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Page 1 of ____
1. EDT 603205

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5. Key Words Neutron, Gamma ray, Dose Rates Shielding, Driver Fuel Assembly, Solid Easte Cask, IEM Cell APPROVED FOR PUBLIC RELEASE <i>V. Burkland</i> 11/12/95	6. Author Name: R. L. Simons <i>Robert L. Simons</i> 11-17-94 Signature Organization/Charge Code 8D530/B193A	
7. Abstract <p>The adapter plate for the Interim Examination and Maintenance (IEM) cell ten foot ceiling valve was modified so that the penetration through the valve is offset to the north side of the steel plate. The modifications required that the shielding effectiveness be evaluated for several operating conditions. The highest gamma ray dose rate (51 mrem/hr) occurs when a Core Component Container (CCC) with six high burn-up driver fuel assemblies is transferred into or out of Solid Waste Cask (SWC). The neutron dose rate at the same source location is 2.5 mrem/hr. The total dose rate during the transfer is less than the 200 mrem/hr limit. If the ten foot ceiling valve is closed, the dose rate with twelve DFA in the cell will be less than 0.1 mrem/hr. However, with the ceiling valve open the dose rate will be as high as 12 mrem/hr. The latter condition will require controlled access to the area around the off set adapter plate when the ceiling valve is open. It was found that gaps in the shield block around the SWC floor valve will allow contact dose rates as high as 350 mrem/hr during the transfer of a fully loaded CCC. Although this situation does not pertain to the offset adapter plate, it will require controlled access around the SWC valve during the transfer of a fully loaded CCC.</p>		
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Shielding Analysis of the IEM Cell Offset Adapter Plate

INTRODUCTION

The FFTF Driver Fuel Assemblies (DFA) and pin containers will be cleaned of sodium and reloaded into a Core Component Container (CCC) in the Interim Examination and Maintenance (IEM) cell [1]. The CCC with six 150,000 MWD/MT maximum burn-up DFA are transferred from the IEM cell to the solid waste cask through the ten foot ceiling valve. The offset adapter plate was designed to support and position the SWC on the IEM cell ten foot ceiling valve. The purpose of this report is to document the shielding evaluation of the offset adapter assembly plate during the transfer of a fully loaded CCC into or out of the SWC. The maximum dose rate allowed during the transfer is ≤ 200 mrem/hr [2]. Several other operating conditions were also analyzed for acceptable radiation levels. These source locations included: 1.) two fully loaded CCC on the Maintenance Turn Table (MTT), 2.) one DFA in the sodium removal system (Ident 89), 3.) two DFA in the fuel storage locations ident 39, 4.) two DFA in the core component pot storage containers at ident 17, 5.) two fully loaded CCC on the MTT while the shielded component transfer cask (SCTC) is on the offset adaptor plate, and 6.) the offset adapter plate cover in place with the 10 foot ceiling valve open or closed and one CCC on the MTT.

The radiation sources are DFA's irradiated to 150,000 MWD/mt and decayed four years [3]. After four years of decay the primary gamma ray source from the DFA fuel zone is Cs137, and from the length of the assembly is Co60 from activation of the stainless steel. Neutrons from the fuel also make a minor contribution to the dose rate.

The Monte Carlo computer code MCNP [4] was used for all calculations. Gamma rays were calculated in the point kernel mode and neutrons were calculated in the Monte Carlo mode. The geometry model used in this analysis was that developed for the IEM cell maintenance support [5]. The model included all relevant details in the cell but did not include any details for the ceiling valves. The geometry details for the ceiling valve and the interface of the SWC and SCTC with the offset adapter plate were developed in this analysis.

ANALYSIS

The geometry model of the IEM cell developed to support the maintenance of the IEM cell was used as the basic starting point for this model. The MTT was added to the main cell and a CCC with six DFA was placed on the MTT below the ten foot ceiling valve. The ten foot ceiling valve was added to the model with the offset adapter plate. Three different equipment scenarios were then added to model of the adapter plate. These included the SWC, SCTC, and the cover plate for the offset adapter plate. The model includes flexibility to position the CCC at any elevation. The IEM cell model modifications were based on H-4 drawings [6]. Figure 1 shows a vertical section of the CCC on the MTT and the SWC positioned on the offset adapter plate. Figure 2 shows a closeup view of the SWC as the CCC is passing through the offset adapter plate. Figure 3 shows the same view of the SWC but the vertical section is rotated 90 degrees. The circled numbers are locations where dose rates were calculated. The valve and adapter plates were modeled in detail to account for any streaming paths. Figure 4 shows a cross section of the SWC valve while the CCC is passing through.

Figure 5 shows a closeup view of the SCTC setting on the offset adapter plate. This situation was modeled to determine if any stream paths existed while DFA were in the

IEM cell. Figure 6 shows the cover in place on the offset adapter plate. The ten foot ceiling valve can be optionally opened or closed. This situation was also modeled to determine if any streaming paths exist. Source locations within the IEM cell include the storage locations IDENT-17 and 39, sodium cleaning location IDENT-89, and the fully loaded CCC at two location on the MTT. Figure 7 show a plan view of these locations in the cell.

The radiation source was previously defined [3]. The gamma rays include 0.662 MeV from Cs137/Ba137 fission products, and Co60 from activation of the stainless steel. The fission products are limited to the 36 inch fuel region while the Co60 is distributed the length of the assembly. Neutrons, which are also limited to the fuel region, are relatively minor contributors to the dose rate.

The MCNP computer code [4] was run in the point kernel mode and the dose rate tallies were made at selected points symmetrically distributed on the offset adapter plate. Statistical uncertainties were less than or equal to 5 percent.

Appendix A gives three MCNP input data files that correspond to the SWC, SCTC, and the cover positioned on the offset adapter plate. The input data files contain the fuel neutron source, and the fission product or Co60 gamma ray source distributions.

RESULTS

The adequacy of the shielding effectiveness of the offset adapter plate was evaluated primarily with the SWC in place. The highest dose rates were found for the case with the CCC passing through the offset adapter plate. Table 1 shows the calculated dose rates on the side, front, and back of the SWC valve for various source configurations. The maximum gamma ray dose rate (51 mrem/hr) occurs on the side of the SWC valve on top of the offset adapter plate. This high dose rate is in part due to the gaps in the shield blocks where the minimum shield thickness is 12.13 inches. In the shield gap around the floor valves the dose rate is 350 mrem/hr at contact of the side of the SWC valve. At about 12 inches distance from the SWC valve the dose rate drops below 200 mrem/hr. On the front side, the gamma ray maximum dose rate (37 mrem/hr) occurs at the interface between the offset adapter plate and the floor. On the back side (i.e., North) the maximum dose rate on top of the offset adapter plate is 6.4 mrem/hr. Above the SWC valve the dose rate increase to 250 mrem/hr at contact where the shield thickness is reduced to 13.75 inches. These dose rates that exceed 200 mrem/hr are not associated with the offset adapter plate, but are due to gaps in the shielding around the SWC valve. Adding additional shield material to the valve or administratively restricting access to these area will keep personnel exposure within the limits of WHC-CM-4-09, "Radiation Design Manual [2]."

During normal in cell operations the location of the DFA controls the dose rate on the top of the offset adapter plate. Five source locations were considered. Table 1 show the dose rates for two DFA in locations IDENT-17 and 39. The maximum combined dose rate (12 mrem/hr) occurs on the side of the adapter plate. If a single DFA is in the sodium cleaning location (IDENT-89), the dose rate at the side of the adapter plate will be 1.7 mrem/hr.

The source on the MTT was positioned at two locations: directly under the SWC and rotated 48 degrees around the MTT. Table 1 gives the dose rates when a fully loaded (6 DFA) CCC is directly under the SWC on the MTT. The maximum dose rate is 2.5 mrem/hr. If a CCC is rotated around the MTT 48 degrees the maximum dose rate will be 3.5 mrem/hr. If two fully loaded CCC's are on the MTT, the combined dose rate will be 5.8 mrem/hr { MTT (1) + MTT (2) } at the side of the SWC valve on top of the adapter plate and 4.3 mrem/hr in the front of the SWC valve.

The ten foot ceiling valve provides shielding above the IEM cell during normal operation. When no equipment is on the offset adapter plate, the entrance through the adapter plate is covered by a four inch steel cover plate. The dose rate through the cover plate will be about 130 rem/hr from one fully loaded CCC on the MTT. If the ten foot ceiling valve is closed, the dose rate is reduced over eight orders of magnitude to 0.0008 mrem/hr. The cover plate can not be relied on as a shielding factor, and therefore the ten foot ceiling valve must be closed when the cover plate is in place or the fuel inventory reduced.

Equipment is passed into the IEM cell through the ten foot ceiling valve from the SCTC. The maximum dose rate contribution from a fully loaded CCC centered below the SCTC is 1.6 mrem/hr on either side of the SCTC and 3.2 mrem/hr on the front side of the SCTC. These dose rates are comparable to those found for the SWC; and consequently, the maximum combination dose rate with 12 DFA being processed in the cell will be 8 to 12 mrem/hr.

The maximum dose rate for controlled access above the IEM cell at the 550 foot level must be less than 2 mrem/hr. If the ten foot ceiling valve is left open while the SWC, SCTC, or cover plate are in place, the 2 mrem/hr limit is exceeded when 12 DFA are being processed in the IEM cell. Therefore, the ten foot ceiling valve must be closed during in-cell operations, and the area must have controlled access during the transfer conditions.

CONCLUSIONS

The maximum gamma ray dose rate above the offset adapter plate during the transfer of a fully loaded CCC is 51 mrem/hr. Thus the 200 mrem/hr transient dose rate limit is met. During non transient conditions and with the ten foot ceiling valve open, the maximum dose rate is between 8 and 12 mrem/hr for both the SWC and the SCTC. Thus the area access must be controlled. When the ten foot ceiling valve is closed the, dose rate from in-cell sources will be less than 0.1 mrem/hr. When the cover plate is the only radiation shield while the ten foot ceiling valve is open, the dose rate will exceed 100 rem/hr. Therefore, the ceiling valve must be closed when the cover plate is in place or the fuel inventory reduced.

REFERENCES

1. D. L. Nielsen and R. B. Packard, "FDC for the IEM Cell Enhancements/Interim Storage Area," WHC-SD-F027-FDC-001, EDT159301, Westinghouse Hanford Company, Richland, WA, June 25, 1993.
2. RADIOLOGICAL DESIGN MANUAL, WHC-CM-4-9, Rev. 3, Westinghouse Hanford Company, Richland, WA, August 12, 1991.
3. L. R. Besel, "Specification for FFTF Interim Storage Cask," WHC-S-4110, Rev. 2, Westinghouse Hanford Company, Richland, WA, April 3, 1992.
4. L. L. Carter, "Certification of MCNP Version 4 for CRAY and Sun Workstations," WHC-SD-MP-SWD-30001, rev 5, ECN-186708, Westinghouse Hanford Company, Richland, WA, April 20, 1993.
5. Memorandum, R. H. Webb to R. L. Simons, "MCNP IEM Cell Model Description," RHW-91-001, July 9, 1991.
6. Westinghouse Hanford Drawings: H-4-302131 sheets 1 through 3, Rev 0, January 4, 1994. H-4-33384 sheet 1, Rev. 1 per ECN A14770, April 29, 1981.

Table 1 Calculated Dose Rate Around the SWC Setting on the Offset Adapter Plate.

Dose Point Location		Calculated Dose Rate (mrem/hr)							Neutron Dose Rate (mrem/hr)
		Source Location							
		MTT (1)	MTT (2)	ID-17	ID-39	ID-89	Transient (3)	Max. Comb. (4)	Transient (3)
Side	3	2.3	3.5	1.7	5.5	1.7	51	12	2.5
	4	0	0	0	0	0.1	29	0.1	0.9
	5	0	0	0	0	0	19	0	0.3
	6	0	0	0	0	0	0	0	0.2
Front	16	2.3	1.7	1.6	3.4	0.4	6.1	8.0	0.2
	17	2.5	1.8	1.7	2.7	0.4	5.1	7.6	0.2
	18	0	0	0	0	0	0.01	0	0.3
	19	0	0	0	0	0	37	0	0.6
Back	28	0	0	0	0	0	6	0	3.4
	29	0	0	0	0	0.2	1.1	0.2	6.9

1. CCC on the MTT directly under the SWC.

2. CCC on the MTT rotated 48 degrees.

3. Maximum transient dose rate includes contributions from six DFA in the CCC and six DFA in the IEM cell.

4. The maximum combination dose rate includes the dose rates from six DFA at location MTT(1), one DFA at location MTT(2), two DFA each in ID-17 and 39, and one DFA in ID-89.

08/02/94 13:58:39
 iem cell 3D model w/
 penetrations and sources.

probid = 08/02/94 13:53:21
 basis:
 (0.000000, 1.000000, 0.000000)
 (0.000000, 0.000000, 1.000000)
 origin:
 (213.00, 535.00, 1000.00)
 extent = (1100.00, 1100.00)

Figure 1 Vertical Section of the IEM Cell Geometry Model.

08/02/94 14:01:29
em cell 3D model w/
penetrations and sources.

robid = 08/02/94 13:53:21
asis:
0.000000, 1.000000, 0.000000)
0.000000, 0.000000, 1.000000)
rigin:
213.00, 535.00, 1700.00)
xtent = (600.00, 600.00)

Figure 2 Vertical Section of the IEM Cell Geometry Model With the CCC Passing Through the Offset Adapter Plate into the SWC.

08/02/94 13:56:36
 iem cell 3D model w/
 penetrations and sources.

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 basis:
 (1.000000, 0.000000, 0.000000)
 (0.000000, 0.000000, 1.000000)
 origin:
 (213.00, 535.00, 1000.00)
 extent = (1100.00, 1100.00)

Z, cm

Figure 3 The Same Geometry Model of Figure 2 But Rotated 90 Degrees.

08/02/94 14:03:58
iem cell 3D model w/
penetrations and sources.

probid = 08/02/94 13:53:21
basis:
(1.000000, 0.000000, 0.000000)
(0.000000, 1.000000, 0.000000)
origin:
(213.00, 535.00, 1725.00)
extent = (150.00, 150.00)

Figure 4 Cross Section Through The SWC Valve With The CCC Passing Through.

08/02/94 13:01:23
 iem cell 3D model w/
 penetrations and sources.

probid = 08/02/94 12:52:10
 basis:
 (1.000000, 0.000000, 0.000000)
 (0.000000, 0.000000, 1.000000)
 origin:
 (213.00, 540.00, 1690.00)
 extent = (300.00, 300.00)

Figure 5 Vertical Section Of The IEM Cell With The SCTC On The Offset Adapter Plate.

Figure 6 Vertical Section Of The Offset Adapter Plate With The Cover In Place.

08/02/94 13:51:52
 iem cell 3D model w/
 penetrations and sources.

probid = 08/02/94 13:46:42
 basis:
 (1.000000, 0.000000, 0.000000)
 (0.000000, 1.000000, 0.000000)
 origin:
 (400.00, 350.00, 725.00)
 extent = (600.00, 600.00)

Figure 7 Plan View Of The IEM Cell Showing The In Cell Source Locations.

APPENDIX A
SAMPLE INPUT DATA FILES TO MCNP

Table A-1 MCNP Input Data File With The SWC In Place and a Neutron Source.

```

IEM Cell 3D model w/ penetrations and sources.
c   DFA MP at _____ foot elevation.
c   .
c   .
c   Six 150,000 MWD/T DFA in CCC (cell 118)
c   DFA fission spectrum.
c   .
c   .
c   All N., NE. and E walls are divided into cells w. thickness
c   of 15.24 cm (about 1 mean-free path).
c   Outside world is defined by cells 47, 48, 67, 68 and 69.
c   Source cells are as follows:
c   ID 89: 93
c   ID 17S: 94
c   ID 17N: 95
c   ID 39W: 96
c   ID 39E: 97
c   ID 41: 98
c   ID 103W: 99
c   ID 103E: 100
c   ID 35W: 101
c   (Note: When ID 35W is in the up position, the tr27 card should read:
c   tr27 327.66 152.4 319.62
c   When ID 35W is in the down position, the tr27 card should read:
c   tr27 327.66 152.4 51.73
c
c   ID 35E: 102
c   (Note: When ID 35E is in the up position, the tr28 card should read:
c   tr28 718.8 152.4 319.62
c   When ID 35E is in the down position, the tr28 card should read:
c   tr28 718.8 152.4 51.73
c
c   If dose is to be predicted without MSM sleeve, then cell 63 should
c   be voided.
c   Cell 63 is voided in this case to remove the MSM sleeves.
1 1 -4.49 -23 19 8 -1 2 -5 $W. wall of S. cell(#43)
2 1 -4.49 -23 19 -2 9 8 -22 $S. wall (not incl. annex)
3 1 -4.49 -23 19 15 9 3 -52 #61 #64 #65 #66 $E. wall of annex(#46)
4 1 -4.49 -23 19 15 9 52 -53 #61 #64 #65 #66 $E. wall of annex(#46)
5 1 -4.49 -23 19 15 9 53 -54 #61 #64 #65 #66 $E. wall of annex(#46)
6 1 -4.49 -23 19 15 9 54 -55 #61 #64 #65 #66 $E. wall of annex(#46)
7 1 -4.49 -23 19 15 9 55 -56 #61 #64 #65 #66 $E. wall of annex(#46)
8 1 -4.49 -23 19 15 9 56 -57 #61 #64 #65 #66 $E. wall of annex(#46)
9 1 -4.49 -23 19 15 9 57 -58 #61 #64 #65 #66 $E. wall of annex(#46)
10 1 -4.49 -23 19 15 9 58 -10 #61 #64 #65 #66 $E. wall of annex(#46)
11 1 -4.49 -23 19 -15 16 4 -45 #82 #83 $NE slant wall of annex(#46)
12 1 -4.49 -23 19 -15 16 45 -46 #82 #83 $NE slant wall of annex(#46)
13 1 -4.49 -23 19 -15 16 46 -47 #82 #83 $NE slant wall of annex(#46)
14 1 -4.49 -23 19 -15 16 47 -48 #82 #83 $NE slant wall of annex(#46)
15 1 -4.49 -23 19 -15 16 48 -49 #82 #83 $NE slant wall of annex(#46)
16 1 -4.49 -23 19 -15 16 49 -50 #82 #83 $NE slant wall of annex(#46)
17 1 -4.49 -23 19 -15 16 50 -51 #82 #83 $NE slant wall of annex(#46)
18 1 -4.49 -23 19 -15 16 51 -11 #82 #83 $NE slant wall of annex(#46)
19 1 -4.49 -23 19 -16 17 5 -38 #78 #79 #80 #81 #103 $N. wall annex(#46)
20 1 -4.49 -23 19 -16 17 38 -39 #78 #79 #80 #81 #103 $N. wall annex(#46)
21 1 -4.49 -23 19 -16 17 39 -40 #78 #79 #80 #81 #103 $N. wall annex(#46)
22 1 -4.49 -23 19 -16 17 40 -41 #78 #79 #80 #81 #103 $N. wall annex(#46)
23 1 -4.49 -23 19 -16 17 41 -42 #78 #79 #80 #81 #103 $N. wall annex(#46)
24 1 -4.49 -23 19 -16 17 42 -43 #78 #79 #80 #81 #103 $N. wall annex(#46)
25 1 -4.49 -23 19 -16 17 43 -44 #78 #79 #80 #81 #103 $N. wall annex(#46)
26 1 -4.49 -23 19 -16 17 44 -12 #78 #79 #80 #81 #103 $N. wall annex(#46)
27 1 -4.49 -23 19 -17 -18 6 -31 #74 #75 #76 #77 $E. slant wall of N. cell
28 1 -4.49 -23 19 -17 -18 31 -32 #74 #75 #76 #77 $E. slant wall of N. cell
29 1 -4.49 -23 19 -17 -18 32 -33 #74 #75 #76 #77 $E. slant wall of N. cell
30 1 -4.49 -23 19 -17 -18 33 -34 #74 #75 #76 #77 $E. slant wall of N. cell
31 1 -4.49 -23 19 -17 -18 34 -35 #74 #75 #76 #77 $E. slant wall of N. cell
32 1 -4.49 -23 19 -17 -18 35 -36 #74 #75 #76 #77 $E. slant wall of N. cell
33 1 -4.49 -23 19 -17 -18 36 -37 #74 #75 #76 #77 $E. slant wall of N. cell
34 1 -4.49 -23 19 -17 -18 37 -13 #74 #75 #76 #77 $E. slant wall of N. cell
35 1 -4.49 -133 20 18 8 7 -24 $N. wall of N. cell(#44)
36 1 -4.49 -133 20 18 8 24 -25 $N. wall of N. cell(#44)
37 1 -4.49 -133 20 18 8 25 -26 $N. wall of N. cell(#44)

```

38 1 -4.49 -133 20 18 8 26 -27 \$N. wall of N. cell(#44)
 39 1 -4.49 -133 20 18 8 27 -28 \$N. wall of N. cell(#44)
 40 1 -4.49 -133 20 18 8 28 -29 \$N. wall of N. cell(#44)
 41 1 -4.49 -21 20 18 8 29 -30 \$N. wall of N. cell(#44)
 42 1 -4.49 -21 20 18 8 30 -14 \$N. wall of N. cell(#44)
 43 0 (-134 19 1 2 -22 -5) (79:84074:-84080) #93 #99 #100 #101
 c cell with wastecan and ID's 103, 89 and 35W
 44 0 -134 20 1 5 -22 -7 #94 #95 #96 #97 #98 #41 \$N. cell w/ ID 17,39 & 41
 (81:86) 103
 45 0 -23 20 5 22 -6 \$triangular part of N cell
 46 0 -23 19 -5 22 2 -3 -4 #102 \$cell annex
 47 0 -20 -14 19 5 8 -22 \$void area of step beneath turntable
 48 0 -20 19 5 22 -6 \$void for step along slant wall in N cell
 49 1 -4.49 23 -21 -29 9 22 -59 #70 #71 #72 #73 #104 \$E. wall above annex
 50 1 -4.49 23 -21 -29 9 59 -60 #70 #71 #72 #73 #104 \$E. wall above annex
 51 1 -4.49 23 -21 -29 9 60 -61 #70 #71 #72 #73 #104 \$E. wall above annex
 52 1 -4.49 23 -21 -29 9 61 -62 #70 #71 #72 #73 #104 \$E. wall above annex
 53 1 -4.49 23 -21 -29 9 62 -63 #70 #71 #72 #73 #104 \$E. wall above annex
 54 1 -4.49 23 -21 -29 9 63 -64 #70 #71 #72 #73 #104 \$E. wall above annex
 55 1 -4.49 23 -21 (-18:-29) 9 64 -65 #70 #71 #72 #73 #104 \$E. wall above annex
 56 1 -4.49 23 -21 -18 9 65 -66 #70 #71 #72 #73 #104 \$E. wall above annex
 57 1 -4.49 23 -21 -14 9 66 -67 #70 #71 #72 #73 #104 \$E. wall above annex
 58 1 -4.49 23 -21 -14 9 67 -68 #70 #71 #72 #73 #104 \$E. wall above annex
 59 1 -4.49 -23 19 22 9 -3 -2 \$S. wall of annex(#46)
 60 1 -4.49 20 -21 -29 5 -1 8 \$W. wall of N cell(#44)
 61 2 -7.93 72 -71 -71 -69 trcl=1 trcl=(853.44 114.3 556.26) \$MSM 121A
 c cells 61, 62 and 63 couple to make the MSM and sleeve.
 62 0 -70 u=1 \$MSM 121A inner cyl.
 63 2 -7.93 70 u=1 \$MSM sleeve; coupled w/ #61
 64 like 61 but trcl=(853.44 190.5 556.26) \$MSM 122A
 65 like 61 but trcl=(853.44 190.5 934.72) \$MSM 116A
 66 like 61 but trcl=(853.44 114.3 934.72) \$MSM 115A
 67 0 23 -21 68 (-13:-12) -11 -10 9 \$Void above cell annex
 68 0 -20 19 -14 18 22 \$triangular void @ bottom
 69 0 (-8:14:(13(11:12)):-9:10:21:-19) #57 #58
 (-8:91:14:68:-9:-21)
 c Outside world.
 70 like 61 but trcl=(426.72 114.3 1409.7) \$MSM 112A
 71 like 61 but trcl=(426.72 190.5 1409.7) \$MSM 111A
 72 like 61 but trcl=(426.72 495.3 1409.7) \$MSM 114A
 73 like 61 but trcl=(426.72 419.1 1409.7) \$MSM 113A
 74 like 61 but trcl=2 \$MSM 125A
 75 like 61 but trcl=3 \$MSM 126A
 76 like 61 but trcl=4 \$MSM 119A
 77 like 61 but trcl=5 \$MSM 120A
 78 like 61 but trcl=6 \$MSM 123A
 79 like 61 but trcl=7 \$MSM 124A
 80 like 61 but trcl=8 \$MSM 117A
 81 like 61 but trcl=9 \$MSM 118A
 82 0 -69 72 -73 trcl=10 \$U-420 periscope
 83 0 -69 72 -73 trcl=11 \$U-310A periscope
 84 0 -78 -74 80 77 #87 #88 #89 #90 #91 #92 trcl=18
 \$WC & contents
 85 2 -7.93 84078 -79 84080 -84074 \$WC thickness
 86 0 -84077 -84074 84080 \$WC hole
 87 3 -5.01 -75 -76 80 trcl=12 \$fuel1 in WC
 88 3 -5.01 -75 -76 80 trcl=13 \$fuel2 in WC
 89 3 -5.01 -75 -76 80 trcl=14 \$fuel3 in WC
 90 3 -5.01 -75 -76 80 trcl=15 \$fuel4 in WC
 91 3 -5.01 -75 -76 80 trcl=16 \$fuel5 in WC
 92 3 -5.01 -75 -76 80 trcl=17 \$fuel6 in WC
 93 3 -5.01 -75 -76 80 trcl=19 \$ident 89
 94 3 -5.01 -75 -76 80 trcl=20 \$ident 17 S
 95 3 -5.01 -75 -76 80 trcl=21 \$ident 17 N
 96 3 -2.50 -75 -76 80 trcl=22 \$ident 39 W
 97 3 -2.50 -75 -76 80 trcl=23 \$ident 39 E
 98 3 -5.01 -75 -76 80 trcl=24 \$ident 41
 99 4 -2.713 -75 -76 80 trcl=25 \$ident 103 W
 100 4 -2.713 -75 -76 80 trcl=26 \$ident 103 E
 101 4 -2.713 -75 -76 80 trcl=27 \$ident 35 W
 102 4 -2.713 -75 -76 80 trcl=28 \$ident 35 E
 103 like 82 but trcl=29 \$W-52A Periscope
 104 like 82 but trcl=30 \$U-471 Periscope
 105 2 -7.93 20 -81 -86 \$ maint. turn table

```

106 0      134 -83 -85 103
107 2 -7.93 83 -21 -85 96
108 2 -7.93 82 -21 85 1 2 -22 -29
109 2 -7.93 21 96 88 -87 -89 90 -84
111 0      21 9 -14 8 -68 -91 (-88:89:87:-90:84)
      102 (129:118:94:97:-95) (117:-98:-125:128:121)
      (100:-95:97:94:-98)
112 0      83 -101 -96 (-93:-84) 103 (-92:-99:93)
113 2 -7.93 99 -101 92 -93
114 2 -7.93 93 84 -100 98 -97 95 -94
115 0      116 -92 -91 103
116 2 -7.93 117 92 -102 -91
117 0      -103 81 -91
      (114:-107:115)
118 0      -114 107 -115
      #119 #120 #121 #122 #123 #124
      #125 #126 #127 #128 #129 #130 #131 #132 #133 #134 #135 #136
      #137 #138 #139
119 2 -7.93 -105 104 107 -114
120 0      -104 106 107 -114
121 0      -106 107 -114
122 2 -7.93 -1051 1041 107 -114
123 0      -1041 1061 107 -114
124 0      -1061      107 -114 fill=2 $ tube A
125 2 -7.93 -1052 1042 107 -114
126 0      -1042 1062 107 -114
127 0      -1062      107 -114 fill=2 $ tube B
128 2 -7.93 -1053 1043 107 -114
129 0      -1043 1063 107 -114
130 0      -1063      107 -114 fill=2 $ tube C
131 2 -7.93 -1054 1044 107 -114
132 0      -1044 1064 107 -114
133 0      -1064      107 -114 fill=2 $ tube D
134 2 -7.93 -1055 1045 107 -114
135 0      -1045 1065 107 -114
136 0      -1065      107 -114 fill=2 $ tube E
137 2 -7.93 -1056 1046 107 -114
138 0      -1046 1066 107 -114
139 0      -1066      107 -114 fill=2 $ tube F
140 5 -5.903 -108      u=2 $ inlet nozzle
141 5 -4.407 108 -109      u=2 $ lower shld
142 7 -4.461 109 -110      u=2 $ lower refl
143 6 -4.960 110 -111      u=2 $ DFA core
144 7 -4.461 111 -112      u=2 $ upper refl
145 5 -1.844 112 -113      u=2 $ plenum
146 5 -1.380 113      u=2 $ H. Socket
c Cells for SWC valve
147 2 -7.93 (100 -101 -94 93 -129 95 -97):
      (129 125 -128 98 -121 100 -101)
148 2 -7.93 101 -116 -120 -121 126 -127
149 0      120 -127 -121 126 119 101 -116
150 2 -7.93 -119 98 -128 125 101 -116
151 2 -7.93 125 -126 119 123 -121 101 -116
152 2 -7.93 127 -128 119 123 -121 101 -116
153 2 -7.93 101 -116 -123 (122:127:-126)
154 0      103 101 -116 -127 -122 126 121
155 2 -7.93 (123:117) #156 -97 -94 95 -129
      (128:-125:121) 101 -118 102
156 0      131 124 (123:117) 122 102 -129 101 -118
157 2 -7.93 (116 -117 92 -123 130):(-128 98 123 -121 116
      -117 130 125)
158 0      -130 116 -117
159 0      117 -118 102 -129 -121 125 -128
160 1 -4.49 -29 132 133 -134 1 -22
161 0      -132 7 133 -134 1 -22
162 8 -11.4 -29 7 134 -82 1 -22
163 0      -7 134 -82 136 1 -22 85
164 2 -7.93 -136 134 -82 2 1 -22

1 px 0
2 py 0
3 px 853.44
4 p 853.44 280.1 0 828.74 304.8 0 828.74 304.8 1064.26
5 py 304.8

```


6 p 426.72 609.6 0 508.39 304.8 0 508.39 304.8 1064.26
7 py 609.6
8 px -15.24
9 py -15.24
10 px 975.36
11 p 975.36 330.6 0 879.24 426.72 0 879.24 426.72 1064.26
12 py 426.72
13 p 601.95 426.72 0 520.27 731.52 0 520.27 731.52 1064.26
14 py 731.52
15 p 975.36 330.6 0 853.44 280.1 0 853.44 280.1 1064.26
16 p 879.24 426.72 0 828.74 304.8 0 828.74 304.8 1064.26
17 p 508.39 304.8 0 601.95 426.72 0 601.95 426.72 1064.26
18 p 426.72 609.6 0 520.27 731.52 0 520.27 731.52 1064.26
19 pz 0 ‡ IEM Cell bottom at 495 foot level.
20 pz 213.36
21 pz 1676.4 ‡ 550 foot level
22 px 426.72
23 pz 1066.8
24 py 624.84
25 py 640.08
26 py 655.32
27 py 670.56
28 py 685.8
29 py 702.31
30 py 716.28
31 p 520.09 320.04 0 438.41 624.84 0 438.41 624.84 1064.26
32 p 531.78 335.28 0 450.11 640.08 0 450.11 640.08 1064.26
33 p 543.48 350.52 0 461.8 655.32 0 461.8 655.32 1064.26
34 p 555.17 365.76 0 473.5 670.56 0 473.5 670.56 1064.26
35 p 566.87 381.0 0 485.19 685.8 0 485.19 685.8 1064.26
36 p 578.56 396.24 0 496.88 701.04 0 496.88 701.04 1064.26
37 p 590.25 411.48 0 508.58 716.28 0 508.58 716.28 1064.26
38 py 320.04
39 py 335.28
40 py 350.52
41 py 365.76
42 py 381.0
43 py 396.24
44 py 411.48
45 p 868.68 286.4125 0 835.0525 320.04 0 835.0525 320.04 1064.26
46 p 883.92 292.725 0 841.365 335.28 0 841.365 335.28 1064.26
47 p 899.16 299.0375 0 847.6775 350.52 0 847.6775 350.52 1064.26
48 p 914.4 305.35 0 853.99 365.76 0 853.99 365.76 1064.26
49 p 929.64 311.6625 0 860.3025 381.0 0 860.3025 381.0 1064.26
50 p 944.88 317.975 0 866.615 396.24 0 866.615 396.24 1064.26
51 p 960.12 324.2875 0 872.9275 411.48 0 872.9275 411.48 1064.26
52 px 868.68
53 px 883.92
54 px 899.16
55 px 914.4
56 px 929.64
57 px 944.88
58 px 960.12
59 px 438.41
60 px 450.1
61 px 461.79
62 px 473.48
63 px 485.17
64 px 496.86
65 px 508.55
66 px 520.24
67 px 534.43
68 px 548.64
69 cx 5.0
70 cx 3.5
71 px 121.9199997
72 px 0.004
73 px 121.90999
74 pz 399.745
75 pz 397.55
76 cz 6.1012
77 cz 6.11
78 cz 24.92
79 c/z 121.92 121.92 25.19

80 pz 30.48
 81 pz 289.56
 82 pz 1624.97 \$ IEM Cell ceiling
 83 pz 1666.24
 84 pz 1696.72
 85 c/z 213.4 449.58 144.78
 86 c/z 213.4 457.20 152.4
 87 px 391.2
 88 px 35.6
 89 py 637.54
 90 py 279.4
 91 pz 2072.64 \$ top of SWC
 92 c/z 213.40 535.94 27.94
 93 c/z 213.40 535.94 41.91
 94 px 306.86
 95 px 120.86
 96 c/z 213.40 535.94 50.88
 97 py 635.99
 98 py 399.70
 99 pz 1693.12
 100 pz 1699.72
 101 pz 1702.61
 102 c/z 213.40 535.94 65.48
 103 c/z 213.40 535.94 25.40
 104 c/z 213.4 535.94 8.10
 105 c/z 213.4 535.94 8.30
 106 c/z 213.4 535.94 6.338
 c
 c The following 8 elevations are adjusted by the same increment
 c to elevate the CCC. The POS parameter must also be adjusted.
 c
 107 pz 1479.20 \$ DFA Midplane at 549 foot level
 108 pz 1519.08 \$ POS elevation is 1646.40 cm.
 109 pz 1588.08
 110 pz 1603.56
 111 pz 1695.00 \$ On MTT the DFA MP is at 510 feet
 112 pz 1710.48
 113 pz 1817.78
 114 pz 1851.31
 115 c/z 213.40 535.94 25.25
 c Surfaces for SWC valve.
 116 pz 1733.04
 117 pz 1738.12
 118 pz 1748.28
 119 py 407.14
 120 c/z 213.40 464.03 56.50
 121 py 505.64
 122 py 570.88
 123 c/z 213.40 535.94 69.86
 124 p 3.20523 1.00 0.00 1225.66
 125 px 165.7700
 126 px 174.35
 127 px 252.45
 128 px 261.03
 129 c/z 213.40 535.94 89.21
 130 c/z 213.40 445.04 21.04
 131 p -3.2052 1.00 0.00 -142.337
 132 py 688.34
 133 pz 1512.41
 134 pz 1582.42
 136 py 289.56
 1041 c/z 230.23 535.94 8.100
 1042 c/z 221.82 550.46 8.100
 1043 c/z 221.82 521.30 8.100
 1044 c/z 196.57 535.94 8.100
 1045 c/z 204.98 521.30 8.100
 1046 c/z 204.98 550.46 8.100
 1051 c/z 230.23 535.94 8.300
 1052 c/z 221.82 550.46 8.300
 1053 c/z 221.82 521.30 8.300
 1054 c/z 196.57 535.94 8.300
 1055 c/z 204.98 521.30 8.300
 1056 c/z 204.98 550.46 8.300
 1061 c/z 230.23 535.94 6.338

```

1062 c/z 221.82 550.46 6.338
1063 c/z 221.82 521.30 6.338
1064 c/z 196.57 535.94 6.338
1065 c/z 204.98 521.30 6.338
1066 c/z 204.98 550.46 6.338

*tr2 464.195 469.75 556.26 15 75 90 105 15 90 90 90 0 1
*tr3 444.47 543.36 556.26 15 75 90 105 15 90 90 90 0 1
*tr4 464.19 469.75 944.88 15 75 90 105 15 90 90 90 0 1
*tr5 444.47 543.36 944.88 15 75 90 105 15 90 90 90 0 1
*tr6 754.38 304.8 556.26 90 0 90 180 90 90 90 90 0 1
*tr7 678.18 304.8 556.26 90 0 90 180 90 90 90 90 0 1
*tr8 754.38 304.8 934.72 90 0 90 180 90 90 90 90 0 1
*tr9 678.18 304.8 934.72 90 0 90 180 90 90 90 90 0 1
*tr10 841.09 292.45 464.82 45 45 90 135 45 90 90 90 0 1
*tr11 841.09 292.45 853.44 45 45 90 135 45 90 90 90 0 1
*tr12 137.555 121.92 .01
*tr13 129.7375 135.46 .01
*tr14 114.1025 135.46 .01
*tr15 106.285 121.92 .01
*tr16 114.1025 108.38 .01
*tr17 129.7375 108.38 .01
*tr18 121.92 121.92 0
tr19 50.165 251.46 377.5358
tr20 31.115 441.96 549.0366
tr21 31.115 502.92 549.0366
tr22 57.15 576.58 682.92
tr23 95.25 576.58 682.92
tr24 392.125 561.19 579.73
tr25 45.72 30.48 1142.66
tr26 91.99 30.48 1142.66
c ID 35E position up
c tr27 327.66 152.4 319.62
c ID 35E position down
tr27 327.66 152.4 51.73
c ID 35W position up
c tr28 718.82 152.4 319.62
c ID 35W position down
tr28 718.8 152.4 51.73
*tr29 680.915 304.8 157.48 90 0 90 180 90 90 90 90 0 1
tr30 426.72 304.8 1353.82
mode n
print
imp:n 1 45r 0 0 1 17r 0 2r 1 91r 1 1
m1 $High Density Concrete
1001.50c -0.0044 8016.50c -0.1753 13027.50c -0.0094
14000.50c -0.0183 20000.50c -0.0604 26000.55c -0.7317
m2 $Stainless Steel
26000.55c -0.68 28000.50c -0.14 24000.50c -0.18
m3 $Fuel for Source
92238.50c -0.459 8016.50c -0.0758 11023.50c -0.06986
26000.55c -0.3952
m4 $Stainless Steel for MOTA Source
26000.55c -0.68 28000.50c -0.14 24000.50c -0.18
m5 $Stainless Steel 316 for shld, plenum, and H. S.
26000.55c -0.67 24000.50c -0.17 28000.50c -0.13 42000.50c -0.02
25055.50c -0.01
m6 $DFA Core in CCC
26000.55c -0.2866 24000.50c -0.0727 28000.50c -0.0556
42000.50c -0.0086 25055.50c -0.0043
8016.50c -0.0678 92238.50c -0.3578 94239.55c -0.1467
m7 $Reflectors
26000.55c -0.3317 24000.50c -0.1643 28000.50c -0.4855
42000.50c -0.0085 25055.50c -0.0100
m8 $lead shld
82000.50c -1.0
c void 63 87 88 89 90 91 92 93 94 95 96 98 99 100 101 102
nps 40000
sdef erg=d1 cel=d4 pos=fcel d5 rad=d2 axs=0.0 0.0 1.0
ext=d3
wgt=3.00e+07
sc1 DFA neutron source from Ombrellaro Memo 6-6-84.
si1 0.0 9.0e-08 2.7e-04 7.5e-04 2.03e-03 5.53e-03 1.503e-02 4.087e-02
1.1e-01 3.0e-01 5.0e-01 3.7e+00 10.0

```

```

sp1  0.0 1.0e-06 5.0e-06 2.2e-05 9.2e-05 4.02e-04 1.691e-03 7.524e-03
      3.0741e-03 0.039251 0.206418 0.60723 0.106561
sb1  0.0 9.0e-08 2.7e-04 7.5e-04 2.03e-03 5.53e-03 1.503e-02 4.087e-02
      1.1e-01 3.0e-01 5.0e-01 3.7e+00 10.0
sc2  radial range of source
sl2  0 6.338
sc3  axial extent of source
sl3  -53.59 -48.49 -43.38 -38.28 -33.18 -29.21
      -24.11 -17.86 -12.62 -6.24 -1.27 2.55
      7.66 12.76 17.87 22.97 28.08 33.11
      38.29 43.4 48.5 53.61
sp3  d      0.0000 0.0321 0.0307 0.0317 0.034 0.0199
      0.0558 0.0407 0.0443 0.0617 0.0212 0.0419
      0.0407 0.0389 0.0367 0.0341 0.0311 0.0282
      0.0255 0.0239 0.0241 0.0227
sc4  cell distribution
sl4  l 124 127 130 133 136 139
sp4  d 1 1 1 1 1 1
sb4  d 1 1 1 1 1 1
de5  l 230.23 535.94 1646.40
      221.82 550.46 1646.40
      221.82 521.36 1646.40
      198.57 535.94 1646.40
      204.98 521.36 1646.40
      204.98 550.46 1646.40
fc5  Dose rates on 550 foot level.
15:n  $ X Y Z r0
      143.40 535.94 1743.20 5.08
      130.80 535.94 1707.69 5.08
      115.78 535.94 1701.80 5.08
      78.23 535.94 1701.80 5.08
      40.68 535.94 1701.80 5.08
      30.52 535.94 1681.48 5.08
      115.78 535.94 1717.00 5.08
      115.78 535.94 1730.00 5.08
      115.78 535.94 1743.20 5.08
      125.34 535.94 1753.36 5.08
      143.40 535.94 1753.36 5.08
      213.40 465.38 1753.36 5.08
      213.40 431.86 1743.16 5.08
      213.40 399.06 1743.16 5.08
      213.40 388.90 1733.00 5.08
      213.40 388.90 1701.78 5.08
      213.40 333.83 1701.78 5.08
      213.40 278.76 1701.78 5.08
      213.40 268.60 1681.48 5.08
      213.40 465.38 1743.16 5.08
      213.40 610.88 1743.16 5.08
      213.40 618.54 1733.04 5.08
      213.40 618.54 1707.69 5.08
      213.40 610.88 1753.36 5.08
      213.40 630.23 1753.36 5.08
      213.40 630.23 1743.20 5.08
      213.40 630.23 1722.00 5.08
      213.40 630.23 1702.00 5.08
      213.40 630.23 1681.48 5.08
      130.80 449.58 1707.69 5.08
      115.78 449.58 1701.80 5.08
      78.23 449.58 1701.80 5.08
      40.68 449.58 1701.80 5.08
      30.52 449.58 1681.48 5.08

```

Table A-2 MCNP Input Data File With The SCTC In Place and a Co60 Gamma Ray Source.

DEM Cell 3D model w/ penetrations and sources.

```

c   DFA MP at _____ foot elevation.
c   .
c   .
c   Six 150,000 MWD/T DFA in CCC (cell 118)
c   .
c   .
c   All N., NE. and E walls are divided into cells w. thickness
c   of 15.24 cm (about 1 mean-free path).
c   Outside world is defined by cells 47, 48, 67, 68 and 69.
c   Source cells are as follows:
c   ID 89: 93
c   ID 17S: 94
c   ID 17N: 95
c   ID 39W: 96
c   ID 39E: 97
c   ID 41: 98
c   ID 103W: 99
c   ID 103E: 100
c   ID 35W: 101
c   (Note: When ID 35W is in the up position, the tr27 card should read:
c   tr27 327.66 152.4 319.62
c   When ID 35W is in the down position, the tr27 card should read:
c   tr27 327.66 152.4 51.73
c
c   ID 35E: 102
c   (Note: When ID 35E is in the up position, the tr28 card should read:
c   tr28 718.8 152.4 319.62
c   When ID 35E is in the down position, the tr28 card should read:
c   tr28 718.8 152.4 51.73
c
c   If dose is to be predicted without MSM sleeve, then cell 63 should
c   be voided.
c   Cell 63 is voided in this case to remove the MSM sleeves.
1 1 -4.49 -21 19 8 -1 2 -5          $W. wall of S. cell(#43)
2 1 -4.49 -21 19 -2 9 8 -22         $S. wall (not incl. annex)
3 1 -4.49 -23 19 15 9 3 -52 #61 #64 #65 #66 $E. wall of annex (#46)
4 1 -4.49 -23 19 15 9 52 -53 #61 #64 #65 #66 $E. wall of annex (#46)
5 1 -4.49 -23 19 15 9 53 -54 #61 #64 #65 #66 $E. wall of annex (#46)
6 1 -4.49 -23 19 15 9 54 -55 #61 #64 #65 #66 $E. wall of annex (#46)
7 1 -4.49 -23 19 15 9 55 -56 #61 #64 #65 #66 $E. wall of annex (#46)
8 1 -4.49 -23 19 15 9 56 -57 #61 #64 #65 #66 $E. wall of annex (#46)
9 1 -4.49 -23 19 15 9 57 -58 #61 #64 #65 #66 $E. wall of annex (#46)
10 1 -4.49 -23 19 15 9 58 -10 #61 #64 #65 #66 $E. wall of annex (#46)
11 1 -4.49 -23 19 -15 16 4 -45 #82 #83 $NE slant wall of annex(#46)
12 1 -4.49 -23 19 -15 16 45 -46 #82 #83 $NE slant wall of annex(#46)
13 1 -4.49 -23 19 -15 16 46 -47 #82 #83 $NE slant wall of annex(#46)
14 1 -4.49 -23 19 -15 16 47 -48 #82 #83 $NE slant wall of annex(#46)
15 1 -4.49 -23 19 -15 16 48 -49 #82 #83 $NE slant wall of annex(#46)
16 1 -4.49 -23 19 -15 16 49 -50 #82 #83 $NE slant wall of annex(#46)
17 1 -4.49 -23 19 -15 16 50 -51 #82 #83 $NE slant wall of annex(#46)
18 1 -4.49 -23 19 -15 16 51 -11 #82 #83 $NE slant wall of annex(#46)
19 1 -4.49 -23 19 -16 17 5 -38 #78 #79 #80 #81 #103 $N. wall annex(#46)
20 1 -4.49 -23 19 -16 17 38 -39 #78 #79 #80 #81 #103 $N. wall annex(#46)
21 1 -4.49 -23 19 -16 17 39 -40 #78 #79 #80 #81 #103 $N. wall annex(#46)
22 1 -4.49 -23 19 -16 17 40 -41 #78 #79 #80 #81 #103 $N. wall annex(#46)
23 1 -4.49 -23 19 -16 17 41 -42 #78 #79 #80 #81 #103 $N. wall annex(#46)
24 1 -4.49 -23 19 -16 17 42 -43 #78 #79 #80 #81 #103 $N. wall annex(#46)
25 1 -4.49 -23 19 -16 17 43 -44 #78 #79 #80 #81 #103 $N. wall annex(#46)
26 1 -4.49 -23 19 -16 17 44 -12 #78 #79 #80 #81 #103 $N. wall annex(#46)
27 1 -4.49 -23 19 -17 -18 6 -31 #74 #75 #76 #77 $E. slant wall of N. cell
28 1 -4.49 -23 19 -17 -18 31 -32 #74 #75 #76 #77 $E. slant wall of N. cell
29 1 -4.49 -23 19 -17 -18 32 -33 #74 #75 #76 #77 $E. slant wall of N. cell
30 1 -4.49 -23 19 -17 -18 33 -34 #74 #75 #76 #77 $E. slant wall of N. cell
31 1 -4.49 -23 19 -17 -18 34 -35 #74 #75 #76 #77 $E. slant wall of N. cell
32 1 -4.49 -23 19 -17 -18 35 -36 #74 #75 #76 #77 $E. slant wall of N. cell
33 1 -4.49 -23 19 -17 -18 36 -37 #74 #75 #76 #77 $E. slant wall of N. cell
34 1 -4.49 -23 19 -17 -18 37 -13 #74 #75 #76 #77 $E. slant wall of N. cell
35 1 -4.49 -21 20 18 8 7 -24         $N. wall of N. cell(#44)
36 1 -4.49 -21 20 18 8 24 -25        $N. wall of N. cell(#44)
37 1 -4.49 -21 20 18 8 25 -26        $N. wall of N. cell(#44)
38 1 -4.49 -21 20 18 8 26 -27        $N. wall of N. cell(#44)

```

39 1 -4.49 -21 20 18 8 27 -28 \$N. wall of N. cell(#44)
 40 1 -4.49 -21 20 18 8 28 -29 \$N. wall of N. cell(#44)
 41 1 -4.49 -21 20 18 8 29 -30 \$N. wall of N. cell(#44)
 42 1 -4.49 -21 20 18 8 30 -14 \$N. wall of N. cell(#44)
 43 0 (-82 19 1 2 -22 -5) (79:84074:-84080) #93 #99 #100 #101
 c cell with wastecan and ID's 103, 89 and 35W
 44 0 -82 20 1 5 -22 -7 #94 #95 #96 #97 #98 #41 \$N. cell w/ ID 17,39 & 41
 (81:86) 103
 45 0 -23 20 5 22 -6 \$triangular part of N cell
 46 0 -23 19 -5 22 2 -3 -4 #102 \$cell annex
 47 0 -20 -14 19 5,8 -22 \$void area of step beneath turntable
 48 0 -20 19 5 22 -6 \$void for step along slant wall in N cell
 49 1 -4.49 23 -21 -18 9 22 -59 #70 #71 #72 #73 #104 \$E. wall above annex
 50 1 -4.49 23 -21 -18 9 59 -60 #70 #71 #72 #73 #104 \$E. wall above annex
 51 1 -4.49 23 -21 -18 9 60 -61 #70 #71 #72 #73 #104 \$E. wall above annex
 52 1 -4.49 23 -21 -18 9 61 -62 #70 #71 #72 #73 #104 \$E. wall above annex
 53 1 -4.49 23 -21 -18 9 62 -63 #70 #71 #72 #73 #104 \$E. wall above annex
 54 1 -4.49 23 -21 -18 9 63 -64 #70 #71 #72 #73 #104 \$E. wall above annex
 55 1 -4.49 23 -21 -18 9 64 -65 #70 #71 #72 #73 #104 \$E. wall above annex
 56 1 -4.49 23 -21 -18 9 65 -66 #70 #71 #72 #73 #104 \$E. wall above annex
 57 1 -4.49 23 -21 -14 9 66 -67 #70 #71 #72 #73 #104 \$E. wall above annex
 58 1 -4.49 23 -21 -14 9 67 -68 #70 #71 #72 #73 #104 \$E. wall above annex
 59 1 -4.49 -23 19 22 9 -3 -2 \$S. wall of annex(#46)
 60 1 -4.49 20 -21 -7 5 -1 8 \$W. wall of N cell(#44)
 61 2 -7.93 72 -71 -71 -69 fill=1 trcl=(853.44 114.3 556.26) \$MSM 121A
 c cells 61, 62 and 63 couple to make the MSM and sleeve.
 62 0 -70 u=1 \$MSM 121A inner cyl.
 63 2 -7.93 70 u=1 \$MSM sleeve; coupled w/ #61
 64 like 61 but trcl=(853.44 190.5 556.26) \$MSM 122A
 65 like 61 but trcl=(853.44 190.5 934.72) \$MSM 116A
 66 like 61 but trcl=(853.44 114.3 934.72) \$MSM 115A
 67 0 23 -21 68 (-13: -12) -11 -10 9 \$Void above cell annex
 68 0 -20 19 -14 18 22 \$triangular void @ bottom
 69 0 (-8: 14: (13 (11: 12)): -9: 10: 21: -19) #57 #58
 (-8:91:14:68:-9:-21)
 c Outside world.
 70 like 61 but trcl=(426.72 114.3 1409.7) \$MSM 112A
 71 like 61 but trcl=(426.72 190.5 1409.7) \$MSM 111A
 72 like 61 but trcl=(426.72 495.3 1409.7) \$MSM 114A
 73 like 61 but trcl=(426.72 419.1 1409.7) \$MSM 113A
 74 like 61 but trcl=2 \$MSM 125A
 75 like 61 but trcl=3 \$MSM 126A
 76 like 61 but trcl=4 \$MSM 119A
 77 like 61 but trcl=5 \$MSM 120A
 78 like 61 but trcl=6 \$MSM 123A
 79 like 61 but trcl=7 \$MSM 124A
 80 like 61 but trcl=8 \$MSM 117A
 81 like 61 but trcl=9 \$MSM 118A
 82 0 -69 72 -73 trcl=10 \$U-420 periscope
 83 0 -69 72 -73 trcl=11 \$U-310A periscope
 84 0 -78 -74 80 77 #87 #88 #89 #90 #91 #92 trcl=18
 \$WC & contents
 85 2 -7.93 84078 -79 84080 -84074 \$WC thickness
 86 0 -84077 -84074 84080 \$WC hole
 87 3 -5.01 -75 -76 80 trcl=12 \$fuel1 in WC
 88 3 -5.01 -75 -76 80 trcl=13 \$fuel2 in WC
 89 3 -5.01 -75 -76 80 trcl=14 \$fuel3 in WC
 90 3 -5.01 -75 -76 80 trcl=15 \$fuel4 in WC
 91 3 -5.01 -75 -76 80 trcl=16 \$fuel5 in WC
 92 3 -5.01 -75 -76 80 trcl=17 \$fuel6 in WC
 93 3 -5.01 -75 -76 80 trcl=19 \$ident 89
 94 3 -5.01 -75 -76 80 trcl=20 \$ident 17 S
 95 3 -5.01 -75 -76 80 trcl=21 \$ident 17 N
 96 3 -2.50 -75 -76 80 trcl=22 \$ident 39 W
 97 3 -2.50 -75 -76 80 trcl=23 \$ident 39 E
 98 3 -5.01 -75 -76 80 trcl=24 \$ident 41
 99 4 -2.713 -75 -76 80 trcl=25 \$ident 103 W
 100 4 -2.713 -75 -76 80 trcl=26 \$ident 103 E
 101 4 -2.713 -75 -76 80 trcl=27 \$ident 35 W
 102 4 -2.713 -75 -76 80 trcl=28 \$ident 35 E
 103 like 82 but trcl=29 \$W-52A Periscope
 104 like 82 but trcl=30 \$U-471 Periscope
 105 2 -7.93 20 -81 -86 \$ maint. turn table
 106 0 82 -83 -85 103

```

107 2 -7.93 83 -21 -85 96
108 1 -4.49 82 -21 85 1 2 -22 -7
109 2 -7.93 21 96 88 -87 -89 90 -84
110 0 97 -98 94 -95 119 -120
111 0 21 9 -14 8 -68 -91 (-88:89:87:-90:84)
      117 (100:101) (+89:99:-94:-92: +93)
112 0 83 -97 -96 103
113 2 -7.93 97 -98 95 -102 119 -120
114 2 -7.93 98 -99 -89 94 92 -93 96
115 2 -7.93 84 -97 94 -89 92 -93 96
116 2 -7.93 117 99 -101 -100
117 0 -103 81 -97
      (114:-107:115)
118 0 -114 107 -115
      #119 #120 #121 #122 #123 #124
      #125 #126 #127 #128 #129 #130 #131 #132 #133 #134 #135 #136
      #137 #138 #139
119 2 -7.93 -105 104 107 -114
120 0 -104 106 107 -114
121 0 -106 107 -114
122 2 -7.93 -1051 1041 107 -114
123 0 -1041 1061 107 -114
124 0 -1061 107 -114 fill=2 $ tube A
125 2 -7.93 -1052 1042 107 -114
126 0 -1042 1062 107 -114
127 0 -1062 107 -114 fill=2 $ tube B
128 2 -7.93 -1053 1043 107 -114
129 0 -1043 1063 107 -114
130 0 -1063 107 -114 fill=2 $ tube C
131 2 -7.93 -1054 1044 107 -114
132 0 -1044 1064 107 -114
133 0 -1064 107 -114 fill=2 $ tube D
134 2 -7.93 -1055 1045 107 -114
135 0 -1045 1065 107 -114
136 0 -1065 107 -114 fill=2 $ tube E
137 2 -7.93 -1056 1046 107 -114
138 0 -1046 1066 107 -114
139 0 -1066 107 -114 fill=2 $ tube F
140 5 -7.930 -108 u=2 $ inlet nozzle
141 5 -7.930 108 -109 u=2 $ lower shld
142 7 -7.930 109 -110 u=2 $ lower refl
143 6 -7.930 110 -111 u=2 $ DFA core
144 7 -7.930 111 -112 u=2 $ upper refl
145 5 -7.930 112 -113 u=2 $ plenum
146 5 -7.930 113 u=2 $ H. Socket
147 2 -7.93 99 -91 96 -116
148 8 -11.40 116 99 -91 -118
149 2 -7.93 99 -91 118 -117
150 2 -7.93 -89 102 97 -98 119 -120
151 2 -7.93 -89 94 97 -98 92 -119
152 2 -7.93 -89 94 97 -98 120 -93
153 0 98 -91 -96

1 px 0
2 py 0
3 px 853.44
4 p 853.44 280.1 0 828.74 304.8 0 828.74 304.8 1064.26
5 py 304.8
6 p 426.72 609.6 0 508.39 304.8 0 508.39 304.8 1064.26
7 py 609.6
8 px -15.24
9 py -15.24
10 px 975.36
11 p 975.36 330.6 0 879.24 426.72 0 879.24 426.72 1064.26
12 py 426.72
13 p 601.95 426.72 0 520.27 731.52 0 520.27 731.52 1064.26
14 py 731.52
15 p 975.36 330.6 0 853.44 280.1 0 853.44 280.1 1064.26
16 p 879.24 426.72 0 828.74 304.8 0 828.74 304.8 1064.26
17 p 508.39 304.8 0 601.95 426.72 0 601.95 426.72 1064.26
18 p 426.72 609.6 0 520.27 731.52 0 520.27 731.52 1064.26
19 pz 0 $ IEM Cell bottom at 495 foot level.
20 pz 213.36
21 pz 1676.4 $ 550 foot level

```

22 px 426.72
23 pz 1066.8
24 py 624.84
25 py 640.08
26 py 655.32
27 py 670.56
28 py 685.8
29 py 701.04
30 py 716.28
31 p 520.09 320.04 O 438.41 624.84 O 438.41 624.84 1064.26
32 p 531.78 335.28 O 450.11 640.08 O 450.11 640.08 1064.26
33 p 543.48 350.52 O 461.8 655.32 O 461.8 655.32 1064.26
34 p 555.17 365.76 O 473.5 670.56 O 473.5 670.56 1064.26
35 p 566.87 381.0 O 485.19 685.8 O 485.19 685.8 1064.26
36 p 578.56 396.24 O 496.88 701.04 O 496.88 701.04 1064.26
37 p 590.25 411.48 O 508.58 716.28 O 508.58 716.28 1064.26
38 py 320.04
39 py 335.28
40 py 350.52
41 py 365.76
42 py 381.0
43 py 396.24
44 py 411.48
45 p 868.68 286.4125 O 835.0525 320.04 O 835.0525 320.04 1064.26
46 p 883.92 292.725 O 841.365 335.28 O 841.365 335.28 1064.26
47 p 899.16 299.0375 O 847.6775 350.52 O 847.6775 350.52 1064.26
48 p 914.4 305.35 O 853.99 365.76 O 853.99 365.76 1064.26
49 p 929.64 311.6625 O 860.3025 381.0 O 860.3025 381.0 1064.26
50 p 944.88 317.975 O 866.615 396.24 O 866.615 396.24 1064.26
51 p 960.12 324.2875 O 872.9275 411.48 O 872.9275 411.48 1064.26
52 px 868.68
53 px 883.92
54 px 899.16
55 px 914.4
56 px 929.64
57 px 944.88
58 px 960.12
59 px 438.41
60 px 450.1
61 px 461.79
62 px 473.48
63 px 485.17
64 px 496.86
65 px 508.55
66 px 520.24
67 px 534.43
68 px 548.64
69 cx 5.0
70 cx 3.5
71 px 121.9199997
72 px 0.004
73 px 121.90999
74 pz 399.745
75 pz 397.55
76 cz 6.1012
77 cz 6.11
78 cz 24.92
79 c/z 121.92 121.92 25.19
80 pz 30.48
81 pz 289.56
82 pz 1625.60 * IEM Cell ceiling
83 pz 1666.24
84 pz 1696.72
85 c/z 213.4 457.2 144.78
86 c/z 213.4 457.2 152.4
87 px 391.2
88 px 35.6
89 py 635.0
90 py 279.4
91 pz 1986.15 * top of SWC
92 px 129.58
93 px 297.22
94 py 302.26
95 py 467.61

96 c/z 213.40 541.66 50.88
97 pz 1706.60
98 pz 1719.33
99 pz 1729.36
100 c/z 213.4 541.66 71.12
101 pz 1751.46
102 py 625.09
103 c/z 213.40 541.66 25.40
104 c/z 213.4 541.6 8.10
105 c/z 213.4 541.6 8.30
106 c/z 213.4 541.6 6.338

c

c The following 8 elevations are adjusted by the same increment
c to elevate the CCC. The POS parameter must also be adjusted.

c

107 pz 290.00 \$ DFA Midplane at 510 foot level
108 pz 329.88 \$ POS elevation is 457.20 cm.
109 pz 398.88
110 pz 414.36
111 pz 505.80 \$ On MTT the DFA MP is at 510 feet
112 pz 521.28
113 pz 628.58
114 pz 662.11
115 c/z 213.40 541.60 25.25
116 c/z 213.4 541.66 53.42
117 c/z 213.4 541.66 63.58
118 c/z 213.4 541.66 61.04
119 px 139.49
120 px 287.31
1041 c/z 230.23 541.60 8.100
1042 c/z 221.82 556.18 8.100
1043 c/z 221.82 527.02 8.100
1044 c/z 196.57 541.60 8.100
1045 c/z 204.98 527.02 8.100
1046 c/z 204.98 556.18 8.100
1051 c/z 230.23 541.60 8.300
1052 c/z 221.82 556.18 8.300
1053 c/z 221.82 527.02 8.300
1054 c/z 196.57 541.60 8.300
1055 c/z 204.98 527.02 8.300
1056 c/z 204.98 556.18 8.300
1061 c/z 230.23 541.60 6.338
1062 c/z 221.82 556.18 6.338
1063 c/z 221.82 527.02 6.338
1064 c/z 196.57 541.60 6.338
1065 c/z 204.98 527.02 6.338
1066 c/z 204.98 556.18 6.338

*tr2 464.195 469.75 556.26 15 75 90 105 15 90 90 90 0 1
*tr3 444.47 543.36 556.26 15 75 90 105 15 90 90 90 0 1
*tr4 464.19 469.75 944.88 15 75 90 105 15 90 90 90 0 1
*tr5 444.47 543.36 944.88 15 75 90 105 15 90 90 90 0 1
*tr6 754.38 304.8 556.26 90 0 90 180 90 90 90 90 0 1
*tr7 678.18 304.8 556.26 90 0 90 180 90 90 90 90 0 1
*tr8 754.38 304.8 934.72 90 0 90 180 90 90 90 90 0 1
*tr9 678.18 304.8 934.72 90 0 90 180 90 90 90 90 0 1
*tr10 841.09 292.45 464.82 45 45 90 135 45 90 90 90 0 1
*tr11 841.09 292.45 853.44 45 45 90 135 45 90 90 90 0 1
*tr12 137.555 121.92 .01
*tr13 129.7375 135.46 .01
*tr14 114.1025 135.46 .01
*tr15 106.285 121.92 .01
*tr16 114.1025 108.38 .01
*tr17 129.7375 108.38 .01
*tr18 121.92 121.92 0
tr19 50.165 251.46 377.5358
tr20 31.115 441.96 549.0366
tr21 31.115 502.92 549.0366
tr22 57.15 576.58 682.92
tr23 95.25 576.58 682.92
tr24 392.125 561.19 579.73
tr25 45.72 30.48 1142.66
tr26 91.99 30.48 1142.66
c ID 35E position up

```

c tr27 327.66 152.4 319.62
c ID 35E position down
tr27 327.66 152.4 51.73
c ID 35W position up
c tr28 718.82 152.4 319.62
c ID 35W position down
tr28 718.8 152.4 51.73
*tr29 680.915 304.8 157.48 90 0 90 180 90 90 90 90 0 1
tr30 426.72 304.8 1353.82
mode p
print
imp:p 1 45r 0 0 1 17r 0 2r 1 82r 1
m1 $High Density Concrete
1001.01p -0.0044 8016.01p -0.1753 13027.01p -0.0094
14000.01p -0.0183 20000.01p -0.0604 26000.01p -0.7317
m2 $Stainless Steel
26000.01p -0.68 28000.01p -0.14 24000.01p -0.18
m3 $Fuel for Source
92238.01p -0.459 8000.01p -0.0758 11023.01p -0.06986
26000.01p -0.3952
m4 $Stainless Steel for MOTA Source
26000.01p -0.68 28000.01p -0.14 24000.01p -0.18
m5 $Stainless Steel 316 for shld, plenum, and H. S.
26000.01p -0.67 24000.01p -0.17 28000.01p -0.13 42000.01p -0.02
25000.01p -0.01
m6 $DFA Core in CCC
26000.01p -0.2866 24000.01p -0.0727 28000.01p -0.0556
42000.01p -0.0086 25000.01p -0.0043
8016.01p -0.0678 92238.01p -0.3578 94239.01p -0.1467
m7 $Reflectors
26000.01p -0.3317 24000.01p -0.1643 28000.01p -0.4855
42000.01p -0.0085 25000.01p -0.0100
m8 $Lead shld
82000.01p -1.0
c void 63 87 88 89 90 91 92 93 94 95 96 98 99 100 101 102
nps 10000
idum 1
phys:p j 1
sdef erg=d1 cel=d4 pos=fcel d5 rad=d2 axs=0.0 0.0 1.0
ext=d3
wgt= 9.98E+14 $ Source strength for 6 DFA containing 2248 Ci each.
sc1 Gamma spectrum for 150,000 MWD/MT burnup DFA decayed 5 years.
# si1 sp1 sb1
l d d
1.1732 1.0 1.1732
1.3332 1.0 1.3332
sc2 radial range of source
si2 0 6.338
sc3 axial extent of source
si3 -170.00 -159.51 -149.03 -138.54 -128.05 -121.45 -114.85 -108.26
-101.67 -95.07 -88.47 -81.88 -75.28 -69.03 -62.78 -57.92
-53.05 -48.19 -46.14 -41.01 -35.89 -30.76 -25.63 -20.51
-15.38 -10.25 -5.13 0.00 5.13 10.25 15.38 20.51
25.63 30.76 35.89 41.01 46.19 48.19 53.05 57.92
62.78 67.19 71.59 81.32 92.28 104.00 113.43 122.86
132.29 141.71 151.14 160.57 170.00 185.00 200.00
sp3 0.00 5.14E-04 1.42E-03 2.65E-03 4.28E-03 6.45E-04 1.01E-03 1.08E-02
1.64E-02 2.45E-02 3.94E-02 5.89E-02 4.60E-02 6.48E-02 7.68E-02 8.49E-02
8.38E-02 6.79E-02 6.15E-03 8.44E-03 6.74E-03 6.93E-03 7.46E-03 7.96E-03
8.40E-03 8.68E-03 8.81E-03 8.83E-03 8.70E-03 8.44E-03 8.09E-03 7.61E-03
7.03E-03 6.41E-03 5.78E-03 5.38E-03 6.32E-03 1.46E-02 4.67E-02 5.38E-02
2.44E-02 1.85E-02 1.64E-02 2.92E-02 2.38E-02 1.75E-02 9.94E-03 7.11E-03
4.98E-03 3.38E-03 2.18E-03 1.26E-03 5.11E-04 1.34E-04 4.46E-05
sc4 cell distribution
si4 1 124 127 130 133 136 139
sp4 d 1 1 1 1 1 1
sb4 d 1 1 1 1 1 1
ds5 1 230.23 541.60 457.20
221.82 556.18 457.20
221.82 527.08 457.20
196.57 541.60 457.20
204.98 527.08 457.20
204.98 556.18 457.20
fc5 SCTC talley locations at 550 level.

```

f5:p	x	y	z	r0
386.12	541.66	1696.72	5.08	
357.78	541.66	1696.72	5.08	
302.30	541.66	1696.72	5.08	
289.60	541.66	1734.44	5.08	
276.98	541.66	1756.54	5.08	
144.74	541.66	1756.54	5.08	
137.20	541.66	1734.44	5.08	
83.82	541.66	1696.72	5.08	
63.54	541.66	1696.72	5.08	
40.68	541.66	1696.72	5.08	
213.40	617.86	1734.44	5.08	
213.40	610.32	1756.54	5.08	
213.40	473.00	1756.54	5.08	
213.40	465.46	1734.44	5.08	
213.40	412.75	1734.44	5.08	
213.40	360.05	1734.44	5.08	
213.40	307.34	1734.44	5.08	
213.40	297.18	1696.72	5.08	
213.40	274.32	1681.48	5.08	

Table A-3 MCNP Input Data File With The Cover Plate In Place and a Core Gamma Ray Source.

DEM Cell 3D model w/ penetrations and sources.

```

c   DFA MP at _____ foot elevation.
c   .
c   .
c   Six 150,000 MWD/T DFA in CCC (cell 118)
c   .
c   .
c   All N., NE. and E walls are divided into cells w. thickness
c   of 15.24 cm (about 1 mean-free path).
c   Outside world is defined by cells 47, 48, 67, 68 and 69.
c   Source cells are as follows:
c   ID 89: 93
c   ID 17S: 94
c   ID 17N: 95
c   ID 39W: 96
c   ID 39E: 97
c   ID 41: 98
c   ID 103W: 99
c   ID 103E: 100
c   ID 35W: 101
c   (Note: When ID 35W is in the up position, the tr27 card should read:
c   tr27 327.66 152.4 319.62
c   When ID 35W is in the down position, the tr27 card should read:
c   tr27 327.66 152.4 51.73
c
c   ID 35E: 102
c   (Note: When ID 35E is in the up position, the tr28 card should read:
c   tr28 718.8 152.4 319.62
c   When ID 35E is in the down position, the tr28 card should read:
c   tr28 718.8 152.4 51.73
c
c   If dose is to be predicted without MSM sleeve, then cell 63 should
c   be voided.
c   Cell 63 is voided in this case to remove the MSM sleeves.
1 1 -4.49 -21 19 8 -1 2 -5          $W. wall of S. cell(#43)
2 1 -4.49 -21 19 -2 9 8 -22         $S. wall (not incl. annex)
3 1 -4.49 -23 19 15 9 3 -52 #61 #64 #65 #66 $E. wall of annex (#46)
4 1 -4.49 -23 19 15 9 52 -53 #61 #64 #65 #66 $E. wall of annex (#46)
5 1 -4.49 -23 19 15 9 53 -54 #61 #64 #65 #66 $E. wall of annex (#46)
6 1 -4.49 -23 19 15 9 54 -55 #61 #64 #65 #66 $E. wall of annex (#46)
7 1 -4.49 -23 19 15 9 55 -56 #61 #64 #65 #66 $E. wall of annex (#46)
8 1 -4.49 -23 19 15 9 56 -57 #61 #64 #65 #66 $E. wall of annex (#46)
9 1 -4.49 -23 19 15 9 57 -58 #61 #64 #65 #66 $E. wall of annex (#46)
10 1 -4.49 -23 19 15 9 58 -10 #61 #64 #65 #66 $E. wall of annex (#46)
11 1 -4.49 -23 19 -15 16 4 -45 #82 #83 $NE slant wall of annex(#46)
12 1 -4.49 -23 19 -15 16 45 -46 #82 #83 $NE slant wall of annex(#46)
13 1 -4.49 -23 19 -15 16 46 -47 #82 #83 $NE slant wall of annex(#46)
14 1 -4.49 -23 19 -15 16 47 -48 #82 #83 $NE slant wall of annex(#46)
15 1 -4.49 -23 19 -15 16 48 -49 #82 #83 $NE slant wall of annex(#46)
16 1 -4.49 -23 19 -15 16 49 -50 #82 #83 $NE slant wall of annex(#46)
17 1 -4.49 -23 19 -15 16 50 -51 #82 #83 $NE slant wall of annex(#46)
18 1 -4.49 -23 19 -15 16 51 -11 #82 #83 $NE slant wall of annex(#46)
19 1 -4.49 -23 19 -16 17 5 -38 #78 #79 #80 #81 #103 $N. wall annex(#46)
20 1 -4.49 -23 19 -16 17 38 -39 #78 #79 #80 #81 #103 $N. wall annex(#46)
21 1 -4.49 -23 19 -16 17 39 -40 #78 #79 #80 #81 #103 $N. wall annex(#46)
22 1 -4.49 -23 19 -16 17 40 -41 #78 #79 #80 #81 #103 $N. wall annex(#46)
23 1 -4.49 -23 19 -16 17 41 -42 #78 #79 #80 #81 #103 $N. wall annex(#46)
24 1 -4.49 -23 19 -16 17 42 -43 #78 #79 #80 #81 #103 $N. wall annex(#46)
25 1 -4.49 -23 19 -16 17 43 -44 #78 #79 #80 #81 #103 $N. wall annex(#46)
26 1 -4.49 -23 19 -16 17 44 -12 #78 #79 #80 #81 #103 $N. wall annex(#46)
27 1 -4.49 -23 19 -17 -18 6 -31 #74 #75 #76 #77 $E. slant wall of N. cell
28 1 -4.49 -23 19 -17 -18 31 -32 #74 #75 #76 #77 $E. slant wall of N. cell
29 1 -4.49 -23 19 -17 -18 32 -33 #74 #75 #76 #77 $E. slant wall of N. cell
30 1 -4.49 -23 19 -17 -18 33 -34 #74 #75 #76 #77 $E. slant wall of N. cell
31 1 -4.49 -23 19 -17 -18 34 -35 #74 #75 #76 #77 $E. slant wall of N. cell
32 1 -4.49 -23 19 -17 -18 35 -36 #74 #75 #76 #77 $E. slant wall of N. cell
33 1 -4.49 -23 19 -17 -18 36 -37 #74 #75 #76 #77 $E. slant wall of N. cell
34 1 -4.49 -23 19 -17 -18 37 -13 #74 #75 #76 #77 $E. slant wall of N. cell
35 1 -4.49 -21 20 18 8 7 -24          $N. wall of N. cell(#44)
36 1 -4.49 -21 20 18 8 24 -25        $N. wall of N. cell(#44)

```

37 1 -4.49 -21 20 18 8 25 -26 \$N. wall of N. cell(#44)
 38 1 -4.49 -21 20 18 8 26 -27 \$N. wall of N. cell(#44)
 39 1 -4.49 -21 20 18 8 27 -28 \$N. wall of N. cell(#44)
 40 1 -4.49 -21 20 18 8 28 -29 \$N. wall of N. cell(#44)
 41 1 -4.49 -21 20 18 8 29 -30 \$N. wall of N. cell(#44)
 42 1 -4.49 -21 20 18 8 30 -14 \$N. wall of N. cell(#44)
 43 0 (-123 19 1 2 -22 -5) (79:84074:-84080) #93 #99 #100 #101
 c cell with wastecan and ID's 103, 89 and 35W
 44 0 -123 20 1 5 -22 -7 #94 #95 #96 #97 #98 #41 \$N. cell w/ ID 17,39 & 41
 (81:86) 103
 45 0 -23 20 5 22 -6 \$triangular part of N cell
 46 0 -23 19 -5 22 2 -3 -4 #102 \$cell annex
 47 0 -20 -14 19 5 8 -22 \$void area of step beneath turntable
 48 0 -20 19 5 22 -6 \$void for step along slant wall in N cell
 49 1 -4.49 23 -21 -18 9 22 -59 #70 #71 #72 #73 #104 \$E. wall above annex
 50 1 -4.49 23 -21 -18 9 59 -60 #70 #71 #72 #73 #104 \$E. wall above annex
 51 1 -4.49 23 -21 -18 9 60 -61 #70 #71 #72 #73 #104 \$E. wall above annex
 52 1 -4.49 23 -21 -18 9 61 -62 #70 #71 #72 #73 #104 \$E. wall above annex
 53 1 -4.49 23 -21 -18 9 62 -63 #70 #71 #72 #73 #104 \$E. wall above annex
 54 1 -4.49 23 -21 -18 9 63 -64 #70 #71 #72 #73 #104 \$E. wall above annex
 55 1 -4.49 23 -21 -18 9 64 -65 #70 #71 #72 #73 #104 \$E. wall above annex
 56 1 -4.49 23 -21 -18 9 65 -66 #70 #71 #72 #73 #104 \$E. wall above annex
 57 1 -4.49 23 -21 -14 9 66 -67 #70 #71 #72 #73 #104 \$E. wall above annex
 58 1 -4.49 23 -21 -14 9 67 -68 #70 #71 #72 #73 #104 \$E. wall above annex
 59 1 -4.49 -23 19 22 9 -3 -2 \$S. wall of annex(#46)
 60 1 -4.49 20 -21 -7 5 -1 8 \$W. wall of N cell(#44)
 61 2 -7.93 72 -71 -71 -69 fill=1 trcl=(853.44 114.3 556.26) \$MSM 121A
 c cells 61, 62 and 63 couple to make the MSM and sleeve.
 62 0 -70 u=1 \$MSM 121A inner cyl.
 63 2 -7.93 70 u=1 \$MSM sleeve; coupled w/ #61
 64 like 61 but trcl=(853.44 190.5 556.26) \$MSM 122A
 65 like 61 but trcl=(853.44 190.5 934.72) \$MSM 116A
 66 like 61 but trcl=(853.44 114.3 934.72) \$MSM 115A
 67 0 23 -21 68 (-13: -12) -11 -10 9 \$Void above cell annex
 68 0 -20 19 -14 18 22 \$triangular void @ bottom
 69 0 (-8: 14: (13 (11: 12)) : -9: 10: 21: -19) #57 #58
 (-8:91:14:68:-9:-21)
 c Outside world.
 70 like 61 but trcl=(426.72 114.3 1409.7) \$MSM 112A
 71 like 61 but trcl=(426.72 190.5 1409.7) \$MSM 111A
 72 like 61 but trcl=(426.72 495.3 1409.7) \$MSM 114A
 73 like 61 but trcl=(426.72 419.1 1409.7) \$MSM 113A
 74 like 61 but trcl=2 \$MSM 125A
 75 like 61 but trcl=3 \$MSM 126A
 76 like 61 but trcl=4 \$MSM 119A
 77 like 61 but trcl=5 \$MSM 120A
 78 like 61 but trcl=6 \$MSM 123A
 79 like 61 but trcl=7 \$MSM 124A
 80 like 61 but trcl=8 \$MSM 117A
 81 like 61 but trcl=9 \$MSM 118A
 82 0 -69 72 -73 trcl=10 \$U-420 periscope
 83 0 -69 72 -73 trcl=11 \$U-310A periscope
 84 0 -78 -74 80 77 #87 #88 #89 #90 #91 #92 trcl=18
 \$WC & contents
 85 2 -7.93 84078 -79 84080 -84074 \$WC thickness
 86 0 -84077 -84074 84080 \$WC hole
 87 3 -5.01 -75 -76 80 trcl=12 \$fuel1 in WC
 88 3 -5.01 -75 -76 80 trcl=13 \$fuel2 in WC
 89 3 -5.01 -75 -76 80 trcl=14 \$fuel3 in WC
 90 3 -5.01 -75 -76 80 trcl=15 \$fuel4 in WC
 91 3 -5.01 -75 -76 80 trcl=16 \$fuel5 in WC
 92 3 -5.01 -75 -76 80 trcl=17 \$fuel6 in WC
 93 3 -5.01 -75 -76 80 trcl=19 \$ident 89
 94 3 -5.01 -75 -76 80 trcl=20 \$ident 17 S
 95 3 -5.01 -75 -76 80 trcl=21 \$ident 17 N
 96 3 -2.50 -75 -76 80 trcl=22 \$ident 39 W
 97 3 -2.50 -75 -76 80 trcl=23 \$ident 39 E
 98 3 -5.01 -75 -76 80 trcl=24 \$ident 41
 99 4 -2.713 -75 -76 80 trcl=25 \$ident 103 W
 100 4 -2.713 -75 -76 80 trcl=26 \$ident 103 E
 101 4 -2.713 -75 -76 80 trcl=27 \$ident 35 W
 102 4 -2.713 -75 -76 80 trcl=28 \$ident 35 E
 103 like 82 but trcl=29 \$W-52A Periscope
 104 like 82 but trcl=30 \$U-471 Periscope

105 2 -7.93 20 -81 -86 \$ maint. turn table
106 0 82 -83 -85
107 2 -7.93 83 -21 -85 96
108 1 -4.49 82 -21 85 1 2 -22 -7
109 2 -7.93 21 96 88 -87 -89 90 -84
111 0 21 9 -14 8 -68 -91 (-88:89:87:-90:84)
 (102:116) (100:-95:94:97:-98)
112 0 83 -84 -96 (93:-99)
113 2 -7.93 99 -101 92 -93
114 2 -7.93 93 84 -100 98 -97 95 -94
115 0 99 -92 -101
116 2 -7.93 100 -116 -102 (101:93)
117 0 -103 81 -123
 (114:-107:115)
118 0 -114 107 -115
 #119 #120 #121 #122 #123 #124
 #125 #126 #127 #129 #128 #130 #131 #132 #133 #134 #135 #136
 #137 #138 #139
119 2 -7.93 -105 104 107 -114
120 0 -104 106 107 -114
121 0 -106 107 -114
122 2 -7.93 -1051 1041 107 -114
123 0 -1041 1061 107 -114
124 0 -1061 107 -114 fill=2 \$ tube A
125 2 -7.93 -1052 1042 107 -114
126 0 -1042 1062 107 -114
127 0 -1062 107 -114 fill=2 \$ tube B
128 2 -7.93 -1053 1043 107 -114
129 0 -1043 1063 107 -114
130 0 -1063 107 -114 fill=2 \$ tube C
131 2 -7.93 -1054 1044 107 -114
132 0 -1044 1064 107 -114
133 0 -1064 107 -114 fill=2 \$ tube D
134 2 -7.93 -1055 1045 107 -114
135 0 -1045 1065 107 -114
136 0 -1065 107 -114 fill=2 \$ tube E
137 2 -7.93 -1056 1046 107 -114
138 0 -1046 1066 107 -114
139 0 -1066 107 -114 fill=2 \$ tube F
140 5 -7.930 -108 u=2 \$ inlet nozzle
141 5 -7.930 108 -109 u=2 \$ lower shld
142 7 -7.930 109 -110 u=2 \$ lower refl
143 6 -7.930 110 -111 u=2 \$ DFA core
144 7 -7.930 111 -112 u=2 \$ upper refl
145 5 -7.930 112 -113 u=2 \$ plenum
146 5 -7.930 113 u=2 \$ H. Socket
154 0 123 -82 1 2 -22 -7 (-127:125)
155 2 -7.93 2 127 -129 -125 123 -82 #156
156 8 -11.4 133 126 -134 -124 -121 122
157 2 -7.93 129 127 -7 -125 -82 123 #158
158 8 -11.4 130 126 -131 -124 122 -121

1 px 0
2 py 0
3 px 853.44
4 p 853.44 280.1 0 828.74 304.8 0 828.74 304.8 1064.26
5 py 304.8
6 p 426.72 609.6 0 508.39 304.8 0 508.39 304.8 1064.26
7 py 609.6
8 px -15.24
9 py -15.24
10 px 975.36
11 p 975.36 330.6 0 879.24 426.72 0 879.24 426.72 1064.26
12 py 426.72
13 p 601.95 426.72 0 520.27 731.52 0 520.27 731.52 1064.26
14 py 731.52
15 p 975.36 330.6 0 853.44 280.1 0 853.44 280.1 1064.26
16 p 879.24 426.72 0 828.74 304.8 0 828.74 304.8 1064.26
17 p 508.39 304.8 0 601.95 426.72 0 601.95 426.72 1064.26
18 p 426.72 609.6 0 520.27 731.52 0 520.27 731.52 1064.26
19 pz 0 \$ IEM Cell bottom at 495 foot level.
20 pz 213.36
21 pz 1676.4 \$ 550 foot level
22 px 426.72

23 pz 1066.8
 24 py 624.84
 25 py 640.08
 26 py 655.32
 27 py 670.56
 28 py 685.8
 29 py 701.04
 30 py 716.28
 31 p 520.09 320.04 0 438.41 624.84 0 438.41 624.84 1064.26
 32 p 531.78 335.28 0 450.11 640.08 0 450.11 640.08 1064.26
 33 p 543.48 350.52 0 461.8 655.32 0 461.8 655.32 1064.26
 34 p 555.17 365.76 0 473.5 670.56 0 473.5 670.56 1064.26
 35 p 566.87 381.0 0 485.19 685.8 0 485.19 685.8 1064.26
 36 p 578.56 396.24 0 496.88 701.04 0 496.88 701.04 1064.26
 37 p 590.25 411.48 0 508.58 716.28 0 508.58 716.28 1064.26
 38 py 320.04
 39 py 335.28
 40 py 350.52
 41 py 365.76
 42 py 381.0
 43 py 396.24
 44 py 411.48
 45 p 868.68 286.4125 0 835.0525 320.04 0 835.0525 320.04 1064.26
 46 p 883.92 292.725 0 841.365 335.28 0 841.365 335.28 1064.26
 47 p 899.16 299.0375 0 847.6775 350.52 0 847.6775 350.52 1064.26
 48 p 914.4 305.35 0 853.99 365.76 0 853.99 365.76 1064.26
 49 p 929.64 311.6625 0 860.3025 381.0 0 860.3025 381.0 1064.26
 50 p 944.88 317.975 0 866.615 396.24 0 866.615 396.24 1064.26
 51 p 960.12 324.2875 0 872.9275 411.48 0 872.9275 411.48 1064.26
 52 px 868.68
 53 px 883.92
 54 px 899.16
 55 px 914.4
 56 px 929.64
 57 px 944.88
 58 px 960.12
 59 px 438.41
 60 px 450.1
 61 px 461.79
 62 px 473.48
 63 px 485.17
 64 px 496.86
 65 px 508.55
 66 px 520.24
 67 px 534.43
 68 px 548.64
 69 cx 5.0
 70 cx 3.5
 71 px 121.9199997
 72 px 0.004
 73 px 121.90999
 74 pz 399.745
 75 pz 397.55
 76 cz 6.1012
 77 cz 6.11
 78 cz 24.92
 79 c/z 121.92 121.92 25.19
 80 pz 30.48
 81 pz 289.56
 82 pz 1625.60 \$ IEM Cell ceiling
 83 pz 1666.24
 84 pz 1696.72
 85 c/z 213.4 457.2 144.78
 86 c/z 213.4 457.2 152.4
 87 px 391.2
 88 px 35.6
 89 py 635.0
 90 py 279.4
 91 pz 2072.64 \$ top of SWC
 92 c/z 213.40 541.66 27.94
 93 c/z 213.40 541.66 41.91
 94 px 297.86
 95 px 128.94
 96 c/z 213.40 541.66 50.88

97 py 626.12
 98 py 414.02
 99 pz 1693.12
 100 pz 1699.72
 101 pz 1702.61
 102 c/z 213.40 541.66 63.4
 103 c/z 213.40 541.66 25.40
 104 c/z 213.4 541.6 8.10
 105 c/z 213.4 541.6 8.30
 106 c/z 213.4 541.6 6.338

c

c The following 8 elevations are adjusted by the same increment
 c to elevate the CCC. The POS parameter must also be adjusted.

c

107 pz 290.00 \$ DFA Midplane at 510 foot level
 108 pz 329.88 \$ POS elevation is 457.20 cm.
 109 pz 398.88
 110 pz 414.36
 111 pz 505.80 \$ On MTT the DFA MP is at 510 feet
 112 pz 521.28
 113 pz 628.58
 114 pz 662.11
 115 c/z 213.40 541.60 25.25
 116 pz 1713.06
 121 pz 1623.60
 122 pz 1600.84
 123 pz 1588.14
 124 px 368.34
 125 px 370.88
 126 px 58.46
 127 px 55.92
 129 py 304.80
 130 py 307.34
 131 py 607.06
 133 py 2.54
 134 py 302.26
 1041 c/z 230.23 541.60 8.100
 1042 c/z 221.82 556.18 8.100
 1043 c/z 221.82 527.02 8.100
 1044 c/z 196.57 541.60 8.100
 1045 c/z 204.98 527.02 8.100
 1046 c/z 204.98 556.18 8.100
 1051 c/z 230.23 541.60 8.300
 1052 c/z 221.82 556.18 8.300
 1053 c/z 221.82 527.02 8.300
 1054 c/z 196.57 541.60 8.300
 1055 c/z 204.98 527.02 8.300
 1056 c/z 204.98 556.18 8.300
 1061 c/z 230.23 541.60 6.338
 1062 c/z 221.82 556.18 6.338
 1063 c/z 221.82 527.02 6.338
 1064 c/z 196.57 541.60 6.338
 1065 c/z 204.98 527.02 6.338
 1066 c/z 204.98 556.18 6.338

*tr2 464.195 469.75 556.26 15 75 90 105 15 90 90 90 0 1
 *tr3 444.47 543.36 556.26 15 75 90 105 15 90 90 90 0 1
 *tr4 464.19 469.75 944.88 15 75 90 105 15 90 90 90 0 1
 *tr5 444.47 543.36 944.88 15 75 90 105 15 90 90 90 0 1
 *tr6 754.38 304.8 556.26 90 0 90 180 90 90 90 90 0 1
 *tr7 678.18 304.8 556.26 90 0 90 180 90 90 90 90 0 1
 *tr8 754.38 304.8 934.72 90 0 90 180 90 90 90 90 0 1
 *tr9 678.18 304.8 934.72 90 0 90 180 90 90 90 90 0 1
 *tr10 841.09 292.45 464.82 45 45 90 135 45 90 90 90 0 1
 *tr11 841.09 292.45 853.44 45 45 90 135 45 90 90 90 0 1
 *tr12 137.555 121.92 .01
 *tr13 129.7375 135.46 .01
 *tr14 114.1025 135.46 .01
 *tr15 106.285 121.92 .01
 *tr16 114.1025 108.38 .01
 *tr17 129.7375 108.38 .01
 *tr18 121.92 121.92 0
 tr19 50.165 251.46 377.5358
 tr20 31.115 441.96 549.0366


```

tr21 31.115 502.92 549.0366
tr22 57.15 576.58 682.92
tr23 95.25 576.58 682.92
tr24 392.125 561.19 579.73
tr25 45.72 30.48 1142.66
tr26 91.99 30.48 1142.66
c ID 35E position up
c tr27 327.66 152.4 319.62
c ID 35E position down
tr27 327.66 152.4 51.73
c ID 35W position up
c tr28 718.82 152.4 319.62
c ID 35W position down
tr28 718.8 152.4 51.73
*tr29 680.915 304.8 157.48 90 0 90 180 90 90 90 0 1
tr30 426.72 304.8 1353.82
mode p
print
imp:p 1 45r 0 0 1 17r 0 2r 1 78r 1 1
m1 $High Density Concrete
1001.01p -0.0044 8016.01p -0.1753 13027.01p -0.0094
14000.01p -0.0183 20000.01p -0.0604 26000.01p -0.7317
m2 $Stainless Steel
26000.01p -0.68 28000.01p -0.14 24000.01p -0.18
m3 $Fuel for Source
92238.01p -0.459 8000.01p -0.0758 11023.01p -0.06986
26000.01p -0.3952
m4 $Stainless Steel for MOTA Source
26000.01p -0.68 28000.01p -0.14 24000.01p -0.18
m5 $Stainless Steel 316 for shld, plenum, and H. S.
26000.01p -0.67 24000.01p -0.17 28000.01p -0.13 42000.01p -0.02
25000.01p -0.01
m6 $DFA Core in CCC
26000.01p -0.2866 24000.01p -0.0727 28000.01p -0.0556
42000.01p -0.0086 25000.01p -0.0043
8016.01p -0.0678 92238.01p -0.3578 94239.01p -0.1467
m7 $Reflectors
26000.01p -0.3317 24000.01p -0.1643 28000.01p -0.4855
42000.01p -0.0085 25000.01p -0.0100
m8 $lead shld
82000.01p -1.0
c void 63 87 88 89 90 91 92 93 94 95 96 98 99 100 101 102
void 155 156 $ This closes the 10 foot ceiling valve.
c void 157 158 $ This opens the 10 foot ceiling valve.
nps 10000
idum 1
phys:p j 1
sdef erg=d1 cel=d4 pos=fcel d5 rad=d2 axe=0.0 0.0 1.0
ext=d3
wgt=5.926e+15
sc1 Gamma spectrum for 150,000 MWD/MT burnup DFA decayed 5 years.
# si1 sp1 sb1
l d d
0.125 5.394E+13 0.125
0.225 4.786E+13 0.225
0.375 3.740E+13 0.375
0.575 7.002E+14 0.575
0.85 1.033E+14 0.85
1.25 4.367E+13 1.25
1.75 1.286E+12 1.75
2.25 7.337E+11 2.25
2.75 3.933E+10 2.75
3.5 5.083E+09 3.5
5.0 2.523E+05 3.5
7.0 2.892E+04 7.0
11.0 2.892E+03 11.0
sc2 radial range of source
si2 0 6.338
sc3 axial extent of source
si3 -45.72 -44.0 -42.0 -40.0 -38.0 -36.0 -34.0 -32.0
-30.0 -28.0 -26.0 -24.0 -22.0 -20.0 -18.0 -16.0
-14.0 -12.0 -10.0 -8.0 -6.0 -4.0 -2.0 0.0
2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0

```

	34.0	36.0	38.0	40.0	42.0	44.0	45.72
sp3	0.0	0.860	0.879	0.901	0.927	0.959	0.991
	1.063	1.091	1.116	1.140	1.166	1.188	1.205
	1.231	1.239	1.244	1.244	1.239	1.233	1.224
	1.198	1.178	1.160	1.138	1.116	1.088	1.067
	1.011	0.981	0.951	0.916	0.879	0.843	0.806
	0.729	0.694	0.657	0.627	0.597	0.567	0.543

sc4 cell distribution

sl4 l 124 127 130 133 136 139

sp4 d 1 1 1 1 1 1

sb4 d 1 1 1 1 1 1

ds5 l 230.23 541.60 460.08

221.82 556.18 460.08

221.82 527.08 460.08

196.57 541.60 460.08

204.98 527.08 460.08

204.98 556.18 460.08

fc5 Dose rates on the 550 foot level.

fb:p	x	y	z	rd
	213.40	541.66	1707.7	5.08
	221.82	541.66	1707.7	5.08
	196.57	541.66	1707.7	5.08
	243.88	541.66	1704.8	5.08
	182.92	541.66	1704.8	5.08
	302.94	541.66	1701.8	5.08
	123.86	541.66	1701.8	5.08
	358.18	541.66	1701.8	5.08
	68.62	541.66	1701.8	5.08
	213.4	556.18	1707.7	5.08
	213.4	527.08	1707.7	5.08
	213.4	473.18	1704.8	5.08
	213.4	408.94	1701.8	5.08
	213.4	396.88	1701.8	5.08
	213.4	610.14	1704.8	5.08

CHECKLIST FOR INDEPENDENT TECHNICAL REVIEW

DOCUMENT REVIEWED

NUMBER: WHC-SD-FF-TA-034 Rev 0

TITLE: Shielding Evaluation of the IEM Cell Offset Adapter Plate

AUTHOR(s): R. L. SIMONS

I. Method(s) of Review

- ☒ Input data checked for accuracy
- ☒ Independent calculation performed
- ☒ Hand calculation
- ☒ Alternate computer code: Microshield
- ☐ Comparison to experiment or previous results
- ☐ Alternate method (define) _____

II. Checklist (either check or enter NA if not applied)

- ☒ Task completely defined
- ☒ Activity consistent with task specification
- ☒ Necessary assumptions explicitly stated and supported
- ☒ Resources properly identified and referenced
- ☒ Resource documentation appropriate for this application
- ☒ Input data explicitly stated
- ☒ Input data verified to be consistent with original source
- ☒ Geometric model adequate representation of actual geometry
- ☒ Material properties appropriate and reasonable
- ☒ Mathematical derivations checked including dimensional consistency
- ☒ Hand calculations checked for errors
- ☒ Assumptions explicitly stated and justified
- ☒ Computer software appropriate for task and used within range of validity
- ☒ Use of resource outside range of established validity is justified
- ☒ Software runstreams correct and consistent with results
- ☒ Software output consistent with input
- ☒ Results consistent with applicable previous experimental or analytical findings
- ☒ Results and conclusions address all points and are consistent with task requirements and/or established limits or criteria
- ☒ Conclusions consistent with analytical results and established limits
- ☒ Uncertainty assessment appropriate and reasonable
- ☐ Other (define) _____

III. Comments:

IV. REVIEWER: RRS DATE: 31 Aug 94