	1.0	0.5
695008	78.033	1.0	0.8
695010	78.033	1.0	1.0
690101	78.033	0.1	0.1
690501	78.033	0.5	0.1
690801	78.033	0.8	0.1

* y is the distance from the centerline of the WP to the top of the clayey material layer.
** Not Applicable (N/A).
*** See Table 5.3-1.
**** See Table 5.3-2.

In the configurations described in the following table, the layer of fuel and the layer of HLW glass are mixed partially or totally as shown in Figures 5.3-3a and 5.3-3b, respectively. Any available void space in the WP is flooded with water.

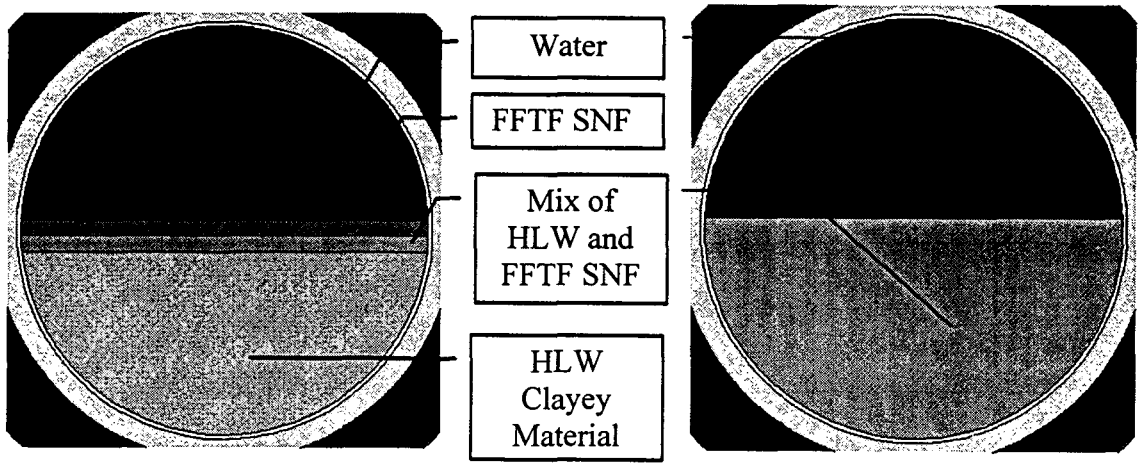

Figure 5.3-3a. Layer of Fuel Partially Mixed with the Layer of HLW Clay

Figure 5.3-3b. Layer of Fuel Totally Mixed with the Layer of HLW Clay

Table 5.3-4. Layer of FFTF Fuel Mixed with Layer of HLW Clayey Material

Case Name	y_1* (cm)	y_2** (cm)	y_3*** (cm)	Fraction of Water in the Fuel	Fraction of Water in the Clay	Description
mixt10	-10.12	-2.25	4.72	0.75	0	90% of the clay is settled on the bottom. A mix composed of 10% of the clay and 10% of the fuel sits on the top of the clay layer followed by 90% of the fuel. The void space in WP is filled with water (see Attachment IV spreadsheet mix).
mixt25	-20.90	-1.09	4.72	0.75	0	75% of the clay is settled on the bottom. A mix composed of 25% of the clay and 25% of the fuel sits on the top of the clay layer followed by 75% of the fuel. The void space in WP is filled with water (see attachment IV spreadsheet mix).
mixt60	-47.63	1.62	4.72	0.75	0	40% of the clay is settled on the bottom. A mix composed of 60% of the clay and 60% of the fuel sits on the top of the clay layer followed by 40% of the fuel. The void space in WP is filled with water (see Attachment IV spreadsheet mix).
mix100	N/A	4.72	N/A	0.75	0	The clay and the fuel are mixed together. The void space in WP is filled with water (see Attachment IV spreadsheet mix).
mx6910	57.43	79.13	94 (1 inner radius)	0.6798	50	10% of the clay and 10% of the fuel are mixed together. Density of the water in the clay is 0.1 g/cm^3 (see Attachment V spreadsheet mix) .

Table 5.3-4. Layer of FFTF Fuel Mixed with Layer of HLW Clayey Material

Case Name	y_1* (cm)	y_2** (cm)	y_3*** (cm)	Fraction of Water in the Fuel	Fraction of Water in the Clay	Description
mx6925	33.08	80.86	94 (1 inner radius)	0.6798	50	25% of the clay and 25% the fuel are mixed together. Density of the water in the clay is 0.1 g/cm^3 (see Attachment V spreadsheet mix).
mx6960	-17.28	85.42	94 (1 inner radius)	0.6798	50	The clay and the fuel are mixed together. Density of the water in the clay is 0.1 g/cm^3 (see Attachment V spreadsheet mix).

* y_1 is the distance from the centerline of the WP to the top of the HLW clay layer.
** y_2 is the distance from the centerline of the WP to the top of the mix layer.
*** y_3 is the distance from the centerline of the WP to the top of the fuel layer.

In the next calculation, the WP contains a mixture of FFTF SNF, HLW, and water such that the inner volume of the WP is filled. Detailed description of the densities used is given in Attachment V spreadsheet mix.

Table 5.3-5. Homogenized FFTF SNF and HLW Clayey Material

Case Name	Density of the Water Needed to Flood the WP (g/cm^3)
homo	1.0
homo08	0.8
homo05	0.5
homo01	0.1

In the previous configurations, the mass of Gd (neutron absorber) present in the WP is 7.7353 kg (see Assumption 3.3). To determine the minimum amount of absorber needed to prevent criticality in the WP, cases described in Table 5.3-6 are developed.

Table 5.3-6. Stratified Layer with Degraded FFTF Fuel on Top with Different Loadings of Neutron Absorber

Case Name	Mass of Gd (kg) in the WP	% Fe_2O_3 Removed from the WP	Fraction of Water in FFTF	Fraction of Water in HLW	Description
nogd75	0	0	0.75	0	No Gd in the fuel layer, WP flooded (see Attachment IV spreadsheet fuel).
nogdfe	0	100	0.75	0	No Gd or hematite in the fuel layer, WP flooded (see Attachment IV spreadsheet fuel).
nogdal	0	0	0.75	0	No Gd in the fuel and clay layer, WP flooded (see Attachment IV spreadsheet fuel).
nogfal	0	100	0.75	0	Neither Gd nor hematite in either the fuel layer or the clay layer, WP flooded (see Attachment IV spreadsheet fuel).
69nogd	0	0	0.6798	0.50	No Gd in the fuel layer (see Attachment V spreadsheet fuel).
69nofe	7.7353	100	0.6798	0.50	No Fe_2O_3 in the fuel layer (see Attachment V spreadsheet fuel).
69nogf	0	100	0.6798	0.50	Neither Gd nor Fe_2O_3 in the fuel layer (see Attachment V spreadsheet fuel).
01gd50	0	0	0	51.41	No Gd in the fuel layer (see Attachment V spreadsheet fuel).
01fe50	7.7353	100	0	51.41	No Fe in the fuel layer (see Attachment V spreadsheet fuel).
01gf50	0	100	0	51.41	Neither Gd nor Fe_2O_3 in the fuel layer (see Attachment V spreadsheet fuel).

5.4 DEGRADED SNF CANISTER SETTLED IN THE BOTTOM OF THE WP, THE HLW CLAYEY MATERIAL ABOVE

This section describes the calculation performed assuming the DOE SNF canister sinks to the bottom of the degraded HLW clay during the degradation process. As the DOE SNF canister degrades, there will be some mixing of the HLW clayey material and the FFTF SNF as shown in

Figure 5.4-1. It is assumed that the water fraction in the bottom layer is the same as the water fraction in the clayey material. Descriptions of the calculations for this scenario are provided in Table 5.4-1. Material volumes and densities used to generate the number densities for the MCNP cases are provided in the spreadsheet "mix" of the Excel file scenario3.xls (see Attachment VI). The MCNP input decks developed for these cases are presented in Attachment I (the electronic Attachment has been moved to Reference 7.14). The MCNP output decks are presented in Attachment II (the electronic Attachment has been moved to Reference 7.14).

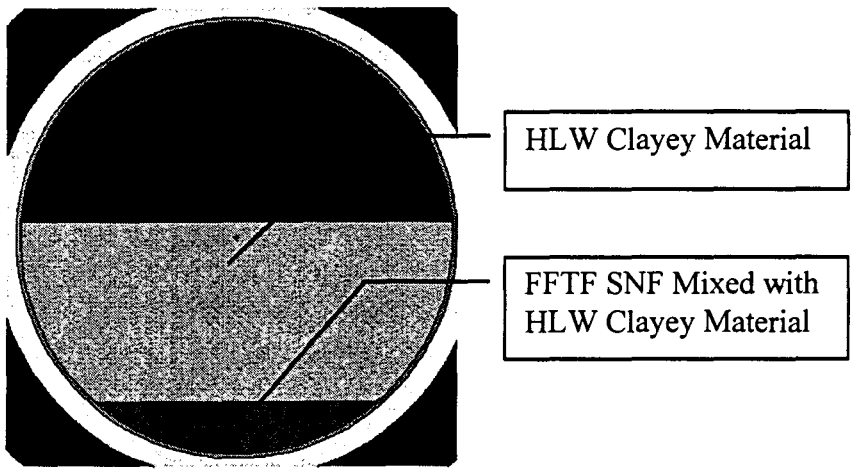

Figure 5.4-1. Degraded DOE SNF Mixed with HLW Glass Clay at the Bottom of the WP

Table 5.4-1. Stratified Layer, FFTF SNF Layer at the Bottom of the WP

Case Name	Water Fraction of the Clay and of the FFTF SNF	% of HLW Mixed With Degraded FFTF SNF	y_1* (cm)	y_2** (cm)
w00h00	0.0	00	-86.597	-1.087
w00h10	0.0	10	-73.035	-1.087
w00h20	0.0	20	-62.773	-1.087
w00h30	0.0	30	-53.741	-1.087
w10h00	0.1	00	-86.054	7.002
w10h10	0.1	10	-71.469	7.002
w10h20	0.1	20	-60.406	7.002
w10h30	0.1	30	-50.645	7.002
w20h00	0.2	00	-85.399	17.196
w20h10	0.2	10	-69.575	17.196
w20h20	0.2	20	-57.534	17.196
w20h30	0.2	30	-46.879	17.196
w30h00	0.3	00	-84.589	30.639

Table 5.4-1. Stratified Layer, FFTF SNF Layer at the Bottom of the WP

Case Name	Water Fraction of the Clay and of the FFTF SNF	% of HLW Mixed With Degraded FFTF SNF	y_1* (cm)	y_2** (cm)
w30h10	0.3	10	-67.227	30.639
w30h20	0.3	20	-53.965	30.639
w30h30	0.3	30	-42.179	30.639
w40h00	0.4	00	-83.559	49.853
w40h10	0.4	10	-64.224	49.853
w40h20	0.4	20	-49.375	49.853
w40h30	0.4	30	-36.108	49.853
w50h00	0.5	00	-82.073	94 (WP filled)
w50h10	0.5	10	-59.864	94 (WP filled)
w50h20	0.5	20	-42.667	94 (WP filled)
w50h30	0.5	30	-27.164	94 (WP filled)

* y_1 is the distance from the centerline of the WP to the top of the FFTF SNF layer.

** y_2 is the distance from the centerline of the WP to the top of the HLW Clayey Material.

Table 5.4-2 describes the calculation developed to predict k_{eff} in case of total loss of the absorber Gd and total loss of the hematite.

Table 5.4-2. Stratified Layers of FFTF SNF and HLW Clayey Material with Different Loading of Neutron Absorber

Case Name	Water Fraction of the Clay and of the FFTF SNF	% of HLW Mixed with Degraded FFTF SNF	Mass of Gd in the Mix Layer (g)	Fraction of Fe_2O_3 from the FFTF SNF Removed from the Mix Layer
nogd30	0.30	10	304.584	0
nogf30	0.30	10	304.584	1
ngd30b	0.30	10	0	0
ngf30b	0.30	10	0	1
nogd50	0.507358	00	0	0
nogf50	0.507358	00	0	1

5.5 EFFECTS OF PLUTONIUM DECAY

In this section, the decay of the following materials is studied: Pu-239, Pu-240, and Pu-241. Pu-239 and Pu-240 are alpha emitters and will decay to U-235 and U-236 respectively (see Ref. 7.13, p. 48). Pu-241 is a β^- emitter and will decay to Am-241. Am-241 is an alpha emitter and decays to Np-237 (see Ref. 7.13, p. 48).
The atomic density of an element/isotope at a time t is given by Equation 5.1:

$$N_X(t) = N_{o_X} * \exp\left(\frac{-\ln 2 * t}{T_{1/2X}}\right) \qquad \text{Equation 5.1.}$$

where : t is the time,
$N_X(t)$ is the atomic density of the isotope X at time t,
N_{oX} is the atomic density of the isotope X at time zero,
$T_{1/2X}$ is the half-life of the isotope X

In this calculation, k_{eff} is evaluated at 4 different times:

- $t = 0$: decays as not started.
- $t = T_{1/2_{Pu-239}} = 2.41E4 years$ (Ref. 7.13, p. 48).
- $t = 2 * T_{1/2_{Pu-239}} = 4.82E4 years$. At this time, practically all Pu-241 has decayed to Np-237 and more than 99% of the Pu-240 has decayed to U-236.
- t = Final. The time "final" refers to the time at which all plutonium isotopes have decayed (e.g., at ten half-lives of Pu-239, more than 99.9% of Pu-239 has decayed to U-235 and all other plutonium isotopes are essentially zero).

Table 5.5-1 gives a list of the cases listed in previous sections that are studied in Section 5.5. Those particular cases were selected because their reactivity is high.
The atomic densities of each fissile material at times of interest are given in Attachment IX.

Table 5.5-1. List of the Cases Studied

Case Name	Case Name
69nogd	mx6925
69nogf	nofe56
754905	nogd56
894508	nogf50
m06f0c	t00f20
m56f0c	w50h00

6. RESULTS

This calculation file documents the criticality evaluations that were performed for a Five-Pack defense HLW waste package containing FFTF fuel in the DOE SNF canister. Sections 6.1 through 6.4 present the k_{eff} results for each of the scenarios depicted in Sections 5.2 through 5.5. The k_{eff} results represent the average combined collision, absorption, and track-length estimator from the MCNP calculations. The standard deviation 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 estimated k_{eff} with 99% confidence are calculated in the spread sheet plot.xls (Attachment VII).

These results are based in part on existing data; therefore, use of any results from this calculation for input into document supporting procurement, fabrication, or construction is required to be identified and tracked as TBV in accordance with appropriate procedures.

6.1 DEGRADED FFTF FUEL IN AN INTACT DOE SNF CANISTER

Table 6.1-1 presents the result for the MNCP calculation described in Section 5.2.1. Results reported in this table show that the most reactive case occur for dry HLW clay and if the DOE SNF canister is located in the middle of the codisposal waste canister. Table 6.1-2 illustrates the results for the MCNP calculation performed using this configuration of the WP and using the configurations of the DOE SNF canister described in Section 5.2.2.

Table 6.1-1. Degraded Dry FFTF Fuel in a WP Containing HLW Clay

Description	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio *	AENCF (MeV) **	MCNP Output File Name
DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. Dry clay. WP and DOE SNF void spaces are flooded with water.	0.2824	0.0008	0.2840	0	0.5756	m00f0c.O
DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. 20% water in the clay. WP and DOE SNF void spaces are flooded with water.	0.2674	0.0009	0.2691	0	0.6012	m00f20.O

Table 6.1-1. Degraded Dry FFTF Fuel in a WP Containing HLW Clay

Description	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio *	AENCF (MeV) **	MCNP Output File Name
DOE SNF canister shell intact in the middle of the WP, FFTF fuel degraded. Mixture of clay and water flooding the WP. DOE SNF void space is flooded with water.	0.2590	0.0008	0.2606	0	0.6095	m00f49.O
DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. Dry clay. WP and DOE SNF void spaces are flooded with water.	0.2695	0.0007	0.2709	0	0.6067	t00f0c.O
DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. 20% water in the clay. WP and DOE SNF void spaces are flooded with water.	0.2720	0.0008	0.2736	0	0.5955	t00f20.O
DOE SNF canister shell intact on the bottom of the WP, FFTF fuel degraded. Mixture of clay and water flooding the WP. DOE SNF void space is flooded with water.	0.2692	0.0009	0.2709	0	0.5938	t00f49.O

* H/X: ratio of hydrogen to fissile material (U^{235} +Pu^{239}).

** AENCF: average energy neutron causing fission.

Table 6.1-2. Degraded FFTF Fuel in a Flooded WP Containing Dry HLW Clay

Description		Results					
% of Fe_2O_3 Occupied by Water	% of Water in the Fuel	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio	AENCF (MeV)	MCNP Output File Name
30	0	0.4471	0.0011	0.4494	20.2	0.3045	m03f0c.O
60	0	0.5383	0.0015	0.5413	40.2	0.2157	m06f0c.O
0	50	0.5245	0.0012	0.5270	61.6	0.1751	m50f0c.O
0	83.374	0.5307	0.0010	0.5327	309.0	0.0675	m80f0c.O
30	50	0.5794	0.0013	0.5820	102.1	0.1286	m53f0c.O

Table 6.1-2. Degraded FFTF Fuel in a Flooded WP Containing Dry HLW Clay

Description		Results					
% of Fe_2O_3 Occupied by Water	% of Water in the Fuel	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio	AENCF (MeV)	MCNP Output File Name
30	83.374	0.5042	0.0009	0.5060	430.6	0.0570	m83f0c.O
60	50	0.5978	0.0013	0.6004	142.5	0.1057	m56f0c.O*
60	83.374	0.4767	0.0008	0.4783	552.3	0.0494	m86f0c.O
0	65	0.5646	0.0012	0.5669	114.4	0.1196	m60f0c.O
30	65	0.5837	0.0013	0.5863	172.2	0.0944	m63f0c.O
60	65	0.5774	0.0011	0.5796	230.0	0.0795	m66f0c.O
0	25	0.4211	0.0011	0.4232	20.5	0.3106	m20f0c.O
30	25	0.5294	0.0013	0.5320	47.5	0.2004	m23f0c.O
60	25	0.5843	0.0014	0.5871	74.5	0.1574	m26f0c.O

* The k_{eff} obtained for the case n_clay (similar to m56f0c except the clay composition) is 0.6006, the standard deviation is 0.0009 (see n_clay.O). Therefore the two cases (m56f0c and n_clay) are statistically identical.

Table 6.1-3 shows the k_{eff} in the WP assuming that some of the principal absorbers have been removed from the WP and that the water fraction in the fuel is 0.50. A detailed description of the different cases studied is given in Table 5.2.3-1.

Table 6.1-3. Degraded FFTF SNF with Different Loadings of Neutron Absorber

Description		Results					
Mass of Gd (kg) in the DOE SNF Canister	% of Fe_2O_3 Removed from the Canister	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio	AENCF (MeV)	MCNP Output File Name
0	0	1.0415	0.0012	1.0439	142.5	0.0604	nogd56.O*
0.3868	0	0.9185	0.0016	0.9217	142.5	0.0700	05gd56.O
0.4641	0	0.9053	0.0016	0.9084	142.5	0.0697	06gd56.O
0.77353	0	0.8518	0.0015	0.8547	142.5	0.0739	10gd56.O
7.7353	100	0.6270	0.0009	0.6288	142.5	0.1211	nofe56.O

* The k_{eff} obtained for the case nogdcl (similar to nogd56 except the clay composition) is 1.0438, the standard deviation is 0.0012 (see nogdcl.O). Therefore the two cases (nogd56and nogdcl) are statistically identical.

6.2 DEGRADED SNF CANISTER SETTLED ABOVE THE HLW GLASS CLAY

The following presents the results of the calculations described in Section 5.3.

Table 6.2-1. Degraded Layer of Dry FFTF Fuel on the Top of a HLW Clay Layer

Fraction of Water in the HLW Clay	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio in the Fuel Section	AENCF (MeV)	MCNP Output File Name
0	0.1561	0.0006	0.1574	0	0.2828	ft00.O
0.25	0.1491	0.0007	0.1505	0	0.2941	ft20.O
0.5141 (WP filled)	0.1969	0.0008	0.1984	0	0.4870	ft50.O

Table 6.2-2. Degraded Layer of FFTF Fuel on the Top of a Dry HLW Clay Layer

Description		Results					
Fraction of Water in the FFTF Fuel	% of the Fe_2O_3 Volume Filled with Water	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio in the Fuel Section	AENCF (MeV)	MCNP Output File Name
0.25	0	0.1930	0.0008	0.1946	33.2	0.2086	f25t00.O
0.50	0	0.2586	0.0009	0.2604	99.6	0.1309	f50t00.O
0.75	0	0.3463	0.0009	0.3481	298.8	0.0670	f75t00.O
0.975	0	0.2310	0.0004	0.2318	3855.7	0.0180	f97t00.O
0.75	30	0.3516	0.0010	0.3535	335.2	0.0629	f75t30.O
0.75	60	0.3562	0.0008	0.3578	371.6	0.0596	f75t60.O

Table 6.2-3 lists the k_{eff} of the configuration developed assuming the density of the water in either the clay or the fuel is variable.

Table 6.2-3. Layers of FFTF SNF and HLW Glass Diluted with Water of Variable Density

Description		Results					
Density of the Water in the FFTF SNF (g/cm^3)	Density of the Water in the HLW Clay (g/cm^3)	k_{eff}	σ	$k_{eff}+2\sigma$	AENCF (MeV)	H/X Ratio in the Fuel Section	MCNP Output File Name
51.41% of Water in the HLW Clayey Material, Dry FFTF SNF							
N/A	0.1	0.2107	0.0007	0.2121	0.4756	0	01ft50.O
N/A	0.5	0.1977	0.0006	0.1989	0.4956	0	05ft50.O
N/A	0.8	0.1972	0.0007	0.1986	0.4957	0	08ft50.O
N/A	1.0	0.1969	0.0008	0.1984	0.4870	0	ft50.O
Dry HLW Clayey Material, 97.48% of Water in the FFTF SNF							
0.1	N/A	0.3434	0.0008	0.3450	0.0580	385.6	f97t01.O
0.5	N/A	0.2840	0.0005	0.2850	0.0253	1927.9	f97t05.O
0.8	N/A	0.2476	0.0004	0.2484	0.0198	3084.6	f97t08.O
1.0	N/A	0.2310	0.0004	0.2318	0.0180	3855.7	f97t00.O
25% of Water in the HLW Clayey Material, 96.37% of Water in the FFTF SNF							
1.0	0.1	0.2622	0.0005	0.2631	0.0206	2641	01ft25.O
1.0	0.5	0.2610	0.0004	0.2618	0.0210	2641	05ft25.O
1.0	0.8	0.2624	0.0004	0.2632	0.0199	2641	08ft25.O
1.0	1.0	0.2617	0.0004	0.2625	0.0213	2641	10ft25.O
0.1	1.0	0.3305	0.0011	0.3327	0.0742	264.1	960125.O
0.5	1.0	0.3189	0.0006	0.3201	0.0301	1320.5	960525.O
0.8	1.0	0.2806	0.0004	0.2813	0.0228	2112.8	960825.O
45% of Water in the HLW Clayey Material, 89.77% of Water in the FFTF SNF							
1.0	0.1	0.3775	0.0007	0.3788	0.0377	874.0	894501.O
1.0	0.5	0.3758	0.0007	0.3771	0.0374	874.0	894505.O
1.0	0.8	0.3739	0.0007	0.3752	0.0373	874.0	894508.O
1.0	1.0	0.3739	0.0007	0.3752	0.0376	874.0	894510.O
49.39% of Water in the HLW Clayey Material, 75% of Water in the FFTF SNF							
1.0	0.1	0.4555	0.0009	0.4574	0.0570	298.8	754901.O
1.0	0.5	0.4726	0.0011	0.4748	0.0648	298.8	754905.O
1.0	0.8	0.4700	0.0009	0.4718	0.0664	298.8	754908.O
1.0	1.0	0.4675	0.0011	0.4696	0.0666	298.8	754910.O
0.1	1.0	0.4198	0.0011	0.4222	0.2243	29.9	750149.O
0.5	1.0	0.4865	0.0012	0.4890	0.0958	149.4	750549.O
0.8	1.0	0.4633	0.0010	0.4653	0.0750	239	750849.O
0.1	0.5	0.2450	0.0008	0.2466	0.2585	29.9	750105.O
0.5	0.5	0.4368	0.0011	0.4390	0.0993	149.4	750505.O

Table 6.2-3. Layers of FFTF SNF and HLW Glass Diluted with Water of Variable Density

Description		Results					
Density of the Water in the FFTF SNF (g/cm^3)	Density of the Water in the HLW Clay (g/cm^3)	k_{eff}	σ	$k_{eff}+2\sigma$	AENCF (MeV)	H/X Ratio in the Fuel Section	MCNP Output File Name
0.8	0.5	0.4676	0.0013	0.4701	0.0767	239	750805.O
50% of Water in the HLW Clayey Material, 67.98% of Water in the FFTF SNF							
1.0	0.1	0.4910	0.0011	0.4932	0.0766	211.4	695001.O
1.0	0.5	0.4788	0.0013	0.4814	0.0782	211.4	695005.O
1.0	0.8	0.4756	0.0010	0.4776	0.0822	211.4	695008.O
1.0	1.0	0.4754	0.0010	0.4775	0.0796	211.4	695010.O
0.1	0.1	0.2503	0.0009	0.2521	0.2866	21.1	690101.O
0.5	0.1	0.4362	0.0012	0.4385	0.1174	105.7	690501.O
0.8	0.1	0.4794	0.0012	0.4818	0.0895	169.2	690801.O

The following table describes the k_{eff} of a WP if one assumes the fuel and the clay layer is mixed.

Table 6.2-4. Stratified Layer with Degraded FFTF Fuel on the Top

Description			Results					
% of Water in the Fuel	% of Water in the Clay	% of Fuel and Clay Mixed	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio in the Mix	AENCF (MeV)	MCNP Output File Name
0.75	0	10	0.3481	0.0009	0.3498	632.6	0.0619	mixt10.O
0.75	0	25	0.3341	0.0009	0.3359	632.6	0.0574	mixt25.O
0.75	0	60	0.2913	0.0007	0.2927	632.6	0.0362	mixt60.O
0.75	0	100	0.2929	0.0005	0.2940	632.6	0.0234	mix100.O
0.6798	50	10	0.4876	0.0012	0.4899	909.7	0.0745	mx6910.O
0.6798	50	25	0.4704	0.0010	0.4725	909.7	0.0691	mx6925.O
0.6798	50	60	0.3997	0.0009	0.4016	909.7	0.0645	mx6960.O

Table 6.2-5. k_{eff} of a WP with Homogenized Mixture of FFTF SNF and HLW Clay Inside

Density of the Water Mixed with the Dry Clay and the Dry Fuel (g/cm^3)	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio	AENCF (MeV)	MCNP Output File Name
1.0	0.1654	0.0002	0.1659	4189.6	0.0149	homo.O
0.8	0.1766	0.0003	0.1772	3418.4	0.0168	homo08.O
0.5	0.2029	0.0003	0.2035	2261.7	0.0172	homo05.O
0.1	0.2744	0.0006	0.2755	719.4	0.0245	homo01.O

Tables 6.2-4 and 6.2-5 show that criticality of the WP will not occur if the layer of degraded fuel and degraded clayey material are mixed. However, one knows that the loss of neutron absorber increases the k_{eff}. Table 6.2-6 presents the results of calculations performed assuming loss of Gd and Fe_2O_3.

Table 6.2-6. Loss of Absorber in a WP with Stratified Layer of Fuel and HLW Glass Clay

Description				Results					
Mass of Gd (kg) in the WP	% of Fe_2O_3 Removed from the WP	% of Water in FFTF	% of Water in HLW	k_{eff}	σ	$k_{eff}+2\sigma$	H/X Ratio	AENCF (MeV)	MCNP Output File Name
3.046*	0	75	0	0.7987	0.0016	0.8018	371.6	0.0269	nogd75.O
3.046*	100	75	0	0.8500	0.0017	0.8534	371.6	0.0274	nogdfe.O
0	0	75	0	0.8031	0.0016	0.8062	371.6	0.0264	nogdal.O
0	100	75	0	0.8539	0.0015	0.8569	371.6	0.0272	nogfal.O
0	0	67.98	50	0.8848	0.0016	0.8881	211.4	0.0438	69nogd.O
10.78**	100	67.98	50	0.4845	0.0011	0.4866	211.4	0.0927	69nofe.O
0	100	67.98	50	0.9213	0.0017	0.9247	211.4	0.0489	69nogf.O
0	0	0	51.41	0.2470	0.0009	0.2488	0	0.4043	01gd50.O
10.78**	100	0	51.41	0.1964	0.0008	0.1979	0	0.7657	01fe50.O
0	100	0	51.41	0.2273	0.0008	0.2290	0	0.6551	01gf50.O

* Mass of Gd in the Clay.

** Mass of Gd in the Clay and the FFTF SNF.

6.3 DEGRADED SNF CANISTER SETTLED AT THE BOTTOM OF THE WP, THE HLW GLASS CLAY LAYER ABOVE

The following Tables present the results of the calculations described in Section 5.4.

Table 6.3-1. k_{eff} for WP Containing Degraded FFTF SNF Layer Beneath a HLW Clayey Material Layer

Description		Results					
Water Fraction in the Clay and in the FFTF SNF	% of HLW Mixed With Degraded FFTF SNF	k_{eff}	σ	$k_{eff}+2\sigma$	AENCF (MeV)	H/X Ratio in the Mix	MCNP Output File Name
0	00	0.2239	0.0007	0.2253	0.4655	0.0	w00h00.O
0	10	0.3221	0.0010	0.3241	0.1421	0.6	w00h10.O
0	20	0.3598	0.0011	0.3619	0.0841	0.6	w00h20.O
0	30	0.3743	0.0009	0.3761	0.0591	0.7	w00h30.O
0.1	00	0.2803	0.0009	0.2822	0.3323	0.8	w10h00.O
0.1	10	0.4001	0.0010	0.4021	0.0944	1.3	w10h10.O
0.1	20	0.4117	0.0009	0.4135	0.0593	1.4	w10h20.O
0.1	30	0.4060	0.0010	0.4079	0.0452	1.4	w10h30.O
0.2	00	0.3284	0.0010	0.3304	0.2530	1.6	w20h00.O
0.2	10	0.4329	0.0011	0.4350	0.0748	2.0	w20h10.O
0.2	20	0.4227	0.0010	0.4247	0.0484	2.1	w20h20.O
0.2	30	0.3936	0.0009	0.3953	0.0392	2.1	w20h30.O
0.3	00	0.3698	0.0011	0.3720	0.1968	2.4	w30h00.O
0.3	10	0.4438	0.0012	0.4461	0.0633	2.8	w30h10.O
0.3	20	0.4084	0.0009	0.4102	0.0406	2.8	w30h20.O
0.3	30	0.3664	0.0007	0.3679	0.0336	2.8	w30h30.O
0.4	00	0.4109	0.0012	0.4134	0.1551	3.1	w40h00.O
0.4	10	0.4356	0.0008	0.4372	0.0515	3.5	w40h10.O
0.4	20	0.3791	0.0007	0.3805	0.0374	3.5	w40h20.O
0.4	30	0.3335	0.0007	0.3348	0.0309	3.5	w40h30.O
0.5	00	0.4468	0.0011	0.4490	0.1234	4.0	w50h00.O
0.5	10	0.4103	0.0008	0.4119	0.0440	4.3	w50h10.O
0.5	20	0.3418	0.0007	0.3432	0.0327	4.3	w50h20.O
0.5	30	0.2960	0.0005	0.2970	0.0255	4.3	w50h30.O

Table 6.3-2. Stratified Layers of FFTF SNF and HLW Clayey Material with Different Loading of Neutron Absorber

Description				Results					
% of Water in the Clay and in the Fuel	% of HLW Mixed With FFTF SNF	Mass of Gd in the Mix Layer (g)	% of Fe_2O_3 in the Fuel	k_{eff}	σ	k_{eff} $+2\sigma$	AENCF (MeV)	H/X Ratio in the Mix	MCNP Output File Name
30	10	304.58	100	0.7072	0.0016	0.7103	0.0387	2.8	nogd30.O
30	10	304.58	0	0.6944	0.0014	0.6972	0.0410	2.8	nogf30.O
30	10	0	100	0.7650	0.0018	0.7685	0.0351	2.8	ngd30b.O
30	10	0	0	0.7640	0.0015	0.7670	0.0377	2.8	ngf30b.O
50.74	00	0	100	0.6175	0.0014	0.6202	0.0808	4.0	nogd50.O
50.74	00	0	0	0.8506	0.0018	0.8542	0.0921	4.0	nogf50.O

6.4 EFFECTS OF PLUTONIUM DECAY

In this section, effect of plutonium decay is calculated. Results of the calculations which are described in Section 5.5 are given in Table 6.4-1.

Table 6.4-1. Plutionium Decays Effects

t=0				t=T ½ Pu-239				t=2*T ½ Pu-239				t=Final			
File Name	k_{eff}	$k_{eff}+2\sigma$	AENCF (MeV)	File Name	k_{eff}	$k_{eff}+2\sigma$	AENCF (MeV)	File Name	k_{eff}	$k_{eff}+2\sigma$	AENCF (MeV)	File Name	k_{eff}	$k_{eff}+2\sigma$	AENCF (MeV)
69nogd[1]	0.8848	0.8881	0.0438	69ng.5	0.8995	0.9025	0.0352	69ng.7	0.8645	0.8677	0.0334	69ngal	0.7872	0.7900	0.0313
69nogf[1]	0.9213	0.9247	0.0489	69no.5	0.9637	0.9670	0.0369	69no.7	0.9444	0.9477	0.0347	69noal	0.8915	0.8947	0.0318
754905[2]	0.4726	0.4748	0.648	7549.5	0.3844	0.3860	0.0687	7549.7	0.3094	0.3106	0.0776	7549al	0.2053	0.2059	0.0980
894508[9]	0.3739	0.3752	0.0373	8945.5	0.2810	0.2818	0.0442	8945.7	0.2223	0.2231	0.0499	8945al	0.1540	0.1545	0.06425
m06f0c[3]	0.5383	0.5413	0.2157	m06f.5	0.5211	0.5233	0.1852	m06f.7	0.4876	0.4901	0.1808	m06fal	0.3951	0.3966	0.1930
m56f0c[3]	0.5978	0.6004	0.1057	m56.5	0.5313	0.5334	0.0975	m56.7	0.4502	0.4517	0.1073	m56al	0.3107	0.3116	0.1302
mx6925[4]	0.4704	0.4725	0.0691	mx69.5	0.4020	0.4038	0.0659	mx69.7	0.3352	0.3364	0.0726	mx69al	0.2441	0.2450	0.0713
nofe56[5]	0.6270	0.6288	0.1211	nofe.5	0.5591	0.5606	0.1140	nofe.7	0.4783	0.4749	0.1233	nofeal	0.3272	0.3280	0.1505
nogd56[5]	1.0415	1.0439	0.0604	nogd.5	1.1098	1.1122	0.0472	nogd.7	1.0998	1.1021	0.0426	nogdal	1.0453	1.0477	0.0390
nogf50[6]	0.8506	0.8542	0.0921	nogf.5	0.9111	0.9145	0.0716	nogf.7	0.9096	0.9131	0.0646	nogfal	0.8667	0.8698	0.577
t00f20[7]	0.2720	0.2736	0.5955	t00f.5	0.2495	0.2511	0.5251	t00f.7	0.2399	0.2415	0.4972	t00fal	0.2209	0.2224	0.4953
w50h00[8]	0.4468	0.4490	0.1234	w50h.5	0.4062	0.4080	0.1136	w50h.7	0.3514	0.3531	0.1208	w50hal	0.2517	0.2528	0.1418

1 H/X ratio=211.4
2 H/X ratio=298.8
3 H/X ratio=40.2
4 H/X ratio=909.7
5 H/X ratio=142.5
6 H/X ratio=4.0
7 H/X ratio=0
8 H/X ratio=4.0
9 H/X ratio=874.0

6.5 VARIATION OF THE CHEMICAL COMPOSITION OF TYPE 316L STAINLESS STEEL

In the previous cases, the weight percent of Mn in the chemical composition of stainless steel 316L is 2, which is the maximum value allowed (see Table 5.1.5-5). However, Mn is an absorber. Therefore, the following cases were run to investigate the sensitivity of k_{eff} to percentage of Mn in the composition of stainless steel 316L. These cases are based on the most reactive cases developed: m56f0c and nogd56. In these cases, the weight percent of Mn in the composition of stainless steel 316L was modified. The results are given in Table 6.5-1. The input and output files are presented in Attachment I and II (the electronic Attachment has been moved to Reference 7.14).

Table 6.5-1. Variation of the Weight Percent of Mn in the Type 316L Stainless Steel Material

Weight Percent of Mn in the Type 316L Stainless Steel	Case Name	k_{eff}	σ	$k_{eff}+2\sigma$	AENCF (MeV)	H/X Ratio	MCNP Output File Name
1	m56f01*	0.5979	0.0012	0.6002	0.1057	142.5	m56f01.O
0	m56f00*	0.6001	0.0013	0.6026	0.1056	142.5	m56f00.O
1	nogd01**	1.0414	0.0013	1.0440	0.0596	142.5	nogd01.O
0	nogd00**	1.0430	0.0013	1.0455	0.0601	142.5	nogd00.O

* Case based on m56f0c.

** Case based on nogd56.

7. REFERENCES

7.1 Los Alamos National Laboratory (LANL) 1997. *MCNP - A General Monte Carlo N-Particle Transport Code*. Los Alamos, New Mexico: LANL. LA-12625-M. TIC: 241044.

7.2 Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) 1998. *EQ6 Calculations for Chemical Degradation of Fast Flux Test Facility (FFTF) Waste Packages*. BBA000000-01717-0210-00028 REV 00. Las Vegas, Nevada: M&O. ACC: MOL.19981229.0081.

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

7.4 CRWMS M&O 1997. *Waste Package Materials Selection Analysis*. BBA000000-01717-0200-00020 REV 01. Las Vegas, Nevada: M&O. ACC: MOL.19980324.0242.

7.5 Oak Ridge National Laboratory (ORNL) 1992. *Characteristics of Potential Repository Wastes*. DOE/RW-0184-R1 Volume 1. Oak Ridge, Tennessee: ORNL. TIC: 5890.

7.6 Idaho National Engineering and Environmental Laboratory (INEEL) 1998. *FFTF (MOX) Fuel Characteristics for Disposal Criticality Analysis*. DOE/SNF/REP-032 Rev 00. Idaho Falls, Idaho: INEEL. TIC: 241492.

7.7 CRWMS M&O 1996. *Material Compositions and Number Densities for Neutronics Calculations*. BBA000000-01717-0200-00002 REV 00. Las Vegas, Nevada: M&O. ACC: MOL.19960624.0023.

7.8 American Society for Testing and Materials (ASTM) 1990. *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*. ASTM A 516/A 516M-90. Philadelphia, Pennsylvania: ASTM. TIC: 237681.

7.9 ASTM 1994. *Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens*. ASTM G 1-90. Philadelphia, Pennsylvania: ASTM. TIC: 238771.

7.10 Inco Alloys International 1988. *Inco Alloys International Literature on Inconel Alloy 600*. Huntington, West Virginia: Inco Alloys International, Inc. TIC: 239841.

7.11 American Society for Metals (ASM) 1990. *Metals Handbook Tenth Edition, Volume 1, Properties and Selection: Irons, Steels, and High-Performance Alloys*. Metals Park, Ohio: ASM. TIC: 241248.

7.12 CRWMS M&O 1997. *Disposal Criticality Analysis for Aluminum-based Fuel in a Codisposal Waste Package – ORR and MIT SNF Phase II*. BBA000000-01717-0200-00060 REV 00. Las Vegas, Nevada: M&O. ACC: MOL.19980224.0670.

7.13 Parrington, J.R. and Knox, H.D. 1996. *Nuclides and Isotopes 15th Edition.* San Jose, California: General Electric Co. & Kapl, Inc. TIC: 233705.

7.14 CRWMS M&O 1999. *Electronic Attachments for BBA000000-01717-0210-00033 REV 01, Compact Disc.* Las Vegas, Nevada: M&O. ACC: MOL.19990601.0234.

8. ATTACHMENTS

Attachments to these calculations are listed in Table 8-1 below.

Table 8-1. List of Attachments

Attachment Number	Description	Pages	Date
I	MCNP input decks	5 (Hard Copy listing of the Tape Content)	05/29/99
II	MCNP output decks	5 (Hard Copy listing of the Tape Content)	05/29/99
III	Excel spreadsheet scenario1.xls	29	05/29/99
IV	Excel spreadsheets scenario2a.xls	32	05/29/99
V	Excel spreadsheets scenario2b.xls	54	05/29/99
VI	Excel spreadsheets scenario3.xls	62	05/29/99
VII	Excel spreadsheets plots.xls	6	05/29/99
VIII	Excel spreadsheet n_clay.xls	1	05/29/99
IX	Excel Spreadsheet minedecay.xls	3	05/29/99
X	Electronic attachments moved to Reference 7.14	N/A	05/18/99

The following is the list of the files in electronic attachments on a Compact Disc (CD). The disc has been moved to Reference 7.14. The CD contains all the cases from REV 00 (without any changes) and all new cases.

INPUTS	<DIR>	05-18-99	10:37a	inputs
INPUTS~8 DOC	32,256	05-29-99	2:51p	inputsatta.doc
MINED~10 XLS	28,672	05-29-99	2:06p	minedecay.xls
N_CLAY XLS	39,936	05-29-99	2:07p	n_clay.xls
OUPUT~14 DOC	36,352	05-29-99	2:51p	ouputsatta.doc
OUTPUTS	<DIR>	05-18-99	10:37a	outputs
PLOTS XLS	44,032	05-29-99	2:42p	plots.xls
SCENA~22 XLS	117,760	05-29-99	1:54p	scenario1.xls
SCENA~24 XLS	176,640	05-29-99	1:56p	scenario2a.xls
SCENA~26 XLS	275,968	05-29-99	2:10p	scenario2b.xls
SCENA~28 XLS	279,552	05-29-99	2:09p	scenario3.xls

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\inputs\inpscenario1

.	<DIR>	05-17-99	1:45p	.
..	<DIR>	05-17-99	1:45p	..
05GD56	4,583	05-17-99	1:25p	05gd56
06GD56	4,583	05-17-99	1:25p	06gd56
10GD56	4,584	05-17-99	1:25p	10gd56
M00F0C	4,506	05-17-99	1:25p	m00f0c
M00F20	4,540	05-17-99	1:25p	m00f20
M00F49	4,542	05-17-99	1:25p	m00f49
M03F0C	4,523	05-17-99	1:25p	m03f0c
M06F0C	4,523	05-17-99	1:25p	m06f0c
M20F0C	4,577	05-17-99	1:25p	m20f0c
M23F0C	4,575	05-17-99	1:25p	m23f0c
M26F0C	4,575	05-17-99	1:25p	m26f0c
M50F0C	4,577	05-17-99	1:25p	m50f0c
M53F0C	4,577	05-17-99	1:25p	m53f0c
M56F00	4,548	05-17-99	1:25p	m56f00
M56F01	4,577	05-17-99	1:25p	m56f01
M56F0C	4,577	05-17-99	1:25p	m56f0c
M60F0C	4,579	05-17-99	1:25p	m60f0c
M63F0C	4,577	05-17-99	1:25p	m63f0c
M66F0C	4,577	05-17-99	1:25p	m66f0c
M80F0C	4,580	05-17-99	1:25p	m80f0c
M83F0C	4,577	05-17-99	1:25p	m83f0c
M86F0C	4,577	05-17-99	1:25p	m86f0c
NOFE56	4,570	05-17-99	1:25p	nofe56
NOGD00	4,552	05-17-99	1:25p	nogd00
NOGD01	4,581	05-17-99	1:25p	nogd01
NOGD56	4,581	05-17-99	1:25p	nogd56
NOGDCL	4,703	05-17-99	1:25p	nogdcl
N_CLAY	4,700	05-17-99	1:25p	n_clay
T00F0C	4,540	05-17-99	1:25p	t00f0c
T00F20	4,542	05-17-99	1:25p	t00f20
T00F49	4,544	05-17-99	1:25p	t00f49

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\inputs\inpscenario2

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01FE50	3,351	05-17-99	1:26p	01fe50
01FT25	3,328	05-17-99	1:26p	01ft25
01FT50	3,354	05-17-99	1:26p	01ft50
01GD50	3,354	05-17-99	1:26p	01gd50
01GF50	3,352	05-17-99	1:26p	01gf50
05FT25	3,328	05-17-99	1:26p	05ft25
05FT50	3,354	05-17-99	1:26p	05ft50
08FT25	3,328	05-17-99	1:26p	08ft25
08FT50	3,354	05-17-99	1:26p	08ft50
10FT25	3,328	05-17-99	1:26p	10ft25
690101	3,368	05-17-99	1:26p	690101
690501	3,368	05-17-99	1:26p	690501
690801	3,368	05-17-99	1:26p	690801
695001	3,368	05-17-99	1:26p	695001
695005	3,368	05-17-99	1:26p	695005
695008	3,368	05-17-99	1:26p	695008
695010	3,368	05-17-99	1:26p	695010
69NOFE	3,367	05-17-99	1:26p	69nofe
69NOGD	3,367	05-17-99	1:26p	69nogd
750105	3,395	05-17-99	1:26p	750105
750149	3,366	05-17-99	1:26p	750149
750505	3,395	05-17-99	1:26p	750505
750549	3,366	05-17-99	1:26p	750549
750805	3,395	05-17-99	1:26p	750805
750849	3,366	05-17-99	1:26p	750849
754901	3,395	05-17-99	1:26p	754901
754905	3,395	05-17-99	1:26p	754905
754908	3,395	05-17-99	1:26p	754908
754910	3,366	05-17-99	1:26p	754910
894501	3,369	05-17-99	1:26p	894501
894505	3,369	05-17-99	1:26p	894505
894508	3,369	05-17-99	1:26p	894508
894510	3,369	05-17-99	1:26p	894510
960125	3,327	05-17-99	1:26p	960125
960525	3,327	05-17-99	1:26p	960525
960825	3,327	05-17-99	1:26p	960825
F25T00	3,367	05-17-99	1:26p	f25t00
F50T00	3,365	05-17-99	1:26p	f50t00
F75T00	3,365	05-17-99	1:26p	f75t00

F75T30	3,366	05-17-99	1:26p	f75t30
F75T60	3,366	05-17-99	1:26p	f75t60
F97T00	3,366	05-17-99	1:26p	f97t00
F97T01	3,366	05-17-99	1:26p	f97t01
F97T05	3,366	05-17-99	1:26p	f97t05
F97T08	3,366	05-17-99	1:26p	f97t08
FT00	3,349	05-17-99	1:26p	ft00
FT25	3,350	05-17-99	1:26p	ft25
FT50	3,354	05-17-99	1:26p	ft50
HOMO	4,154	05-17-99	1:26p	homo
HOMO01	4,154	05-17-99	1:26p	homo01
HOMO05	4,154	05-17-99	1:26p	homo05
HOMO08	4,154	05-17-99	1:26p	homo08
MIX100	4,153	05-17-99	1:26p	mix100
MIXT10	4,145	05-17-99	1:26p	mixt10
MIXT25	4,154	05-17-99	1:26p	mixt25
MIXT60	4,147	05-17-99	1:26p	mixt60
MX6910	4,022	05-17-99	1:26p	mx6910
MX6925	4,022	05-17-99	1:26p	mx6925
MX6960	4,023	05-17-99	1:26p	mx6960
NOGD75	3,365	05-17-99	1:26p	nogd75
NOGDAL	3,366	05-17-99	1:26p	nogdal
NOGDFE	3,378	05-17-99	1:26p	nogdfe
NOGFAL	3,380	05-17-99	1:26p	nogfal

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Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\inputs\inpscenario3

.	<DIR>	05-17-99	1:46p	.
..	<DIR>	05-17-99	1:46p	..
NGD30B	3,452	05-17-99	1:26p	ngd30b
NGF30B	3,453	05-17-99	1:26p	ngf30b
NOGD30	3,451	05-17-99	1:26p	nogd30
NOGD50	3,444	05-17-99	1:26p	nogd50
NOGF30	3,452	05-17-99	1:26p	nogf30
NOGF50	3,445	05-17-99	1:26p	nogf50
W00H00	3,465	05-17-99	1:26p	w00h00
W00H10	3,480	05-17-99	1:26p	w00h10
W00H20	3,482	05-17-99	1:26p	w00h20
W00H30	3,482	05-17-99	1:26p	w00h30

W10H00	3,462	05-17-99	1:26p	w10h00
W10H10	3,457	05-17-99	1:26p	w10h10
W10H20	3,436	05-17-99	1:26p	w10h20
W10H30	3,458	05-17-99	1:26p	w10h30
W20H00	3,455	05-17-99	1:26p	w20h00
W20H10	3,475	05-17-99	1:26p	w20h10
W20H20	3,474	05-17-99	1:26p	w20h20
W20H30	3,473	05-17-99	1:26p	w20h30
W30H00	3,454	05-17-99	1:26p	w30h00
W30H10	3,451	05-17-99	1:26p	w30h10
W30H20	3,453	05-17-99	1:26p	w30h20
W30H30	3,453	05-17-99	1:26p	w30h30
W40H00	3,440	05-17-99	1:26p	w40h00
W40H10	3,435	05-17-99	1:26p	w40h10
W40H20	3,437	05-17-99	1:26p	w40h20
W40H30	3,431	05-17-99	1:26p	w40h30
W50H00	3,443	05-17-99	1:26p	w50h00
W50H10	3,448	05-17-99	1:26p	w50h10
W50H20	3,448	05-17-99	1:26p	w50h20
W50H30	3,448	05-17-99	1:26p	w50h30

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\inputs\inputrev01

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69NG 5	3,630	05-17-99	1:56p	69ng.5
69NG 7	3,565	05-17-99	1:56p	69ng.7
69NGAL	3,513	05-17-99	1:56p	69ngal
69NO 5	3,631	05-17-99	1:56p	69no.5
69NO 7	3,566	05-17-99	1:56p	69no.7
69NOAL	3,514	05-17-99	1:56p	69noal
69NOGD	3,367	05-17-99	1:56p	69nogd
69NOGF	3,368	05-17-99	1:56p	69nogf
7549 5	3,661	05-17-99	1:56p	7549.5
7549 7	3,594	05-17-99	1:56p	7549.7
754905	3,395	05-17-99	1:56p	754905
7549AL	3,541	05-17-99	1:56p	7549al
8945 5	3,635	05-17-99	1:56p	8945.5
8945 7	3,568	05-17-99	1:56p	8945.7

894508	3,369	05-17-99	1:56p	894508
8945AL	3,515	05-17-99	1:56p	8945al
M06F 5	4,779	05-17-99	1:56p	m06f.5
M06F 7	4,715	05-17-99	1:56p	m06f.7
M06F0C	4,523	05-17-99	1:56p	m06f0c
M06FAL	4,664	05-17-99	1:56p	m06fal
M56 5	4,842	05-17-99	1:56p	m56.5
M56 7	4,776	05-17-99	1:56p	m56.7
M56AL	4,724	05-17-99	1:56p	m56al
M56F0C	4,577	05-17-99	1:56p	m56f0c
MX69 5	4,291	05-17-99	1:56p	mx69.5
MX69 7	4,225	05-17-99	1:56p	mx69.7
MX6925	4,022	05-17-99	1:56p	mx6925
MX69AL	4,171	05-17-99	1:56p	mx69al
NOFE 5	4,834	05-17-99	1:56p	nofe.5
NOFE 7	4,767	05-17-99	1:56p	nofe.7
NOFE56	4,570	05-17-99	1:56p	nofe56
NOFEAL	4,716	05-17-99	1:56p	nofeal
NOGD 5	4,845	05-17-99	1:56p	nogd.5
NOGD 7	4,780	05-17-99	1:56p	nogd.7
NOGD56	4,581	05-17-99	1:56p	nogd56
NOGDAL	4,726	05-17-99	1:56p	nogdal
NOGF 5	3,718	05-17-99	1:56p	nogf.5
NOGF 7	3,651	05-17-99	1:56p	nogf.7
NOGF50	3,445	05-17-99	1:56p	nogf50
NOGFAL	3,598	05-17-99	1:56p	nogfal
T00F 5	4,798	05-17-99	1:56p	t00f.5
T00F 7	4,734	05-17-99	1:56p	t00f.7
T00F20	4,542	05-17-99	1:56p	t00f20
T00FAL	4,683	05-17-99	1:56p	t00fal
W50H 5	3,716	05-17-99	1:56p	w50h.5
W50H 7	3,650	05-17-99	1:57p	w50h.7
W50H00	3,443	05-17-99	1:57p	w50h00
W50HAL	3,597	05-17-99	1:57p	w50hal
49 file(s)	196,135 bytes			
2 dir(s)	630,489,088 bytes free			

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\outputs\outscenario1

.	<DIR>	05-17-99	1:46p	.
..	<DIR>	05-17-99	1:46p	..
05GD56 O	233,274	05-17-99	1:33p	
05gd56.O				
06GD56 O	233,238	05-17-99	1:33p	
06gd56.O				
10GD56 O	233,425	05-17-99	1:33p	
10gd56.O				
M00F0C O	232,590	05-17-99	1:33p	
m00f0c.O				
M00F20 O	233,074	05-17-99	1:33p	m00f20.O
M00F49 O	232,343	05-17-99	1:33p	m00f49.O
M03F0C O	233,596	05-17-99	1:33p	m03f0c.O
M06F0C O	233,548	05-17-99	1:33p	m06f0c.O
M20F0C O	232,566	05-17-99	1:33p	m20f0c.O
M23F0C O	233,499	05-17-99	1:33p	m23f0c.O
M26F0C O	233,537	05-17-99	1:33p	m26f0c.O
M50F0C O	233,279	05-17-99	1:33p	m50f0c.O
M53F0C O	233,327	05-17-99	1:33p	m53f0c.O
M56F00 O	233,329	05-17-99	1:33p	m56f00.O
M56F01 O	233,440	05-17-99	1:33p	m56f01.O
M56F0C O	233,537	05-17-99	1:33p	m56f0c.O
M60F0C O	233,327	05-17-99	1:33p	m60f0c.O
M63F0C O	233,341	05-17-99	1:33p	m63f0c.O
M66F0C O	233,474	05-17-99	1:33p	m66f0c.O
M80F0C O	232,388	05-17-99	1:33p	m80f0c.O
M83F0C O	232,437	05-17-99	1:33p	m83f0c.O
M86F0C O	232,500	05-17-99	1:33p	m86f0c.O
NOFE56 O	306,252	05-17-99	1:33p	nofe56.O
NOGD00 O	305,998	05-17-99	1:33p	nogd00.O
NOGD01 O	306,154	05-17-99	1:33p	nogd01.O
NOGD56 O	306,301	05-17-99	1:33p	nogd56.O
NOGDCL O	306,805	05-17-99	1:33p	nogdcl.O
N_CLAY O	306,961	05-17-99	1:33p	n_clay.O
T00F0C O	233,112	05-17-99	1:33p	t00f0c.O
T00F20 O	233,161	05-17-99	1:33p	t00f20.O
T00F49 O	232,179	05-17-99	1:33p	t00f49.O

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\outputs\outscenario2

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..	<DIR>	05-17-99	1:46p ..
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01FT25 O	214,596	05-17-99	1:33p 01ft25.O
01FT50 O	214,459	05-17-99	1:33p 01ft50.O
01GD50 O	214,105	05-17-99	1:33p 01gd50.O
01GF50 O	215,279	05-17-99	1:33p 01gf50.O
05FT25 O	215,134	05-17-99	1:33p 05ft25.O
05FT50 O	215,560	05-17-99	1:33p 05ft50.O
08FT25 O	216,153	05-17-99	1:33p 08ft25.O
08FT50 O	215,560	05-17-99	1:33p 08ft50.O
10FT25 O	216,097	05-17-99	1:33p 10ft25.O
690101 O	213,741	05-17-99	1:34p 690101.O
690501 O	214,536	05-17-99	1:34p 690501.O
690801 O	216,167	05-17-99	1:34p 690801.O
695001 O	215,917	05-17-99	1:34p 695001.O
695005 O	215,629	05-17-99	1:34p 695005.O
695008 O	216,167	05-17-99	1:34p 695008.O
695010 O	216,167	05-17-99	1:34p 695010.O
69NOFE O	215,407	05-17-99	1:34p 69nofe.O
69NOGD O	215,367	05-17-99	1:34p 69nogd.O
750105 O	215,566	05-17-99	1:34p 750105.O
750149 O	214,980	05-17-99	1:34p 750149.O
750505 O	214,536	05-17-99	1:34p 750505.O
750549 O	214,847	05-17-99	1:34p 750549.O
750805 O	215,566	05-17-99	1:34p 750805.O
750849 O	214,330	05-17-99	1:34p 750849.O
754901 O	216,167	05-17-99	1:34p 754901.O
754905 O	214,868	05-17-99	1:34p 754905.O
754908 O	214,868	05-17-99	1:34p 754908.O
754910 O	216,104	05-17-99	1:34p 754910.O
894501 O	215,003	05-17-99	1:34p 894501.O
894505 O	216,070	05-17-99	1:34p 894505.O
894508 O	216,214	05-17-99	1:34p 894508.O
894510 O	215,197	05-17-99	1:34p 894510.O
960125 O	215,613	05-17-99	1:34p 960125.O
960525 O	215,629	05-17-99	1:34p 960525.O

960825 O	215,566	05-17-99	1:34p	960825.O
F25T00 O	217,471	05-17-99	1:34p	f25t00.O
F50T00 O	217,374	05-17-99	1:34p	f50t00.O
F75T00 O	216,943	05-17-99	1:34p	f75t00.O
F75T30 O	217,006	05-17-99	1:34p	f75t30.O
F75T60 O	215,585	05-17-99	1:34p	f75t60.O
F97T00 O	214,940	05-17-99	1:34p	f97t00.O
F97T01 O	215,566	05-17-99	1:34p	f97t01.O
F97T05 O	214,314	05-17-99	1:34p	f97t05.O
F97T08 O	216,104	05-17-99	1:34p	f97t08.O
FT00 O	217,080	05-17-99	1:34p	ft00.O
FT25 O	217,227	05-17-99	1:34p	ft25.O
FT50 O	216,094	05-17-99	1:34p	ft50.O
HOMO O	217,015	05-17-99	1:34p	homo.O
HOMO01 O	216,540	05-17-99	1:34p	homo01.O
HOMO05 O	216,540	05-17-99	1:34p	homo05.O
HOMO08 O	216,477	05-17-99	1:34p	homo08.O
MIX100 O	217,463	05-17-99	1:34p	mix100.O
MIXT10 O	224,603	05-17-99	1:34p	mixt10.O
MIXT25 O	224,922	05-17-99	1:34p	mixt25.O
MIXT60 O	223,366	05-17-99	1:34p	mixt60.O
MX6910 O	223,393	05-17-99	1:34p	mx6910.O
MX6925 O	221,863	05-17-99	1:34p	mx6925.O
MX6960 O	223,320	05-17-99	1:34p	mx6960.O
NOGD75 O	216,834	05-17-99	1:34p	nogd75.O
NOGDAL O	216,253	05-17-99	1:34p	nogdal.O
NOGDFE O	216,271	05-17-99	1:34p	nogdfe.O
NOGFAL O	215,862	05-17-99	1:34p	nogfal.O

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\outputs\outscenario3

.	<DIR>	05-17-99	1:47p	.
..	<DIR>	05-17-99	1:47p	..
NGD30B O	218,453	05-17-99	1:35p	ngd30b.O
NGF30B O	218,523	05-17-99	1:35p	ngf30b.O
NOGD30 O	218,975	05-17-99	1:35p	nogd30.O
NOGD50 O	214,723	05-17-99	1:35p	nogd50.O
NOGF30 O	218,779	05-17-99	1:35p	nogf30.O
NOGF50 O	216,003	05-17-99	1:35p	nogf50.O

W00H00	O	216,989	05-17-99	1:35p w00h00.O
W00H10	O	218,196	05-17-99	1:35p w00h10.O
W00H20	O	217,057	05-17-99	1:35p w00h20.O
W00H30	O	218,196	05-17-99	1:35p w00h30.O
W10H00	O	216,156	05-17-99	1:35p w10h00.O
W10H10	O	218,291	05-17-99	1:35p w10h10.O
W10H20	O	217,152	05-17-99	1:35p w10h20.O
W10H30	O	217,152	05-17-99	1:35p w10h30.O
W20H00	O	217,799	05-17-99	1:35p w20h00.O
W20H10	O	218,829	05-17-99	1:35p w20h10.O
W20H20	O	218,388	05-17-99	1:35p w20h20.O
W20H30	O	217,358	05-17-99	1:35p w20h30.O
W30H00	O	216,392	05-17-99	1:35p w30h00.O
W30H10	O	218,391	05-17-99	1:35p w30h10.O
W30H20	O	218,461	05-17-99	1:35p w30h20.O
W30H30	O	217,638	05-17-99	1:35p w30h30.O
W40H00	O	217,677	05-17-99	1:35p w40h00.O
W40H10	O	218,510	05-17-99	1:35p w40h10.O
W40H20	O	218,510	05-17-99	1:35p w40h20.O
W40H30	O	217,493	05-17-99	1:35p w40h30.O
W50H00	O	216,484	05-17-99	1:35p w50h00.O
W50H10	O	217,622	05-17-99	1:35p w50h10.O
W50H20	O	217,622	05-17-99	1:35p w50h20.O
W50H30	O	217,084	05-17-99	1:35p w50h30.O

Volume in drive C has no label
Volume Serial Number is 07CE-031A
Directory of C:\fftf\rev01\outputs\outputrev01

.		<DIR>	05-17-99	1:46p .
..		<DIR>	05-17-99	1:46p ..
69NG5~1	O	216,938	05-17-99	1:30p 69ng.5.O
69NG7~1	O	216,305	05-17-99	1:30p 69ng.7.O
69NGAL	O	215,690	05-17-99	1:30p 69ngal.O
69NO5~1	O	216,338	05-17-99	1:30p 69no.5.O
69NO7~1	O	215,826	05-17-99	1:30p 69no.7.O
69NOAL	O	215,781	05-17-99	1:30p 69noal.O
69NOGD	O	215,367	05-17-99	1:30p 69nogd.O
69NOGF	O	215,573	05-17-99	1:30p 69nogf.O
75495~1	O	216,004	05-17-99	1:30p 7549.5.O
75497~1	O	216,645	05-17-99	1:30p 7549.7.O

754905 O	214,868	05-17-99	1:30p 754905.O
7549AL O	216,159	05-17-99	1:30p 7549al.O
89455~1 O	217,257	05-17-99	1:30p 8945.5.O
89457~1 O	216,771	05-17-99	1:30p 8945.7.O
894508 O	216,214	05-17-99	1:30p 894508.O
8945AL O	216,285	05-17-99	1:30p 8945al.O
M06F5~1 O	234,672	05-17-99	1:30p m06f.5.O
M06F7~1 O	234,333	05-17-99	1:30p m06f.7.O
M06F0C O	233,548	05-17-99	1:30p m06f0c.O
M06FAL O	232,365	05-17-99	1:30p m06fal.O
M565~1 O	234,564	05-17-99	1:30p m56.5.O
M567~1 O	234,078	05-17-99	1:30p m56.7.O
M56AL O	232,428	05-17-99	1:30p m56al.O
M56F0C O	233,537	05-17-99	1:30p m56f0c.O
MX695~1 O	223,388	05-17-99	1:30p mx69.5.O
MX697~1 O	224,088	05-17-99	1:30p mx69.7.O
MX6925 O	221,863	05-17-99	1:30p mx6925.O
MX69AL O	224,152	05-17-99	1:30p mx69al.O
NOFE5~1 O	306,666	05-17-99	1:30p nofe.5.O
NOFE7~1 O	307,013	05-17-99	1:30p nofe.7.O
NOFE56 O	306,252	05-17-99	1:30p nofe56.O
NOFEAL O	306,478	05-17-99	1:30p nofeal.O
NOGD5~1 O	307,915	05-17-99	1:30p nogd.5.O
NOGD7~1 O	307,062	05-17-99	1:30p nogd.7.O
NOGD56 O	306,301	05-17-99	1:30p nogd56.O
NOGDAL O	307,015	05-17-99	1:30p nogdal.O
NOGF5~1 O	217,374	05-17-99	1:30p nogf.5.O
NOGF7~1 O	216,965	05-17-99	1:30p nogf.7.O
NOGF50 O	216,003	05-17-99	1:30p nogf50.O
NOGFAL O	216,327	05-17-99	1:30p nogfal.O
T00F5~1 O	233,588	05-17-99	1:30p t00f.5.O
T00F7~1 O	232,035	05-17-99	1:30p t00f.7.O
T00F20 O	233,161	05-17-99	1:30p t00f20.O
T00FAL O	233,556	05-17-99	1:30p t00fal.O
W50H5~1 O	215,619	05-17-99	1:30p w50h.5.O
W50H7~1 O	216,166	05-17-99	1:30p w50h.7.O
W50H00 O	216,484	05-17-99	1:30p w50h00.O
W50HAL O	216,906	05-17-99	1:30p w50hal.O
OUTPUT~1		05-17-99	1:51p outputsce1
49 file(s)	11,339,923 bytes		
2 dir(s)	636,354,560 bytes free		

	A	B	C	D	E	F	G
1	Appendix	Specifications for DOE FFTF Canister Components					
2							
3	FFTF SNF Assembly	parts/canister:	5				
4		components:	fuel pin:	parts/assem.:	217		
5				components:	MOX:	O.D.:	0.49403cm
6						length:	91.44cm
7						material:	UO1.96+PuO1.96
8						density:	10.02g/cc
9					insulator:	parts/assem.:	2
10						material:	natural UO2
11						density:	10.42g/cc
12						length:	2.032
13					reflector:	parts/assem.:	2
14						material:	Inconel 600
15						density:	8.47g/cc
16						length:	14.478cm
17					spring:	material:	SS302
18						volume:	2.7264cc
19						density:	8g/cc
20					plenum:	material:	SS316
21						length:	86.21cm
22						O.D.:	0.49022cm
23						wall thickness:	0.01397cm
24					top cap:	material:	SS316
25						length:	10.46cm
26						O.D.:	0.5842cm
27					bottom cap:	material:	SS316
28						length:	4.06cm
29						O.D.:	0.5842cm
30					cladding	material:	SS316
31						I.D.:	0.508 cm
32						O.D.:	0.5842 cm
33						length:	223.224cm
34						density:	7.9497g/cc
35			Components other than	fuel pins:	material:	SS316	
36					total mass:	172.819-217*0.4536=	74.3878 kg
37	Ident 69	components:	fuel pin:	parts:	217		
38			container:	mass:	59.09Kg		
39				material:	SS304L		
40	Basket Assembly	material:	SS316L				
41		components:	center tube:	O.D.:	17.3cm		
42				I.D.:	15.3cm		
43				length:	412.5cm		
44			divider plates:	parts/canister:	5		
45				length:	14.6448cm		
46				height:	412.5cm		

	A	B	C	D	E	F	G
47				thickness:	1cm		
48			canister Shell	O.R.:	22.86cm		
49				I.R.:	21.9075cm		
50				length:	456.9cm		
51				material:	ss-316		
52				density	7.952g/cm3		
53	Volume for homogenizing isotopes:		pi*22.86**2*456.9=	750107.4569cc			
54	Total fuel pins per canister:		217*6=	1302			

	A	B	C	D	E	F	G
1	Cladding:	material:	SS316				
2		I.D.:	0.508 cm				
3		O.D.:	0.5842 cm				
4		length:	(237.744-10.46-4.06)cm=	223.224cm			
5		vol:	pi*(0.5842**2-0.508**2)*223.224/4cc=	14.5911cc			
6		total vol:	1302*14.5911cc=	18997.6122cc			
7		vol fraction:	18997.6122/103905.6147=	0.18283528			
8		density:	7.98g/cc				
9							
10	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
11					(at/cm*b)	(at./cm*b)	
12						(homogenized)	
13	C	6000.50c	12.01115	0.08	3.2007E-04	5.8521E-05	
14	Mn	25055.50c	54.9380503	2	1.7494E-03	3.1986E-04	
15	P	15031.50c	30.9737647	0.045	6.9817E-05	1.2765E-05	
16	S	16032.50c	31.9720737	0.03	4.5091E-05	8.2443E-06	
17	Si	14000.50c	28.086	0.75	1.2833E-03	2.3463E-04	
18	Cr	24000.50c	51.996	17	1.5712E-02	2.8726E-03	
19	Ni	28000.50c	58.71	12	9.8223E-03	1.7959E-03	
20	Mo	42000.50c	95.94	2.5	1.2522E-03	2.2895E-04	
21	N	7014.50c	14.00307439	0.1	3.4318E-04	6.2745E-05	
22	Fe	26000.50c	55.847	65.495	5.6358E-02	1.0304E-02	
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							

	A	B	C	D	E	F
1	MOX:	material:	UO1.96+PuO1.96			
2		density:	10.02g/cc			
3		length:	91.44cm			
4		O.D.:	0.49403cm			
5		vol:	pi*0.49403**2*91.44/4cc=	17.5280cc		
6		total vol:	1302*17.5280cc=	22821.456cc		
7		vol fraction:	22821.456/103905.6147=	0.21963641		
8						
9	Pu(moles):	38.4/239.1891=	0.16054			
10	U(moles):	114.3/238.04476=	0.48016			
11	O(moles):	1.96*(0.16054+0.48016)=	1.25577			
12	O(mass):	15.998985*1.25577=	20.091g			
13	Total mass:	38.4+114.3+20.091=	172.791g			
14						
15	Pu:	mass:	38.4g			
16		weight fraction:	0.22223			
17						
18	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
19	Pu239	239.052146	0.8735	239.189095		
20	Pu240	240.053882	0.1163			
21	Pu241	241.056737	0.0102			
22						
23	U:	mass:	114.3g			
24		weight fraction:	0.66149			
25						
26	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
27	U235	235.043915	0.002	238.044756		
28	U238	238.05077	0.998			
29						
30						
31	O:	mass:	20.091g			
32		weight fraction:	0.11627			
33						
34	MOX					
35	Isotope	Identifier	Isotopic Mass	Wt. Fraction	At. Density	At. Density
36					(at/cm*b)	(at/cm*b)
37						(homogenized)
38	O16	8016.50c	15.998985	0.11627	4.3851E-02	9.6314E-03
39	U235	92235.50c	235.043915	0.00132	3.3887E-05	7.4428E-06
40	U238	92238.50c	238.05077	0.66017	1.6734E-02	3.6754E-03

	A	B	C	D	E	F
41	Pu239	94239.50c	239.052146	0.19412	4.8999E-03	1.0762E-03
42	Pu240	94240.50c	240.053882	0.02585	6.4977E-04	1.4271E-04
43	Pu241	94241.50c	241.056737	0.00227	5.6822E-05	1.2480E-05

	A	B	C	D	E	F
1						
2						
3	Endcap	material:	SS316			
4		length:	10.46+4.06=	14.52cm		
5		diameter:	0.5842cm			
6		vol:	pi*0.5842**2*14.52/4=	3.89206cc		
7		total vol:	1302*3.89206=	5067.46212cc		
8		vol. fraction:	5067.46212/103905.6147=	0.0487699		
9		density:	7.98g/cc			
10						
11	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
12					(at/cm*b)	(at/cm*b)
13						(homogenized)
14	C	6000.50c	12.01115	0.08	3.2007E-04	1.5610E-05
15	Mn	25055.50c	54.9380503	2	1.7494E-03	8.5320E-05
16	P	15031.50c	30.9737647	0.045	6.9817E-05	3.4050E-06
17	S	16032.50c	31.9720737	0.03	4.5091E-05	2.1991E-06
18	Si	14000.50c	28.086	0.75	1.2833E-03	6.2584E-05
19	Cr	24000.50c	51.996	17	1.5712E-02	7.6626E-04
20	Ni	28000.50c	58.71	12	9.8223E-03	4.7903E-04
21	Mo	42000.50c	95.94	2.5	1.2522E-03	6.1071E-05
22	N	7014.50c	14.00307439	0.1	3.4318E-04	1.6737E-05
23	Fe	26000.50c	55.847	65.495	5.6358E-02	2.7485E-03

	A	B	C	D	E	F	G
1	Insulator	material:	natural UO2				
2		parts per rod:	2				
3		length:	2.032cm				
4		diameter:	0.508cm				
5		vol:	pi*0.508**2*2.032*2/4=	0.8237cc			
6		total vol:	1302*0.8237=	1072.4574cc			
7		vol. fraction:	1072.4574/103905.6147=	0.010321458			
8		density:	10.42g/cc				
9		U mass/assembly:	1500g				
10							
11	U(moles):	1500/238.0289=	6.3018				
12	O(moles):	2*6.3018=	12.6035				
13	O(mass):	16*12.6035=	201.656				
14	total mass:	1701.656					
15	U(Wt. Fraction):	1500/1701.656=	0.8815				
16	O(Wt. Fraction):	201.656/1701.656=	0.1185				
17							
18	Isotope	Identifier	At. Mass	Wt. Fraction	At. Density	At. Density	
19					(at/cm*b)	(at/cm*b)	
20						(homogenized)	
21	U235	92235.50c	235.043915	0.00626	1.6712E-04	1.7249E-06	
22	U238	92238.50c	238.05077	0.87524	2.3071E-02	2.3813E-04	
23	O16	8016.50c	15.998985	0.1185	4.6477E-02	4.7971E-04	
24							

	A	B	C	D	E	F
1	Ident 69	material:	SS304L			
2		density:	7.9g/cc			
3		mass:	59.09kg			
4		vol:	59090/7.9=	7479.75		
5		vol. fraction:	7479.75/103905.6147=	0.071986		
6						
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
8					(at/cm*b)	(at/cm*b)
9						(homogenized)
10	C	6000.50c	12.01115	0.03	1.1882E-04	8.5537E-06
11	Mn	25055.50c	54.9380503	2	1.7319E-03	1.2467E-04
12	P	15031.50c	30.9737647	0.045	6.9117E-05	4.9755E-06
13	S	16032.50c	31.9720737	0.03	4.4639E-05	3.2134E-06
14	Si	14000.50c	28.086	0.75	1.2704E-03	9.1451E-05
15	Cr	24000.50c	51.996	19	1.7384E-02	1.2514E-03
16	Ni	28000.50c	58.69	10	8.1059E-03	5.8351E-04
17	N	7014.50c	14.00307439	0.1	3.3974E-04	2.4456E-05
18	Fe	26000.50c	55.847	68.045	5.7965E-02	4.1727E-03

	A	B	C	D	E	F	G
1	Basket	material:	SS316L				
2		density:	7.98g/cc				
3		components:	center tube:	O.D.:	17.3cm		
4				I.D.:	15.3cm		
5				length:	412.5cm		
6				vol:	pi*(17.3**2-15.3**2)*412.5/4=	21123.2836cc	
7			divider plates:	parts/canister:	5		
8				thickness:	1cm		
9				length:	(43.815-17.3)/2=	13.2575cm	
10				height:	412.5cm		
11				vol:	5*1*13.2575*412.5=	27343.5938cc	
12							
13		total vol:	48466.8774	cc			
14		vol fraction:	48466.877/103905.6147=	0.466450992			
15							
16	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
17					(at/cm*b)	(at/cm*b)	
18						(homogenized)	
19	C	6000.50c	12.01115	0.03	1.2003E-04	5.5987E-05	
20	Mn	25055.50c	54.9380503	2	1.7494E-03	8.1603E-04	
21	P	15031.50c	30.9737647	0.045	6.9817E-05	3.2566E-05	
22	S	16032.50c	31.9720737	0.03	4.5091E-05	2.1033E-05	
23	Si	14000.50c	28.086	0.75	1.2833E-03	5.9858E-04	
24	Cr	24000.50c	51.996	17	1.5712E-02	7.3287E-03	
25	Ni	28000.50c	58.71	12	9.8223E-03	4.5816E-03	
26	Mo	42000.50c	95.94	2.5	1.2522E-03	5.8410E-04	
27	N	7014.50c	14.00307439	0.1	3.4318E-04	1.6008E-04	
28	Fe	26000.50c	55.847	65.545	5.6401E-02	2.6308E-02	
29							

	A	B	C	D	E
1	**Gd**				
2	Volume of basket (cc)	48466.8774			
3	density of SS316 (g/cc)	7.98			
4	Mass Basket (g)	386765.6817			
5	2% of the mass is Gd	0.02			
6	Mass Gd (g)	7735.313633	464.118818		
7	Mole of Gd (M=157.25 g/mol)	49.19118368			
8	Atomes of Gd	2.96229E+25			
9	Volume of the SNF DOE Canister	103905.6147			
10	Homogenized Density at/b.cm	0.000285095			
11					
12					
13		atom/density	volume	mole	mass
14		6.93356E-05	0.000104	1.16E-08	1.82E-06
15		0.000672942	0.00100941	1.09E-06	0.000172
16		2.68559E-05	4.0284E-05	1.74E-09	2.74E-07
17		1.73449E-05	2.6017E-05	7.26E-10	1.14E-07
18		1.43E-04	207811.229	47.62519	7489.061

	A	B	C	D	E
1		Volume cc		Volume Fraction	
2	Clad	18997.6122		0.030398	
3	Mox	22821.456		0.036516	
4	End Cap	5067.46212		0.008108	
5	Insulator	1072.4574		0.001716	
6	Indent	7479.75		0.011968	
7	basket	48466.877		0.077551	
8	Dry Volume	103905.6147		0.166257	
9	Volume Canister	624971.2629			
10	Volume of Water to add to flood the canister	521065.6482		0.833743	
11	Mass(g) of Water to add	521065.6482			
12	Mole of Water to add	28931.11			
13	Atomes of O to add	1.74223E+28			
14	Atomes of H to add	3.48446E+28			
15	density of H homogenized to add (at/cm.b)	0.06687186			
16	density of O homogenized to add (at/cm.b)	0.03343593			

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	**hematite forms at 10.26 1000s of years +**				0	***100 % of water**		**total volume**	6145900	cc	**tot mass**	23921.4	**tot density**	0.0039
3														
4	ρ=	3.892	kg/l		Na=	6.02E-01	at/bcm		Volume=	6145900	cc	mass	23921.4	kg
5	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.700146	g
6	H	1.0078252	1001.50c	6.4551	6.30E+04	6.13E-03			6.1256E-03			968471.992	moles	
7	C	12.01115	6000.50c	0.0002	2.33E+01	1.90E-07			1.8979E-07					
8	O	15.994915	8016.50c	59.7993	9.26E+06	5.67E-02			5.6746E-02					
9	Na	22.989771	11023.50c	0.0761	1.69E+04	7.22E-05			7.2215E-05					
10	Al	26.981539	13027.50c	1.1394	2.98E+05	1.08E-03			1.0812E-03					
11	Si	28.086	14000.50c	11.893	3.23E+06	1.13E-02			1.1286E-02					
12	Ca	40.08	20000.50c	0.2762	1.07E+05	2.62E-04			2.6210E-04					
13	K	39.102	19000.50c	0.3872	1.47E+05	3.67E-04			3.6743E-04					
14	Ti	47.9	22000.50c	0.1819	8.44E+04	1.73E-04			1.7261E-04					
15	Mn	54.93805	25055.50c	0.7144	3.80E+05	6.78E-04			6.7793E-04					
16	Fe	55.847	26000.55c	18.8429	1.02E+07	1.79E-02			1.7881E-02					
17	Ni	58.71	28000.50c	0.22	1.25E+05	2.09E-04			2.0877E-04					
18	Cu	63.54	29000.50c	0.0123	7.57E+03	1.17E-05			1.1672E-05					
19	Gd	157.25	64000.35c	0.002	3.05E+03	1.90E-06			1.8979E-06					
20				100	23921400	0.0948948			9.4895E-02			tot moles	968471.99	
21														
22	**water**				**mass (g)**	**number densities (at/bar.cm)**								
23	ρ=	1	kg/l		Na=	6.02E-01	at/bcm		Volume=	0	cc	mass=	0	g
24	H	1.0078252	1001.50c	200	0.00E+00	0.00E+00						1 mol is	1.80E+01	
25	O	15.994915	8016.50c	100	0.00E+00	0.00E+00						0.00E+00	mole of h2o	
26					0.00E+00	0.00E+00								
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38	**hematite forms at 10.26 1000s of years +**				0.2	***100 % of water**		**total volume**	7682375	cc	**tot mass**	1560396.4	**tot density**	0.2031
39														
40	ρ=	3.892	kg/l		Na=	6.02E-01	at/bcm		Volume=	6145900	cc	mass	23921.4	kg

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
41	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.700146	g
42	H	1.0078252	1001.50c	6.4551	6.30E+04	4.90E-03			1.8275E-02			968471.992	moles	
43	C	12.01115	6000.50c	0.0002	2.33E+01	1.52E-07			1.5183E-07					
44	O	15.994915	8016.50c	59.7993	9.26E+06	4.54E-02			5.2084E-02					
45	Na	22.989771	11023.50c	0.0761	1.69E+04	5.78E-05			5.7772E-05					
46	Al	26.981539	13027.50c	1.1394	2.98E+05	8.65E-04			8.6498E-04					
47	Si	28.086	14000.50c	11.893	3.23E+06	9.03E-03			9.0287E-03					
48	Ca	40.08	20000.50c	0.2762	1.07E+05	2.10E-04			2.0968E-04					
49	K	39.102	19000.50c	0.3872	1.47E+05	2.94E-04			2.9395E-04					
50	Ti	47.9	22000.50c	0.1819	8.44E+04	1.38E-04			1.3809E-04					
51	Mn	54.93805	25055.50c	0.7144	3.80E+05	5.42E-04			5.4234E-04					
52	Fe	55.847	26000.55c	18.8429	1.02E+07	1.43E-02			1.4305E-02					
53	Ni	58.71	28000.50c	0.22	1.25E+05	1.67E-04			1.6701E-04					
54	Cu	63.54	29000.50c	0.0123	7.57E+03	9.34E-06			9.3376E-06					
55	Gd	157.25	64000.35c	0.002	3.05E+03	1.52E-06			1.5183E-06					
56				100	23921400	0.0759158			9.5977E-02			tot moles	1053781.6	
57														
58	**water**				**mass (g)**	**number densities (at/bar.cm)**								
59	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	1536475	cc	mass=	1536475	g
60	H	1.0078252	1001.50c	200	1.72E+05	1.34E-02						1 mol is	1.80E+01	
61	O	15.994915	8016.50c	100	1.36E+06	6.69E-03						8.53E+04	mole of h2o	
62					1.54E+06	2.01E-02								
63														
64														
65														
66														
67	**hematite forms at 10.26 1000s of years +**				0.4906547	***100 % of water**		**total volume**	12066275	cc	**tot mass**	5944296.27	**tot density**	0.4926
68								Max Volume	12066275					
69	ρ=	3.892	kg/l		Na=	6.02E-01	at/bcm		Volume=	6145900	cc	mass	23921.4	kg
70	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.700146	g
71	H	1.0078252	1001.50c	6.4551	6.30E+04	3.12E-03			3.5931E-02			968471.992	moles	
72	C	12.01115	6000.50c	0.0002	2.33E+01	9.67E-08			9.6668E-08					
73	O	15.994915	8016.50c	59.7993	9.26E+06	2.89E-02			4.5309E-02					
74	Na	22.989771	11023.50c	0.0761	1.69E+04	3.68E-05			3.6782E-05					
75	Al	26.981539	13027.50c	1.1394	2.98E+05	5.51E-04			5.5072E-04					
76	Si	28.086	14000.50c	11.893	3.23E+06	5.75E-03			5.7484E-03					
77	Ca	40.08	20000.50c	0.2762	1.07E+05	1.33E-04			1.3350E-04					
78	K	39.102	19000.50c	0.3872	1.47E+05	1.87E-04			1.8715E-04					
79	Ti	47.9	22000.50c	0.1819	8.44E+04	8.79E-05			8.7920E-05					
80	Mn	54.93805	25055.50c	0.7144	3.80E+05	3.45E-04			3.4530E-04					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
81	Fe	55.847	26000.55c	18.8429	1.02E+07	9.11E-03			9.1076E-03					
82	Ni	58.71	28000.50c	0.22	1.25E+05	1.06E-04			1.0634E-04					
83	Cu	63.54	29000.50c	0.0123	7.57E+03	5.95E-06			5.9451E-06					
84	Gd	157.25	64000.35c	0.002	3.05E+03	9.67E-07			9.6668E-07					
85				100	23921400	0.0483342			9.7551E-02			tot moles	1297188.8	
86														
87	**water**				**mass (g)**	**number densities (at/bar.cm)**								
88	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5920375	cc	mass=	5920374.9	g
89	H	1.0078252	1001.50c	200	6.63E+05	3.28E-02						1 mol is	1.80E+01	
90	O	15.994915	8016.50c	100	5.26E+06	1.64E-02						3.29E+05	mole of h2o	
91					5.92E+06	4.92E-02								

	O	P	Q	R	S	T	U	V	W	X	Y
1											
2	**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value				
3	hematite forms 3.765 1000s y	1.3E+07	461.7	94	95.71047131	6556651.196	1.7104713				
4		750107	456.9	22.86	24.57047131	410751.1957	1.7104713				
5											
6					final	6145900					
7											
8											
9					Volume of clay neede	6145900					
10											
11											
12	**SNF in the Bottom**										
13											
14		1.3E+07	461.7	94	99.62337999	6896007					
15					5.623379986						
16	clay needed	6145900									
17					final	6896007.457					
18											
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38	**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value				
39	hematite forms 3.765 1000s y	1.3E+07	461.7	94	117.5708312	8432482.457	23.570831				
40		750107	456.9	22.86	45.72	750107.4569	22.86				

	O	P	Q	R	S	T	U	V	W	X	Y
41											
42					final	7682375					
43											
44											
45					Volume of clay neede	7682375					
46											
47											
48	**SNF in the Bottom**										
49											
50		1.3E+07	461.7	94	117.5708258	8432482					
51					23.57082581						
52	clay needed	7682375									
53					final	8432482.457					
54											
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	A	B	C	D	E	F	G	H	I
1	Atomic Densities (at/cm*b)			Assembly hardware, Reflector, Plenum, Spring neglected					
2									
3	Canister Component:	Ident 69	Basket	Cladding	Endcaps	MOX	Insulator		Total
4									
5	MCNP Isotope ID								
6	64000.35c								
7	1001.50c (H)								
8	6000.50c (C)	8.5537E-06	5.5987E-05	5.8521E-05	1.5610E-05	0.0000E+00	0.0000E+00		1.3867E-04
9	25055.50c (Mn)	1.2467E-04	8.1603E-04	3.1986E-04	8.5320E-05	0.0000E+00	0.0000E+00		1.3459E-03
10	15031.50c (P)	4.9755E-06	3.2566E-05	1.2765E-05	3.4050E-06	0.0000E+00	0.0000E+00		5.3712E-05
11	16032.50c (S)	3.2134E-06	2.1033E-05	8.2443E-06	2.1991E-06	0.0000E+00	0.0000E+00		3.4690E-05
12	14000.50c (Si)	9.1451E-05	5.9858E-04	2.3463E-04	6.2584E-05	0.0000E+00	0.0000E+00		9.8724E-04
13	24000.50c (Cr)	1.2514E-03	7.3287E-03	2.8726E-03	7.6626E-04	0.0000E+00	0.0000E+00		1.2219E-02
14	28000.50c (Ni)	5.8351E-04	4.5816E-03	1.7959E-03	4.7903E-04	0.0000E+00	0.0000E+00		7.4400E-03
15	42000.50c (Mo)	0.0000E+00	5.8410E-04	2.2895E-04	6.1071E-05	0.0000E+00	0.0000E+00		8.7413E-04
16	7014.50c (N)	2.4456E-05	1.6008E-04	6.2745E-05	1.6737E-05	0.0000E+00	0.0000E+00		2.6401E-04
17	26000.55c (Fe)	4.1727E-03	2.6308E-02	1.0304E-02	2.7485E-03	0.0000E+00	0.0000E+00		4.3533E-02
18	29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00		0.0000E+00
19	8016.50C (O)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	9.6314E-03	4.7971E-04		1.0111E-02
20	92235.50C (U235)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	7.4428E-06	1.7249E-06		9.1678E-06
21	92238.50C (U238)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.6754E-03	2.3813E-04		3.9135E-03
22	94239.55C (Pu239)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0762E-03	0.0000E+00		1.0762E-03
23	94240.50C (Pu240)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4271E-04	0.0000E+00		1.4271E-04
24	94241.50C (Pu241)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.2480E-05	0.0000E+00		1.2480E-05
25									8.2156E-02
26									
27									
28	**0 % of water in the hematite**				% of water in fuel	0.00%	25.00%	50.00%	65.00%
29					MCNP Isotope ID	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)
30	Density of Hematite (g/cc)	5.2749E+00			64000.35c	2.8509E-04	2.1382E-04	1.4255E-04	9.9783E-05
31	Volume of the fuel Homogenized	1.0391E+05			1001.50c (H)	0.0000E+00	1.67180E-02	3.34359E-02	4.34667E-02
32	Mole/cc.b. of Hematite	3.6145E-26			6000.50c (C)	1.3867E-04	1.0400E-04	6.9336E-05	4.8535E-05
33	Mole of hematite in the fuel	3.7557E+03			25055.50c (Mn)	1.3459E-03	1.0094E-03	6.7294E-04	4.7106E-04
34	Mass of Hematite(g)	5.9971E+05			15031.50c (P)	5.3712E-05	4.0284E-05	2.6856E-05	1.8799E-05
35	Volume of Hematite (cc)	1.1369E+05			16032.50c (S)	3.4690E-05	2.6017E-05	1.7345E-05	1.2141E-05
36	Volume of Hematite (l)	1.1369E+02			14000.50c (Si)	9.8724E-04	7.4043E-04	4.9362E-04	3.4553E-04
37	0 % of this volume is water	0.0000E+00			24000.50c (Cr)	1.2219E-02	9.1643E-03	6.1095E-03	4.2767E-03
38	volume of water (cc)	0.0000E+00			28000.50c (Ni)	7.4400E-03	5.5800E-03	3.7200E-03	2.6040E-03
39					42000.50c (Mo)	8.7413E-04	6.5559E-04	4.3706E-04	3.0594E-04
40	*Mass(g) of Water to add*	0			7014.50c (N)	2.6401E-04	1.9801E-04	1.3201E-04	9.2405E-05

	A	B	C	D	E	F	G	H	I
41	Mole of Water to add	0			26000.55c (Fe)	4.3533E-02	3.2650E-02	2.1767E-02	1.5237E-02
42	Atomes of O to add	0			29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
43	Atomes of H to add	0			8016.50C (O)	7.5411E-02	6.4917E-02	5.4424E-02	4.8127E-02
44	density of H homogenized to add (at/cm.b.)	0.0000E+00			92235.50C (U235)	9.1678E-06	6.8758E-06	4.5839E-06	3.2087E-06
45	density of O homogenized to add (at/cm.b.)	0.0000E+00			92238.50C (U238)	3.9135E-03	2.9351E-03	1.9567E-03	1.3697E-03
46					94239.55C (Pu239)	1.0762E-03	8.0715E-04	5.3810E-04	3.7667E-04
47	Max Volume of the canister	624971.2629			94240.50C (Pu240)	1.4271E-04	1.0704E-04	7.1357E-05	4.9950E-05
48					94241.50C (Pu241)	1.2480E-05	9.3601E-06	6.2401E-06	4.3680E-06
49					total volume	1.0391E+05	1.38541E+05	2.07811E+05	2.96873E+05
50					total # density	1.4774E-01	1.3588E-01	1.2402E-01	1.1691E-01
51					water in the snf	5.2107E+05	4.8643E+05	4.1716E+05	3.2810E+05
52					H/X in the snf	0.0	20.5	61.6	114.4
53									
54	**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value		
55									
56		624971.2629	414.5	21.9075	9.769585275	103910	-12.13791472		
57		624971.2629	414.5	21.9075	11.9784322	138540	-9.929067804		
58		624971.2629	414.5	21.9075	16.07415808	207810	-5.83334192		
59		624971.2629	414.5	21.9075	21.04744981	296870	-0.860050191		
60		624971.2629	414.5	21.9075	43.815	6.25E+05	21.9075		
61									
62									
63									
64	**30 % of water in the hematite**				% of water in fuel	0.00%	25.00%	50.00%	65.00%
65					MCNP Isotope ID	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)
66	Density of Hematite (g/cc)	5.2749E+00			64000.35c	2.8509E-04	2.1382E-04	1.4255E-04	9.9783E-05
67	Volume of the fuel Homogenized	1.0391E+05			1001.50c (H)	2.19508E-02	3.86688E-02	5.53868E-02	6.54175E-02
68	Mole/cc.b. of Hematite	3.6145E-26			6000.50c (C)	1.3867E-04	1.0400E-04	6.9336E-05	4.8535E-05
69	Mole of hematite in the fuel	3.7559E+03			25055.50c (Mn)	1.3459E-03	1.0094E-03	6.7294E-04	4.7106E-04
70	Mass of Hematite(g)	5.9973E+05			15031.50c (P)	5.3712E-05	4.0284E-05	2.6856E-05	1.8799E-05
71	Volume of Hematite (cc)	1.1370E+05			16032.50c (S)	3.4690E-05	2.6017E-05	1.7345E-05	1.2141E-05
72	Volume of Hematite (l)	1.1370E+02			14000.50c (Si)	9.8724E-04	7.4043E-04	4.9362E-04	3.4553E-04
73	0 % of this volume is water	3.0000E-01			24000.50c (Cr)	1.2219E-02	9.1643E-03	6.1095E-03	4.2767E-03
74	volume of water (cc)	3.4109E+04			28000.50c (Ni)	7.4400E-03	5.5800E-03	3.7200E-03	2.6040E-03
75					42000.50c (Mo)	8.7413E-04	6.5559E-04	4.3706E-04	3.0594E-04
76	Mass(g) of Water to add	34108.68621			7014.50c (N)	2.6401E-04	1.9801E-04	1.3201E-04	9.2405E-05
77	Mole of Water to add	1893.815407			26000.55c (Fe)	4.3533E-02	3.2650E-02	2.1767E-02	1.5237E-02
78	Atomes of O to add	1.14046E+27			29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
79	Atomes of H to add	2.28091E+27			8016.50C (O)	8.6387E-02	7.58928E-02	6.53990E-02	5.91027E-02

	A	B	C	D	E	F	G	H	I
80	density of H homogenized to add (at/cm.b.)	2.1951E-02			92235.50C (U235)	9.1678E-06	6.8758E-06	4.5839E-06	3.2087E-06
81	density of O homogenized to add (at/cm.b.)	1.0975E-02			92238.50C (U238)	3.9135E-03	2.9351E-03	1.9567E-03	1.3697E-03
82					94239.55C (Pu239)	1.0762E-03	8.0715E-04	5.3810E-04	3.7667E-04
83	Max Volume of the canister	624971.2629			94240.50C (Pu240)	1.4271E-04	1.0704E-04	7.1357E-05	4.9950E-05
84					94241.50C (Pu241)	1.2480E-05	9.3601E-06	6.2401E-06	4.3680E-06
85					total volume	1.0391E+05	1.38547E+05	2.07820E+05	2.96886E+05
86					total # density	1.8066746E-01	1.6881E-01	1.5695E-01	1.4984E-01
87					water in the snf	5.2106E+05	4.8642E+05	4.1715E+05	3.2809E+05
88					H/X in the snf	20.2	47.5	102.1	172.2
89									
90									
91									
92									
93	**60 % of water in the hematite**				% of water in fuel	0.00%	25.00%	50.00%	65.00%
94					MCNP Isotope ID	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)	density (at/b.cm)
95	Density of Hematite (g/cc)	5.2749E+00			64000.35c	2.8509E-04	2.1382E-04	1.4255E-04	9.9783E-05
96	Volume of the fuel Homogenized	1.0391E+05			1001.50c (H)	4.3902E-02	6.06196E-02	7.73376E-02	8.73684E-02
97	Mole/cc.b. of Hematite	3.6145E-26			6000.50c (C)	1.3867E-04	1.0400E-04	6.9336E-05	4.8535E-05
98	Mole of hematite in the fuel	3.7559E+03			25055.50c (Mn)	1.3459E-03	1.0094E-03	6.7294E-04	4.7106E-04
99	Mass of Hematite(g)	5.9973E+05			15031.50c (P)	5.3712E-05	4.0284E-05	2.6856E-05	1.8799E-05
100	Volume of Hematite (cc)	1.1370E+05			16032.50c (S)	3.4690E-05	2.6017E-05	1.7345E-05	1.2141E-05
101	Volume of Hematite (l)	1.1370E+02			14000.50c (Si)	9.8724E-04	7.4043E-04	4.9362E-04	3.4553E-04
102	0 % of this volume is water	6.0000E-01			24000.50c (Cr)	1.2219E-02	9.1643E-03	6.1095E-03	4.2767E-03
103	volume of water (cc)	6.8217E+04			28000.50c (Ni)	7.4400E-03	5.5800E-03	3.7200E-03	2.6040E-03
104					42000.50c (Mo)	8.7413E-04	6.5559E-04	4.3706E-04	3.0594E-04
105	Mass(g) of Water to add	68217.37242			7014.50c (N)	2.6401E-04	1.9801E-04	1.3201E-04	9.2405E-05
106	Mole of Water to add	3787.630814			26000.55c (Fe)	4.3533E-02	3.2650E-02	2.1767E-02	1.5237E-02
107	Atomes of O to add	2.28091E+27			29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
108	Atomes of H to add	4.56182E+27			8016.50C (O)	9.7362E-02	8.68682E-02	7.63744E-02	7.00781E-02
109	density of H homogenized to add (at/cm.b.)	4.3902E-02			92235.50C (U235)	9.1678E-06	6.8758E-06	4.5839E-06	3.2087E-06
110	density of O homogenized to add (at/cm.b.)	2.1951E-02			92238.50C (U238)	3.9135E-03	2.9351E-03	1.9567E-03	1.3697E-03
111					94239.55C (Pu239)	1.0762E-03	8.0715E-04	5.3810E-04	3.7667E-04
112	Max Volume of the canister	624971.2629			94240.50C (Pu240)	1.4271E-04	1.0704E-04	7.1357E-05	4.9950E-05
113					94241.50C (Pu241)	1.2480E-05	9.3601E-06	6.2401E-06	4.3680E-06
114					total volume	1.0391E+05	1.38547E+05	2.07820E+05	2.96886E+05
115					total # density	2.1359E-01	2.0174E-01	1.8988E-01	1.8276E-01
116					water in the snf	5.2106E+05	4.8642E+05	4.1715E+05	3.2809E+05
117					H/X in the snf	40.4	74.5	142.5	230.0

	J	K	L	M	N	O
1						
2						
3	Total degraded fuel	Total degraded fuel				
4	in SNF Canister	in SNF Canister				
5	(Fe becomes Fe2O3)	Saturation of the hematite				
6		2.8509E-04		64000.35c (Gd)		
7		0.0000E+00		1001.50c (H)		
8	1.3867E-04	1.3867E-04		6000.50c (C)		
9	1.3459E-03	1.3459E-03		25055.50c (Mn)		
10	5.3712E-05	5.3712E-05		15031.50c (P)		
11	3.4690E-05	3.4690E-05		16032.50c (S)		
12	9.8724E-04	9.8724E-04		14000.50c (Si)		
13	1.2219E-02	1.2219E-02		24000.50c (Cr)		
14	7.4400E-03	7.4400E-03		28000.50c (Ni)		
15	8.7413E-04	8.7413E-04		42000.50c (Mo)		
16	2.6401E-04	2.6401E-04		7014.50c (N)		
17	4.3533E-02	4.3533E-02		26000.55c (Fe)		
18	0.0000E+00	0.0000E+00		29000.50C (Cu)		
19	7.5411E-02	7.5411E-02		8016.50C (O)		
20	9.1678E-06	9.1678E-06		92235.50C (U235)		
21	3.9135E-03	3.9135E-03		92238.50C (U238)		
22	1.0762E-03	1.0762E-03		94239.55C (Pu239)		
23	1.4271E-04	1.4271E-04		94240.50C (Pu240)		
24	1.2480E-05	1.2480E-05		94241.50C (Pu241)		
25	1.4746E-01	1.4746E-01				
26						
27						
28	83.37%					
29	density (at/b.cm)					
30	4.7399E-05					
31	5.57540E-02					
32	2.3055E-05					
33	2.2376E-04					
34	8.9299E-06					
35	5.7674E-06					
36	1.6414E-04					
37	2.0315E-03					
38	1.2370E-03					
39	1.4533E-04					
40	4.3894E-05					

	J	K	L	M	N	O
41	7.2377E-03					
42	0.0000E+00					
43	4.0415E-02					
44	1.5242E-06					
45	6.5064E-04					
46	1.7892E-04					
47	2.3727E-05					
48	2.0749E-06					
49	6.24971E+05					
50	1.0819E-01					
51	0.0000E+00					
52	309.0					
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64	83.37%					
65	density (at/b.cm)					
66	4.7399E-05					
67	7.77048E-02					
68	2.3055E-05					
69	2.2376E-04					
70	8.9299E-06					
71	5.7674E-06					
72	1.6414E-04					
73	2.0315E-03					
74	1.2370E-03					
75	1.4533E-04					
76	4.3894E-05					
77	7.2377E-03					
78	0.0000E+00					
79	5.13900E-02					

	J	K	L	M	N	O
80	1.5242E-06					
81	6.5064E-04					
82	1.7892E-04					
83	2.3727E-05					
84	2.0749E-06					
85	6.24998E+05					
86	1.4112E-01					
87	0.0000E+00					
88	430.6					
89						
90						
91						
92						
93	83.37%	50.00%	50.00%	50.00%	50.00%	50.00%
94	density (at/b.cm)	nogd	05gd	06gd	10gd	nofe
95	4.7399E-05	0	7.1274E-06	8.5528E-06	1.4255E-05	1.4255E-04
96	9.96556E-02	7.73376E-02	7.73376E-02	7.73376E-02	7.73376E-02	7.73376E-02
97	2.3055E-05	6.93356E-05	6.93356E-05	6.93356E-05	6.93356E-05	6.93356E-05
98	2.2376E-04	6.72942E-04	6.72942E-04	6.72942E-04	6.72942E-04	6.72942E-04
99	8.9299E-06	2.68559E-05	2.68559E-05	2.68559E-05	2.68559E-05	2.68559E-05
100	5.7674E-06	1.73449E-05	1.73449E-05	1.73449E-05	1.73449E-05	1.73449E-05
101	1.6414E-04	4.93619E-04	4.93619E-04	4.93619E-04	4.93619E-04	4.93619E-04
102	2.0315E-03	6.10952E-03	6.10952E-03	6.10952E-03	6.10952E-03	6.10952E-03
103	1.2370E-03	3.72001E-03	3.72001E-03	3.72001E-03	3.72001E-03	3.72001E-03
104	1.4533E-04	4.37063E-04	4.37063E-04	4.37063E-04	4.37063E-04	4.37063E-04
105	4.3894E-05	1.32007E-04	1.32007E-04	1.32007E-04	1.32007E-04	1.32007E-04
106	7.2377E-03	2.17667E-02	2.17667E-02	2.17667E-02	2.17667E-02	0.00000E+00
107	0.0000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
108	6.23654E-02	7.63744E-02	7.63744E-02	7.63744E-02	7.63744E-02	4.37243E-02
109	1.5242E-06	4.58388E-06	4.58388E-06	4.58388E-06	4.58388E-06	4.58388E-06
110	6.5064E-04	1.95674E-03	1.95674E-03	1.95674E-03	1.95674E-03	1.95674E-03
111	1.7892E-04	5.38097E-04	5.38097E-04	5.38097E-04	5.38097E-04	5.38097E-04
112	2.3727E-05	7.13567E-05	7.13567E-05	7.13567E-05	7.13567E-05	7.13567E-05
113	2.0749E-06	6.24007E-06	6.24007E-06	6.24007E-06	6.24007E-06	6.24007E-06
114	6.24998E+05	2.07820E+05	2.07820E+05	2.07820E+05	2.07820E+05	2.07820E+05
115	1.7405E-01	1.8973E-01	1.8974E-01	1.8974E-01	1.8975E-01	1.3546E-01
116	0.0000E+00	4.17151E+05	4.17151E+05	4.17151E+05	4.17151E+05	4.17151E+05
117	552.3	142.5	142.5	142.5	142.5	142.5

	A	B	C	D	E	F	G	H
1	Appendix	Specifications for DOE FFTF Canister Components						
2								
3	FFTF SNF Assembly	parts/canister:	5					
4		components:	fuel pin:	parts/assem.:	217			
5				components:	MOX:	O.D.:	0.49403cm	
6						length:	91.44cm	
7						material:	UO1.96+PuO1.96	
8						density:	10.02g/cc	
9					insulator:	parts/assem.:	2	
10						material:	natural UO2	
11						density:	10.42g/cc	
12						length:	2.032	
13					reflector:	parts/assem.:	2	
14						material:	Inconel 600	
15						density:	8.47g/cc	
16						length:	14.478cm	
17					spring:	material:	SS302	
18						volume:	2.7264cc	
19						density:	8g/cc	
20					plenum:	material:	SS316	
21						length:	86.21cm	
22						O.D.:	0.49022cm	
23						wall thickness:	0.01397cm	
24					top cap:	material:	SS316	
25						length:	10.46cm	
26						O.D.:	0.5842cm	
27					bottom cap:	material:	SS316	
28						length:	4.06cm	
29						O.D.:	0.5842cm	
30					cladding	material:	SS316	
31						I.D.:	0.508 cm	
32						O.D.:	0.5842 cm	
33						length:	223.224cm	
34						density:	7.9497g/cc	
35			Components other than	fuel pins:	material:	SS316		
36					total mass:	172.819-217*0.4536=	74.3878 kg	
37	Ident 69	components:	fuel pin:	parts:	217			
38			container:	mass:	59.09Kg			
39				material:	SS304L			
40	Basket Assembly	material:	SS316L					
41		components:	center tube:	O.D.:	17.3cm			
42				I.D.:	15.3cm			
43				length:	412.5cm			
44			divider plates:	parts/canister:	5			
45				length:	14.6448cm			
46				height:	412.5cm			

	A	B	C	D	E	F	G	H
47				thickness:	1cm			
48			canister Shell	O.R.:	22.86cm			
49				I.R.:	21.9075cm			
50				length:	456.9cm			
51				material:	ss-316			
52				density	7.952g/cm3			
53	Volume for homogenizing isotopes:		pi*22.86**2*456.9=	750107.4569cc				
54	Total fuel pins per canister:		217*6=	1302				

	A	B	C	D	E	F	G
1	Cladding:	material:	SS316				
2		I.D.:	0.508 cm				
3		O.D.:	0.5842 cm				
4		length:	(237.744-10.46-4.06)cm=	223.224cm			
5		vol:	pi*(0.5842**2-0.508**2)*223.224/4cc=	14.5911cc			
6		total vol:	1302*14.5911cc=	18997.6122	cc		
7		vol fraction:	18997.6122/167983.6=	0.113092065			
8		density:	7.98g/cc				
9							
10	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
11					(at/cm*b)	(at./cm*b)	
12						(homogenized)	
13	C	6000.50c	12.01115	0.08	3.2007E-04	3.6198E-05	
14	Mn	25055.50c	54.9380503	2	1.7494E-03	1.9785E-04	
15	P	15031.50c	30.9737647	0.045	6.9817E-05	7.8958E-06	
16	S	16032.50c	31.9720737	0.03	4.5091E-05	5.0995E-06	
17	Si	14000.50c	28.086	0.75	1.2833E-03	1.4513E-04	
18	Cr	24000.50c	51.996	17	1.5712E-02	1.7769E-03	
19	Ni	28000.50c	58.71	12	9.8223E-03	1.1108E-03	
20	Mo	42000.50c	95.94	2.5	1.2522E-03	1.4162E-04	
21	N	7014.50c	14.00307439	0.1	3.4318E-04	3.8811E-05	
22	Fe	26000.50c	55.847	65.495	5.6358E-02	6.3736E-03	

	A	B	C	D	E	F
1	MOX:	material:	UO1.96+PuO1.96			
2		density:	10.02g/cc			
3		length:	91.44cm			
4		O.D.:	0.49403cm			
5		vol:	pi*0.49403**2*91.44/4cc=	17.5280cc		
6		total vol:	1302*17.5280cc=	22821.456cc		
7		vol fraction:	22821.456/103905.6147=	0.21963641		
8						
9	Pu(moles):	38.4/239.1891=	0.16054			
10	U(moles):	114.3/238.04476=	0.48016			
11	O(moles):	1.96*(0.16054+0.48016)=	1.25577			
12	O(mass):	15.998985*1.25577=	20.091g			
13	Total mass:	38.4+114.3+20.091=	172.791g			
14						
15	Pu:	mass:	38.4g			
16		weight fraction:	0.22223			
17						
18	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
19	Pu239	239.052146	0.8735	239.189095		
20	Pu240	240.053882	0.1163			
21	Pu241	241.056737	0.0102			
22						
23	U:	mass:	114.3g			
24		weight fraction:	0.66149			
25						
26	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
27	U235	235.043915	0.002	238.044756		
28	U238	238.05077	0.998			
29						
30						
31	O:	mass:	20.091g			
32		weight fraction:	0.11627			
33						
34	MOX					
35	Isotope	Identifier	Isotopic Mass	Wt. Fraction	At. Density	At. Density
36					(at/cm*b)	(at/cm*b)
37						(homogenized)
38	O16	8016.50c	15.998985	0.11627	4.3851E-02	9.6314E-03
39	U235	92235.50c	235.043915	0.00132	3.3887E-05	7.4428E-06
40	U238	92238.50c	238.05077	0.66017	1.6734E-02	3.6754E-03

	A	B	C	D	E	F	G
41	Pu239	94239.50c	239.052146	0.19412	4.8999E-03	6.6568E-04	
42	Pu240	94240.50c	240.053882	0.02585	6.4977E-04	8.8275E-05	
43	Pu241	94241.50c	241.056737	0.00227	5.6822E-05	7.7195E-06	

	A	B	C	D	E	F
1						
2						
3	Endcap	material:	SS316			
4		length:	10.46+4.06=	14.52cm		
5		diameter:	0.5842cm			
6		vol:	pi*0.5842**2*14.52/4=	3.89206cc		
7		total vol:	1302*3.89206=	5067.46212cc		
8		vol. fraction:	5067.46212/103905.6147=	0.0487699		
9		density:	7.98g/cc			
10						
11	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
12					(at/cm*b)	(at/cm*b)
13						(homogenized)
14	C	6000.50c	12.01115	0.08	3.2007E-04	1.5610E-05
15	Mn	25055.50c	54.9380503	2	1.7494E-03	8.5320E-05
16	P	15031.50c	30.9737647	0.045	6.9817E-05	3.4050E-06
17	S	16032.50c	31.9720737	0.03	4.5091E-05	2.1991E-06
18	Si	14000.50c	28.086	0.75	1.2833E-03	6.2584E-05
19	Cr	24000.50c	51.996	17	1.5712E-02	7.6626E-04
20	Ni	28000.50c	58.71	12	9.8223E-03	4.7903E-04
21	Mo	42000.50c	95.94	2.5	1.2522E-03	6.1071E-05
22	N	7014.50c	14.00307439	0.1	3.4318E-04	1.6737E-05
23	Fe	26000.50c	55.847	65.495	5.6358E-02	2.7485E-03

	A	B	C	D	E	F	G
1	Insulator	material:	natural UO2				
2		parts per rod:	2				
3		length:	2.032cm				
4		diameter:	0.508cm				
5		vol:	pi*0.508**2*2.032*2/4=	0.8237cc			
6		total vol:	1302*0.8237=	1072.4574cc			
7		vol. fraction:	1072.4574/103905.6147=	0.010321458			
8		density:	10.42g/cc				
9		U mass/assembly:	1500g				
10							
11	U(moles):	1500/238.0289=	6.3018				
12	O(moles):	2*6.3018=	12.6035				
13	O(mass):	16*12.6035=	201.656				
14	total mass:	1701.656					
15	U(Wt. Fraction):	1500/1701.656=	0.8815				
16	O(Wt. Fraction):	201.656/1701.656=	0.1185				
17							
18	Isotope	Identifier	At. Mass	Wt. Fraction	At. Density	At. Density	
19					(at/cm*b)	(at/cm*b)	
20						(homogenized)	
21	U235	92235.50c	235.043915	0.00626	1.6712E-04	1.7249E-06	
22	U238	92238.50c	238.05077	0.87524	2.3071E-02	2.3813E-04	
23	O16	8016.50c	15.998985	0.1185	4.6477E-02	4.7971E-04	
24							

	A	B	C	D	E	F
1	Ident 69	material:	SS304L			
2		density:	7.9g/cc			
3		mass:	59.09kg			
4		vol:	59090/7.9=	7479.75		
5		vol. fraction:	7479.75/103905.6147=	0.071986		
6						
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
8					(at/cm*b)	(at/cm*b)
9						(homogenized)
10	C	6000.50c	12.01115	0.03	1.1882E-04	8.5537E-06
11	Mn	25055.50c	54.9380503	2	1.7319E-03	1.2467E-04
12	P	15031.50c	30.9737647	0.045	6.9117E-05	4.9755E-06
13	S	16032.50c	31.9720737	0.03	4.4639E-05	3.2134E-06
14	Si	14000.50c	28.086	0.75	1.2704E-03	9.1451E-05
15	Cr	24000.50c	51.996	19	1.7384E-02	1.2514E-03
16	Ni	28000.50c	58.69	10	8.1059E-03	5.8351E-04
17	N	7014.50c	14.00307439	0.1	3.3974E-04	2.4456E-05
18	Fe	26000.50c	55.847	68.045	5.7965E-02	4.1727E-03

	A	B	C	D	E	F	G
1	Basket	material:	SS316L				
2		density:	7.98g/cc				
3		components:	center tube:	O.D.:	17.3cm		
4				I.D.:	15.3cm		
5				length:	412.5cm		
6				vol:	pi*(17.3**2-15.3**2)*412.5/4=	21123.2836cc	
7			divider plates:	parts/canister:	5		
8				thickness:	1cm		
9				length:	(43.815-17.3)/2=	13.2575cm	
10				height:	412.5cm		
11				vol:	5*1*13.2575*412.5=	27343.5938cc	
12							
13		total vol:	48466.8774	cc			
14		vol fraction:	48466.877/103905.6147=	0.466450992			
15							
16	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
17					(at/cm*b)	(at/cm*b)	
18						(homogenized)	
19	C	6000.50c	12.01115	0.03	1.2003E-04	5.5987E-05	
20	Mn	25055.50c	54.9380503	2	1.7494E-03	8.1603E-04	
21	P	15031.50c	30.9737647	0.045	6.9817E-05	3.2566E-05	
22	S	16032.50c	31.9720737	0.03	4.5091E-05	2.1033E-05	
23	Si	14000.50c	28.086	0.75	1.2833E-03	5.9858E-04	
24	Cr	24000.50c	51.996	17	1.5712E-02	7.3287E-03	
25	Ni	28000.50c	58.71	12	9.8223E-03	4.5816E-03	
26	Mo	42000.50c	95.94	2.5	1.2522E-03	5.8410E-04	
27	N	7014.50c	14.00307439	0.1	3.4318E-04	1.6008E-04	
28	Fe	26000.50c	55.847	65.545	5.6401E-02	2.6308E-02	
29							

	A	B	C	D	E
1	Gd				
2	Volume of basket (cc)	48466.8774			
3	density of SS316.(g/cc)	7.98			
4	Mass Basket (g)	386765.6817			
5	2% of the mass is Gd	0.02			
6	Mass Gd (g)	7735.313633	464.118818		
7	Mole of Gd (M=157.25 g/mol)	49.19118368			
8	Atomes of Gd	2.96229E+25			
9	Volume of the SNF DOE Canister	103905.6147			
10	Homogenized Density at/b.cm	0.000285095			
11					
12					
13		atom/density	volume	mole	mass
14		6.93356E-05	0.000104	1.16E-08	1.82E-06
15		0.000672942	0.00100941	1.09E-06	0.000172
16		2.68559E-05	4.0284E-05	1.74E-09	2.74E-07
17		1.73449E-05	2.6017E-05	7.26E-10	1.14E-07
18		1.43E-04	207811.229	47.62519	7489.061

	A	B
1	**Gd**	
2	Volume of basket (cc)	48466.8774
3	density of ss316.(g/cc)	7.98
4	Mass Basket (g)	386765.6817
5	2% of the mass is Gd	0.02
6	Mass Gd (g)	7735.313633
7	Mole of Gd (M=157.25 g/mol)	49.19118368
8	Atomes of Gd	2.96229E+25
9	Volume of the SNF DOE Canister	167984.6046
10	Homogenized Density at/b.cc	0.000176343

	A	B	C	D	E
1		Volume cc	Density	Mass (g)	Volume fraction
2	Clad	18997.612	7.98	151600.9454	0.113091389
3	Mox	22821.456	10.02	228670.9891	0.13585445
4	End Cap	5067.4621	7.98	40438.34772	0.030166229
5	Insulator	1072.4574	10.42	11175.00611	0.00638426
6	Indent	7479.75	7.9	59090.025	0.044526402
7	basket	48466.877	7.98	386765.6817	0.288519758
8	canister	64078.9895	7.98	511350.3358	0.381457513
9	Dry Volume	**167984.6**		1389091.331	
10					
11					
12					
13					
14				total Mass should not exceed 3400kg	

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**75% water in the fuel**												
2	% of clay and fule mix together			10%			25%			60%			100%
3	at dentity in	fuel 75% water	dry clay	mix	fuel	clay	Mix	fuel	clay	Mix	fuel	clay	Mix
4	at/bcm												
5	64000.35c	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06
6	1001.50c (H)	5.02E-02	6.13E-03	1.05E-02	5.02E-02	6.13E-03	1.05E-02	5.02E-02	6.13E-03	1.05E-02	5.02E-02	6.13E-03	1.05E-02
7	6000.50c (C)	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06
8	25055.50c (Mn)	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04
9	15031.50c (P)	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06
10	16032.50c (S)	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07
11	14000.50c (Si)	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02
12	24000.50c (Cr)	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04
13	28000.50c (Ni)	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04
14	42000.50c (Mo)	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05
15	7014.50c (N)	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06
16	26000.55c (Fe)	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02
17	29000.50C (Cu)	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05
18	8016.50C (O)	4.48E-02	5.67E-02	5.56E-02	4.48E-02	5.67E-02	5.56E-02	4.48E-02	5.67E-02	5.56E-02	4.48E-02	5.67E-02	5.56E-02
19	92235.50C (U235)	1.42E-06		1.40E-07	1.42E-06	0.00E+00	1.40E-07	1.42E-06	0.00E+00	1.40E-07	1.42E-06	0.00E+00	1.40E-07
20	92238.50C (U238)	6.05E-04		5.96E-05	6.05E-04	0.00E+00	5.96E-05	6.05E-04	0.00E+00	5.96E-05	6.05E-04	0.00E+00	5.96E-05
21	94239.55C (Pu239)	1.66E-04		1.64E-05	1.66E-04	0.00E+00	1.64E-05	1.66E-04	0.00E+00	1.64E-05	1.66E-04	0.00E+00	1.64E-05
22	94240.50C (Pu240)	2.21E-05		2.18E-06	2.21E-05	0.00E+00	2.18E-06	2.21E-05	0.00E+00	2.18E-06	2.21E-05	0.00E+00	2.18E-06
23	94241.50C (Pu241)	1.93E-06		1.90E-07	1.93E-06	0.00E+00	1.90E-07	1.93E-06	0.00E+00	1.90E-07	1.93E-06	0.00E+00	1.90E-07
24	11023.50c (Na)		7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05
25	13027.50c (Al)		1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04
26	20000.50c (Ca)		2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04
27	19000.50c (K)		3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04
28	22000.50c (Ti)		1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04
29	total	1.14E-01	9.49E-02	9.68E-02	1.14E-01	9.49E-02	9.68E-02	1.14E-01	9.49E-02	9.68E-02	1.14E-01	9.49E-02	9.68E-02
30	volume	6.72E+05	6.15E+06	6.82E+05	6.05E+05	5.53E+06	1.70E+06	5.04E+05	4.61E+06	4.09E+06	2.69E+05	2.46E+06	6.82E+06
31	TOTAL	6.82E+06		6.82E+06			6.82E+06			6.82E+06			6.82E+06
32	VOID	6.00E+06		6.00E+06			6.00E+06			6.00E+06			6.00E+06
33	H/X Ratio			632.6			632.6			632.6			632.6
34													
35	**SNF in the middle**	Volume	Length	Radius	Height of the	Cylinder Seg	x value						
36	hematite forms 3.765 10	5.53E+06	4.62E+02	9.40E+01	8.39E+01	5.53E+06	-1.01E+01						
37		6.21E+06	4.62E+02	9.40E+01	9.18E+01	6.21E+06	-2.25E+00						
38		6.82E+06	4.62E+02	9.40E+01	9.87E+01	6.82E+06	4.72E+00						
39		4.61E+06	4.62E+02	9.40E+01	7.31E+01	4.61E+06	-2.09E+01						
40		6.31E+06	4.62E+02	9.40E+01	9.29E+01	6.31E+06	-1.09E+00						

	A	B	C	D	E	F	G	H	I	J	K	L	M
41		6.82E+06	4.62E+02	9.40E+01	9.87E+01	6.82E+06	4.72E+00						
42		2.46E+06	4.62E+02	9.40E+01	4.64E+01	2.46E+06	-4.76E+01						
43		6.55E+06	4.62E+02	9.40E+01	9.56E+01	6.55E+06	1.62E+00						
44		6.82E+06	4.62E+02	9.40E+01	9.87E+01	6.82E+06	4.72E+00						
45		0.00E+00	4.62E+02	9.40E+01	0.00E+00	0.00E+00	-9.40E+01						
46		6.82E+06	4.62E+02	9.40E+01	9.87E+01	6.82E+06	4.72E+00						
47													
48													
49													
50		no water in hematite				no water in hematite				no water in hematite			
51		dry fuel	dry clay	water to fill the void space of density	total	dry fuel	dry clay	water to fill the void space of density	total	dry fuel	dry clay	water to fill the void space of density	total
52	**Hom over the entire volume**			0.1				0.5				0.8	
53	64000.35c	1.76E-04	1.90E-06		3.22E-06	1.76E-04	1.90E-06		3.22E-06	1.76E-04	1.90E-06		3.22E-06
54	1001.50c (H)		6.13E-03	6.69E-03	6.33E-03		6.13E-03	3.34E-02	1.99E-02		6.13E-03	5.35E-02	3.01E-02
55	6000.50c (C)	2.08E-04	1.90E-07		2.82E-06	2.08E-04	1.90E-07		2.82E-06	2.08E-04	1.90E-07		2.82E-06
56	25055.50c (Mn)	1.50E-03	6.78E-04		3.45E-04	1.50E-03	6.78E-04		3.45E-04	1.50E-03	6.78E-04		3.45E-04
57	15031.50c (P)	5.99E-05	0.00E+00		7.85E-07	5.99E-05	0.00E+00		7.85E-07	5.99E-05	0.00E+00		7.85E-07
58	16032.50c (S)	3.87E-05	0.00E+00		5.07E-07	3.87E-05	0.00E+00		5.07E-07	3.87E-05	0.00E+00		5.07E-07
59	14000.50c (Si)	1.10E-03	1.13E-02		5.43E-03	1.10E-03	1.13E-02		5.43E-03	1.10E-03	1.13E-02		5.43E-03
60	24000.50c (Cr)	1.36E-02	0.00E+00		1.78E-04	1.36E-02	0.00E+00		1.78E-04	1.36E-02	0.00E+00		1.78E-04
61	28000.50c (Ni)	8.35E-03	2.09E-04		2.10E-04	8.35E-03	2.09E-04		2.10E-04	8.35E-03	2.09E-04		2.10E-04
62	42000.50c (Mo)	1.02E-03	0.00E+00		1.33E-05	1.02E-03	0.00E+00		1.33E-05	1.02E-03	0.00E+00		1.33E-05
63	7014.50c (N)	2.94E-04	0.00E+00		3.86E-06	2.94E-04	0.00E+00		3.86E-06	2.94E-04	0.00E+00		3.86E-06
64	26000.55c (Fe)	4.84E-02	1.79E-02		9.21E-03	4.84E-02	1.79E-02		9.21E-03	4.84E-02	1.79E-02		9.21E-03
65	29000.50C (Cu)	0.00E+00	1.17E-05		5.60E-06	0.00E+00	1.17E-05		5.60E-06	0.00E+00	1.17E-05		5.60E-06
66	8016.50C (O)	7.89E-02	5.67E-02	3.34E-03	2.99E-02	7.89E-02	5.67E-02	1.67E-02	3.67E-02	7.89E-02	5.67E-02	2.67E-02	4.18E-02
67	92235.50C (U235)	5.67E-06			7.43E-08	5.67E-06			7.43E-08	5.67E-06			7.43E-08
68	92238.50C (U238)	2.42E-03			3.17E-05	2.42E-03			3.17E-05	2.42E-03			3.17E-05
69	94239.55C (Pu239)	6.66E-04			8.73E-06	6.66E-04			8.73E-06	6.66E-04			8.73E-06
70	94240.50C (Pu240)	8.83E-05			1.16E-06	8.83E-05			1.16E-06	8.83E-05			1.16E-06
71	94241.50C (Pu241)	7.72E-06			1.01E-07	7.72E-06			1.01E-07	7.72E-06			1.01E-07
72	11023.50c (Na)		7.22E-05		3.46E-05		7.22E-05		3.46E-05		7.22E-05		3.46E-05
73	13027.50c (Al)		1.08E-03		5.18E-04		1.08E-03		5.18E-04		1.08E-03		5.18E-04

	A	B	C	D	E	F	G	H	I	J	K	L	M
74	20000.50c (Ca)		2.62E-04		1.26E-04		2.62E-04		1.26E-04		2.62E-04		1.26E-04
75	19000.50c (K)		3.67E-04		1.76E-04		3.67E-04		1.76E-04		3.67E-04		1.76E-04
76	22000.50c (Ti)		1.73E-04		8.28E-05		1.73E-04		8.28E-05		1.73E-04		8.28E-05
77	total	1.57E-01	9.49E-02	1.00E-02	5.26E-02	1.57E-01	9.49E-02	5.02E-02	7.30E-02	1.57E-01	9.49E-02	8.02E-02	8.83E-02
78	volume	1.68E+05	6.15E+06	6.50E+06	1.28E+07	1.68E+05	6.15E+06	6.50E+06	1.28E+07	1.68E+05	6.15E+06	6.50E+06	1.28E+07
79	TOTAL				719.4				2261.7				3418.4
80	VOID												
81													
82													
83	**60% of water in the hematite**												
84	**75% water in the fuel**												
85	% of clay and fule mix together			10%			25%			60%			100%
86	at dentity in	fuel 75% wat	dry clay	mix	fuel	clay	Mix	fuel	clay	Mix	fuel	clay	Mix
87	at/bcm												
88	64000.35c	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06	4.41E-05	1.90E-06	6.06E-06
89	1001.50c (H)	6.24E-02	6.13E-03	1.17E-02	6.24E-02	6.13E-03	1.17E-02	6.24E-02	6.13E-03	1.17E-02	6.24E-02	6.13E-03	1.17E-02
90	6000.50c (C)	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06	5.20E-05	1.90E-07	5.29E-06
91	25055.50c (Mn)	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04	3.75E-04	6.78E-04	6.48E-04
92	15031.50c (P)	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06	1.50E-05	0.00E+00	1.47E-06
93	16032.50c (S)	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07	9.66E-06	0.00E+00	9.52E-07
94	14000.50c (Si)	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02	2.75E-04	1.13E-02	1.02E-02
95	24000.50c (Cr)	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04	3.39E-03	0.00E+00	3.34E-04
96	28000.50c (Ni)	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04	2.09E-03	2.09E-04	3.94E-04
97	42000.50c (Mo)	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05	2.55E-04	0.00E+00	2.51E-05
98	7014.50c (N)	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06	7.36E-05	0.00E+00	7.25E-06
99	26000.55c (Fe)	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02	1.21E-02	1.79E-02	1.73E-02
100	29000.50C (Cu)	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05	0.00E+00	1.17E-05	1.05E-05
101	8016.50C (O)	5.09E-02	5.67E-02	5.62E-02	5.09E-02	5.67E-02	5.62E-02	5.09E-02	5.67E-02	5.62E-02	5.09E-02	5.67E-02	5.62E-02
102	92235.50C (U235)	1.42E-06	0.00E+00	1.40E-07	1.42E-06	0.00E+00	1.40E-07	1.42E-06	0.00E+00	1.40E-07	1.42E-06	0.00E+00	1.40E-07
103	92238.50C (U238)	6.05E-04	0.00E+00	5.96E-05	6.05E-04	0.00E+00	5.96E-05	6.05E-04	0.00E+00	5.96E-05	6.05E-04	0.00E+00	5.96E-05
104	94239.55C (Pu239)	1.66E-04	0.00E+00	1.64E-05	1.66E-04	0.00E+00	1.64E-05	1.66E-04	0.00E+00	1.64E-05	1.66E-04	0.00E+00	1.64E-05
105	94240.50C (Pu240)	2.21E-05	0.00E+00	2.18E-06	2.21E-05	0.00E+00	2.18E-06	2.21E-05	0.00E+00	2.18E-06	2.21E-05	0.00E+00	2.18E-06
106	94241.50C (Pu241)	1.93E-06	0.00E+00	1.90E-07	1.93E-06	0.00E+00	1.90E-07	1.93E-06	0.00E+00	1.90E-07	1.93E-06	0.00E+00	1.90E-07
107	11023.50c (Na)		7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05	0.00E+00	7.22E-05	6.51E-05
108	13027.50c (Al)		1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04	0.00E+00	1.08E-03	9.75E-04
109	20000.50c (Ca)		2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04	0.00E+00	2.62E-04	2.36E-04
110	19000.50c (K)		3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04	0.00E+00	3.67E-04	3.31E-04
111	22000.50c (Ti)		1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04	0.00E+00	1.73E-04	1.56E-04
112	total	1.33E-01	9.49E-02	9.86E-02	1.33E-01	9.49E-02	9.86E-02	1.33E-01	9.49E-02	9.86E-02	1.33E-01	9.49E-02	9.86E-02
113	volume	6.72E+05	6.15E+06	6.82E+05	6.05E+05	5.53E+06	1.70E+06	5.04E+05	4.61E+06	4.09E+06	2.69E+05	2.46E+06	6.82E+06

	A	B	C	D	E	F	G	H	I	J	K	L	M
114	TOTAL	6.82E+06		6.82E+06			6.82E+06			6.82E+06			6.82E+06
115	VOID	6.00E+06					6.00E+06						
116	H/X Ratio	4262.3		705.4									
117				705.4									
118													
119													
120	Lost of absorber												
121		fuel 75% water											
122		atdensity		dry clay									
123	%of gd in fuel	no gd	nogd no Fe2O	no gd	nogd no Fe2O3								
124	64000.35c	0.00E+00	0.00E+00	0.00E+00	0.00E+00								
125	1001.50c (H)	6.24E-02	6.24E-02	6.13E-03	6.13E-03								
126	6000.50c (C)	5.20E-05	5.20E-05	1.90E-07	1.90E-07								
127	25055.50c (Mn)	3.75E-04	3.75E-04	6.78E-04	6.78E-04								
128	15031.50c (P)	1.50E-05	1.50E-05	0.00E+00	0.00E+00								
129	16032.50c (S)	9.66E-06	9.66E-06	0.00E+00	0.00E+00								
130	14000.50c (Si)	2.75E-04	2.75E-04	1.13E-02	1.13E-02								
131	24000.50c (Cr)	3.39E-03	3.39E-03	0.00E+00	0.00E+00								
132	28000.50c (Ni)	2.09E-03	2.09E-03	2.09E-04	2.09E-04								
133	42000.50c (Mo)	2.55E-04	2.55E-04	0.00E+00	0.00E+00								
134	7014.50c (N)	7.36E-05	7.36E-05	0.00E+00	0.00E+00								
135	26000.55c (Fe)	1.21E-02	0.00E+00	1.79E-02	1.79E-02								
136	29000.50C (Cu)	0.00E+00	0.00E+00	1.17E-05	1.17E-05								
137	8016.50C (O)	5.09E-02	3.27E-02	5.67E-02	2.99E-02								
138	92235.50C (U235)	1.42E-06	1.42E-06	0.00E+00	0.00E+00								
139	92238.50C (U238)	6.05E-04	6.05E-04	0.00E+00	0.00E+00								
140	94239.55C (Pu239)	1.66E-04	1.66E-04	0.00E+00	0.00E+00								
141	94240.50C (Pu240)	2.21E-05	2.21E-05	0.00E+00	0.00E+00								
142	94241.50C (Pu241)	1.93E-06	1.93E-06	0.00E+00	0.00E+00								
143	11023.50c (Na)	0.00E+00	0.00E+00	7.22E-05	7.22E-05								
144	13027.50c (Al)	0.00E+00	0.00E+00	1.08E-03	1.08E-03								
145	20000.50c (Ca)	0.00E+00	0.00E+00	2.62E-04	2.62E-04								
146	19000.50c (K)	0.00E+00	0.00E+00	3.67E-04	3.67E-04								
147	22000.50c (Ti)	0.00E+00	0.00E+00	1.73E-04	1.73E-04								
148	total	1.33E-01	1.02E-01	9.49E-02	6.81E-02								
149	volume	6.72E+05	6.72E+05	6.15E+06	6.15E+05								
150	h/X	3.7157E+02	3.7157E+02										

	N	O	P	Q	R	S	T	U
1								
2								
3	fuel	clay						
4								
5	4.41E-05	1.90E-06						
6	5.02E-02	6.13E-03						
7	5.20E-05	1.90E-07						
8	3.75E-04	6.78E-04						
9	1.50E-05	0.00E+00						
10	9.66E-06	0.00E+00						
11	2.75E-04	1.13E-02						
12	3.39E-03	0.00E+00						
13	2.09E-03	2.09E-04						
14	2.55E-04	0.00E+00						
15	7.36E-05	0.00E+00						
16	1.21E-02	1.79E-02						
17	0.00E+00	1.17E-05						
18	4.48E-02	5.67E-02						
19	1.42E-06	0.00E+00						
20	6.05E-04	0.00E+00						
21	1.66E-04	0.00E+00						
22	2.21E-05	0.00E+00						
23	1.93E-06	0.00E+00						
24	0.00E+00	7.22E-05						
25	0.00E+00	1.08E-03						
26	0.00E+00	2.62E-04						
27	0.00E+00	3.67E-04						
28	0.00E+00	1.73E-04						
29	1.14E-01	9.49E-02						
30	0.00E+00	0.00E+00						
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								

	N	O	P	Q	R	S	T	U
41								
42								
43								
44								
45								
46								
47								
48								
49								
50	no water in hematite				60% of water in hematite			
51	dry fuel	dry clay	water to fill the void space of density	total	dry fuel	dry clay	water to fill the void space	total
52			1					
53	1.76E-04	1.90E-06		3.22E-06	1.76E-04	1.90E-06		9.22E-07
54		6.13E-03	6.69E-02	3.69E-02	4.88E-02	6.13E-03	6.69E-02	3.74E-02
55	2.08E-04	1.90E-07		2.82E-06	2.08E-04	1.90E-07		9.22E-08
56	1.50E-03	6.78E-04		3.45E-04	1.50E-03	6.78E-04		3.29E-04
57	5.99E-05	0.00E+00		7.85E-07	5.99E-05	0.00E+00		0.00E+00
58	3.87E-05	0.00E+00		5.07E-07	3.87E-05	0.00E+00		0.00E+00
59	1.10E-03	1.13E-02		5.43E-03	1.10E-03	1.13E-02		5.48E-03
60	1.36E-02	0.00E+00		1.78E-04	1.36E-02	0.00E+00		0.00E+00
61	8.35E-03	2.09E-04		2.10E-04	8.35E-03	2.09E-04		1.01E-04
62	1.02E-03	0.00E+00		1.33E-05	1.02E-03	0.00E+00		0.00E+00
63	2.94E-04	0.00E+00		3.86E-06	2.94E-04	0.00E+00		0.00E+00
64	4.84E-02	1.79E-02		9.21E-03	4.84E-02	1.79E-02		8.69E-03
65	0.00E+00	1.17E-05		5.60E-06	0.00E+00	1.17E-05		5.67E-06
66	7.89E-02	5.67E-02	3.34E-02	4.52E-02	1.03E-01	5.67E-02	3.34E-02	4.48E-02
67	5.67E-06			7.43E-08	5.67E-06			0.00E+00
68	2.42E-03			3.17E-05	2.42E-03			0.00E+00
69	6.66E-04			8.73E-06	6.66E-04			0.00E+00
70	8.83E-05			1.16E-06	8.83E-05			0.00E+00
71	7.72E-06			1.01E-07	7.72E-06			0.00E+00
72		7.22E-05		3.46E-05		7.22E-05		3.51E-05
73		1.08E-03		5.18E-04		1.08E-03		5.25E-04

	N	O	P	Q	R	S	T	U
74		2.62E-04		1.26E-04		2.62E-04		1.27E-04
75		3.67E-04		1.76E-04		3.67E-04		1.79E-04
76		1.73E-04		8.28E-05		1.73E-04		8.39E-05
77	1.57E-01	9.49E-02	1.00E-01	9.85E-02	2.30E-01	9.49E-02	1.00E-01	9.77E-02
78	1.68E+05	6.15E+06	6.50E+06	1.28E+07	0.00E+00	6.15E+06	6.50E+06	1.26E+07
79				4189.6				
80								
81								
82								
83								
84								
85								
86	fuel	clay						
87								
88	4.41E-05	1.90E-06						
89	6.24E-02	6.13E-03						
90	5.20E-05	1.90E-07						
91	3.75E-04	6.78E-04						
92	1.50E-05	0.00E+00						
93	9.66E-06	0.00E+00						
94	2.75E-04	1.13E-02						
95	3.39E-03	0.00E+00						
96	2.09E-03	2.09E-04						
97	2.55E-04	0.00E+00						
98	7.36E-05	0.00E+00						
99	1.21E-02	1.79E-02						
100	0.00E+00	1.17E-05						
101	5.09E-02	5.67E-02						
102	1.42E-06	0.00E+00						
103	6.05E-04	0.00E+00						
104	1.66E-04	0.00E+00						
105	2.21E-05	0.00E+00						
106	1.93E-06	0.00E+00						
107	0.00E+00	7.22E-05						
108	0.00E+00	1.08E-03						
109	0.00E+00	2.62E-04						
110	0.00E+00	3.67E-04						
111	0.00E+00	1.73E-04						
112	1.33E-01	9.49E-02						
113	0.00E+00	0.00E+00						

	N	O	P	Q	R	S	T	U
114								
115								
116								
117								
118								
119								
120								
121								
122								
123								
124								
125								
126								
127								
128								
129								
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145								
146								
147								
148								
149								
150								

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	**hematite forms at 10.26 1000s of years +**				0	***100 % of water**		**total volume**	6145900	cc	**tot mass**	23921.4	**tot density**	0.003892
3														
4	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass	23921.4	kg
5	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.7001464	g
6	H	1.00782519	1001.50c	6.4551	6.30E+04	6.13E-03			6.1256E-03			968472	moles	
7	C	12.01115	6000.50c	0.0002	2.33E+01	1.90E-07			1.8979E-07					
8	O	15.994915	8016.50c	59.7993	9.26E+06	5.67E-02			5.6746E-02					
9	Na	22.9897707	11023.50c	0.0761	1.69E+04	7.22E-05			7.2215E-05					
10	Al	26.9815389	13027.50c	1.1394	2.98E+05	1.08E-03			1.0812E-03					
11	Si	28.086	14000.50c	11.893	3.23E+06	1.13E-02			1.1286E-02					
12	Ca	40.08	20000.50c	0.2762	1.07E+05	2.62E-04			2.6210E-04					
13	K	39.102	19000.50c	0.3872	1.47E+05	3.67E-04			3.6743E-04					
14	Ti	47.9	22000.50c	0.1819	8.44E+04	1.73E-04			1.7261E-04					
15	Mn	54.9380503	25055.50c	0.7144	3.80E+05	6.78E-04			6.7793E-04					
16	Fe	55.847	26000.55c	18.8429	1.02E+07	1.79E-02			1.7881E-02					
17	Ni	58.71	28000.50c	0.22	1.25E+05	2.09E-04			2.0877E-04					
18	Cu	63.54	29000.50c	0.0123	7.57E+03	1.17E-05			1.1672E-05					
19	Gd	157.25	64000.35c	0.002	3.05E+03	1.90E-06			1.8979E-06					
20				100	23921400	0.0948948			9.4895E-02			tot moles	968471.992	
21														
22	**water**				**mass (g)**	**number densities (at/bar.cm)**								
23	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	0	cc	mass=	0	g
24	H	1.00782519	1001.50c	200	0.00E+00	0.00E+00						1 mol is	1.80E+01	
25	O	15.994915	8016.50c	100	0.00E+00	0.00E+00						0.00E+00	mole of h2o	
26					0.00E+00	0.00E+00								
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38	**hematite forms at 10.26 1000s of years +**				0.25	***100 % of water**		**total volume**	8194533.3	cc	**tot mass**	2072555	**tot density**	0.252919
39														
40	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass	23921.4	kg

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
41	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.7001464	g
42	H	1.00782519	1001.50c	6.4551	6.30E+04	4.59E-03			2.1312E-02			968472	moles	
43	C	12.01115	6000.50c	0.0002	2.33E+01	1.42E-07			1.4234E-07					
44	O	15.994915	8016.50c	59.7993	9.26E+06	4.26E-02			5.0919E-02					
45	Na	22.9897707	11023.50c	0.0761	1.69E+04	5.42E-05			5.4161E-05					
46	Al	26.9815389	13027.50c	1.1394	2.98E+05	8.11E-04			8.1092E-04					
47	Si	28.086	14000.50c	11.893	3.23E+06	8.46E-03			8.4644E-03					
48	Ca	40.08	20000.50c	0.2762	1.07E+05	1.97E-04			1.9657E-04					
49	K	39.102	19000.50c	0.3872	1.47E+05	2.76E-04			2.7557E-04					
50	Ti	47.9	22000.50c	0.1819	8.44E+04	1.29E-04			1.2946E-04					
51	Mn	54.9380503	25055.50c	0.7144	3.80E+05	5.08E-04			5.0845E-04					
52	Fe	55.847	26000.55c	18.8429	1.02E+07	1.34E-02			1.3411E-02					
53	Ni	58.71	28000.50c	0.22	1.25E+05	1.57E-04			1.5658E-04					
54	Cu	63.54	29000.50c	0.0123	7.57E+03	8.75E-06			8.7540E-06					
55	Gd	157.25	64000.35c	0.002	3045.84	1.42E-06			1.4234E-06					
56				100	23921400	0.0711711			9.6248E-02			tot moles	1082218.19	
57														
58	**water**				**mass (g)**	**number densities (at/bar.cm)**								
59	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	2E+06	cc	mass=	2048633.33	g
60	H	1.00782519	1001.50c	200	2.29E+05	1.67E-02						1 mol is	1.80E+01	
61	O	15.994915	8016.50c	100	1.82E+06	8.36E-03						1.14E+05	mole of h2o	
62					2.05E+06	2.51E-02								
63														
64														
65														
66														
67	**hematite forms at 10.26 1000s of years +**				0.51409656	***100 % of water**		**total volume**	12648398	cc	**tot mass**	6526419	**tot density**	0.515988
68						12144444		Max Volume						
69	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass	23921.4	kg
70	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.7001464	g
71	H	1.00782519	1001.50c	6.4551	6.30E+04	2.98E-03			3.7355E-02			968472	moles	
72	C	12.01115	6000.50c	0.0002	2.33E+01	9.22E-08			9.2219E-08					
73	O	15.994915	8016.50c	59.7993	9.26E+06	2.76E-02			4.4763E-02					
74	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.51E-05			3.5089E-05					
75	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.25E-04			5.2537E-04					
76	Si	28.086	14000.50c	11.893	3.23E+06	5.48E-03			5.4838E-03					
77	Ca	40.08	20000.50c	0.2762	1.07E+05	1.27E-04			1.2735E-04					
78	K	39.102	19000.50c	0.3872	1.47E+05	1.79E-04			1.7854E-04					
79	Ti	47.9	22000.50c	0.1819	8.44E+04	8.39E-05			8.3874E-05					
80	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.29E-04			3.2941E-04					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
81	Fe	55.847	26000.55c	18.8429	1.02E+07	8.69E-03			8.6884E-03					
82	Ni	58.71	28000.50c	0.22	1.25E+05	1.01E-04			1.0144E-04					
83	Cu	63.54	29000.50c	0.0123	7.57E+03	5.67E-06			5.6715E-06					
84	Gd	157.25	64000.35c	0.002	3.05E+03	9.22E-07			9.2219E-07					
85				100	23921400	0.0461097			9.7678E-02			tot moles	1329509.95	
86														
87	**water**				**mass (g)**	**number densities (at/bar.cm)**								
88	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	7E+06	cc	mass=	6502497.7	g
89	H	1.00782519	1001.50c	200	7.28E+05	3.44E-02						1 mol is	1.80E+01	
90	O	15.994915	8016.50c	100	5.77E+06	1.72E-02						3.61E+05	mole of h2o	
91					6.50E+06	5.16E-02								
92														
93														
94														
95														

	O	P	Q	R	S	T	U	V
1								
2		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volu	x value
3		hematite forms 3.765 1000s y	1E+07	461.7	94	90.97767766	6145900	-3.022322
4		FFTF SNF	167985	461.7	94	92.91348971	6313884.605	-1.08651
5		total	6E+06					
6		FFTF SNF 25% water	223979	461.7	94	93.55861742	6369879.473	-0.441383
7			6E+06					
8		FFTF SNF 50% water	335969	461.7	94	94.84884085	6481869.209	0.848841
9			6E+06					
10		FFTF SNF 75% water	671938	461.7	94	98.72144618	6817838.418	4.721446
11			7E+06					
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volu	x value
39		hematite forms 3.765 1000s y	1E+07	461.7	94	114.749842	8194533.333	20.74984
40		FFTF SNF	167985	461.7	94	116.7391545	8362517.94	22.73915

	O	P	Q	R	S	T	U	V
41		total						
42							8362517.938	
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56								
57								
58								
59								
60								
61								
62								
63								
64								
65								
66								
67		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volu	x value
68		hematite forms 3.765 1000s y	1E+07	461.7	94	180.5972475	12648397.72	86.59725
69		FFTF SNF	-1E+07	461.7	94	7.4027525	167984.6049	-86.59725
70		total	3E+07			188		
71							12816382.33	
72								
73								
74								
75								
76								
77								
78								
79								
80								

	O	P	Q	R	S	T	U	V
81								
82								
83								
84								
85								
86								
87								
88								
89								
90								
91								
92								
93								
94								
95								

	A	B	C	D	E	F	G	H	I
1	Atomic Densities (at/cm*b)								
2									
3	Canister Component:	Ident 69	Basket	Cladding	Endcaps	MOX	Insulator	Canister shell	Total
4									
5	MCNP Isotope Identifier								
6	64000.35c								
7	1001.50c (H)								
8	6000.50c (C)	5.29084E-06	3.463E-05	3.61977E-05	9.65545E-06			0.000122095	0.000207869
9	25055.50c (Mn)	7.71161E-05	0.0005048	0.000197848	5.27745E-05			0.000667343	0.001499835
10	15031.50c (P)	3.07756E-06	2.014E-05	7.89577E-06	2.10613E-06			2.66324E-05	5.98556E-05
11	16032.50c (S)	1.98764E-06	1.301E-05	5.09948E-06	1.36025E-06			1.72006E-05	3.86578E-05
12	14000.50c (Si)	5.65665E-05	0.0003702	0.000145127	3.87114E-05			0.000489512	0.001100165
13	24000.50c (Cr)	0.000774055	0.0045332	0.001776866	0.000473965			0.005993374	0.013551418
14	28000.50c (Ni)	0.000360931	0.0028339	0.001110823	0.000296303			0.003746809	0.008348808
15	42000.50c (Mo)	0	0.0003613	0.000141617	3.77753E-05			0.000477675	0.001018363
16	7014.50c (N)	1.51274E-05	9.901E-05	3.88108E-05	1.03525E-05			0.000130909	0.000294214
17	26000.55c (Fe)	0.002580979	0.0162728	0.006373589	0.001700104			0.021498131	0.048425575
18	29000.50C (Cu)	0							0
19	8016.50C (O)	0				0.005957447	0.000296721		0.006254167
20	92235.50C (U235)	0				4.60373E-06	1.06696E-06		5.67069E-06
21	92238.50C (U238)	0				0.002273375	0.000147292		0.002420667
22	94239.55C (Pu239)	0				0.000665675	0		0.000665675
23	94240.50C (Pu240)	0				8.82748E-05	0		8.82748E-05
24	94241.50C (Pu241)	0				7.71954E-06			7.71954E-06
25	total	0.00387513	0.025043	0.009833875	0.002623108	0.008997096	0.000445079	0.033169682	0.083986935
26	volume	167984.6046							
27									
28	**0% hematite occupied by water**					See table 6.2-2			
29						**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	**FFTF SNF Diluted at**
30	Density of Hematite (g/cc)	5.2749E+00		**MCNP Isotope Identifier**		**0.00%**	**25.00%**	**50.00%**	**75.00%**
31	Volume of the fuel Homogenized	1.6798E+05		**64000.35c**	1.7634E-04	1.7634E-04	1.3226E-04	8.8172E-05	4.4086E-05
32	Mole/cc.b of Hematite	4.0207E-26		**1001.50c (H)**	0.0000E+00	0.0000E+00	1.6718E-02	3.3436E-02	5.0154E-02
33	Mole of hematite in the fuel	6.7542E+03		**6000.50c (C)**	2.0787E-04	2.0787E-04	1.5590E-04	1.0393E-04	5.1967E-05
34	Mass of Hematite(g)	1.0785E+06		**25055.50c (Mn)**	1.4998E-03	1.4998E-03	1.1249E-03	7.4992E-04	3.7496E-04
35	Volume of Hematite (cc)	2.0446E+05		**15031.50c (P)**	5.9856E-05	5.9856E-05	4.4892E-05	2.9928E-05	1.4964E-05
36	Volume of Hematite (l)	2.0446E+02		**16032.50c (S)**	3.8658E-05	3.8658E-05	2.8993E-05	1.9329E-05	9.6644E-06
37	**0 % of this volume is water**	**0.0000E+00**		**14000.50c (Si)**	1.1002E-03	1.1002E-03	8.2512E-04	5.5008E-04	2.7504E-04
38	volume of water (cc)	0.0000E+00		**24000.50c (Cr)**	1.3551E-02	1.3551E-02	1.0164E-02	6.7757E-03	3.3879E-03
39				**28000.50c (Ni)**	8.3488E-03	8.3488E-03	6.2616E-03	4.1744E-03	2.0872E-03
40	Mass(g) of Water to add	0		**42000.50c (Mo)**	1.0184E-03	1.0184E-03	7.6377E-04	5.0918E-04	2.5459E-04

	A	B	C	D	E	F	G	H	I
41	Mole of Water to add	0		**7014.50c (N)**	2.9421E-04	2.9421E-04	2.2066E-04	1.4711E-04	7.3553E-05
42	Atomes of O to add	0		**26000.55c (Fe)**	4.8426E-02	4.8426E-02	3.6319E-02	2.4213E-02	1.2106E-02
43	Atomes of H to add	0		**29000.50C (Cu)**	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
44	density of H homogenized to add (at/cm.b)	0.0000E+00		**8016.50C (O)**	7.8893E-02	7.8893E-02	6.7528E-02	5.6164E-02	4.4800E-02
45	density of O homogenized to add (at/cm.b)	0.0000E+00		**92235.50C (U235)**	5.6707E-06	5.6707E-06	4.2530E-06	2.8353E-06	1.4177E-06
46				**92238.50C (U238)**	2.4207E-03	2.4207E-03	1.8155E-03	1.2103E-03	6.0517E-04
47	Max Volume of the canister	624971.2629		**94239.55C (Pu239)**	6.6568E-04	6.6568E-04	4.9926E-04	3.3284E-04	1.6642E-04
48				**94240.50C (Pu240)**	8.8275E-05	8.8275E-05	6.6206E-05	4.4137E-05	2.2069E-05
49				**94241.50C (Pu241)**	7.7195E-06	7.7195E-06	5.7897E-06	3.8598E-06	1.9299E-06
50				total	1.5680E-01	1.5680E-01	1.4268E-01	1.2855E-01	1.1443E-01
51				volume	1.6798E+05	1.6798E+05	2.2398E+05	3.3597E+05	6.7194E+05
52									2.5000E-01
53				h/x	0.0	0.0	33.2	99.6	298.8
54						See table 6.2-2			
55	**30% hematite occupied by water**					**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	
56	Density of Hematite (g/cc)	5.2749E+00		**MCNP Isotope Identifier**		**0.00%**	**25.00%**	**50.00%**	**75.00%**
57	Volume of the fuel Homogenized	1.6798E+05		**64000.35c**	1.7634E-04	1.7634E-04	1.3226E-04	8.8172E-05	4.4086E-05
58	Mole/cc.b of Hematite	4.0207E-26		**1001.50c (H)**	0.0000E+00	2.4418E-02	3.5031E-02	4.5645E-02	5.6258E-02
59	Mole of hematite in the fuel	6.7542E+03		**6000.50c (C)**	2.0787E-04	2.0787E-04	1.5590E-04	1.0393E-04	5.1967E-05
60	Mass of Hematite(g)	1.0785E+06		**25055.50c (Mn)**	1.4998E-03	1.4998E-03	1.1249E-03	7.4992E-04	3.7496E-04
61	Volume of Hematite (cc)	2.0446E+05		**15031.50c (P)**	5.9856E-05	5.9856E-05	4.4892E-05	2.9928E-05	1.4964E-05
62	Volume of Hematite (l)	2.0446E+02		**16032.50c (S)**	3.8658E-05	3.8658E-05	2.8993E-05	1.9329E-05	9.6644E-06
63	**0 % of this volume is water**	**3.0000E-01**		**14000.50c (Si)**	1.1002E-03	1.1002E-03	8.2512E-04	5.5008E-04	2.7504E-04
64	volume of water (cc)	6.1338E+04		**24000.50c (Cr)**	1.3551E-02	1.3551E-02	1.0164E-02	6.7757E-03	3.3879E-03
65				**28000.50c (Ni)**	8.3488E-03	8.3488E-03	6.2616E-03	4.1744E-03	2.0872E-03
66	Mass(g) of Water to add	61337.90271		**42000.50c (Mo)**	1.0184E-03	1.0184E-03	7.6377E-04	5.0918E-04	2.5459E-04
67	Mole of Water to add	3405.662255		**7014.50c (N)**	2.9421E-04	2.9421E-04	2.2066E-04	1.4711E-04	7.3553E-05
68	Atomes of O to add	2.05089E+27		**26000.55c (Fe)**	4.8426E-02	4.8426E-02	3.6319E-02	2.4213E-02	1.2106E-02
69	Atomes of H to add	4.10178E+27		**29000.50C (Cu)**	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
70	density of H homogenized to add (at/cm.b)	2.4418E-02		**8016.50C (O)**	7.8893E-02	9.1101E-02	7.6685E-02	6.2269E-02	4.7852E-02
71	density of O homogenized to add (at/cm.b)	1.2209E-02		**92235.50C (U235)**	5.6707E-06	5.6707E-06	4.2530E-06	2.8353E-06	1.4177E-06
72				**92238.50C (U238)**	2.4207E-03	2.4207E-03	1.8155E-03	1.2103E-03	6.0517E-04
73	Max Volume of the canister	624971.2629		**94239.55C (Pu239)**	6.6568E-04	6.6568E-04	4.9926E-04	3.3284E-04	1.6642E-04
74				**94240.50C (Pu240)**	8.8275E-05	8.8275E-05	6.6206E-05	4.4137E-05	2.2069E-05
75				**94241.50C (Pu241)**	7.7195E-06	7.7195E-06	5.7897E-06	3.8598E-06	1.9299E-06
76				volume	1.6798E+05	1.6798E+05	2.2398E+05	3.3597E+05	6.7194E+05
77				total	1.5680E-01	1.9343E-01	1.7015E-01	1.4687E-01	1.2359E-01
78									2.5000E-01
79				h/x	0.0	36.4	69.6	136.0	335.2
80						See table 6.2-2			

	A	B	C	D	E	F	G	H	I
81	**60% hematite occupied by water**					**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	**FFTF SNF Diluted at**	**FFTF SNF Diluted at**
82	Density of Hematite (g/cc)	5.2749E+00		**MCNP Isotope Identifier**		**0.0000E+00**	**2.5000E-01**	**5.0000E-01**	**7.5000E-01**
83	Volume of the fuel Homogenized	1.6798E+05		**64000.35c**	1.7634E-04	1.7634E-04	1.3226E-04	8.8172E-05	4.4086E-05
84	Mole/cc.b of Hematite	4.0207E-26		**1001.50c (H)**	0.0000E+00	4.8835E-02	5.3344E-02	5.7854E-02	6.2363E-02
85	Mole of hematite in the fuel	6.7542E+03		**6000.50c (C)**	2.0787E-04	2.0787E-04	1.5590E-04	1.0393E-04	5.1967E-05
86	Mass of Hematite(g)	1.0785E+06		**25055.50c (Mn)**	1.4998E-03	1.4998E-03	1.1249E-03	7.4992E-04	3.7496E-04
87	Volume of Hematite (cc)	2.0446E+05		**15031.50c (P)**	5.9856E-05	5.9856E-05	4.4892E-05	2.9928E-05	1.4964E-05
88	Volume of Hematite (l)	2.0446E+02		**16032.50c (S)**	3.8658E-05	3.8658E-05	2.8993E-05	1.9329E-05	9.6644E-06
89	**0 % of this volume is water**	**6.0000E-01**		**14000.50c (Si)**	1.1002E-03	1.1002E-03	8.2512E-04	5.5008E-04	2.7504E-04
90	volume of water (cc)	1.2268E+05		**24000.50c (Cr)**	1.3551E-02	1.3551E-02	1.0164E-02	6.7757E-03	3.3879E-03
91				**28000.50c (Ni)**	8.3488E-03	8.3488E-03	6.2616E-03	4.1744E-03	2.0872E-03
92	Mass(g) of Water to add	122675.8054		**42000.50c (Mo)**	1.0184E-03	1.0184E-03	7.6377E-04	5.0918E-04	2.5459E-04
93	Mole of Water to add	6811.32451		**7014.50c (N)**	2.9421E-04	2.9421E-04	2.2066E-04	1.4711E-04	7.3553E-05
94	Atomes of O to add	4.10178E+27		**26000.55c (Fe)**	4.8426E-02	4.8426E-02	3.6319E-02	2.4213E-02	1.2106E-02
95	Atomes of H to add	8.20356E+27		**29000.50C (Cu)**	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
96	density of H homogenized to add (at/cm.b)	4.8835E-02		**8016.50C (O)**	7.8893E-02	1.0331E-01	8.5842E-02	6.8373E-02	5.0904E-02
97	density of O homogenized to add (at/cm.b)	2.4418E-02		**92235.50C (U235)**	5.6707E-06	5.6707E-06	4.2530E-06	2.8353E-06	1.4177E-06
98				**92238.50C (U238)**	2.4207E-03	2.4207E-03	1.8155E-03	1.2103E-03	6.0517E-04
99	Max Volume of the canister	624971.2629		**94239.55C (Pu239)**	6.6568E-04	6.6568E-04	4.9926E-04	3.3284E-04	1.6642E-04
100				**94240.50C (Pu240)**	8.8275E-05	8.8275E-05	6.6206E-05	4.4137E-05	2.2069E-05
101				**94241.50C (Pu241)**	7.7195E-06	7.7195E-06	5.7897E-06	3.8598E-06	1.9299E-06
102				volume	1.6798E+05	1.6798E+05	2.2398E+05	3.3597E+05	6.7194E+05
103				total	1.5680E-01	2.3005E-01	1.9762E-01	1.6518E-01	1.3274E-01
104									
105				h/x	0.0	72.7	105.9	172.4	371.6

	J	K	L	M
1				
2				
3	Total degraded dry			
4	(Fe becomes Fe2O3)			
5				
6	0.000176343			
7				
8	0.000207869			
9	0.001499835			
10	5.98556E-05			
11	3.86578E-05			
12	0.001100165			
13	0.013551418			
14	0.008348808			
15	0.001018363			
16	0.000294214			
17	0.048425575			
18	0			
19	0.078892529			
20	5.67069E-06			
21	0.002420667			
22	0.000665675			
23	8.82748E-05			
24	7.71954E-06			
25	0.15680164		H/X	0
26				
27				
28				
29	**FFTF SNF Diluted at**			
30	**97.48%**			
31	4.4409E-06			
32	6.5188E-02			
33	5.2348E-06			
34	3.7771E-05			
35	1.5074E-06			
36	9.7353E-07			
37	2.7706E-05			
38	3.4127E-04			
39	2.1025E-04			
40	2.5646E-05			

	J	K	L	M
41	7.4093E-06			
42	1.2195E-03			
43	0.0000E+00			
44	3.4581E-02			
45	1.4281E-07			
46	6.0960E-05			
47	1.6764E-05			
48	2.2230E-06			
49	1.9440E-07			
50	1.0173E-01			
51	6.6705E+06			
52	2.5183E-02			
53	3855.7			
54				
55				
56	**97.48%**			
57	4.4409E-06			
58	6.5803E-02			
59	5.2348E-06			
60	3.7771E-05			
61	1.5074E-06			
62	9.7353E-07			
63	2.7706E-05			
64	3.4127E-04			
65	2.1025E-04			
66	2.5646E-05			
67	7.4093E-06			
68	1.2195E-03			
69	0.0000E+00			
70	3.4888E-02			
71	1.4281E-07			
72	6.0960E-05			
73	1.6764E-05			
74	2.2230E-06			
75	1.9440E-07			
76	6.6705E+06			
77	1.0265E-01			
78	2.5183E-02			
79	3892.1			
80				

	J	K	L	M
81			no gd	nogdfe
82	9.7482E-01		0.75	0.75
83	4.4409E-06		0	0.0000E+00
84	6.6418E-02		6.24E-02	6.24E-02
85	5.2348E-06		5.20E-05	5.20E-05
86	3.7771E-05		3.75E-04	3.75E-04
87	1.5074E-06		1.50E-05	1.50E-05
88	9.7353E-07		9.66E-06	9.66E-06
89	2.7706E-05		2.75E-04	2.75E-04
90	3.4127E-04		3.39E-03	3.39E-03
91	2.1025E-04		2.09E-03	2.09E-03
92	2.5646E-05		2.55E-04	2.55E-04
93	7.4093E-06		7.36E-05	7.36E-05
94	1.2195E-03		1.21E-02	0.00E+00
95	0.0000E+00		0.00E+00	0.00E+00
96	3.5196E-02		5.09E-02	3.27E-02
97	1.4281E-07		1.42E-06	1.42E-06
98	6.0960E-05		6.05E-04	6.05E-04
99	1.6764E-05		1.66E-04	1.66E-04
100	2.2230E-06		2.21E-05	2.21E-05
101	1.9440E-07		1.93E-06	1.93E-06
102	6.6705E+06		1.33E-01	1.02E-01
103	1.0358E-01		1.3270E-01	1.33E-01
104				
105	3928.5		371.6	371.6

	A	B	C	D	E	F	G
1	Appendix	Specifications for DOE FFTF Canister Components					
2							
3	FFTF SNF Assembly	parts/canister:	5				
4		components:	fuel pin:	parts/assem.:	217		
5				components:	MOX:	O.D.:	0.49403cm
6						length:	91.44cm
7						material:	UO1.96+PuO1.96
8						density:	10.02g/cc
9					insulator:	parts/assem.:	2
10						material:	natural UO2
11						density:	10.42g/cc
12						length:	2.032
13					reflector:	parts/assem.:	2
14						material:	Inconel 600
15						density:	8.47g/cc
16						length:	14.478cm
17					spring:	material:	SS302
18						volume:	2.7264cc
19						density:	8g/cc
20					plenum:	material:	SS316
21						length:	86.21cm
22						O.D.:	0.49022cm
23						wall thickness:	0.01397cm
24					top cap:	material:	SS316
25						length:	10.46cm
26						O.D.:	0.5842cm
27					bottom cap:	material:	SS316
28						length:	4.06cm
29						O.D.:	0.5842cm
30					cladding	material:	SS316
31						I.D.:	0.508 cm
32						O.D.:	0.5842 cm
33						length:	223.224cm
34						density:	7.9497g/cc
35			Components other than	fuel pins:	material:	SS316	
36					total mass:	172.819-217*0.4536	74.3878 kg
37	Ident 69	components:	fuel pin:	parts:	217		
38			container:	mass:	59.09Kg		
39				material:	SS304L		
40	Basket Assembly	material:	SS316L				
41		components:	center tube:	O.D.:	17.3cm		
42				I.D.:	15.3cm		
43				length:	412.5cm		
44			divider plates:	parts/canister:	5		
45				length:	14.6448cm		
46				height:	412.5cm		

	A	B	C	D	E	F	G
47				thickness:	1cm		
48			canister Shell	O.R.:	22.86cm		
49				I.R.:	21.9075cm		
50				length:	456.9cm		
51				material:	ss-316		
52				density	7.952g/cm3		
53	Volume for homogenizing isotopes:		pi*22.86**2*456.9=	750107.4569cc			
54	Total fuel pins per canister:		217*6=	1302			

	A	B	C	D	E	F	G
1	Cladding:	material:	SS316				
2		I.D.:	0.508 cm				
3		O.D.:	0.5842 cm				
4		length:	(237.744-10.46-4.06)cm=	223.224cm			
5		vol:	pi*(0.5842**2-0.508**2)*223.224/4cc	14.5911cc			
6		total vol:	1302*14.5911cc=	18997.6122	cc		
7		vol fraction:	18997.6122/167983.6=	0.113092065			
8		density:	7.98g/cc				
9							
10	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
11					(at/cm*b)	(at./cm*b)	
12						(homogenized)	
13	C	6000.50c	12.01115	0.08	3.2007E-04	3.6198E-05	
14	Mn	25055.50c	54.9380503	2	1.7494E-03	1.9785E-04	
15	P	15031.50c	30.9737647	0.045	6.9817E-05	7.8958E-06	
16	S	16032.50c	31.9720737	0.03	4.5091E-05	5.0995E-06	
17	Si	14000.50c	28.086	0.75	1.2833E-03	1.4513E-04	
18	Cr	24000.50c	51.996	17	1.5712E-02	1.7769E-03	
19	Ni	28000.50c	58.71	12	9.8223E-03	1.1108E-03	
20	Mo	42000.50c	95.94	2.5	1.2522E-03	1.4162E-04	
21	N	7014.50c	14.00307439	0.1	3.4318E-04	3.8811E-05	
22	Fe	26000.50c	55.847	65.495	5.6358E-02	6.3736E-03	
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							

	A	B	C	D	E	F
1	MOX:	material:	UO1.96+PuO1.96			
2		density:	10.02g/cc			
3		length:	91.44cm			
4		O.D.:	0.49403cm			
5		vol:	pi*0.49403**2*91.44/4cc=	17.5280cc		
6		total vol:	1302*17.5280cc=	22821.456	cc	
7		vol fraction:	22821.456/167983.6=	0.135855262		
8						
9	Pu(moles):	38.4/239.1891=	0.16054			
10	U(moles):	114.3/238.04476=	0.48016			
11	O(moles):	1.96*(0.16054+0.48016)=	1.25577			
12	O(mass):	15.998985*1.25577=	20.091g			
13	Total mass:	38.4+114.3+20.091=	172.791g			
14						
15	Pu:	mass:	38.4g			
16		weight fraction:	0.22223			
17						
18	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
19	Pu239	239.052146	0.8735	239.1890947		
20	Pu240	240.053882	0.1163			
21	Pu241	241.056737	0.0102			
22						
23	U:	mass:	114.3g			
24		weight fraction:	0.66149			
25						
26	Isotope	Isotopic Mass	Weight Fraction	At. Mass		
27	U235	235.043915	0.002	238.0447563		
28	U238	238.05077	0.998			
29						
30						
31	O:	mass:	20.091g			
32		weight fraction:	0.11627			
33						
34	MOX					
35	Isotope	Identifier	Isotopic Mass	Wt. Fraction	At. Density	At. Density
36					(at/cm*b)	(at/cm*b)
37						(homogenized)
38	O16	8016.50c	15.998985	0.11627	4.3851E-02	5.9574E-03
39	U235	92235.50c	235.043915	0.00132	3.3887E-05	4.6037E-06
40	U238	92238.50c	238.05077	0.66017	1.6734E-02	2.2734E-03

	A	B	C	D	E	F
41	Pu239	94239.50c	239.052146	0.19412	4.8999E-03	6.6568E-04
42	Pu240	94240.50c	240.053882	0.02585	6.4977E-04	8.8275E-05
43	Pu241	94241.50c	241.056737	0.00227	5.6822E-05	7.7195E-06

	A	B	C	D	E	F
1						
2						
3	Endcaps	material:	SS316			
4		length:	10.46+4.06=	14.52cm		
5		diameter:	0.5842cm			
6		vol:	pi*0.5842**2*14.52/4=	3.89206cc		
7		total vol:	1302*3.89206=	5067.46212	cc	
8		vol. fraction:	5067.46212/167983.6=	0.03016641		
9		density:	7.98g/cc			
10						
11	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
12					(at/cm*b)	(at/cm*b)
13						(homogenized)
14	C	6000.50c	12.01115	0.08	3.2007E-04	9.6555E-06
15	Mn	25055.50c	54.9380503	2	1.7494E-03	5.2774E-05
16	P	15031.50c	30.9737647	0.045	6.9817E-05	2.1061E-06
17	S	16032.50c	31.9720737	0.03	4.5091E-05	1.3602E-06
18	Si	14000.50c	28.086	0.75	1.2833E-03	3.8711E-05
19	Cr	24000.50c	51.996	17	1.5712E-02	4.7396E-04
20	Ni	28000.50c	58.71	12	9.8223E-03	2.9630E-04
21	Mo	42000.50c	95.94	2.5	1.2522E-03	3.7775E-05
22	N	7014.50c	14.00307439	0.1	3.4318E-04	1.0352E-05
23	Fe	26000.50c	55.847	65.495	5.6358E-02	1.7001E-03

	A	B	C	D	E	F
1	Insulator	material:	natural UO2			
2		parts per rod:	2			
3		length:	2.032cm			
4		diameter:	0.508cm			
5		vol:	pi*0.508**2*2.032*2/4=	0.8237cc		
6		total vol:	1302*0.8237=	1072.4574	cc	
7		vol. fraction:	1072.4574/167983.6=	0.006384298		
8		density:	10.42g/cc			
9		U mass/assembly:	1500g			
10						
11	U(moles):	1500/238.0289=	6.3018			
12	O(moles):	2*6.3018=	12.6035			
13	O(mass):	16*12.6035=	201.656			
14	total mass:	1701.656				
15	U(Wt. Fraction):	1500/1701.656=	0.8815			
16	O(Wt. Fraction):	201.656/1701.656=	0.1185			
17						
18	Isotope	Identifier	At. Mass	Wt. Fraction	At. Density	At. Density
19					(at/cm*b)	(at/cm*b)
20						(homogenized)
21	U235	92235.50c	235.043915	0.00626	1.6712E-04	1.0670E-06
22	U238	92238.50c	238.05077	0.87524	2.3071E-02	1.4729E-04
23	O16	8016.50c	15.998985	0.1185	4.6477E-02	2.9672E-04
24						

	A	B	C	D	E	F
1	Ident 69	material:	SS304L			
2		density:	7.9g/cc			
3		mass:	59.09kg			
4		vol:	59090/7.9=	7479.75		
5		vol. fraction:	7479.75/167983.6=	0.044526668		
6						
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
8					(at/cm*b)	(at/cm*b)
9						(homogenized)
10	C	6000.50c	12.01115	0.03	1.1882E-04	5.2908E-06
11	Mn	25055.50c	54.9380503	2	1.7319E-03	7.7116E-05
12	P	15031.50c	30.9737647	0.045	6.9117E-05	3.0776E-06
13	S	16032.50c	31.9720737	0.03	4.4639E-05	1.9876E-06
14	Si	14000.50c	28.086	0.75	1.2704E-03	5.6567E-05
15	Cr	24000.50c	51.996	19	1.7384E-02	7.7405E-04
16	Ni	28000.50c	58.69	10	8.1059E-03	3.6093E-04
17	N	7014.50c	14.00307439	0.1	3.3974E-04	1.5127E-05
18	Fe	26000.50c	55.847	68.045	5.7965E-02	2.5810E-03

	A	B	C	D	E	F	G
1	Basket	material:	SS316L				
2		density:	7.98g/cc				
3		components:	center tube:	O.D.:	17.3cm		
4				I.D.:	15.3cm		
5				length:	412.5cm		
6				vol:	pi*(17.3**2-15.3**2)*412.5/4=	21123.2836	cc
7			divider plates:	parts/canister:	5		
8				thickness:	1cm		
9				length:	(43.815-17.3)/2=	13.2575cm	
10				height:	412.5cm		
11				vol:	5*1*13.2575*412.5=	27343.5938	cc
12							
13		total vol:	48466.8774	cc			
14		vol fraction:	48466.877/167983.6=	0.288521481			
15							
16	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
17					(at/cm*b)	(at/cm*b)	
18						(homogenized)	
19	C	6000.50c	12.01115	0.03	1.2003E-04	3.4630E-05	
20	Mn	25055.50c	54.9380503	2	1.7494E-03	5.0475E-04	
21	P	15031.50c	30.9737647	0.045	6.9817E-05	2.0144E-05	
22	S	16032.50c	31.9720737	0.03	4.5091E-05	1.3010E-05	
23	Si	14000.50c	28.086	0.75	1.2833E-03	3.7025E-04	
24	Cr	24000.50c	51.996	17	1.5712E-02	4.5332E-03	
25	Ni	28000.50c	58.71	12	9.8223E-03	2.8339E-03	
26	Mo	42000.50c	95.94	2.5	1.2522E-03	3.6130E-04	
27	N	7014.50c	14.00307439	0.1	3.4318E-04	9.9014E-05	
28	Fe	26000.50c	55.847	65.545	5.6401E-02	1.6273E-02	
29							

	A	B	C	D	E	F
1	DOE SNF Canister shell			material:	SS316L	
2				mass:	511350.3358	509.556kg
3				vol:	64078.98945	64078.98945cc
4				total vol.:		
5				vol. fraction:	64078.98945/167983.6=	0.381459794
6						
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
8					(at/cm*b)	(at/cm*b)
9						(homogenized)
10	C	6000.50c	12.01115	0.08	3.2007E-04	1.2209E-04
11	Mn	25055.50c	54.93805	2	1.7494E-03	6.6734E-04
12	P	15031.50c	30.973765	0.045	6.9817E-05	2.6632E-05
13	S	16032.50c	31.972074	0.03	4.5091E-05	1.7201E-05
14	Si	14000.50c	28.086	0.75	1.2833E-03	4.8951E-04
15	Cr	24000.50c	51.996	17	1.5712E-02	5.9934E-03
16	Ni	28000.50c	58.71	12	9.8223E-03	3.7468E-03
17	Mo	42000.50c	95.94	2.5	1.2522E-03	4.7768E-04
18	N	7014.50c	14.003074	0.1	3.4318E-04	1.3091E-04
19	Fe	26000.50c	55.847	65.495	5.6358E-02	2.1498E-02

	A	B
1	**Gd**	
2	Volume of basket (cc)	48466.8774
3	density of ss316 (g/cc)	7.98
4	Mass Basket (g)	386765.6817
5	2% of the mass is Gd	0.02
6	Mass Gd (g)	7735.313633
7	Mole of Gd (M=157.25 g/mol)	49.19118368
8	Atomes of Gd	2.96229E+25
9	Volume of the SNF DOE Canister	167984.6046
10	Homogenized Density at/b.cc	0.000176343

	A	B	C	D	E
1		Volume cc	Density	Mass (g)	Volume fraction
2	Clad	18997.61	7.98	151600.9454	0.113091389
3	Mox	22821.46	10.02	228670.9891	0.13585445
4	End Cap	5067.462	7.98	40438.34772	0.030166229
5	Insulator	1072.457	10.42	11175.00611	0.00638426
6	Indent	7479.75	7.9	59090.025	0.044526402
7	basket	48466.88	7.98	386765.6817	0.288519758
8	canister	64078.989	7.98	511350.3358	0.381457513
9	Dry Volume	**167984.6**		1389091.331	
10					
11					
12					
13					
14				total Mass should not exceed 3400kg	

	A	B	C	D	E	F	G	H	I
1	**67.98% water in the fuel**	**50% water inclay**							
2	% of clay and fule mix together			1.0000E-01			0.25		
3		fuel 67.98% water	50% water in clay	mix	fuel 67.98% water	50% water in clay	mix	fuel 67.98% water	50% water in clay
4	at/bcm								
5	64000.35c	5.6470E-05	9.4895E-07	3.2214E-06	5.6470E-05	9.4895E-07	3.2214E-06	5.6470E-05	9.4895E-07
6	1001.50c (H)	4.5458E-02	6.4064E-03	8.0048E-03	4.5458E-02	6.4064E-03	8.0048E-03	4.5458E-02	6.4064E-03
7	6000.50c (C)	6.6565E-05	9.4895E-08	2.8156E-06	6.6565E-05	9.4895E-08	2.8156E-06	6.6565E-05	9.4895E-08
8	25055.50c (Mn)	4.8029E-04	3.3896E-04	3.4475E-04	4.8029E-04	3.3896E-04	3.4475E-04	4.8029E-04	3.3896E-04
9	15031.50c (P)	1.9167E-05	0.0000E+00	7.8453E-07	1.9167E-05	0.0000E+00	7.8453E-07	1.9167E-05	0.0000E+00
10	16032.50c (S)	1.2379E-05	0.0000E+00	5.0669E-07	1.2379E-05	0.0000E+00	5.0669E-07	1.2379E-05	0.0000E+00
11	14000.50c (Si)	3.5230E-04	5.6429E-03	5.4264E-03	3.5230E-04	5.6429E-03	5.4264E-03	3.5230E-04	5.6429E-03
12	24000.50c (Cr)	4.3395E-03	0.0000E+00	1.7762E-04	4.3395E-03	0.0000E+00	1.7762E-04	4.3395E-03	0.0000E+00
13	28000.50c (Ni)	2.6735E-03	1.0438E-04	2.0954E-04	2.6735E-03	1.0438E-04	2.0954E-04	2.6735E-03	1.0438E-04
14	42000.50c (Mo)	3.2611E-04	0.0000E+00	1.3348E-05	3.2611E-04	0.0000E+00	1.3348E-05	3.2611E-04	0.0000E+00
15	7014.50c (N)	9.4215E-05	0.0000E+00	3.8563E-06	9.4215E-05	0.0000E+00	3.8563E-06	9.4215E-05	0.0000E+00
16	26000.55c (Fe)	1.5507E-02	8.9405E-03	9.2092E-03	1.5507E-02	8.9405E-03	9.2092E-03	1.5507E-02	8.9405E-03
17	29000.50C (Cu)	0.0000E+00	5.8360E-06	5.5972E-06	0.0000E+00	5.8360E-06	5.5972E-06	0.0000E+00	5.8360E-06
18	8016.50C (O)	4.7992E-02	3.0045E-02	3.0780E-02	4.7992E-02	3.0045E-02	3.0780E-02	4.7992E-02	3.0045E-02
19	92235.50C (U235)	1.8159E-06		7.4326E-08	1.8159E-06	0.0000E+00	7.4326E-08	1.8159E-06	0.0000E+00
20	92238.50C (U238)	7.7516E-04		3.1728E-05	7.7516E-04	0.0000E+00	3.1728E-05	7.7516E-04	0.0000E+00
21	94239.55C (Pu239)	2.1317E-04		8.7250E-06	2.1317E-04	0.0000E+00	8.7250E-06	2.1317E-04	0.0000E+00
22	94240.50C (Pu240)	2.8268E-05		1.1570E-06	2.8268E-05	0.0000E+00	1.1570E-06	2.8268E-05	0.0000E+00
23	94241.50C (Pu241)	2.4720E-06		1.0118E-07	2.4720E-06	0.0000E+00	1.0118E-07	2.4720E-06	0.0000E+00
24	11023.50c (Na)		3.6107E-05	3.4630E-05	0.0000E+00	3.6107E-05	3.4630E-05	0.0000E+00	3.6107E-05
25	13027.50c (Al)		5.4062E-04	5.1849E-04	0.0000E+00	5.4062E-04	5.1849E-04	0.0000E+00	5.4062E-04
26	20000.50c (Ca)		1.3105E-04	1.2569E-04	0.0000E+00	1.3105E-04	1.2569E-04	0.0000E+00	1.3105E-04
27	19000.50c (K)		1.8372E-04	1.7620E-04	0.0000E+00	1.8372E-04	1.7620E-04	0.0000E+00	1.8372E-04
28	22000.50c (Ti)		8.6307E-05	8.2774E-05	0.0000E+00	8.6307E-05	8.2774E-05	0.0000E+00	8.6307E-05
29	total	1.1840E-01	5.2463E-02	5.5162E-02	1.1840E-01	5.2463E-02	5.5162E-02	1.1840E-01	5.2463E-02
30	volume	5.2458E+05	1.2292E+07	1.2816E+06	4.7212E+05	1.1063E+07	3.2041E+06	3.9344E+05	9.2189E+06
31	H/X			909.7			909.7		
32	% of fuel mixt			Lenght	Radius	Segment height	Segment Volume	X value	
33	0.1	Clay	1.1063E+07	4.6170E+02	9.4000E+01	151.4335342	1.1063E+07	57.43353416	
34		Clay + mix	1.2344E+07	4.6170E+02	9.4000E+01	173.129233	1.2344E+07	79.12923298	
35		Clay+mix+fuel	1.2816E+07	4.6170E+02	9.4000E+01	188	1.2816E+07	94	
36	0.25	Clay	9.2189E+06	4.6170E+02	9.4000E+01	127.0775029	9.2189E+06	33.07750285	
37		Clay + mix	1.2423E+07	4.6170E+02	9.4000E+01	174.8627266	1.2423E+07	80.86272655	
38		Clay+mix+fuel	1.2816E+07	4.6170E+02	9.4000E+01	188	1.2816E+07	94	
39	0.6	Clay	4.9167E+06	4.6170E+02	9.4000E+01	76.71900151	4.9167E+06	-17.28099849	
40		Clay + mix	1.2607E+07	4.6170E+02	9.4000E+01	179.415095	1.2607E+07	85.41509501	

	A	B	C	D	E	F	G	H	I
41		Clay+mix+fuel	1.2816E+07	4.6170E+02	9.4000E+01	188	1.2816E+07	94	

	J	K	L	M	N	O
1						
2	0.6			1		
3	mix	fuel 67.98% water	50% water in clay	mix	fuel 67.98% water	50% water in clay
4						
5	3.2214E-06	5.6470E-05	9.4895E-07	3.2214E-06	5.6470E-05	9.4895E-07
6	8.0048E-03	4.5458E-02	6.4064E-03	8.0048E-03	4.5458E-02	6.4064E-03
7	2.8156E-06	6.6565E-05	9.4895E-08	2.8156E-06	6.6565E-05	9.4895E-08
8	3.4475E-04	4.8029E-04	3.3896E-04	3.4475E-04	4.8029E-04	3.3896E-04
9	7.8453E-07	1.9167E-05	0.0000E+00	7.8453E-07	1.9167E-05	0.0000E+00
10	5.0669E-07	1.2379E-05	0.0000E+00	5.0669E-07	1.2379E-05	0.0000E+00
11	5.4264E-03	3.5230E-04	5.6429E-03	5.4264E-03	3.5230E-04	5.6429E-03
12	1.7762E-04	4.3395E-03	0.0000E+00	1.7762E-04	4.3395E-03	0.0000E+00
13	2.0954E-04	2.6735E-03	1.0438E-04	2.0954E-04	2.6735E-03	1.0438E-04
14	1.3348E-05	3.2611E-04	0.0000E+00	1.3348E-05	3.2611E-04	0.0000E+00
15	3.8563E-06	9.4215E-05	0.0000E+00	3.8563E-06	9.4215E-05	0.0000E+00
16	9.2092E-03	1.5507E-02	8.9405E-03	9.2092E-03	1.5507E-02	8.9405E-03
17	5.5972E-06	0.0000E+00	5.8360E-06	5.5972E-06	0.0000E+00	5.8360E-06
18	3.0780E-02	4.7992E-02	3.0045E-02	3.0780E-02	4.7992E-02	3.0045E-02
19	7.4326E-08	1.8159E-06	0.0000E+00	7.4326E-08	1.8159E-06	0.0000E+00
20	3.1728E-05	7.7516E-04	0.0000E+00	3.1728E-05	7.7516E-04	0.0000E+00
21	8.7250E-06	2.1317E-04	0.0000E+00	8.7250E-06	2.1317E-04	0.0000E+00
22	1.1570E-06	2.8268E-05	0.0000E+00	1.1570E-06	2.8268E-05	0.0000E+00
23	1.0118E-07	2.4720E-06	0.0000E+00	1.0118E-07	2.4720E-06	0.0000E+00
24	3.4630E-05	0.0000E+00	3.6107E-05	3.4630E-05	0.0000E+00	3.6107E-05
25	5.1849E-04	0.0000E+00	5.4062E-04	5.1849E-04	0.0000E+00	5.4062E-04
26	1.2569E-04	0.0000E+00	1.3105E-04	1.2569E-04	0.0000E+00	1.3105E-04
27	1.7620E-04	0.0000E+00	1.8372E-04	1.7620E-04	0.0000E+00	1.8372E-04
28	8.2774E-05	0.0000E+00	8.6307E-05	8.2774E-05	0.0000E+00	8.6307E-05
29	5.5162E-02	1.1840E-01	5.2463E-02	5.5162E-02	1.1840E-01	5.2463E-02
30	7.6898E+06	2.0983E+05	4.9167E+06	1.2816E+07	0.0000E+00	0.0000E+00
31	909.7			909.7		
32						
33						
34						
35						
36						
37						
38						
39						
40						

	J	K	L	M	N	O
41						

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	**hematite forms at 10.26 1000s of years +**				0	***100 % of water**		**total volume**	6145900	cc	**tot mass**	23921.4
3												
4	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
5	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
6	H	1.00782519	1001.50c	6.4551	6.30E+04	6.13E-03			6.1256E-03			968471.992
7	C	12.01115	6000.50c	0.0002	2.33E+01	1.90E-07			1.8979E-07			
8	O	15.994915	8016.50c	59.7993	9.26E+06	5.67E-02			5.6746E-02			
9	Na	22.9897707	11023.50c	0.0761	1.69E+04	7.22E-05			7.2215E-05			
10	Al	26.9815389	13027.50c	1.1394	2.98E+05	1.08E-03			1.0812E-03			
11	Si	28.086	14000.50c	11.893	3.23E+06	1.13E-02			1.1286E-02			
12	Ca	40.08	20000.50c	0.2762	1.07E+05	2.62E-04			2.6210E-04			
13	K	39.102	19000.50c	0.3872	1.47E+05	3.67E-04			3.6743E-04			
14	Ti	47.9	22000.50c	0.1819	8.44E+04	1.73E-04			1.7261E-04			
15	Mn	54.9380503	25055.50c	0.7144	3.80E+05	6.78E-04			6.7793E-04			
16	Fe	55.847	26000.55c	18.8429	1.02E+07	1.79E-02			1.7881E-02			
17	Ni	58.71	28000.50c	0.22	1.25E+05	2.09E-04			2.0877E-04			
18	Cu	63.54	29000.50c	0.0123	7.57E+03	1.17E-05			1.1672E-05			
19	Gd	157.25	64000.35c	0.002	3.05E+03	1.90E-06			1.8979E-06			
20				100	23921400	0.0948948			9.4895E-02			tot moles
21												
22	**water**				**mass (g)**	**number densities (at/bar.cm)**						
23	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	0	cc	mass=
24	H	1.00782519	1001.50c	200	0.00E+00	0.00E+00						1 mol is
25	O	15.994915	8016.50c	100	0.00E+00	0.00E+00						0.00E+00
26					0.00E+00	0.00E+00						
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38	**hematite forms at 10.26 1000s of years +**				0.25	***100 % of water**		**total volume**	8194533.333	cc	**tot mass**	228784.733
39									4621848.994			
40	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass

	A	B	C	D	E	F	G	H	I	J	K	L
41	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
42	H	1.00782519	1001.50c	6.4551	6.30E+04	4.59E-03			6.2660E-03			968471.992
43	C	12.01115	6000.50c	0.0002	2.33E+01	1.42E-07			1.4234E-07			
44	O	15.994915	8016.50c	59.7993	9.26E+06	4.26E-02			4.3396E-02			
45	Na	22.9897707	11023.50c	0.0761	1.69E+04	5.42E-05			5.4161E-05			
46	Al	26.9815389	13027.50c	1.1394	2.98E+05	8.11E-04			8.1092E-04			
47	Si	28.086	14000.50c	11.893	3.23E+06	8.46E-03			8.4644E-03			
48	Ca	40.08	20000.50c	0.2762	1.07E+05	1.97E-04			1.9657E-04			
49	K	39.102	19000.50c	0.3872	1.47E+05	2.76E-04			2.7557E-04			
50	Ti	47.9	22000.50c	0.1819	8.44E+04	1.29E-04			1.2946E-04			
51	Mn	54.9380503	25055.50c	0.7144	3.80E+05	5.08E-04			5.0845E-04			
52	Fe	55.847	26000.55c	18.8429	1.02E+07	1.34E-02			1.3411E-02			
53	Ni	58.71	28000.50c	0.22	1.25E+05	1.57E-04			1.5658E-04			
54	Cu	63.54	29000.50c	0.0123	7.57E+03	8.75E-06			8.7540E-06			
55	Gd	157.25	64000.35c	0.002	3.05E+03	1.42E-06			1.4234E-06			
56				100	23921400	0.0711711			7.3679E-02			tot moles
57												
58	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.1
59	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	2048633.333	cc	mass=
60	H	1.00782519	1001.50c	200	2.29E+04	1.67E-03						1 mol is
61	O	15.994915	8016.50c	100	1.82E+05	8.36E-04						1.14E+04
62					2.05E+05	2.51E-03						
63												
64												
65												
66												
67	**hematite forms at 10.26 1000s of years +**				0.514096556	***100 % of water**		**total volume**	12648397.7	cc	**tot mass**	674171.17
68						12144444		Max Volume				
69	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
70	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			
71	H	1.00782519	1001.50c	6.4551	6.30E+04	2.98E-03			6.4143E-03			
72	C	12.01115	6000.50c	0.0002	2.33E+01	9.22E-08			9.2219E-08			
73	O	15.994915	8016.50c	59.7993	9.26E+06	2.76E-02			2.9292E-02			
74	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.51E-05			3.5089E-05			
75	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.25E-04			5.2537E-04			
76	Si	28.086	14000.50c	11.893	3.23E+06	5.48E-03			5.4838E-03			
77	Ca	40.08	20000.50c	0.2762	1.07E+05	1.27E-04			1.2735E-04			
78	K	39.102	19000.50c	0.3872	1.47E+05	1.79E-04			1.7854E-04			
79	Ti	47.9	22000.50c	0.1819	8.44E+04	8.39E-05			8.3874E-05			
80	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.29E-04			3.2941E-04			

	A	B	C	D	E	F	G	H	I	J	K	L
81	Fe	55.847	26000.55c	18.8429	1.02E+07	8.69E-03			8.6884E-03			
82	Ni	58.71	28000.50c	0.22	1.25E+05	1.01E-04			1.0144E-04			
83	Cu	63.54	29000.50c	0.0123	7.57E+03	5.67E-06			5.6715E-06			
84	Gd	157.25	64000.35c	0.002	3.05E+03	9.22E-07			9.2219E-07			
85				100	23921400	0.0461097			5.1266E-02			
86												
87	**water**				**mass (g)**	**number densities (at/bar.cm)**					**density**	0.1
88	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6502497.7	cc	mass=
89	H	1.00782519	1001.50c	200	7.28E+04	3.44E-03						1 mol is
90	O	15.994915	8016.50c	100	5.77E+05	1.72E-03						3.61E+04
91					6.50E+05	5.16E-03						
92												
93												
94												
95												
96												
97	**hematite forms at 10.26 1000s of years +**				0.493933189	***100 % of water**		**total volume**	12144443.91	cc	**tot mass**	623775.791
98												
99	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
100	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
101	H	1.00782519	1001.50c	6.4551	6.30E+04	3.10E-03			6.4030E-03			968471.992
102	C	12.01115	6000.50c	0.0002	2.33E+01	9.60E-08			9.6046E-08			
103	O	15.994915	8016.50c	59.7993	9.26E+06	2.87E-02			3.0369E-02			
104	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.65E-05			3.6546E-05			
105	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.47E-04			5.4718E-04			
106	Si	28.086	14000.50c	11.893	3.23E+06	5.71E-03			5.7114E-03			
107	Ca	40.08	20000.50c	0.2762	1.07E+05	1.33E-04			1.3264E-04			
108	K	39.102	19000.50c	0.3872	1.47E+05	1.86E-04			1.8595E-04			
109	Ti	47.9	22000.50c	0.1819	8.44E+04	8.74E-05			8.7354E-05			
110	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.43E-04			3.4308E-04			
111	Fe	55.847	26000.55c	18.8429	1.02E+07	9.05E-03			9.0489E-03			
112	Ni	58.71	28000.50c	0.22	1.25E+05	1.06E-04			1.0565E-04			
113	Cu	63.54	29000.50c	0.0123	7.57E+03	5.91E-06			5.9068E-06			
114	Gd	157.25	64000.35c	0.002	3.05E+03	9.60E-07			9.6046E-07			
115				100	23921400	0.0480231			5.2978E-02			tot moles
116												
117	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.1
118	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5998543.91	cc	mass=
119	H	1.00782519	1001.50c	200	6.71E+04	3.30E-03						1 mol is
120	O	15.994915	8016.50c	100	5.33E+05	1.65E-03						3.33E+04

	A	B	C	D	E	F	G	H	I	J	K	L
121					6.00E+05	4.95E-03						
122												
123												
124												
125												
126												
127	**hematite forms at 10.26 1000s of years +**				0.5	***100 % of water**		**total volume**	12291800	cc	**tot mass**	638511.4
128												
129	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
130	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
131	H	1.00782519	1001.50c	6.4551	6.30E+04	3.06E-03			6.4064E-03			968471.992
132	C	12.01115	6000.50c	0.0002	2.33E+01	9.49E-08			9.4895E-08			
133	O	15.994915	8016.50c	59.7993	9.26E+06	2.84E-02			3.0045E-02			
134	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.61E-05			3.6107E-05			
135	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.41E-04			5.4062E-04			
136	Si	28.086	14000.50c	11.893	3.23E+06	5.64E-03			5.6429E-03			
137	Ca	40.08	20000.50c	0.2762	1.07E+05	1.31E-04			1.3105E-04			
138	K	39.102	19000.50c	0.3872	1.47E+05	1.84E-04			1.8372E-04			
139	Ti	47.9	22000.50c	0.1819	8.44E+04	8.63E-05			8.6307E-05			
140	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.39E-04			3.3896E-04			
141	Fe	55.847	26000.55c	18.8429	1.02E+07	8.94E-03			8.9405E-03			
142	Ni	58.71	28000.50c	0.22	1.25E+05	1.04E-04			1.0438E-04			
143	Cu	63.54	29000.50c	0.0123	7.57E+03	5.84E-06			5.8360E-06			
144	Gd	157.25	64000.35c	0.002	3.05E+03	9.49E-07			9.4895E-07			
145				100	23921400	0.0474474			5.2463E-02			tot moles
146												
147	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.1
148	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass=
149	H	1.00782519	1001.50c	200	6.88E+04	3.34E-03						1 mol is
150	O	15.994915	8016.50c	100	5.46E+05	1.67E-03						3.41E+04
151					6.15E+05	5.02E-03						
152												
153												
154												
155												
156	**hematite forms at 10.26 1000s of years +**				0.45	***100 % of water**		**total volume**	11174363.64	cc	**tot mass**	526767.764
157												
158	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
159	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
160	H	1.00782519	1001.50c	6.4551	6.30E+04	3.37E-03			6.3783E-03			968471.992

	A	B	C	D	E	F	G	H	I	J	K	L
161	C	12.01115	6000.50c	0.0002	2.33E+01	1.04E-07			1.0438E-07			
162	O	15.994915	8016.50c	59.7993	9.26E+06	3.12E-02			3.2715E-02			
163	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.97E-05			3.9718E-05			
164	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.95E-04			5.9468E-04			
165	Si	28.086	14000.50c	11.893	3.23E+06	6.21E-03			6.2072E-03			
166	Ca	40.08	20000.50c	0.2762	1.07E+05	1.44E-04			1.4415E-04			
167	K	39.102	19000.50c	0.3872	1.47E+05	2.02E-04			2.0209E-04			
168	Ti	47.9	22000.50c	0.1819	8.44E+04	9.49E-05			9.4937E-05			
169	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.73E-04			3.7286E-04			
170	Fe	55.847	26000.55c	18.8429	1.02E+07	9.83E-03			9.8345E-03			
171	Ni	58.71	28000.50c	0.22	1.25E+05	1.15E-04			1.1482E-04			
172	Cu	63.54	29000.50c	0.0123	7.57E+03	6.42E-06			6.4196E-06			
173	Gd	157.25	64000.35c	0.002	3.05E+03	1.04E-06			1.0438E-06			
174				100	23921400	0.0521921			5.6706E-02			tot moles
175												
176	water				mass (g)	number densities (at/bar.cm)					density	0.1
177	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5028463.636	cc	mass=
178	H	1.00782519	1001.50c	200	5.63E+04	3.01E-03						1 mol is
179	O	15.994915	8016.50c	100	4.47E+05	1.50E-03						2.79E+04
180					5.03E+05	4.51E-03						
181												

	M	N	O	P	Q	R	S	T	U	V	W	X
1												
2	tot density	0.0038923		SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value		
3				hematite forms 3.765 1000s y	12816382.33	461.7	94	90.97767766	6145900	-3.022322		
4	23921.4	kg		FFTF SNF	167984.6046	461.7	94	92.91348971	6313884.605	-1.08651		
5	24.70014642	g		total	6313884.605							
6	moles			FFTF SNF 25% water	223979.4728	461.7	94	93.55861742	6369879.473	-0.441383		
7					6369879.473							
8				FFTF SNF 50% water	335969.2091	461.7	94	94.84884085	6481869.209	0.8488409		
9					6481869.209							
10				FFTF SNF 75% water		461.7	94	98.72144618	6817838.418	4.7214462		
11												
12												
13												
14												
15												
16												
17												
18												
19												
20	968471.9918											
21												
22												
23	0	g										
24	1.80E+01											
25	mole of h2o											
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38	tot density	0.0279192		SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value	hematite forms at 10.26 1000s	
39				hematite forms 3.765 1000s y	12816382.33	461.7	94	114.749842	8194533.333	20.749842		
40	23921.4	kg		FFTF SNF	167984.6067	461.7	94	116.7391545	8362517.94	22.739155	ρ=	3.892

	M	N	O	P	Q	R	S	T	U	V	W	X
41	24.70014642	g		total							**Isotopes**	**Atomic Mass**
42	moles								8362517.938		H	1.00782519
43											C	12.01115
44											O	15.994915
45											Na	22.9897707
46											Al	26.9815389
47											Si	28.086
48											Ca	40.08
49											K	39.102
50											Ti	47.9
51											Mn	54.9380503
52											Fe	55.847
53											Ni	58.71
54											Cu	63.54
55											Gd	157.25
56	979846.6115											
57												
58	g/cc										**water**	
59	204863.3333	g									ρ=	1
60	1.80E+01										H	1.00782519
61	mole of h2o										O	15.994915
62												
63												
64												
65												
66												
67	**tot density**	0.0533009		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value	**hematite forms at 10.26 1000s**	
68				hematite forms 3.765 1000s y	12816382.33	461.7	94	180.5972475	12648397.72	86.597248		
69	23921.4	kg		FFTF SNF	-12480413.12	461.7	94	7.4027525	167984.6049	-86.59725	ρ=	3.892
70			1 mol is	24.70014642	g		total	25296795.45			188	
71			968472	moles								12816382.33
72												
73												
74												
75												
76												
77												
78												
79												
80												

	M	N	O	P	Q	R	S	T	U	V	W	X
81												
82												
83												
84												
85			tot mole	1004575.787								
86												
87	g/cc										water	
88	650249.77	g									ρ=	1
89	1.80E+01										H	1.00782519
90	mole of h2o										O	15.994915
91												
92												
93												
94												
95												
96												
97	**tot density**	0.0513631		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value	**hematite forms at 10.26 1000s**	
98				hematite forms 3.765 1000s y	12816382.33	461.7	94	169.1055893	12144443.91	75.105589		
99	23921.4	kg		FFTF SNF	-11976459.31	461.7	94	7.4027525	167984.6049	-86.59725	ρ=	3.892
100	24.70014642	g		total	24792841.63			176.5083418			**Isotopes**	**Atomic Mass**
101	moles								12144443.91		H	1.00782519
102											C	12.01115
103											O	15.994915
104							0				Na	22.9897707
105											Al	26.9815389
106											Si	28.086
107											Ca	40.08
108											K	39.102
109											Ti	47.9
110											Mn	54.9380503
111											Fe	55.847
112											Ni	58.71
113											Cu	63.54
114											Gd	157.25
115	1001777.686											
116												
117											**water**	
118	599854.391	g									ρ=	1
119	1.80E+01										H	1.00782519
120	mole of h2o										O	15.994915

	M	N	O	P	Q	R	S	T	U	V	W	X
121												
122												
123												
124												
125												
126												
127	**tot density**	0.0519461		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value		
128				hematite forms 3.765 1000s y	12816382.33	461.7	94	172.033294	12291800.02	78.033294		
129	23921.4	kg		FFTF SNF	-12123815.42	461.7	94	7.4027525	167984.6049	-86.59725	3.892	kg/l
130	24.70014642	g		total	24940197.74			179.4360465			**Atomic Mass**	**MCNP ID**
131	moles								12291800		1.00782519	1001.50c
132											12.01115	6000.50c
133											15.994915	8016.50c
134											22.9897707	11023.50c
135											26.9815389	13027.50c
136											28.086	14000.50c
137											40.08	20000.50c
138											39.102	19000.50c
139											47.9	22000.50c
140											54.9380503	25055.50c
141											55.847	26000.55c
142											58.71	28000.50c
143											63.54	29000.50c
144											157.25	64000.35c
145	1002595.851											
146												
147												
148	614590	g									1	kg/l
149	1.80E+01										1.00782519	1001.50c
150	mole of h2o										15.994915	8016.50c
151												
152												
153												
154												
155												
156	**tot density**	0.0471407		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment	x value	**hematite forms at 10.26 1000s**	
157				hematite forms 3.765 1000s y	12816382.33	461.7	94	153.0683054	11174364	59.068305		
158	23921.4	kg		FFTF SNF	-11006379.4	461.7	94	7.4027525	167984.6049	-86.59725	ρ=	3.892
159	24.70014642	g		total	23822761.72			160.4710579			**Isotopes**	**Atomic Mass**
160	moles										H	1.00782519

	M	N	O	P	Q	R	S	T	U	V	W	X
161											C	12.01115
162											O	15.994915
163											Na	22.9897707
164											Al	26.9815389
165											Si	28.086
166											Ca	40.08
167											K	39.102
168											Ti	47.9
169											Mn	54.9380503
170											Fe	55.847
171											Ni	58.71
172											Cu	63.54
173											Gd	157.25
174	996391.5131											
175												
176											water	
177	502846.3636	g									ρ=	1
178	1.80E+01										H	1.00782519
179	mole of h2o										O	15.994915
180												
181												

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1												
2												
3												
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30												
31												
32												
33												
34												
35												
36												
37												
38	**f years +**		0.25	***100 % of water**		**total volume**	8194533.333	cc	**tot mass**	1048238.067	**tot density**	0.1279192
39							-8194533.333					
40	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
41	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.70014642	g
42	1001.50c	6.4551	6.30E+04	4.59E-03			1.2953E-02			968471.9918	moles	
43	6000.50c	0.0002	2.33E+01	1.42E-07			1.4234E-07					
44	8016.50c	59.7993	9.26E+06	4.26E-02			4.6739E-02					
45	11023.50c	0.0761	1.69E+04	5.42E-05			5.4161E-05					
46	13027.50c	1.1394	2.98E+05	8.11E-04			8.1092E-04					
47	14000.50c	11.893	3.23E+06	8.46E-03			8.4644E-03					
48	20000.50c	0.2762	1.07E+05	1.97E-04			1.9657E-04					
49	19000.50c	0.3872	1.47E+05	2.76E-04			2.7557E-04					
50	22000.50c	0.1819	8.44E+04	1.29E-04			1.2946E-04					
51	25055.50c	0.7144	3.80E+05	5.08E-04			5.0845E-04					
52	26000.55c	18.8429	1.02E+07	1.34E-02			1.3411E-02					
53	28000.50c	0.22	1.25E+05	1.57E-04			1.5658E-04					
54	29000.50c	0.0123	7.57E+03	8.75E-06			8.7540E-06					
55	64000.35c	0.002	3.05E+03	1.42E-06			1.4234E-06					
56		100	23921400	0.071171086			8.3710E-02			tot moles	1025345.091	
57												
58			**mass (g)**	**number densities (at/bar.cm)**					density	0.5	g/cc	
59	kg/l		Na=	6.02E-01	at/b.cm		Volume=	2048633.3	cc	mass=	1024316.667	g
60	1001.50c	200	1.15E+05	8.36E-03						1 mol is	1.80E+01	
61	8016.50c	100	9.10E+05	4.18E-03						5.69E+04	mole of h2o	
62			1.02E+06	1.25E-02								
63												
64												
65												
66												
67	**f years +**		0.514096556	***100 % of water**		**total volume**	12648397.7	cc	**tot mass**	3275170.25	**tot density**	0.2589395
68				12144443.91		Max Volume						
69	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg
70		**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm		
71		H	1.00782519	1001.50c	6.4551	6.30E+04	2.98E-03			2.0166E-02		
72		C	12.01115	6000.50c	0.0002	2.33E+01	9.22E-08			9.2219E-08		
73		O	15.994915	8016.50c	59.7993	9.26E+06	2.76E-02			3.6168E-02		
74		Na	22.9897707	11023.50c	0.0761	1.69E+04	3.51E-05			3.5089E-05		
75		Al	26.9815389	13027.50c	1.1394	2.98E+05	5.25E-04			5.2537E-04		
76		Si	28.086	14000.50c	11.893	3.23E+06	5.48E-03			5.4838E-03		
77		Ca	40.08	20000.50c	0.2762	1.07E+05	1.27E-04			1.2735E-04		
78		K	39.102	19000.50c	0.3872	1.47E+05	1.79E-04			1.7854E-04		
79		Ti	47.9	22000.50c	0.1819	8.44E+04	8.39E-05			8.3874E-05		
80		Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.29E-04			3.2941E-04		

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
81		Fe	55.847	26000.55c	18.8429	1.02E+07	8.69E-03			8.6884E-03		
82		Ni	58.71	28000.50c	0.22	1.25E+05	1.01E-04			1.0144E-04		
83		Cu	63.54	29000.50c	0.0123	7.57E+03	5.67E-06			5.6715E-06		
84		Gd	157.25	64000.35c	0.002	3.05E+03	9.22E-07			9.2219E-07		
85					100	23921400	0.046109701			7.1894E-02		
86												
87			mass (g)	number densities (at/bar.cm)					density	0.5		
88	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6502497.7	cc	mass=	3251248.85	g
89	1001.50c	200	3.64E+05	1.72E-02						1 mol is	1.80E+01	
90	8016.50c	100	2.89E+06	8.59E-03						1.81E+05	mole of h2o	
91			3.25E+06	2.58E-02								
92												
93												
94												
95												
96												
97	f years +		0.493933189	*100 % of water		total volume	12144443.91	cc	tot mass	3023193.355	tot density	0.2489363
98												
99	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg
100	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.70014642	g
101	1001.50c	6.4551	6.30E+04	3.10E-03			1.9615E-02			968471.9918	moles	
102	6000.50c	0.0002	2.33E+01	9.60E-08			9.6046E-08					
103	8016.50c	59.7993	9.26E+06	2.87E-02			3.6975E-02					
104	11023.50c	0.0761	1.69E+04	3.65E-05			3.6546E-05					
105	13027.50c	1.1394	2.98E+05	5.47E-04			5.4718E-04					
106	14000.50c	11.893	3.23E+06	5.71E-03			5.7114E-03					
107	20000.50c	0.2762	1.07E+05	1.33E-04			1.3264E-04					
108	19000.50c	0.3872	1.47E+05	1.86E-04			1.8595E-04					
109	22000.50c	0.1819	8.44E+04	8.74E-05			8.7354E-05					
110	25055.50c	0.7144	3.80E+05	3.43E-04			3.4308E-04					
111	26000.55c	18.8429	1.02E+07	9.05E-03			9.0489E-03					
112	28000.50c	0.22	1.25E+05	1.06E-04			1.0565E-04					
113	29000.50c	0.0123	7.57E+03	5.91E-06			5.9068E-06					
114	64000.35c	0.002	3.05E+03	9.60E-07			9.6046E-07					
115		100	23921400	0.048023099			7.2796E-02			tot moles	1135000.465	
116												
117			mass (g)	number densities (at/bar.cm)					density	0.5		
118	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5998543.9	cc	mass=	2999271.955	g
119	1001.50c	200	3.36E+05	1.65E-02						1 mol is	1.80E+01	
120	8016.50c	100	2.66E+06	8.26E-03						1.67E+05	mole of h2o	

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
121			3.00E+06	2.48E-02								
122												
123												
124												
125												
126												
127		0.5	*100 % of water		total volume	12291800	cc	tot mass	3096871.4	tot density	0.251946127	
128												
129		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg	3.892
130	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.70014642	g	Atomic Ma
131	6.4551	6.30E+04	3.06E-03			1.9781E-02			968471.9918	moles		1.0078252
132	0.0002	2.33E+01	9.49E-08			9.4895E-08						12.01115
133	59.7993	9.26E+06	2.84E-02			3.6732E-02						15.994915
134	0.0761	1.69E+04	3.61E-05			3.6107E-05						22.989771
135	1.1394	2.98E+05	5.41E-04			5.4062E-04						26.981539
136	11.893	3.23E+06	5.64E-03			5.6429E-03						28.086
137	0.2762	1.07E+05	1.31E-04			1.3105E-04						40.08
138	0.3872	1.47E+05	1.84E-04			1.8372E-04						39.102
139	0.1819	8.44E+04	8.63E-05			8.6307E-05						47.9
140	0.7144	3.80E+05	3.39E-04			3.3896E-04						54.93805
141	18.8429	1.02E+07	8.94E-03			8.9405E-03						55.847
142	0.22	1.25E+05	1.04E-04			1.0438E-04						58.71
143	0.0123	7.57E+03	5.84E-06			5.8360E-06						63.54
144	0.002	3.05E+03	9.49E-07			9.4895E-07						157.25
145	100	23921400	0.04744739			7.2524E-02			tot moles	1139091.289		
146												
147		mass (g)	number densities (at/bar.cm)					density	0.5			
148		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass=	3072950	g	1
149	200	3.44E+05	1.67E-02						1 mol is	1.80E+01		1.0078252
150	100	2.73E+06	8.36E-03						1.71E+05	mole of h2o		15.994915
151		3.07E+06	2.51E-02									
152												
153												
154												
155												
156	f years +		0.45	*100 % of water		total volume	11174363.64	cc	tot mass	2538153.218	tot density	0.2271407
157												
158	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg
159	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.70014642	g
160	1001.50c	6.4551	6.30E+04	3.37E-03			1.8415E-02			968471.9918	moles	

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
161	6000.50c	0.0002	2.33E+01	1.04E-07			1.0438E-07					
162	8016.50c	59.7993	9.26E+06	3.12E-02			3.8734E-02					
163	11023.50c	0.0761	1.69E+04	3.97E-05			3.9718E-05					
164	13027.50c	1.1394	2.98E+05	5.95E-04			5.9468E-04					
165	14000.50c	11.893	3.23E+06	6.21E-03			6.2072E-03					
166	20000.50c	0.2762	1.07E+05	1.44E-04			1.4415E-04					
167	19000.50c	0.3872	1.47E+05	2.02E-04			2.0209E-04					
168	22000.50c	0.1819	8.44E+04	9.49E-05			9.4937E-05					
169	25055.50c	0.7144	3.80E+05	3.73E-04			3.7286E-04					
170	26000.55c	18.8429	1.02E+07	9.83E-03			9.8345E-03					
171	28000.50c	0.22	1.25E+05	1.15E-04			1.1482E-04					
172	29000.50c	0.0123	7.57E+03	6.42E-06			6.4196E-06					
173	64000.35c	0.002	3.05E+03	1.04E-06			1.0438E-06					
174		100	23921400	0.052192129			7.4761E-02			tot moles	1108069.598	
175												
176			mass (g)	number densities (at/bar.cm)					density	0.5		
177	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5028463.6	cc	mass=	2514231.818	g
178	1001.50c	200	2.81E+05	1.50E-02						1 mol is	1.80E+01	
179	8016.50c	100	2.23E+06	7.52E-03						1.40E+05	mole of h2o	
180			2.51E+06	2.26E-02								
181												

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1													
2													
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32													
33													
34													
35													
36													
37													
38			**hematite forms at 10.26 1000s of years +**				0.25	***100 % of water**		**total volume**	8194533.333	cc	**tot mass**
39											-8194533.333		
40			ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
41			**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm		
42			H	1.00782519	1001.50c	6.4551	6.30E+04	4.59E-03			1.7969E-02		
43			C	12.01115	6000.50c	0.0002	2.33E+01	1.42E-07			1.4234E-07		
44			O	15.994915	8016.50c	59.7993	9.26E+06	4.26E-02			4.9247E-02		
45			Na	22.9897707	11023.50c	0.0761	1.69E+04	5.42E-05			5.4161E-05		
46			Al	26.9815389	13027.50c	1.1394	2.98E+05	8.11E-04			8.1092E-04		
47			Si	28.086	14000.50c	11.893	3.23E+06	8.46E-03			8.4644E-03		
48			Ca	40.08	20000.50c	0.2762	1.07E+05	1.97E-04			1.9657E-04		
49			K	39.102	19000.50c	0.3872	1.47E+05	2.76E-04			2.7557E-04		
50			Ti	47.9	22000.50c	0.1819	8.44E+04	1.29E-04			1.2946E-04		
51			Mn	54.9380503	25055.50c	0.7144	3.80E+05	5.08E-04			5.0845E-04		
52			Fe	55.847	26000.55c	18.8429	1.02E+07	1.34E-02			1.3411E-02		
53			Ni	58.71	28000.50c	0.22	1.25E+05	1.57E-04			1.5658E-04		
54			Cu	63.54	29000.50c	0.0123	7.57E+03	8.75E-06			8.7540E-06		
55			Gd	157.25	64000.35c	0.002	3.05E+03	1.42E-06			1.4234E-06		
56						100	23921400	0.0711711			9.1233E-02		
57													
58			**water**				**mass (g)**	**number densities (at/bar.cm)**					density
59			ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	2048633.3	cc
60			H	1.00782519	1001.50c	200	1.83E+05	1.34E-02					
61			O	15.994915	8016.50c	100	1.46E+06	6.69E-03					
62							1.64E+06	2.01E-02					
63													
64													
65													
66													
67			**hematite forms at 10.26 1000s of years +**				0.514096556	***100 % of water**		**total volume**	12648397.7	cc	**tot mass**
68								12144444		Max Volume			
69			ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc
70	1 mol is	24.700146	#VALUE!			**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**		
71	968471.99	moles		0		H	1.00782519	1001.50c	6.4551	6.30E+04	2.98E-03		
72						C	12.01115	6000.50c	0.0002	2.33E+01	9.22E-08		
73						O	15.994915	8016.50c	59.7993	9.26E+06	2.76E-02		
74						Na	22.9897707	11023.50c	0.0761	1.69E+04	3.51E-05		
75						Al	26.9815389	13027.50c	1.1394	2.98E+05	5.25E-04		
76						Si	28.086	14000.50c	11.893	3.23E+06	5.48E-03		
77						Ca	40.08	20000.50c	0.2762	1.07E+05	1.27E-04		
78						K	39.102	19000.50c	0.3872	1.47E+05	1.79E-04		
79						Ti	47.9	22000.50c	0.1819	8.44E+04	8.39E-05		
80						Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.29E-04		

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
81						Fe	55.847	26000.55c	18.8429	1.02E+07	8.69E-03		
82						Ni	58.71	28000.50c	0.22	1.25E+05	1.01E-04		
83						Cu	63.54	29000.50c	0.0123	7.57E+03	5.67E-06		
84						Gd	157.25	64000.35c	0.002	3.05E+03	9.22E-07		
85	tot moles	1148991							100	23921400	0.046109701		
86													
87			water				mass (g)	number densities (at/bar.cm)					density
88			ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6502497.7	cc
89			H	1.00782519	1001.50c	200	5.82E+05	2.75E-02					
90			O	15.994915	8016.50c	100	4.62E+06	1.38E-02					
91							5.20E+06	4.13E-02					
92													
93													
94													
95													
96													
97	hematite forms at 10.26 1000s of years +				0.493933189	*100 % of water		total volum	12144443.91	cc	tot mass	4822756.5	tot density
98													
99	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4
100	Isotopes	Atomic Ma	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.7001464
101	H	1.0078252	1001.50c	6.4551	6.30E+04	3.10E-03			2.9524E-02			968471.99	moles
102	C	12.01115	6000.50c	0.0002	2.33E+01	9.60E-08			9.6046E-08				
103	O	15.994915	8016.50c	59.7993	9.26E+06	2.87E-02			4.1930E-02				
104	Na	22.989771	11023.50c	0.0761	1.69E+04	3.65E-05			3.6546E-05				
105	Al	26.981539	13027.50c	1.1394	2.98E+05	5.47E-04			5.4718E-04				
106	Si	28.086	14000.50c	11.893	3.23E+06	5.71E-03			5.7114E-03				
107	Ca	40.08	20000.50c	0.2762	1.07E+05	1.33E-04			1.3264E-04				
108	K	39.102	19000.50c	0.3872	1.47E+05	1.86E-04			1.8595E-04				
109	Ti	47.9	22000.50c	0.1819	8.44E+04	8.74E-05			8.7354E-05				
110	Mn	54.93805	25055.50c	0.7144	3.80E+05	3.43E-04			3.4308E-04				
111	Fe	55.847	26000.55c	18.8429	1.02E+07	9.05E-03			9.0489E-03				
112	Ni	58.71	28000.50c	0.22	1.25E+05	1.06E-04			1.0565E-04				
113	Cu	63.54	29000.50c	0.0123	7.57E+03	5.91E-06			5.9068E-06				
114	Gd	157.25	64000.35c	0.002	3.05E+03	9.60E-07			9.6046E-07				
115				100	23921400	0.048023099			8.7659E-02			tot moles	1234917.55
116													
117	water				mass (g)	number densities (at/bar.cm)					density	0.8	
118	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5998543.91	cc	mass=	4798835.13
119	H	1.0078252	1001.50c	200	5.37E+05	2.64E-02						1 mol is	1.80E+01
120	O	15.994915	8016.50c	100	4.26E+06	1.32E-02						2.66E+05	mole of h2o

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
121					4.80E+06	3.96E-02							
122													
123													
124													
125													
126													
127			0.5	*100 % of water		total volume	12291800	cc	tot mass	4940641.4	tot density	0.4019461	
128													
129	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg	3.892
130	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.70014642	g	Atomic Mas
131	1001.50c	6.4551	6.30E+04	3.06E-03			2.9812E-02			968471.9918	moles		1.00782519
132	6000.50c	0.0002	2.33E+01	9.49E-08			9.4895E-08						12.01115
133	8016.50c	59.7993	9.26E+06	2.84E-02			4.1748E-02						15.994915
134	11023.50c	0.0761	1.69E+04	3.61E-05			3.6107E-05						22.9897707
135	13027.50c	1.1394	2.98E+05	5.41E-04			5.4062E-04						26.9815389
136	14000.50c	11.893	3.23E+06	5.64E-03			5.6429E-03						28.086
137	20000.50c	0.2762	1.07E+05	1.31E-04			1.3105E-04						40.08
138	19000.50c	0.3872	1.47E+05	1.84E-04			1.8372E-04						39.102
139	22000.50c	0.1819	8.44E+04	8.63E-05			8.6307E-05						47.9
140	25055.50c	0.7144	3.80E+05	3.39E-04			3.3896E-04						54.9380503
141	26000.55c	18.8429	1.02E+07	8.94E-03			8.9405E-03						55.847
142	28000.50c	0.22	1.25E+05	1.04E-04			1.0438E-04						58.71
143	29000.50c	0.0123	7.57E+03	5.84E-06			5.8360E-06						63.54
144	64000.35c	0.002	3.05E+03	9.49E-07			9.4895E-07						157.25
145		100	23921400	0.04744739			8.7571E-02			tot moles	1241462.867		
146													
147			mass (g)	number densities (at/bar.cm)					density	0.8			
148	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass=	4916720	g	1
149	1001.50c	200	5.50E+05	2.67E-02						1 mol is	1.80E+01		1.00782519
150	8016.50c	100	4.37E+06	1.34E-02						2.73E+05	mole of h2o		15.994915
151			4.92E+06	4.01E-02									
152													
153													
154													
155													
156	hematite forms at 10.26 1000s of years +				0.45	*100 % of water		total volum	11174363.64	cc	tot mass	4046692.3	tot density
157													
158	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4
159	Isotopes	Atomic Ma	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.7001464
160	H	1.0078252	1001.50c	6.4551	6.30E+04	3.37E-03			2.7443E-02			968471.99	moles

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
161	C	12.01115	6000.50c	0.0002	2.33E+01	1.04E-07			1.0438E-07				
162	O	15.994915	8016.50c	59.7993	9.26E+06	3.12E-02			4.3247E-02				
163	Na	22.989771	11023.50c	0.0761	1.69E+04	3.97E-05			3.9718E-05				
164	Al	26.981539	13027.50c	1.1394	2.98E+05	5.95E-04			5.9468E-04				
165	Si	28.086	14000.50c	11.893	3.23E+06	6.21E-03			6.2072E-03				
166	Ca	40.08	20000.50c	0.2762	1.07E+05	1.44E-04			1.4415E-04				
167	K	39.102	19000.50c	0.3872	1.47E+05	2.02E-04			2.0209E-04				
168	Ti	47.9	22000.50c	0.1819	8.44E+04	9.49E-05			9.4937E-05				
169	Mn	54.93805	25055.50c	0.7144	3.80E+05	3.73E-04			3.7286E-04				
170	Fe	55.847	26000.55c	18.8429	1.02E+07	9.83E-03			9.8345E-03				
171	Ni	58.71	28000.50c	0.22	1.25E+05	1.15E-04			1.1482E-04				
172	Cu	63.54	29000.50c	0.0123	7.57E+03	6.42E-06			6.4196E-06				
173	Gd	157.25	64000.35c	0.002	3.05E+03	1.04E-06			1.0438E-06				
174				100	23921400	0.052192129			8.8303E-02			tot moles	1191828.16
175													
176	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.8	
177	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5028463.636	cc	mass=	4022770.91
178	H	1.0078252	1001.50c	200	4.50E+05	2.41E-02						1 mol is	1.80E+01
179	O	15.994915	8016.50c	100	3.57E+06	1.20E-02						2.23E+05	mole of h2o
180					4.02E+06	3.61E-02							
181													

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ
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35													
36													
37													
38	1662828.067	tot density	0.20291919			hematite forms at 10.26 1000s of years +				0.25	*100 % of water		total volu
39													
40	mass	23921.4	kg			ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm	

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ
41	1 mol is	24.70014642	g			Isotopes	Atomic Mass	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)		
42	968471.9918	moles				H	1.00782519	1001.50c	6.4551	6.30E+04	4.59E-03		
43						C	12.01115	6000.50c	0.0002	2.33E+01	1.42E-07		
44						O	15.994915	8016.50c	59.7993	9.26E+06	4.26E-02		
45						Na	22.9897707	11023.50c	0.0761	1.69E+04	5.42E-05		
46						Al	26.9815389	13027.50c	1.1394	2.98E+05	8.11E-04		
47						Si	28.086	14000.50c	11.893	3.23E+06	8.46E-03		
48						Ca	40.08	20000.50c	0.2762	1.07E+05	1.97E-04		
49						K	39.102	19000.50c	0.3872	1.47E+05	2.76E-04		
50						Ti	47.9	22000.50c	0.1819	8.44E+04	1.29E-04		
51						Mn	54.9380503	25055.50c	0.7144	3.80E+05	5.08E-04		
52						Fe	55.847	26000.55c	18.8429	1.02E+07	1.34E-02		
53						Ni	58.71	28000.50c	0.22	1.25E+05	1.57E-04		
54						Cu	63.54	29000.50c	0.0123	7.57E+03	8.75E-06		
55						Gd	157.25	64000.35c	0.002	3.05E+03	1.42E-06		
56	tot moles	1059468.95							100	23921400	0.07117109		
57													
58	0.8	g/cc				water				mass (g)	number densities (at/bar.cm)		
59	mass=	1638906.667	g			ρ=	1	kg/l		Na=	6.02E-01	at/b.cm	
60	1 mol is	1.80E+01				H	1.00782519	1001.50c	200	2.29E+05	1.67E-02		
61	9.10E+04	mole of h2o				O	15.994915	8016.50c	100	1.82E+06	8.36E-03		
62										2.05E+06	2.51E-02		
63													
64													
65													
66													
67	5225919.56	tot density	0.413168504			hematite forms at 10.26 1000s of years +				0.514096556	*100 % of water		total volu
68											12144443.9		Max Volum
69	mass	23921.4	kg			ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm	
70	at/bar.cm			1 mol is	24.700146	#VALUE!			Isotopes	Atomic Mass	MCNP ID	Mole%	mass (g)
71	3.0479E-02			968471.99	moles		0		H	1.00782519	1001.50c	6.4551	6.30E+04
72	9.2219E-08								C	12.01115	6000.50c	0.0002	2.33E+01
73	4.1325E-02								O	15.994915	8016.50c	59.7993	9.26E+06
74	3.5089E-05								Na	22.9897707	11023.50c	0.0761	1.69E+04
75	5.2537E-04								Al	26.9815389	13027.50c	1.1394	2.98E+05
76	5.4838E-03								Si	28.086	14000.50c	11.893	3.23E+06
77	1.2735E-04								Ca	40.08	20000.50c	0.2762	1.07E+05
78	1.7854E-04								K	39.102	19000.50c	0.3872	1.47E+05
79	8.3874E-05								Ti	47.9	22000.50c	0.1819	8.44E+04
80	3.2941E-04								Mn	54.9380503	25055.50c	0.7144	3.80E+05

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ
81	8.6884E-03								Fe	55.847	26000.55c	18.8429	1.02E+07
82	1.0144E-04								Ni	58.71	28000.50c	0.22	1.25E+05
83	5.6715E-06								Cu	63.54	29000.50c	0.0123	7.57E+03
84	9.2219E-07								Gd	157.25	64000.35c	0.002	3.05E+03
85	8.7364E-02			tot moles	1257302.4							100	23921400
86													
87	0.8					water				mass (g)	number densities (at/bar.cm)		
88	mass=	5201998.16	g			ρ=	1	kg/l		Na=	6.02E-01	at/b.cm	
89	1 mol is	1.80E+01				H	1.00782519	1001.50c	200	7.28E+05	3.44E-02		
90	2.89E+05	mole of h2o				O	15.994915	8016.50c	100	5.77E+06	1.72E-02		
91										6.50E+06	5.16E-02		
92													
93													
94													
95													
96													
97	0.397116292	hematite forms at 10.26 1000s of years +				0.49393319	*100 % of water		total volume	12144443.91	cc	tot mass	6022465
98													
99	kg	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
100	g	Isotopes	Atomic Mass	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is
101		H	1.00782519	1001.50c	6.4551	6.30E+04	3.10E-03			3.6130E-02			968472
102		C	12.01115	6000.50c	0.0002	2.33E+01	9.60E-08			9.6046E-08			
103		O	15.994915	8016.50c	59.7993	9.26E+06	2.87E-02			4.5233E-02			
104		Na	22.9897707	11023.50c	0.0761	1.69E+04	3.65E-05			3.6546E-05			
105		Al	26.9815389	13027.50c	1.1394	2.98E+05	5.47E-04			5.4718E-04			
106		Si	28.086	14000.50c	11.893	3.23E+06	5.71E-03			5.7114E-03			
107		Ca	40.08	20000.50c	0.2762	1.07E+05	1.33E-04			1.3264E-04			
108		K	39.102	19000.50c	0.3872	1.47E+05	1.86E-04			1.8595E-04			
109		Ti	47.9	22000.50c	0.1819	8.44E+04	8.74E-05			8.7354E-05			
110		Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.43E-04			3.4308E-04			
111		Fe	55.847	26000.55c	18.8429	1.02E+07	9.05E-03			9.0489E-03			
112		Ni	58.71	28000.50c	0.22	1.25E+05	1.06E-04			1.0565E-04			
113		Cu	63.54	29000.50c	0.0123	7.57E+03	5.91E-06			5.9068E-06			
114		Gd	157.25	64000.35c	0.002	3.05E+03	9.60E-07			9.6046E-07			
115					100	23921400	0.048023099			9.7568E-02			tot moles
116													
117		water				mass (g)	number densities (at/bar.cm)					density	1
118	g	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5998543.91	cc	mass=
119		H	1.00782519	1001.50c	200	6.71E+05	3.30E-02						1 mol is
120		O	15.994915	8016.50c	100	5.33E+06	1.65E-02						3.33E+05

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ
121						6.00E+06	4.95E-02						
122													
123													
124													
125													
126													
127			0.5	*100 % of water		total volum	12291800	cc	tot mass	6169821.4	tot density	0.501946127	
128													
129	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass	23921.4	kg	
130	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is	24.7001464	g	
131	1001.50c	6.4551	6.30E+04	3.06E-03			3.6499E-02			968471.9918	moles		
132	6000.50c	0.0002	2.33E+01	9.49E-08			9.4895E-08						
133	8016.50c	59.7993	9.26E+06	2.84E-02			4.5091E-02						
134	11023.50c	0.0761	1.69E+04	3.61E-05			3.6107E-05						
135	13027.50c	1.1394	2.98E+05	5.41E-04			5.4062E-04						
136	14000.50c	11.893	3.23E+06	5.64E-03			5.6429E-03						
137	20000.50c	0.2762	1.07E+05	1.31E-04			1.3105E-04						
138	19000.50c	0.3872	1.47E+05	1.84E-04			1.8372E-04						
139	22000.50c	0.1819	8.44E+04	8.63E-05			8.6307E-05						
140	25055.50c	0.7144	3.80E+05	3.39E-04			3.3896E-04						
141	26000.55c	18.8429	1.02E+07	8.94E-03			8.9405E-03						
142	28000.50c	0.22	1.25E+05	1.04E-04			1.0438E-04						
143	29000.50c	0.0123	7.57E+03	5.84E-06			5.8360E-06						
144	64000.35c	0.002	3.05E+03	9.49E-07			9.4895E-07						
145		100	23921400	0.0474474			9.7601E-02			tot moles	1309710.59		
146													
147			mass (g)	number densities (at/bar.cm)					density	1			
148	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass=	6145900	g	
149	1001.50c	200	6.88E+05	3.34E-02						1 mol is	1.80E+01		
150	8016.50c	100	5.46E+06	1.67E-02						3.41E+05	mole of h2o		
151			6.15E+06	5.02E-02									
152													
153													
154													
155													
156	0.362140739	hematite forms at 10.26 1000s of years +				0.45	*100 % of water		total volume	11174363.64	cc	tot mass	5052385
157													
158	kg	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6145900	cc	mass
159	g	Isotopes	Atomic Mass	MCNP ID	Mole%	mass (g)	number densities (at/bar.cm)			at/bar.cm			1 mol is
160		H	1.00782519	1001.50c	6.4551	6.30E+04	3.37E-03			3.3461E-02			968472

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ
161		C	12.01115	6000.50c	0.0002	2.33E+01	1.04E-07			1.0438E-07			
162		O	15.994915	8016.50c	59.7993	9.26E+06	3.12E-02			4.6257E-02			
163		Na	22.9897707	11023.50c	0.0761	1.69E+04	3.97E-05			3.9718E-05			
164		Al	26.9815389	13027.50c	1.1394	2.98E+05	5.95E-04			5.9468E-04			
165		Si	28.086	14000.50c	11.893	3.23E+06	6.21E-03			6.2072E-03			
166		Ca	40.08	20000.50c	0.2762	1.07E+05	1.44E-04			1.4415E-04			
167		K	39.102	19000.50c	0.3872	1.47E+05	2.02E-04			2.0209E-04			
168		Ti	47.9	22000.50c	0.1819	8.44E+04	9.49E-05			9.4937E-05			
169		Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.73E-04			3.7286E-04			
170		Fe	55.847	26000.55c	18.8429	1.02E+07	9.83E-03			9.8345E-03			
171		Ni	58.71	28000.50c	0.22	1.25E+05	1.15E-04			1.1482E-04			
172		Cu	63.54	29000.50c	0.0123	7.57E+03	6.42E-06			6.4196E-06			
173		Gd	157.25	64000.35c	0.002	3.05E+03	1.04E-06			1.0438E-06			
174					100	23921400	0.052192129			9.7331E-02			tot moles
175													
176		water				mass (g)	number densities (at/bar.cm)					density	1
177	g	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5028463.64	cc	mass=
178		H	1.00782519	1001.50c	200	5.63E+05	3.01E-02						1 mol is
179		O	15.994915	8016.50c	100	4.47E+06	1.50E-02						2.79E+05
180						5.03E+06	4.51E-02						
181													

	BK	BL	BM	BN	BO	BP	BQ	BR
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38	8194533.333	cc	**tot mass**	2072554.733	**tot density**	0.2529192		
39	-8194533.333							
40	Volume=	6145900	cc	mass	23921.4	kg		

	BK	BL	BM	BN	BO	BP	BQ	BR
41	at/bar.cm			1 mol is	24.700146	g		
42	2.1312E-02			968471.9918	moles			
43	1.4234E-07							
44	5.0919E-02							
45	5.4161E-05							
46	8.1092E-04							
47	8.4644E-03							
48	1.9657E-04							
49	2.7557E-04							
50	1.2946E-04							
51	5.0845E-04							
52	1.3411E-02							
53	1.5658E-04							
54	8.7540E-06							
55	1.4234E-06							
56	9.6248E-02			tot moles	1082218.2			
57								
58			density	1	g/cc			
59	Volume=	2048633.333	cc	mass=	2048633.3	g		
60				1 mol is	1.80E+01			
61				1.14E+05	mole of h2o			
62								
63								
64								
65								
66								
67	12648397.7	cc	**tot mass**	6526419.1	**tot density**	0.5159878		
68	e							
69	Volume=	6145900	cc	mass	23921.4	kg		
70	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.700146
71	2.98E-03			3.7355E-02			968471.99	moles
72	9.22E-08			9.2219E-08				
73	2.76E-02			4.4763E-02				
74	3.51E-05			3.5089E-05				
75	5.25E-04			5.2537E-04				
76	5.48E-03			5.4838E-03				
77	1.27E-04			1.2735E-04				
78	1.79E-04			1.7854E-04				
79	8.39E-05			8.3874E-05				
80	3.29E-04			3.2941E-04				

	BK	BL	BM	BN	BO	BP	BQ	BR
81	8.69E-03			8.6884E-03				
82	1.01E-04			1.0144E-04				
83	5.67E-06			5.6715E-06				
84	9.22E-07			9.2219E-07				
85	0.046109701			9.7678E-02			tot moles	1329509.9
86								
87			density	1				
88	Volume=	6502497.7	cc	mass=	6502497.7	g		
89				1 mol is	1.80E+01			
90				3.61E+05	mole of h2o			
91								
92								
93								
94								
95								
96								
97	**tot density**	0.495902929						
98								
99	23921.4	kg						
100	24.70014642	g						
101	moles							
102								
103								
104								
105								
106								
107								
108								
109								
110								
111								
112								
113								
114								
115	1301528.938							
116								
117								
118	5998543.91	g						
119	1.80E+01							
120	mole of h2o							

	BK	BL	BM	BN	BO	BP	BQ	BR
121								
122								
123								
124								
125								
126								
127								
128								
129								
130								
131								
132								
133								
134								
135								
136								
137								
138								
139								
140								
141								
142								
143								
144								
145								
146								
147								
148								
149								
150								
151								
152								
153								
154								
155								
156	**tot density**	0.452140739						
157								
158	23921.4	kg						
159	24.70014642	g						
160	moles							

	BK	BL	BM	BN	BO	BP	BQ	BR
161								
162								
163								
164								
165								
166								
167								
168								
169								
170								
171								
172								
173								
174	1247667.205							
175								
176								
177	5028463.636	g						
178	1.80E+01							
179	mole of h2o							
180								
181								

	A	B	C	D	E	F	G	H	I
1	Atomic Densities (at/cm*b)								
2									
3	Canister Component:	Ident 69	Basket	Cladding	Endcaps	MOX	Insulator	Canister shell	Total
4									
5	MCNP Isotope ID								
6	64000.35c								
7	1001.50c (H)								
8	6000.50c (C)	5.29084E-06	3.46E-05	3.61977E-05	9.65545E-06			0.000122095	0.000207869
9	25055.50c (Mn)	7.71161E-05	0.000505	0.000197848	5.27745E-05			0.000667343	0.001499835
10	15031.50c (P)	3.07756E-06	2.01E-05	7.89577E-06	2.10613E-06			2.66324E-05	5.98556E-05
11	16032.50c (S)	1.98764E-06	1.3E-05	5.09948E-06	1.36025E-06			1.72006E-05	3.86578E-05
12	14000.50c (Si)	5.65665E-05	0.00037	0.000145127	3.87114E-05			0.000489512	0.001100165
13	24000.50c (Cr)	0.000774055	0.004533	0.001776866	0.000473965			0.005993374	0.013551418
14	28000.50c (Ni)	0.000360931	0.002834	0.001110823	0.000296303			0.003746809	0.008348808
15	42000.50c (Mo)	0	0.000361	0.000141617	3.77753E-05			0.000477675	0.001018363
16	7014.50c (N)	1.51274E-05	9.9E-05	3.88108E-05	1.03525E-05			0.000130909	0.000294214
17	26000.55c (Fe)	0.002580979	0.016273	0.006373589	0.001700104			0.021498131	0.048425575
18	29000.50C (Cu)	0							0
19	8016.50C (O)	0				0.00595745	0.00029672		0.006254167
20	92235.50C (U235)	0				4.6037E-06	1.067E-06		5.67069E-06
21	92238.50C (U238)	0				0.00227338	0.00014729		0.002420667
22	94239.55C (Pu239)	0				0.00066568	0		0.000665675
23	94240.50C (Pu240)	0				8.8275E-05	0		8.82748E-05
24	94241.50C (Pu241)	0				7.7195E-06			7.71954E-06
25	total	0.00387513	0.025043	0.009833875	0.002623108	0.0089971	0.00044508	0.033169682	0.083986935
26	volume	167984.6046							
27									
28									**97.5% of water in the**
29					**Density of water (g/cc)**	**1.0**	**1.0**	**1.0**	**1.0**
30	Density of Hematite (g/cc)	5.2749E+00		**MCNP Isotope ID**	**%of water in the fftf SNF**	**0.00%**	**25.00%**	**50.00%**	**97.48%**
31	Volume of the fuel Homogenized	1.6798E+05		**64000.35c**	1.7634E-04	1.7634E-04	1.3226E-04	8.8172E-05	4.4409E-06
32	Mole/cc.b of Hematite	4.0207E-26		**1001.50c (H)**	0.0000E+00	0.0000E+00	1.6718E-02	3.3436E-02	6.5188E-02
33	Mole of hematite in the fuel	6.7542E+03		**6000.50c (C)**	2.0787E-04	2.0787E-04	1.5590E-04	1.0393E-04	5.2348E-06
34	Mass of Hematite(g)	1.0785E+06		**25055.50c (Mn)**	1.4998E-03	1.4998E-03	1.1249E-03	7.4992E-04	3.7771E-05
35	Volume of Hematite (cc)	2.0446E+05		**15031.50c (P)**	5.9856E-05	5.9856E-05	4.4892E-05	2.9928E-05	1.5074E-06
36	Volume of Hematite (l)	2.0446E+02		**16032.50c (S)**	3.8658E-05	3.8658E-05	2.8993E-05	1.9329E-05	9.7353E-07
37	**0 % of this volume is water**	**0.0000E+00**		**14000.50c (Si)**	1.1002E-03	1.1002E-03	8.2512E-04	5.5008E-04	2.7706E-05
38	volume of water (cc)	0.0000E+00		**24000.50c (Cr)**	1.3551E-02	1.3551E-02	1.0164E-02	6.7757E-03	3.4127E-04
39				**28000.50c (Ni)**	8.3488E-03	8.3488E-03	6.2616E-03	4.1744E-03	2.1025E-04
40	Mass(g) of Water to add	0		**42000.50c (Mo)**	1.0184E-03	1.0184E-03	7.6377E-04	5.0918E-04	2.5646E-05

	A	B	C	D	E	F	G	H	I
41	Mole of Water to add	0		7014.50c (N)	2.9421E-04	2.9421E-04	2.2066E-04	1.4711E-04	7.4093E-06
42	Atomes of O to add	0		26000.55c (Fe)	4.8426E-02	4.8426E-02	3.6319E-02	2.4213E-02	1.2195E-03
43	Atomes of H to add	0		29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
44	density of H homogenized to add (at/cm.b)	0.0000E+00		8016.50C (O)	7.8893E-02	7.8893E-02	6.7528E-02	5.6164E-02	3.4581E-02
45	density of O homogenized to add (at/cm.b)	0.0000E+00		92235.50C (U235)	5.6707E-06	5.6707E-06	4.2530E-06	2.8353E-06	1.4281E-07
46				92238.50C (U238)	2.4207E-03	2.4207E-03	1.8155E-03	1.2103E-03	6.0960E-05
47	Max Volume of the canister	624971.2629		94239.55C (Pu239)	6.6568E-04	6.6568E-04	4.9926E-04	3.3284E-04	1.6764E-05
48				94240.50C (Pu240)	8.8275E-05	8.8275E-05	6.6206E-05	4.4137E-05	2.2230E-06
49				94241.50C (Pu241)	7.7195E-06	7.7195E-06	5.7897E-06	3.8598E-06	1.9440E-07
50				total	1.5680E-01	1.5680E-01	1.4268E-01	1.2855E-01	1.0173E-01
51				volume	1.6798E+05	1.6798E+05	2.2398E+05	3.3597E+05	6.6705E+06
52									
53				H/x	0.0000E+00	0.0000E+00	3.3203E+01	9.9609E+01	3855.7
54									
55						96.37% of water in the fuel			
56					Density of water (g/cc)	1.0		1.0	0.8
57	Density of Hematite (g/cc)	5.2749E+00		MCNP Isotope ID	%of water in the fftf SNF	0.00%	96.37%	96.37%	96.37%
58	Volume of the fuel Homogenized	1.6798E+05		64000.35c	1.7634E-04	1.7634E-04	6.4093E-06	6.4093E-06	6.4093E-06
59	Mole/cc.b of Hematite	4.0207E-26		1001.50c (H)	0.0000E+00	0.0000E+00	6.4441E-02	6.4441E-02	5.1553E-02
60	Mole of hematite in the fuel	6.7542E+03		6000.50c (C)	2.0787E-04	2.0787E-04	7.5552E-06	7.5552E-06	7.5552E-06
61	Mass of Hematite(g)	1.0785E+06		25055.50c (Mn)	1.4998E-03	1.4998E-03	5.4513E-05	5.4513E-05	5.4513E-05
62	Volume of Hematite (cc)	2.0446E+05		15031.50c (P)	5.9856E-05	5.9856E-05	2.1755E-06	2.1755E-06	2.1755E-06
63	Volume of Hematite (l)	2.0446E+02		16032.50c (S)	3.8658E-05	3.8658E-05	1.4050E-06	1.4050E-06	1.4050E-06
64	0 % of this volume is water	0.0000E+00		14000.50c (Si)	1.1002E-03	1.1002E-03	3.9986E-05	3.9986E-05	3.9986E-05
65	volume of water (cc)	0.0000E+00		24000.50c (Cr)	1.3551E-02	1.3551E-02	4.9254E-04	4.9254E-04	4.9254E-04
66				28000.50c (Ni)	8.3488E-03	8.3488E-03	3.0344E-04	3.0344E-04	3.0344E-04
67	Mass(g) of Water to add	0		42000.50c (Mo)	1.0184E-03	1.0184E-03	3.7013E-05	3.7013E-05	3.7013E-05
68	Mole of Water to add	0		7014.50c (N)	2.9421E-04	2.9421E-04	1.0693E-05	1.0693E-05	1.0693E-05
69	Atomes of O to add	0		26000.55c (Fe)	4.8426E-02	4.8426E-02	1.7601E-03	1.7601E-03	1.7601E-03
70	Atomes of H to add	0		29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
71	density of H homogenized to add (at/cm.b)	0.0000E+00		8016.50C (O)	7.8893E-02	7.8893E-02	3.5088E-02	3.5088E-02	2.8644E-02
72	density of O homogenized to add (at/cm.b)	0.0000E+00		92235.50C (U235)	5.6707E-06	5.6707E-06	2.0611E-07	2.0611E-07	2.0611E-07
73				92238.50C (U238)	2.4207E-03	2.4207E-03	8.7981E-05	8.7981E-05	8.7981E-05
74	Max Volume of the canister	624971.2629		94239.55C (Pu239)	6.6568E-04	6.6568E-04	2.4194E-05	2.4194E-05	2.4194E-05
75				94240.50C (Pu240)	8.8275E-05	8.8275E-05	3.2084E-06	3.2084E-06	3.2084E-06
76				94241.50C (Pu241)	7.7195E-06	7.7195E-06	2.8057E-07	2.8057E-07	2.8057E-07
77				volume	1.6798E+05	1.6798E+05	4.6218E+06	4.6218E+06	4.6218E+06
78				total	1.5680E-01	1.5680E-01	1.0236E-01	1.0236E-01	8.3029E-02
79							3.6346E-02	3.6346E-02	3.6346E-02
80				H/x	0.0	0.0	2641.0	2641.0	2112.8

	A	B	C	D	E	F	G	H	I
81									
82						67.98% of water in the fuel			
83					Density of water (g/cc)	1.0	0.8	0.5	0.1
84	Density of Hematite (g/cc)	5.2749E+00		MCNP Isotope ID	%of water in the fftf SNF	67.98%	67.98%	67.98%	67.98%
85	Volume of the fuel Homogenized	1.6798E+05		64000.35c	1.7634E-04	5.6470E-05	5.6470E-05	5.6470E-05	5.6470E-05
86	Mole/cc.b of Hematite	4.0207E-26		1001.50c (H)	0.0000E+00	4.5458E-02	3.6366E-02	2.2729E-02	4.5458E-03
87	Mole of hematite in the fuel	6.7542E+03		6000.50c (C)	2.0787E-04	6.6565E-05	6.6565E-05	6.6565E-05	6.6565E-05
88	Mass of Hematite(g)	1.0785E+06		25055.50c (Mn)	1.4998E-03	4.8029E-04	4.8029E-04	4.8029E-04	4.8029E-04
89	Volume of Hematite (cc)	2.0446E+05		15031.50c (P)	5.9856E-05	1.9167E-05	1.9167E-05	1.9167E-05	1.9167E-05
90	Volume of Hematite (l)	2.0446E+02		16032.50c (S)	3.8658E-05	1.2379E-05	1.2379E-05	1.2379E-05	1.2379E-05
91	**0 % of this volume is water**	**0.0000E+00**		14000.50c (Si)	1.1002E-03	3.5230E-04	3.5230E-04	3.5230E-04	3.5230E-04
92	volume of water (cc)	0.0000E+00		24000.50c (Cr)	1.3551E-02	4.3395E-03	4.3395E-03	4.3395E-03	4.3395E-03
93				28000.50c (Ni)	8.3488E-03	2.6735E-03	2.6735E-03	2.6735E-03	2.6735E-03
94	Mass(g) of Water to add	0		42000.50c (Mo)	1.0184E-03	3.2611E-04	3.2611E-04	3.2611E-04	3.2611E-04
95	Mole of Water to add	0		7014.50c (N)	2.9421E-04	9.4215E-05	9.4215E-05	9.4215E-05	9.4215E-05
96	Atomes of O to add	0		26000.55c (Fe)	4.8426E-02	1.5507E-02	1.5507E-02	1.5507E-02	1.5507E-02
97	Atomes of H to add	0		29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
98	density of H homogenized to add (at/cm.b)	0.0000E+00		8016.50C (O)	7.8893E-02	4.7992E-02	4.3447E-02	3.6628E-02	2.7536E-02
99	density of O homogenized to add (at/cm.b)	0.0000E+00		92235.50C (U235)	5.6707E-06	1.8159E-06	1.8159E-06	1.8159E-06	1.8159E-06
100				92238.50C (U238)	2.4207E-03	7.7516E-04	7.7516E-04	7.7516E-04	7.7516E-04
101	Max Volume of the canister	624971.2629		94239.55C (Pu239)	6.6568E-04	2.1317E-04	2.1317E-04	2.1317E-04	2.1317E-04
102				94240.50C (Pu240)	8.8275E-05	2.8268E-05	2.8268E-05	2.8268E-05	2.8268E-05
103				94241.50C (Pu241)	7.7195E-06	2.4720E-06	2.4720E-06	2.4720E-06	2.4720E-06
104				volume	1.6798E+05	5.2458E+05	5.2458E+05	5.2458E+05	5.2458E+05
105				total	1.5680E-01	1.1840E-01	1.0476E-01	8.4305E-02	5.7031E-02
106									
107				H/x	0.0	211.4	169.2	105.7	21.1
108									
109									Absober loading
110									Density of water (g/cc
111									%wter in fuel
112									64000.35c
113									1001.50c (H)
114									6000.50c (C)
115									25055.50c (Mn)
116									15031.50c (P)
117									16032.50c (S)
118									14000.50c (Si)
119									24000.50c (Cr)
120									28000.50c (Ni)

	A	B	C	D	E	F	G	H	I
121									42000.50c (Mo)
122									7014.50c (N)
123									26000.55c (Fe)
124									29000.50C (Cu)
125									8016.50C (O)
126									92235.50C (U235)
127									92238.50C (U238)
128									94239.55C (Pu239)
129									94240.50C (Pu240)
130									94241.50C (Pu241)
131									volume
132									total
133									H/x

	J	K	L	M	N	O	P
1							
2							
3	Total degraded dry -		dry no Gd	dry no Fe2O3	dry no gd Fe2O3		
4	(Fe becomes Fe2O3)						
5							
6	0.000176343		0.0000E+00	0.000176343	0		
7				0	0		
8	0.000207869		2.0787E-04	0.000207869	0.000207869		
9	0.001499835		1.4998E-03	0.001499835	0.001499835		
10	5.98556E-05		5.9856E-05	5.98556E-05	5.98556E-05		
11	3.86578E-05		3.8658E-05	3.86578E-05	3.86578E-05		
12	0.001100165		1.1002E-03	0.001100165	0.001100165		
13	0.013551418		1.3551E-02	0.013551418	0.013551418		
14	0.008348808		8.3488E-03	0.008348808	0.008348808		
15	0.001018363		1.0184E-03	0.001018363	0.001018363		
16	0.000294214		2.9421E-04	0.000294214	0.000294214		
17	0.048425575		4.8426E-02	0	0		
18	0		0.0000E+00	0	0		
19	0.078892529		7.8893E-02	6.2542E-03	0.006254167		
20	5.67069E-06		5.6707E-06	5.67069E-06	5.67069E-06		
21	0.002420667		2.4207E-03	0.002420667	0.002420667		
22	0.000665675		6.6568E-04	0.000665675	0.000665675		
23	8.82748E-05		8.8275E-05	8.82748E-05	8.82748E-05		
24	7.71954E-06		7.7195E-06	7.71954E-06	7.71954E-06		
25	0.15680164	0	1.5663E-01	3.5738E-02	3.5561E-02		
26							
27							
28	uel			75% of water in the fuel			
29	0.8	0.5	0.1	1.0	0.8	0.5	0.1
30	97.48%	97.48%	97.48%	75.00%	75.00%	75.00%	75.00%
31	4.4409E-06	4.4409E-06	4.4409E-06	4.4086E-05	4.4086E-05	4.4086E-05	4.4086E-05
32	5.2150E-02	3.2594E-02	6.5188E-03	5.0154E-02	4.0123E-02	2.5077E-02	5.0154E-03
33	5.2348E-06	5.2348E-06	5.2348E-06	5.1967E-05	5.1967E-05	5.1967E-05	5.1967E-05
34	3.7771E-05	3.7771E-05	3.7771E-05	3.7496E-04	3.7496E-04	3.7496E-04	3.7496E-04
35	1.5074E-06	1.5074E-06	1.5074E-06	1.4964E-05	1.4964E-05	1.4964E-05	1.4964E-05
36	9.7353E-07	9.7353E-07	9.7353E-07	9.6644E-06	9.6644E-06	9.6644E-06	9.6644E-06
37	2.7706E-05	2.7706E-05	2.7706E-05	2.7504E-04	2.7504E-04	2.7504E-04	2.7504E-04
38	3.4127E-04	3.4127E-04	3.4127E-04	3.3879E-03	3.3879E-03	3.3879E-03	3.3879E-03
39	2.1025E-04	2.1025E-04	2.1025E-04	2.0872E-03	2.0872E-03	2.0872E-03	2.0872E-03
40	2.5646E-05	2.5646E-05	2.5646E-05	2.5459E-04	2.5459E-04	2.5459E-04	2.5459E-04

	J	K	L	M	N	O	P
41	7.4092E-06	7.4092E-06	7.4092E-06	7.3553E-05	7.3553E-05	7.3553E-05	7.3553E-05
42	1.2195E-03	1.2195E-03	1.2195E-03	1.2106E-02	1.2106E-02	1.2106E-02	1.2106E-02
43	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
44	2.8062E-02	1.8284E-02	5.2462E-03	4.4800E-02	3.9785E-02	3.2262E-02	2.2231E-02
45	1.4281E-07	1.4281E-07	1.4281E-07	1.4177E-06	1.4177E-06	1.4177E-06	1.4177E-06
46	6.0960E-05	6.0960E-05	6.0960E-05	6.0517E-04	6.0517E-04	6.0517E-04	6.0517E-04
47	1.6764E-05	1.6764E-05	1.6764E-05	1.6642E-04	1.6642E-04	1.6642E-04	1.6642E-04
48	2.2230E-06	2.2230E-06	2.2230E-06	2.2069E-05	2.2069E-05	2.2069E-05	2.2069E-05
49	1.9440E-07	1.9440E-07	1.9440E-07	1.9299E-06	1.9299E-06	1.9299E-06	1.9299E-06
50	8.2174E-02	5.2840E-02	1.3727E-02	1.1443E-01	9.9385E-02	7.6816E-02	4.6723E-02
51	6.6705E+06	6.6705E+06	6.6705E+06	6.7194E+05	6.7194E+05	6.7194E+05	6.7194E+05
52							
53	3084.6	1927.9	385.6	298.8	239.1	149.4	29.9
54							
55							
56	**0.5**	**0.1**					
57	**96.37%**	**96.37%**					
58	6.4093E-06	6.4093E-06					
59	3.2221E-02	6.4441E-03					
60	7.5552E-06	7.5552E-06					
61	5.4513E-05	5.4513E-05					
62	2.1755E-06	2.1755E-06					
63	1.4050E-06	1.4050E-06					
64	3.9986E-05	3.9986E-05					
65	4.9254E-04	4.9254E-04					
66	3.0344E-04	3.0344E-04					
67	3.7013E-05	3.7013E-05					
68	1.0693E-05	1.0693E-05					
69	1.7601E-03	1.7601E-03					
70	0.0000E+00	0.0000E+00					
71	1.8978E-02	6.0895E-03					
72	2.0611E-07	2.0611E-07					
73	8.7981E-05	8.7981E-05					
74	2.4194E-05	2.4194E-05					
75	3.2084E-06	3.2084E-06					
76	2.8057E-07	2.8057E-07					
77	4.6218E+06	4.6218E+06					
78	5.4030E-02	1.5365E-02					
79	3.6346E-02	3.6346E-02					
80	1320.5	264.1					

	J	K	L	M	N	O	P
81							
82	**89.77% of water in the fuel**						
83	**1.0**	**0.8**	**0.5**	**0.1**			
84	89.77%	89.77%	89.77%	89.77%			
85	1.8041E-05	1.8041E-05	1.8041E-05	1.8041E-05			
86	6.0031E-02	4.8024E-02	3.0015E-02	6.0031E-03			
87	2.1266E-05	2.1266E-05	2.1266E-05	2.1266E-05			
88	1.5344E-04	1.5344E-04	1.5344E-04	1.5344E-04			
89	6.1235E-06	6.1235E-06	6.1235E-06	6.1235E-06			
90	3.9548E-06	3.9548E-06	3.9548E-06	3.9548E-06			
91	1.1255E-04	1.1255E-04	1.1255E-04	1.1255E-04			
92	1.3864E-03	1.3864E-03	1.3864E-03	1.3864E-03			
93	8.5411E-04	8.5411E-04	8.5411E-04	8.5411E-04			
94	1.0418E-04	1.0418E-04	1.0418E-04	1.0418E-04			
95	3.0099E-05	3.0099E-05	3.0099E-05	3.0099E-05			
96	4.9541E-03	4.9541E-03	4.9541E-03	4.9541E-03			
97	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00			
98	3.8086E-02	3.2083E-02	2.3079E-02	1.1073E-02			
99	5.8013E-07	5.8013E-07	5.8013E-07	5.8013E-07			
100	2.4764E-04	2.4764E-04	2.4764E-04	2.4764E-04			
101	6.8101E-05	6.8101E-05	6.8101E-05	6.8101E-05			
102	9.0308E-06	9.0308E-06	9.0308E-06	9.0308E-06			
103	7.8974E-07	7.8974E-07	7.8974E-07	7.8974E-07			
104	1.6420E+06	1.6420E+06	1.6420E+06	1.6420E+06			
105	1.0609E-01	8.8078E-02	6.1064E-02	2.5046E-02			
106							
107	874.0	699.2	437.0	87.4			
108							
109		**nogd**	**no fe2o3**	**nogdnofe2o3**			
110	**1**	**1**	**1**	**1**			
111	**67.9775%**	**67.9775%**	**67.9775%**	**67.9775%**			
112	5.6470E-05	0	5.6470E-05	0.0000E+00			
113	4.5458E-02	4.5458E-02	4.5458E-02	4.5458E-02			
114	6.6565E-05	6.6565E-05	6.6565E-05	6.6565E-05			
115	4.8029E-04	4.8029E-04	4.8029E-04	4.8029E-04			
116	1.9167E-05	1.9167E-05	1.9167E-05	1.9167E-05			
117	1.2379E-05	1.2379E-05	1.2379E-05	1.2379E-05			
118	3.5230E-04	3.5230E-04	3.5230E-04	3.5230E-04			
119	4.3395E-03	4.3395E-03	4.3395E-03	4.3395E-03			
120	2.6735E-03	2.6735E-03	2.6735E-03	2.6735E-03			

	J	K	L	M	N	O	P
121	3.2611E-04	3.2611E-04	3.2611E-04	3.2611E-04			
122	9.4215E-05	9.4215E-05	9.4215E-05	9.4215E-05			
123	1.5507E-02	1.5507E-02	0.0000E+00	0.0000E+00			
124	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00			
125	4.7992E-02	4.7992E-02	2.4732E-02	2.4732E-02			
126	1.8159E-06	1.8159E-06	1.8159E-06	1.8159E-06			
127	7.7516E-04	7.7516E-04	7.7516E-04	7.7516E-04			
128	2.1317E-04	2.1317E-04	2.1317E-04	2.1317E-04			
129	2.8268E-05	2.8268E-05	2.8268E-05	2.8268E-05			
130	2.4720E-06	2.4720E-06	2.4720E-06	2.4720E-06			
131	5.2458E+05	5.2458E+05	5.2458E+05	5.2458E+05			
132	1.1840E-01	1.1834E-01	7.9631E-02	7.9574E-02			
133	211.4	211.4	211.4	211.4			

	A	B	C	D	E	F	G
1	Appendix	Specifications for DOE FFTF Canister Components					
2							
3	FFTF SNF Assembly	parts/canister:	5				
4		components:	fuel pin:	parts/assem.:	217		
5				components:	MOX:	O.D.:	0.49403cm
6						length:	91.44cm
7						material:	UO1.96+PuO1.96
8						density:	10.02g/cc
9					insulator:	parts/assem.:	2
10						material:	natural UO2
11						density:	10.42g/cc
12						length:	2.032
13					reflector:	parts/assem.:	2
14						material:	Inconel 600
15						density:	8.47g/cc
16						length:	14.478cm
17					spring:	material:	SS302
18						volume:	2.7264cc
19						density:	8g/cc
20					plenum:	material:	SS316
21						length:	86.21cm
22						O.D.:	0.49022cm
23						wall thickness:	0.01397cm
24					top cap:	material:	SS316
25						length:	10.46cm
26						O.D.:	0.5842cm
27					bottom cap:	material:	SS316
28						length:	4.06cm
29						O.D.:	0.5842cm
30					cladding	material:	SS316
31						I.D.:	0.508 cm
32						O.D.:	0.5842 cm
33						length:	223.224cm
34						density:	7.9497g/cc
35		Components other than		fuel pins:	material:	SS316	
36					total mass:	172.819-217*0.4536=	74.3878 kg
37	Ident 69	components:	fuel pin:	parts:	217		
38			container:	mass:	59.09Kg		
39				material:	SS304L		
40	Basket Assembly	material:	SS316L				
41		components:	center tube:	O.D.:	17.3cm		
42				I.D.:	15.3cm		
43				length:	412.5cm		
44			divider plates:	parts/canister:	5		
45				length:	14.6448cm		
46				height:	412.5cm		

	A	B	C	D	E	F	G
47				thickness:	1cm		
48			canister Shell	O.R.:	22.86cm		
49				I.R.:	21.9075cm		
50				length:	456.9cm		
51				material:	ss-316		
52				density	7.952g/cm3		
53	Volume for homogenizing isotopes:		pi*22.86**2*45	750107.4569cc			
54	Total fuel pins per canister:		217*6=	1302			

	A	B	C	D	E	F	G
1	Cladding:	material:	SS316				
2		I.D.:	0.508 cm				
3		O.D.:	0.5842 cm				
4		length:	(237.744-10.46-4.06)cm=	223.224cm			
5		vol:	pi*(0.5842**2-0.508**2)*223.224/4cc=	14.5911cc			
6		total vol:	1302*14.5911cc=	18997.6122	cc		
7		vol fraction:	18997.6122/167983.6=	0.113092065			
8		density:	7.98g/cc				
9							
10	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
11					(at/cm*b)	(at./cm*b)	
12						(homogenized)	
13	C	6000.50c	12.01115	0.08	3.2007E-04	3.6198E-05	
14	Mn	25055.50c	54.9380503	2	1.7494E-03	1.9785E-04	
15	P	15031.50c	30.9737647	0.045	6.9817E-05	7.8958E-06	
16	S	16032.50c	31.9720737	0.03	4.5091E-05	5.0995E-06	
17	Si	14000.50c	28.086	0.75	1.2833E-03	1.4513E-04	
18	Cr	24000.50c	51.996	17	1.5712E-02	1.7769E-03	
19	Ni	28000.50c	58.71	12	9.8223E-03	1.1108E-03	
20	Mo	42000.50c	95.94	2.5	1.2522E-03	1.4162E-04	
21	N	7014.50c	14.00307439	0.1	3.4318E-04	3.8811E-05	
22	Fe	26000.50c	55.847	65.495	5.6358E-02	6.3736E-03	
23							
24							

	A	B	C	D	E	F	G
1	MOX:	material:	UO1.96+PuO1.96				
2		density:	10.02g/cc				
3		length:	91.44cm				
4		O.D.:	0.49403cm				
5		vol:	pi*0.49403**2*91.44/4cc=	17.5280cc			
6		total vol:	1302*17.5280cc=	22821.456	cc		
7		vol fraction:	22821.456/167983.6=	0.135855262			
8							
9	Pu(moles):	38.4/239.1891=	0.16054				
10	U(moles):	114.3/238.04476=	0.48016				
11	O(moles):	1.96*(0.16054+0.4	1.25577				
12	O(mass):	15.998985*1.2557	20.091g				
13	Total mass:	38.4+114.3+20.09	172.791g				
14							
15	Pu:	mass:	38.4g				
16		weight fraction:	0.22223				
17							
18	Isotope	Isotopic Mass	Weight Fraction	At. Mass			
19	Pu239	239.052146	0.8735	239.1890947			
20	Pu240	240.053882	0.1163				
21	Pu241	241.056737	0.0102				
22							
23	U:	mass:	114.3g				
24		weight fraction:	0.66149				
25							
26	Isotope	Isotopic Mass	Weight Fraction	At. Mass			
27	U235	235.043915	0.002	238.0447563			
28	U238	238.05077	0.998				
29							
30							
31	O:	mass:	20.091g				
32		weight fraction:	0.11627				
33							
34	MOX						
35	Isotope	Identifier	Isotopic Mass	Wt. Fraction	At. Density	At. Density	
36					(at/cm*b)	(at/cm*b)	
37						(homogenized)	
38	O16	8016.50c	15.998985	0.11627	4.3851E-02	5.9574E-03	
39	U235	92235.50c	235.043915	0.00132	3.3887E-05	4.6037E-06	
40	U238	92238.50c	238.05077	0.66017	1.6734E-02	2.2734E-03	

	A	B	C	D	E	F	G
41	Pu239	94239.50c	239.052146	0.19412	4.8999E-03	6.6568E-04	
42	Pu240	94240.50c	240.053882	0.02585	6.4977E-04	8.8275E-05	
43	Pu241	94241.50c	241.056737	0.00227	5.6822E-05	7.7195E-06	

	A	B	C	D	E	F
1						
2						
3	Endcaps	material:	SS316			
4		length:	10.46+4.06=	14.52cm		
5		diameter:	0.5842cm			
6		vol:	pi*0.5842**2*14.52/4=	3.89206cc		
7		total vol:	1302*3.89206=	5067.46212	cc	
8		vol. fraction:	5067.46212/167983.6=	0.03016641		
9		density:	7.98g/cc			
10						
11	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
12					(at/cm*b)	(at/cm*b)
13						(homogenized)
14	C	6000.50c	12.01115	0.08	3.2007E-04	9.6555E-06
15	Mn	25055.50c	54.9380503	2	1.7494E-03	5.2774E-05
16	P	15031.50c	30.9737647	0.045	6.9817E-05	2.1061E-06
17	S	16032.50c	31.9720737	0.03	4.5091E-05	1.3602E-06
18	Si	14000.50c	28.086	0.75	1.2833E-03	3.8711E-05
19	Cr	24000.50c	51.996	17	1.5712E-02	4.7396E-04
20	Ni	28000.50c	58.71	12	9.8223E-03	2.9630E-04
21	Mo	42000.50c	95.94	2.5	1.2522E-03	3.7775E-05
22	N	7014.50c	14.00307439	0.1	3.4318E-04	1.0352E-05
23	Fe	26000.50c	55.847	65.495	5.6358E-02	1.7001E-03

	A	B	C	D	E	F
1	Insulator	material:	natural UO2			
2		parts per rod:	2			
3		length:	2.032cm			
4		diameter:	0.508cm			
5		vol:	pi*0.508**2*2.032*2/4=	0.8237cc		
6		total vol:	1302*0.8237=	1072.4574	cc	
7		vol. fraction:	1072.4574/167983.6=	0.006384298		
8		density:	10.42g/cc			
9		U mass/assembly	1500g			
10						
11	U(moles):	1500/238.0289=	6.3018			
12	O(moles):	2*6.3018=	12.6035			
13	O(mass):	16*12.6035=	201.656			
14	total mass:	1701.656				
15	U(Wt. Fraction):	1500/1701.656=	0.8815			
16	O(Wt. Fraction):	201.656/1701.65	0.1185			
17						
18	Isotope	Identifier	At. Mass	Wt. Fraction	At. Density	At. Density
19					(at/cm*b)	(at/cm*b)
20						(homogenized)
21	U235	92235.50c	235.043915	0.00626	1.6712E-04	1.0670E-06
22	U238	92238.50c	238.05077	0.87524	2.3071E-02	1.4729E-04
23	O16	8016.50c	15.998985	0.1185	4.6477E-02	2.9672E-04
24						

	A	B	C	D	E	F
1	Ident 69	material:	SS304L			
2		density:	7.9g/cc			
3		mass:	59.09kg			
4		vol:	59090/7.9=	7479.75		
5		vol. fraction:	7479.75/167983.6=	0.04452667		
6						
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density
8					(at/cm*b)	(at/cm*b)
9						(homogenized
10	C	6000.50c	12.01115	0.03	1.1882E-04	5.2908E-06
11	Mn	25055.50c	54.9380503	2	1.7319E-03	7.7116E-05
12	P	15031.50c	30.9737647	0.045	6.9117E-05	3.0776E-06
13	S	16032.50c	31.9720737	0.03	4.4639E-05	1.9876E-06
14	Si	14000.50c	28.086	0.75	1.2704E-03	5.6567E-05
15	Cr	24000.50c	51.996	19	1.7384E-02	7.7405E-04
16	Ni	28000.50c	58.69	10	8.1059E-03	3.6093E-04
17	N	7014.50c	14.00307439	0.1	3.3974E-04	1.5127E-05
18	Fe	26000.50c	55.847	68.045	5.7965E-02	2.5810E-03

	A	B	C	D	E	F	G
1	Basket	material:	SS316L				
2		density:	7.98g/cc				
3		components:	center tube:	O.D.:	17.3cm		
4				I.D.:	15.3cm		
5				length:	412.5cm		
6				vol:	pi*(17.3**2-15.3**2)*412.5/4=	21123.2836	cc
7			divider plates:	parts/canister:	5		
8				thickness:	1cm		
9				length:	(43.815-17.3)/2=	13.2575cm	
10				height:	412.5cm		
11				vol:	5*1*13.2575*412.5=	27343.5938	cc
12							
13		total vol:	48466.8774	cc			
14		vol fraction:	48466.877/16798	0.288521481			
15							
16	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
17					(at/cm*b)	(at/cm*b)	
18						(homogenized)	
19	C	6000.50c	12.01115	0.03	1.2003E-04	3.4630E-05	
20	Mn	25055.50c	54.9380503	2	1.7494E-03	5.0475E-04	
21	P	15031.50c	30.9737647	0.045	6.9817E-05	2.0144E-05	
22	S	16032.50c	31.9720737	0.03	4.5091E-05	1.3010E-05	
23	Si	14000.50c	28.086	0.75	1.2833E-03	3.7025E-04	
24	Cr	24000.50c	51.996	17	1.5712E-02	4.5332E-03	
25	Ni	28000.50c	58.71	12	9.8223E-03	2.8339E-03	
26	Mo	42000.50c	95.94	2.5	1.2522E-03	3.6130E-04	
27	N	7014.50c	14.00307439	0.1	3.4318E-04	9.9014E-05	
28	Fe	26000.50c	55.847	65.545	5.6401E-02	1.6273E-02	
29							

	A	B	C	D	E	F	G
1	DOE SNF Canister shell			material:	SS316L		
2				mass:	511350.3358	509.556kg	
3				vol:	64078.98945	64078.98945cc	
4				total vol.:			
5				vol. fraction	64078.98945/167983	0.38145979	
6							
7	Element	Identifier	At. Mass	Wt.%	At. Density	At. Density	
8					(at/cm*b)	(at/cm*b)	
9						(homogenized)	
10	C	6000.50c	12.01115	0.08	3.2007E-04	1.2209E-04	
11	Mn	25055.50c	54.93805	2	1.7494E-03	6.6734E-04	
12	P	15031.50c	30.973765	0.045	6.9817E-05	2.6632E-05	
13	S	16032.50c	31.972074	0.03	4.5091E-05	1.7201E-05	
14	Si	14000.50c	28.086	0.75	1.2833E-03	4.8951E-04	
15	Cr	24000.50c	51.996	17	1.5712E-02	5.9934E-03	
16	Ni	28000.50c	58.71	12	9.8223E-03	3.7468E-03	
17	Mo	42000.50c	95.94	2.5	1.2522E-03	4.7768E-04	
18	N	7014.50c	14.003074	0.1	3.4318E-04	1.3091E-04	
19	Fe	26000.50c	55.847	65.495	5.6358E-02	2.1498E-02	

	A	B
1	**Gd**	
2	Volume of basket (cc)	48466.8774
3	density of ss316 (g/cc)	7.98
4	Mass Basket (g)	386765.6817
5	2% of the mass is Gd	0.02
6	Mass Gd (g)	7735.313633
7	Mole of Gd (M=157.25 g/mol)	49.19118368
8	Atomes of Gd	2.96229E+25
9	Volume of the SNF DOE Canister	167984.6046
10	Homogenized Density at/b.cc	0.000176343

	A	B	C	D	E	F	G
1		Volume	Densit	Mass (g)	Volume fraction		
2	Clad	18997.6	7.98	151600.95	0.113091		
3	Mox	22821.5	10.02	228670.99	0.135854		
4	End Cap	5067.46	7.98	40438.348	0.030166		
5	Insulator	1072.46	10.42	11175.006	0.006384		
6	Indent	7479.75	7.9	59090.025	0.044526		
7	basket	48466.9	7.98	386765.68	0.28852		
8	canister	64079	7.98	511350.34	0.381458		
9	Dry Volume	**167985**		1389091.3			
10							
11							
12							
13							
14				total Mass should not exceed 3400kg			

	A	B	C	D	E	F	G	H
1	0%	of the HLW mixt with DOE SNF		water fraction	0%			
2	Isotope	Fuel	Clay	Mixt	Water			
3	MCNP ID	at/density	at/density	at/density	1	g/cc		
4	64000.35c	1.7634E-04	1.8979E-06	1.7634E-04				
5	1001.50c (H)	0.0000E+00	6.1256E-03	0.0000E+00	0.066871842			
6	6000.50c (C)	2.0787E-04	1.8979E-07	2.0787E-04				
7	25055.50c (Mn)	1.4998E-03	6.7793E-04	1.4998E-03				
8	15031.50c (P)	5.9856E-05		5.9856E-05				
9	16032.50c (S)	3.8658E-05		3.8658E-05				
10	14000.50c (Si)	1.1002E-03	1.1286E-02	1.1002E-03				
11	24000.50c (Cr)	1.3551E-02	0.0000E+00	1.3551E-02				
12	28000.50c (Ni)	8.3488E-03	2.0877E-04	8.3488E-03				
13	42000.50c (Mo)	1.0184E-03		1.0184E-03				
14	7014.50c (N)	2.9421E-04		2.9421E-04				
15	26000.55c (Fe)	4.8426E-02	1.7881E-02	4.8426E-02				
16	29000.50C (Cu)	0.0000E+00	1.1672E-05	0.0000E+00				
17	8016.50C (O)	7.8893E-02	5.6746E-02	7.8893E-02	0.033435921			
18	92235.50C (U235)	5.6707E-06		5.6707E-06				
19	92238.50C (U238)	2.4207E-03		2.4207E-03				
20	94239.55C (Pu239)	6.6568E-04		6.6568E-04				
21	94240.50C (Pu240)	8.8275E-05		8.8275E-05				
22	94241.50C (Pu241)	7.7195E-06		7.7195E-06				
23	11023.50c (Na)		7.2215E-05	0.0000E+00				
24	13027.50c (Al)		1.0812E-03	0.0000E+00				
25	20000.50c (Ca)		2.6210E-04	0.0000E+00				
26	19000.50c (K)		3.6743E-04	0.0000E+00				
27	22000.50c (Ti)		1.7261E-04	0.0000E+00				
28	total	1.5680E-01	9.4895E-02	1.5680E-01	1.0031E-01			
29	volume	167984.6046	6145900	1.6798E+05	6502497.723			
30	TOTAL Mixt+ clay	6313884.605				H/X Fuel	H/X mixt	
31	TOTAL Mixt+ clay+water	12816382.33				0	0.0000E+00	
32								
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
34	Fuel layer	12816382.33	461.7	94	7.40275249	167984.6046	-86.59724751	
35	Clay layer		461.7	94	92.91348971	6313884.605	-1.086510293	
36	water layer		461.7	94	188	12816382.33	94	
37								
38								
39								
40								

	A	B	C	D	E	F	G	H
41								
42	10%	of the HLW mixt with DOE SNF		water fraction	0%			
43	Isotope	Fuel	Clay	Mixt	Water			
44	MCNP ID	at/density	at/density	at/density	1	g/cc		
45	64000.35c	1.7634E-04	1.8979E-06	3.9344E-05				
46	1001.50c (H)	0.0000E+00	6.1256E-03	4.8107E-03	0.066871842			
47	6000.50c (C)	2.0787E-04	1.8979E-07	4.4770E-05				
48	25055.50c (Mn)	1.4998E-03	6.7793E-04	8.5436E-04				
49	15031.50c (P)	5.9856E-05		1.2848E-05				
50	16032.50c (S)	3.8658E-05		8.2981E-06				
51	14000.50c (Si)	1.1002E-03	1.1286E-02	9.0994E-03				
52	24000.50c (Cr)	1.3551E-02	0.0000E+00	2.9089E-03				
53	28000.50c (Ni)	8.3488E-03	2.0877E-04	1.9561E-03				
54	42000.50c (Mo)	1.0184E-03		2.1860E-04				
55	7014.50c (N)	2.9421E-04		6.3155E-05				
56	26000.55c (Fe)	4.8426E-02	1.7881E-02	2.4438E-02				
57	29000.50C (Cu)		1.1672E-05	9.1666E-06				
58	8016.50C (O)	7.8893E-02	5.6746E-02	6.1500E-02	0.033435921			
59	92235.50C (U235)	5.6707E-06		1.2172E-06				
60	92238.50C (U238)	2.4207E-03		5.1961E-04				
61	94239.55C (Pu239)	6.6568E-04		1.4289E-04				
62	94240.50C (Pu240)	8.8275E-05		1.8949E-05				
63	94241.50C (Pu241)	7.7195E-06		1.6570E-06				
64	11023.50c (Na)		7.2215E-05	5.6714E-05				
65	13027.50c (Al)		1.0812E-03	8.4914E-04				
66	20000.50c (Ca)		2.6210E-04	2.0584E-04				
67	19000.50c (K)		3.6743E-04	2.8856E-04				
68	22000.50c (Ti)		1.7261E-04	1.3556E-04				
69	total	1.5680E-01	9.4895E-02	1.0818E-01	1.0031E-01			
70	volume	167984.6046	5531310	7.8257E+05	6502497.723			
71	TOTAL Mixt+ clay	6313884.605				H/X Fuel	H/X mixt	
72	TOTAL Mixt+ clay+water	12816382.33		6.1459E+06	5.3633E+06	0	0.6	
73								
74	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
75	Fuel layer	12816382.33	461.7	94	20.96481586	782570	-73.03518414	
76	Clay layer		461.7	94	92.91348971	6313884.605	-1.086510293	
77	water layer		461.7	94	188	12816382.33	94	
78								
79								
80								

	A	B	C	D	E	F	G	H
81								
82								
83	20%	of the HLW mixt with DOE SNF		water fraction	0%			
84	Isotope	Fuel	Clay	Mixt	Water			
85	MCNP ID	at/density	at/density	at/density	1	g/cc		
86	64000.35c	1.7634E-04	1.8979E-06	2.2872E-05				
87	1001.50c (H)	0.0000E+00	6.1256E-03	5.3891E-03	0.066871842			
88	6000.50c (C)	2.0787E-04	1.8979E-07	2.5160E-05				
89	25055.50c (Mn)	1.4998E-03	6.7793E-04	7.7675E-04				
90	15031.50c (P)	5.9856E-05		7.1966E-06				
91	16032.50c (S)	3.8658E-05		4.6479E-06				
92	14000.50c (Si)	1.1002E-03	1.1286E-02	1.0061E-02				
93	24000.50c (Cr)	1.3551E-02	0.0000E+00	1.6293E-03				
94	28000.50c (Ni)	8.3488E-03	2.0877E-04	1.1875E-03				
95	42000.50c (Mo)	1.0184E-03		1.2244E-04				
96	7014.50c (N)	2.9421E-04		3.5374E-05				
97	26000.55c (Fe)	4.8426E-02	1.7881E-02	2.1553E-02				
98	29000.50C (Cu)		1.1672E-05	1.0269E-05				
99	8016.50C (O)	7.8893E-02	5.6746E-02	5.9409E-02	0.033435921			
100	92235.50C (U235)	5.6707E-06		6.8180E-07				
101	92238.50C (U238)	2.4207E-03		2.9104E-04				
102	94239.55C (Pu239)	6.6568E-04		8.0036E-05				
103	94240.50C (Pu240)	8.8275E-05		1.0614E-05				
104	94241.50C (Pu241)	7.7195E-06		9.2814E-07				
105	11023.50c (Na)		7.2215E-05	6.3532E-05				
106	13027.50c (Al)		1.0812E-03	9.5123E-04				
107	20000.50c (Ca)		2.6210E-04	2.3059E-04				
108	19000.50c (K)		3.6743E-04	3.2326E-04				
109	22000.50c (Ti)		1.7261E-04	1.5186E-04				
110	total	1.5680E-01	9.4895E-02	1.0234E-01	1.0031E-01			
111	volume	167984.6046	4916720	1.3972E+06	6502497.723			
112	TOTAL Mixt+ clay	6313884.605				H/X Fuel	H/X mixt	
113	TOTAL Mixt+ clay+water	12816382.33		6.1459E+06		0	6.3262E-01	
114								
115	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
116	Fuel layer	12816382.33	461.7	94	31.22741776	1397200	-62.77258224	
117	Clay layer		461.7	94	92.91348971	6313884.605	-1.086510293	
118	water layer		461.7	94	188	12816382.33	94	
119								
120								

	A	B	C	D	E	F	G	H
121								
122								
123								
124	30%	of the HLW mixt with DOE SNF		water fraction	0%		mixt w/o gd	
125	Isotope	Fuel	Clay	Mixt	Water			
126	MCNP ID	at/density	at/density	at/density	1	g/cc		
127	64000.35c	1.7634E-04	1.8979E-06	1.6464E-05			0	
128	1001.50c (H)	0.0000E+00	6.1256E-03	5.6141E-03	0.066871842		0.00561406	
129	6000.50c (C)	2.0787E-04	1.8979E-07	1.7531E-05			1.75314E-05	
130	25055.50c (Mn)	1.4998E-03	6.7793E-04	7.4656E-04			0.000746559	
131	15031.50c (P)	5.9856E-05		4.9980E-06			4.99804E-06	
132	16032.50c (S)	3.8658E-05		3.2280E-06			3.22799E-06	
133	14000.50c (Si)	1.1002E-03	1.1286E-02	1.0435E-02			0.010435317	
134	24000.50c (Cr)	1.3551E-02	0.0000E+00	1.1316E-03			0.001131564	
135	28000.50c (Ni)	8.3488E-03	2.0877E-04	8.8847E-04			0.000888474	
136	42000.50c (Mo)	1.0184E-03		8.5035E-05			8.50349E-05	
137	7014.50c (N)	2.9421E-04		2.4567E-05			2.45673E-05	
138	26000.55c (Fe)	4.8426E-02	1.7881E-02	2.0431E-02			0.020431454	
139	29000.50C (Cu)		1.1672E-05	1.0697E-05			1.06974E-05	
140	8016.50C (O)	7.8893E-02	5.6746E-02	5.8596E-02	0.033435921		0.058595649	
141	92235.50C (U235)	5.6707E-06		4.7351E-07			4.73511E-07	
142	92238.50C (U238)	2.4207E-03		2.0213E-04			0.000202129	
143	94239.55C (Pu239)	6.6568E-04		5.5585E-05			5.55849E-05	
144	94240.50C (Pu240)	8.8275E-05		7.3711E-06			7.37108E-06	
145	94241.50C (Pu241)	7.7195E-06		6.4459E-07			6.44594E-07	
146	11023.50c (Na)		7.2215E-05	6.6185E-05			6.61849E-05	
147	13027.50c (Al)		1.0812E-03	9.9095E-04			0.000990947	
148	20000.50c (Ca)		2.6210E-04	2.4021E-04			0.000240214	
149	19000.50c (K)		3.6743E-04	3.3675E-04			0.000336751	
150	22000.50c (Ti)		1.7261E-04	1.5820E-04			0.0001582	
151	total	1.5680E-01	9.4895E-02	1.0006E-01	1.0031E-01		1.0005E-01	
152	volume	167984.6046	4302130	2.0118E+06	6502497.723			
153	TOTAL Mixt+ clay	6313884.605				H/X Fuel	H/X mixt	
154	TOTAL Mixt+ clay+water	12816382.33		6.1459E+06		0	6.5903E-01	
155								
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
157	Fuel layer	12816382.33	461.7	94	40.25890774	2011800	-53.74109226	
158	Clay layer		461.7	94	92.91348971	6313884.605	-1.086510293	
159	water layer		461.7	94	188	12816382.33	94	
160								

	A	B	C	D	E	F	G	H
161								
162								
163								
164								
165								
166								
167								
168								
169							Mass of Gd (g)	
170	1.0000E-01	of the HLW mixt with DOE SNF					water fraction	3.0000E-01
171	Isotope	Fuel	Fuel	Fuel		Clay	Mixt	Water
172	MCNP ID	at/density	w/o gd	w/o gd or fe		at/density	at/density	1.0000E+00
173	64000.35c	1.2344E-04	0.0000E+00	0.0000E+00		1.3285E-06	2.7541E-05	
174	1001.50c (H)	2.0062E-02	2.0062E-02	2.0062E-02		2.4349E-02	2.3429E-02	6.6872E-02
175	6000.50c (C)	1.4551E-04	1.4551E-04	1.4551E-04		1.3285E-07	3.1339E-05	
176	25055.50c (Mn)	1.0499E-03	1.0499E-03	1.0499E-03		4.7455E-04	5.9805E-04	
177	15031.50c (P)	4.1899E-05	4.1899E-05	4.1899E-05		0.0000E+00	8.9939E-06	
178	16032.50c (S)	2.7060E-05	2.7060E-05	2.7060E-05		0.0000E+00	5.8087E-06	
179	14000.50c (Si)	7.7012E-04	7.7012E-04	7.7012E-04		7.9001E-03	6.3696E-03	
180	24000.50c (Cr)	9.4860E-03	9.4860E-03	9.4860E-03		0.0000E+00	2.0362E-03	
181	28000.50c (Ni)	5.8442E-03	5.8442E-03	5.8442E-03		1.4614E-04	1.3693E-03	
182	42000.50c (Mo)	7.1285E-04	7.1285E-04	7.1285E-04		0.0000E+00	1.5302E-04	
183	7014.50c (N)	2.0595E-04	2.0595E-04	2.0595E-04		0.0000E+00	4.4208E-05	
184	26000.55c (Fe)	3.3898E-02	3.3898E-02	0.0000E+00		1.2517E-02	1.7106E-02	
185	29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00		8.1704E-06	6.4166E-06	
186	8016.50C (O)	6.5256E-02	6.5256E-02	1.4409E-02		4.9753E-02	5.3081E-02	3.3436E-02
187	92235.50C (U235)	3.9695E-06	3.9695E-06	3.9695E-06			8.5207E-07	
188	92238.50C (U238)	1.6945E-03	1.6945E-03	1.6945E-03			3.6373E-04	
189	94239.55C (Pu239)	4.6597E-04	4.6597E-04	4.6597E-04			1.0002E-04	
190	94240.50C (Pu240)	6.1792E-05	6.1792E-05	6.1792E-05			1.3264E-05	
191	94241.50C (Pu241)	5.4037E-06	5.4037E-06	5.4037E-06			1.1599E-06	
192	11023.50c (Na)					5.0550E-05	3.9699E-05	
193	13027.50c (Al)					7.5686E-04	5.9440E-04	
194	20000.50c (Ca)					1.8347E-04	1.4409E-04	
195	19000.50c (K)					2.5720E-04	2.0199E-04	
196	22000.50c (Ti)					1.2083E-04	9.4893E-05	
197	total	1.3985E-01	1.3973E-01	5.4985E-02		9.6519E-02	1.0582E-01	1.0031E-01
198	volume	2.3998E+05	2.3998E+05	2.3998E+05		7.9019E+06	1.1180E+06	3.7965E+06
199	TOTAL Mixt+ clay	9.0198E+06						
200	TOTAL Mixt+ clay+water	1.2816E+07						

	A	B	C	D	E	F	G	H
201								
202	SNF in the middle	Volume				Length	Radius	Height of the segment
203	Fuel layer	1.2816E+07				4.6170E+02	9.4000E+01	2.6773E+01
204	Clay layer					4.6170E+02	9.4000E+01	1.2464E+02
205	water layer					4.6170E+02	9.4000E+01	1.8800E+02
206								
207								
208								
209	0.0000%	of the HLW mixt with DOE SNF		water fraction	50.7358%	mixt w/o Gd Fe	mixt w/o Gd	
210	Isotope	Fuel				Clay	Mixt	Water
211	MCNP ID	at/density				at/density	at/density	1.0000E+00
212	64000.35c	8.6874E-05	0.0000E+00	0.0000E+00		9.3498E-07	8.6874E-05	
213	1001.50c (H)	3.3928E-02	3.3928E-02	3.3928E-02		3.6946E-02	3.3928E-02	6.6872E-02
214	6000.50c (C)	1.0241E-04	1.0241E-04	1.0241E-04		9.3498E-08	1.0241E-04	
215	25055.50c (Mn)	7.3888E-04	7.3888E-04	7.3888E-04		3.3398E-04	7.3888E-04	
216	15031.50c (P)	2.9487E-05	2.9487E-05	2.9487E-05		0.0000E+00	2.9487E-05	
217	16032.50c (S)	1.9044E-05	1.9044E-05	1.9044E-05		0.0000E+00	1.9044E-05	
218	14000.50c (Si)	5.4199E-04	5.4199E-04	5.4199E-04		5.5599E-03	5.4199E-04	
219	24000.50c (Cr)	6.6760E-03	6.6760E-03	6.6760E-03		0.0000E+00	6.6760E-03	
220	28000.50c (Ni)	4.1130E-03	4.1130E-03	4.1130E-03		1.0285E-04	4.1130E-03	
221	42000.50c (Mo)	5.0169E-04	5.0169E-04	5.0169E-04		0.0000E+00	5.0169E-04	
222	7014.50c (N)	1.4494E-04	1.4494E-04	1.4494E-04		0.0000E+00	1.4494E-04	
223	26000.55c (Fe)	2.3856E-02	2.3856E-02	0.0000E+00		8.8089E-03	2.3856E-02	
224	29000.50C (Cu)	0.0000E+00	0.0000E+00	0.0000E+00		5.7501E-06	0.0000E+00	
225	8016.50C (O)	5.5830E-02	5.5830E-02	2.0045E-02		4.4920E-02	5.5830E-02	3.3436E-02
226	92235.50C (U235)	2.7936E-06	2.7936E-06	2.7936E-06			2.7936E-06	
227	92238.50C (U238)	1.1925E-03	1.1925E-03	1.1925E-03			1.1925E-03	
228	94239.55C (Pu239)	3.2794E-04	3.2794E-04	3.2794E-04			3.2794E-04	
229	94240.50C (Pu240)	4.3488E-05	4.3488E-05	4.3488E-05			4.3488E-05	
230	94241.50C (Pu241)	3.8030E-06	3.8030E-06	3.8030E-06			3.8030E-06	
231	11023.50c (Na)					3.5576E-05	0.0000E+00	
232	13027.50c (Al)					5.3266E-04	0.0000E+00	
233	20000.50c (Ca)					1.2912E-04	0.0000E+00	
234	19000.50c (K)					1.8101E-04	0.0000E+00	
235	22000.50c (Ti)					8.5037E-05	0.0000E+00	
236	total	1.2814E-01	1.2805E-01	6.8411E-02		9.7641E-02	1.2814E-01	1.0031E-01
237	volume	3.4099E+05	3.4099E+05	3.4099E+05		1.2475E+07	3.4099E+05	-3.5577E-07
238	TOTAL Mixt+ clay	1.2816E+07						
239	TOTAL Mixt+ clay+water	1.2816E+07						
240								

	I	J	K	L	M	N	O	P
1	0.0000%	of the HLW mixt with DOE SNF		water fraction	10.0000%			
2	Isotope	Fuel	Clay	Mixt	Water			
3	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
4	64000.35c	1.5871E-04	1.7081E-06	1.5871E-04				
5	1001.50c (H)	6.6872E-03	1.2200E-02	6.6872E-03	6.6872E-02			
6	6000.50c (C)	1.8708E-04	1.7081E-07	1.8708E-04				
7	25055.50c (Mn)	1.3499E-03	6.1014E-04	1.3499E-03				
8	15031.50c (P)	5.3870E-05	0.0000E+00	5.3870E-05				
9	16032.50c (S)	3.4792E-05	0.0000E+00	3.4792E-05				
10	14000.50c (Si)	9.9015E-04	1.0157E-02	9.9015E-04				
11	24000.50c (Cr)	1.2196E-02	0.0000E+00	1.2196E-02				
12	28000.50c (Ni)	7.5139E-03	1.8789E-04	7.5139E-03				
13	42000.50c (Mo)	9.1653E-04	0.0000E+00	9.1653E-04				
14	7014.50c (N)	2.6479E-04	0.0000E+00	2.6479E-04				
15	26000.55c (Fe)	4.3583E-02	1.6093E-02	4.3583E-02				
16	29000.50C (Cu)	0.0000E+00	1.0505E-05	0.0000E+00				
17	8016.50C (O)	7.4347E-02	5.4415E-02	7.4347E-02	3.3436E-02			
18	92235.50C (U235)	5.1036E-06		5.1036E-06				
19	92238.50C (U238)	2.1786E-03		2.1786E-03				
20	94239.55C (Pu239)	5.9911E-04		5.9911E-04				
21	94240.50C (Pu240)	7.9447E-05		7.9447E-05				
22	94241.50C (Pu241)	6.9476E-06		6.9476E-06				
23	11023.50c (Na)		6.4993E-05	0.0000E+00				
24	13027.50c (Al)		9.7311E-04	0.0000E+00				
25	20000.50c (Ca)		2.3589E-04	0.0000E+00				
26	19000.50c (K)		3.3069E-04	0.0000E+00				
27	22000.50c (Ti)		1.5535E-04	0.0000E+00				
28	total	1.5115E-01	9.5436E-02	1.5115E-01	1.0031E-01			
29	volume	1.8665E+05	6.8288E+06	1.8665E+05	5.8010E+06			
30	TOTAL Mixt+ clay	7.0154E+06				H/X Fuel	H/X mixt	
31	TOTAL Mixt+ clay+water	1.2816E+07				11.06762035	7.8500E-01	
32								
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
34	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	7.9462E+00	1.8665E+05	-86.05384749	
35	Clay layer		4.6170E+02	9.4000E+01	1.0100E+02	7.0154E+06	7.002006452	
36	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
37								
38								
39								
40								

	I	J	K	L	M	N	O	P
41								
42	10.0000%	of the HLW mixt with DOE SNF		water fraction	10.0000%			
43	Isotope	Fuel	Clay	Mixt	Water			
44	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
45	64000.35c	1.5871E-04	1.7081E-06	3.5409E-05				
46	1001.50c (H)	6.6872E-03	1.2200E-02	1.1017E-02	6.6872E-02			
47	6000.50c (C)	1.8708E-04	1.7081E-07	4.0293E-05				
48	25055.50c (Mn)	1.3499E-03	6.1014E-04	7.6892E-04				
49	15031.50c (P)	5.3870E-05		1.1564E-05				
50	16032.50c (S)	3.4792E-05		7.4683E-06				
51	14000.50c (Si)	9.9015E-04	1.0157E-02	8.1895E-03				
52	24000.50c (Cr)	1.2196E-02		2.6180E-03				
53	28000.50c (Ni)	7.5139E-03	1.8789E-04	1.7605E-03				
54	42000.50c (Mo)	9.1653E-04		1.9674E-04				
55	7014.50c (N)	2.6479E-04		5.6839E-05				
56	26000.55c (Fe)	4.3583E-02	1.6093E-02	2.1994E-02				
57	29000.50C (Cu)	0.0000E+00	1.0505E-05	8.2499E-06				
58	8016.50C (O)	7.4347E-02	5.4415E-02	5.8694E-02	3.3436E-02			
59	92235.50C (U235)	5.1036E-06		1.0955E-06				
60	92238.50C (U238)	2.1786E-03		4.6765E-04				
61	94239.55C (Pu239)	5.9911E-04		1.2860E-04				
62	94240.50C (Pu240)	7.9447E-05		1.7054E-05				
63	94241.50C (Pu241)	6.9476E-06		1.4913E-06				
64	11023.50c (Na)		6.4993E-05	5.1042E-05				
65	13027.50c (Al)		9.7311E-04	7.6422E-04				
66	20000.50c (Ca)		2.3589E-04	1.8525E-04				
67	19000.50c (K)		3.3069E-04	2.5970E-04				
68	22000.50c (Ti)		1.5535E-04	1.2200E-04				
69	total	1.5115E-01	9.5436E-02	1.0740E-01	1.0031E-01			
70	volume	1.8665E+05	6.1459E+06	8.6953E+05	5.8010E+06			
71	TOTAL Mixt+ clay	7.0154E+06				H/X Fuel	H/X mixt	
72	TOTAL Mixt+ clay+water	1.2816E+07				11.06762035	1.2932E+00	
73								
74	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
75	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	2.2531E+01	8.6953E+05	-71.46891283	
76	Clay layer		4.6170E+02	9.4000E+01	1.0100E+02	7.0154E+06	7.002006452	
77	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
78								
79								
80								

	I	J	K	L	M	N	O	P
81								
82								
83	**20.0000%**	**of the HLW mixt with DOE SNF**		**water fraction**	**10.0000%**			
84	**Isotope**	**Fuel**	**Clay**	**Mixt**	**Water**			
85	**MCNP ID**	**at/density**	**at/density**	**at/density**	**1.0000E+00**	**g/cc**		
86	64000.35c	1.5871E-04	1.7081E-06	2.0585E-05				
87	1001.50c (H)	6.6872E-03	1.2200E-02	1.1537E-02	6.6872E-02			
88	6000.50c (C)	1.8708E-04	1.7081E-07	2.2644E-05				
89	25055.50c (Mn)	1.3499E-03	6.1014E-04	6.9907E-04				
90	15031.50c (P)	5.3870E-05		6.4769E-06				
91	16032.50c (S)	3.4792E-05		4.1831E-06				
92	14000.50c (Si)	9.9015E-04	1.0157E-02	9.0551E-03				
93	24000.50c (Cr)	1.2196E-02		1.4664E-03				
94	28000.50c (Ni)	7.5139E-03	1.8789E-04	1.0687E-03				
95	42000.50c (Mo)	9.1653E-04		1.1020E-04				
96	7014.50c (N)	2.6479E-04		3.1837E-05				
97	26000.55c (Fe)	4.3583E-02	1.6093E-02	1.9398E-02				
98	29000.50C (Cu)	0.0000E+00	1.0505E-05	9.2418E-06				
99	8016.50C (O)	7.4347E-02	5.4415E-02	5.6812E-02	3.3436E-02			
100	92235.50C (U235)	5.1036E-06		6.1362E-07				
101	92238.50C (U238)	2.1786E-03		2.6194E-04				
102	94239.55C (Pu239)	5.9911E-04		7.2032E-05				
103	94240.50C (Pu240)	7.9447E-05		9.5522E-06				
104	94241.50C (Pu241)	6.9476E-06		8.3533E-07				
105	11023.50c (Na)		6.4993E-05	5.7179E-05				
106	13027.50c (Al)		9.7311E-04	8.5611E-04				
107	20000.50c (Ca)		2.3589E-04	2.0753E-04				
108	19000.50c (K)		3.3069E-04	2.9093E-04				
109	22000.50c (Ti)		1.5535E-04	1.3667E-04				
110	total	1.5115E-01	9.5436E-02	1.0213E-01	1.0031E-01			
111	volume	1.8665E+05	5463022.222	1.5524E+06	5.8010E+06			
112	TOTAL Mixt+ clay	7.0154E+06				H/X Fuel	H/X mixt	
113	TOTAL Mixt+ clay+water	1.2816E+07				11.06762035	1.3544E+00	
114								
115	**SNF in the middle**	**Volume**	**Length**	**Radius**	**Height of the segment**	**Cylinder Segment Volume**	**x value**	
116	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	3.3594E+01	1.5524E+06	-60.40556289	
117	Clay layer		4.6170E+02	9.4000E+01	1.0100E+02	7.0154E+06	7.002006452	
118	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
119								
120								

	I	J	K	L	M	N	O	P
121								
122								
123								
124	30.0000%	of the HLW mixt with DOE SNF		water fraction	10.0000%			
125	Isotope	Fuel	Clay	Mixt	Water			
126	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
127	64000.35c	1.5871E-04	1.7081E-06	1.4818E-05				
128	1001.50c (H)	6.6872E-03	1.2200E-02	1.1740E-02	6.6872E-02			
129	6000.50c (C)	1.8708E-04	1.7081E-07	1.5778E-05				
130	25055.50c (Mn)	1.3499E-03	6.1014E-04	6.7190E-04				
131	15031.50c (P)	5.3870E-05		4.4982E-06				
132	16032.50c (S)	3.4792E-05		2.9052E-06				
133	14000.50c (Si)	9.9015E-04	1.0157E-02	9.3918E-03				
134	24000.50c (Cr)	1.2196E-02		1.0184E-03				
135	28000.50c (Ni)	7.5139E-03	1.8789E-04	7.9963E-04				
136	42000.50c (Mo)	9.1653E-04		7.6531E-05				
137	7014.50c (N)	2.6479E-04		2.2111E-05				
138	26000.55c (Fe)	4.3583E-02	1.6093E-02	1.8388E-02				
139	29000.50C (Cu)	0.0000E+00	1.0505E-05	9.6277E-06				
140	8016.50C (O)	7.4347E-02	5.4415E-02	5.6080E-02	3.3436E-02			
141	92235.50C (U235)	5.1036E-06		4.2616E-07				
142	92238.50C (U238)	2.1786E-03		1.8192E-04				
143	94239.55C (Pu239)	5.9911E-04		5.0026E-05				
144	94240.50C (Pu240)	7.9447E-05		6.6340E-06				
145	94241.50C (Pu241)	6.9476E-06		5.8013E-07				
146	11023.50c (Na)		6.4993E-05	5.9566E-05				
147	13027.50c (Al)		9.7311E-04	8.9185E-04				
148	20000.50c (Ca)		2.3589E-04	2.1619E-04				
149	19000.50c (K)		3.3069E-04	3.0308E-04				
150	22000.50c (Ti)		1.5535E-04	1.4238E-04				
151	total	1.5115E-01	9.5436E-02	1.0009E-01	1.0031E-01			
152	volume	1.8665E+05	4780144.444	2.2353E+06	5.8010E+06			
153	TOTAL Mixt+ clay	7.0154E+06				H/X Fuel	H/X mixt	
154	TOTAL Mixt+ clay+water	1.2816E+07				11.06762035	1.3781E+00	
155								
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
157	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	4.3355E+01	2.2353E+06	-50.6448087	
158	Clay layer		4.6170E+02	9.4000E+01	1.0100E+02	7.0154E+06	7.002006452	
159	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
160								

	I	J	K	L	M	N	O	P
161								
162								
163								
164								
165								
166								
167								
168								
169	304.5844414	304.5844414						
170		**Mixt With**	**Mixt with**					
171	Mixt w/o fegd	no	0.0000E+00					
172	g/cc	g of gd	g of gd					
173	1.0434E-06	1.0434E-06						
174	2.3429E-02	2.3429E-02						
175	3.1339E-05	3.1339E-05						
176	5.9805E-04	5.9805E-04						
177	8.9939E-06	8.9939E-06						
178	5.8087E-06	5.8087E-06						
179	6.3696E-03	6.3696E-03						
180	2.0362E-03	2.0362E-03						
181	1.3693E-03	1.3693E-03						
182	1.5302E-04	1.5302E-04						
183	4.4209E-05	4.4208E-05						
184	9.8299E-03	1.7106E-02						
185	6.4166E-06	6.4166E-06						
186	4.2166E-02	5.3081E-02						
187	8.5208E-07	8.5207E-07						
188	3.6373E-04	3.6373E-04						
189	1.0002E-04	1.0002E-04						
190	1.3264E-05	1.3264E-05						
191	1.1599E-06	1.1599E-06						
192	3.9699E-05	3.9699E-05						
193	5.9440E-04	5.9440E-04						
194	1.4409E-04	1.4409E-04						
195	2.0199E-04	2.0199E-04						
196	9.4893E-05	9.4893E-05						
197	8.0134E-02	1.0579E-01						
198	1.1180E+06	1.1180E+06						
199								
200								

	I	J	K	L	M	N	O	P
201								
202	Cylinder Segment Volume	x value						
203	1.1180E+06	-6.7227E+01						
204	9.0198E+06	3.0639E+01						
205	1.2816E+07	9.4000E+01						
206								
207								
208	=							
209		**Mixt With**						
210	Mixt w/o fegd	no						
211	g/cc	g of gd						
212	0.0000E+00	0.0000E+00						
213	3.3928E-02	3.3928E-02						
214	1.0241E-04	1.0241E-04						
215	7.3888E-04	7.3888E-04						
216	2.9487E-05	2.9487E-05						
217	1.9044E-05	1.9044E-05						
218	5.4199E-04	5.4199E-04						
219	6.6760E-03	6.6760E-03						
220	4.1130E-03	4.1130E-03						
221	5.0169E-04	5.0169E-04						
222	1.4494E-04	1.4494E-04						
223	0.0000E+00	2.3856E-02						
224	0.0000E+00	0.0000E+00						
225	2.0045E-02	5.5830E-02						
226	2.7936E-06	2.7936E-06						
227	1.1925E-03	1.1925E-03						
228	3.2794E-04	3.2794E-04						
229	4.3488E-05	4.3488E-05						
230	3.8030E-06	3.8030E-06						
231	0.0000E+00	0.0000E+00						
232	0.0000E+00	0.0000E+00						
233	0.0000E+00	0.0000E+00						
234	0.0000E+00	0.0000E+00						
235	0.0000E+00	0.0000E+00						
236	8.0134E-02	1.0579E-01						
237	3.4099E+05	3.4099E+05						
238								
239								
240								

	Q	R	S	T	U	V	W	X
1	0.0000%	of the HLW mixt with DOE SNF		water fraction	20.0000%			
2	Isotope	Fuel	Clay	Mixt	Water			
3	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
4	64000.35c	1.4107E-04	1.5183E-06	1.4107E-04				
5	1001.50c (H)	1.3374E-02	1.8275E-02	1.3374E-02	6.6872E-02			
6	6000.50c (C)	1.6630E-04	1.5183E-07	1.6630E-04				
7	25055.50c (Mn)	1.1999E-03	5.4234E-04	1.1999E-03				
8	15031.50c (P)	4.7885E-05	0.0000E+00	4.7885E-05				
9	16032.50c (S)	3.0926E-05	0.0000E+00	3.0926E-05				
10	14000.50c (Si)	8.8013E-04	9.0287E-03	8.8013E-04				
11	24000.50c (Cr)	1.0841E-02	0.0000E+00	1.0841E-02				
12	28000.50c (Ni)	6.6790E-03	1.6701E-04	6.6790E-03				
13	42000.50c (Mo)	8.1469E-04	0.0000E+00	8.1469E-04				
14	7014.50c (N)	2.3537E-04	0.0000E+00	2.3537E-04				
15	26000.55c (Fe)	3.8740E-02	1.4305E-02	3.8740E-02				
16	29000.50C (Cu)	0.0000E+00	9.3376E-06	0.0000E+00				
17	8016.50C (O)	6.9801E-02	5.2084E-02	6.9801E-02	3.3436E-02			
18	92235.50C (U235)	4.5365E-06		4.5365E-06				
19	92238.50C (U238)	1.9365E-03		1.9365E-03				
20	94239.55C (Pu239)	5.3254E-04		5.3254E-04				
21	94240.50C (Pu240)	7.0620E-05		7.0620E-05				
22	94241.50C (Pu241)	6.1756E-06		6.1756E-06				
23	11023.50c (Na)		5.7772E-05	0.0000E+00				
24	13027.50c (Al)		8.6498E-04	0.0000E+00				
25	20000.50c (Ca)		2.0968E-04	0.0000E+00				
26	19000.50c (K)		2.9395E-04	0.0000E+00				
27	22000.50c (Ti)		1.3809E-04	0.0000E+00				
28	total	1.4550E-01	9.5977E-02	1.4550E-01	1.0031E-01			
29	volume	2.0998E+05	7.6824E+06	2.0998E+05	4.9240E+06			
30	TOTAL Mixt+ clay	7.8924E+06				H/X Fuel	H/X mixt	
31	TOTAL Mixt+ clay+water	1.2816E+07				24.90214578	1.5700E+00	
32								
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
34	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	8.6014E+00	2.0998E+05	-85.39861044	
35	Clay layer		4.6170E+02	9.4000E+01	1.1120E+02	7.8924E+06	17.19565293	
36	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
37								
38								
39								
40								

	Q	R	S	T	U	V	W	X
41								
42	10.0000%	of the HLW mixt with DOE SNF		water fraction	20.0000%			
43	Isotope	Fuel	Clay	Mixt	Water			
44	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
45	64000.35c	1.4107E-04	1.5183E-06	3.1475E-05				
46	1001.50c (H)	1.3374E-02	1.8275E-02	1.7223E-02	6.6872E-02			
47	6000.50c (C)	1.6630E-04	1.5183E-07	3.5816E-05				
48	25055.50c (Mn)	1.1999E-03	5.4234E-04	6.8348E-04				
49	15031.50c (P)	4.7885E-05		1.0279E-05				
50	16032.50c (S)	3.0926E-05		6.6385E-06				
51	14000.50c (Si)	8.8013E-04	9.0287E-03	7.2795E-03				
52	24000.50c (Cr)	1.0841E-02		2.3271E-03				
53	28000.50c (Ni)	6.6790E-03	1.6701E-04	1.5649E-03				
54	42000.50c (Mo)	8.1469E-04		1.7488E-04				
55	7014.50c (N)	2.3537E-04		5.0524E-05				
56	26000.55c (Fe)	3.8740E-02	1.4305E-02	1.9550E-02				
57	29000.50C (Cu)	0.0000E+00	9.3376E-06	7.3333E-06				
58	8016.50C (O)	6.9801E-02	5.2084E-02	5.5887E-02	3.3436E-02			
59	92235.50C (U235)	4.5365E-06		9.7380E-07				
60	92238.50C (U238)	1.9365E-03		4.1569E-04				
61	94239.55C (Pu239)	5.3254E-04		1.1431E-04				
62	94240.50C (Pu240)	7.0620E-05		1.5159E-05				
63	94241.50C (Pu241)	6.1756E-06		1.3256E-06				
64	11023.50c (Na)		5.7772E-05	4.5371E-05				
65	13027.50c (Al)		8.6498E-04	6.7931E-04				
66	20000.50c (Ca)		2.0968E-04	1.6467E-04				
67	19000.50c (K)		2.9395E-04	2.3085E-04				
68	22000.50c (Ti)		1.3809E-04	1.0845E-04				
69	total	1.4550E-01	9.5977E-02	1.0661E-01	1.0031E-01			
70	volume	2.0998E+05	6.9141E+06	9.7822E+05	4.9240E+06			
71	TOTAL Mixt+ clay	7.8924E+06				H/X Fuel	H/X mixt	
72	TOTAL Mixt+ clay+water	1.2816E+07				24.90214578	2.0218E+00	
73								
74	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
75	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	2.4425E+01	9.7822E+05	-69.57484865	
76	Clay layer		4.6170E+02	9.4000E+01	1.1120E+02	7.8924E+06	17.19565293	
77	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
78								
79								
80								

	Q	R	S	T	U	V	W	X
81								
82								
83	**20.0000%**	**of the HLW mixt with DOE SNF**		**water fraction**	**20.0000%**			
84	**Isotope**	**Fuel**	**Clay**	**Mixt**	**Water**			
85	**MCNP ID**	**at/density**	**at/density**	**at/density**	**1.0000E+00**	**g/cc**		
86	64000.35c	1.4107E-04	1.5183E-06	1.8298E-05				
87	1001.50c (H)	1.3374E-02	1.8275E-02	1.7686E-02	6.6872E-02			
88	6000.50c (C)	1.6630E-04	1.5183E-07	2.0128E-05				
89	25055.50c (Mn)	1.1999E-03	5.4234E-04	6.2140E-04				
90	15031.50c (P)	4.7885E-05		5.7573E-06				
91	16032.50c (S)	3.0926E-05		3.7183E-06				
92	14000.50c (Si)	8.8013E-04	9.0287E-03	8.0490E-03				
93	24000.50c (Cr)	1.0841E-02		1.3035E-03				
94	28000.50c (Ni)	6.6790E-03	1.6701E-04	9.4997E-04				
95	42000.50c (Mo)	8.1469E-04		9.7952E-05				
96	7014.50c (N)	2.3537E-04		2.8299E-05				
97	26000.55c (Fe)	3.8740E-02	1.4305E-02	1.7243E-02				
98	29000.50C (Cu)	0.0000E+00	9.3376E-06	8.2150E-06				
99	8016.50C (O)	6.9801E-02	5.2084E-02	5.4214E-02	3.3436E-02			
100	92235.50C (U235)	4.5365E-06		5.4544E-07				
101	92238.50C (U238)	1.9365E-03		2.3283E-04				
102	94239.55C (Pu239)	5.3254E-04		6.4029E-05				
103	94240.50C (Pu240)	7.0620E-05		8.4908E-06				
104	94241.50C (Pu241)	6.1756E-06		7.4251E-07				
105	11023.50c (Na)		5.7772E-05	5.0826E-05				
106	13027.50c (Al)		8.6498E-04	7.6099E-04				
107	20000.50c (Ca)		2.0968E-04	1.8447E-04				
108	19000.50c (K)		2.9395E-04	2.5860E-04				
109	22000.50c (Ti)		1.3809E-04	1.2149E-04				
110	total	1.4550E-01	9.5977E-02	1.0193E-01	1.0031E-01			
111	volume	2.0998E+05	6.1459E+06	1.7465E+06	4.9240E+06			
112	TOTAL Mixt+ clay	7.8924E+06				H/X Fuel	H/X mixt	
113	TOTAL Mixt+ clay+water	1.2816E+07				24.90214578	2.0761E+00	
114								
115	**SNF in the middle**	**Volume**	**Length**	**Radius**	**Height of the segment**	**Cylinder Segment Volume**	**x value**	
116	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	3.6466E+01	1.7465E+06	-57.53374597	
117	Clay layer		4.6170E+02	9.4000E+01	1.1120E+02	7.8924E+06	17.19565293	
118	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
119								
120								

	Q	R	S	T	U	V	W	X
121								
122								
123								
124	30.0000%	of the HLW mixt with DOE SNF		water fraction	20.0000%			
125	Isotope	Fuel	Clay	Mixt	Water			
126	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
127	64000.35c	1.4107E-04	1.5183E-06	1.3171E-05				
128	1001.50c (H)	1.3374E-02	1.8275E-02	1.7866E-02	6.6872E-02			
129	6000.50c (C)	1.6630E-04	1.5183E-07	1.4025E-05				
130	25055.50c (Mn)	1.1999E-03	5.4234E-04	5.9725E-04				
131	15031.50c (P)	4.7885E-05		3.9984E-06				
132	16032.50c (S)	3.0926E-05		2.5824E-06				
133	14000.50c (Si)	8.8013E-04	9.0287E-03	8.3483E-03				
134	24000.50c (Cr)	1.0841E-02		9.0525E-04				
135	28000.50c (Ni)	6.6790E-03	1.6701E-04	7.1078E-04				
136	42000.50c (Mo)	8.1469E-04		6.8028E-05				
137	7014.50c (N)	2.3537E-04		1.9654E-05				
138	26000.55c (Fe)	3.8740E-02	1.4305E-02	1.6345E-02				
139	29000.50C (Cu)	0.0000E+00	9.3376E-06	8.5579E-06				
140	8016.50C (O)	6.9801E-02	5.2084E-02	5.3564E-02	3.3436E-02			
141	92235.50C (U235)	4.5365E-06		3.7881E-07				
142	92238.50C (U238)	1.9365E-03		1.6170E-04				
143	94239.55C (Pu239)	5.3254E-04		4.4468E-05				
144	94240.50C (Pu240)	7.0620E-05		5.8969E-06				
145	94241.50C (Pu241)	6.1756E-06		5.1567E-07				
146	11023.50c (Na)		5.7772E-05	5.2948E-05				
147	13027.50c (Al)		8.6498E-04	7.9276E-04				
148	20000.50c (Ca)		2.0968E-04	1.9217E-04				
149	19000.50c (K)		2.9395E-04	2.6940E-04				
150	22000.50c (Ti)		1.3809E-04	1.2656E-04				
151	total	1.4550E-01	9.5977E-02	1.0011E-01	1.0031E-01			
152	volume	2.0998E+05	5.3777E+06	2.5147E+06	4.9240E+06			
153	TOTAL Mixt+ clay	7.8924E+06				H/X Fuel	H/X mixt	
154	TOTAL Mixt+ clay+water	1.2816E+07				24.90214578	2.0972E+00	
155								
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
157	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	4.7121E+01	2.5147E+06	-46.87921948	
158	Clay layer		4.6170E+02	9.4000E+01	1.1120E+02	7.8924E+06	17.19565293	
159	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
160								

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	Y	Z	AA	AB	AC	AD	AE	AF
1	0.0000%	of the HLW mixt with DOE SNF		water fraction	30.0000%			
2	Isotope	Fuel	Clay	Mixt	Water			
3	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
4	64000.35c	1.2344E-04	1.3285E-06	1.2344E-04				
5	1001.50c (H)	2.0062E-02	2.4349E-02	2.0062E-02	6.6872E-02			
6	6000.50c (C)	1.4551E-04	1.3285E-07	1.4551E-04				
7	25055.50c (Mn)	1.0499E-03	4.7455E-04	1.0499E-03				
8	15031.50c (P)	4.1899E-05	0.0000E+00	4.1899E-05				
9	16032.50c (S)	2.7060E-05	0.0000E+00	2.7060E-05				
10	14000.50c (Si)	7.7012E-04	7.9001E-03	7.7012E-04				
11	24000.50c (Cr)	9.4860E-03	0.0000E+00	9.4860E-03				
12	28000.50c (Ni)	5.8442E-03	1.4614E-04	5.8442E-03				
13	42000.50c (Mo)	7.1285E-04	0.0000E+00	7.1285E-04				
14	7014.50c (N)	2.0595E-04	0.0000E+00	2.0595E-04				
15	26000.55c (Fe)	3.3898E-02	1.2517E-02	3.3898E-02				
16	29000.50C (Cu)	0.0000E+00	8.1704E-06	0.0000E+00				
17	8016.50C (O)	6.5256E-02	4.9753E-02	6.5256E-02	3.3436E-02			
18	92235.50C (U235)	3.9695E-06		3.9695E-06				
19	92238.50C (U238)	1.6945E-03		1.6945E-03				
20	94239.55C (Pu239)	4.6597E-04		4.6597E-04				
21	94240.50C (Pu240)	6.1792E-05		6.1792E-05				
22	94241.50C (Pu241)	5.4037E-06		5.4037E-06				
23	11023.50c (Na)		5.0550E-05	0.0000E+00				
24	13027.50c (Al)		7.5686E-04	0.0000E+00				
25	20000.50c (Ca)		1.8347E-04	0.0000E+00				
26	19000.50c (K)		2.5720E-04	0.0000E+00				
27	22000.50c (Ti)		1.2083E-04	0.0000E+00				
28	total	1.3985E-01	9.6519E-02	1.3985E-01	1.0031E-01			
29	volume	2.3998E+05	8.7799E+06	2.3998E+05	3.7965E+06			
30	TOTAL Mixt+ clay	9.0198E+06				H/X Fuel	H/X mixt	
31	TOTAL Mixt+ clay+water	1.2816E+07				42.68939276	2.3550E+00	
32								
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
34	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	9.4106E+00	2.3998E+05	-84.58935415	
35	Clay layer		4.6170E+02	9.4000E+01	1.2464E+02	9.0198E+06	30.63932917	
36	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
37								
38								
39								
40								

	Y	Z	AA	AB	AC	AD	AE	AF
41								
42	10.0000%	of the HLW mixt with DOE SNF		water fraction	30.0000%		Mixt With	
43	Isotope	Fuel	Clay	Mixt	Water	Mixt w/o fegd	1.0000E+00	
44	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc	g of gd	
45	64000.35c	1.2344E-04	1.3285E-06	2.7541E-05		0.0000E+00	0.0000E+00	
46	1001.50c (H)	2.0062E-02	2.4349E-02	2.3429E-02	6.6872E-02	2.3429E-02	2.3429E-02	
47	6000.50c (C)	1.4551E-04	1.3285E-07	3.1339E-05		3.1339E-05	3.1339E-05	
48	25055.50c (Mn)	1.0499E-03	4.7455E-04	5.9805E-04		5.9805E-04	5.9805E-04	
49	15031.50c (P)	4.1899E-05	0.0000E+00	8.9939E-06		8.9939E-06	8.9939E-06	
50	16032.50c (S)	2.7060E-05	0.0000E+00	5.8087E-06		5.8087E-06	5.8087E-06	
51	14000.50c (Si)	7.7012E-04	7.9001E-03	6.3696E-03		6.3696E-03	6.3696E-03	
52	24000.50c (Cr)	9.4860E-03	0.0000E+00	2.0362E-03		2.0362E-03	2.0362E-03	
53	28000.50c (Ni)	5.8442E-03	1.4614E-04	1.3693E-03		1.3693E-03	1.3693E-03	
54	42000.50c (Mo)	7.1285E-04	0.0000E+00	1.5302E-04		1.5302E-04	1.5302E-04	
55	7014.50c (N)	2.0595E-04	0.0000E+00	4.4208E-05		4.4208E-05	4.4208E-05	
56	26000.55c (Fe)	3.3898E-02	1.2517E-02	1.7106E-02		1.7106E-02	1.7106E-02	
57	29000.50C (Cu)	0.0000E+00	8.1704E-06	6.4166E-06		6.4166E-06	6.4166E-06	
58	8016.50C (O)	6.5256E-02	4.9753E-02	5.3081E-02	3.3436E-02	2.7422E-02	5.3081E-02	
59	92235.50C (U235)	3.9695E-06		8.5207E-07		8.5207E-07	8.5207E-07	
60	92238.50C (U238)	1.6945E-03		3.6373E-04		3.6373E-04	3.6373E-04	
61	94239.55C (Pu239)	4.6597E-04		1.0002E-04		1.0002E-04	1.0002E-04	
62	94240.50C (Pu240)	6.1792E-05		1.3264E-05		1.3264E-05	1.3264E-05	
63	94241.50C (Pu241)	5.4037E-06		1.1599E-06		1.1599E-06	1.1599E-06	
64	11023.50c (Na)		5.0550E-05	3.9699E-05		3.9699E-05	3.9699E-05	
65	13027.50c (Al)		7.5686E-04	5.9440E-04		5.9440E-04	5.9440E-04	
66	20000.50c (Ca)		1.8347E-04	1.4409E-04		1.4409E-04	1.4409E-04	
67	19000.50c (K)		2.5720E-04	2.0199E-04		2.0199E-04	2.0199E-04	
68	22000.50c (Ti)		1.2083E-04	9.4893E-05		9.4893E-05	9.4893E-05	
69	total	1.3985E-01	9.6519E-02	1.0582E-01	1.0031E-01	8.0134E-02	1.0579E-01	
70	volume	2.3998E+05	7.9019E+06	1.1180E+06	3.7965E+06			
71	TOTAL Mixt+ clay	9.0198E+06				H/X Fuel	H/X mixt	
72	TOTAL Mixt+ clay+water	1.2816E+07				42.68939276	2.7503E+00	
73								
74	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
75	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	2.6773E+01	1.1180E+06	-67.22684247	
76	Clay layer		4.6170E+02	9.4000E+01	1.2464E+02	9.0198E+06	30.63932917	
77	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
78								
79								
80								

	Y	Z	AA	AB	AC	AD	AE	AF
81								
82								
83	20.0000%	of the HLW mixt with DOE SNF		water fraction	30.0000%			
84	Isotope	Fuel	Clay	Mixt	Water			
85	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
86	64000.35c	1.2344E-04	1.3285E-06	1.6010E-05				
87	1001.50c (H)	2.0062E-02	2.4349E-02	2.3834E-02	6.6872E-02			
88	6000.50c (C)	1.4551E-04	1.3285E-07	1.7612E-05				
89	25055.50c (Mn)	1.0499E-03	4.7455E-04	5.4372E-04				
90	15031.50c (P)	4.1899E-05	0.0000E+00	5.0376E-06				
91	16032.50c (S)	2.7060E-05	0.0000E+00	3.2535E-06				
92	14000.50c (Si)	7.7012E-04	7.9001E-03	7.0428E-03				
93	24000.50c (Cr)	9.4860E-03	0.0000E+00	1.1405E-03				
94	28000.50c (Ni)	5.8442E-03	1.4614E-04	8.3123E-04				
95	42000.50c (Mo)	7.1285E-04	0.0000E+00	8.5708E-05				
96	7014.50c (N)	2.0595E-04	0.0000E+00	2.4762E-05				
97	26000.55c (Fe)	3.3898E-02	1.2517E-02	1.5087E-02				
98	29000.50C (Cu)	0.0000E+00	8.1704E-06	7.1881E-06				
99	8016.50C (O)	6.5256E-02	4.9753E-02	5.1617E-02	3.3436E-02			
100	92235.50C (U235)	3.9695E-06		4.7726E-07				
101	92238.50C (U238)	1.6945E-03		2.0373E-04				
102	94239.55C (Pu239)	4.6597E-04		5.6025E-05				
103	94240.50C (Pu240)	6.1792E-05		7.4295E-06				
104	94241.50C (Pu241)	5.4037E-06		6.4970E-07				
105	11023.50c (Na)		5.0550E-05	4.4473E-05				
106	13027.50c (Al)		7.5686E-04	6.6586E-04				
107	20000.50c (Ca)		1.8347E-04	1.6141E-04				
108	19000.50c (K)		2.5720E-04	2.2628E-04				
109	22000.50c (Ti)		1.2083E-04	1.0630E-04				
110	total	1.3985E-01	9.6519E-02	1.0173E-01	1.0031E-01			
111	volume	2.3998E+05	7.0239E+06	1.9959E+06	3.7965E+06			
112	TOTAL Mixt+ clay	9.0198E+06				H/X Fuel	H/X mixt	
113	TOTAL Mixt+ clay+water	1.2816E+07				42.68939276	2.7978E+00	
114								
115	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
116	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	4.0035E+01	1.9959E+06	-53.96458593	
117	Clay layer		4.6170E+02	9.4000E+01	1.2464E+02	9.0198E+06	30.63932917	
118	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
119								
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	Y	Z	AA	AB	AC	AD	AE	AF
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123								
124	30.0000%	of the HLW mixt with DOE SNF		water fraction	30.0000%			
125	Isotope	Fuel	Clay	Mixt	Water			
126	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
127	64000.35c	1.2344E-04	1.3285E-06	1.1525E-05				
128	1001.50c (H)	2.0062E-02	2.4349E-02	2.3991E-02	6.6872E-02			
129	6000.50c (C)	1.4551E-04	1.3285E-07	1.2272E-05				
130	25055.50c (Mn)	1.0499E-03	4.7455E-04	5.2259E-04				
131	15031.50c (P)	4.1899E-05	0.0000E+00	3.4986E-06				
132	16032.50c (S)	2.7060E-05	0.0000E+00	2.2596E-06				
133	14000.50c (Si)	7.7012E-04	7.9001E-03	7.3047E-03				
134	24000.50c (Cr)	9.4860E-03	0.0000E+00	7.9209E-04				
135	28000.50c (Ni)	5.8442E-03	1.4614E-04	6.2193E-04				
136	42000.50c (Mo)	7.1285E-04	0.0000E+00	5.9524E-05				
137	7014.50c (N)	2.0595E-04	0.0000E+00	1.7197E-05				
138	26000.55c (Fe)	3.3898E-02	1.2517E-02	1.4302E-02				
139	29000.50C (Cu)	0.0000E+00	8.1704E-06	7.4882E-06				
140	8016.50C (O)	6.5256E-02	4.9753E-02	5.1048E-02	3.3436E-02			
141	92235.50C (U235)	3.9695E-06		3.3146E-07				
142	92238.50C (U238)	1.6945E-03		1.4149E-04				
143	94239.55C (Pu239)	4.6597E-04		3.8909E-05				
144	94240.50C (Pu240)	6.1792E-05		5.1598E-06				
145	94241.50C (Pu241)	5.4037E-06		4.5122E-07				
146	11023.50c (Na)		5.0550E-05	4.6329E-05				
147	13027.50c (Al)		7.5686E-04	6.9366E-04				
148	20000.50c (Ca)		1.8347E-04	1.6815E-04				
149	19000.50c (K)		2.5720E-04	2.3573E-04				
150	22000.50c (Ti)		1.2083E-04	1.1074E-04				
151	total	1.3985E-01	9.6519E-02	1.0014E-01	1.0031E-01			
152	volume	2.3998E+05	6.1459E+06	2.8739E+06	3.7965E+06			
153	TOTAL Mixt+ clay	9.0198E+06				H/X Fuel	H/X mixt	
154	TOTAL Mixt+ clay+water	1.2816E+07				42.68939276	2.8163E+00	
155								
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
157	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	5.1821E+01	2.8739E+06	-42.17944597	
158	Clay layer		4.6170E+02	9.4000E+01	1.2464E+02	9.0198E+06	30.63932917	
159	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
160								

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	AG	AH	AI	AJ	AK	AL	AM	AN
1	0.0000%	of the HLW mixt with DOE SNF		water fraction	40.0000%			
2	Isotope	Fuel	Clay	Mixt	Water			
3	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
4	64000.35c	1.0581E-04	1.1387E-06	1.0581E-04				
5	1001.50c (H)	2.6749E-02	3.0424E-02	2.6749E-02	6.6872E-02			
6	6000.50c (C)	1.2472E-04	1.1387E-07	1.2472E-04				
7	25055.50c (Mn)	8.9990E-04	4.0676E-04	8.9990E-04				
8	15031.50c (P)	3.5913E-05	0.0000E+00	3.5913E-05				
9	16032.50c (S)	2.3195E-05	0.0000E+00	2.3195E-05				
10	14000.50c (Si)	6.6010E-04	6.7715E-03	6.6010E-04				
11	24000.50c (Cr)	8.1309E-03	0.0000E+00	8.1309E-03				
12	28000.50c (Ni)	5.0093E-03	1.2526E-04	5.0093E-03				
13	42000.50c (Mo)	6.1102E-04	0.0000E+00	6.1102E-04				
14	7014.50c (N)	1.7653E-04	0.0000E+00	1.7653E-04				
15	26000.55c (Fe)	2.9055E-02	1.0729E-02	2.9055E-02				
16	29000.50C (Cu)	0.0000E+00	7.0032E-06	0.0000E+00				
17	8016.50C (O)	6.0710E-02	4.7422E-02	6.0710E-02	3.3436E-02			
18	92235.50C (U235)	3.4024E-06		3.4024E-06				
19	92238.50C (U238)	1.4524E-03		1.4524E-03				
20	94239.55C (Pu239)	3.9941E-04		3.9941E-04				
21	94240.50C (Pu240)	5.2965E-05		5.2965E-05				
22	94241.50C (Pu241)	4.6317E-06		4.6317E-06				
23	11023.50c (Na)		4.3329E-05	0.0000E+00				
24	13027.50c (Al)		6.4874E-04	0.0000E+00				
25	20000.50c (Ca)		1.5726E-04	0.0000E+00				
26	19000.50c (K)		2.2046E-04	0.0000E+00				
27	22000.50c (Ti)		1.0357E-04	0.0000E+00				
28	total	1.3420E-01	9.7060E-02	1.3420E-01	1.0031E-01			
29	volume	2.7997E+05	1.0243E+07	2.7997E+05	2.2932E+06			
30	TOTAL Mixt+ clay	1.0523E+07				H/X Fuel	H/X mixt	
31	TOTAL Mixt+ clay+water	1.2816E+07				66.40572207	3.1400E+00	
32								
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
34	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	1.0441E+01	2.7997E+05	-83.5591	
35	Clay layer		4.6170E+02	9.4000E+01	1.4385E+02	1.0523E+07	49.8530	
36	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94.0000	
37								
38								
39								
40								

	AG	AH	AI	AJ	AK	AL	AM	AN
41								
42	10.0000%	of the HLW mixt with DOE SNF		water fraction	40.0000%			
43	Isotope	Fuel	Clay	Mixt	Water			
44	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
45	64000.35c	1.0581E-04	1.1387E-06	2.3606E-05				
46	1001.50c (H)	2.6749E-02	3.0424E-02	2.9635E-02	6.6872E-02			
47	6000.50c (C)	1.2472E-04	1.1387E-07	2.6862E-05				
48	25055.50c (Mn)	8.9990E-04	4.0676E-04	5.1261E-04				
49	15031.50c (P)	3.5913E-05	0.0000E+00	7.7090E-06				
50	16032.50c (S)	2.3195E-05	0.0000E+00	4.9789E-06				
51	14000.50c (Si)	6.6010E-04	6.7715E-03	5.4597E-03				
52	24000.50c (Cr)	8.1309E-03	0.0000E+00	1.7453E-03				
53	28000.50c (Ni)	5.0093E-03	1.2526E-04	1.1736E-03				
54	42000.50c (Mo)	6.1102E-04	0.0000E+00	1.3116E-04				
55	7014.50c (N)	1.7653E-04	0.0000E+00	3.7893E-05				
56	26000.55c (Fe)	2.9055E-02	1.0729E-02	1.4663E-02				
57	29000.50C (Cu)	0.0000E+00	7.0032E-06	5.4999E-06				
58	8016.50C (O)	6.0710E-02	4.7422E-02	5.0274E-02	3.3436E-02			
59	92235.50C (U235)	3.4024E-06		7.3035E-07				
60	92238.50C (U238)	1.4524E-03		3.1177E-04				
61	94239.55C (Pu239)	3.9941E-04		8.5735E-05				
62	94240.50C (Pu240)	5.2965E-05		1.1369E-05				
63	94241.50C (Pu241)	4.6317E-06		9.9423E-07				
64	11023.50c (Na)		4.3329E-05	3.4028E-05				
65	13027.50c (Al)		6.4874E-04	5.0948E-04				
66	20000.50c (Ca)		1.5726E-04	1.2350E-04				
67	19000.50c (K)		2.2046E-04	1.7314E-04				
68	22000.50c (Ti)		1.0357E-04	8.1337E-05				
69	total	1.3420E-01	9.7060E-02	1.0503E-01	1.0031E-01			
70	volume	2.7997E+05	9.2189E+06	1.3043E+06	2.2932E+06			
71	TOTAL Mixt+ clay	1.0523E+07				H/X Fuel	H/X mixt	
72	TOTAL Mixt+ clay+water	1.2816E+07				66.40572207	3.4788E+00	
73								
74	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
75	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	2.9776E+01	1.3043E+06	-64.22416198	
76	Clay layer		4.6170E+02	9.4000E+01	1.4385E+02	1.0523E+07	49.85302606	
77	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
78								
79								
80								

	AG	AH	AI	AJ	AK	AL	AM	AN
81								
82								
83	**20.0000%**	**of the HLW mixt with DOE SNF**		**water fraction**	**40.0000%**			
84	**Isotope**	**Fuel**	**Clay**	**Mixt**	**Water**			
85	**MCNP ID**	**at/density**	**at/density**	**at/density**	**1.0000E+00**	**g/cc**		
86	64000.35c	1.0581E-04	1.1387E-06	1.3723E-05				
87	1001.50c (H)	2.6749E-02	3.0424E-02	2.9982E-02	6.6872E-02			
88	6000.50c (C)	1.2472E-04	1.1387E-07	1.5096E-05				
89	25055.50c (Mn)	8.9990E-04	4.0676E-04	4.6605E-04				
90	15031.50c (P)	3.5913E-05	0.0000E+00	4.3180E-06				
91	16032.50c (S)	2.3195E-05	0.0000E+00	2.7888E-06				
92	14000.50c (Si)	6.6010E-04	6.7715E-03	6.0367E-03				
93	24000.50c (Cr)	8.1309E-03	0.0000E+00	9.7759E-04				
94	28000.50c (Ni)	5.0093E-03	1.2526E-04	7.1248E-04				
95	42000.50c (Mo)	6.1102E-04	0.0000E+00	7.3464E-05				
96	7014.50c (N)	1.7653E-04	0.0000E+00	2.1224E-05				
97	26000.55c (Fe)	2.9055E-02	1.0729E-02	1.2932E-02				
98	29000.50C (Cu)	0.0000E+00	7.0032E-06	6.1612E-06				
99	8016.50C (O)	6.0710E-02	4.7422E-02	4.9020E-02	3.3436E-02			
100	92235.50C (U235)	3.4024E-06		4.0908E-07				
101	92238.50C (U238)	1.4524E-03		1.7463E-04				
102	94239.55C (Pu239)	3.9941E-04		4.8022E-05				
103	94240.50C (Pu240)	5.2965E-05		6.3681E-06				
104	94241.50C (Pu241)	4.6317E-06		5.5688E-07				
105	11023.50c (Na)		4.3329E-05	3.8119E-05				
106	13027.50c (Al)		6.4874E-04	5.7074E-04				
107	20000.50c (Ca)		1.5726E-04	1.3835E-04				
108	19000.50c (K)		2.2046E-04	1.9395E-04				
109	22000.50c (Ti)		1.0357E-04	9.1116E-05				
110	total	1.3420E-01	9.7060E-02	1.0153E-01	1.0031E-01			
111	volume	2.7997E+05	8.1945E+06	2.3286E+06	2.2932E+06			
112	TOTAL Mixt+ clay	1.0523E+07				H/X Fuel	H/X mixt	
113	TOTAL Mixt+ clay+water	1.2816E+07				66.40572207	3.5196E+00	
114								
115	**SNF in the middle**	**Volume**	**Length**	**Radius**	**Height of the segment**	**Cylinder Segment Volume**	**x value**	
116	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	4.4625E+01	2.3286E+06	-49.37533085	
117	Clay layer		4.6170E+02	9.4000E+01	1.4385E+02	1.0523E+07	49.85302606	
118	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
119								
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	AG	AH	AI	AJ	AK	AL	AM	AN
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124	30.0000%	of the HLW mixt with DOE SNF		water fraction	40.0000%			
125	Isotope	Fuel	Clay	Mixt	Water			
126	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc		
127	64000.35c	1.0581E-04	1.1387E-06	9.8786E-06				
128	1001.50c (H)	2.6749E-02	3.0424E-02	3.0117E-02	6.6872E-02			
129	6000.50c (C)	1.2472E-04	1.1387E-07	1.0519E-05				
130	25055.50c (Mn)	8.9990E-04	4.0676E-04	4.4794E-04				
131	15031.50c (P)	3.5913E-05	0.0000E+00	2.9988E-06				
132	16032.50c (S)	2.3195E-05	0.0000E+00	1.9368E-06				
133	14000.50c (Si)	6.6010E-04	6.7715E-03	6.2612E-03				
134	24000.50c (Cr)	8.1309E-03	0.0000E+00	6.7894E-04				
135	28000.50c (Ni)	5.0093E-03	1.2526E-04	5.3308E-04				
136	42000.50c (Mo)	6.1102E-04	0.0000E+00	5.1021E-05				
137	7014.50c (N)	1.7653E-04	0.0000E+00	1.4740E-05				
138	26000.55c (Fe)	2.9055E-02	1.0729E-02	1.2259E-02				
139	29000.50C (Cu)	0.0000E+00	7.0032E-06	6.4185E-06				
140	8016.50C (O)	6.0710E-02	4.7422E-02	4.8532E-02	3.3436E-02			
141	92235.50C (U235)	3.4024E-06		2.8411E-07				
142	92238.50C (U238)	1.4524E-03		1.2128E-04				
143	94239.55C (Pu239)	3.9941E-04		3.3351E-05				
144	94240.50C (Pu240)	5.2965E-05		4.4226E-06				
145	94241.50C (Pu241)	4.6317E-06		3.8676E-07				
146	11023.50c (Na)		4.3329E-05	3.9711E-05				
147	13027.50c (Al)		6.4874E-04	5.9457E-04				
148	20000.50c (Ca)		1.5726E-04	1.4413E-04				
149	19000.50c (K)		2.2046E-04	2.0205E-04				
150	22000.50c (Ti)		1.0357E-04	9.4920E-05				
151	total	1.3420E-01	9.7060E-02	1.0016E-01	1.0031E-01			
152	volume	2.7997E+05	7.1702E+06	3.3529E+06	2.2932E+06			
153	TOTAL Mixt+ clay	1.0523E+07				H/X Fuel	H/X mixt	
154	TOTAL Mixt+ clay+water	1.2816E+07				66.40572207	3.5354E+00	
155								
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value	
157	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	5.7892E+01	3.3529E+06	-36.10813018	
158	Clay layer		4.6170E+02	9.4000E+01	1.4385E+02	1.0523E+07	49.85302606	
159	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94	
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1	0.0000%	of the HLW mixt with DOE SNF		water fraction	50.7358%	mixt w/o Gd Fe	mixt w/o Gd
2	Isotope	Fuel	Clay	Mixt	Water		
3	MCNP ID	at/density	at/density	at/density	1.0000E+00		
4	64000.35c	8.6874E-05	9.3498E-07	8.6874E-05		0.0000E+00	0.0000E+00
5	1001.50c (H)	3.3928E-02	3.6946E-02	3.3928E-02	6.6872E-02	3.3928E-02	3.3928E-02
6	6000.50c (C)	1.0241E-04	9.3498E-08	1.0241E-04		1.0241E-04	1.0241E-04
7	25055.50c (Mn)	7.3888E-04	3.3398E-04	7.3888E-04		7.3888E-04	7.3888E-04
8	15031.50c (P)	2.9487E-05	0.0000E+00	2.9487E-05		2.9487E-05	2.9487E-05
9	16032.50c (S)	1.9044E-05	0.0000E+00	1.9044E-05		1.9044E-05	1.9044E-05
10	14000.50c (Si)	5.4199E-04	5.5599E-03	5.4199E-04		5.4199E-04	5.4199E-04
11	24000.50c (Cr)	6.6760E-03	0.0000E+00	6.6760E-03		6.6760E-03	6.6760E-03
12	28000.50c (Ni)	4.1130E-03	1.0285E-04	4.1130E-03		4.1130E-03	4.1130E-03
13	42000.50c (Mo)	5.0169E-04	0.0000E+00	5.0169E-04		5.0169E-04	5.0169E-04
14	7014.50c (N)	1.4494E-04	0.0000E+00	1.4494E-04		1.4494E-04	1.4494E-04
15	26000.55c (Fe)	2.3856E-02	8.8089E-03	2.3856E-02		0.0000E+00	2.3856E-02
16	29000.50C (Cu)	0.0000E+00	5.7501E-06	0.0000E+00		0.0000E+00	0.0000E+00
17	8016.50C (O)	5.5830E-02	4.4920E-02	5.5830E-02	3.3436E-02	2.0045E-02	5.5830E-02
18	92235.50C (U235)	2.7936E-06		2.7936E-06		2.7936E-06	2.7936E-06
19	92238.50C (U238)	1.1925E-03		1.1925E-03		1.1925E-03	1.1925E-03
20	94239.55C (Pu239)	3.2794E-04		3.2794E-04		3.2794E-04	3.2794E-04
21	94240.50C (Pu240)	4.3488E-05		4.3488E-05		4.3488E-05	4.3488E-05
22	94241.50C (Pu241)	3.8030E-06		3.8030E-06		3.8030E-06	3.8030E-06
23	11023.50c (Na)		3.5576E-05	0.0000E+00		0.0000E+00	0.0000E+00
24	13027.50c (Al)		5.3266E-04	0.0000E+00		0.0000E+00	0.0000E+00
25	20000.50c (Ca)		1.2912E-04	0.0000E+00		0.0000E+00	0.0000E+00
26	19000.50c (K)		1.8101E-04	0.0000E+00		0.0000E+00	0.0000E+00
27	22000.50c (Ti)		8.5037E-05	0.0000E+00		0.0000E+00	0.0000E+00
28	total	1.2814E-01	9.7641E-02	1.2814E-01	1.0031E-01	6.8411E-02	1.2805E-01
29	volume	3.4099E+05	1.2475E+07	3.4099E+05	-3.5577E-07		
30	TOTAL Mixt+ clay	1.2816E+07				H/X Fuel	H/X mixt
31	TOTAL Mixt+ clay+water	1.2816E+07				102.5841658	3.9828E+00
32							
33	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
34	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	1.1927E+01	3.4099E+05	-82.07280447
35	Clay layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
36	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
37							
38							
39							
40							

	AO	AP	AQ	AR	AS	AT	AU
41							
42	**10.0000%**	**of the HLW mixt with DOE SNF**		**water fraction**	**50.7358%**		
43	**Isotope**	**Fuel**	**Clay**	**Mixt**	**Water**		
44	**MCNP ID**	**at/density**	**at/density**	**at/density**	**1.0000E+00**	**g/cc**	
45	64000.35c	8.6874E-05	9.3498E-07	1.9382E-05			
46	1001.50c (H)	3.3928E-02	3.6946E-02	3.6298E-02	6.6872E-02		
47	6000.50c (C)	1.0241E-04	9.3498E-08	2.2055E-05			
48	25055.50c (Mn)	7.3888E-04	3.3398E-04	4.2089E-04			
49	15031.50c (P)	2.9487E-05	0.0000E+00	6.3297E-06			
50	16032.50c (S)	1.9044E-05	0.0000E+00	4.0880E-06			
51	14000.50c (Si)	5.4199E-04	5.5599E-03	4.4828E-03			
52	24000.50c (Cr)	6.6760E-03	0.0000E+00	1.4330E-03			
53	28000.50c (Ni)	4.1130E-03	1.0285E-04	9.6365E-04			
54	42000.50c (Mo)	5.0169E-04	0.0000E+00	1.0769E-04			
55	7014.50c (N)	1.4494E-04	0.0000E+00	3.1113E-05			
56	26000.55c (Fe)	2.3856E-02	8.8089E-03	1.2039E-02			
57	29000.50C (Cu)	0.0000E+00	5.7501E-06	4.5158E-06			
58	8016.50C (O)	5.5830E-02	4.4920E-02	4.7262E-02	3.3436E-02		
59	92235.50C (U235)	2.7936E-06		5.9967E-07			
60	92238.50C (U238)	1.1925E-03		2.5598E-04			
61	94239.55C (Pu239)	3.2794E-04		7.0394E-05			
62	94240.50C (Pu240)	4.3488E-05		9.3349E-06			
63	94241.50C (Pu241)	3.8030E-06		8.1633E-07			
64	11023.50c (Na)		3.5576E-05	2.7939E-05			
65	13027.50c (Al)		5.3266E-04	4.1832E-04			
66	20000.50c (Ca)		1.2912E-04	1.0140E-04			
67	19000.50c (K)		1.8101E-04	1.4216E-04			
68	22000.50c (Ti)		8.5037E-05	6.6783E-05			
69	total	1.2814E-01	9.7641E-02	1.0419E-01	1.0031E-01		
70	volume	3.4099E+05	1.1228E+07	1.5885E+06	7.3442E+00		
71	TOTAL Mixt+ clay	1.2816E+07				H/X Fuel	H/X mixt
72	TOTAL Mixt+ clay+water	1.2816E+07				102.5840499	4.2610E+00
73							
74	**SNF in the middle**	**Volume**	**Length**	**Radius**	**Height of the segment**	**Cylinder Segment Volume**	**x value**
75	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	3.4136E+01	1.5885E+06	-59.86444375
76	Clay layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
77	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
78							
79							
80							

	AO	AP	AQ	AR	AS	AT	AU
81							
82							
83	**20.0000%**	**of the HLW mixt with DOE SNF**		**water fraction**	**50.7368%**		
84	**Isotope**	**Fuel**	**Clay**	**Mixt**	**Water**		
85	**MCNP ID**	**at/density**	**at/density**	**at/density**	**1.0000E+00**	**g/cc**	
86	64000.35c	8.6874E-05	9.3498E-07	1.1268E-05			
87	1001.50c (H)	3.3928E-02	3.6946E-02	3.6583E-02	6.6872E-02		
88	6000.50c (C)	1.0241E-04	9.3498E-08	1.2395E-05			
89	25055.50c (Mn)	7.3888E-04	3.3398E-04	3.8266E-04			
90	15031.50c (P)	2.9487E-05	0.0000E+00	3.5453E-06			
91	16032.50c (S)	1.9044E-05	0.0000E+00	2.2898E-06			
92	14000.50c (Si)	5.4199E-04	5.5599E-03	4.9566E-03			
93	24000.50c (Cr)	6.6760E-03	0.0000E+00	8.0267E-04			
94	28000.50c (Ni)	4.1130E-03	1.0285E-04	5.8500E-04			
95	42000.50c (Mo)	5.0169E-04	0.0000E+00	6.0319E-05			
96	7014.50c (N)	1.4494E-04	0.0000E+00	1.7427E-05			
97	26000.55c (Fe)	2.3856E-02	8.8089E-03	1.0618E-02			
98	29000.50C (Cu)	0.0000E+00	5.7501E-06	5.0588E-06			
99	8016.50C (O)	5.5830E-02	4.4920E-02	4.6231E-02	3.3436E-02		
100	92235.50C (U235)	2.7936E-06		3.3588E-07			
101	92238.50C (U238)	1.1925E-03		1.4338E-04			
102	94239.55C (Pu239)	3.2794E-04		3.9429E-05			
103	94240.50C (Pu240)	4.3488E-05		5.2287E-06			
104	94241.50C (Pu241)	3.8030E-06		4.5724E-07			
105	11023.50c (Na)		3.5576E-05	3.1299E-05			
106	13027.50c (Al)		5.3266E-04	4.6862E-04			
107	20000.50c (Ca)		1.2912E-04	1.1360E-04			
108	19000.50c (K)		1.8101E-04	1.5925E-04			
109	22000.50c (Ti)		8.5037E-05	7.4812E-05			
110	total	1.2814E-01	9.7641E-02	1.0131E-01	1.0031E-01		
111	volume	3.4099E+05	9.9803E+06	2.8361E+06	7.3442E+00		
112	TOTAL Mixt+ clay	1.2816E+07				H/X Fuel	H/X mixt
113	TOTAL Mixt+ clay+water	1.2816E+07				102.5840499	4.2944E+00
114							
115	**SNF in the middle**	**Volume**	**Length**	**Radius**	**Height of the segment**	**Cylinder Segment Volume**	**x value**
116	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	5.1333E+01	2.8361E+06	-42.66745971
117	Clay layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
118	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
119							
120							

	AO	AP	AQ	AR	AS	AT	AU
121							
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123							
124	30.0000%	of the HLW mixt with DOE SNF		water fraction	50.7358%		
125	Isotope	Fuel	Clay	Mixt	Water		
126	MCNP ID	at/density	at/density	at/density	1.0000E+00	g/cc	
127	64000.35c	8.6874E-05	9.3498E-07	8.1110E-06			
128	1001.50c (H)	3.3928E-02	3.6946E-02	3.6694E-02	6.6872E-02		
129	6000.50c (C)	1.0241E-04	9.3498E-08	8.6367E-06			
130	25055.50c (Mn)	7.3888E-04	3.3398E-04	3.6779E-04			
131	15031.50c (P)	2.9487E-05	0.0000E+00	2.4622E-06			
132	16032.50c (S)	1.9044E-05	0.0000E+00	1.5902E-06			
133	14000.50c (Si)	5.4199E-04	5.5599E-03	5.1409E-03			
134	24000.50c (Cr)	6.6760E-03	0.0000E+00	5.5746E-04			
135	28000.50c (Ni)	4.1130E-03	1.0285E-04	4.3770E-04			
136	42000.50c (Mo)	5.0169E-04	0.0000E+00	4.1892E-05			
137	7014.50c (N)	1.4494E-04	0.0000E+00	1.2103E-05			
138	26000.55c (Fe)	2.3856E-02	8.8089E-03	1.0065E-02			
139	29000.50C (Cu)	0.0000E+00	5.7501E-06	5.2700E-06			
140	8016.50C (O)	5.5830E-02	4.4920E-02	4.5831E-02	3.3436E-02		
141	92235.50C (U235)	2.7936E-06		2.3327E-07			
142	92238.50C (U238)	1.1925E-03		9.9577E-05			
143	94239.55C (Pu239)	3.2794E-04		2.7383E-05			
144	94240.50C (Pu240)	4.3488E-05		3.6313E-06			
145	94241.50C (Pu241)	3.8030E-06		3.1755E-07			
146	11023.50c (Na)		3.5576E-05	3.2605E-05			
147	13027.50c (Al)		5.3266E-04	4.8818E-04			
148	20000.50c (Ca)		1.2912E-04	1.1834E-04			
149	19000.50c (K)		1.8101E-04	1.6590E-04			
150	22000.50c (Ti)		8.5037E-05	7.7936E-05			
151	total	1.2814E-01	9.7641E-02	1.0019E-01	1.0031E-01		
152	volume	3.4099E+05	8.7328E+06	4.0836E+06	7.3442E+00		
153	TOTAL Mixt+ clay	1.2816E+07				H/X Fuel	H/X mixt
154	TOTAL Mixt+ clay+water	1.2816E+07				102.5840499	4.3074E+00
155							
156	SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
157	Fuel layer	1.2816E+07	4.6170E+02	9.4000E+01	6.6836E+01	4.0836E+06	-27.16408612
158	Clay layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
159	water layer		4.6170E+02	9.4000E+01	1.8800E+02	1.2816E+07	94
160							

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	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	**hematite forms at 10.26 1000s of years +**				0	***100 % of water**		**total volume**	6145900	cc	**tot mass**	23921.4
3												
4	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass
5	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
6	H	1.00782519	1001.50c	6.4551	6.30E+04	6.13E-03			6.1256E-03			968471.99
7	C	12.01115	6000.50c	0.0002	2.33E+01	1.90E-07			1.8979E-07			
8	O	15.994915	8016.50c	59.7993	9.26E+06	5.67E-02			5.6746E-02			
9	Na	22.9897707	11023.50c	0.0761	1.69E+04	7.22E-05			7.2215E-05			
10	Al	26.9815389	13027.50c	1.1394	2.98E+05	1.08E-03			1.0812E-03			
11	Si	28.086	14000.50c	11.893	3.23E+06	1.13E-02			1.1286E-02			
12	Ca	40.08	20000.50c	0.2762	1.07E+05	2.62E-04			2.6210E-04			
13	K	39.102	19000.50c	0.3872	1.47E+05	3.67E-04			3.6743E-04			
14	Ti	47.9	22000.50c	0.1819	8.44E+04	1.73E-04			1.7261E-04			
15	Mn	54.9380503	25055.50c	0.7144	3.80E+05	6.78E-04			6.7793E-04			
16	Fe	55.847	26000.55c	18.8429	1.02E+07	1.79E-02			1.7881E-02			
17	Ni	58.71	28000.50c	0.22	1.25E+05	2.09E-04			2.0877E-04			
18	Cu	63.54	29000.50c	0.0123	7.57E+03	1.17E-05			1.1672E-05			
19	Gd	157.25	64000.35c	0.002	3.05E+03	1.90E-06			1.8979E-06			
20				100	23921400	0.09489478			9.4895E-02			tot moles
21												
22	**water**				**mass (g)**	**number densities (at/bar.cm)**						
23	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	0	cc	mass=
24	H	1.00782519	1001.50c	200	0.00E+00	0.00E+00						1 mol is
25	O	15.994915	8016.50c	100	0.00E+00	0.00E+00						0.00E+00
26					0.00E+00	0.00E+00						
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38	**hematite forms at 10.26 1000s of years +**				0.25	***100 % of water**		**total volume**	8194533.333	cc	**tot mass**	1048238.1
39									4621848.994			
40	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass

	A	B	C	D	E	F	G	H	I	J	K	L
41	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
42	H	1.00782519	1001.50c	6.4551	6.30E+04	4.59E-03			1.2953E-02			968471.99
43	C	12.01115	6000.50c	0.0002	2.33E+01	1.42E-07			1.4234E-07			
44	O	15.994915	8016.50c	59.7993	9.26E+06	4.26E-02			4.6739E-02			
45	Na	22.9897707	11023.50c	0.0761	1.69E+04	5.42E-05			5.4161E-05			
46	Al	26.9815389	13027.50c	1.1394	2.98E+05	8.11E-04			8.1092E-04			
47	Si	28.086	14000.50c	11.893	3.23E+06	8.46E-03			8.4644E-03			
48	Ca	40.08	20000.50c	0.2762	1.07E+05	1.97E-04			1.9657E-04			
49	K	39.102	19000.50c	0.3872	1.47E+05	2.76E-04			2.7557E-04			
50	Ti	47.9	22000.50c	0.1819	8.44E+04	1.29E-04			1.2946E-04			
51	Mn	54.9380503	25055.50c	0.7144	3.80E+05	5.08E-04			5.0845E-04			
52	Fe	55.847	26000.55c	18.8429	1.02E+07	1.34E-02			1.3411E-02			
53	Ni	58.71	28000.50c	0.22	1.25E+05	1.57E-04			1.5658E-04			
54	Cu	63.54	29000.50c	0.0123	7.57E+03	8.75E-06			8.7540E-06			
55	Gd	157.25	64000.35c	0.002	3.05E+03	1.42E-06			1.4234E-06			
56				100	23921400	0.07117109			8.3710E-02			tot moles
57												
58	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.5
59	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	2E+06	cc	mass=
60	H	1.00782519	1001.50c	200	1.15E+05	8.36E-03						1 mol is
61	O	15.994915	8016.50c	100	9.10E+05	4.18E-03						5.69E+04
62					1.02E+06	1.25E-02						
63												
64												
65												
66												
67	**hematite forms at 10.26 1000s of years +**				0.51409656	***100 % of water**		**total volume**	12648397.7	cc	**tot mass**	674171.17
68						12144443.9		Max Volume				
69	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass
70	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
71	H	1.00782519	1001.50c	6.4551	6.30E+04	2.98E-03			6.4143E-03			968471.99
72	C	12.01115	6000.50c	0.0002	2.33E+01	9.22E-08			9.2219E-08			
73	O	15.994915	8016.50c	59.7993	9.26E+06	2.76E-02			2.9292E-02			
74	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.51E-05			3.5089E-05			
75	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.25E-04			5.2537E-04			
76	Si	28.086	14000.50c	11.893	3.23E+06	5.48E-03			5.4838E-03			
77	Ca	40.08	20000.50c	0.2762	1.07E+05	1.27E-04			1.2735E-04			
78	K	39.102	19000.50c	0.3872	1.47E+05	1.79E-04			1.7854E-04			
79	Ti	47.9	22000.50c	0.1819	8.44E+04	8.39E-05			8.3874E-05			
80	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.29E-04			3.2941E-04			

	A	B	C	D	E	F	G	H	I	J	K	L
81	Fe	55.847	26000.55c	18.8429	1.02E+07	8.69E-03			8.6884E-03			
82	Ni	58.71	28000.50c	0.22	1.25E+05	1.01E-04			1.0144E-04			
83	Cu	63.54	29000.50c	0.0123	7.57E+03	5.67E-06			5.6715E-06			
84	Gd	157.25	64000.35c	0.002	3.05E+03	9.22E-07			9.2219E-07			
85				100	23921400	0.0461097			5.1266E-02			tot moles
86												
87	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.1
88	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	7E+06	cc	mass=
89	H	1.00782519	1001.50c	200	7.28E+04	3.44E-03						1 mol is
90	O	15.994915	8016.50c	100	5.77E+05	1.72E-03						3.61E+04
91					6.50E+05	5.16E-03						
92												
93												
94												
95												
96												
97												
98	**hematite forms at 10.26 1000s of years +**				0.49393319	***100 % of water**		**total volume**	12144443.91	cc	**tot mass**	3023193.4
99								Max Volume	12816382.33			
100	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass
101	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
102	H	1.00782519	1001.50c	6.4551	6.30E+04	3.10E-03			1.9615E-02			968471.99
103	C	12.01115	6000.50c	0.0002	2.33E+01	9.60E-08			9.6046E-08			
104	O	15.994915	8016.50c	59.7993	9.26E+06	2.87E-02			3.6975E-02			
105	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.65E-05			3.6546E-05			
106	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.47E-04			5.4718E-04			
107	Si	28.086	14000.50c	11.893	3.23E+06	5.71E-03			5.7114E-03			
108	Ca	40.08	20000.50c	0.2762	1.07E+05	1.33E-04			1.3264E-04			
109	K	39.102	19000.50c	0.3872	1.47E+05	1.86E-04			1.8595E-04			
110	Ti	47.9	22000.50c	0.1819	8.44E+04	8.74E-05			8.7354E-05			
111	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.43E-04			3.4308E-04			
112	Fe	55.847	26000.55c	18.8429	1.02E+07	9.05E-03			9.0489E-03			
113	Ni	58.71	28000.50c	0.22	1.25E+05	1.06E-04			1.0565E-04			
114	Cu	63.54	29000.50c	0.0123	7.57E+03	5.91E-06			5.9068E-06			
115	Gd	157.25	64000.35c	0.002	3.05E+03	9.60E-07			9.6046E-07			
116				100	23921400	0.0480231			7.2796E-02			tot moles
117												
118	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.5
119	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass=
120	H	1.00782519	1001.50c	200	3.36E+05	1.65E-02						1 mol is

	A	B	C	D	E	F	G	H	I	J	K	L
121	O	15.994915	8016.50c	100	2.66E+06	8.26E-03						1.67E+05
122					3.00E+06	2.48E-02						
123												
124												
125												
126												
127												
128												
129	**hematite forms at 10.26 1000s of years +**				0.5	***100 % of water**		**total volume**	12291800	cc	**tot mass**	638511.4
130												
131	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass
132	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
133	H	1.00782519	1001.50c	6.4551	6.30E+04	3.06E-03			6.4064E-03			968471.99
134	C	12.01115	6000.50c	0.0002	2.33E+01	9.49E-08			9.4895E-08			
135	O	15.994915	8016.50c	59.7993	9.26E+06	2.84E-02			3.0045E-02			
136	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.61E-05			3.6107E-05			
137	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.41E-04			5.4062E-04			
138	Si	28.086	14000.50c	11.893	3.23E+06	5.64E-03			5.6429E-03			
139	Ca	40.08	20000.50c	0.2762	1.07E+05	1.31E-04			1.3105E-04			
140	K	39.102	19000.50c	0.3872	1.47E+05	1.84E-04			1.8372E-04			
141	Ti	47.9	22000.50c	0.1819	8.44E+04	8.63E-05			8.6307E-05			
142	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.39E-04			3.3896E-04			
143	Fe	55.847	26000.55c	18.8429	1.02E+07	8.94E-03			8.9405E-03			
144	Ni	58.71	28000.50c	0.22	1.25E+05	1.04E-04			1.0438E-04			
145	Cu	63.54	29000.50c	0.0123	7.57E+03	5.84E-06			5.8360E-06			
146	Gd	157.25	64000.35c	0.002	3.05E+03	9.49E-07			9.4895E-07			
147				100	23921400	0.04744739			5.2463E-02			tot moles
148												
149	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	0.1
150	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass=
151	H	1.00782519	1001.50c	200	6.88E+04	3.34E-03						1 mol is
152	O	15.994915	8016.50c	100	5.46E+05	1.67E-03						3.41E+04
153					6.15E+05	5.02E-03						
154												
155												
156												
157												
158												
159												
160												

	A	B	C	D	E	F	G	H	I	J	K	L
161												
162	**hematite forms at 10.26 1000s of years +**				0.45	***100 % of water**		**total volume**	11174363.64	cc	**tot mass**	5052385
163												
164	ρ=	3.892	kg/l		Na=	6.02E-01	at/b.cm		Volume=	6E+06	cc	mass
165	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is
166	H	1.00782519	1001.50c	6.4551	6.30E+04	3.37E-03			3.1058E-02			968471.99
167	C	12.01115	6000.50c	0.0002	2.33E+01	1.04E-07			1.0438E-07			
168	O	15.994915	8016.50c	59.7993	9.26E+06	3.12E-02			4.5055E-02			
169	Na	22.9897707	11023.50c	0.0761	1.69E+04	3.97E-05			3.9718E-05			
170	Al	26.9815389	13027.50c	1.1394	2.98E+05	5.95E-04			5.9468E-04			
171	Si	28.086	14000.50c	11.893	3.23E+06	6.21E-03			6.2072E-03			
172	Ca	40.08	20000.50c	0.2762	1.07E+05	1.44E-04			1.4415E-04			
173	K	39.102	19000.50c	0.3872	1.47E+05	2.02E-04			2.0209E-04			
174	Ti	47.9	22000.50c	0.1819	8.44E+04	9.49E-05			9.4937E-05			
175	Mn	54.9380503	25055.50c	0.7144	3.80E+05	3.73E-04			3.7286E-04			
176	Fe	55.847	26000.55c	18.8429	1.02E+07	9.83E-03			9.8345E-03			
177	Ni	58.71	28000.50c	0.22	1.25E+05	1.15E-04			1.1482E-04			
178	Cu	63.54	29000.50c	0.0123	7.57E+03	6.42E-06			6.4196E-06			
179	Gd	157.25	64000.35c	0.002	3.05E+03	1.04E-06			1.0438E-06			
180				100	23921400	0.05219213			9.3725E-02			tot moles
181												
182	**water**				**mass (g)**	**number densities (at/bar.cm)**					density	1
183	ρ=	1	kg/l		Na=	6.02E-01	at/b.cm		Volume=	5E+06	cc	mass=
184	H	1.00782519	1001.50c	200	5.63E+05	2.77E-02						1 mol is
185	O	15.994915	8016.50c	100	4.47E+06	1.38E-02						2.79E+05
186					5.03E+06	4.15E-02						

	M	N	O	P	Q	R	S	T	U	V
1										
2	**tot density**	0.0038923		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
3				hematite forms 3.765 1000s y	12816382	461.7	94	90.97767766	6145900	-3.022322341
4	23921.4	kg		FFTF SNF	0	461.7	94	92.91348971	6313884.605	-1.086510293
5	24.70014642	g		total	6145900					
6	moles			FFTF SNF 25% water	186649.6	461.7	94	93.55861742	6369879.473	-0.441382582
7					6332550					
8				FFTF SNF 50% water	209980.8	461.7	94	94.84884085	6481869.209	0.848840854
9					6355881					
10				FFTF SNF 75% water	239978	461.7	94	98.72144618	6817838.418	4.721446176
11					6385878					
12										
13										
14										
15										
16										
17										
18										
19										
20	968471.9918									
21										
22										
23	0	g								
24	1.80E+01									
25	mole of h2o									
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38	**tot density**	0.1279192		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
39				hematite forms 3.765 1000s y	12816382	461.7	94	114.749842	8194533.333	20.74984196
40	23921.4	kg		FFTF SNF	167984.6	461.7	94	116.7391545	8362517.94	22.73915452

	M	N	O	P	Q	R	S	T	U	V
41	24.70014642	g		total						
42	moles								8362517.938	
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56	1025345.091									
57										
58										
59	1024316.667	g								
60	1.80E+01									
61	mole of h2o									
62										
63										
64										
65										
66										
67	**tot density**	0.0533009		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
68				hematite forms 3.765 1000s y	12816382	461.7	94	180.5972475	12648397.72	86.5972475
69	23921.4	kg		FFTF SNF	-1.2E+07	461.7	94	7.4027525	167984.6049	-86.5972475
70	24.70014642	g		total	25296795			188		
71	moles								12816382.33	
72										
73										
74										
75										
76										
77										
78										
79										
80										

	M	N	O	P	Q	R	S	T	U	V
81										
82										
83										
84										
85	1004575.787									
86										
87										
88	650249.77	g								
89	1.80E+01									
90	mole of h2o									
91										
92										
93										
94										
95										
96										
97										
98	**tot density**	0.2489363		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
99				hematite forms 3.765 1000s y	12816382	461.7	94	169.1055893	12144443.91	75.10558929
100	23921.4	kg		FFTF SNF	-1.2E+07	461.7	94	7.4027525	167984.6049	-86.5972475
101	24.70014642	g		total	24792842			176.5083418		
102	moles								12144443.91	
103										
104										
105							0			
106										
107										
108										
109										
110										
111										
112										
113										
114										
115										
116	1135000.465									
117										
118										
119	2999271.955	g								
120	1.80E+01									

	M	N	O	P	Q	R	S	T	U	V
121	mole of h2o									
122										
123										
124										
125										
126										
127										
128										
129	**tot density**	0.0519461		**SNF in the middle**	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
130				hematite forms 3.765 1000s y	12816382	461.7	94	172.033294	12291800.02	78.033294
131	23921.4	kg		FFTF SNF	-1.2E+07	461.7	94	7.4027525	167984.6049	-86.5972475
132	24.70014642	g		total	24940198			179.4360465		
133	moles								12291800	
134										
135										
136										
137										
138										
139										
140										
141										
142										
143										
144										
145										
146										
147	1002595.851									
148										
149										
150	614590	g								
151	1.80E+01									
152	mole of h2o									
153										
154										
155										
156										
157										
158										
159										
160										

	M	N	O	P	Q	R	S	T	U	V
161										
162	tot density	0.4521407		SNF in the middle	Volume	Length	Radius	Height of the segment	Cylinder Segment Volume	x value
163				hematite forms 3.765 1000s y	12816382	461.7	94	153.0683054	11174364	59.06830536
164	23921.4	kg		FFTF SNF	-1.1E+07	461.7	94	7.4027525	167984.6049	-86.5972475
165	24.70014642	g		total	23822762			160.4710579		
166	moles									
167										
168										
169										
170										
171										
172										
173										
174										
175										
176										
177										
178										
179										
180	1247667.205									
181										
182										
183	5028463.636	g								
184	1.80E+01									
185	mole of h2o									
186										

	A	B	C	D	E	F	G	H	I	J
1	Atomic Densities (at/cm*b)									
2										
3	Canister Component:	Ident 69	Basket	Cladding	Endcaps	MOX	Insulator	Canister shell	Total	Total degraded dry
4										(Fe becomes Fe2O3)
5	MCNP Isotope ID									
6	64000.35c									0.000176343
7	1001.50c (H)									
8	6000.50c (C)	5.29084E-06	3.463E-05	3.61977E-05	9.65545E-06			0.000122095	0.000207869	0.000207869
9	25055.50c (Mn)	7.71161E-05	0.0005048	0.000197848	5.27745E-05			0.000667343	0.001499835	0.001499835
10	15031.50c (P)	3.07756E-06	2.014E-05	7.89577E-06	2.10613E-06			2.66324E-05	5.98556E-05	5.98556E-05
11	16032.50c (S)	1.98764E-06	1.301E-05	5.09948E-06	1.36025E-06			1.72006E-05	3.86578E-05	3.86578E-05
12	14000.50c (Si)	5.65665E-05	0.0003702	0.000145127	3.87114E-05			0.000489512	0.001100165	0.001100165
13	24000.50c (Cr)	0.000774055	0.0045332	0.001776866	0.000473965			0.005993374	0.013551418	0.013551418
14	28000.50c (Ni)	0.000360931	0.0028339	0.001110823	0.000296303			0.003746809	0.008348808	0.008348808
15	42000.50c (Mo)	0	0.0003613	0.000141617	3.77753E-05			0.000477675	0.001018363	0.001018363
16	7014.50c (N)	1.51274E-05	9.901E-05	3.88108E-05	1.03525E-05			0.000130909	0.000294214	0.000294214
17	26000.55c (Fe)	0.002580979	0.0162728	0.006373589	0.001700104			0.021498131	0.048425575	0.048425575
18	29000.50C (Cu)	0							0	0
19	8016.50C (O)	0				0.005957447	0.000296721		0.006254167	0.078892529
20	92235.50C (U235)	0				4.60373E-06	1.06696E-06		5.67069E-06	5.67069E-06
21	92238.50C (U238)	0				0.002273375	0.000147292		0.002420667	0.002420667
22	94239.55C (Pu239)	0				0.000665675	0		0.000665675	0.000665675
23	94240.50C (Pu240)	0				8.82748E-05	0		8.82748E-05	8.82748E-05
24	94241.50C (Pu241)	0				7.71954E-06			7.71954E-06	7.71954E-06
25	total	0.00387513	0.025043	0.009833875	0.002623108	0.008997096	0.000445079	0.033169682	0.083986935	0.15680164
26	volume	167984.6046								
27										
28										
29						FFTF SNF	FFTF SNF	FFTF SNF	FFTF SNF	
30	Density of Hematite (g/cc)	5.2749E+00		**MCNP Isotope ID**		**0.00%**	**10.00%**	**20.00%**	**30.00%**	**40.00%**
31	Volume of the fuel Homogenized	1.6798E+05		**64000.35c**	1.7634E-04	1.7634E-04	1.5871E-04	1.4107E-04	1.2344E-04	1.0581E-04
32	Mole/cc.b of Hematite	4.0207E-26		**1001.50c (H)**	0.0000E+00	0.0000E+00	6.6872E-03	1.3374E-02	2.0062E-02	2.6749E-02
33	Mole of hematite in the fuel	6.7542E+03		**6000.50c (C)**	2.0787E-04	2.0787E-04	1.8708E-04	1.6630E-04	1.4551E-04	1.2472E-04
34	Mass of Hematite(g)	1.0785E+06		**25055.50c (Mn)**	1.4998E-03	1.4998E-03	1.3499E-03	1.1999E-03	1.0499E-03	8.9990E-04
35	Volume of Hematite (cc)	2.0446E+05		**15031.50c (P)**	5.9856E-05	5.9856E-05	5.3870E-05	4.7885E-05	4.1899E-05	3.5913E-05
36	Volume of Hematite (l)	2.0446E+02		**16032.50c (S)**	3.8658E-05	3.8658E-05	3.4792E-05	3.0926E-05	2.7060E-05	2.3195E-05
37	**0 % of this volume is water**	**0.0000E+00**		**14000.50c (Si)**	1.1002E-03	1.1002E-03	9.9015E-04	8.8013E-04	7.7012E-04	6.6010E-04
38	volume of water (cc)	0.0000E+00		**24000.50c (Cr)**	1.3551E-02	1.3551E-02	1.2196E-02	1.0841E-02	9.4860E-03	8.1309E-03
39				**28000.50c (Ni)**	8.3488E-03	8.3488E-03	7.5139E-03	6.6790E-03	5.8442E-03	5.0093E-03
40	Mass(g) of Water to add	0		**42000.50c (Mo)**	1.0184E-03	1.0184E-03	9.1653E-04	8.1469E-04	7.1285E-04	6.1102E-04

	A	B	C	D	E	F	G	H	I	J
41	Mole of Water to add	0		**7014.50c (N)**	2.9421E-04	2.9421E-04	2.6479E-04	2.3537E-04	2.0595E-04	1.7653E-04
42	Atomes of O to add	0		**26000.55c (Fe)**	4.8426E-02	4.8426E-02	4.3583E-02	3.8740E-02	3.3898E-02	2.9055E-02
43	Atomes of H to add	0		**29000.50C (Cu)**	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
44	density of H homogenized to add (at/cm.b)	0.0000E+00		**8016.50C (O)**	7.8893E-02	7.8893E-02	7.4347E-02	6.9801E-02	6.5256E-02	6.0710E-02
45	density of O homogenized to add (at/cm.b)	0.0000E+00		**92235.50C (U235)**	5.6707E-06	5.6707E-06	5.1036E-06	4.5365E-06	3.9695E-06	3.4024E-06
46				**92238.50C (U238)**	2.4207E-03	2.4207E-03	2.1786E-03	1.9365E-03	1.6945E-03	1.4524E-03
47	Max Volume of the canister	624971.2629		**94239.55C (Pu239)**	6.6568E-04	6.6568E-04	5.9911E-04	5.3254E-04	4.6597E-04	3.9941E-04
48				**94240.50C (Pu240)**	8.8275E-05	8.8275E-05	7.9447E-05	7.0620E-05	6.1792E-05	5.2965E-05
49				**94241.50C (Pu241)**	7.7195E-06	7.7195E-06	6.9476E-06	6.1756E-06	5.4037E-06	4.6317E-06
50				total	1.5680E-01	1.5680E-01	1.5115E-01	1.4550E-01	1.3985E-01	1.3420E-01
51				volume	1.6798E+05	1.6798E+05	1.8665E+05	2.0998E+05	2.3998E+05	2.7997E+05
52									7.0000E-01	

	K	L	M	N	O	P	Q	R	S
1									
2									
3		dry no Gd	dry no Fe2O3	dry no gd Fe2O3					
4									
5									
6		0.0000E+00	0.000176343	0					
7			0	0					
8		2.0787E-04	0.000207869	0.000207869					
9		1.4998E-03	0.001499835	0.001499835					
10		5.9856E-05	5.98556E-05	5.98556E-05					
11		3.8658E-05	3.86578E-05	3.86578E-05					
12		1.1002E-03	0.001100165	0.001100165					
13		1.3551E-02	0.013551418	0.013551418					
14		8.3488E-03	0.008348808	0.008348808					
15		1.0184E-03	0.001018363	0.001018363					
16		2.9421E-04	0.000294214	0.000294214					
17		4.8426E-02	0	0					
18		0.0000E+00	0	0					
19		7.8893E-02	6.2542E-03	0.006254167					
20		5.6707E-06	5.67069E-06	5.67069E-06					
21		2.4207E-03	0.002420667	0.002420667					
22		6.6568E-04	0.000665675	0.000665675					
23		8.8275E-05	8.82748E-05	8.82748E-05					
24		7.7195E-06	7.71954E-06	7.71954E-06					
25	0	1.5663E-01	3.5738E-02	3.5561E-02					
26									
27									
28									
29		1	0.8	0.5	0.1	1	0.8	0.5	0.1
30		50.74%	97.48%	97.48%	97.48%	75.00%	75.00%	75.00%	75.00%
31		8.6874E-05	4.4409E-06	4.4409E-06	4.4409E-06	4.4086E-05	4.4086E-05	4.4086E-05	4.4086E-05
32		3.3928E-02	5.2001E-02	3.2383E-02	6.4466E-03	5.0154E-02	4.0123E-02	2.5077E-02	5.0154E-03
33		1.0241E-04	5.2348E-06	5.2348E-06	5.2348E-06	5.1967E-05	5.1967E-05	5.1967E-05	5.1967E-05
34		7.3888E-04	3.7771E-05	3.7771E-05	3.7771E-05	3.7496E-04	3.7496E-04	3.7496E-04	3.7496E-04
35		2.9487E-05	1.5074E-06	1.5074E-06	1.5074E-06	1.4964E-05	1.4964E-05	1.4964E-05	1.4964E-05
36		1.9044E-05	9.7353E-07	9.7353E-07	9.7353E-07	9.6644E-06	9.6644E-06	9.6644E-06	9.6644E-06
37		5.4199E-04	2.7706E-05	2.7706E-05	2.7706E-05	2.7504E-04	2.7504E-04	2.7504E-04	2.7504E-04
38		6.6760E-03	3.4127E-04	3.4127E-04	3.4127E-04	3.3879E-03	3.3879E-03	3.3879E-03	3.3879E-03
39		4.1130E-03	2.1025E-04	2.1025E-04	2.1025E-04	2.0872E-03	2.0872E-03	2.0872E-03	2.0872E-03
40		5.0169E-04	2.5646E-05	2.5646E-05	2.5646E-05	2.5459E-04	2.5459E-04	2.5459E-04	2.5459E-04

	K	L	M	N	O	P	Q	R	S
41		1.4494E-04	7.4092E-06	7.4092E-06	7.4092E-06	7.3553E-05	7.3553E-05	7.3553E-05	7.3553E-05
42		2.3856E-02	1.2195E-03	1.2195E-03	1.2195E-03	1.2106E-02	1.2106E-02	1.2106E-02	1.2106E-02
43		0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
44		5.5830E-02	2.7987E-02	1.8178E-02	5.2101E-03	4.4800E-02	3.9785E-02	3.2262E-02	2.2231E-02
45		2.7936E-06	1.4281E-07	1.4281E-07	1.4281E-07	1.4177E-06	1.4177E-06	1.4177E-06	1.4177E-06
46		1.1925E-03	6.0960E-05	6.0960E-05	6.0960E-05	6.0517E-04	6.0517E-04	6.0517E-04	6.0517E-04
47		3.2794E-04	1.6764E-05	1.6764E-05	1.6764E-05	1.6642E-04	1.6642E-04	1.6642E-04	1.6642E-04
48		4.3488E-05	2.2230E-06	2.2230E-06	2.2230E-06	2.2069E-05	2.2069E-05	2.2069E-05	2.2069E-05
49		3.8030E-06	1.9440E-07	1.9440E-07	1.9440E-07	1.9299E-06	1.9299E-06	1.9299E-06	1.9299E-06
50		1.2814E-01	8.1950E-02	5.2524E-02	1.3619E-02	1.1443E-01	9.9385E-02	7.6816E-02	4.6723E-02
51		3.4099E+05	6.6705E+06	6.6705E+06	6.6705E+06	6.7194E+05	6.7194E+05	6.7194E+05	6.7194E+05
52									

	A	B	C	D	E	F
1		keff	σ	keff+2σ		AECNF
2	m00f0c.O	0.2824	0.0008	0.2840		0.5756
3	m00f20.O	0.2674	0.0009	0.2691		0.6012
4	m00f49.O	0.2590	0.0008	0.2606		0.6095
5	t00f0c.O	0.2695	0.0007	0.2709		0.6067
6	t00f20.O	0.2720	0.0008	0.2736		0.5955
7	t00f49.O	0.2692	0.0009	0.2709		0.5938
8	m03f0c.O	0.4471	0.0011	0.4494		0.3045
9	m06f0c.O	0.5383	0.0015	0.5413		0.2157
10	m50f0c.O	0.5245	0.0012	0.5270		0.1751
11	m80f0c.O	0.5307	0.0010	0.5327		0.0675
12	m53f0c.O	0.5794	0.0013	0.5820		0.1286
13	m83f0c.O	0.5042	0.0009	0.5060		0.0570
14	m56f0c.O	0.5978	0.0013	0.6004		0.1057
15	m86f0c.O	0.4767	0.0008	0.4783		0.0494
16	m60f0c.O	0.5646	0.0012	0.5669		0.1196
17	m63f0c.O	0.5837	0.0013	0.5863		0.0944
18	m66f0c.O	0.5774	0.0011	0.5796		0.0795
19	m20f0c.O	0.4211	0.0011	0.4232		0.3106
20	m23f0c.O	0.5294	0.0013	0.5320		0.2004
21	m26f0c.O	0.5843	0.0014	0.5871		0.1574
22	nogd56.O	1.0415	0.0012	1.0439		0.0604
23	05gd56.O	0.9185	0.0016	0.9217		0.0700
24	06gd56.O	0.9053	0.0016	0.9084		0.0697
25	10gd56.O	0.8518	0.0015	0.8547		0.0739
26	nofe56.O	0.6270	0.0009	0.6288		0.1211
27	m56f00.O	0.5979	0.0012	0.6002		0.1057
28	m56f01.O	0.6001	0.0013	0.6026		0.1056
29	nogd00.O	1.0414	0.0013	1.0440		0.0596
30	nogd01.O	1.0430	0.0013	1.0455		0.0601

	A	B	C	D	E	F
1		all absorder	keff	σ	keff+2σ	AENCF
2	ft00	**dry clay dry fuel**	0.1561	0.0006	0.1574	0.2828
3	ft25	**25% water in the clay dry fuel**	0.1491	0.0007	0.1505	0.2941
4						
5		**51%water in the clay dry fuel**				
6		water density of the clay	keff	σ	keff+2σ	AENCF
7	01ft50	0.1	0.2107	0.0007	0.2121	0.4756
8	05ft50	0.5	0.1977	0.0006	0.1989	0.4956
9	08ft50	0.8	0.1972	0.0007	0.1986	0.4957
10	ft50	1	0.1969	0.0008	0.1984	0.4870
11		**0%water in the clay 97% water in the fuel**				
12		water density of the fuel	keff	σ	keff+2σ	AENCF
13	f97t01	0.1	0.3434	0.0008	0.3450	0.0580
14	f97t05	0.5	0.2840	0.0005	0.2850	0.0253
15	f97t08	0.8	0.2476	0.0004	0.2484	0.0198
16	f97t00	1	0.2310	0.0004	0.2318	0.0180
17		**25% water in the clay 96% water in the fuel**				
18		water density of the clay	keff	σ	keff+2σ	AENCF
19	01ft25	0.1	0.2622	0.0005	0.2631	0.0206
20	05ft25	0.5	0.2610	0.0004	0.2618	0.0210
21	08ft25	0.8	0.2624	0.0004	0.2632	0.0199
22	10ft25	1	0.2617	0.0004	0.2625	0.0213
23						
24		water density in the fuel (r clay=1)	keff	σ	keff+2σ	AENCF
25	960125	0.1	0.3305	0.0011	0.3327	0.0742
26	960525	0.5	0.3189	0.0006	0.3201	0.0301
27	960825	0.8	0.2806	0.0004	0.2813	0.0228
28	10ft25	1	0.2617	0.0004	0.2625	0.0213
29		**49% water in the clay 75%water in fuel**				
30		water density in the clay	keff	σ	keff+2σ	AENCF
31	754901	0.1	0.4555	0.0009	0.4574	0.0570
32	754905	0.5	0.4726	0.0011	0.4748	0.0648
33	754908	0.8	0.4700	0.0009	0.4718	0.0664
34	754910	1	0.4675	0.0011	0.4696	0.0666
35						
36		water density in fuel (r clay=1)	keff	σ	keff+2σ	AENCF
37	750149	0.1	0.4198	0.0012	0.4222	0.2243
38	750549	0.5	0.4865	0.0012	0.4890	0.0958
39	750849	0.8	0.4633	0.0010	0.4653	0.0750

	A	B	C	D	E	F
40	751049	1	0.4675	0.0011	0.4696	0.0666
41						
42		water denisty in fuel (r clay=0.5)	keff	σ	keff+2σ	AENCF
43	750105		0.2450	0.0008	0.2466	0.2585
44	750505		0.4368	0.0011	0.4390	0.0993
45	750805		0.4676	0.0013	0.4701	0.0767
46	751005		0.4726	0.0011	0.4748	0.0476
47	**40% water in the clay 93%water in fuel**					
48		water density in the clay	keff	σ	keff+2σ	AENCF
49	934001	0.1	0.3227	0.0006	0.3238	0.0286
50	934005	0.5	0.3223	0.0005	0.3234	0.0303
51	934008	0.8	0.3218	0.0006	0.3230	0.0284
52	934010	1	0.3222	0.0005	0.3232	0.0289
53	**45% water in the clay 90%water in fuel**					
54		water density in the clay	keff	σ	keff+2σ	AENCF
55	894501	0.1	0.3775	0.0007	0.3788	0.0377
56	894505	0.5	0.3758	0.0007	0.3771	0.0374
57	894508	0.8	0.3739	0.0007	0.3752	0.0373
58	894510	1	0.3739	0.0007	0.3752	0.0376
59	**50%water in the clay 68% water in the fuel**					
60		water density in clay	keff	σ	keff+2σ	AENCF
61	695001	0.1	0.4910	0.0011	0.4932	0.0766
62	695005	0.5	0.4788	0.0013	0.4814	0.0782
63	695008	0.8	0.4756	0.0010	0.4776	0.0822
64	695010	1	0.4754	0.0010	0.4775	0.0796
65						
66		water density in fuel (r clay=0.1)	keff	σ	keff+2σ	AENCF
67	690101	0.1	0.2503	0.0009	0.2521	0.2866
68	690501	0.5	0.4362	0.0012	0.4385	0.1174
69	690801	0.8	0.4794	0.0012	0.4818	0.0895
70	691001	1	0.4910	0.0011	0.4932	0.0766
71			keff	σ	keff+2σ	AENCF
72	mx6910		0.4876	0.0012	0.4899	0.0745
73	mx6925		0.4704	0.0010	0.4725	0.0691
74	mx6960		0.3997	0.0009	0.4016	0.0645
75			keff	σ	keff+2σ	AENCF
76	homo	1	0.1654	0.0002	0.1659	0.0149
77	homo08	0.8	0.1766	0.0003	0.1772	0.0168
78	homo05	0.5	0.2029	0.0003	0.2035	0.0172

	A	B	C	D	E	F
79	homo01	0.1	0.2744	0.0006	0.2755	0.0245
80		different loading of poison	keff	σ	keff+2σ	AENCF
81	69nogd		0.8848	0.0016	0.8881	0.0438
82	69nofe		0.4845	0.0011	0.4866	0.0927
83	69nogf		0.9213	0.0017	0.9247	0.0489
84		different loading of poison	keff	σ	keff+2σ	AENCF
85	01gd50		0.2470	0.0009	0.2488	0.4043
86	01fe50		0.1964	0.0008	0.1979	0.7657
87	01gf50		0.2273	0.0008	0.2290	0.6551
88		mix	keff	σ	keff+2σ	AENCF
89	mixt10.O		0.3481	0.0009	0.3498	0.0619
90	mixt25.O		0.3341	0.0009	0.3359	0.0574
91	mixt60.O		0.2913	0.0007	0.2927	0.0362
92	mixt100.O		0.2929	0.0005	0.2940	0.0234
93		different loading of poison	keff	σ	keff+2σ	AENCF
94	nogd75.O		0.7987	0.0016	0.8018	0.0269
95	nogdfe.O		0.8500	0.0017	0.8534	0.0274
96	nogdal.O		0.8031	0.0016	0.8062	0.0264
97	nogfal.O		0.8539	0.0015	0.8569	0.0272
98			keff	σ	keff+2σ	AENCF
99	f25t00.O		0.1930	0.0008	0.1946	0.2086
100	f50t00.O		0.2586	0.0009	0.2604	0.1309
101	f75t00.O		0.3463	0.0009	0.3481	0.0670
102	f97t00.O		0.2310	0.0004	0.2318	0.0180
103	f75t30.O		0.3516	0.0010	0.3535	0.0629
104	f75t60.O		0.3562	0.0008	0.3578	0.0596

	A	B	C	D	E
1		keff	σ	keff+2σ	AENCF
2	69ng.5.O	0.89945	0.00152	0.90249	3.52E-02
3	69ng.7.O	0.86447	0.00161	0.86769	3.34E-02
4	69ngal.O	0.78719	0.00139	0.78997	3.13E-02
5	69no.5.O	0.96374	0.00163	0.967	3.69E-02
6	69no.7.O	0.94443	0.00163	0.94769	3.47E-02
7	69noal.O	0.89154	0.00157	0.89468	3.18E-02
8	7549.5.O	0.38442	0.00081	0.38604	6.87E-02
9	7549.7.O	0.30937	0.00061	0.31059	7.76E-02
10	7549al.O	0.2053	0.00028	0.20586	9.80E-02
11	8945.5.O	0.28098	0.00043	0.28184	4.42E-02
12	8945.7.O	0.2223	0.0004	0.2231	4.99E-02
13	8945al.O	0.15404	0.00023	0.1545	6.25E-02
14	m06f.5.O	0.5211	0.0011	0.5233	0.185158
15	m06f.7.O	0.48763	0.00122	0.49007	0.180793
16	m06fal.O	0.39508	0.00074	0.39656	0.192985
17	m56.5.O	0.53128	0.00105	0.53338	9.75E-02
18	m56.7.O	0.45015	0.00075	0.45165	0.107335
19	m56al.O	0.31066	0.00049	0.31164	0.130183
20	mx69.5.O	0.402	0.00089	0.40378	6.59E-02
21	mx69.7.O	0.33519	0.0006	0.33639	7.26E-02
22	mx69al.O	0.24413	0.00043	0.24499	7.13E-02
23	nofe.5.O	0.55913	0.00073	0.56059	0.113962
24	nofe.7.O	0.4738	0.00057	0.47494	0.12335
25	nofeal.O	0.32721	0.00039	0.32799	0.150547
26	nogd.5.O	1.10976	0.00123	1.11222	4.72E-02
27	nogd.7.O	1.09981	0.00116	1.10213	4.26E-02
28	nogdal.O	1.04529	0.00118	1.04765	3.90E-02
29	nogf.5.O	0.91105	0.0017	0.91445	7.16E-02
30	nogf.7.O	0.90962	0.00173	0.91308	6.46E-02
31	nogfal.O	0.86668	0.00155	0.86978	5.77E-02
32	t00f.5.O	0.2495	0.00078	0.25106	0.525051
33	t00f.7.O	0.23992	0.00078	0.24148	0.497244
34	t00fal.O	0.22092	0.00075	0.22242	0.495299
35	w50h.5.O	0.40624	0.00086	0.40796	0.113614
36	w50h.7.O	0.35137	0.00085	0.35307	0.120787
37	w50hal.O	0.25174	0.00055	0.25284	0.141801

	A	B	C	D	E
1		keff	σ	keff+2σ	AENF
2	w00h00.O	0.2239	0.0007	0.2253	0.4655
3	w00h10.O	0.3221	0.0010	0.3241	0.1421
4	w00h20.O	0.3598	0.0011	0.3619	0.0841
5	w00h30.O	0.3743	0.0009	0.3761	0.0591
6	w10h00.O	0.2803	0.0009	0.2822	0.3323
7	w10h10.O	0.4001	0.0010	0.4021	0.0944
8	w10h20.O	0.4117	0.0009	0.4135	0.0593
9	w10h30.O	0.4060	0.0010	0.4079	0.0452
10	w20h00.O	0.3284	0.0010	0.3304	0.2530
11	w20h10.O	0.4329	0.0011	0.4350	0.0748
12	w20h20.O	0.4227	0.0010	0.4247	0.0484
13	w20h30.O	0.3936	0.0009	0.3953	0.0392
14	w30h00.O	0.3698	0.0011	0.3720	0.1968
15	w30h10.O	0.4438	0.0012	0.4461	0.0633
16	w30h20.O	0.4084	0.0009	0.4102	0.0406
17	w30h30.O	0.3664	0.0007	0.3679	0.0336
18	w40h00.O	0.4109	0.0012	0.4134	0.1551
19	w40h10.O	0.4356	0.0008	0.4372	0.0515
20	w40h20.O	0.3791	0.0007	0.3805	0.0374
21	w40h30.O	0.3335	0.0007	0.3348	0.0309
22	w50h00.O	0.4468	0.0011	0.4490	0.1234
23	w50h10.O	0.4103	0.0008	0.4119	0.0440
24	w50h20.O	0.3418	0.0007	0.3432	0.0327
25	w50h30.O	0.2960	0.0005	0.2970	0.0255
26	nogd30	0.7072	0.0016	0.7103	0.0387
27	nogf30	0.6944	0.0014	0.6972	0.0410
28	nogd50	0.6175	0.0014	0.6202	0.0808
29	nogf50	0.8506	0.0018	0.8542	0.0921
30	ngd30b	0.7650	0.0018	0.7685	0.0351
31	ngf30b	0.7640	0.0015	0.7670	0.0377

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	**hematite forms at 10.26 1000s of years +**				0	***100 % of water**		**total volume**	6145900	cc	**tot mass**	23921.4	**tot density**	0.00389
3														
4	ρ=	3.892	kg/l		Na=	6.02E-01	at/barn.cm		Volume=	6145900	cc	mass	23921.4	kg
5	**Isotopes**	**Atomic Mass**	**MCNP ID**	**Mole%**	**mass (g)**	**number densities (at/bar.cm)**			at/bar.cm			1 mol is	24.607342	g
6	H	1.00782519	1001.50c	6.455	6.32E+04	6.15E-03			6.1486E-03			972124.51	moles	
7	C	12.01115	6000.50c	0.0002	2.34E+01	1.91E-07			1.9051E-07					
8	O	15.994915	8016.50c	59.8	9.30E+06	5.70E-02			5.6961E-02					
9	Na	22.9897707	11023.50c	0.0291	6.50E+03	2.77E-05			2.7719E-05					
10	Al	26.9815389	13027.50c	1.139	2.99E+05	1.08E-03			1.0849E-03					
11	Si	28.086	14000.50c	11.89	3.25E+06	1.13E-02			1.1326E-02					
12	Ca	40.08	20000.50c	0.1994	7.77E+04	1.90E-04			1.8993E-04					
13	K	39.102	19000.50c	0.105	3.99E+04	1.00E-04			1.0002E-04					
14	Ti	47.9	22000.50c	0.1819	8.47E+04	1.73E-04			1.7326E-04					
15	Mn	54.9380503	25055.50c	0.7144	3.82E+05	6.80E-04			6.8049E-04					
16	Fe	55.847	26000.55c	18.84	1.02E+07	1.79E-02			1.7946E-02					
17	Ni	58.71	28000.50c	0.3249	1.85E+05	3.09E-04			3.0948E-04					
18	Cu	63.54	29000.50c	0.0123	7.60E+03	1.17E-05			1.1716E-05					
19	Gd	157.25	64000.35c	0.002	3.06E+03	1.91E-06			1.9051E-06					
20	Mg	24.312	12000.50c	0.2597	6.14E+04	2.47E-04			2.4737E-04					
21				99.9529	2.40E+07	9.52E-02			9.5208E-02			tot moles	972124.51	
22														
23	**water**				**mass (g)**	**number densities (at/bar.cm)**								
24	ρ=	1	kg/l		Na=	6.02E-01	at/barn.cm		Volume=	0	cc	mass=	0	g
25	H	1.00782519	1001.50c	200	0.00E+00	0.00E+00						1 mol is	1.80E+01	
26	O	15.994915	8016.50c	100	0.00E+00	0.00E+00						0.00E+00	mole of h2o	
27					0.00E+00	0.00E+00								

file name	69nogd	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	2.1317E-04	1.0659E-04	5.3293E-05	0.0000E+00
Pu-240	6.5600E+03	2.8268E-05	2.2150E-06	0.0000E+00	0.0000E+00
Pu-241		2.4720E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		1.8159E-06	1.0840E-04	1.6169E-04	2.1499E-04
U-236		0.0000E+00	2.6053E-05	2.8268E-05	2.8268E-05
Np-237		0.0000E+00	2.4720E-06	2.4720E-06	2.4720E-06
ref 13	15th edition of chart of nuclide				

file name	754905	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	1.6642E-04	8.3210E-05	4.1605E-05	0.0000E+00
Pu-240	6.5600E+03	2.2069E-05	1.7293E-06	0.0000E+00	0.0000E+00
Pu-241		1.9299E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		1.4177E-06	8.4628E-05	1.2623E-04	1.6784E-04
U-236		0.0000E+00	2.0340E-05	2.2069E-05	2.2069E-05
Np-237		0.0000E+00	1.9299E-06	1.9299E-06	1.9299E-06
ref 13	15th edition of chart of nuclide				

file name	o894508	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	6.8101E-05	3.4051E-05	1.7025E-05	0.0000E+00
Pu-240	6.5600E+03	9.0308E-06	7.0763E-07	0.0000E+00	0.0000E+00
Pu-241		7.8974E-07	0.0000E+00	0.0000E+00	0.0000E+00
U-235		5.8013E-07	3.4631E-05	5.1656E-05	6.8681E-05
U-236		0.0000E+00	8.3232E-06	9.0308E-06	9.0308E-06
Np-237		0.0000E+00	7.8974E-07	7.8974E-07	7.8974E-07
ref 13	15th edition of chart of nuclide				

file name	m06f0c	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	1.0762E-03	5.3810E-04	2.6905E-04	0.0000E+00
Pu-240	6.5600E+03	1.4271E-04	1.1182E-05	0.0000E+00	0.0000E+00
Pu-241		1.2480E-05	0.0000E+00	0.0000E+00	0.0000E+00
U-235		9.1678E-06	5.4727E-04	8.1632E-04	1.0854E-03
U-236		0.0000E+00	1.3153E-04	1.4271E-04	1.4271E-04
Np-237		0.0000E+00	1.2480E-05	1.2480E-05	1.2480E-05
ref 13	15th edition of chart of nuclide				

file name	m56f0c	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	5.3810E-04	2.6905E-04	1.3453E-04	0.0000E+00
Pu-240	6.5600E+03	7.1357E-05	5.5914E-06	0.0000E+00	0.0000E+00
Pu-241		6.2401E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		4.5839E-06	2.7363E-04	4.0816E-04	5.4268E-04
U-236		0.0000E+00	6.5766E-05	7.1357E-05	7.1357E-05
Np-237		0.0000E+00	6.2401E-06	6.2401E-06	6.2401E-06
ref 13	15th edition of chart of nuclide				

file name	mx6925				
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	2.1317E-04	1.0659E-04	5.3293E-05	0.0000E+00
Pu-240	6.5600E+03	2.8268E-05	2.2150E-06	0.0000E+00	0.0000E+00
Pu-241		2.4720E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		1.8159E-06	1.0840E-04	1.6169E-04	2.1499E-04
U-236		0.0000E+00	2.6053E-05	2.8268E-05	2.8268E-05
Np-237		0.0000E+00	2.4720E-06	2.4720E-06	2.4720E-06
ref 13	15th edition of chart of nuclide				

file name	nofe56 nogd56	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	5.3810E-04	2.6905E-04	1.3453E-04	0.0000E+00
Pu-240	6.5600E+03	7.1357E-05	5.5914E-06	0.0000E+00	0.0000E+00
Pu-241		6.2401E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		4.5839E-06	2.7363E-04	4.0816E-04	5.4268E-04
U-236		0.0000E+00	6.5766E-05	7.1357E-05	7.1357E-05
Np-237		0.0000E+00	6.2401E-06	6.2401E-06	6.2401E-06
ref 13	15th edition of chart of nuclide				

file name	nogf50	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	3.2794E-04	1.6397E-04	8.1985E-05	0.0000E+00
Pu-240	6.5600E+03	4.3488E-05	3.4076E-06	0.0000E+00	0.0000E+00
Pu-241		3.8030E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		2.7936E-06	1.6676E-04	2.4875E-04	3.3073E-04
U-236		0.0000E+00	4.0080E-05	4.3488E-05	4.3488E-05
Np-237		0.0000E+00	3.8030E-06	3.8030E-06	3.8030E-06
ref 13	15th edition of chart of nuclide				

file name	t00f20				
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	1.0762E-03	5.3810E-04	2.6905E-04	0.0000E+00
Pu-240	6.5600E+03	1.4271E-04	1.1182E-05	0.0000E+00	0.0000E+00
Pu-241		1.2480E-05	0.0000E+00	0.0000E+00	0.0000E+00
U-235		9.1678E-06	5.4727E-04	8.1632E-04	1.0854E-03
U-236		0.0000E+00	1.3153E-04	1.4271E-04	1.4271E-04
Np-237		0.0000E+00	1.2480E-05	1.2480E-05	1.2480E-05
ref 13	15th edition of chart of nuclide				

file name	w50h00	Atomic Densities			
		t=0	t=T1/2	t=2*T1/2	t=final
	half life (ref 1)	0.0000E+00	2.4100E+04	4.8200E+04	
Pu-239	2.4100E+04	3.2794E-04	1.6397E-04	8.1985E-05	0.0000E+00
Pu-240	6.5600E+03	4.3488E-05	3.4076E-06	0.0000E+00	0.0000E+00
Pu-241		3.8030E-06	0.0000E+00	0.0000E+00	0.0000E+00
U-235		2.7936E-06	1.6676E-04	2.4875E-04	3.3073E-04
U-236		0.0000E+00	4.0080E-05	4.3488E-05	4.3488E-05
Np-237		0.0000E+00	3.8030E-06	3.8030E-06	3.8030E-06
ref 13	15th edition of chart of nuclide				