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Packaging Certification Program Methodology for Determining Dose Rates for Small Gram Quantities in Shipping Packagings

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EXECUTIVE SUMMARY

The Small Gram Quantity (SGQ) concept is based on the understanding that small amounts of hazardous materials, in this case radioactive materials, are significantly less hazardous than large amounts of the same materials. This study describes a methodology designed to estimate an SGQ for several neutron and gamma emitting isotopes that can be shipped in a package compliant with 10 CFR Part 71 external radiation level limits regulations. These regulations require packaging for the shipment of radioactive materials perform, under both normal and accident conditions, the essential functions of material containment, subcriticality, and maintain external radiation levels within regulatory limits. 10 CFR 71.33(b)(1)(2)&(3) state radioactive and fissile materials must be identified and their maximum quantity, chemical and physical forms be included in an application. Furthermore, the U.S. Federal Regulations require application contain an evaluation demonstrating the package (i.e., the packaging and its contents) satisfies the external radiation standards for all packages (10 CFR 71.31(2), 71.35(a), & 71.47). By placing the contents in a He leak-tight containment vessel, and limiting the mass to ensure subcriticality, the first two essential functions are readily met. Some isotopes emit sufficiently strong photon radiation that small amounts of material can yield a large external dose rate. Quantifying of the dose rate for a proposed content is a challenging issue for the SGQ approach. It is essential to quantify external radiation levels from several common gamma and neutron sources that can be safely placed in a specific packaging, to ensure compliance with federal regulations.

The Packaging Certification Program (PCP) Methodology for Determining Dose Rate for Small Gram Quantities in Shipping Packagings described in this report provides bounding mass limits for a set of proposed SGQ isotopes. Methodology calculations were performed to estimate external radiation levels for the 9977 shipping package using the MCNP radiation transport code to develop a set of response multipliers (Green's functions) for "dose per particle" for each neutron and photon spectral group. The source spectrum for each isotope generated using the ORIGEN-S and RASTA computer codes was folded with the response multipliers to generate the dose rate per gram of each isotope in the 9977 shipping package and its associated shielded containers.

The maximum amount of a single isotope that could be shipped within the regulatory limits contained in 10 CFR 71.47 for dose rate at the surface of the package is determined. If a package contains a mixture of isotopes, the acceptability for shipment can be determined by a sum of fractions approach. Furthermore, the results of this analysis can be easily extended to additional radioisotopes by simply evaluating the neutron and/or photon spectra of those isotopes and folding the spectral data with the Green's functions provided.

TABLE OF CONTENTS

LIST OF TABLES	vii
LIST OF FIGURES	ix
1.0 Introduction	1
2.0 Analytic Methodology	1
2.1 Shielding Models	2
2.2 Material Compositions	3
2.3 Radiation Sources	3
2.4 Radiation Transport	4
3.0 Results and Discussion	17
3.1 Radiation Sources	17
3.2 Radiation Transport	18
3.2.1 No Shielded Container	18
3.2.2 SC1 Lead Shielded Container	18
3.2.3 SC2 Polyethylene Shielded Container	18
3.2.4 SC3 Tungsten Shielded Container	19
3.3 Dose Rate	19
4.0 Conclusions	96
5.0 References	96
Appendix A Radiation Source Input Files	99
Appendix B Radiation Transport Input Files	108
Appendix C Python Scripts	130

LIST OF TABLES

Table 2-1. Material Compositions.....	13
Table 2-2. Typical Sealed Source Isotopes	13
Table 2-3. Neutron Spectra 47 Group Structure.....	14
Table 2-4. Photon Spectra 77 Group Structure.....	15
Table 2-5. Flux-to-Dose-Rate Conversion Factors.....	16
Table 3-1. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 0 days)	25
Table 3-2. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 30 days)	26
Table 3-3. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 100 days)	27
Table 3-4. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 30,000 days)	28
Table 3-5. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 0 days).....	29
Table 3-6. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 30 days).....	30
Table 3-7. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 100 days).....	31
Table 3-8. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 30,000 days)...	32
Table 3-9. Neutron Source from RASTA w/o Beryllium (Decay Time = 0 days).....	33
Table 3-10. Neutron Source from RASTA w/90% Beryllium (Decay Time = 0 days)	34
Table 3-11. Total Neutron Source (Decay Time = 0 days)	35
Table 3-12. Neutron Source as a Function of Decay Time	35
Table 3-13. Photon Source from ORIGEN-S (Decay Time = 0 days)	36
Table 3-14. Photon Source from ORIGEN-S (Decay Time = 0 days)	38
Table 3-15. Photon Source from ORIGEN-S (Decay Time = 0 days)	40
Table 3-16. Photon Source from ORIGEN-S (Decay Time = 0 days)	42
Table 3-17. Photon Source from ORIGEN-S (Decay Time = 0 days)	44
Table 3-18. Photon Source from RASTA (Decay Time = 0 days).....	46
Table 3-19. Photon Source from RASTA (Decay Time = 0 days).....	48
Table 3-20. Photon Source from RASTA (Decay Time = 0 days).....	50
Table 3-21. Photon Source from RASTA (Decay Time = 0 days).....	52
Table 3-22. Photon Source from RASTA (Decay Time = 0 days).....	54
Table 3-23. Photon Source from ORIGEN-S (Decay Time = 30 days)	56
Table 3-24. Photon Source from ORIGEN-S (Decay Time = 100 days)	58
Table 3-25. Photon Source from ORIGEN-S (Decay Time = 30,000 days)	60
Table 3-26. Total Photon Source Strength	62
Table 3-27 Photons from Nuclides with Bremsstrahlung	63

Table 3-28. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - No Self-shielding	67
Table 3-29. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - No Self-shielding.....	68
Table 3-30. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container - No Self-shielding	69
Table 3-31. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - PuO ₂ Self-shielding.....	71
Table 3-32. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - PuO ₂ Self-shielding	72
Table 3-33. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container – PuO ₂ Self-shielding	73
Table 3-34. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC1 Lead Shielded Container.....	75
Table 3-35. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – SC2 Polyethylene Shielded Container	77
Table 3-36. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – SC2 Polyethylene Shielded Container.....	78
Table 3-37. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC2 Polyethylene Shielded Container	79
Table 3-38. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC3 Tungsten Shielded Container.....	81
Table 3-39. Actinide Total Dose Rate - No Shielded Container	83
Table 3-40. Effect of PuO ₂ Self-shielding.....	85
Table 3-41. Actinide Total Dose Rate – SC2 Polyethylene Shielded Container.....	86
Table 3-42. Dose Rate from Actinides as a Function of Time	88
Table 3-43. Primary Photon Dose Rate.....	89
Table 3-44. Effect of Self-shielding by Iron on Primary Photon Dose Rate.....	90
Table 3-45. Maximum Dose Rate without Impurities	91
Table 3-46. Maximum Dose Rate with Impurities	92
Table 3-47. Allowed Mass for Shipment – NCT without Impurities	93
Table 3-48. Allowed Mass for Shipment – Exclusive Use without Impurities	94
Table 3-49. Allowed Actinide Mass for Shipment – NCT with Impurities	95
Table 3-50. Allowed Actinide Mass for Shipment – Exclusive Use with Impurities	95

LIST OF FIGURES

Figure 2-1. Model of 9977 Under NCT.....	5
Figure 2-2. SGQ-SC1 Lead Shielded Container	6
Figure 2-3. SGQ-SC2 HDPE Shielded Container	7
Figure 2-4. SGQ-SC3 Tungsten Shielded Container.....	8
Figure 2-5. 9977 NCT Neutron Source without Shielded Container	9
Figure 2-6. 9977 NCT Photon Source in SC1 Lead Container	10
Figure 2-7. 9977 NCT Neutron Source in SC2 Polyethylene Container.....	11
Figure 2-8. 9977 NCT Photon Source in SC3 Tungsten Container	12
Figure 3-1. Am-243 Fission Neutron Spectrum	21
Figure 3-2. Pu-239 Fission Neutron Spectrum.....	21
Figure 3-3. Pu-241 Fission Neutron Spectrum.....	22
Figure 3-4. Am-241 Photon Spectra.....	22
Figure 3-5. Cm-248 Photon Spectra.....	23
Figure 3-6. Ho-166m Photon Spectra.....	23
Figure 3-7. Ir-192 Photon Spectra	24
Figure 3-8. Pu-241 Photon Spectra	24

LIST OF ABBREVIATIONS

6CV	six-inch containment vessel
ANL	Argonne National Laboratory
ANS	American Nuclear Society
BUGLE	<u>B</u> road <u>U</u> ser <u>G</u> roup <u>L</u> ibrary <u>E</u> NDF/B
CV	Containment Vessel
HDPE	High Density Polyethylene
LLNL	Lawrence Livermore National Laboratory
MCNP	<u>M</u> onte <u>C</u> arlo <u>N</u> - <u>P</u> article
MCTAL	ASCII tally results file
NCT	Normal Conditions of Transport
ORIGEN	Oak Ridge Isotope GEneration Code
ORIGEN-S	ORIGEN for SCALE
ORNL	Oak Ridge National Laboratory
PCP	Packaging Certification Program
RAM	Radioactive Material
RASTA	Radiation Source Term Analysis
SC	Shielded Container
SCALE	A Modular Code System for Performing <u>S</u> tandardized <u>C</u> omputer <u>A</u> nalyses for <u>L</u> icensing <u>E</u> valuation
SGQ	Small Gram Quantity
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SS	Stainless Steel
WSMS	Westinghouse Safety Management Solutions

1.0 Introduction

The Small Gram Quantity (SGQ) concept is based on the understanding that small amounts of hazardous materials, in this case radioactive materials (RAM), are significantly less hazardous than large amounts of the same materials. This study describes a methodology designed to estimate an SGQ for several neutron and gamma emitting isotopes that can be shipped in a package in compliant with 10 CFR Part 71 external radiation level limits regulations. These regulations require packaging for the shipment of radioactive materials perform, under both normal and accident conditions, the essential functions of material containment, subcriticality, and maintain external radiation levels within the regulatory limits. 10 CFR 71.33(b)(1)(2)&(3) state radioactive and fissile materials must be identified and their maximum quantity, chemical and physical forms be included in an application. Furthermore, the U.S. Federal Regulations require application contain an evaluation demonstrating the package (i.e., the packaging and its contents) satisfies the external radiation standards for all packages (10 CFR 71.31(2), 71.35(a), & 71.47). By placing the contents in a He leak-tight containment vessel, and limiting the mass to ensure subcriticality, the first two essential functions are readily met. Some isotopes emit sufficiently strong photon radiation that small amounts of material can yield a large external dose rate. Quantifying of the dose rate for a proposed content is a challenging issue for the SGQ approach. It is essential to quantify external radiation levels from several common gamma and neutron sources that can be safely placed in a specific packaging, to ensure compliance with federal regulations. The Packaging Certification Program (PCP) Methodology for Determining Dose Rate for Small Gram Quantities in Shipping Packagings provides bounding shielding calculations that define mass limits compliant with 10 CFR 71.47 for a set of proposed SGQ isotopes. The approach is based on energy superposition with dose response calculated for a set of spectral groups for a baseline physical configuration. The methodology includes using the MCNP radiation transport code to evaluate a family of neutron and photon spectral groups using the 9977 shipping package and its associated shielded containers as the base case. This results in a set of multipliers for “dose per particle” for each spectral group. For a given isotope, the source spectrum is folded with the response for each group. The summed contribution determines the total dose from the RAM in the container.

2.0 Analytic Methodology

The MCNP(Monte Carlo N-Particle) [LA-UR-03-1987] code package was used for three dimensional Monte Carlo transport calculations to determine the radiation absorbed dose rates outside the package under Normal Conditions of Transport (NCT). The neutron transport calculations were performed as a series of calculations starting a unit source in each group using the BUGLE forty seven group structure [DLC-75]. Similarly, photon transport calculations were performed as a series of calculations starting a unit source in each group using a seventy seven group structure. Radiation source spectra and strengths were characterized using ORIGEN-S [ORNL/TM-2005/39, Section F7] and RASTA (Radiation Source Term Analysis) [SRNS-RP-2009-00275]. The neutron sources were defined using energy groups from the BUGLE 47 group structure.

The following paragraphs summarize features and use of the ORIGEN-S, RASTA, and MCNP codes:

ORIGEN-S computes time-dependent concentrations and source terms of a large number of isotopes, which are simultaneously generated and depleted through neutronic transmutation, fission, radioactive decay, input feed rates, and physical or chemical removal rates. The matrix exponential model of the ORIGEN code is unaltered in ORIGEN-S. The version of ORIGEN applied in the SCALE system [ORNL/TM-2005/39], ORIGEN-S, has several improvements over the original program. The code has been modified to include dynamic storage allocation, free-form input processing, and flexible dimensioning.

RASTA (Radiation Source Term Analysis) is a code that computes neutron and photon source terms arising from (α -n) events, spontaneous fission, bremsstrahlung, and decay. The code was written to consolidate existing capabilities into a single, easy to use code with flexible, extensive output edits, while also adding new capabilities. Specifically, the gamma decay calculation from the GAMSRC code, bremsstrahlung production calculations from the BREMRAD code [HW-82784], and the (α -n) and spontaneous fission neutron calculations from the SOURCES code [LA-13639] have been incorporated into RASTA. In addition, RASTA provides calculational routines to find the photon source arising from decay of the product isotope resulting from an (α -n) calculation, and to find the photon source arising from both prompt and delayed spontaneous fission events. The RASTA methodology for all processes is generalized and applicable to any isotopes for which data is available.

MCNP is a general-purpose Monte Carlo N-Particle code that can be used for neutron, photon, electron, or coupled neutron/photon/electron transport, including the capability to calculate eigenvalues for critical systems. The code treats an arbitrary three-dimensional configuration of materials in geometric cells bounded by first- and second-degree surfaces and fourth-degree elliptical tori. Pointwise cross-section data are used. For neutrons, all reactions given in a particular cross-section evaluation (such as ENDF/B-VI) are accounted for. Thermal neutrons are described by both the free gas and $S(\alpha, \beta)$ models. For photons, the code accounts for incoherent and coherent scattering, the possibility of fluorescent emission after photoelectric absorption, absorption in pair production with local emission of annihilation radiation, and bremsstrahlung. A continuous-slowing-down model is used for electron transport that includes positrons, k-shell x-rays, and bremsstrahlung, but does not include external or self-induced fields.

The ORIGEN-S, RASTA, and MCNP, calculations were performed on the SRNS Criticality Safety Advanced Computing Center stand-alone computers, using code and libraries under configuration control [SRNS-RP-2008-00150, SRNS-RP-2009-00276, and SRNS-RP-2008-00117] and verified on that system [SRNS-RP-2008-00151, SRNS-RP-2009-00277, SRNS-RP-2009-00285].

2.1 Shielding Models

The 9977 is a single containment drum type package with a bolted flange closure and a right circular cylinder Containment Vessel (CV) enclosed by LAST-A-FOAM® and Fiberfrax® insulation. Major materials of construction include stainless steel, polyurethane, and aluminum.

The drum consists of a SS outer shell with a SS liner, aluminum load distribution fixtures and miscellaneous other hardware, as shown in Figure 2-1. The drum is modeled as a right circular cylinder, simplifying some of the components. The simplifications are conservative since they place the source material closer to the surface of the drum being analyzed. These simplifications include:

- The bottom of the drum is modeled as flat rather than convex.
- The drum top rim and bottom wear ring are not modeled.
- The drum rolling hoops are not modeled.

The six-inch containment vessel (6CV) is modeled as a cylindrical main portion with a conical transition at the top, a short upper cylinder, a Cone-Seal Plug, and the Cone-Seal Nut. Some of the components of the 6CV that are simple to model (e.g., the conical transition at the top) are

included exactly. Other more complex components are modeled as simpler shapes; these are discussed below.

- The Gland Nut is a complex set of cones and cylinders inside the Gland Nut Plug. For simplicity the nut and plug are modeled together as a single cylinder of 304L stainless steel with a small cylindrical cavity at the top to account for the nut being shorter than the plug. This does not impact the radiation transport calculations, since the limiting dose point is at the bottom of the package.
- The End Cap of the 6CV is modeled as a 2/1 ellipse with the axis of rotation (the “z-axis”) set to half the radius of the 6CV cylindrical portion and the minor axis set to the radius of the 6CV cylindrical portion. The bottom of the cylindrical portion of the 6CV is extended down to the point at which the ellipse intersects it.

The SGQ-SC1 Lead Shielded Container [R-R1-G-00037] (Figure 2-2) was modeled as a right circular cylinder (9.354" tall and 5.625" in diameter). The content cavity was modeled as 5.5" tall by 1.625" diameter, 2" above the outside bottom of the container.

The SGQ-SC2 Polyethylene Shielded Container [R-R1-G-00038] (Figure 2-3) was modeled as a right circular cylinder (12.25" tall and 5.875" in diameter). The content cavity was modeled as 8.00" tall by 1.625" diameter, 2.00" above the outside bottom¹ of the container.

The SGQ-SC3 Tungsten Shielded Container [R-R1-G-00039] (Figure 2-4) was modeled as a right circular cylinder (7.480" tall and 5.480" in diameter²). The content cavity was modeled as 3.330" tall by 1.330" diameter, 2.075" above the outside bottom of the container.

Representing the shielded containers as right circular cylinders simplifies the geometric modeling without impacting the calculated dose rates since the detectors are located on the source axis or mid-plane.

2.2 Material Compositions

The 9977 Package consists of a stainless steel cylindrical CV, a 35 gallon steel drum, Fiberfrax[®], LAST-A-FOAM[®] insulation, aluminum load distribution fixtures, and a lid filled with TR-19[®] Block/Min K[®] 2000.

Ten material compositions (Table 2-1), other than the source region, are used to model the 9977. [WSMS CRT 02 0060, LA 12827 M, Midwest Tungsten Service]

2.3 Radiation Sources

A set of thirty six source isotopes was proposed by personnel at Lawrence Livermore National Laboratory [LLNL-TR-461255]. Thirty five of these isotopes (with the exception of the very short lived Pd-103), listed in Table 2-2, were analyzed to determine the neutron and photon source strengths. The 47 group structure used to calculate neutron spectra is shown in Table 2-3. The 77 group structure used to calculate photon spectra is shown in Table 2-4. The sources were computed as a function of decay time using ORIGEN-S and without decay using RASTA. Actinides were analyzed with varying amounts of beryllium to determine the effects of (α -n)

¹ These dimensions are based on an earlier design of the SGQ-SC2 Shielded Container. The impact of the differences on calculated dose is conservative since the thickness of polyethylene is less than the current design.

² These dimensions are based on an earlier design of the SGQ-SC3 Shielded Container. The impact of the differences on calculated dose is minimal since the thickness of tungsten is the same as the current design.

interactions on the neutron source. The added beryllium is modeled as a percent of the actinide mass (e.g., ten percent added beryllium in Pu-238 is modeled as 1 gram of Pu-238 and 0.1 grams of beryllium).

The input files used are described in Appendix A.

2.4 Radiation Transport

For NCT, the package is considered to be intact and dose rates are calculated on contact at the side, bottom, and top of the package. NCT models were developed for no shielded container (Figure 2-5), the SGQ-SC1 lead shielded container (Figure 2-6), the SGQ-SC2 polyethylene shielded container (Figure 2-7), and the SGQ-SC3 tungsten shielded container (Figure 2-8). The source region is modeled as a void for each of the shielded containers.

The neutron source was modeled as a cylinder centered at the bottom of the CV. The cylinder was 2.5 cm in diameter by 4 cm tall based on the average source dimensions as presented by Monsanto [ANS-1981]. The source cylinders were run initially as void and then as reduced density plutonium oxide without shielded containers to determine the effects of self-shielding.

The gamma source was modeled as a cylinder centered at the bottom of the CV. The cylinder dimensions were 1 cm in diameter by 2 cm tall based on the average dimensions obtained from sources listed in a catalog from AEA Technology [AEA Technology QSA]. The source cylinders were run initially as void and then as reduced density (1 g/cc) iron³ without shielded containers to determine the effects of self-shielding.

The source cylinders are placed at the bottom of the CV or at the base of the shielded containers with the cylinder centerline on the package centerline. The source region is modeled as a void for the shielded containers.

Separate MCNP cases were run with a unit source in each of the neutron groups (Table 2-3) and each of the photon groups (Table 2-4). The input files are described in Appendix B.

Neutron and photon flux-to-dose-rate conversion factors were obtained from the 1977 American Nuclear Society Standard [ANSI/ANS-6.1.1-1977] and are given in Table 2-5. The 1977 values were used rather than those from the 1991 standard because the neutron dose conversion factors more closely reflect those provided in federal regulations [49 CFR 173.403], and the photon dose conversion factors more closely correspond to the response measured by instrumentation.

Dose points were modeled as both segmented surface tallies and point detectors located:

- At the bottom surface on the centerline of the package
- At the top surface on the centerline of the package
- At the side surface of the package axially centered on the source

Output from the MCNP cases was written to MCTAL files to facilitate collecting the response per unit source. The MCTAL files were collected using a set of Python scripts (see Appendix C).

³ Iron was chosen for the self-shielding material since it should be representative of several of the isotopes being analyzed.

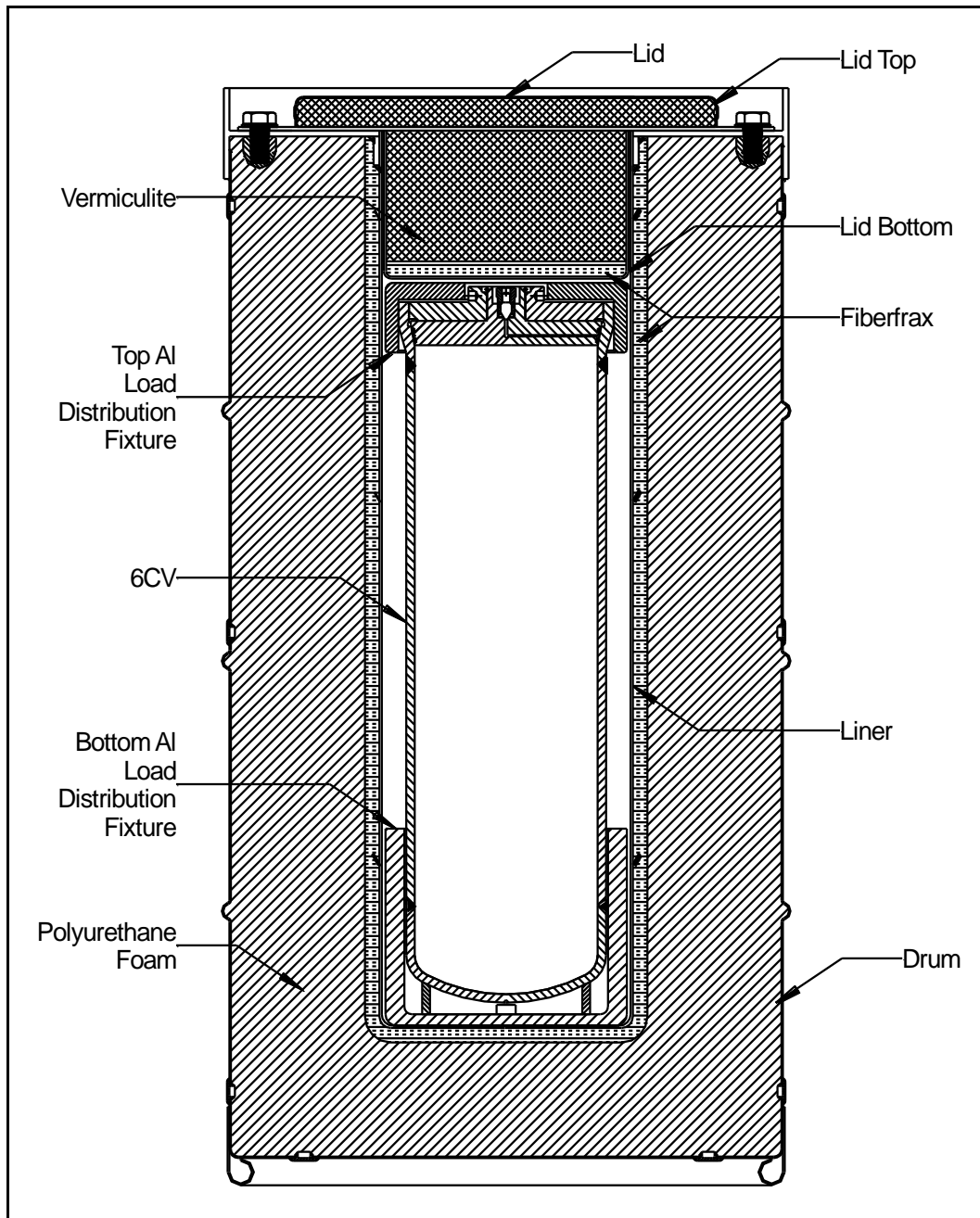


Figure 2-1. Model of 9977 Under NCT

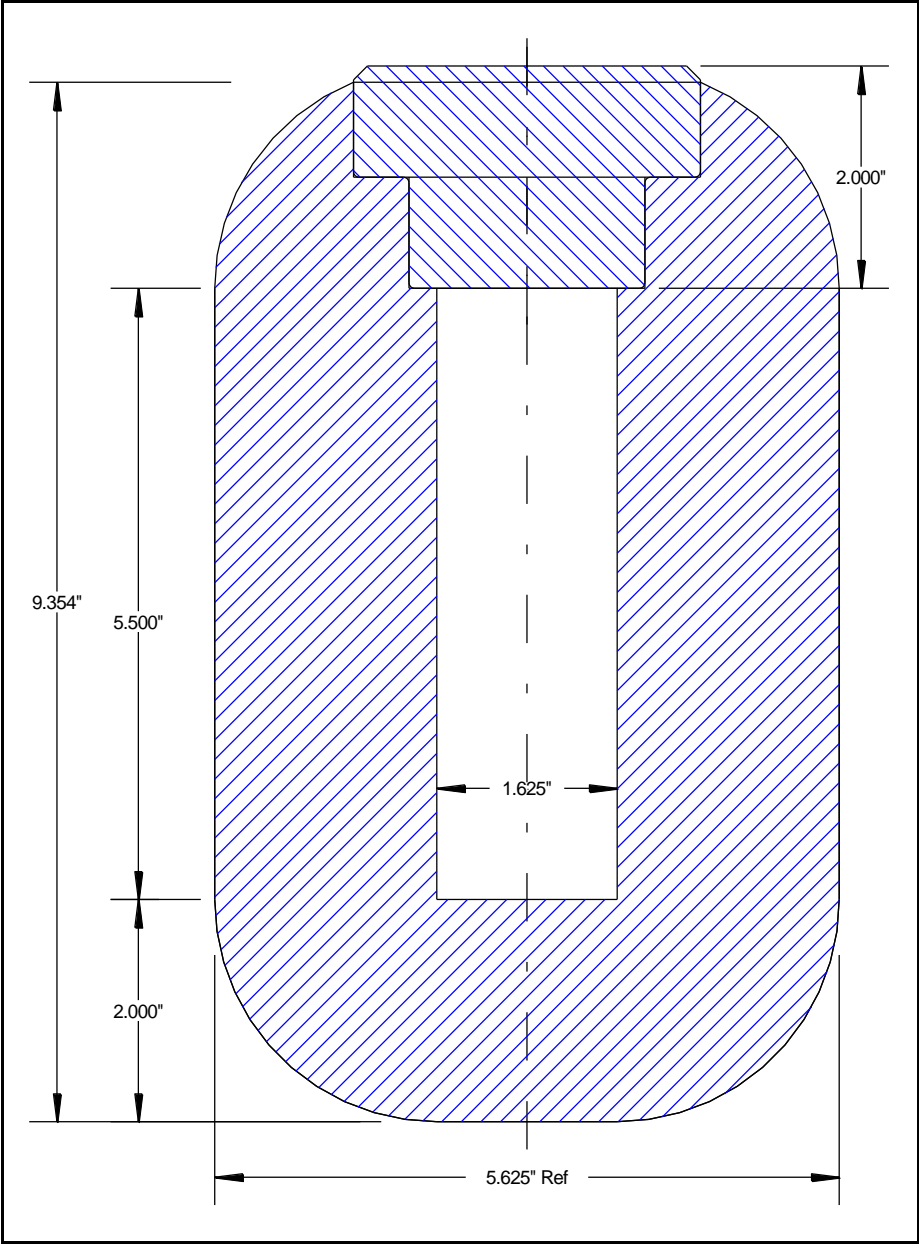


Figure 2-2. SGQ-SC1 Lead Shielded Container



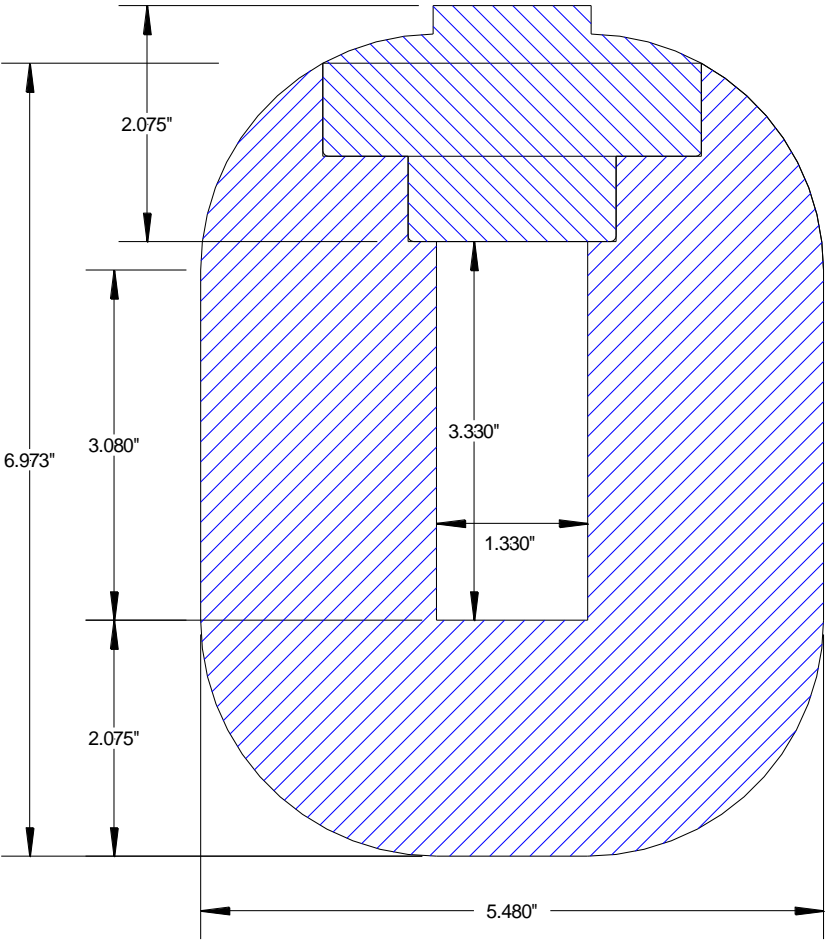


Figure 2-4. SGQ-SC3 Tungsten Shielded Container

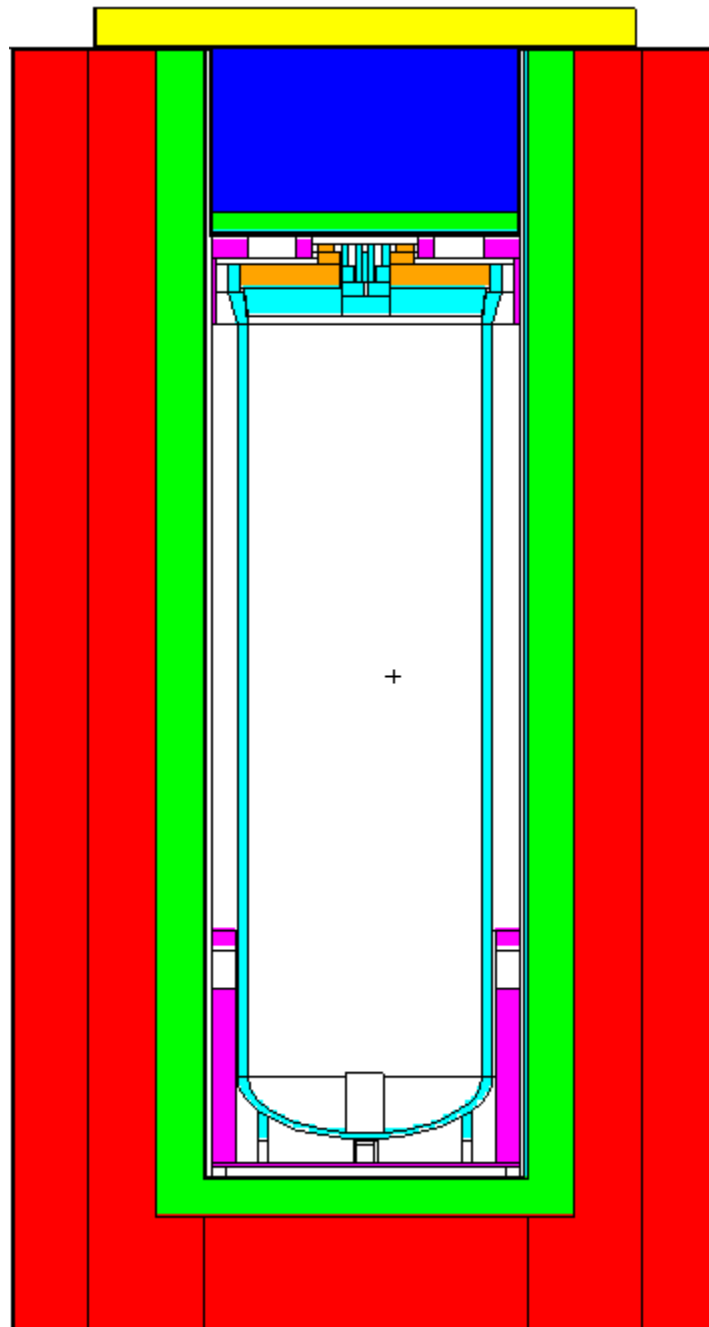


Figure 2-5. 9977 NCT Neutron Source without Shielded Container

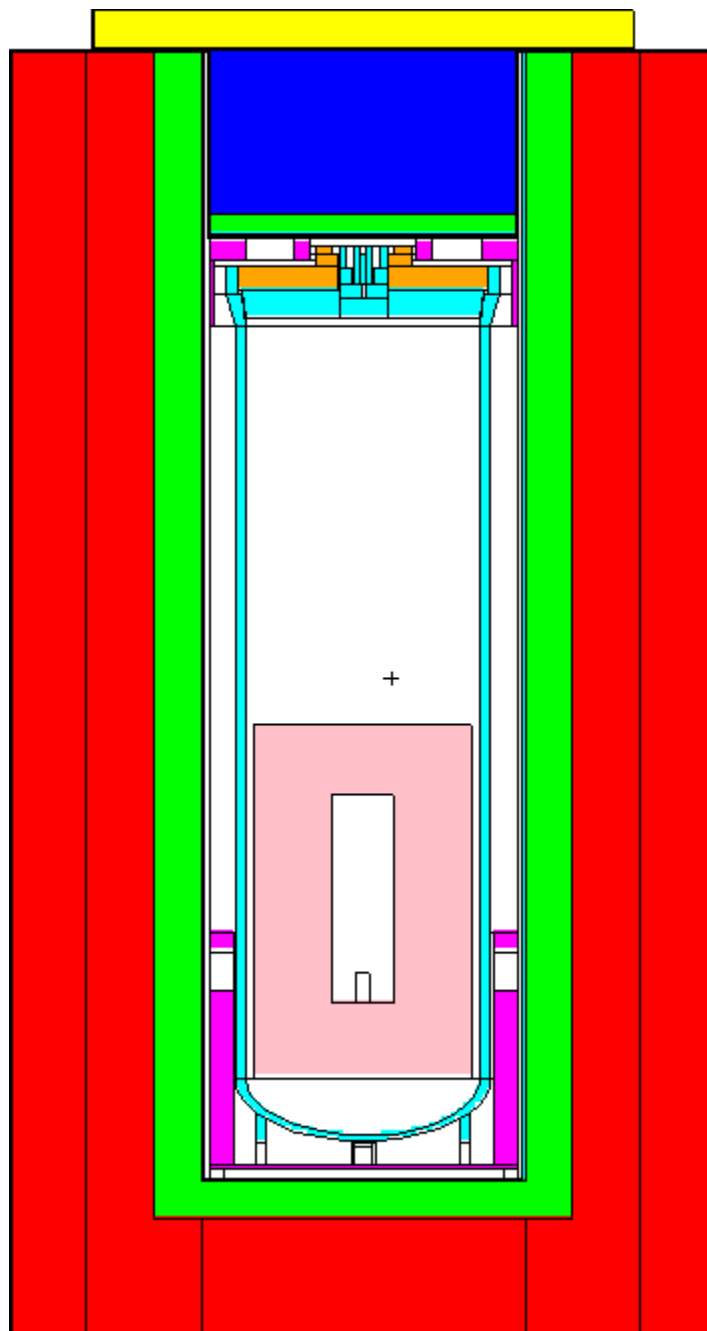


Figure 2-6. 9977 NCT Photon Source in SC1 Lead Container

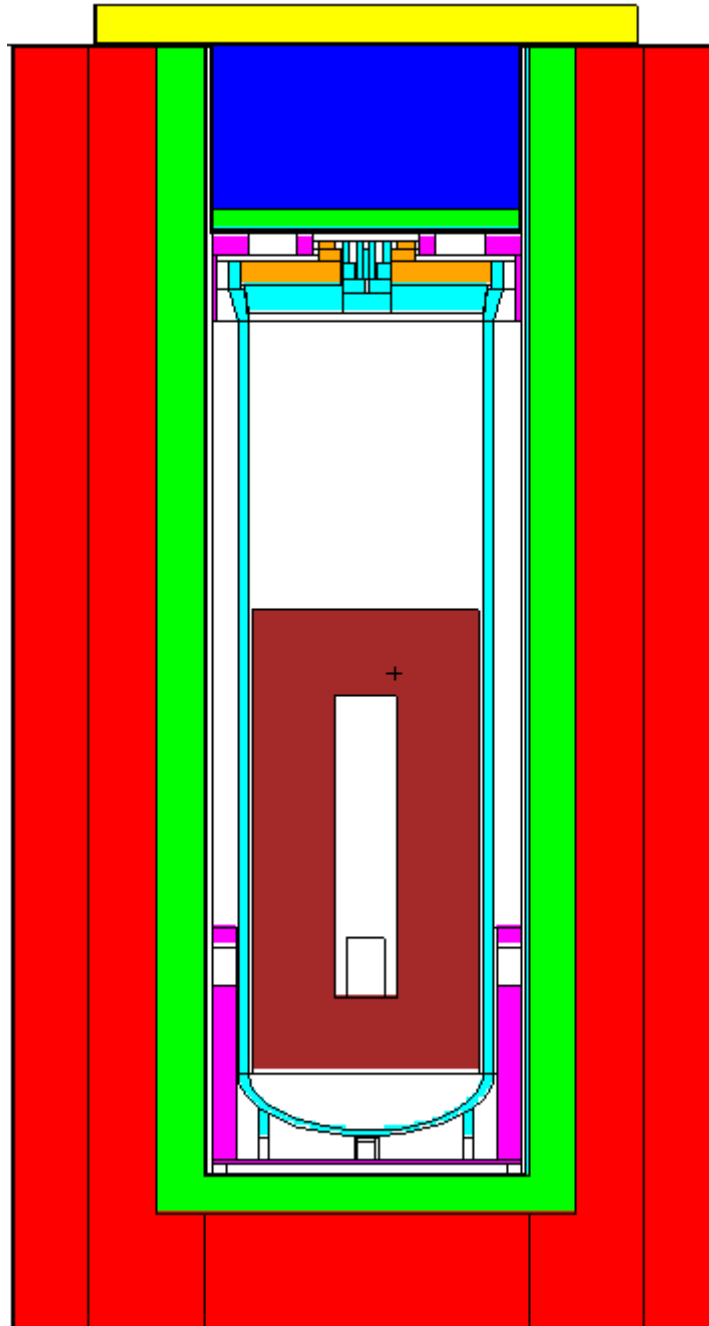


Figure 2-7. 9977 NCT Neutron Source in SC2 Polyethylene Container

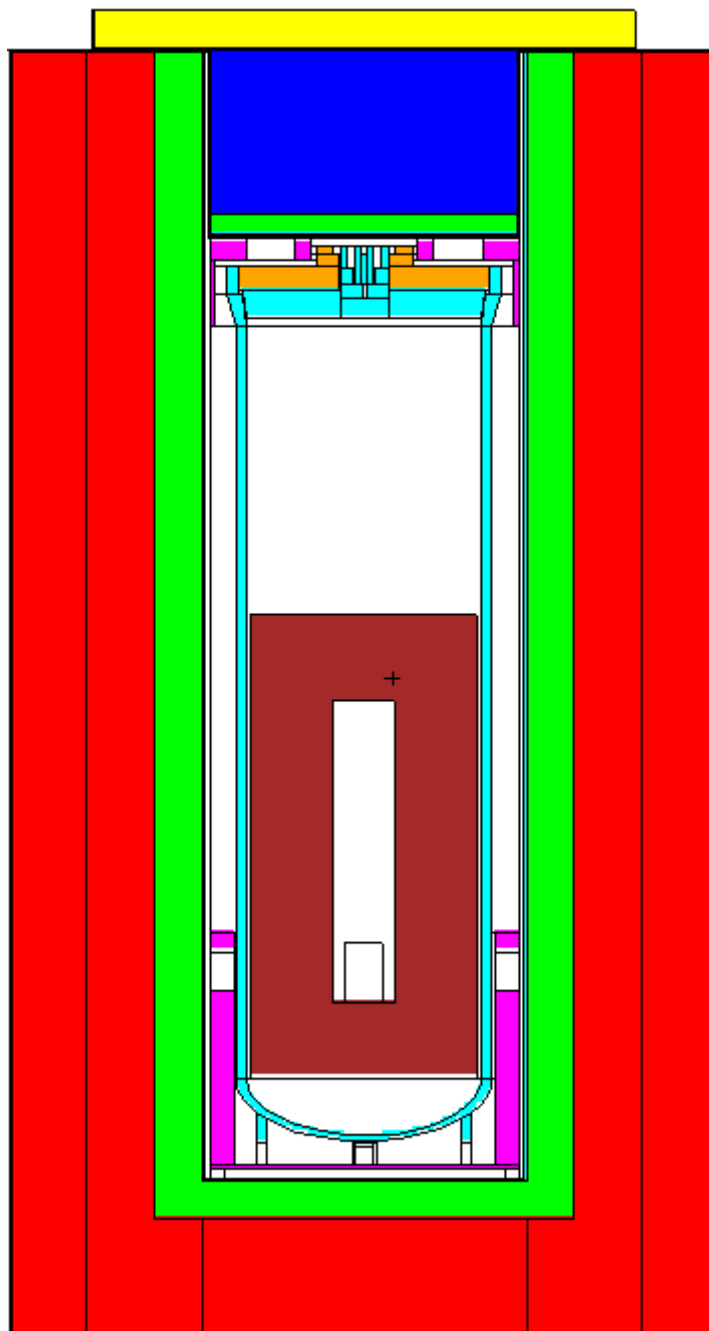


Figure 2-8. 9977 NCT Photon Source in SC3 Tungsten Container

Table 2-1. Material Compositions

	Nitronic® 60	SS 304L	6061 Aluminum	Foam	Vermiculite	Min-K® 2000	Fiberfrax®	Lead	Tungsten	HDPE
density (g/cc)	7.584	7.9	2.7	0.256	0.3684	0.3204	0.2563	11.34	17	0.95
Element	Weight Percent									
H				4.1		0.84				14.37
C		0.03		54.4		1.28				85.63
O				29.4	45.53	48.01	50.03			
N	0.14			12.1						
Si	4	1	0.6		21.22	37.71	23.14			
Ni	8.5	10							6	
Cr	17	19	0.2							
Mn	8	2								
Fe	62.36	67.895			5.4					
P		0.045								
S					0.18					
Ca					12.17					
Al			97.9		5.47	6.39	26.46			
Cu			0.28						4	
Mg			1		8.9					
Ti					0.82	5.53				
Na					1.09		0.37			
K					1.22					
Ga						0.15				
Sb						0.09				
W									90	
Pb								100		

Table 2-2. Typical Sealed Source Isotopes

Nuclide	Half Life (days)	E-max (MeV)		Nuclide	Half Life (days)	E-max (MeV)	
		Gamma	Alpha			Gamma	Alpha
Ac-227	7.95E+03	0.242	4.953	Pm-147	9.58E+02	0.121	0
Am-241	1.58E+05	0.060	5.49	Po-210	1.38E+02	-	5.304
Am-241/Be	1.58E+05	0.060	5.49	Pu-238	3.20E+04	0.014	5.5
Am-243	2.69E+06	0.075	5.28	Pu-238/Be	3.20E+04	0.014	5.5
Am-243/Be	2.69E+06	0.075	5.28	Pu-239	8.80E+06	0.014	5.16
Cd-109	4.63E+02	0.088	0	Pu-239/Be	8.80E+06	0.014	5.16
Cf-252	9.66E+02	0.160	6.12	Pu-240	2.40E+06	0.014	5.168
Cm-244	6.61E+03	0.153	5.81	Pu-240/Be	2.40E+06	0.014	5.168
Cm-244/Be	6.61E+03	0.153	5.81	Pu-241	5.26E+03	0.060*	4.896
Cm-248	1.27E+08	-	5.078	Pu-241/Be	5.26E+03	0.060*	4.896
Co-60	1.93E+03	1.333	0	Pu-242	1.37E+08	0.014	4.9
Cs-137	1.10E+04	0.662*	0	Pu-242/Be	1.37E+08	0.014	4.9
Eu-152	4.93E+03	1.410	0	Ra-226	5.84E+05	0.186	4.78
Fe-59	4.45E+01	1.292	0	Ru-106	3.73E+02	0.622*	0
Gd-153	2.42E+02	0.103	0	Sc-46	8.38E+01	1.120	0
Hf-181	4.24E+01	0.482	0	Se-75	1.20E+02	0.401	0
Ho-166m	4.38E+05	0.951	0	Sm-145	3.40E+02	0.061	0
Ir-192	7.38E+01	0.612	0	Sr-90	1.05E+04	0.018*	0
Mn-54	3.12E+02	0.835	0	Tm-170	1.29E+02	0.084	0
Np-237	7.82E+08	0.415*	4.79	Yb-169	3.20E+01	0.198	0
Np-237/Be	7.82E+08	0.415*	4.79	Zn-65	2.44E+02	1.116	0
Pb-210	8.15E+03	0.047	0	Zr-95	6.40E+01	0.757	0

* Radiation from daughter isotope

Table 2-3. Neutron Spectra 47 Group Structure

Group	E-upper (MeV)	E-lower (MeV)	Group	E-upper (MeV)	E-lower (MeV)
47	1.00E-07	1.00E-11	23	4.98E-01	3.69E-01
46	4.14E-07	1.00E-07	22	6.08E-01	4.98E-01
45	8.76E-07	4.14E-07	21	7.43E-01	6.08E-01
44	1.86E-06	8.76E-07	20	8.21E-01	7.43E-01
43	5.04E-06	1.86E-06	19	1.00E+00	8.21E-01
42	1.07E-05	5.04E-06	18	1.35E+00	1.00E+00
41	3.73E-05	1.07E-05	17	1.65E+00	1.35E+00
40	1.01E-04	3.73E-05	16	1.92E+00	1.65E+00
39	2.14E-04	1.01E-04	15	2.23E+00	1.92E+00
38	4.54E-04	2.14E-04	14	2.35E+00	2.23E+00
37	1.58E-03	4.54E-04	13	2.37E+00	2.35E+00
36	3.35E-03	1.58E-03	12	2.47E+00	2.37E+00
35	7.10E-03	3.35E-03	11	2.73E+00	2.47E+00
34	1.50E-02	7.10E-03	10	3.01E+00	2.73E+00
33	2.19E-02	1.50E-02	9	3.68E+00	3.01E+00
32	2.42E-02	2.19E-02	8	4.97E+00	3.68E+00
31	2.61E-02	2.42E-02	7	6.07E+00	4.97E+00
30	3.18E-02	2.61E-02	6	7.41E+00	6.07E+00
29	4.09E-02	3.18E-02	5	8.61E+00	7.41E+00
28	5.74E-02	4.09E-02	4	1.00E+01	8.61E+00
27	1.11E-01	5.74E-02	3	1.22E+01	1.00E+01
26	1.83E-01	1.11E-01	2	1.42E+01	1.22E+01
25	2.97E-01	1.83E-01	1	1.73E+01	1.42E+01
24	3.69E-01	2.97E-01			

Note: Group structure is for RASTA. ORIGEN-S group structure differs for groups 1, 27, and 28. ORIGEN-ARP Group 1 Upper Bound is 1.96E+01, Group 27 Lower Bound/ Group 28 Upper Bound is 6.74 E-02.

Values are reported to three significant figures. Full precision is used in calculations.

Table 2-4. Photon Spectra 77 Group Structure

Group	E-upper (MeV)	E-lower (MeV)	Group	E-upper (MeV)	E-lower (MeV)	Group	E-upper (MeV)	E-lower (MeV)
77	0.020	0.010	51	0.280	0.270	25	0.900	0.875
76	0.030	0.020	50	0.290	0.280	24	0.925	0.900
75	0.040	0.030	49	0.300	0.290	23	0.950	0.925
74	0.050	0.040	48	0.325	0.300	22	0.975	0.950
73	0.060	0.050	47	0.350	0.325	21	1.000	0.975
72	0.070	0.060	46	0.375	0.350	20	1.250	1.000
71	0.080	0.070	45	0.400	0.375	19	1.500	1.250
70	0.090	0.080	44	0.425	0.400	18	1.750	1.500
69	0.100	0.090	43	0.450	0.425	17	2.000	1.750
68	0.110	0.100	42	0.475	0.450	16	2.250	2.000
67	0.120	0.110	41	0.500	0.475	15	2.500	2.250
66	0.130	0.120	40	0.525	0.500	14	2.750	2.500
65	0.140	0.130	39	0.550	0.525	13	3.000	2.750
64	0.150	0.140	38	0.575	0.550	12	3.500	3.000
63	0.160	0.150	37	0.600	0.575	11	4.000	3.500
62	0.170	0.160	36	0.625	0.600	10	4.500	4.000
61	0.180	0.170	35	0.650	0.625	9	5.000	4.500
60	0.190	0.180	34	0.675	0.650	8	5.500	5.000
59	0.200	0.190	33	0.700	0.675	7	6.000	5.500
58	0.210	0.200	32	0.725	0.700	6	6.500	6.000
57	0.220	0.210	31	0.750	0.725	5	7.000	6.500
56	0.230	0.220	30	0.775	0.750	4	7.500	7.000
55	0.240	0.230	29	0.800	0.775	3	8.000	7.500
54	0.250	0.240	28	0.825	0.800	2	9.000	8.000
53	0.260	0.250	27	0.850	0.825	1	10.000	9.000
52	0.270	0.260	26	0.875	0.850			

Table 2-5. Flux-to-Dose-Rate Conversion Factors

Neutron		Photon	
Energy (MeV)	Factor (rem/hr per n/cm ² /sec)	Energy (MeV)	Factor (rem/hr per p/cm ² /sec)
2.50E-08	3.67E-06	1.00E-02	3.96E-06
1.00E-07	3.67E-06	3.00E-02	5.82E-07
1.00E-06	4.46E-06	5.00E-02	2.90E-07
1.00E-05	4.54E-06	7.00E-02	2.58E-07
1.00E-04	4.18E-06	1.00E-01	2.83E-07
1.00E-03	3.76E-06	1.50E-01	3.79E-07
1.00E-02	3.56E-06	2.00E-01	5.01E-07
1.00E-01	2.17E-05	2.50E-01	6.31E-07
5.00E-01	9.26E-05	3.00E-01	7.59E-07
1.00E+00	1.32E-04	3.50E-01	8.78E-07
2.50E+00	1.25E-04	4.00E-01	9.85E-07
5.00E+00	1.56E-04	4.50E-01	1.08E-06
7.00E+00	1.47E-04	5.00E-01	1.17E-06
1.00E+01	1.47E-04	5.50E-01	1.27E-06
1.40E+01	2.08E-04	6.00E-01	1.36E-06
2.00E+01	2.27E-04	6.50E-01	1.44E-06
		7.00E-01	1.52E-06
		8.00E-01	1.68E-06
		1.00E+00	1.98E-06
		1.40E+00	2.51E-06
		1.80E+00	2.99E-06
		2.20E+00	3.42E-06
		2.60E+00	3.82E-06
		2.80E+00	4.01E-06
		3.25E+00	4.41E-06
		3.75E+00	4.83E-06
		4.25E+00	5.23E-06
		4.75E+00	5.60E-06
		5.00E+00	5.80E-06
		5.25E+00	6.01E-06
		5.75E+00	6.37E-06
		6.25E+00	6.74E-06
		6.75E+00	7.11E-06
		7.50E+00	7.66E-06
		9.00E+00	8.77E-06
		1.10E+01	1.03E-05
		1.30E+01	1.18E-05
		1.50E+01	1.33E-05

3.0 Results and Discussion

The neutron and photon sources were calculated in the group structure shown in Table 2-3 and Table 2-4 using both ORIGEN-S and RASTA. The response from a unit source in each neutron and photon group was calculated using MCNP5 with each unshielded and shielded container configuration. Effects of self-shielding on both neutron and photon response were evaluated by including either plutonium oxide or iron in the source region for the case with no shielded container.

3.1 Radiation Sources

The neutron source strengths are presented in Table 3-1 through Table 3-10. The total neutron source strengths as a function of added beryllium as calculated by ORIGEN-S and RASTA are compared in Table 3-11. It can be seen from Table 3-11 that the sources calculated by ORIGEN-S are significantly greater than the sources calculated by RASTA except for Am-243, Pu-239, and Pu-241 without any beryllium. Examination of the spectra for these isotopes (Figure 3-1, Figure 3-2, and Figure 3-3) indicates that the RASTA source and ORIGEN-S source have similar energy dependence with the RASTA source magnitude being higher in each. For these three isotopes, the RASTA source was used for conservatism.

The total neutron source strength as a function of decay time as calculated using ORIGEN-S is shown in Table 3-12. This table indicates that the total neutron source is steady or declines with increasing decay time for all isotopes except Pu-241. The monotonic increase in total neutron source strength with decay time for Pu-241 is due to the formation of Am-241. The source strength for Pu-241 after 30,000 days decay was used for conservatism.

Photon source strengths are presented in Table 3-13 through Table 3-25. The total photon source strength as a function of decay time is presented in Table 3-26 which also compares the source strength calculated by ORIGEN-S and RASTA. Table 3-26 shows that RASTA calculates higher source strength than ORIGEN-S for Am-241, Cm-248, Ho-166m, Ir-192, and Pu-241.

Examination of the spectra for Am-241 (Figure 3-4) indicates that the RASTA source is higher than the ORIGEN-S source at low energies (0.01 to 1.0 MeV) but the ORIGEN-S source is higher than the RASTA source at high energies (1.0 to 10.0 MeV). Since the high energies will dominate the dose rate, the ORIGEN-S source was retained for conservatism.

Examination of the spectra for Cm-248 (Figure 3-5) shows the ORIGEN-S source significantly below the RASTA source for energies below 1 MeV. The RASTA source was retained for conservatism.

Examination of the spectra for Ho-166m (Figure 3-6) shows that the ORIGEN-S source is lower than the RASTA source over the entire range of energies. The RASTA source was retained for conservatism.

Examination of the spectra for Ir-192 (Figure 3-7) shows that ORIGEN-S is missing data over much of the range of energies. This is a known problem with this isotope in the ORIGEN data library. The RASTA source was used for conservatism.

Examination of the spectra for Pu-241 (Figure 3-8) shows that the ORIGEN-S source is significantly lower than the RASTA source for energies below 1 MeV, while the ORIGEN-S source is significantly higher than the RASTA source for most energies above 1 MeV. The ORIGEN-S source was retained for conservatism.

Table 3-26 shows that the sources for Ac-227, Am-243, Np-237, Pb-201, Pu-241, Ra-226, Sr-90, and Zr-95 increase more than two percent with decay time. This is due to the build-in of daughter isotopes. Source strength for these isotopes will be at the time the total source reaches its peak:

Ac-227	300 days
Am-243	100 days
Np-237	3000 days
Pb-210	100 days
Pu-241	30,000 days
Ra-226	30,000 days
Sr-90	30 days
Zr-95	30 days

Five isotopes (Ac-227, Cs-137, Pb-210, Ru-106, and Sr-90) are beta emitters and have significant contributions to the photon source from bremsstrahlung. For these isotopes, the ORIGEN-S calculated isotopic concentration at the time of peak source strength was used in RASTA to calculate the photon source. The resulting photon sources which were used in the dose rate computation are presented in Table 3-27.

3.2 Radiation Transport

The dose rate outside the shipping package was calculated for a unit source in each neutron and photon group. Several configurations were evaluated for placing the sources in the package:

- Source without any shielded container
- Source in an SC1 Lead Shielded Container
- Actinide Source in an SC2 Polyethylene Shielded Container
- Source in an SC3 Tungsten Shielded Container

3.2.1 *No Shielded Container*

The dose rates without any shielded container were evaluated without any self-shielding. Table 3-28 and Table 3-29 present the neutron and secondary photon dose rates from a unit source in each neutron group. Table 3-30 lists photon dose rates from a unit source in each primary photon group.

The neutron and secondary photon dose rates from a unit source in each neutron group with self-shielding by twenty-five grams of PuO₂ in the source volume are presented in Table 3-31 and Table 3-32. Table 3-33 contains the primary photon dose rate with self-shielding by 1 g/cc of iron in the source volume for a unit source in each photon group.

3.2.2 *SC1 Lead Shielded Container*

The primary photon dose rates from a unit source in each photon group in the SC1 Lead Shielded Container are presented in Table 3-34.

3.2.3 *SC2 Polyethylene Shielded Container*

The neutron and secondary photon dose rates from a unit source in each neutron group in the SC2 Polyethylene Shielded Container are shown in Table 3-35 and Table 3-36. Table 3-37 lists dose rates from a unit source in each primary photon group.

3.2.4 SC3 Tungsten Shielded Container

The primary photon dose rates from a unit source in each photon group in the SC1 Tungsten Shielded Container are presented in Table 3-38.

3.3 Dose Rate

The dose rate from one gram of each of the isotopes listed in Table 2-2 is computed by folding the source strength for the isotope with the dose rate from a unit source for the appropriate shielded container:

$$D_j^c = \sum_{g=1}^{NG} S_j^g * R_g^c$$

Where:

D_j^c is the dose rate for isotope “j” in container “c”

S_j^g is the source strength for isotope “j” in group “g”

R_g^c is the dose rate from a unit source in group “g” for container “c”

NG is the number of groups, 77 for photons or 47 for neutrons

The results are presented in Table 3-39 (No Shielded Container), Table 3-41 (SC2 Polyethylene Shielded Container), Table 3-43 (Primary Photon Dose Rate all Containers), Table 3-45 (Maximum Dose Rate without Impurities), and Table 3-46 (Maximum Dose Rate with Impurities).

The effects of self-shielding by PuO₂ on the actinide dose rates are shown in Table 3-40. A comparison of the results in this table indicates that self-shielding by twenty-five grams of PuO₂ has a negligible effect on dose rate.

Table 3-44 compares the dose rate from primary photons with and without shielding by low density iron (1 g/cc). Examination of the results in this table indicates that the effects on primary photon dose rate are not significant for most isotopes. The exceptions are: Am-241, Cd-109, Pu-241, and Sm-145.

The dose rates from Am-241 and Pu-241 (which decays to Am-241) are dominated by the neutron dose rate when impurities are present. Therefore, the effects of self-shielding on dose rate are not significant for these two isotopes.

The other two isotopes emit only low energy photons: less than 0.09 MeV from Cd-109 and less than 0.07 MeV from Sm-145. Both of these isotopes have allowed mass limits in excess of 1 kg when shipped in the SC-1 Lead Shielded Container or the SC-3 Tungsten Shielded Container.

The allowable mass for shipment under NCT (dose rate at the surface of the package < 2 mSv/hr [200 mrem/hr]) is listed in Table 3-47 (isotopes without impurities) and Table 3-49 (actinide isotopes with impurities). Previous calculations have shown the dose rate at the surface package is the limiting case for non-exclusive use shipments. The dose rate at the package surface also bounds the dose rate under hypothetical accident conditions.

The allowable mass for shipment under Exclusive Use (dose rate at the surface of the package < 10 mSv/hr [1000 mrem/hr]) is listed in Table 3-48 (isotopes without impurities) and Table 3-50 (actinide isotopes with impurities).

Table 3-47 through Table 3-50 present the maximum amount of a single isotope that could be shipped within the regulatory dose limits at the surface of the package. If a package contains a mixture of isotopes, the acceptability for shipment can be determined by a sum of fractions approach. The package would be acceptable if:

$$\sum_i \frac{M_i}{Limit_i} \leq$$

Where:

M_i is the mass of isotope i in the package

$Limit_i$ is the allowed mass from Table 3-47 through Table 3-50.

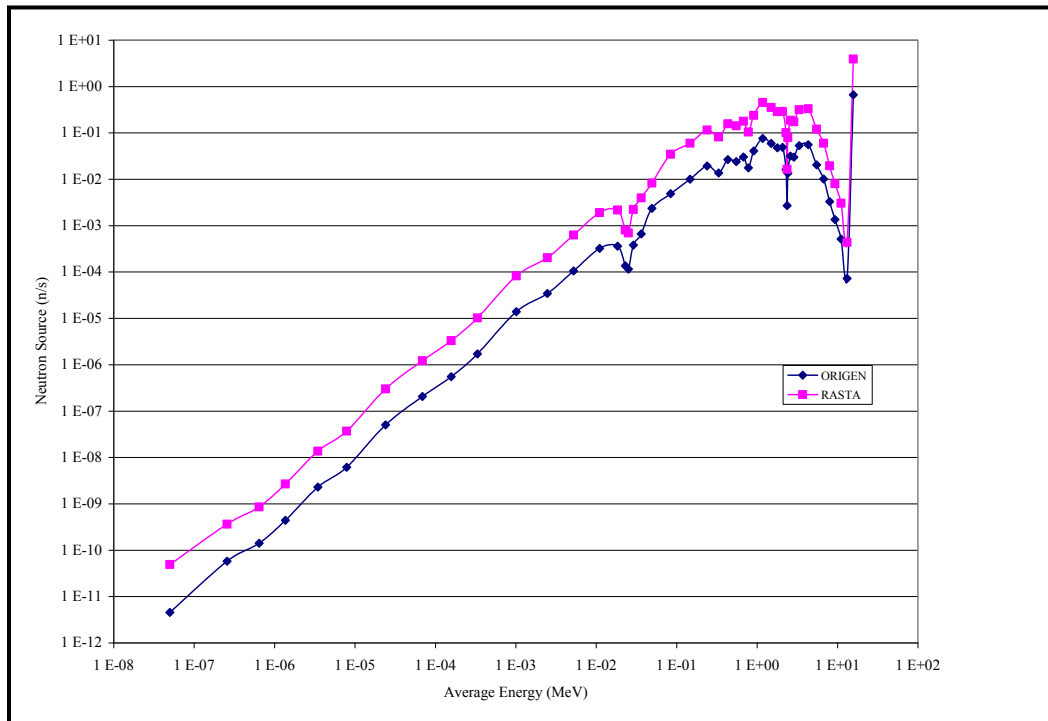


Figure 3-1. Am-243 Fission Neutron Spectrum

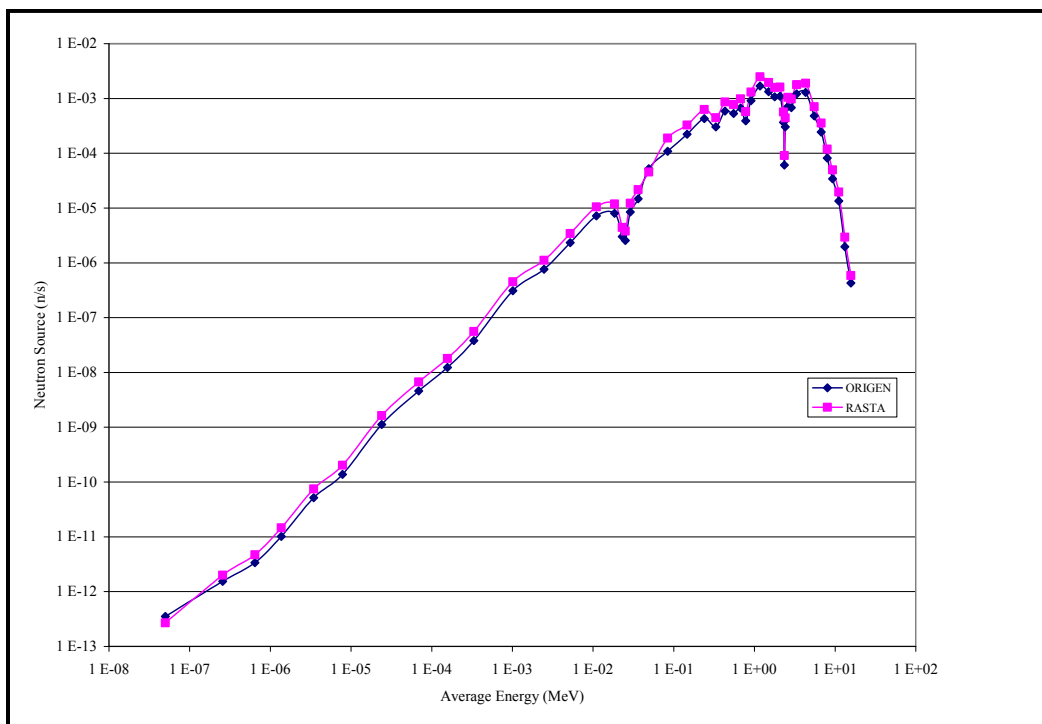


Figure 3-2. Pu-239 Fission Neutron Spectrum

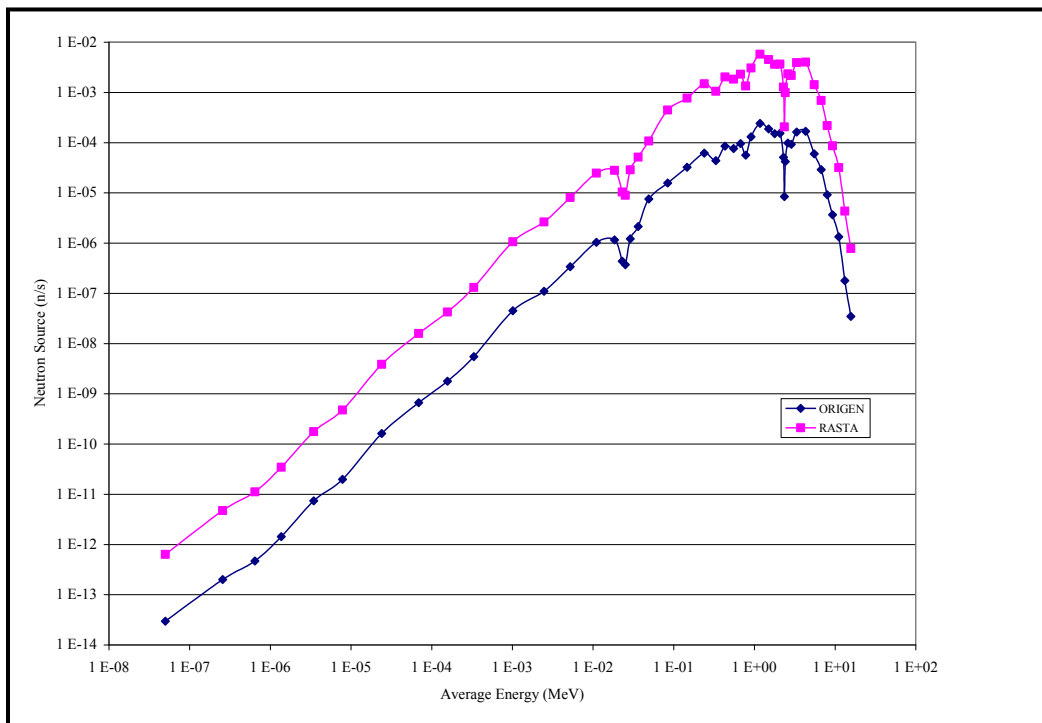


Figure 3-3. Pu-241 Fission Neutron Spectrum

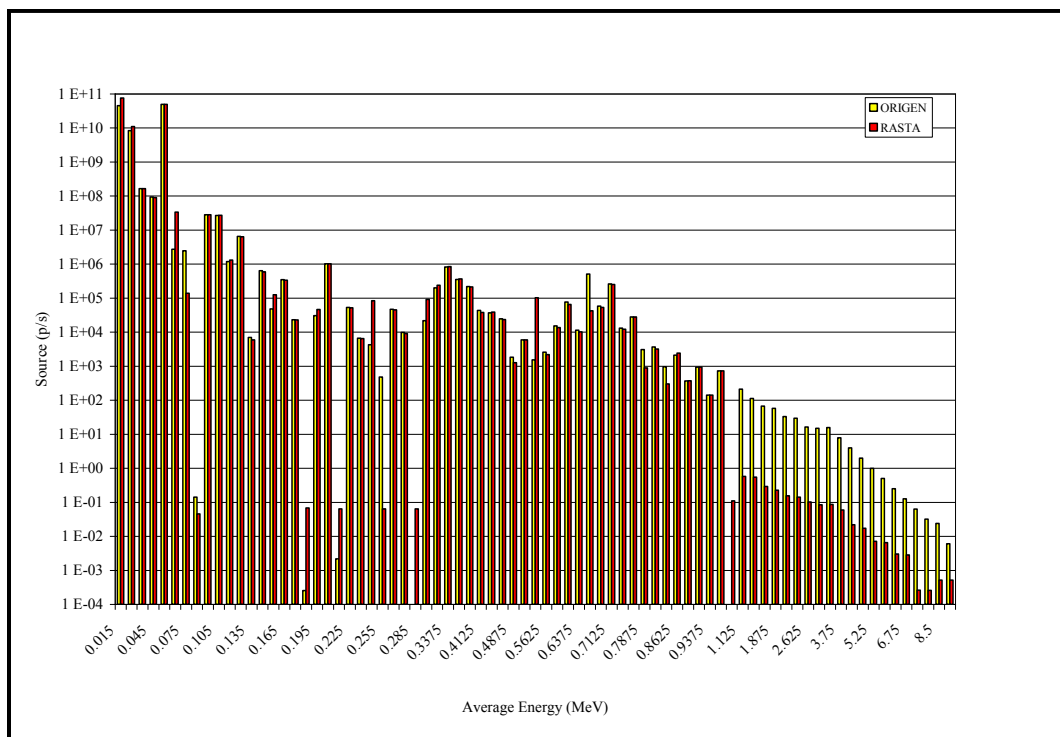


Figure 3-4. Am-241 Photon Spectra

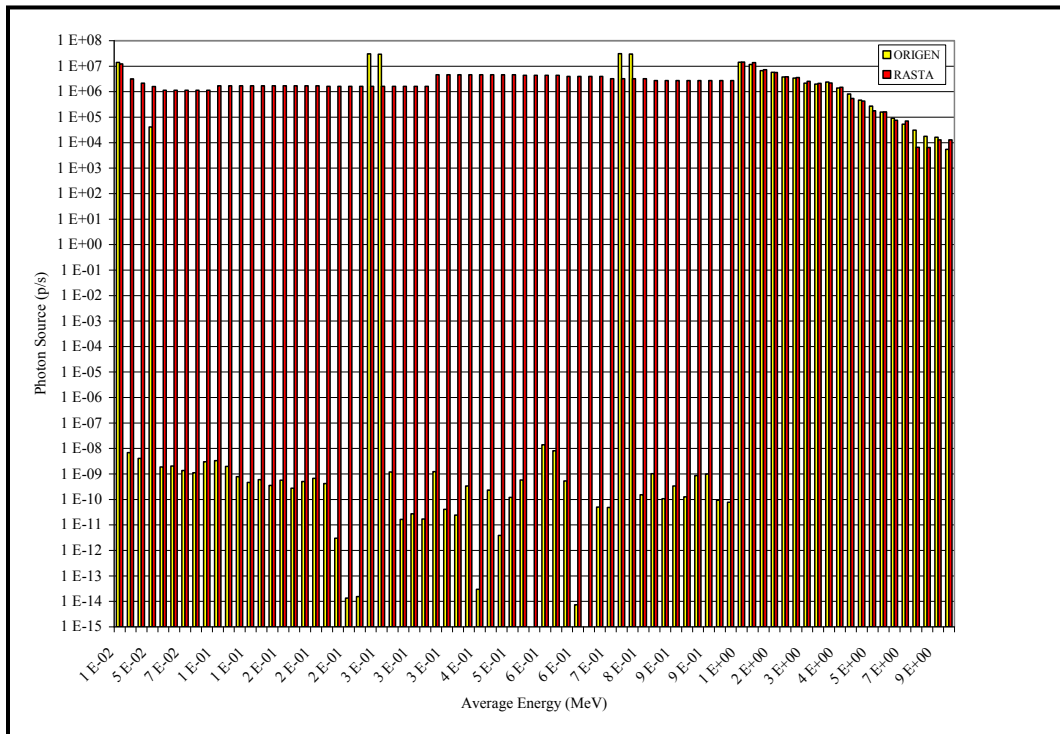


Figure 3-5. Cm-248 Photon Spectra

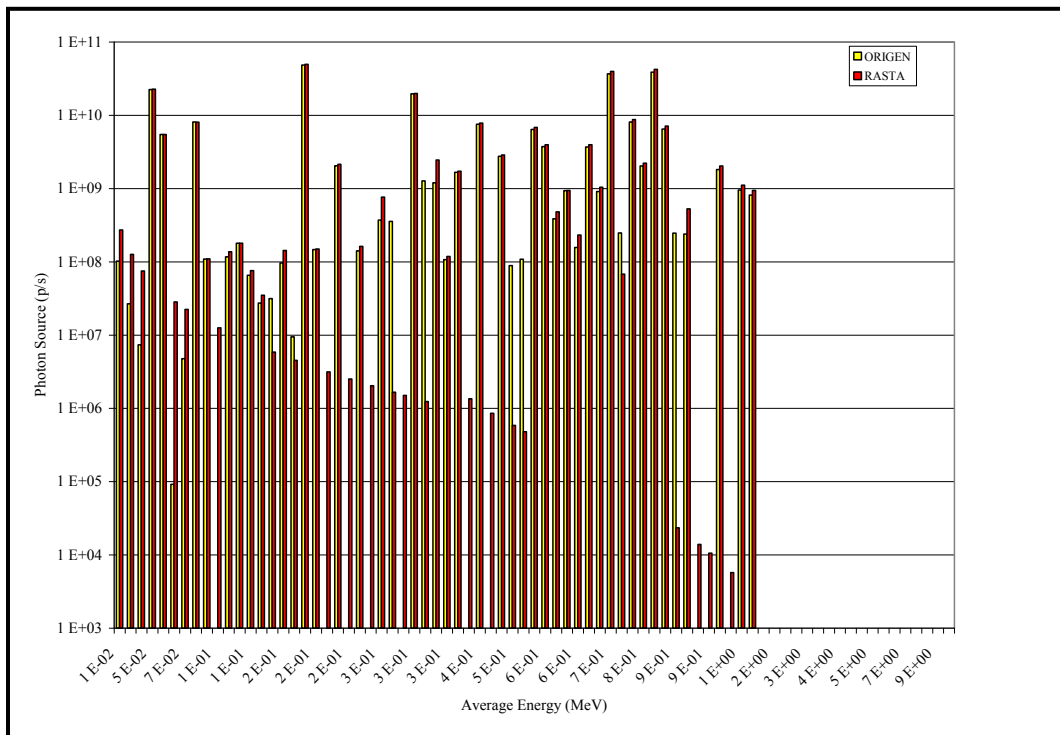


Figure 3-6. Ho-166m Photon Spectra

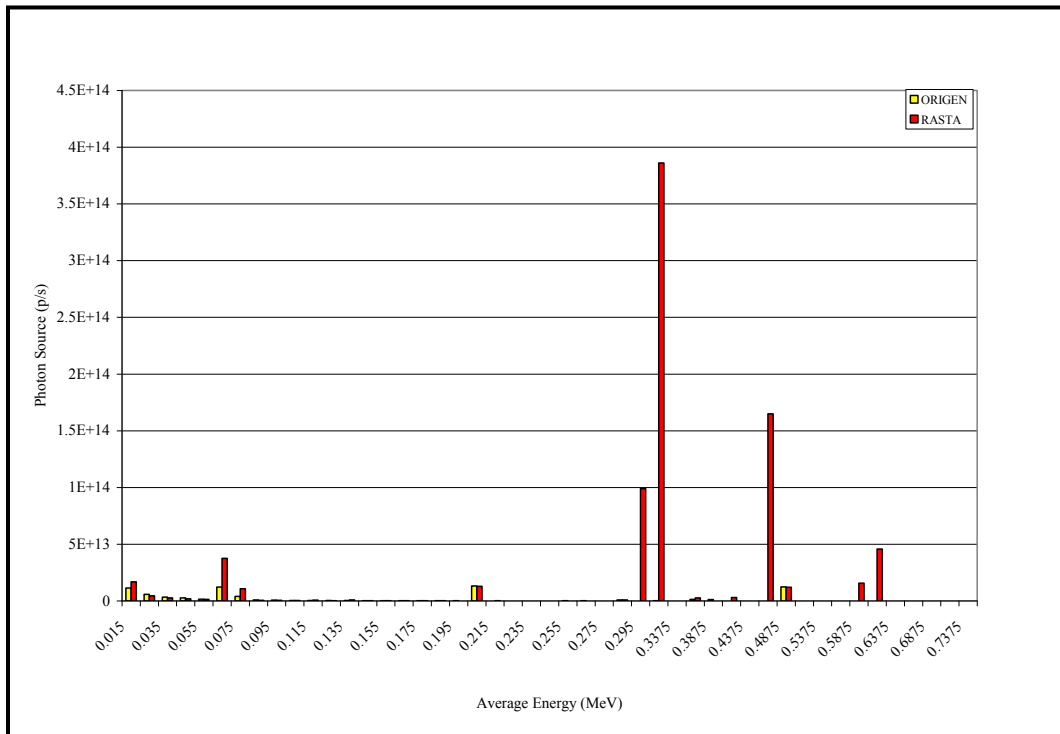
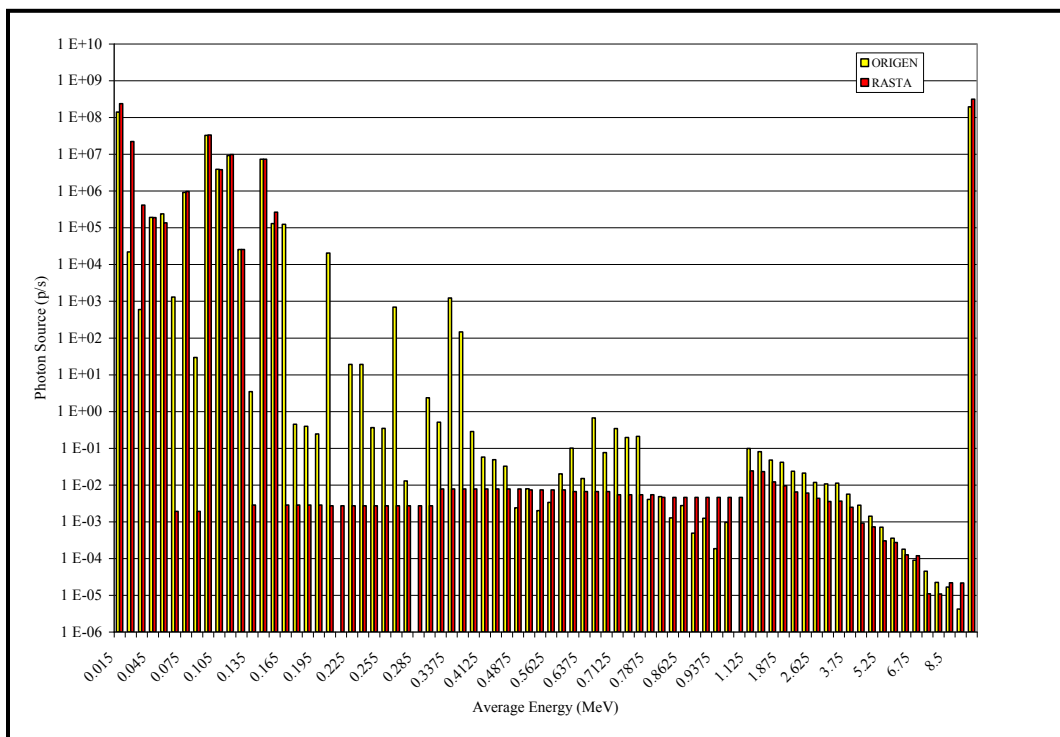
**Figure 3-7. Ir-192 Photon Spectra****Figure 3-8. Pu-241 Photon Spectra**

Table 3-1. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 0 days)

Energy Bound		Neutron Source (n/s/g-actinide)										
Upper	Lower	Am-241	Am-243	Cf-252	Cm-244	Cm-248	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.58E+01	1.32E-04	3.55E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	2.97E-14	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	1.76E+02	9.83E-04	3.79E-03	1.07E-14	2.41E-07	1.54E-12	1.03E-07	2.00E-13	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	4.30E+02	2.32E-03	9.22E-03	2.53E-14	5.73E-07	3.37E-12	2.43E-07	4.68E-13	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	1.34E+03	7.15E-03	2.87E-02	7.82E-14	1.77E-06	1.01E-11	7.46E-07	1.44E-12	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	6.94E+03	3.68E-02	1.49E-01	4.03E-13	9.11E-06	5.14E-11	3.84E-06	7.39E-12	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	1.86E+04	9.86E-02	3.99E-01	1.08E-12	2.44E-05	1.37E-10	1.03E-05	1.98E-11	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	1.52E+05	8.06E-01	3.26E+00	8.84E-12	2.00E-04	1.12E-09	8.40E-05	1.62E-10	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	6.27E+05	3.32E+00	1.34E+01	3.63E-11	8.21E-04	4.59E-09	3.45E-04	6.64E-10	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.55E-07	1.68E+06	8.88E+00	3.59E+01	9.73E-11	2.20E-03	1.23E-08	9.25E-04	1.78E-09	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	5.17E+06	2.74E+01	1.11E+02	3.00E-10	6.77E-03	3.78E-08	2.85E-03	5.48E-09	4.72E-03
1.58E-03	4.54E-04	2.46E-05	1.40E-05	4.22E+07	2.24E+02	9.04E+02	2.45E-09	5.53E-02	3.09E-07	2.33E-02	4.48E-08	3.86E-02
3.35E-03	1.58E-03	6.04E-05	3.43E-05	1.04E+08	5.49E+02	2.22E+03	6.01E-09	1.36E-01	7.59E-07	5.72E-02	1.10E-07	9.48E-02
7.10E-03	3.35E-03	1.86E-04	1.05E-04	3.19E+08	1.69E+03	6.83E+03	1.85E-08	4.18E-01	2.34E-06	1.76E-01	3.38E-07	2.92E-01
1.50E-02	7.10E-03	5.71E-04	3.24E-04	9.80E+08	5.18E+03	2.10E+04	5.68E-08	1.28E+00	7.17E-06	5.40E-01	1.04E-06	8.95E-01
2.19E-02	1.50E-02	6.36E-04	3.61E-04	1.09E+09	5.78E+03	2.34E+04	6.33E-08	1.43E+00	7.99E-06	6.02E-01	1.16E-06	9.97E-01
2.42E-02	2.19E-02	2.39E-04	1.35E-04	4.10E+08	2.17E+03	8.77E+03	2.38E-08	5.37E-01	3.00E-06	2.26E-01	4.34E-07	3.74E-01
2.61E-02	2.42E-02	2.04E-04	1.16E-04	3.50E+08	1.85E+03	7.49E+03	2.03E-08	4.58E-01	2.56E-06	1.93E-01	3.71E-07	3.20E-01
3.18E-02	2.61E-02	6.69E-04	3.79E-04	1.15E+09	6.08E+03	2.46E+04	6.66E-08	1.50E+00	8.40E-06	6.33E-01	1.22E-06	1.05E+00
4.09E-02	3.18E-02	1.17E-03	6.64E-04	2.01E+09	1.06E+04	4.30E+04	1.16E-07	2.63E+00	1.47E-05	1.11E+00	2.13E-06	1.84E+00
6.74E-02	4.09E-02	4.14E-03	2.35E-03	7.11E+09	3.76E+04	1.52E+05	4.12E-07	9.31E+00	5.20E-05	3.92E+00	7.53E-06	6.49E+00
1.11E-01	6.74E-02	8.61E-03	4.88E-03	1.48E+10	7.82E+04	3.17E+05	8.57E-07	1.94E+01	1.08E-04	8.15E+00	1.57E-05	1.35E+01
1.83E-01	1.11E-01	1.77E-02	1.00E-02	3.04E+10	1.61E+05	6.51E+05	1.76E-06	3.98E+01	2.22E-04	1.68E+01	3.22E-05	2.77E+01
2.97E-01	1.83E-01	3.41E-02	1.93E-02	5.87E+10	3.10E+05	1.25E+06	3.39E-06	7.67E+01	4.28E-04	3.23E+01	6.19E-05	5.34E+01
3.69E-01	2.97E-01	2.41E-02	1.36E-02	4.15E+10	2.19E+05	8.84E+05	2.39E-06	5.41E+01	3.02E-04	2.28E+01	4.36E-05	3.76E+01
4.98E-01	3.69E-01	4.68E-02	2.65E-02	8.08E+10	4.25E+05	1.72E+06	4.64E-06	1.05E+02	5.86E-04	4.42E+01	8.47E-05	7.30E+01
6.08E-01	4.98E-01	4.23E-02	2.39E-02	7.33E+10	3.85E+05	1.55E+06	4.18E-06	9.49E+01	5.29E-04	3.99E+01	7.63E-05	6.58E+01
7.43E-01	6.08E-01	5.33E-02	3.00E-02	9.26E+10	4.84E+05	1.94E+06	5.25E-06	1.19E+02	6.66E-04	5.00E+01	9.59E-05	8.25E+01
8.21E-01	7.43E-01	3.13E-02	1.76E-02	5.46E+10	2.85E+05	1.14E+06	3.07E-06	7.00E+01	3.91E-04	2.93E+01	5.62E-05	4.83E+01
1.00E+00	8.21E-01	7.29E-02	4.09E-02	1.28E+11	6.62E+05	2.63E+06	7.12E-06	1.62E+02	9.07E-04	6.78E+01	1.30E-04	1.12E+02
1.35E+00	1.00E+00	1.36E-01	7.59E-02	2.40E+11	1.23E+06	4.86E+06	1.32E-05	3.01E+02	1.69E-03	1.25E+02	2.41E-04	2.06E+02
1.65E+00	1.35E+00	1.08E-01	5.93E-02	1.92E+11	9.72E+05	3.77E+06	1.02E-05	2.35E+02	1.32E-03	9.66E+01	1.87E-04	1.60E+02
1.92E+00	1.65E+00	8.75E-02	4.77E-02	1.58E+11	7.88E+05	3.01E+06	8.18E-06	1.89E+02	1.07E-03	7.69E+01	1.50E-04	1.28E+02
2.23E+00	1.92E+00	9.07E-02	4.90E-02	1.66E+11	8.14E+05	3.05E+06	8.34E-06	1.93E+02	1.10E-03	7.79E+01	1.53E-04	1.30E+02
2.35E+00	2.23E+00	3.04E-02	1.63E-02	5.63E+10	2.72E+05	1.01E+06	2.76E-06	6.42E+01	3.66E-04	2.57E+01	5.08E-05	4.28E+01
2.37E+00	2.35E+00	5.04E-03	2.69E-03	9.36E+09	4.51E+04	1.66E+05	4.56E-07	1.06E+01	6.06E-05	4.23E+00	8.39E-06	7.06E+00
2.47E+00	2.37E+00	2.53E-02	1.35E-02	4.70E+10	2.26E+05	8.28E+05	2.27E-06	5.29E+01	3.03E-04	2.11E+01	4.19E-05	3.52E+01
2.73E+00	2.47E+00	5.97E-02	3.15E-02	1.12E+11	5.31E+05	1.93E+06	5.31E-06	1.24E+02	7.11E-04	4.90E+01	9.78E-05	8.20E+01
3.01E+00	2.73E+00	5.75E-02	3.00E-02	1.10E+11	5.09E+05	1.81E+06	5.02E-06	1.18E+02	6.79E-04	4.59E+01	9.26E-05	7.72E+01
3.68E+00	3.01E+00	1.04E-01	5.29E-02	2.02E+11	9.11E+05	3.14E+06	8.75E-06	2.07E+02	1.21E-03	7.91E+01	1.62E-04	1.34E+02
4.97E+00	3.68E+00	1.14E-01	5.56E-02	2.35E+11	9.85E+05	3.16E+06	8.97E-06	2.15E+02	1.29E-03	7.88E+01	1.67E-04	1.36E+02
6.07E+00	4.97E+00	4.47E-02	2.04E-02	9.92E+10	3.77E+05	1.09E+06	3.18E-06	7.77E+01	4.81E-04	2.68E+01	5.98E-05	4.73E+01
7.41E+00	6.07E+00	2.37E-02	1.01E-02	5.69E+10	1.94E+05	5.09E+05	1.52E-06	3.79E+01	2.44E-04	1.23E+01	2.89E-05	2.22E+01
8.61E+00	7.41E+00	8.34E-03	3.30E-03	2.19E+10	6.64E+04	1.54E+05	4.76E-07	1.21E+01	8.13E-05	3.66E+00	9.15E-06	6.82E+00
1.00E+01	8.61E+00	3.69E-03	1.35E-03	1.06E+10	2.85E+04	5.88E+04	1.87E-07	4.87E+00	3.41E-05	1.37E+00	3.64E-06	2.63E+00
1.22E+01	1.00E+01	1.55E-03	5.12E-04	5.00E+09	1.15E+04	2.03E+04	6.73E-08	1.80E+00	1.34E-05	4.61E-01	1.33E-06	9.22E-01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	9.53E+08	1.76E+03	2.51E+03	8.83E-09	2.46E-01	1.97E-06	5.52E-02	1.78E-07	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	2.76E+08	3.98E+02	4.47E+02	1.68E-09	4.86E-02	4.25E-07	9.46E-03	3.46E-08	2.13E-02
	Total	1.24E+00	6.61E-01	2.31E+12	1.10E+07	4.09E+07	1.12E-04	2.60E+03	1.49E-02	1.04E+03	2.07E-03	1.74E+03

Table 3-2. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 30 days)

Energy Bound		Neutron Source (n/s/g-actinide)										
Upper	Lower	Am-241	Am-243	Cf-252	Cm-244	Cm-248	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.54E+01	1.32E-04	3.55E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	1.22E-13	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	1.72E+02	9.80E-04	3.79E-03	1.07E-14	2.41E-07	1.54E-12	1.03E-07	6.64E-13	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	4.21E+02	2.31E-03	9.22E-03	2.53E-14	5.72E-07	3.37E-12	2.43E-07	1.51E-12	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	1.31E+03	7.12E-03	2.87E-02	7.82E-14	1.77E-06	1.01E-11	7.46E-07	4.59E-12	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	6.79E+03	3.67E-02	1.49E-01	4.03E-13	9.11E-06	5.14E-11	3.84E-06	2.35E-11	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	1.82E+04	9.83E-02	3.99E-01	1.08E-12	2.44E-05	1.37E-10	1.03E-05	6.28E-11	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	1.49E+05	8.04E-01	3.26E+00	8.84E-12	2.00E-04	1.12E-09	8.40E-05	5.13E-10	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	6.13E+05	3.31E+00	1.34E+01	3.63E-11	8.20E-04	4.59E-09	3.45E-04	2.11E-09	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.55E-07	1.64E+06	8.85E+00	3.59E+01	9.73E-11	2.20E-03	1.23E-08	9.25E-04	5.64E-09	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	5.06E+06	2.73E+01	1.11E+02	3.00E-10	6.77E-03	3.78E-08	2.85E-03	1.74E-08	4.72E-03
1.58E-03	4.54E-04	2.46E-05	1.40E-05	4.13E+07	2.23E+02	9.04E+02	2.45E-09	5.53E-02	3.09E-07	2.33E-02	1.42E-07	3.86E-02
3.35E-03	1.58E-03	6.04E-05	3.43E-05	1.02E+08	5.47E+02	2.22E+03	6.01E-09	1.36E-01	7.59E-07	5.72E-02	3.49E-07	9.48E-02
7.10E-03	3.35E-03	1.86E-04	1.05E-04	3.12E+08	1.68E+03	6.83E+03	1.85E-08	4.18E-01	2.34E-06	1.76E-01	1.07E-06	2.92E-01
1.50E-02	7.10E-03	5.71E-04	3.24E-04	9.59E+08	5.17E+03	2.10E+04	5.68E-08	1.28E+00	7.17E-06	5.40E-01	3.29E-06	8.95E-01
2.19E-02	1.50E-02	6.36E-04	3.61E-04	1.07E+09	5.76E+03	2.34E+04	6.33E-08	1.43E+00	7.99E-06	6.02E-01	3.67E-06	9.97E-01
2.42E-02	2.19E-02	2.39E-04	1.35E-04	4.01E+08	2.16E+03	8.77E+03	2.38E-08	5.36E-01	3.00E-06	2.26E-01	1.38E-06	3.74E-01
2.61E-02	2.42E-02	2.04E-04	1.16E-04	3.42E+08	1.85E+03	7.49E+03	2.03E-08	4.58E-01	2.56E-06	1.93E-01	1.18E-06	3.20E-01
3.18E-02	2.61E-02	6.69E-04	3.79E-04	1.12E+09	6.06E+03	2.46E+04	6.66E-08	1.50E+00	8.40E-06	6.33E-01	3.86E-06	1.05E+00
4.09E-02	3.18E-02	1.17E-03	6.64E-04	1.97E+09	1.06E+04	4.30E+04	1.16E-07	2.63E+00	1.47E-05	1.11E+00	6.75E-06	1.84E+00
6.74E-02	4.09E-02	4.14E-03	2.35E-03	6.96E+09	3.75E+04	1.52E+05	4.12E-07	9.31E+00	5.20E-05	3.92E+00	2.39E-05	6.49E+00
1.11E-01	6.74E-02	8.61E-03	4.88E-03	1.45E+10	7.80E+04	3.17E+05	8.57E-07	1.94E+01	1.08E-04	8.15E+00	4.97E-05	1.35E+01
1.83E-01	1.11E-01	1.77E-02	1.00E-02	2.98E+10	1.60E+05	6.51E+05	1.76E-06	3.98E+01	2.22E-04	1.68E+01	1.02E-04	2.77E+01
2.97E-01	1.83E-01	3.41E-02	1.93E-02	5.74E+10	3.09E+05	1.25E+06	3.39E-06	7.66E+01	4.28E-04	3.23E+01	1.97E-04	5.34E+01
3.69E-01	2.97E-01	2.41E-02	1.36E-02	4.06E+10	2.18E+05	8.84E+05	2.39E-06	5.41E+01	3.02E-04	2.28E+01	1.39E-04	3.76E+01
4.98E-01	3.69E-01	4.68E-02	2.65E-02	7.91E+10	4.24E+05	1.72E+06	4.64E-06	1.05E+02	5.86E-04	4.42E+01	2.70E-04	7.30E+01
6.08E-01	4.98E-01	4.23E-02	2.39E-02	7.17E+10	3.83E+05	1.55E+06	4.18E-06	9.49E+01	5.29E-04	3.99E+01	2.44E-04	6.58E+01
7.43E-01	6.08E-01	5.33E-02	3.00E-02	9.06E+10	4.83E+05	1.94E+06	5.25E-06	1.19E+02	6.66E-04	5.00E+01	3.07E-04	8.25E+01
8.21E-01	7.43E-01	3.13E-02	1.76E-02	5.34E+10	2.84E+05	1.14E+06	3.07E-06	6.99E+01	3.91E-04	2.93E+01	1.80E-04	4.83E+01
1.00E+00	8.21E-01	7.29E-02	4.09E-02	1.25E+11	6.60E+05	2.63E+06	7.12E-06	1.62E+02	9.07E-04	6.78E+01	4.18E-04	1.12E+02
1.35E+00	1.00E+00	1.36E-01	7.59E-02	2.35E+11	1.23E+06	4.86E+06	1.32E-05	3.01E+02	1.69E-03	1.25E+02	7.79E-04	2.06E+02
1.65E+00	1.35E+00	1.08E-01	5.93E-02	1.88E+11	9.69E+05	3.77E+06	1.02E-05	2.35E+02	1.32E-03	9.66E+01	6.13E-04	1.60E+02
1.92E+00	1.65E+00	8.75E-02	4.77E-02	1.55E+11	7.85E+05	3.01E+06	8.18E-06	1.89E+02	1.07E-03	7.69E+01	4.96E-04	1.28E+02
2.23E+00	1.92E+00	9.07E-02	4.90E-02	1.63E+11	8.11E+05	3.05E+06	8.34E-06	1.93E+02	1.10E-03	7.79E+01	5.12E-04	1.30E+02
2.35E+00	2.23E+00	3.04E-02	1.63E-02	5.51E+10	2.71E+05	1.01E+06	2.76E-06	6.41E+01	3.66E-04	2.57E+01	1.71E-04	4.28E+01
2.37E+00	2.35E+00	5.04E-03	2.69E-03	9.16E+09	4.49E+04	1.66E+05	4.56E-07	1.06E+01	6.06E-05	4.23E+00	2.83E-05	7.06E+00
2.47E+00	2.37E+00	2.53E-02	1.35E-02	4.60E+10	2.25E+05	8.28E+05	2.27E-06	5.29E+01	3.03E-04	2.11E+01	1.42E-04	3.52E+01
2.73E+00	2.47E+00	5.97E-02	3.15E-02	1.10E+11	5.30E+05	1.93E+06	5.31E-06	1.24E+02	7.11E-04	4.90E+01	3.34E-04	8.20E+01
3.01E+00	2.73E+00	5.75E-02	3.00E-02	1.07E+11	5.08E+05	1.81E+06	5.02E-06	1.18E+02	6.79E-04	4.59E+01	3.20E-04	7.72E+01
3.68E+00	3.01E+00	1.04E-01	5.29E-02	1.98E+11	9.09E+05	3.14E+06	8.75E-06	2.06E+02	1.21E-03	7.91E+01	5.72E-04	1.34E+02
4.97E+00	3.68E+00	1.14E-01	5.56E-02	2.30E+11	9.82E+05	3.16E+06	8.97E-06	2.15E+02	1.29E-03	7.88E+01	6.18E-04	1.36E+02
6.07E+00	4.97E+00	4.47E-02	2.04E-02	9.71E+10	3.75E+05	1.09E+06	3.18E-06	7.76E+01	4.81E-04	2.68E+01	2.36E-04	4.73E+01
7.41E+00	6.07E+00	2.37E-02	1.01E-02	5.56E+10	1.94E+05	5.09E+05	1.52E-06	3.79E+01	2.44E-04	1.23E+01	1.23E-04	2.22E+01
8.61E+00	7.41E+00	8.34E-03	3.30E-03	2.14E+10	6.62E+04	1.54E+05	4.76E-07	1.21E+01	8.13E-05	3.66E+00	4.21E-05	6.82E+00
1.00E+01	8.61E+00	3.69E-03	1.35E-03	1.04E+10	2.84E+04	5.88E+04	1.87E-07	4.87E+00	3.41E-05	1.37E+00	1.82E-05	2.63E+00
1.22E+01	1.00E+01	1.55E-03	5.12E-04	4.89E+09	1.15E+04	2.03E+04	6.73E-08	1.80E+00	1.34E-05	4.61E-01	7.46E-06	9.22E-01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	9.33E+08	1.76E+03	2.51E+03	8.83E-09	2.46E-01	1.97E-06	5.52E-02	1.18E-06	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	2.70E+08	3.97E+02	4.47E+02	1.68E-09	4.86E-02	4.25E-07	9.46E-03	2.74E-07	2.13E-02
	Total	1.24E+00	6.61E-01	2.26E+12	1.10E+07	4.09E+07	1.12E-04	2.60E+03	1.49E-02	1.04E+03	6.96E-03	1.74E+03

Table 3-3. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 100 days)

Energy Bound		Neutron Source (n/s/g-actinide)										
Upper	Lower	Am-241	Am-243	Cf-252	Cm-244	Cm-248	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.47E+01	1.31E-04	3.55E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	3.36E-13	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	1.64E+02	9.73E-04	3.79E-03	1.07E-14	2.41E-07	1.54E-12	1.03E-07	1.74E-12	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	4.00E+02	2.30E-03	9.22E-03	2.53E-14	5.71E-07	3.37E-12	2.43E-07	3.93E-12	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	1.25E+03	7.07E-03	2.87E-02	7.82E-14	1.76E-06	1.01E-11	7.46E-07	1.19E-11	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	6.46E+03	3.65E-02	1.49E-01	4.03E-13	9.09E-06	5.14E-11	3.84E-06	6.09E-11	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	1.73E+04	9.76E-02	3.99E-01	1.08E-12	2.44E-05	1.37E-10	1.03E-05	1.63E-10	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	1.42E+05	7.98E-01	3.26E+00	8.84E-12	1.99E-04	1.12E-09	8.40E-05	1.33E-09	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	5.83E+05	3.28E+00	1.34E+01	3.63E-11	8.19E-04	4.59E-09	3.45E-04	5.45E-09	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.55E-07	1.56E+06	8.79E+00	3.59E+01	9.73E-11	2.19E-03	1.23E-08	9.25E-04	1.46E-08	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	4.81E+06	2.71E+01	1.11E+02	3.00E-10	6.76E-03	3.78E-08	2.85E-03	4.50E-08	4.72E-03
1.58E-03	4.54E-04	2.46E-05	1.40E-05	3.93E+07	2.21E+02	9.04E+02	2.45E-09	5.52E-02	3.09E-07	2.33E-02	3.68E-07	3.86E-02
3.35E-03	1.58E-03	6.04E-05	3.43E-05	9.65E+07	5.43E+02	2.22E+03	6.01E-09	1.36E-01	7.59E-07	5.71E-02	9.02E-07	9.48E-02
7.10E-03	3.35E-03	1.86E-04	1.05E-04	2.97E+08	1.67E+03	6.83E+03	1.85E-08	4.17E-01	2.34E-06	1.76E-01	2.78E-06	2.92E-01
1.50E-02	7.10E-03	5.71E-04	3.24E-04	9.12E+08	5.13E+03	2.10E+04	5.68E-08	1.28E+00	7.17E-06	5.40E-01	8.52E-06	8.95E-01
2.19E-02	1.50E-02	6.36E-04	3.61E-04	1.02E+09	5.72E+03	2.34E+04	6.33E-08	1.43E+00	7.99E-06	6.02E-01	9.50E-06	9.97E-01
2.42E-02	2.19E-02	2.39E-04	1.35E-04	3.81E+08	2.15E+03	8.77E+03	2.38E-08	5.35E-01	3.00E-06	2.26E-01	3.56E-06	3.74E-01
2.61E-02	2.42E-02	2.04E-04	1.16E-04	3.26E+08	1.83E+03	7.49E+03	2.03E-08	4.57E-01	2.56E-06	1.93E-01	3.04E-06	3.20E-01
3.18E-02	2.61E-02	6.69E-04	3.79E-04	1.07E+09	6.01E+03	2.46E+04	6.66E-08	1.50E+00	8.40E-06	6.33E-01	9.99E-06	1.05E+00
4.09E-02	3.18E-02	1.17E-03	6.64E-04	1.87E+09	1.05E+04	4.30E+04	1.16E-07	2.63E+00	1.47E-05	1.11E+00	1.75E-05	1.84E+00
6.74E-02	4.09E-02	4.14E-03	2.35E-03	6.62E+09	3.72E+04	1.52E+05	4.12E-07	9.29E+00	5.20E-05	3.92E+00	6.18E-05	6.49E+00
1.11E-01	6.74E-02	8.61E-03	4.88E-03	1.38E+10	7.74E+04	3.17E+05	8.57E-07	1.93E+01	1.08E-04	8.15E+00	1.29E-04	1.35E+01
1.83E-01	1.11E-01	1.77E-02	1.00E-02	2.83E+10	1.59E+05	6.51E+05	1.76E-06	3.97E+01	2.22E-04	1.68E+01	2.64E-04	2.77E+01
2.97E-01	1.83E-01	3.41E-02	1.93E-02	5.46E+10	3.07E+05	1.25E+06	3.39E-06	7.65E+01	4.28E-04	3.23E+01	5.09E-04	5.34E+01
3.69E-01	2.97E-01	2.41E-02	1.36E-02	3.86E+10	2.16E+05	8.84E+05	2.39E-06	5.40E+01	3.02E-04	2.28E+01	3.59E-04	3.76E+01
4.98E-01	3.69E-01	4.68E-02	2.65E-02	7.52E+10	4.21E+05	1.72E+06	4.64E-06	1.05E+02	5.86E-04	4.42E+01	6.98E-04	7.30E+01
6.08E-01	4.98E-01	4.23E-02	2.39E-02	6.82E+10	3.81E+05	1.55E+06	4.18E-06	9.47E+01	5.29E-04	3.99E+01	6.31E-04	6.58E+01
7.43E-01	6.08E-01	5.33E-02	3.00E-02	8.62E+10	4.79E+05	1.94E+06	5.25E-06	1.19E+02	6.66E-04	5.00E+01	7.95E-04	8.25E+01
8.21E-01	7.43E-01	3.13E-02	1.76E-02	5.08E+10	2.82E+05	1.14E+06	3.07E-06	6.98E+01	3.91E-04	2.93E+01	4.67E-04	4.83E+01
1.00E+00	8.21E-01	7.29E-02	4.09E-02	1.19E+11	6.55E+05	2.63E+06	7.12E-06	1.62E+02	9.07E-04	6.78E+01	1.09E-03	1.12E+02
1.35E+00	1.00E+00	1.36E-01	7.59E-02	2.24E+11	1.22E+06	4.86E+06	1.32E-05	3.00E+02	1.69E-03	1.25E+02	2.03E-03	2.06E+02
1.65E+00	1.35E+00	1.08E-01	5.93E-02	1.79E+11	9.62E+05	3.77E+06	1.02E-05	2.35E+02	1.32E-03	9.66E+01	1.60E-03	1.60E+02
1.92E+00	1.65E+00	8.74E-02	4.77E-02	1.47E+11	7.79E+05	3.01E+06	8.18E-06	1.88E+02	1.07E-03	7.69E+01	1.30E-03	1.28E+02
2.23E+00	1.92E+00	9.07E-02	4.90E-02	1.55E+11	8.05E+05	3.05E+06	8.34E-06	1.93E+02	1.10E-03	7.79E+01	1.34E-03	1.30E+02
2.35E+00	2.23E+00	3.04E-02	1.63E-02	5.24E+10	2.69E+05	1.01E+06	2.76E-06	6.40E+01	3.66E-04	2.57E+01	4.50E-04	4.28E+01
2.37E+00	2.35E+00	5.04E-03	2.69E-03	8.71E+09	4.46E+04	1.66E+05	4.56E-07	1.06E+01	6.06E-05	4.23E+00	7.45E-05	7.06E+00
2.47E+00	2.37E+00	2.53E-02	1.35E-02	4.38E+10	2.23E+05	8.28E+05	2.27E-06	5.28E+01	3.03E-04	2.11E+01	3.73E-04	3.52E+01
2.73E+00	2.47E+00	5.97E-02	3.15E-02	1.04E+11	5.26E+05	1.93E+06	5.31E-06	1.24E+02	7.11E-04	4.90E+01	8.81E-04	8.20E+01
3.01E+00	2.73E+00	5.74E-02	3.00E-02	1.02E+11	5.04E+05	1.81E+06	5.02E-06	1.17E+02	6.79E-04	4.59E+01	8.46E-04	7.72E+01
3.68E+00	3.01E+00	1.04E-01	5.29E-02	1.88E+11	9.02E+05	3.14E+06	8.75E-06	2.06E+02	1.21E-03	7.91E+01	1.52E-03	1.34E+02
4.97E+00	3.68E+00	1.14E-01	5.56E-02	2.19E+11	9.75E+05	3.16E+06	8.97E-06	2.14E+02	1.29E-03	7.88E+01	1.66E-03	1.36E+02
6.07E+00	4.97E+00	4.46E-02	2.04E-02	9.23E+10	3.73E+05	1.09E+06	3.18E-06	7.75E+01	4.81E-04	2.68E+01	6.46E-04	4.73E+01
7.41E+00	6.07E+00	2.37E-02	1.01E-02	5.29E+10	1.92E+05	5.09E+05	1.52E-06	3.78E+01	2.44E-04	1.23E+01	3.40E-04	2.22E+01
8.61E+00	7.41E+00	8.33E-03	3.30E-03	2.03E+10	6.57E+04	1.54E+05	4.76E-07	1.21E+01	8.13E-05	3.66E+00	1.19E-04	6.82E+00
1.00E+01	8.61E+00	3.69E-03	1.35E-03	9.85E+09	2.82E+04	5.88E+04	1.87E-07	4.86E+00	3.41E-05	1.37E+00	5.21E-05	2.63E+00
1.22E+01	1.00E+01	1.55E-03	5.12E-04	4.65E+09	1.14E+04	2.03E+04	6.73E-08	1.80E+00	1.34E-05	4.61E-01	2.17E-05	9.22E-01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	8.87E+08	1.75E+03	2.51E+03	8.83E-09	2.45E-01	1.97E-06	5.52E-02	3.49E-06	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	2.56E+08	3.94E+02	4.47E+02	1.68E-09	4.85E-02	4.25E-07	9.46E-03	8.30E-07	2.13E-02
	Total	1.24E+00	6.61E-01	2.15E+12	1.09E+07	4.09E+07	1.12E-04	2.60E+03	1.49E-02	1.04E+03	1.83E-02	1.74E+03

Table 3-4. Neutron Source from ORIGEN-S w/o Beryllium (Decay Time = 30,000 days)

Energy (MeV)		Neutron Source (n/s/g-actinide)											
Upper	Lower	Am-241	Am-243	Cf-252	Cm-244	Cm-248	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	
1.00E-07	1.00E-11	2.05E-11	4.49E-12	3.38E-04	5.71E-06	3.55E-04	1.34E-15	1.62E-08	3.51E-13	1.46E-08	2.07E-11	2.92E-08	
4.14E-07	1.00E-07	1.03E-10	5.70E-11	3.61E-03	4.24E-05	3.79E-03	1.07E-14	1.26E-07	1.53E-12	1.03E-07	1.04E-10	1.76E-07	
8.76E-07	4.14E-07	2.31E-10	1.40E-10	8.79E-03	1.00E-04	9.22E-03	2.53E-14	2.99E-07	3.36E-12	2.40E-07	2.34E-10	4.07E-07	
1.86E-06	8.76E-07	7.01E-10	4.38E-10	2.73E-02	3.08E-04	2.87E-02	7.82E-14	9.23E-07	1.01E-11	7.39E-07	7.09E-10	1.24E-06	
5.04E-06	1.86E-06	3.58E-09	2.27E-09	1.42E-01	1.59E-03	1.49E-01	4.03E-13	4.76E-06	5.13E-11	3.81E-06	3.62E-09	6.38E-06	
1.07E-05	5.04E-06	9.55E-09	6.10E-09	3.80E-01	4.26E-03	3.99E-01	1.08E-12	1.28E-05	1.37E-10	1.02E-05	9.67E-09	1.71E-05	
3.73E-05	1.07E-05	7.79E-08	5.00E-08	3.11E+00	3.48E-02	3.26E+00	8.84E-12	1.04E-04	1.11E-09	8.33E-05	7.89E-08	1.39E-04	
1.01E-04	3.73E-05	3.20E-07	2.06E-07	1.28E+01	1.43E-01	1.34E+01	3.63E-11	4.29E-04	4.58E-09	3.42E-04	3.24E-07	5.73E-04	
2.14E-04	1.01E-04	8.57E-07	5.50E-07	3.43E+01	3.83E-01	3.59E+01	9.73E-11	1.15E-03	1.23E-08	9.17E-04	8.68E-07	1.53E-03	
4.54E-04	2.14E-04	2.64E-06	1.70E-06	1.06E+02	1.18E+00	1.11E+02	3.00E-10	3.54E-03	3.78E-08	2.82E-03	2.67E-06	4.72E-03	
1.58E-03	4.54E-04	2.16E-05	1.39E-05	8.62E+02	9.64E+00	9.04E+02	2.45E-09	2.89E-02	3.08E-07	2.31E-02	2.18E-05	3.86E-02	
3.35E-03	1.58E-03	5.30E-05	3.40E-05	2.12E+03	2.37E+01	2.22E+03	6.01E-09	7.10E-02	7.57E-07	5.67E-02	5.36E-05	9.48E-02	
7.10E-03	3.35E-03	1.63E-04	1.05E-04	6.51E+03	7.28E+01	6.83E+03	1.85E-08	2.18E-01	2.33E-06	1.74E-01	1.65E-04	2.92E-01	
1.50E-02	7.10E-03	5.01E-04	3.21E-04	2.00E+04	2.24E+02	2.10E+04	5.68E-08	6.71E-01	7.15E-06	5.35E-01	5.07E-04	8.95E-01	
2.19E-02	1.50E-02	5.58E-04	3.58E-04	2.23E+04	2.49E+02	2.34E+04	6.33E-08	7.47E-01	7.97E-06	5.96E-01	5.64E-04	9.97E-01	
2.42E-02	2.19E-02	2.09E-04	1.34E-04	8.36E+03	9.35E+01	8.77E+03	2.38E-08	2.80E-01	2.99E-06	2.24E-01	2.12E-04	3.74E-01	
2.61E-02	2.42E-02	1.79E-04	1.15E-04	7.14E+03	7.99E+01	7.49E+03	2.03E-08	2.39E-01	2.55E-06	1.91E-01	1.81E-04	3.20E-01	
3.18E-02	2.61E-02	5.86E-04	3.77E-04	2.34E+04	2.62E+02	2.46E+04	6.66E-08	7.86E-01	8.38E-06	6.27E-01	5.94E-04	1.05E+00	
4.09E-02	3.18E-02	1.03E-03	6.59E-04	4.10E+04	4.58E+02	4.30E+04	1.16E-07	1.37E+00	1.47E-05	1.10E+00	1.04E-03	1.83E+00	
6.74E-02	4.09E-02	3.63E-03	2.33E-03	1.45E+05	1.62E+03	1.52E+05	4.12E-07	4.87E+00	5.19E-05	3.89E+00	3.67E-03	6.49E+00	
1.11E-01	6.74E-02	7.55E-03	4.85E-03	3.02E+05	3.38E+03	3.17E+05	8.57E-07	1.01E+01	1.08E-04	8.08E+00	7.64E-03	1.35E+01	
1.83E-01	1.11E-01	1.55E-02	9.96E-03	6.21E+05	6.94E+03	6.51E+05	1.76E-06	2.08E+01	2.22E-04	1.66E+01	1.57E-02	2.77E+01	
2.97E-01	1.83E-01	2.99E-02	1.92E-02	1.20E+06	1.34E+04	1.25E+06	3.39E-06	4.01E+01	4.27E-04	3.20E+01	3.02E-02	5.34E+01	
3.69E-01	2.97E-01	2.11E-02	1.35E-02	8.43E+05	9.44E+03	8.84E+05	2.39E-06	2.83E+01	3.01E-04	2.26E+01	2.14E-02	3.76E+01	
4.98E-01	3.69E-01	4.10E-02	2.63E-02	1.64E+06	1.84E+04	1.72E+06	4.64E-06	5.49E+01	5.85E-04	4.38E+01	4.15E-02	7.30E+01	
6.08E-01	4.98E-01	3.71E-02	2.37E-02	1.48E+06	1.66E+04	1.55E+06	4.18E-06	4.96E+01	5.28E-04	3.95E+01	3.75E-02	6.58E+01	
7.43E-01	6.08E-01	4.67E-02	2.98E-02	1.85E+06	2.09E+04	1.94E+06	5.25E-06	6.24E+01	6.64E-04	4.96E+01	4.73E-02	8.25E+01	
8.21E-01	7.43E-01	2.75E-02	1.75E-02	1.09E+06	1.23E+04	1.14E+06	3.07E-06	3.66E+01	3.90E-04	2.90E+01	2.78E-02	4.83E+01	
1.00E+00	8.21E-01	6.39E-02	4.06E-02	2.51E+06	2.86E+04	2.63E+06	7.12E-06	8.48E+01	9.05E-04	6.72E+01	6.47E-02	1.12E+02	
1.35E+00	1.00E+00	1.19E-01	7.53E-02	4.63E+06	5.33E+04	4.86E+06	1.32E-05	1.57E+02	1.68E-03	1.24E+02	1.21E-01	2.06E+02	
1.65E+00	1.35E+00	9.44E-02	5.89E-02	3.59E+06	4.20E+04	3.77E+06	1.02E-05	1.23E+02	1.32E-03	9.58E+01	9.55E-02	1.60E+02	
1.92E+00	1.65E+00	7.67E-02	4.74E-02	2.87E+06	3.40E+04	3.01E+06	8.18E-06	9.87E+01	1.07E-03	7.62E+01	7.76E-02	1.28E+02	
2.23E+00	1.92E+00	7.95E-02	4.86E-02	2.91E+06	3.51E+04	3.05E+06	8.34E-06	1.01E+02	1.10E-03	7.73E+01	8.05E-02	1.30E+02	
2.35E+00	2.23E+00	2.67E-02	1.62E-02	9.61E+05	1.17E+04	1.01E+06	2.76E-06	3.35E+01	3.65E-04	2.54E+01	2.70E-02	4.28E+01	
2.37E+00	2.35E+00	4.42E-03	2.67E-03	1.58E+05	1.94E+03	1.66E+05	4.56E-07	5.54E+00	6.04E-05	4.19E+00	4.47E-03	7.06E+00	
2.47E+00	2.37E+00	2.22E-02	1.34E-02	7.90E+05	9.73E+03	8.28E+05	2.27E-06	2.77E+01	3.02E-04	2.09E+01	2.24E-02	3.52E+01	
2.73E+00	2.47E+00	5.23E-02	3.13E-02	1.84E+06	2.29E+04	1.93E+06	5.31E-06	6.48E+01	7.10E-04	4.85E+01	5.30E-02	8.20E+01	
3.01E+00	2.73E+00	5.04E-02	2.98E-02	1.73E+06	2.20E+04	1.81E+06	5.02E-06	6.14E+01	6.78E-04	4.55E+01	5.10E-02	7.72E+01	
3.68E+00	3.01E+00	9.09E-02	5.25E-02	2.99E+06	3.93E+04	3.14E+06	8.75E-06	1.08E+02	1.20E-03	7.84E+01	9.19E-02	1.34E+02	
4.97E+00	3.68E+00	9.99E-02	5.52E-02	3.02E+06	4.25E+04	3.16E+06	8.97E-06	1.12E+02	1.28E-03	7.81E+01	1.01E-01	1.36E+02	
6.07E+00	4.97E+00	3.92E-02	2.03E-02	1.04E+06	1.62E+04	1.09E+06	3.18E-06	4.06E+01	4.80E-04	2.66E+01	3.96E-02	4.73E+01	
7.41E+00	6.07E+00	2.08E-02	1.00E-02	4.85E+05	8.38E+03	5.08E+05	1.52E-06	1.98E+01	2.43E-04	1.22E+01	2.10E-02	2.22E+01	
8.61E+00	7.41E+00	7.31E-03	3.27E-03	1.47E+05	2.86E+03	1.54E+05	4.76E-07	6.33E+00	8.11E-05	3.63E+00	7.40E-03	6.82E+00	
1.00E+01	8.61E+00	3.24E-03	1.34E-03	5.61E+04	1.23E+03	5.88E+04	1.87E-07	2.55E+00	3.40E-05	1.36E+00	3.28E-03	2.63E+00	
1.22E+01	1.00E+01	1.36E-03	5.08E-04	1.94E+04	4.95E+02	2.03E+04	6.73E-08	9.42E-01	1.33E-05	4.57E-01	1.38E-03	9.21E-01	
1.42E+01	1.22E+01	2.21E-04	7.17E-05	2.40E+03	7.60E+01	2.51E+03	8.83E-09	1.29E-01	1.97E-06	5.47E-02	2.24E-04	1.17E-01	
1.96E+01	1.42E+01	5.31E-05	1.47E-05	4.26E+02	1.71E+01	4.47E+02	1.68E-09	2.54E-02	4.24E-07	9.38E-03	5.38E-05	2.13E-02	
	Total	1.09E+00	6.56E-01	3.90E+07	4.77E+05	4.09E+07	1.12E-04	1.36E+03	1.48E-02	1.03E+03	1.10E+00	1.74E+03	

Table 3-5. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 0 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)								
Upper	Upper	Am-241	Am-243	Cm-244	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.32E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	2.97E-14	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	9.83E-04	1.07E-14	2.41E-07	1.54E-12	1.03E-07	2.00E-13	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	2.32E-03	2.53E-14	5.73E-07	3.37E-12	2.42E-07	4.68E-13	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	7.15E-03	7.82E-14	1.77E-06	1.01E-11	7.46E-07	1.44E-12	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	3.68E-02	4.03E-13	9.11E-06	5.14E-11	3.84E-06	7.38E-12	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	9.86E-02	1.08E-12	2.44E-05	1.37E-10	1.03E-05	1.98E-11	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	8.06E-01	8.84E-12	2.00E-04	1.12E-09	8.40E-05	1.61E-10	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	3.32E+00	3.63E-11	8.21E-04	4.59E-09	3.45E-04	6.64E-10	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.54E-07	8.88E+00	9.73E-11	2.20E-03	1.23E-08	9.25E-04	1.78E-09	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	2.74E+01	3.00E-10	6.77E-03	3.78E-08	2.85E-03	5.48E-09	4.72E-03
1.58E-03	4.54E-04	2.70E-03	1.40E-05	2.24E+02	3.82E-08	5.53E-02	2.19E-04	2.33E-02	2.17E-05	3.86E-02
3.35E-03	1.58E-03	2.05E-01	1.18E-02	5.53E+02	3.47E-05	1.17E+00	3.12E-03	6.98E-02	1.57E-04	9.50E-02
7.10E-03	3.35E-03	1.40E+00	7.85E-02	1.72E+03	2.87E-04	6.94E+00	2.68E-02	2.64E-01	1.03E-03	2.93E-01
1.50E-02	7.10E-03	7.20E+00	4.18E-01	5.35E+03	1.39E-03	3.70E+01	1.30E-01	1.01E+00	5.33E-03	9.04E-01
2.19E-02	1.50E-02	1.00E+01	5.77E-01	6.01E+03	1.97E-03	5.16E+01	1.81E-01	1.25E+00	7.41E-03	1.01E+00
2.42E-02	2.19E-02	4.00E+00	2.38E-01	2.26E+03	7.89E-04	2.01E+01	7.32E-02	5.04E-01	3.05E-03	3.79E-01
2.61E-02	2.42E-02	3.68E+00	2.08E-01	1.94E+03	7.09E-04	1.90E+01	6.47E-02	4.21E-01	2.63E-03	3.24E-01
3.18E-02	2.61E-02	1.24E+01	7.15E-01	6.37E+03	2.40E-03	6.31E+01	2.25E-01	1.45E+00	9.09E-03	1.06E+00
4.09E-02	3.18E-02	2.36E+01	1.38E+00	1.12E+04	4.64E-03	1.20E+02	4.26E-01	2.67E+00	1.76E-02	1.86E+00
6.74E-02	4.09E-02	9.72E+01	5.63E+00	3.99E+04	1.90E-02	4.93E+02	1.76E+00	1.03E+01	7.20E-02	6.61E+00
1.11E-01	6.74E-02	2.33E+02	1.36E+01	8.38E+04	4.58E-02	1.18E+03	4.22E+00	2.36E+01	1.73E-01	1.38E+01
1.83E-01	1.11E-01	5.11E+02	2.97E+01	1.73E+05	1.00E-01	2.59E+03	9.25E+00	5.06E+01	3.79E-01	2.83E+01
2.97E-01	1.83E-01	2.05E+03	1.19E+02	3.58E+05	4.01E-01	1.03E+04	3.71E+01	1.68E+02	1.52E+00	5.57E+01
3.69E-01	2.97E-01	6.37E+03	3.72E+02	3.70E+05	1.25E+00	3.18E+04	1.15E+02	4.46E+02	4.73E+00	4.50E+01
4.98E-01	3.69E-01	2.71E+04	1.58E+03	1.07E+06	5.32E+00	1.35E+05	4.90E+02	1.84E+03	2.01E+01	1.04E+02
6.08E-01	4.98E-01	3.53E+04	2.05E+03	1.22E+06	6.89E+00	1.76E+05	6.36E+02	2.38E+03	2.61E+01	1.07E+02
7.43E-01	6.08E-01	5.45E+04	3.17E+03	1.77E+06	9.43E+00	2.72E+05	9.83E+02	3.66E+03	3.85E+01	1.43E+02
8.21E-01	7.43E-01	3.62E+04	2.10E+03	1.14E+06	5.45E+00	1.81E+05	6.36E+02	2.37E+03	2.27E+01	8.36E+01
1.00E+00	8.21E-01	9.30E+04	5.03E+03	2.93E+06	1.27E+01	4.65E+05	1.48E+03	5.51E+03	5.26E+01	1.94E+02
1.35E+00	1.00E+00	1.78E+05	9.47E+03	5.91E+06	2.36E+01	8.89E+05	2.78E+03	1.04E+04	9.85E+01	3.60E+02
1.65E+00	1.35E+00	1.20E+05	6.25E+03	4.22E+06	1.40E+01	6.02E+05	1.81E+03	6.75E+03	6.07E+01	2.55E+02
1.92E+00	1.65E+00	1.10E+05	5.72E+03	3.75E+06	1.30E+01	5.50E+05	1.66E+03	6.18E+03	5.61E+01	2.15E+02
2.23E+00	1.92E+00	1.71E+05	9.20E+03	5.29E+06	2.42E+01	8.58E+05	2.72E+03	1.01E+04	9.76E+01	2.82E+02
2.35E+00	2.23E+00	6.99E+04	3.79E+03	2.08E+06	1.13E+01	3.50E+05	1.13E+03	4.16E+03	4.26E+01	1.09E+02
2.37E+00	2.35E+00	1.22E+04	6.61E+02	3.60E+05	2.04E+00	6.10E+04	1.97E+02	7.26E+02	7.71E+00	1.91E+01
2.47E+00	2.37E+00	6.44E+04	3.50E+03	1.89E+06	1.11E+01	3.22E+05	1.04E+03	3.84E+03	4.19E+01	1.01E+02
2.73E+00	2.47E+00	1.90E+05	1.06E+04	5.38E+06	3.53E+01	9.49E+05	3.26E+03	1.20E+04	1.33E+02	2.90E+02
3.01E+00	2.73E+00	3.13E+05	1.82E+04	8.16E+06	6.05E+01	1.56E+06	5.65E+03	2.08E+04	2.31E+02	4.39E+02
3.68E+00	3.01E+00	1.01E+06	5.39E+04	2.73E+07	1.30E+02	5.06E+06	1.57E+04	5.78E+04	5.37E+02	9.72E+02
4.97E+00	3.68E+00	1.71E+06	8.58E+04	4.97E+07	1.82E+02	8.55E+06	2.42E+04	8.93E+04	7.76E+02	1.34E+03
6.07E+00	4.97E+00	9.50E+05	4.32E+04	3.01E+07	6.13E+01	4.78E+06	1.12E+04	4.16E+04	2.89E+02	4.96E+02
7.41E+00	6.07E+00	9.51E+05	4.74E+04	3.03E+07	1.27E+02	4.77E+06	1.38E+04	5.06E+04	5.05E+02	8.11E+02
8.61E+00	7.41E+00	7.92E+05	4.00E+04	2.35E+07	1.01E+02	3.97E+06	1.15E+04	4.24E+04	4.08E+02	6.44E+02
1.00E+01	8.61E+00	5.99E+05	2.82E+04	1.96E+07	6.21E+01	3.01E+06	7.83E+03	2.89E+04	2.60E+02	4.07E+02
1.22E+01	1.00E+01	6.74E+04	2.81E+03	2.75E+06	2.10E+00	3.40E+05	6.65E+02	2.48E+03	1.30E+01	2.09E+01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	1.76E+03	8.83E-09	2.46E-01	1.97E-06	5.52E-02	1.78E-07	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	3.98E+02	1.68E-09	4.86E-02	4.25E-07	9.46E-03	3.45E-08	2.13E-02
	Total	7.56E+06	3.83E+05	2.29E+08	9.03E+02	3.79E+07	1.09E+05	4.04E+05	3.72E+03	7.55E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-6. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 30 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)								
Upper	Upper	Am-241	Am-243	Cm-244	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.32E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	1.22E-13	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	9.80E-04	1.07E-14	2.41E-07	1.54E-12	1.03E-07	6.64E-13	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	2.31E-03	2.53E-14	5.72E-07	3.37E-12	2.42E-07	1.51E-12	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	7.12E-03	7.82E-14	1.77E-06	1.01E-11	7.46E-07	4.59E-12	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	3.67E-02	4.03E-13	9.11E-06	5.14E-11	3.84E-06	2.35E-11	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	9.83E-02	1.08E-12	2.44E-05	1.37E-10	1.03E-05	6.28E-11	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	8.04E-01	8.84E-12	2.00E-04	1.12E-09	8.40E-05	5.13E-10	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	3.31E+00	3.63E-11	8.20E-04	4.59E-09	3.45E-04	2.11E-09	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.54E-07	8.85E+00	9.73E-11	2.20E-03	1.23E-08	9.25E-04	5.64E-09	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	2.73E+01	3.00E-10	6.77E-03	3.78E-08	2.85E-03	1.74E-08	4.72E-03
1.58E-03	4.54E-04	2.70E-03	1.40E-05	2.24E+02	3.82E-08	5.53E-02	2.19E-04	2.33E-02	3.23E-05	3.86E-02
3.35E-03	1.58E-03	2.05E-01	1.18E-02	5.51E+02	3.47E-05	1.17E+00	3.12E-03	6.98E-02	9.68E-04	9.50E-02
7.10E-03	3.35E-03	1.40E+00	7.85E-02	1.72E+03	2.87E-04	6.94E+00	2.68E-02	2.64E-01	6.58E-03	2.93E-01
1.50E-02	7.10E-03	7.20E+00	4.18E-01	5.34E+03	1.39E-03	3.70E+01	1.30E-01	1.01E+00	3.39E-02	9.04E-01
2.19E-02	1.50E-02	1.00E+01	5.77E-01	5.99E+03	1.97E-03	5.15E+01	1.81E-01	1.25E+00	4.72E-02	1.01E+00
2.42E-02	2.19E-02	4.00E+00	2.38E-01	2.26E+03	7.89E-04	2.01E+01	7.32E-02	5.04E-01	1.89E-02	3.79E-01
2.61E-02	2.42E-02	3.68E+00	2.08E-01	1.93E+03	7.09E-04	1.90E+01	6.47E-02	4.21E-01	1.72E-02	3.24E-01
3.18E-02	2.61E-02	1.24E+01	7.15E-01	6.35E+03	2.40E-03	6.31E+01	2.25E-01	1.45E+00	5.81E-02	1.06E+00
4.09E-02	3.18E-02	2.36E+01	1.38E+00	1.11E+04	4.64E-03	1.20E+02	4.26E-01	2.67E+00	1.11E-01	1.86E+00
6.74E-02	4.09E-02	9.71E+01	5.63E+00	3.98E+04	1.90E-02	4.93E+02	1.76E+00	1.03E+01	4.57E-01	6.61E+00
1.11E-01	6.74E-02	2.33E+02	1.36E+01	8.35E+04	4.58E-02	1.18E+03	4.22E+00	2.36E+01	1.10E+00	1.38E+01
1.83E-01	1.11E-01	5.11E+02	2.97E+01	1.72E+05	1.00E-01	2.59E+03	9.25E+00	5.06E+01	2.41E+00	2.83E+01
2.97E-01	1.83E-01	2.05E+03	1.19E+02	3.57E+05	4.01E-01	1.03E+04	3.71E+01	1.68E+02	9.66E+00	5.57E+01
3.69E-01	2.97E-01	6.37E+03	3.72E+02	3.69E+05	1.25E+00	3.18E+04	1.15E+02	4.46E+02	3.00E+01	4.50E+01
4.98E-01	3.69E-01	2.71E+04	1.58E+03	1.06E+06	5.32E+00	1.35E+05	4.90E+02	1.84E+03	1.28E+02	1.04E+02
6.08E-01	4.98E-01	3.52E+04	2.05E+03	1.22E+06	6.89E+00	1.76E+05	6.36E+02	2.38E+03	1.66E+02	1.07E+02
7.43E-01	6.08E-01	5.44E+04	3.17E+03	1.77E+06	9.43E+00	2.71E+05	9.83E+02	3.66E+03	2.54E+02	1.43E+02
8.21E-01	7.43E-01	3.62E+04	2.10E+03	1.14E+06	5.45E+00	1.81E+05	6.36E+02	2.37E+03	1.66E+02	8.36E+01
1.00E+00	8.21E-01	9.30E+04	5.03E+03	2.92E+06	1.27E+01	4.64E+05	1.48E+03	5.51E+03	4.21E+02	1.94E+02
1.35E+00	1.00E+00	1.78E+05	9.47E+03	5.90E+06	2.36E+01	8.88E+05	2.78E+03	1.04E+04	8.04E+02	3.60E+02
1.65E+00	1.35E+00	1.20E+05	6.25E+03	4.21E+06	1.40E+01	6.02E+05	1.81E+03	6.75E+03	5.38E+02	2.55E+02
1.92E+00	1.65E+00	1.10E+05	5.72E+03	3.74E+06	1.30E+01	5.50E+05	1.66E+03	6.18E+03	4.91E+02	2.15E+02
2.23E+00	1.92E+00	1.71E+05	9.20E+03	5.27E+06	2.42E+01	8.57E+05	2.72E+03	1.01E+04	7.77E+02	2.82E+02
2.35E+00	2.23E+00	6.99E+04	3.79E+03	2.08E+06	1.13E+01	3.50E+05	1.13E+03	4.16E+03	3.20E+02	1.09E+02
2.37E+00	2.35E+00	1.22E+04	6.61E+02	3.59E+05	2.04E+00	6.10E+04	1.97E+02	7.26E+02	5.61E+01	1.91E+01
2.47E+00	2.37E+00	6.43E+04	3.50E+03	1.88E+06	1.11E+01	3.22E+05	1.04E+03	3.84E+03	2.97E+02	1.01E+02
2.73E+00	2.47E+00	1.90E+05	1.06E+04	5.36E+06	3.53E+01	9.49E+05	3.26E+03	1.20E+04	8.86E+02	2.90E+02
3.01E+00	2.73E+00	3.13E+05	1.82E+04	8.13E+06	6.05E+01	1.56E+06	5.65E+03	2.08E+04	1.47E+03	4.39E+02
3.68E+00	3.01E+00	1.01E+06	5.39E+04	2.72E+07	1.30E+02	5.06E+06	1.57E+04	5.78E+04	4.55E+03	9.72E+02
4.97E+00	3.68E+00	1.71E+06	8.58E+04	4.95E+07	1.82E+02	8.55E+06	2.42E+04	8.93E+04	7.54E+03	1.34E+03
6.07E+00	4.97E+00	9.50E+05	4.32E+04	3.01E+07	6.13E+01	4.77E+06	1.12E+04	4.16E+04	4.06E+03	4.96E+02
7.41E+00	6.07E+00	9.51E+05	4.74E+04	3.02E+07	1.27E+02	4.77E+06	1.38E+04	5.06E+04	4.28E+03	8.11E+02
8.61E+00	7.41E+00	7.91E+05	4.00E+04	2.34E+07	1.01E+02	3.97E+06	1.15E+04	4.24E+04	3.55E+03	6.44E+02
1.00E+01	8.61E+00	5.99E+05	2.82E+04	1.96E+07	6.21E+01	3.01E+06	7.83E+03	2.89E+04	2.64E+03	4.07E+02
1.22E+01	1.00E+01	6.74E+04	2.81E+03	2.74E+06	2.10E+00	3.40E+05	6.65E+02	2.48E+03	2.81E+02	2.09E+01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	1.76E+03	8.83E-09	2.46E-01	1.97E-06	5.52E-02	1.18E-06	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	3.97E+02	1.68E-09	4.86E-02	4.25E-07	9.46E-03	2.74E-07	2.13E-02
	Total	7.56E+06	3.83E+05	2.29E+08	9.03E+02	3.79E+07	1.09E+05	4.04E+05	3.37E+04	7.55E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-7. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 100 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)								
Upper	Upper	Am-241	Am-243	Cm-244	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.34E-11	4.52E-12	1.31E-04	1.34E-15	3.09E-08	3.52E-13	1.47E-08	3.36E-13	2.92E-08
4.14E-07	1.00E-07	1.17E-10	5.75E-11	9.73E-04	1.07E-14	2.41E-07	1.54E-12	1.03E-07	1.74E-12	1.76E-07
8.76E-07	4.14E-07	2.64E-10	1.41E-10	2.30E-03	2.53E-14	5.71E-07	3.37E-12	2.42E-07	3.93E-12	4.07E-07
1.86E-06	8.76E-07	7.99E-10	4.41E-10	7.07E-03	7.82E-14	1.76E-06	1.01E-11	7.46E-07	1.19E-11	1.24E-06
5.04E-06	1.86E-06	4.08E-09	2.29E-09	3.65E-02	4.03E-13	9.09E-06	5.14E-11	3.84E-06	6.09E-11	6.38E-06
1.07E-05	5.04E-06	1.09E-08	6.15E-09	9.76E-02	1.08E-12	2.44E-05	1.37E-10	1.03E-05	1.63E-10	1.71E-05
3.73E-05	1.07E-05	8.89E-08	5.03E-08	7.98E-01	8.84E-12	1.99E-04	1.12E-09	8.40E-05	1.33E-09	1.39E-04
1.01E-04	3.73E-05	3.65E-07	2.07E-07	3.28E+00	3.63E-11	8.19E-04	4.59E-09	3.45E-04	5.45E-09	5.73E-04
2.14E-04	1.01E-04	9.78E-07	5.54E-07	8.79E+00	9.73E-11	2.19E-03	1.23E-08	9.25E-04	1.46E-08	1.53E-03
4.54E-04	2.14E-04	3.01E-06	1.71E-06	2.71E+01	3.00E-10	6.76E-03	3.78E-08	2.85E-03	4.50E-08	4.72E-03
1.58E-03	4.54E-04	2.70E-03	1.40E-05	2.22E+02	3.82E-08	5.52E-02	2.19E-04	2.33E-02	5.69E-05	3.86E-02
3.35E-03	1.58E-03	2.04E-01	1.18E-02	5.47E+02	3.47E-05	1.17E+00	3.12E-03	6.98E-02	2.85E-03	9.50E-02
7.10E-03	3.35E-03	1.40E+00	7.85E-02	1.71E+03	2.87E-04	6.93E+00	2.68E-02	2.64E-01	1.94E-02	2.93E-01
1.50E-02	7.10E-03	7.20E+00	4.18E-01	5.30E+03	1.39E-03	3.69E+01	1.30E-01	1.01E+00	1.00E-01	9.04E-01
2.19E-02	1.50E-02	1.00E+01	5.77E-01	5.95E+03	1.97E-03	5.14E+01	1.81E-01	1.25E+00	1.39E-01	1.01E+00
2.42E-02	2.19E-02	3.99E+00	2.38E-01	2.24E+03	7.89E-04	2.01E+01	7.32E-02	5.04E-01	5.56E-02	3.79E-01
2.61E-02	2.42E-02	3.68E+00	2.08E-01	1.92E+03	7.09E-04	1.89E+01	6.47E-02	4.21E-01	5.10E-02	3.24E-01
3.18E-02	2.61E-02	1.24E+01	7.15E-01	6.30E+03	2.40E-03	6.30E+01	2.25E-01	1.45E+00	1.72E-01	1.06E+00
4.09E-02	3.18E-02	2.36E+01	1.38E+00	1.11E+04	4.64E-03	1.20E+02	4.26E-01	2.67E+00	3.28E-01	1.86E+00
6.74E-02	4.09E-02	9.71E+01	5.63E+00	3.95E+04	1.90E-02	4.92E+02	1.76E+00	1.03E+01	1.35E+00	6.61E+00
1.11E-01	6.74E-02	2.33E+02	1.36E+01	8.29E+04	4.58E-02	1.18E+03	4.22E+00	2.36E+01	3.24E+00	1.38E+01
1.83E-01	1.11E-01	5.11E+02	2.97E+01	1.71E+05	1.00E-01	2.58E+03	9.25E+00	5.06E+01	7.10E+00	2.83E+01
2.97E-01	1.83E-01	2.05E+03	1.19E+02	3.55E+05	4.01E-01	1.03E+04	3.71E+01	1.68E+02	2.85E+01	5.57E+01
3.69E-01	2.97E-01	6.37E+03	3.72E+02	3.66E+05	1.25E+00	3.17E+04	1.15E+02	4.46E+02	8.85E+01	4.50E+01
4.98E-01	3.69E-01	2.71E+04	1.58E+03	1.06E+06	5.32E+00	1.35E+05	4.90E+02	1.84E+03	3.77E+02	1.04E+02
6.08E-01	4.98E-01	3.52E+04	2.05E+03	1.21E+06	6.89E+00	1.75E+05	6.36E+02	2.38E+03	4.90E+02	1.07E+02
7.43E-01	6.08E-01	5.44E+04	3.17E+03	1.75E+06	9.43E+00	2.71E+05	9.83E+02	3.66E+03	7.55E+02	1.43E+02
8.21E-01	7.43E-01	3.62E+04	2.10E+03	1.13E+06	5.45E+00	1.80E+05	6.36E+02	2.37E+03	4.99E+02	8.36E+01
1.00E+00	8.21E-01	9.29E+04	5.03E+03	2.90E+06	1.27E+01	4.63E+05	1.48E+03	5.51E+03	1.28E+03	1.94E+02
1.35E+00	1.00E+00	1.78E+05	9.47E+03	5.85E+06	2.36E+01	8.87E+05	2.78E+03	1.04E+04	2.44E+03	3.60E+02
1.65E+00	1.35E+00	1.20E+05	6.25E+03	4.18E+06	1.40E+01	6.01E+05	1.81E+03	6.75E+03	1.64E+03	2.55E+02
1.92E+00	1.65E+00	1.10E+05	5.72E+03	3.71E+06	1.30E+01	5.49E+05	1.66E+03	6.18E+03	1.50E+03	2.15E+02
2.23E+00	1.92E+00	1.71E+05	9.20E+03	5.24E+06	2.42E+01	8.56E+05	2.72E+03	1.01E+04	2.35E+03	2.82E+02
2.35E+00	2.23E+00	6.99E+04	3.79E+03	2.06E+06	1.13E+01	3.49E+05	1.13E+03	4.16E+03	9.63E+02	1.09E+02
2.37E+00	2.35E+00	1.22E+04	6.61E+02	3.56E+05	2.04E+00	6.09E+04	1.97E+02	7.26E+02	1.68E+02	1.91E+01
2.47E+00	2.37E+00	6.43E+04	3.50E+03	1.87E+06	1.11E+01	3.21E+05	1.04E+03	3.84E+03	8.88E+02	1.01E+02
2.73E+00	2.47E+00	1.90E+05	1.06E+04	5.32E+06	3.53E+01	9.47E+05	3.26E+03	1.20E+04	2.63E+03	2.90E+02
3.01E+00	2.73E+00	3.13E+05	1.82E+04	8.07E+06	6.05E+01	1.56E+06	5.65E+03	2.08E+04	4.35E+03	4.39E+02
3.68E+00	3.01E+00	1.01E+06	5.39E+04	2.70E+07	1.30E+02	5.05E+06	1.57E+04	5.78E+04	1.39E+04	9.72E+02
4.97E+00	3.68E+00	1.71E+06	8.58E+04	4.92E+07	1.82E+02	8.53E+06	2.42E+04	8.93E+04	2.32E+04	1.34E+03
6.07E+00	4.97E+00	9.50E+05	4.32E+04	2.98E+07	6.13E+01	4.77E+06	1.12E+04	4.16E+04	1.28E+04	4.96E+02
7.41E+00	6.07E+00	9.51E+05	4.74E+04	2.99E+07	1.27E+02	4.76E+06	1.38E+04	5.06E+04	1.30E+04	8.11E+02
8.61E+00	7.41E+00	7.91E+05	4.00E+04	2.32E+07	1.01E+02	3.96E+06	1.15E+04	4.24E+04	1.08E+04	6.44E+02
1.00E+01	8.61E+00	5.99E+05	2.82E+04	1.94E+07	6.21E+01	3.01E+06	7.83E+03	2.89E+04	8.14E+03	4.07E+02
1.22E+01	1.00E+01	6.74E+04	2.81E+03	2.72E+06	2.10E+00	3.39E+05	6.65E+02	2.48E+03	9.01E+02	2.09E+01
1.42E+01	1.22E+01	2.52E-04	7.22E-05	1.75E+03	8.83E-09	2.45E-01	1.97E-06	5.52E-02	3.49E-06	1.17E-01
1.96E+01	1.42E+01	6.06E-05	1.48E-05	3.94E+02	1.68E-09	4.85E-02	4.25E-07	9.46E-03	8.30E-07	2.13E-02
	Total	7.56E+06	3.83E+05	2.27E+08	9.03E+02	3.78E+07	1.09E+05	4.04E+05	1.03E+05	7.55E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-8. Neutron Source from ORIGEN-S w/90% Beryllium (Decay Time = 30,000 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)								
Upper	Upper	Am-241	Am-243	Cm-244	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	2.05E-11	4.49E-12	5.71E-06	1.34E-15	1.62E-08	3.51E-13	1.46E-08	2.07E-11	2.92E-08
4.14E-07	1.00E-07	1.03E-10	5.70E-11	4.24E-05	1.07E-14	1.26E-07	1.53E-12	1.03E-07	1.04E-10	1.76E-07
8.76E-07	4.14E-07	2.31E-10	1.40E-10	1.00E-04	2.53E-14	2.99E-07	3.36E-12	2.40E-07	2.34E-10	4.07E-07
1.86E-06	8.76E-07	7.00E-10	4.38E-10	3.08E-04	7.82E-14	9.23E-07	1.01E-11	7.39E-07	7.09E-10	1.24E-06
5.04E-06	1.86E-06	3.58E-09	2.27E-09	1.59E-03	4.03E-13	4.76E-06	5.13E-11	3.81E-06	3.62E-09	6.38E-06
1.07E-05	5.04E-06	9.55E-09	6.10E-09	4.26E-03	1.08E-12	1.28E-05	1.37E-10	1.02E-05	9.67E-09	1.71E-05
3.73E-05	1.07E-05	7.79E-08	5.00E-08	3.48E-02	8.84E-12	1.04E-04	1.11E-09	8.33E-05	7.89E-08	1.39E-04
1.01E-04	3.73E-05	3.20E-07	2.06E-07	1.43E-01	3.63E-11	4.29E-04	4.58E-09	3.42E-04	3.24E-07	5.73E-04
2.14E-04	1.01E-04	8.57E-07	5.50E-07	3.83E-01	9.73E-11	1.15E-03	1.23E-08	9.17E-04	8.68E-07	1.53E-03
4.54E-04	2.14E-04	2.64E-06	1.70E-06	1.18E+00	3.00E-10	3.54E-03	3.77E-08	2.82E-03	2.67E-06	4.72E-03
1.58E-03	4.54E-04	2.36E-03	1.39E-05	9.68E+00	3.82E-08	2.89E-02	2.18E-04	2.31E-02	2.40E-03	3.86E-02
3.35E-03	1.58E-03	1.79E-01	1.17E-02	2.39E+01	3.47E-05	6.14E-01	3.11E-03	6.92E-02	1.82E-01	9.50E-02
7.10E-03	3.35E-03	1.23E+00	7.79E-02	7.44E+01	2.87E-04	3.63E+00	2.67E-02	2.62E-01	1.24E+00	2.93E-01
1.50E-02	7.10E-03	6.31E+00	4.15E-01	2.32E+02	1.39E-03	1.93E+01	1.30E-01	1.01E+00	6.40E+00	9.04E-01
2.19E-02	1.50E-02	8.79E+00	5.73E-01	2.60E+02	1.97E-03	2.69E+01	1.80E-01	1.24E+00	8.92E+00	1.01E+00
2.42E-02	2.19E-02	3.50E+00	2.36E-01	9.78E+01	7.89E-04	1.05E+01	7.31E-02	4.99E-01	3.55E+00	3.79E-01
2.61E-02	2.42E-02	3.22E+00	2.06E-01	8.39E+01	7.09E-04	9.91E+00	6.46E-02	4.17E-01	3.27E+00	3.24E-01
3.18E-02	2.61E-02	1.08E+01	7.10E-01	2.76E+02	2.40E-03	3.30E+01	2.25E-01	1.44E+00	1.10E+01	1.06E+00
4.09E-02	3.18E-02	2.07E+01	1.37E+00	4.84E+02	4.64E-03	6.26E+01	4.25E-01	2.64E+00	2.10E+01	1.86E+00
6.74E-02	4.09E-02	8.52E+01	5.59E+00	1.73E+03	1.90E-02	2.58E+02	1.75E+00	1.03E+01	8.64E+01	6.61E+00
1.11E-01	6.74E-02	2.04E+02	1.35E+01	3.63E+03	4.58E-02	6.17E+02	4.21E+00	2.34E+01	2.07E+02	1.38E+01
1.83E-01	1.11E-01	4.48E+02	2.95E+01	7.49E+03	1.00E-01	1.35E+03	9.22E+00	5.02E+01	4.54E+02	2.83E+01
2.97E-01	1.83E-01	1.80E+03	1.19E+02	1.56E+04	4.01E-01	5.38E+03	3.70E+01	1.67E+02	1.83E+03	5.57E+01
3.69E-01	2.97E-01	5.59E+03	3.69E+02	1.63E+04	1.25E+00	1.66E+04	1.15E+02	4.42E+02	5.66E+03	4.50E+01
4.98E-01	3.69E-01	2.38E+04	1.57E+03	4.77E+04	5.32E+00	7.06E+04	4.88E+02	1.83E+03	2.41E+04	1.04E+02
6.08E-01	4.98E-01	3.09E+04	2.04E+03	5.47E+04	6.89E+00	9.18E+04	6.35E+02	2.36E+03	3.13E+04	1.07E+02
7.43E-01	6.08E-01	4.77E+04	3.15E+03	7.98E+04	9.43E+00	1.42E+05	9.81E+02	3.63E+03	4.84E+04	1.43E+02
8.21E-01	7.43E-01	3.17E+04	2.09E+03	5.14E+04	5.45E+00	9.44E+04	6.34E+02	2.35E+03	3.22E+04	8.36E+01
1.00E+00	8.21E-01	8.15E+04	4.99E+03	1.31E+05	1.27E+01	2.43E+05	1.48E+03	5.46E+03	8.27E+04	1.94E+02
1.35E+00	1.00E+00	1.56E+05	9.40E+03	2.64E+05	2.36E+01	4.64E+05	2.77E+03	1.03E+04	1.58E+05	3.60E+02
1.65E+00	1.35E+00	1.05E+05	6.20E+03	1.88E+05	1.40E+01	3.15E+05	1.80E+03	6.69E+03	1.07E+05	2.55E+02
1.92E+00	1.65E+00	9.62E+04	5.68E+03	1.67E+05	1.30E+01	2.88E+05	1.65E+03	6.12E+03	9.76E+04	2.15E+02
2.23E+00	1.92E+00	1.50E+05	9.13E+03	2.37E+05	2.42E+01	4.48E+05	2.71E+03	9.98E+03	1.52E+05	2.82E+02
2.35E+00	2.23E+00	6.13E+04	3.76E+03	9.36E+04	1.13E+01	1.83E+05	1.12E+03	4.12E+03	6.22E+04	1.09E+02
2.37E+00	2.35E+00	1.07E+04	6.56E+02	1.62E+04	2.04E+00	3.19E+04	1.96E+02	7.20E+02	1.08E+04	1.91E+01
2.47E+00	2.37E+00	5.64E+04	3.47E+03	8.48E+04	1.11E+01	1.68E+05	1.04E+03	3.81E+03	5.72E+04	1.01E+02
2.73E+00	2.47E+00	1.66E+05	1.05E+04	2.43E+05	3.53E+01	4.96E+05	3.25E+03	1.19E+04	1.69E+05	2.90E+02
3.01E+00	2.73E+00	2.74E+05	1.81E+04	3.71E+05	6.05E+01	8.16E+05	5.64E+03	2.06E+04	2.78E+05	4.39E+02
3.68E+00	3.01E+00	8.87E+05	5.34E+04	1.23E+06	1.30E+02	2.65E+06	1.56E+04	5.73E+04	9.00E+05	9.71E+02
4.97E+00	3.68E+00	1.50E+06	8.52E+04	2.22E+06	1.82E+02	4.47E+06	2.41E+04	8.85E+04	1.52E+06	1.34E+03
6.07E+00	4.97E+00	8.33E+05	4.29E+04	1.34E+06	6.13E+01	2.50E+06	1.12E+04	4.12E+04	8.45E+05	4.96E+02
7.41E+00	6.07E+00	8.34E+05	4.70E+04	1.35E+06	1.27E+02	2.49E+06	1.37E+04	5.02E+04	8.46E+05	8.10E+02
8.61E+00	7.41E+00	6.94E+05	3.97E+04	1.05E+06	1.01E+02	2.07E+06	1.15E+04	4.20E+04	7.04E+05	6.43E+02
1.00E+01	8.61E+00	5.25E+05	2.80E+04	8.71E+05	6.21E+01	1.57E+06	7.81E+03	2.86E+04	5.33E+05	4.07E+02
1.22E+01	1.00E+01	5.91E+04	2.79E+03	1.21E+05	2.10E+00	1.78E+05	6.64E+02	2.46E+03	6.00E+04	2.09E+01
1.42E+01	1.22E+01	2.21E-04	7.17E-05	7.60E+01	8.84E-09	1.29E-01	1.96E-06	5.47E-02	2.24E-04	1.17E-01
1.96E+01	1.42E+01	5.31E-05	1.47E-05	1.71E+01	1.68E-09	2.54E-02	4.24E-07	9.38E-03	5.38E-05	2.13E-02
	Total	6.63E+06	3.80E+05	1.03E+07	9.03E+02	1.98E+07	1.09E+05	4.01E+05	6.72E+06	7.55E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-9. Neutron Source from RASTA w/o Beryllium (Decay Time = 0 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)										
Upper	Lower	Am-241	Am-243	Cf-252	Cm-244	Cm-248	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	1.39E-11	4.91E-11	#N/A	1.30E-04	5.28E-04	1.48E-15	3.26E-08	5.84E-07	1.36E-08	6.34E-13	2.25E-08
4.14E-07	1.00E-07	1.03E-10	3.64E-10	#N/A	9.65E-04	3.92E-03	1.10E-14	2.42E-07	2.94E-06	1.01E-07	4.70E-12	1.67E-07
8.76E-07	4.14E-07	2.43E-10	8.59E-10	#N/A	2.27E-03	9.24E-03	2.59E-14	5.70E-07	1.95E-05	2.37E-07	1.11E-11	3.94E-07
1.86E-06	8.76E-07	7.55E-10	2.66E-09	#N/A	7.06E-03	2.86E-02	8.02E-14	1.77E-06	4.98E-05	7.36E-07	3.44E-11	1.22E-06
5.04E-06	1.86E-06	3.86E-09	1.36E-08	#N/A	3.61E-02	1.46E-01	4.10E-13	9.04E-06	1.19E-04	3.76E-06	1.76E-10	6.25E-06
1.07E-05	5.04E-06	1.04E-08	3.68E-08	#N/A	9.73E-02	3.95E-01	1.11E-12	2.44E-05	3.55E-04	1.02E-05	4.75E-10	1.69E-05
3.73E-05	1.07E-05	8.48E-08	2.99E-07	#N/A	7.92E-01	3.22E+00	9.01E-12	1.99E-04	7.04E-04	8.27E-05	3.86E-09	1.37E-04
1.01E-04	3.73E-05	3.46E-07	1.22E-06	#N/A	3.24E+00	1.31E+01	3.68E-11	8.11E-04	1.88E-03	3.38E-04	1.58E-08	5.61E-04
2.14E-04	1.01E-04	9.30E-07	3.28E-06	#N/A	8.69E+00	3.53E+01	9.89E-11	2.18E-03	1.78E-03	9.07E-04	4.24E-08	1.51E-03
4.54E-04	2.14E-04	2.88E-06	1.02E-05	#N/A	2.69E+01	1.09E+02	3.06E-10	6.74E-03	9.72E-04	2.81E-03	1.31E-07	4.66E-03
1.58E-03	4.54E-04	2.34E-05	8.24E-05	#N/A	2.18E+02	8.86E+02	2.48E-09	5.47E-02	1.04E-03	2.28E-02	1.06E-06	3.78E-02
3.35E-03	1.58E-03	5.76E-05	2.03E-04	#N/A	5.38E+02	2.18E+03	6.12E-09	1.35E-01	4.40E-04	5.62E-02	2.62E-06	9.33E-02
7.10E-03	3.35E-03	1.77E-04	6.26E-04	#N/A	1.66E+03	6.73E+03	1.88E-08	4.15E-01	9.06E-05	1.73E-01	8.08E-06	2.87E-01
1.50E-02	7.10E-03	5.42E-04	1.91E-03	#N/A	5.06E+03	2.06E+04	5.76E-08	1.27E+00	5.63E-04	5.28E-01	2.47E-05	8.78E-01
2.19E-02	1.50E-02	6.12E-04	2.16E-03	#N/A	5.72E+03	2.32E+04	6.50E-08	1.43E+00	1.61E-03	5.97E-01	2.79E-05	9.91E-01
2.42E-02	2.19E-02	2.28E-04	8.04E-04	#N/A	2.13E+03	8.64E+03	2.42E-08	5.33E-01	1.58E-03	2.22E-01	1.04E-05	3.69E-01
2.61E-02	2.42E-02	1.96E-04	6.93E-04	#N/A	1.83E+03	7.45E+03	2.09E-08	4.60E-01	1.94E-03	1.91E-01	8.94E-06	3.18E-01
3.18E-02	2.61E-02	6.30E-04	2.22E-03	#N/A	5.89E+03	2.39E+04	6.70E-08	1.48E+00	2.47E-03	6.15E-01	2.87E-05	1.02E+00
4.09E-02	3.18E-02	1.12E-03	3.96E-03	#N/A	1.05E+04	4.26E+04	1.19E-07	2.63E+00	1.31E-03	1.10E+00	5.12E-05	1.82E+00
5.74E-02	4.09E-02	2.35E-03	8.30E-03	#N/A	2.20E+04	8.93E+04	2.50E-07	5.51E+00	5.72E-04	2.30E+00	1.07E-04	3.81E+00
1.11E-01	5.74E-02	9.79E-03	3.45E-02	#N/A	9.15E+04	3.72E+05	1.04E-06	2.29E+01	9.79E-04	9.56E+00	4.46E-04	1.59E+01
1.83E-01	1.11E-01	1.69E-02	5.95E-02	#N/A	1.58E+05	6.40E+05	1.79E-06	3.95E+01	7.74E-04	1.65E+01	7.68E-04	2.73E+01
2.97E-01	1.83E-01	3.25E-02	1.15E-01	#N/A	3.04E+05	1.23E+06	3.45E-06	7.61E+01	8.59E-04	3.17E+01	1.48E-03	5.25E+01
3.69E-01	2.97E-01	2.31E-02	8.13E-02	#N/A	2.16E+05	8.75E+05	2.44E-06	5.40E+01	4.45E-04	2.25E+01	1.05E-03	3.72E+01
4.98E-01	3.69E-01	4.46E-02	1.57E-01	#N/A	4.18E+05	1.69E+06	4.72E-06	1.04E+02	6.27E-04	4.35E+01	2.02E-03	7.19E+01
6.08E-01	4.98E-01	4.03E-02	1.42E-01	#N/A	3.77E+05	1.52E+06	4.25E-06	9.41E+01	3.25E-04	3.91E+01	1.82E-03	6.47E+01
7.43E-01	6.08E-01	5.10E-02	1.79E-01	#N/A	4.77E+05	1.92E+06	5.36E-06	1.19E+02	1.89E-04	4.93E+01	2.30E-03	8.15E+01
8.21E-01	7.43E-01	2.98E-02	1.04E-01	#N/A	2.79E+05	1.12E+06	3.13E-06	6.94E+01	4.54E-05	2.88E+01	1.34E-03	4.75E+01
1.00E+00	8.21E-01	6.85E-02	2.39E-01	#N/A	6.40E+05	2.56E+06	7.14E-06	1.59E+02	2.17E-05	6.56E+01	3.06E-03	1.08E+02
1.35E+00	1.00E+00	1.30E-01	4.50E-01	#N/A	1.21E+06	4.78E+06	1.34E-05	2.99E+02	1.22E-05	1.23E+02	5.74E-03	2.03E+02
1.65E+00	1.35E+00	1.03E-01	3.53E-01	#N/A	9.56E+05	3.72E+06	1.04E-05	2.34E+02	3.79E-06	9.52E+01	4.49E-03	1.58E+02
1.92E+00	1.65E+00	8.43E-02	2.86E-01	#N/A	7.81E+05	2.99E+06	8.42E-06	1.90E+02	4.40E-06	7.64E+01	3.63E-03	1.27E+02
2.23E+00	1.92E+00	8.63E-02	2.90E-01	#N/A	7.97E+05	3.00E+06	8.48E-06	1.92E+02	1.18E-05	7.65E+01	3.66E-03	1.27E+02
2.35E+00	2.23E+00	3.04E-02	1.01E-01	#N/A	2.80E+05	1.04E+06	2.95E-06	6.68E+01	1.05E-05	2.65E+01	1.27E-03	4.42E+01
2.37E+00	2.35E+00	4.91E-03	1.63E-02	#N/A	4.52E+04	1.67E+05	4.74E-07	1.08E+01	3.42E-06	4.24E+00	2.05E-04	7.10E+00
2.47E+00	2.37E+00	2.39E-02	7.91E-02	#N/A	2.19E+05	8.08E+05	2.29E-06	5.21E+01	1.11E-06	2.05E+01	9.91E-04	3.43E+01
2.73E+00	2.47E+00	5.69E-02	1.87E-01	#N/A	5.22E+05	1.90E+06	5.41E-06	1.23E+02	4.51E-07	4.82E+01	2.34E-03	8.08E+01
3.01E+00	2.73E+00	5.35E-02	1.74E-01	#N/A	4.88E+05	1.74E+06	4.99E-06	1.14E+02	5.55E-08	4.41E+01	2.16E-03	7.43E+01
3.68E+00	3.01E+00	9.93E-02	3.16E-01	#N/A	8.99E+05	3.11E+06	8.96E-06	2.06E+02	1.80E-08	7.82E+01	3.89E-03	1.33E+02
4.97E+00	3.68E+00	1.09E-01	3.30E-01	#N/A	9.67E+05	3.12E+06	9.14E-06	2.14E+02	6.68E-09	7.76E+01	4.00E-03	1.34E+02
6.07E+00	4.97E+00	4.25E-02	1.21E-01	#N/A	3.69E+05	1.07E+06	3.23E-06	7.70E+01	1.64E-09	2.63E+01	1.43E-03	4.64E+01
7.41E+00	6.07E+00	2.25E-02	5.97E-02	#N/A	1.90E+05	4.98E+05	1.54E-06	3.75E+01	2.01E-10	1.20E+01	6.87E-04	2.18E+01
8.61E+00	7.41E+00	7.95E-03	1.95E-02	#N/A	6.51E+04	1.52E+05	4.84E-07	1.20E+01	7.45E-11	3.59E+00	2.18E-04	6.71E+00
1.00E+01	8.61E+00	3.51E-03	7.98E-03	#N/A	2.79E+04	5.77E+04	1.90E-07	4.83E+00	1.46E-11	1.34E+00	8.67E-05	2.58E+00
1.22E+01	1.00E+01	1.48E-03	3.03E-03	#N/A	1.13E+04	1.99E+04	6.84E-08	1.79E+00	4.70E-12	4.52E-01	3.17E-05	9.06E-01
1.42E+01	1.22E+01	2.44E-04	4.36E-04	#N/A	1.76E+03	2.52E+03	9.15E-09	2.48E-01	1.99E-12	5.52E-02	4.33E-06	1.17E-01
1.73E+01	1.42E+01	5.37E-05	8.27E-05	#N/A	3.65E+02	4.17E+02	1.61E-09	4.55E-02	2.69E-13	8.83E-03	7.79E-07	1.98E-02
	Total	1.18E+00	3.93E+00	#N/A	1.08E+07	4.03E+07	1.14E-04	2.59E+03	2.18E-02	1.03E+03	4.94E-02	1.72E+03

Table 3-10. Neutron Source from RASTA w/90% Beryllium (Decay Time = 0 days)

Energy Bound (MeV)		Neutron Source (n/s/g-actinide)								
Upper	Lower	Am-241	Am-243	Cm-244	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
1.00E-07	1.00E-11	1.39E-11	4.91E-11	1.30E-04	1.48E-15	3.26E-08	5.84E-07	1.36E-08	6.34E-13	2.25E-08
4.14E-07	1.00E-07	1.03E-10	3.64E-10	9.65E-04	1.10E-14	2.42E-07	2.94E-06	1.01E-07	4.70E-12	1.67E-07
8.76E-07	4.14E-07	2.43E-10	8.59E-10	2.27E-03	2.59E-14	5.70E-07	6.63E+02	2.37E-07	1.11E-11	3.94E-07
1.86E-06	8.76E-07	7.55E-10	2.66E-09	7.06E-03	8.02E-14	1.77E-06	7.80E+03	7.36E-07	3.44E-11	1.22E-06
5.04E-06	1.86E-06	3.86E-09	1.36E-08	3.61E-02	4.10E-13	9.04E-06	1.15E+04	3.76E-06	1.76E-10	6.25E-06
1.07E-05	5.04E-06	1.04E-08	3.68E-08	9.73E-02	1.11E-12	2.44E-05	1.37E+04	1.02E-05	4.75E-10	1.69E-05
3.73E-05	1.07E-05	8.48E-08	2.99E-07	7.92E-01	9.01E-12	1.99E-04	1.12E+04	8.27E-05	3.86E-09	1.37E-04
1.01E-04	3.73E-05	3.46E-07	1.22E-06	3.24E+00	3.68E-11	8.11E-04	2.42E+04	3.38E-04	1.58E-08	5.61E-04
2.14E-04	1.01E-04	9.30E-07	3.28E-06	8.69E+00	9.89E-11	2.18E-03	1.57E+04	9.07E-04	4.24E-08	1.51E-03
4.54E-04	2.14E-04	2.88E-06	1.02E-05	2.69E+01	3.06E-10	6.74E-03	5.54E+03	2.81E-03	1.31E-07	4.66E-03
1.58E-03	4.54E-04	1.58E-02	9.97E-04	2.19E+02	3.24E-06	1.33E-01	3.29E+03	2.38E-02	1.24E-05	3.79E-02
3.35E-03	1.58E-03	1.94E-01	1.15E-02	5.43E+02	3.98E-05	1.10E+00	1.04E+03	6.90E-02	1.43E-04	9.35E-02
7.10E-03	3.35E-03	1.41E+00	8.26E-02	1.69E+03	2.89E-04	7.43E+00	2.01E+02	2.66E-01	1.02E-03	2.89E-01
1.50E-02	7.10E-03	7.13E+00	4.17E-01	5.23E+03	1.46E-03	3.68E+01	1.18E+03	1.00E+00	5.17E-03	8.86E-01
2.19E-02	1.50E-02	1.01E+01	5.87E-01	5.95E+03	2.06E-03	5.15E+01	2.71E+03	1.26E+00	7.28E-03	1.00E+00
2.42E-02	2.19E-02	4.06E+00	2.37E-01	2.22E+03	8.33E-04	2.08E+01	1.67E+03	4.92E-01	2.94E-03	3.74E-01
2.61E-02	2.42E-02	3.61E+00	2.11E-01	1.92E+03	7.41E-04	1.85E+01	1.82E+03	4.31E-01	2.62E-03	3.22E-01
3.18E-02	2.61E-02	1.22E+01	7.14E-01	6.18E+03	2.51E-03	6.24E+01	2.78E+03	1.43E+00	8.86E-03	1.04E+00
4.09E-02	3.18E-02	2.38E+01	1.39E+00	1.11E+04	4.87E-03	1.21E+02	1.46E+03	2.67E+00	1.72E-02	1.85E+00
5.74E-02	4.09E-02	5.58E+01	3.26E+00	2.33E+04	1.15E-02	2.84E+02	6.35E+02	6.00E+00	4.04E-02	3.87E+00
1.11E-01	5.74E-02	2.74E+02	1.60E+01	9.80E+04	5.62E-02	1.39E+03	9.87E+02	2.77E+01	1.98E-01	1.62E+01
1.83E-01	1.11E-01	5.10E+02	2.98E+01	1.70E+05	1.05E-01	2.58E+03	6.36E+02	5.03E+01	3.69E-01	2.79E+01
2.97E-01	1.83E-01	2.04E+03	1.19E+02	3.52E+05	4.18E-01	1.02E+04	4.90E+02	1.67E+02	1.47E+00	5.49E+01
3.69E-01	2.97E-01	6.40E+03	3.73E+02	3.67E+05	1.31E+00	3.19E+04	1.16E+02	4.47E+02	4.62E+00	4.46E+01
4.98E-01	3.69E-01	2.71E+04	1.58E+03	1.06E+06	5.56E+00	1.35E+05	3.69E+01	1.84E+03	1.96E+01	1.03E+02
6.08E-01	4.98E-01	3.52E+04	2.05E+03	1.21E+06	7.19E+00	1.75E+05	9.23E+00	2.37E+03	2.54E+01	1.05E+02
7.43E-01	6.08E-01	5.46E+04	3.18E+03	1.77E+06	9.90E+00	2.72E+05	4.95E+00	3.67E+03	3.76E+01	1.41E+02
8.21E-01	7.43E-01	3.62E+04	2.10E+03	1.13E+06	5.70E+00	1.80E+05	1.01E+00	2.37E+03	2.21E+01	8.25E+01
1.00E+00	8.21E-01	9.15E+04	4.95E+03	2.87E+06	1.30E+01	4.57E+05	4.30E-01	5.43E+03	5.05E+01	1.89E+02
1.35E+00	1.00E+00	1.77E+05	9.45E+03	5.87E+06	2.47E+01	8.87E+05	2.21E-01	1.04E+04	9.59E+01	3.55E+02
1.65E+00	1.35E+00	1.21E+05	6.29E+03	4.22E+06	1.48E+01	6.05E+05	6.53E-02	6.79E+03	5.97E+01	2.52E+02
1.92E+00	1.65E+00	1.11E+05	5.76E+03	3.76E+06	1.37E+01	5.53E+05	7.34E-02	6.22E+03	5.50E+01	2.14E+02
2.23E+00	1.92E+00	1.71E+05	9.17E+03	5.26E+06	2.52E+01	8.54E+05	1.82E-01	1.01E+04	9.49E+01	2.78E+02
2.35E+00	2.23E+00	7.34E+04	3.97E+03	2.18E+06	1.24E+01	3.67E+05	1.29E-01	4.37E+03	4.37E+01	1.14E+02
2.37E+00	2.35E+00	1.25E+04	6.78E+02	3.68E+05	2.19E+00	6.25E+04	2.55E-02	7.46E+02	7.73E+00	1.94E+01
2.47E+00	2.37E+00	6.41E+04	3.48E+03	1.87E+06	1.16E+01	3.20E+05	3.51E-03	3.83E+03	4.07E+01	9.90E+01
2.73E+00	2.47E+00	1.91E+05	1.07E+04	5.40E+06	3.73E+01	9.56E+05	2.86E-04	1.21E+04	1.31E+02	2.89E+02
3.01E+00	2.73E+00	3.06E+05	1.78E+04	7.97E+06	6.20E+01	1.53E+06	5.55E-08	2.04E+04	2.21E+02	4.25E+02
3.68E+00	3.01E+00	1.02E+06	5.41E+04	2.74E+07	1.37E+02	5.08E+06	1.80E-08	5.81E+04	5.27E+02	9.68E+02
4.97E+00	3.68E+00	1.71E+06	8.60E+04	4.97E+07	1.91E+02	8.56E+06	6.68E-09	8.95E+04	7.58E+02	1.33E+03
6.07E+00	4.97E+00	9.49E+05	4.31E+04	3.01E+07	6.41E+01	4.77E+06	1.64E-09	4.15E+04	2.81E+02	4.90E+02
7.41E+00	6.07E+00	9.49E+05	4.73E+04	3.01E+07	1.33E+02	4.76E+06	2.01E-10	5.06E+04	4.92E+02	8.03E+02
8.61E+00	7.41E+00	7.92E+05	4.00E+04	2.34E+07	1.06E+02	3.97E+06	7.45E-11	4.24E+04	3.98E+02	6.38E+02
1.00E+01	8.61E+00	5.98E+05	2.81E+04	1.95E+07	6.48E+01	3.00E+06	1.46E-11	2.88E+04	2.52E+02	4.03E+02
1.22E+01	1.00E+01	6.75E+04	2.81E+03	2.75E+06	2.22E+00	3.40E+05	4.70E-12	2.48E+03	1.26E+01	2.08E+01
1.42E+01	1.22E+01	2.44E-04	4.36E-04	1.76E+03	9.15E-09	2.48E-01	1.99E-12	5.52E-02	4.33E-06	1.17E-01
1.73E+01	1.42E+01	5.37E-05	8.27E-05	3.65E+02	1.61E-09	4.55E-02	2.69E-13	8.83E-03	7.79E-07	1.98E-02
	Total	7.56E+06	3.83E+05	2.29E+08	9.45E+02	3.79E+07	1.09E+05	4.05E+05	3.63E+03	7.48E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-11. Total Neutron Source (Decay Time = 0 days)

Isotope	Code	0 % Be	10 % Be	30 % Be	50 % Be	70 % Be	90 % Be
Am-241	ORIGEN	1.24E+00	2.55E+06	5.07E+06	6.32E+06	7.06E+06	7.56E+06
	RASTA	1.18E+00	2.55E+06	5.07E+06	6.32E+06	7.07E+06	7.56E+06
Am-243	ORIGEN	6.61E-01	1.30E+05	2.58E+05	3.21E+05	3.58E+05	3.83E+05
	RASTA	3.93E+00	1.30E+05	2.58E+05	3.21E+05	3.58E+05	3.83E+05
Cm-244	ORIGEN	1.10E+07	8.49E+07	1.58E+08	1.94E+08	2.15E+08	2.29E+08
	RASTA	1.08E+07	8.44E+07	1.57E+08	1.93E+08	2.15E+08	2.29E+08
Np-237	ORIGEN	1.12E-04	3.06E+02	6.07E+02	7.55E+02	8.44E+02	9.03E+02
	RASTA	1.14E-04	3.20E+02	6.35E+02	7.91E+02	8.84E+02	9.45E+02
Pu-238	ORIGEN	2.60E+03	1.28E+07	2.54E+07	3.17E+07	3.54E+07	3.79E+07
	RASTA	2.59E+03	1.27E+07	2.54E+07	3.16E+07	3.54E+07	3.79E+07
Pu-239	ORIGEN	1.49E-02	3.70E+04	7.35E+04	9.15E+04	1.02E+05	1.09E+05
	RASTA	2.18E-02	3.70E+04	7.35E+04	9.15E+04	1.02E+05	1.09E+05
Pu-240	ORIGEN	1.04E+03	1.38E+05	2.72E+05	3.38E+05	3.78E+05	4.04E+05
	RASTA	1.03E+03	1.38E+05	2.72E+05	3.39E+05	3.78E+05	4.05E+05
Pu-241	ORIGEN	2.07E-03	1.27E+03	2.51E+03	3.12E+03	3.48E+03	3.72E+03
	RASTA	4.94E-02	1.24E+03	2.45E+03	3.04E+03	3.40E+03	3.63E+03
Pu-242	ORIGEN	1.74E+03	3.73E+03	8.38E+04	6.61E+03	7.17E+03	7.55E+03
	RASTA	1.72E+03	3.68E+03	5.60E+03	6.55E+03	7.11E+03	7.48E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-12. Neutron Source as a Function of Decay Time

Isotope	No Beryllium Decay Time (in days)				90% Beryllium Added Decay Time (in days)			
	0	30	100	30000	0	30	100	30000
Am-241	1.24E+00	1.24E+00	1.24E+00	1.09E+00	7.56E+06	7.56E+06	7.56E+06	6.63E+06
Am-243	6.61E-01	6.61E-01	6.61E-01	6.56E-01	3.83E+05	3.83E+05	3.83E+05	3.80E+05
Cf-252	2.31E+12	2.26E+12	2.15E+12	3.90E+07				
Cm-244	1.10E+07	1.10E+07	1.09E+07	4.77E+05	2.29E+08	2.29E+08	2.27E+08	1.03E+07
Cm-248	4.09E+07	4.09E+07	4.09E+07	4.09E+07				
Np-237	1.12E-04	1.12E-04	1.12E-04	1.12E-04	9.03E+02	9.03E+02	9.03E+02	9.03E+02
Pu-238	2.60E+03	2.60E+03	2.60E+03	1.36E+03	3.79E+07	3.79E+07	3.78E+07	1.98E+07
Pu-239	1.49E-02	1.49E-02	1.49E-02	1.48E-02	1.09E+05	1.09E+05	1.09E+05	1.09E+05
Pu-240	1.04E+03	1.04E+03	1.04E+03	1.03E+03	4.04E+05	4.04E+05	4.04E+05	4.01E+05
Pu-241	2.07E-03	6.96E-03	1.83E-02	1.10E+00	3.72E+03	3.37E+04	1.03E+05	6.72E+06
Pu-242	1.74E+03	1.74E+03	1.74E+03	1.74E+03	7.55E+03	7.55E+03	7.55E+03	7.55E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-13. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ac-227	Am-241	Am-243	Cd-109	Cf-252	Cm-244	Cm-248
0.020	0.010	2.04E+10	4.54E+10	1.95E+09	0.00E+00	1.84E+12	3.65E+11	1.40E+07
0.030	0.020	7.48E+08	8.33E+09	2.51E+05	8.57E+13	1.33E-14	4.19E+01	6.85E-09
0.040	0.030	3.10E+08	1.65E+08	5.06E+06	0.00E+00	7.80E-15	0.00E+00	4.03E-09
0.050	0.040	2.97E+09	9.36E+07	4.29E+08	0.00E+00	2.84E+09	7.07E+08	4.12E+04
0.060	0.050	2.33E+09	4.93E+10	1.07E+06	0.00E+00	3.56E-15	0.00E+00	1.86E-09
0.070	0.060	5.31E+08	2.71E+06	3.35E+05	0.00E+00	4.01E-15	4.14E-27	2.04E-09
0.080	0.070	9.83E+08	2.47E+06	5.02E+09	0.00E+00	2.56E-15	0.00E+00	1.35E-09
0.090	0.080	1.35E+09	1.42E-01	2.55E+07	3.58E+12	2.09E-15	2.41E-14	1.10E-09
0.100	0.090	6.55E+08	2.81E+07	4.71E+06	0.00E+00	1.32E+09	3.62E+07	3.00E-09
0.110	0.100	6.31E+08	2.68E+07	1.20E+07	0.00E+00	1.25E+09	2.84E+06	3.30E-09
0.120	0.110	5.63E+07	1.19E+06	4.56E+07	0.00E+00	4.16E-15	1.20E+06	1.95E-09
0.130	0.120	1.88E+08	6.47E+06	3.28E+05	0.00E+00	1.50E+07	1.69E+05	7.74E-10
0.140	0.130	1.81E+08	6.95E+03	7.28E+03	0.00E+00	8.61E-16	0.00E+00	4.64E-10
0.150	0.140	2.59E+08	6.39E+05	8.70E+06	0.00E+00	1.17E-15	4.14E-28	5.94E-10
0.160	0.150	2.57E+07	4.80E+04	4.50E+03	0.00E+00	1.99E+08	2.92E+07	3.51E-10
0.170	0.160	5.27E+08	3.47E+05	1.14E+05	0.00E+00	1.87E+08	3.38E-02	5.66E-10
0.180	0.170	1.47E+08	2.31E+04	2.82E+03	0.00E+00	5.04E-16	0.00E+00	2.74E-10
0.190	0.180	6.00E+07	2.54E-04	1.99E+04	0.00E+00	1.04E-15	0.00E+00	5.06E-10
0.200	0.190	2.99E+07	3.03E+04	7.37E+04	0.00E+00	1.33E-15	0.00E+00	6.71E-10
0.210	0.200	1.64E+08	1.02E+06	3.83E+05	0.00E+00	7.62E-16	0.00E+00	4.16E-10
0.220	0.210	1.27E+07	2.18E-03	3.62E+05	0.00E+00	6.78E-18	2.48E-03	2.97E-12
0.230	0.220	1.49E+05	5.30E+04	2.54E+06	0.00E+00	1.91E-20	0.00E+00	1.33E-14
0.240	0.230	5.76E+08	6.62E+03	1.25E-09	0.00E+00	2.21E-20	0.00E+00	1.54E-14
0.250	0.240	1.11E+07	4.26E+03	2.96E+01	0.00E+00	1.44E+12	9.48E+06	3.04E+07
0.260	0.250	1.15E+08	4.80E+02	2.60E+04	0.00E+00	1.38E+12	9.40E+06	2.92E+07
0.270	0.260	2.84E+07	4.66E+04	2.07E+03	0.00E+00	2.16E-15	1.60E+06	1.19E-09
0.280	0.270	5.96E+06	9.76E+03	3.17E+06	0.00E+00	3.76E-17	0.00E+00	1.65E-11
0.290	0.280	5.85E+07	6.21E-20	1.72E+05	0.00E+00	5.72E-17	1.43E+04	2.74E-11
0.300	0.290	1.88E+07	2.18E+04	4.29E-09	0.00E+00	3.89E-17	0.00E+00	1.71E-11
0.325	0.300	1.52E+08	2.00E+05	3.52E+05	0.00E+00	2.25E-15	4.82E+05	1.23E-09
0.350	0.325	6.70E+07	8.23E+05	4.45E+05	0.00E+00	7.44E-17	5.14E+04	4.09E-11
0.375	0.350	2.28E+07	3.53E+05	8.53E-08	0.00E+00	4.41E-17	0.00E+00	2.43E-11
0.400	0.375	1.60E+07	2.17E+05	6.64E+02	0.00E+00	6.06E-16	0.00E+00	3.34E-10
0.425	0.400	4.52E+05	4.34E+04	1.37E-07	0.00E+00	4.21E-20	0.00E+00	2.94E-14
0.450	0.425	8.83E+06	3.70E+04	3.65E+03	0.00E+00	4.21E-16	0.00E+00	2.32E-10
0.475	0.450	2.62E+03	2.46E+04	5.81E+02	0.00E+00	6.99E-18	0.00E+00	3.86E-12
0.500	0.475	3.32E+06	1.82E+03	2.94E+03	0.00E+00	2.18E-16	0.00E+00	1.20E-10
0.525	0.500	3.16E+06	5.93E+03	2.26E+01	0.00E+00	1.05E-15	2.37E+05	5.76E-10
0.550	0.525	1.60E+04	1.53E+03	4.89E-11	0.00E+00	1.09E-31	1.27E-05	7.63E-26
0.575	0.550	1.10E+04	2.56E+03	2.08E-11	0.00E+00	2.53E-14	2.33E+06	1.39E-08
0.600	0.575	1.87E+06	1.52E+04	4.61E+00	0.00E+00	1.48E-14	1.49E+06	8.13E-09
0.625	0.600	1.80E+06	7.62E+04	4.42E+00	0.00E+00	9.65E-16	2.19E+05	5.31E-10
0.650	0.625	2.25E+03	1.14E+04	2.19E+04	0.00E+00	1.05E-20	1.13E-03	7.34E-15
0.675	0.650	6.01E+02	5.05E+05	8.86E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.700	0.675	6.42E+05	5.76E+04	5.64E-02	0.00E+00	9.14E-17	3.03E-04	5.03E-11
0.725	0.700	7.66E+06	2.60E+05	5.45E-02	0.00E+00	8.82E-17	0.00E+00	4.85E-11
0.750	0.725	3.28E+06	1.31E+04	1.51E+01	0.00E+00	1.45E+12	9.51E+06	3.05E+07

Table 3-13. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ac-227	Am-241	Am-243	Cd-109	Cf-252	Cm-244	Cm-248
0.775	0.750	3.81E+07	2.81E+04	1.46E+01	0.00E+00	1.40E+12	9.58E+06	2.95E+07
0.800	0.775	3.46E+07	3.07E+03	2.72E-11	0.00E+00	2.76E-16	0.00E+00	1.52E-10
0.825	0.800	1.22E+07	3.66E+03	2.82E-11	0.00E+00	1.86E-15	1.92E+06	1.02E-09
0.850	0.825	1.45E+07	9.65E+02	3.26E-11	0.00E+00	1.95E-16	0.00E+00	1.07E-10
0.875	0.850	9.27E+05	2.09E+03	0.00E+00	0.00E+00	6.10E-16	1.61E+05	3.36E-10
0.900	0.875	8.85E+06	3.69E+02	1.17E-11	0.00E+00	2.30E-16	6.96E+04	1.27E-10
0.925	0.900	1.90E+06	9.37E+02	2.55E-12	0.00E+00	1.56E-15	1.77E+04	8.57E-10
0.950	0.925	8.72E+02	1.41E+02	5.39E-12	0.00E+00	1.79E-15	0.00E+00	9.84E-10
0.975	0.950	1.09E+03	7.31E+02	7.76E-12	0.00E+00	1.70E-16	0.00E+00	9.37E-11
1.000	0.975	5.12E+03	2.39E-22	8.21E-12	0.00E+00	1.41E-16	0.00E+00	7.74E-11
1.250	1.000	5.52E+03	2.10E+02	8.24E+00	0.00E+00	6.74E+11	4.43E+06	1.42E+07
1.500	1.250	6.80E+01	1.12E+02	6.74E+00	0.00E+00	5.51E+11	3.63E+06	1.16E+07
1.750	1.500	1.98E+01	6.66E+01	4.00E+00	0.00E+00	3.13E+11	2.06E+06	6.61E+06
2.000	1.750	1.72E+01	5.77E+01	3.47E+00	0.00E+00	2.71E+11	1.78E+06	5.73E+06
2.250	2.000	9.78E+00	3.29E+01	1.98E+00	0.00E+00	1.78E+11	1.17E+06	3.77E+06
2.500	2.250	8.75E+00	2.94E+01	1.77E+00	0.00E+00	1.60E+11	1.05E+06	3.37E+06
2.750	2.500	4.85E+00	1.63E+01	9.90E-01	0.00E+00	1.02E+11	6.73E+05	2.16E+06
3.000	2.750	4.43E+00	1.49E+01	9.04E-01	0.00E+00	9.34E+10	6.15E+05	1.97E+06
3.500	3.000	4.65E+00	1.56E+01	9.55E-01	0.00E+00	1.13E+11	7.45E+05	2.39E+06
4.000	3.500	2.33E+00	7.85E+00	4.83E-01	0.00E+00	6.57E+10	4.32E+05	1.39E+06
4.500	4.000	1.17E+00	3.94E+00	2.45E-01	0.00E+00	3.81E+10	2.51E+05	8.04E+05
5.000	4.500	5.86E-01	1.98E+00	1.24E-01	0.00E+00	2.21E+10	1.45E+05	4.66E+05
5.500	5.000	2.94E-01	9.94E-01	6.30E-02	0.00E+00	1.28E+10	8.42E+04	2.70E+05
6.000	5.500	1.48E-01	4.99E-01	3.20E-02	0.00E+00	7.43E+09	4.88E+04	1.57E+05
6.500	6.000	7.40E-02	2.51E-01	1.63E-02	0.00E+00	4.31E+09	2.83E+04	9.09E+04
7.000	6.500	3.71E-02	1.26E-01	8.34E-03	0.00E+00	2.50E+09	1.64E+04	5.27E+04
7.500	7.000	1.86E-02	6.34E-02	4.27E-03	0.00E+00	1.45E+09	9.52E+03	3.06E+04
8.000	7.500	9.34E-03	3.19E-02	2.19E-03	0.00E+00	8.39E+08	5.52E+03	1.77E+04
9.000	8.000	6.96E-03	2.39E-02	1.70E-03	0.00E+00	7.63E+08	5.02E+03	1.61E+04
10.000	9.000	1.75E-03	6.07E-03	4.56E-04	0.00E+00	2.57E+08	1.69E+03	5.42E+03
	Total	3.38E+10	1.03E+11	7.51E+09	8.93E+13	1.01E+13	3.66E+11	1.89E+08

Table 3-14. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Co-60	Cs-137	Eu-152	Fe-59	Gd-153	Hf-181	Ho-166m
0.020	0.010	7.62E+11	1.12E+11	3.27E+10	4.19E+13	2.23E+10	1.47E+13	1.02E+08
0.030	0.020	3.66E+11	5.71E+10	1.74E+10	2.06E+13	0.00E+00	7.26E+12	2.67E+07
0.040	0.030	1.97E+11	2.37E+11	2.98E+12	1.14E+13	0.00E+00	4.01E+12	7.36E+06
0.050	0.040	1.45E+11	2.56E+10	2.14E+12	8.65E+12	1.52E+14	3.04E+12	2.25E+10
0.060	0.050	7.49E+10	1.40E+10	5.97E+09	4.59E+12	3.89E+10	1.64E+14	5.48E+09
0.070	0.060	6.42E+10	1.26E+10	4.43E+09	4.04E+12	3.57E+12	4.34E+13	9.17E+04
0.080	0.070	4.46E+10	9.42E+09	3.45E+09	2.91E+12	1.03E+11	1.01E+12	4.75E+06
0.090	0.080	3.16E+10	7.22E+09	2.76E+09	2.15E+12	3.67E+11	7.45E+11	8.09E+09
0.100	0.090	2.78E+10	6.96E+09	2.78E+09	1.99E+12	4.05E+13	6.85E+11	1.09E+08
0.110	0.100	1.37E+10	3.58E+09	1.46E+09	1.00E+12	2.75E+13	3.45E+11	0.00E+00
0.120	0.110	1.25E+10	3.74E+09	1.63E+09	9.89E+11	0.00E+00	3.36E+11	1.17E+08
0.130	0.120	1.15E+10	3.44E+09	1.81E+12	9.09E+11	0.00E+00	3.09E+11	1.79E+08
0.140	0.130	6.63E+09	2.46E+09	1.18E+09	5.99E+11	0.00E+00	3.12E+14	6.56E+07
0.150	0.140	6.18E+09	2.29E+09	3.74E+09	1.90E+13	0.00E+00	1.85E+11	2.73E+07
0.160	0.150	3.51E+09	1.67E+09	8.78E+08	3.72E+11	0.00E+00	1.19E+11	3.15E+07
0.170	0.160	3.30E+09	1.57E+09	8.25E+08	3.49E+11	0.00E+00	1.12E+11	9.62E+07
0.180	0.170	1.82E+09	1.15E+09	6.99E+08	2.34E+11	3.90E+10	7.14E+10	9.44E+06
0.190	0.180	1.72E+09	1.09E+09	6.36E+08	4.66E+11	0.00E+00	6.75E+10	4.83E+10
0.200	0.190	1.83E+09	1.62E+09	1.49E+09	5.62E+13	0.00E+00	8.51E+10	1.47E+08
0.210	0.200	1.74E+09	1.54E+09	1.82E+09	2.84E+11	0.00E+00	8.09E+10	0.00E+00
0.220	0.210	0.00E+00	0.00E+00	1.27E+09	0.00E+00	0.00E+00	0.00E+00	2.04E+09
0.230	0.220	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	0.00E+00	0.00E+00	8.96E+08	0.00E+00	0.00E+00	0.00E+00	1.41E+08
0.250	0.240	0.00E+00	0.00E+00	4.90E+11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.260	0.250	6.29E+08	1.23E+09	5.03E+09	1.85E+11	0.00E+00	4.25E+10	3.70E+08
0.270	0.260	6.05E+08	1.19E+09	1.23E+09	1.78E+11	0.00E+00	4.09E+10	3.56E+08
0.280	0.270	0.00E+00	0.00E+00	7.15E+09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.290	0.280	0.00E+00	0.00E+00	7.24E+08	0.00E+00	0.00E+00	0.00E+00	1.96E+10
0.300	0.290	0.00E+00	0.00E+00	2.88E+10	0.00E+00	0.00E+00	0.00E+00	1.27E+09
0.325	0.300	2.58E+08	9.67E+08	7.24E+09	9.82E+10	0.00E+00	1.18E+10	1.20E+09
0.350	0.325	3.27E+09	0.00E+00	1.78E+12	4.93E+12	0.00E+00	9.76E+13	1.07E+08
0.375	0.350	0.00E+00	0.00E+00	5.78E+10	0.00E+00	0.00E+00	0.00E+00	1.66E+09
0.400	0.375	1.55E+08	3.97E+08	1.27E+09	3.51E+11	0.00E+00	4.97E+08	0.00E+00
0.425	0.400	0.00E+00	0.00E+00	1.53E+11	0.00E+00	0.00E+00	0.00E+00	7.55E+09
0.450	0.425	1.04E+08	2.01E+08	2.08E+11	9.96E+09	0.00E+00	0.00E+00	0.00E+00
0.475	0.450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E+09
0.500	0.475	4.73E+07	7.68E+07	3.18E+10	4.31E+09	0.00E+00	5.06E+14	8.89E+07
0.525	0.500	4.50E+07	7.30E+07	1.79E+10	4.10E+09	0.00E+00	0.00E+00	1.08E+08
0.550	0.525	0.00E+00	0.00E+00	4.42E+09	0.00E+00	0.00E+00	0.00E+00	6.40E+09
0.575	0.550	0.00E+00	0.00E+00	4.26E+10	0.00E+00	0.00E+00	0.00E+00	3.74E+09
0.600	0.575	3.53E+07	4.75E+07	3.01E+10	3.19E+09	0.00E+00	0.00E+00	3.87E+08
0.625	0.600	3.39E+07	4.56E+07	7.00E+08	3.06E+09	0.00E+00	1.64E+12	9.34E+08
0.650	0.625	0.00E+00	0.00E+00	3.85E+08	0.00E+00	0.00E+00	0.00E+00	1.57E+08
0.675	0.650	0.00E+00	2.68E+12	1.82E+10	0.00E+00	0.00E+00	0.00E+00	3.70E+09
0.700	0.675	1.89E+07	1.90E+07	9.33E+10	1.69E+09	0.00E+00	0.00E+00	9.11E+08
0.725	0.700	1.82E+07	1.83E+07	2.81E+10	1.63E+09	0.00E+00	0.00E+00	3.68E+10
0.750	0.725	0.00E+00	0.00E+00	1.11E+09	0.00E+00	0.00E+00	0.00E+00	2.47E+08

Table 3-14. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Co-60	Cs-137	Eu-152	Fe-59	Gd-153	Hf-181	Ho-166m
0.775	0.750	0.00E+00	0.00E+00	1.77E+10	0.00E+00	0.00E+00	0.00E+00	8.08E+09
0.800	0.775	1.00E+07	6.86E+06	8.39E+11	8.86E+08	0.00E+00	0.00E+00	2.03E+09
0.825	0.800	9.71E+06	6.65E+06	2.15E+10	8.59E+08	0.00E+00	0.00E+00	3.86E+10
0.850	0.825	3.14E+09	0.00E+00	1.18E+10	0.00E+00	0.00E+00	0.00E+00	6.49E+09
0.875	0.850	0.00E+00	0.00E+00	2.77E+11	0.00E+00	0.00E+00	0.00E+00	2.46E+08
0.900	0.875	5.16E+06	2.06E+06	1.35E+07	4.53E+08	0.00E+00	0.00E+00	2.39E+08
0.925	0.900	5.02E+06	2.00E+06	3.56E+10	4.40E+08	0.00E+00	0.00E+00	0.00E+00
0.950	0.925	0.00E+00	0.00E+00	2.20E+10	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.975	0.950	0.00E+00	0.00E+00	9.59E+11	0.00E+00	0.00E+00	0.00E+00	1.82E+09
1.000	0.975	2.50E+06	4.30E+05	2.36E+10	2.20E+08	0.00E+00	0.00E+00	0.00E+00
1.250	1.000	4.36E+13	4.54E+05	1.76E+12	1.02E+15	0.00E+00	0.00E+00	9.52E+08
1.500	1.250	4.05E+13	0.00E+00	1.55E+12	7.48E+14	0.00E+00	0.00E+00	8.11E+08
1.750	1.500	5.61E+01	0.00E+00	1.75E+10	2.07E+05	0.00E+00	0.00E+00	0.00E+00
2.000	1.750	0.00E+00	0.00E+00	5.40E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.250	2.000	4.72E+08	0.00E+00	8.26E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.500	2.250	4.41E+05	0.00E+00	7.39E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.750	2.500	3.99E+05	0.00E+00	4.10E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.000	2.750	0.00E+00	0.00E+00	3.74E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.500	3.000	0.00E+00	0.00E+00	3.92E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.000	3.500	0.00E+00	0.00E+00	1.97E-17	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.500	4.000	0.00E+00	0.00E+00	9.87E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.000	4.500	0.00E+00	0.00E+00	4.95E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.500	5.000	0.00E+00	0.00E+00	2.48E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.000	5.500	0.00E+00	0.00E+00	1.25E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.500	6.000	0.00E+00	0.00E+00	6.25E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.000	6.500	0.00E+00	0.00E+00	3.13E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.500	7.000	0.00E+00	0.00E+00	1.57E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.000	7.500	0.00E+00	0.00E+00	7.89E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.000	8.000	0.00E+00	0.00E+00	5.88E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.000	9.000	0.00E+00	0.00E+00	1.48E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	8.59E+13	3.19E+12	1.56E+13	1.95E+15	2.24E+14	1.16E+15	2.35E+11

Table 3-15. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ir-192	Mn-54	Np-237	Pb-210	Pm-147	Po-210	Pu-238
0.020	0.010	1.14E+13	0.00E+00	1.66E+07	5.97E+11	3.72E+11	5.05E+06	7.31E+10
0.030	0.020	5.83E+12	0.00E+00	4.69E+06	3.38E+08	1.67E+11	0.00E+00	3.53E+09
0.040	0.030	3.33E+12	0.00E+00	1.98E+01	1.39E+08	8.45E+10	0.00E+00	4.80E-24
0.050	0.040	2.63E+12	0.00E+00	2.86E+04	1.18E+11	5.71E+10	0.00E+00	2.42E+08
0.060	0.050	1.44E+12	0.00E+00	1.03E+05	4.88E+07	2.73E+10	0.00E+00	5.82E-02
0.070	0.060	1.21E+13	0.00E+00	4.59E+03	4.52E+07	2.18E+10	0.00E+00	2.15E+02
0.080	0.070	3.89E+12	0.00E+00	5.89E+03	3.53E+07	1.37E+10	1.07E+07	5.12E-23
0.090	0.080	7.53E+11	0.00E+00	3.30E+06	2.83E+07	8.72E+09	3.02E+06	6.68E-04
0.100	0.090	7.29E+11	0.00E+00	1.43E+06	2.87E+07	6.70E+09	0.00E+00	2.55E+07
0.110	0.100	3.75E+11	0.00E+00	3.09E+05	1.51E+07	3.12E+09	0.00E+00	2.21E+07
0.120	0.110	3.95E+11	0.00E+00	1.36E+05	1.69E+07	2.26E+09	0.00E+00	2.81E+05
0.130	0.120	3.63E+11	0.00E+00	1.03E+00	1.56E+07	3.03E+09	0.00E+00	1.62E-02
0.140	0.130	2.62E+11	0.00E+00	4.09E+04	1.23E+07	8.24E+08	0.00E+00	6.52E-25
0.150	0.140	2.44E+11	0.00E+00	1.12E+05	1.14E+07	7.67E+08	0.00E+00	6.13E+01
0.160	0.150	1.79E+11	0.00E+00	8.50E+04	9.20E+06	2.59E+08	0.00E+00	5.85E+06
0.170	0.160	1.68E+11	0.00E+00	2.72E+04	8.64E+06	2.43E+08	0.00E+00	3.29E-25
0.180	0.170	1.24E+11	0.00E+00	9.81E+03	7.05E+06	6.20E+07	0.00E+00	3.16E+01
0.190	0.180	1.18E+11	0.00E+00	5.89E+03	6.67E+06	5.87E+07	0.00E+00	5.43E-13
0.200	0.190	1.75E+11	0.00E+00	7.31E+04	1.10E+07	1.50E+07	0.00E+00	5.34E-25
0.210	0.200	1.32E+13	0.00E+00	1.73E+04	1.05E+07	1.41E+07	0.00E+00	2.56E+04
0.220	0.210	0.00E+00	0.00E+00	5.06E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.230	0.220	0.00E+00	0.00E+00	2.38E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	0.00E+00	0.00E+00	1.74E+04	0.00E+00	0.00E+00	0.00E+00	6.36E+01
0.250	0.240	0.00E+00	0.00E+00	1.33E+03	6.15E-04	2.41E-11	6.52E+05	5.31E+03
0.260	0.250	1.34E+11	0.00E+00	1.68E+03	1.05E+07	2.32E-11	6.27E+05	5.81E+03
0.270	0.260	1.29E+11	0.00E+00	1.76E+03	1.01E+07	0.00E+00	0.00E+00	1.18E-21
0.280	0.270	0.00E+00	0.00E+00	5.52E+02	0.00E+00	0.00E+00	0.00E+00	9.48E-25
0.290	0.280	9.01E+11	0.00E+00	4.31E-12	0.00E+00	0.00E+00	0.00E+00	2.25E-26
0.300	0.290	0.00E+00	0.00E+00	2.28E+02	0.00E+00	0.00E+00	0.00E+00	4.50E+02
0.325	0.300	9.89E+10	0.00E+00	2.80E+03	1.14E+07	0.00E+00	0.00E+00	6.80E-25
0.350	0.325	0.00E+00	0.00E+00	3.04E+02	0.00E+00	0.00E+00	0.00E+00	7.70E-26
0.375	0.350	1.28E+12	0.00E+00	2.36E+01	0.00E+00	0.00E+00	0.00E+00	1.01E-22
0.400	0.375	1.23E+12	0.00E+00	1.19E+02	6.19E+06	0.00E+00	0.00E+00	3.52E-25
0.425	0.400	0.00E+00	0.00E+00	1.17E+02	0.00E+00	0.00E+00	0.00E+00	7.35E-23
0.450	0.425	1.11E+10	0.00E+00	9.50E-03	3.69E+06	0.00E+00	0.00E+00	2.39E-23
0.475	0.450	0.00E+00	0.00E+00	1.13E-13	0.00E+00	0.00E+00	0.00E+00	1.20E-05
0.500	0.475	1.23E+13	0.00E+00	8.27E-04	1.47E+06	0.00E+00	0.00E+00	2.24E-24
0.525	0.500	1.99E+09	0.00E+00	7.86E-04	1.40E+06	0.00E+00	0.00E+00	7.74E-06
0.550	0.525	0.00E+00	0.00E+00	3.06E-14	0.00E+00	0.00E+00	0.00E+00	6.49E-25
0.575	0.550	0.00E+00	0.00E+00	1.54E-14	0.00E+00	0.00E+00	0.00E+00	2.41E-16
0.600	0.575	2.88E+08	0.00E+00	4.92E-07	8.97E+05	0.00E+00	0.00E+00	5.82E-06
0.625	0.600	2.76E+08	0.00E+00	4.72E-07	8.60E+05	0.00E+00	0.00E+00	2.05E-07
0.650	0.625	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-07
0.675	0.650	0.00E+00	0.00E+00	1.19E-14	0.00E+00	0.00E+00	0.00E+00	3.24E-25
0.700	0.675	7.48E+04	0.00E+00	0.00E+00	3.49E+05	0.00E+00	0.00E+00	4.82E-07
0.725	0.700	1.78E+10	0.00E+00	1.11E-14	3.37E+05	0.00E+00	0.00E+00	3.27E+03
0.750	0.725	0.00E+00	0.00E+00	5.12E-02	3.07E-04	1.21E-11	3.26E+05	5.26E+04

Table 3-15. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ir-192	Mn-54	Np-237	Pb-210	Pm-147	Po-210	Pu-238
0.775	0.750	0.00E+00	0.00E+00	4.95E-02	2.97E-04	1.17E-11	3.15E+05	2.14E+05
0.800	0.775	0.00E+00	0.00E+00	0.00E+00	1.22E+05	0.00E+00	0.00E+00	3.06E+04
0.825	0.800	0.00E+00	0.00E+00	0.00E+00	1.18E+05	0.00E+00	1.74E+09	8.07E+03
0.850	0.825	0.00E+00	2.86E+14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-24
0.875	0.850	0.00E+00	0.00E+00	8.43E-15	0.00E+00	0.00E+00	0.00E+00	1.19E+04
0.900	0.875	0.00E+00	0.00E+00	0.00E+00	3.49E+04	0.00E+00	0.00E+00	8.38E+03
0.925	0.900	0.00E+00	0.00E+00	0.00E+00	3.39E+04	0.00E+00	0.00E+00	6.28E+02
0.950	0.925	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E+04
0.975	0.950	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.71E-26
1.000	0.975	0.00E+00	0.00E+00	1.66E-14	6.76E+03	0.00E+00	0.00E+00	5.00E+03
1.250	1.000	0.00E+00	0.00E+00	2.80E-02	6.92E+03	6.60E-12	1.79E+05	8.27E+03
1.500	1.250	0.00E+00	0.00E+00	2.29E-02	1.38E-04	5.40E-12	1.46E+05	1.64E+03
1.750	1.500	0.00E+00	0.00E+00	1.36E-02	8.19E-05	3.21E-12	8.69E+04	9.45E+02
2.000	1.750	0.00E+00	0.00E+00	1.18E-02	7.09E-05	2.78E-12	7.53E+04	8.19E+02
2.250	2.000	0.00E+00	0.00E+00	6.72E-03	4.04E-05	1.58E-12	4.28E+04	5.13E+02
2.500	2.250	0.00E+00	0.00E+00	6.02E-03	3.61E-05	1.42E-12	3.83E+04	4.59E+02
2.750	2.500	0.00E+00	0.00E+00	3.34E-03	2.00E-05	7.86E-13	2.13E+04	2.82E+02
3.000	2.750	0.00E+00	0.00E+00	3.05E-03	1.83E-05	7.17E-13	1.94E+04	2.57E+02
3.500	3.000	0.00E+00	0.00E+00	3.20E-03	1.92E-05	7.52E-13	2.04E+04	3.00E+02
4.000	3.500	0.00E+00	0.00E+00	1.60E-03	9.62E-06	3.77E-13	1.02E+04	1.68E+02
4.500	4.000	0.00E+00	0.00E+00	8.04E-04	4.83E-06	1.89E-13	5.12E+03	9.43E+01
5.000	4.500	0.00E+00	0.00E+00	4.03E-04	2.42E-06	9.49E-14	2.57E+03	5.31E+01
5.500	5.000	0.00E+00	0.00E+00	2.02E-04	1.21E-06	4.76E-14	1.29E+03	3.00E+01
6.000	5.500	0.00E+00	0.00E+00	1.01E-04	6.09E-07	2.39E-14	6.46E+02	1.70E+01
6.500	6.000	0.00E+00	0.00E+00	5.09E-05	3.05E-07	1.20E-14	3.24E+02	9.68E+00
7.000	6.500	0.00E+00	0.00E+00	2.55E-05	1.53E-07	6.01E-15	1.63E+02	5.52E+00
7.500	7.000	0.00E+00	0.00E+00	1.28E-05	7.68E-08	3.01E-15	8.16E+01	3.15E+00
8.000	7.500	0.00E+00	0.00E+00	6.42E-06	3.85E-08	1.51E-15	4.09E+01	1.80E+00
9.000	8.000	0.00E+00	0.00E+00	4.79E-06	2.87E-08	1.13E-15	3.05E+01	1.61E+00
10.000	9.000	0.00E+00	0.00E+00	1.21E-06	7.24E-09	2.84E-16	7.68E+00	5.33E-01
	Total	7.38E+13	2.86E+14	2.71E+07	7.16E+11	7.69E+11	1.76E+09	7.69E+10

Table 3-16. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Pu-239	Pu-240	Pu-241	Pu-242	Ra-226	Ru-106	Sc-46
0.020	0.010	1.05E+08	8.38E+08	1.41E+08	1.24E+07	3.01E+08	3.77E+13	2.69E+13
0.030	0.020	4.91E+06	4.07E+07	2.19E+04	6.37E+05	2.11E+05	2.13E+13	1.32E+13
0.040	0.030	2.68E+05	8.07E-28	5.94E+02	5.49E-12	1.24E+05	1.31E+13	7.22E+12
0.050	0.040	2.70E+04	3.77E+06	1.90E+05	5.45E+04	1.01E+05	1.13E+13	5.41E+12
0.060	0.050	6.15E+05	5.19E-28	2.38E+05	2.67E-12	1.24E+05	6.60E+12	2.84E+12
0.070	0.060	1.49E+04	1.20E-20	1.30E+03	6.44E-12	5.24E+04	6.35E+12	2.47E+12
0.080	0.070	1.40E+04	2.86E-28	9.18E+05	2.03E-12	1.15E+06	5.15E+12	1.75E+12
0.090	0.080	7.26E+02	4.68E-08	2.96E+01	4.04E-12	1.82E+08	4.28E+12	1.27E+12
0.100	0.090	1.57E+05	1.42E+04	3.28E+07	7.26E+01	5.35E+07	4.51E+12	1.14E+12
0.110	0.100	5.18E+03	5.95E+05	3.88E+06	3.68E+03	1.68E+04	2.40E+12	5.72E+11
0.120	0.110	6.03E+04	3.61E+03	9.24E+06	1.99E+01	1.85E+04	2.84E+12	5.40E+11
0.130	0.120	1.53E+05	7.92E-28	2.56E+04	9.75E-13	1.71E+04	2.61E+12	4.97E+11
0.140	0.130	7.76E-09	1.11E-28	3.49E+00	8.05E-13	1.70E+04	2.20E+12	3.05E+11
0.150	0.140	1.05E+04	1.21E-21	7.29E+06	7.50E-13	1.47E+04	2.05E+12	2.84E+11
0.160	0.150	9.70E+01	2.69E-28	1.30E+05	4.50E+02	9.70E+03	1.77E+12	1.73E+11
0.170	0.160	2.90E+03	3.28E+04	1.24E+05	5.93E-13	9.12E+03	1.66E+12	1.62E+11
0.180	0.170	4.10E+03	6.79E-29	4.47E-01	5.08E-13	7.32E+03	1.45E+12	9.66E+10
0.190	0.180	2.25E+03	7.42E-29	3.94E-01	4.92E-13	1.29E+09	1.37E+12	9.14E+10
0.200	0.190	2.75E+03	2.13E-28	2.46E-01	8.33E-13	1.44E+04	2.43E+12	1.05E+11
0.210	0.200	1.30E+04	1.17E-27	2.06E+04	7.93E-13	1.07E+04	2.31E+12	1.00E+11
0.220	0.210	2.79E+01	2.41E+03	2.25E-09	4.03E-16	0.00E+00	0.00E+00	0.00E+00
0.230	0.220	3.47E+02	1.47E-29	1.90E+01	9.78E-17	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	3.35E+02	6.64E-30	1.92E+01	2.87E-17	0.00E+00	0.00E+00	0.00E+00
0.250	0.240	1.04E+03	1.16E+03	3.65E-01	1.89E+03	4.63E+05	0.00E+00	0.00E+00
0.260	0.250	1.85E+03	1.11E+03	3.46E-01	1.81E+03	4.57E+04	2.65E+12	4.09E+10
0.270	0.260	6.43E+02	5.60E-28	6.92E+02	8.40E-13	1.78E+06	2.55E+12	3.93E+10
0.280	0.270	2.00E-07	4.98E-28	1.29E-02	2.08E-16	2.18E+04	0.00E+00	0.00E+00
0.290	0.280	9.12E+01	1.67E-29	3.20E-26	2.13E-18	9.12E+02	0.00E+00	0.00E+00
0.300	0.290	1.15E+03	0.00E+00	2.36E+00	4.40E-16	1.21E+06	0.00E+00	0.00E+00
0.325	0.300	3.81E+03	1.68E-28	5.14E-01	1.11E-12	1.85E+04	3.57E+12	5.06E+09
0.350	0.325	2.83E+04	3.97E-27	1.22E+03	7.15E-16	2.64E+03	6.54E+09	0.00E+00
0.375	0.350	2.29E+04	6.45E-30	1.46E+02	9.64E-16	2.26E+06	0.00E+00	0.00E+00
0.400	0.375	4.30E+04	8.35E-29	2.87E-01	7.15E-13	1.29E+04	2.43E+12	1.70E+08
0.425	0.400	3.69E+04	5.21E-28	5.74E-02	4.20E-18	1.12E+05	0.00E+00	0.00E+00
0.450	0.425	8.67E+02	8.59E-29	4.89E-02	5.11E-13	4.07E+04	1.97E+12	1.12E+08
0.475	0.450	4.34E+03	1.21E-27	3.25E-02	6.19E-15	4.90E+04	0.00E+00	0.00E+00
0.500	0.475	1.32E+02	9.36E-29	2.41E-03	2.50E-13	5.09E+04	9.54E+11	4.99E+07
0.525	0.500	2.50E-10	2.48E-28	7.85E-03	2.39E-13	5.39E+04	2.59E+13	4.75E+07
0.550	0.525	1.31E+01	1.24E+01	2.02E-03	2.38E-15	1.52E+04	0.00E+00	0.00E+00
0.575	0.550	5.58E+00	3.29E-28	3.38E-03	1.16E-15	6.76E+02	0.00E+00	0.00E+00
0.600	0.575	6.17E+01	4.26E-29	2.01E-02	2.05E-13	1.16E+05	8.63E+11	3.61E+07
0.625	0.600	1.41E+02	6.54E-29	1.01E-01	1.97E-13	4.63E+05	1.41E+13	3.46E+07
0.650	0.625	6.87E+02	1.10E+03	1.50E-02	2.14E-15	1.40E+03	0.00E+00	0.00E+00
0.675	0.650	4.84E+02	7.62E-29	6.68E-01	1.56E-15	1.31E+04	0.00E+00	0.00E+00
0.700	0.675	4.66E+01	2.94E+02	7.62E-02	1.33E-13	1.85E+03	6.05E+11	1.83E+07
0.725	0.700	1.71E+02	9.97E-29	3.44E-01	1.30E-13	8.86E+03	5.85E+11	1.77E+07
0.750	0.725	1.08E+01	1.14E+03	1.97E-01	1.89E+03	9.02E+02	0.00E+00	0.00E+00

Table 3-16. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Pu-239	Pu-240	Pu-241	Pu-242	Ra-226	Ru-106	Sc-46
0.775	0.750	3.66E+02	1.11E+03	2.11E-01	1.83E+03	4.62E+04	1.31E+09	0.00E+00
0.800	0.775	7.31E+00	1.30E-27	4.05E-03	1.15E-13	7.18E+04	4.14E+11	9.18E+06
0.825	0.800	7.58E+00	2.05E-29	4.84E-03	8.30E-14	1.22E+04	4.01E+11	8.90E+06
0.850	0.825	8.75E+00	8.43E-28	1.28E-03	3.42E-15	3.80E+04	0.00E+00	0.00E+00
0.875	0.850	3.32E-33	4.94E+01	2.77E-03	4.56E-15	0.00E+00	5.45E+11	0.00E+00
0.900	0.875	3.14E+00	2.11E-29	4.88E-04	6.06E-14	3.45E+02	2.99E+11	1.26E+15
0.925	0.900	6.86E-01	7.24E-27	1.24E-03	5.71E-14	1.37E+03	2.91E+11	4.29E+06
0.950	0.925	1.45E+00	6.11E-29	1.86E-04	1.05E-14	2.58E+04	7.04E+08	0.00E+00
0.975	0.950	2.08E+00	5.73E-27	9.67E-04	5.41E-16	3.12E+03	0.00E+00	0.00E+00
1.000	0.975	2.20E+00	7.01E-29	1.23E-28	3.03E-13	5.14E+02	2.20E+11	1.96E+06
1.250	1.000	3.92E+00	5.35E+02	9.86E-02	8.82E+02	2.05E+05	3.22E+12	1.25E+15
1.500	1.250	2.03E+00	4.38E+02	8.06E-02	7.22E+02	8.56E+04	4.09E+11	1.19E+05
1.750	1.500	1.21E+00	2.48E+02	4.79E-02	4.10E+02	7.18E+04	4.04E+11	4.77E+00
2.000	1.750	1.04E+00	2.15E+02	4.15E-02	3.55E+02	1.47E+05	2.41E+11	0.00E+00
2.250	2.000	5.95E-01	1.41E+02	2.36E-02	2.34E+02	5.50E+04	7.92E+10	1.54E+08
2.500	2.250	5.32E-01	1.26E+02	2.11E-02	2.09E+02	1.64E+04	1.23E+11	0.00E+00
2.750	2.500	2.95E-01	8.09E+01	1.17E-02	1.34E+02	3.53E+02	1.45E+10	0.00E+00
3.000	2.750	2.70E-01	7.39E+01	1.07E-02	1.22E+02	7.34E+02	1.23E+10	0.00E+00
3.500	3.000	2.83E-01	8.94E+01	1.12E-02	1.48E+02	2.81E+02	2.71E+09	0.00E+00
4.000	3.500	1.42E-01	5.18E+01	5.63E-03	8.60E+01	2.25E+00	1.63E+06	0.00E+00
4.500	4.000	7.14E-02	3.00E+01	2.82E-03	4.99E+01	1.13E+00	0.00E+00	0.00E+00
5.000	4.500	3.59E-02	1.74E+01	1.42E-03	2.89E+01	5.67E-01	0.00E+00	0.00E+00
5.500	5.000	1.80E-02	1.01E+01	7.10E-04	1.68E+01	2.85E-01	0.00E+00	0.00E+00
6.000	5.500	9.05E-03	5.83E+00	3.56E-04	9.72E+00	1.43E-01	0.00E+00	0.00E+00
6.500	6.000	4.55E-03	3.38E+00	1.79E-04	5.64E+00	7.16E-02	0.00E+00	0.00E+00
7.000	6.500	2.29E-03	1.96E+00	8.96E-05	3.27E+00	3.59E-02	0.00E+00	0.00E+00
7.500	7.000	1.15E-03	1.13E+00	4.50E-05	1.89E+00	1.80E-02	0.00E+00	0.00E+00
8.000	7.500	5.79E-04	6.57E-01	2.25E-05	1.10E+00	9.03E-03	0.00E+00	0.00E+00
9.000	8.000	4.34E-04	5.97E-01	1.68E-05	9.99E-01	6.74E-03	0.00E+00	0.00E+00
10.000	9.000	1.10E-04	2.01E-01	4.23E-06	3.36E-01	1.70E-03	0.00E+00	0.00E+00
	Total	1.11E+08	8.83E+08	1.96E+08	1.31E+07	1.84E+09	1.96E+14	2.58E+15

Table 3-17. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Se-75	Sm-145	Sr-90	Tm-170	Yb-169	Zn-65	Zr-95
0.020	0.010	2.15E+14	0.00E+00	2.13E+11	1.47E+13	0.00E+00	5.34E+11	1.88E+13
0.030	0.020	1.72E+11	0.00E+00	1.10E+11	7.80E+12	1.41E+12	2.91E+11	8.81E+12
0.040	0.030	0.00E+00	1.22E+14	6.30E+10	4.60E+12	0.00E+00	1.76E+11	4.85E+12
0.050	0.040	0.00E+00	2.68E+13	4.99E+10	3.95E+12	2.62E+14	1.47E+11	3.66E+12
0.060	0.050	0.00E+00	0.00E+00	2.74E+10	2.16E+12	1.35E+15	8.44E+10	1.93E+12
0.070	0.060	6.23E+12	1.17E+13	2.49E+10	1.96E+12	3.83E+14	7.98E+10	1.69E+12
0.080	0.070	0.00E+00	2.38E+06	1.88E+10	1.52E+12	0.00E+00	6.32E+10	1.21E+12
0.090	0.080	3.63E+10	0.00E+00	1.45E+10	1.21E+12	1.28E+10	5.14E+10	8.85E+11
0.100	0.090	1.91E+13	0.00E+00	1.41E+10	1.21E+12	2.29E+13	5.29E+10	8.09E+11
0.110	0.100	0.00E+00	0.00E+00	7.25E+09	6.32E+11	8.16E+13	2.78E+10	4.06E+11
0.120	0.110	0.00E+00	0.00E+00	7.65E+09	7.00E+11	9.20E+13	3.19E+10	3.92E+11
0.130	0.120	9.02E+13	0.00E+00	7.04E+09	6.44E+11	1.33E+12	2.93E+10	3.61E+11
0.140	0.130	3.20E+14	0.00E+00	5.10E+09	4.98E+11	9.88E+13	2.37E+10	2.29E+11
0.150	0.140	0.00E+00	0.00E+00	4.74E+09	4.64E+11	0.00E+00	2.21E+10	2.14E+11
0.160	0.150	0.00E+00	0.00E+00	3.48E+09	3.66E+11	9.01E+10	1.82E+10	1.36E+11
0.170	0.160	0.00E+00	0.00E+00	3.27E+09	3.43E+11	0.00E+00	1.71E+10	1.28E+11
0.180	0.170	0.00E+00	0.00E+00	2.42E+09	2.75E+11	2.00E+14	1.43E+10	8.07E+10
0.190	0.180	0.00E+00	0.00E+00	2.29E+09	2.60E+11	0.00E+00	1.35E+10	7.63E+10
0.200	0.190	8.06E+12	0.00E+00	3.40E+09	4.20E+11	3.25E+14	2.28E+10	9.52E+10
0.210	0.200	0.00E+00	0.00E+00	3.24E+09	3.99E+11	1.14E+11	2.17E+10	9.10E+10
0.220	0.210	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E+10	0.00E+00	0.00E+00
0.230	0.220	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.09E+09
0.250	0.240	5.17E+08	1.15E-09	0.00E+00	0.00E+00	9.97E+11	0.00E+00	0.00E+00
0.260	0.250	0.00E+00	1.11E-09	2.56E+09	3.80E+11	0.00E+00	2.28E+10	4.80E+10
0.270	0.260	3.17E+14	0.00E+00	2.46E+09	3.66E+11	1.51E+13	2.19E+10	4.62E+10
0.280	0.270	1.38E+14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.290	0.280	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.300	0.290	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E+10	0.00E+00	0.00E+00
0.325	0.300	7.02E+12	0.00E+00	1.82E+09	3.83E+11	9.06E+13	2.66E+10	1.82E+10
0.350	0.325	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.68E+10	9.35E+09	0.00E+00
0.375	0.350	1.38E+10	0.00E+00	0.00E+00	0.00E+00	6.57E+10	0.00E+00	0.00E+00
0.400	0.375	3.21E+13	0.00E+00	5.80E+08	1.90E+11	1.06E+10	1.56E+10	5.28E+09
0.425	0.400	3.03E+13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.450	0.425	0.00E+00	4.91E+07	1.93E+08	1.02E+11	0.00E+00	1.01E+10	2.74E+09
0.475	0.450	1.93E+09	0.00E+00	0.00E+00	0.00E+00	3.21E+07	0.00E+00	0.00E+00
0.500	0.475	0.00E+00	3.40E+09	5.46E+07	3.57E+10	1.35E+10	4.39E+09	9.44E+08
0.525	0.500	0.00E+00	0.00E+00	5.19E+07	3.39E+10	3.72E+10	8.61E+12	8.98E+08
0.550	0.525	7.05E+08	0.00E+00	0.00E+00	0.00E+00	1.33E+07	0.00E+00	0.00E+00
0.575	0.550	1.62E+11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E+07
0.600	0.575	0.00E+00	0.00E+00	4.11E+07	1.74E+10	0.00E+00	3.05E+09	4.46E+08
0.625	0.600	1.99E+10	0.00E+00	3.94E+07	1.67E+10	2.23E+10	2.92E+09	4.19E+08
0.650	0.625	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E+10	0.00E+00	0.00E+00
0.675	0.650	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.700	0.675	0.00E+00	0.00E+00	2.59E+07	4.56E+09	7.80E+07	1.45E+09	9.69E+07
0.725	0.700	0.00E+00	0.00E+00	2.50E+07	4.40E+09	0.00E+00	1.40E+09	3.56E+14
0.750	0.725	0.00E+00	5.77E-10	0.00E+00	0.00E+00	1.63E+07	0.00E+00	0.00E+00

Table 3-17. Photon Source from ORIGEN-S (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Se-75	Sm-145	Sr-90	Tm-170	Yb-169	Zn-65	Zr-95
0.775	0.750	0.00E+00	5.58E-10	0.00E+00	0.00E+00	7.33E+06	9.24E+09	4.30E+14
0.800	0.775	0.00E+00	0.00E+00	1.68E+07	8.23E+08	2.66E+07	6.65E+08	1.33E+07
0.825	0.800	9.00E+08	0.00E+00	1.63E+07	7.98E+08	0.00E+00	6.45E+08	1.05E+07
0.850	0.825	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E+03
0.875	0.850	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.900	0.875	0.00E+00	0.00E+00	1.11E+07	6.24E+07	0.00E+00	2.82E+08	2.61E+04
0.925	0.900	0.00E+00	0.00E+00	1.08E+07	6.07E+07	0.00E+00	2.74E+08	2.54E+04
0.950	0.925	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.975	0.950	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.000	0.975	0.00E+00	0.00E+00	7.32E+06	7.99E+03	0.00E+00	1.05E+08	0.00E+00
1.250	1.000	0.00E+00	3.16E-10	2.25E+07	7.02E+03	0.00E+00	1.53E+14	0.00E+00
1.500	1.250	0.00E+00	2.59E-10	7.32E+06	0.00E+00	0.00E+00	7.58E+05	0.00E+00
1.750	1.500	0.00E+00	1.54E-10	2.16E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.000	1.750	0.00E+00	1.33E-10	4.13E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.250	2.000	0.00E+00	7.58E-11	4.83E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.500	2.250	0.00E+00	6.78E-11	1.91E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.750	2.500	0.00E+00	3.76E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.000	2.750	0.00E+00	3.44E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.500	3.000	0.00E+00	3.60E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.000	3.500	0.00E+00	1.81E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.500	4.000	0.00E+00	9.07E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.000	4.500	0.00E+00	4.55E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.500	5.000	0.00E+00	2.28E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.000	5.500	0.00E+00	1.14E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.500	6.000	0.00E+00	5.74E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.000	6.500	0.00E+00	2.88E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.500	7.000	0.00E+00	1.44E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.000	7.500	0.00E+00	7.24E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.000	8.000	0.00E+00	5.40E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.000	9.000	0.00E+00	1.36E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	1.18E+15	1.61E+14	5.93E+11	4.56E+13	2.93E+15	1.63E+14	8.31E+14

Table 3-18. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ac-227	Am-241	Am-243	Cd-109	Cf-252	Cm-244	Cm-248
0.020	0.010	1.96E+10	7.58E+10	1.32E+09	0.00E+00	1.33E+12	2.89E+11	1.22E+07
0.030	0.020	1.48E+08	1.10E+10	1.39E+08	8.79E+13	1.38E+11	2.81E+10	3.14E+06
0.040	0.030	2.04E+06	1.63E+08	4.76E+06	0.00E+00	0.00E+00	6.73E+05	2.16E+06
0.050	0.040	3.82E+07	8.97E+07	4.00E+08	0.00E+00	2.84E+09	7.41E+08	1.57E+06
0.060	0.050	0.00E+00	4.91E+10	9.53E+05	0.00E+00	0.00E+00	3.51E+05	1.13E+06
0.070	0.060	1.58E+08	3.36E+07	1.41E-01	0.00E+00	0.00E+00	3.51E+05	1.13E+06
0.080	0.070	4.15E+08	1.38E+05	4.85E+09	0.00E+00	0.00E+00	3.51E+05	1.13E+06
0.090	0.080	2.47E+08	4.54E-02	2.54E+07	3.58E+12	0.00E+00	3.51E+05	1.13E+06
0.100	0.090	9.46E+08	2.80E+07	1.19E+06	0.00E+00	0.00E+00	3.51E+05	1.13E+06
0.110	0.100	5.32E+07	2.69E+07	7.22E+05	0.00E+00	2.44E+09	5.27E+05	1.69E+06
0.120	0.110	0.00E+00	1.31E+06	4.22E+07	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.130	0.120	1.44E+08	6.33E+06	2.12E-01	0.00E+00	1.54E+07	5.27E+05	1.69E+06
0.140	0.130	7.34E+07	5.89E+03	2.12E-01	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.150	0.140	2.33E+08	5.91E+05	9.08E+06	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.160	0.150	0.00E+00	1.26E+05	2.12E-01	0.00E+00	3.97E+08	5.27E+05	1.69E+06
0.170	0.160	5.06E+08	3.35E+05	9.98E+04	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.180	0.170	1.09E+08	2.28E+04	2.12E-01	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.190	0.180	0.00E+00	6.80E-02	2.12E-01	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.200	0.190	0.00E+00	4.62E+04	6.82E+04	0.00E+00	0.00E+00	5.27E+05	1.69E+06
0.210	0.200	0.00E+00	1.02E+06	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.220	0.210	0.00E+00	6.44E-02	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.230	0.220	3.68E+06	5.17E+04	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.240	0.230	0.00E+00	6.45E+03	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.250	0.240	0.00E+00	8.38E+04	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.260	0.250	0.00E+00	6.44E-02	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.270	0.260	0.00E+00	4.49E+04	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.280	0.270	0.00E+00	9.01E+03	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.290	0.280	0.00E+00	6.44E-02	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.300	0.290	0.00E+00	9.11E+04	2.01E-01	0.00E+00	0.00E+00	4.98E+05	1.60E+06
0.325	0.300	3.77E+06	2.37E+05	5.73E-01	0.00E+00	0.00E+00	1.42E+06	4.58E+06
0.350	0.325	0.00E+00	8.43E+05	5.73E-01	0.00E+00	0.00E+00	1.42E+06	4.58E+06
0.375	0.350	1.72E+07	3.65E+05	5.73E-01	0.00E+00	0.00E+00	1.42E+06	4.58E+06
0.400	0.375	0.00E+00	2.13E+05	5.73E-01	0.00E+00	0.00E+00	1.42E+06	4.58E+06
0.425	0.400	0.00E+00	3.77E+04	5.75E-01	0.00E+00	0.00E+00	1.43E+06	4.60E+06
0.450	0.425	0.00E+00	3.89E+04	5.75E-01	0.00E+00	0.00E+00	1.43E+06	4.60E+06
0.475	0.450	0.00E+00	2.35E+04	5.75E-01	0.00E+00	0.00E+00	1.43E+06	4.60E+06
0.500	0.475	0.00E+00	1.27E+03	5.75E-01	0.00E+00	0.00E+00	1.43E+06	4.60E+06
0.525	0.500	0.00E+00	5.89E+03	5.45E-01	0.00E+00	0.00E+00	1.35E+06	4.35E+06
0.550	0.525	0.00E+00	1.02E+05	5.45E-01	0.00E+00	0.00E+00	1.35E+06	4.35E+06
0.575	0.550	0.00E+00	2.18E+03	5.45E-01	0.00E+00	0.00E+00	1.35E+06	4.35E+06
0.600	0.575	0.00E+00	1.36E+04	5.45E-01	0.00E+00	0.00E+00	1.35E+06	4.35E+06
0.625	0.600	0.00E+00	6.50E+04	2.32E+04	0.00E+00	0.00E+00	1.21E+06	3.90E+06
0.650	0.625	0.00E+00	1.01E+04	4.88E-01	0.00E+00	0.00E+00	1.21E+06	3.90E+06
0.675	0.650	0.00E+00	4.21E+04	7.22E+04	0.00E+00	0.00E+00	1.21E+06	3.90E+06
0.700	0.675	0.00E+00	5.30E+04	4.88E-01	0.00E+00	0.00E+00	1.21E+06	3.90E+06
0.725	0.700	0.00E+00	2.51E+05	4.02E-01	0.00E+00	0.00E+00	9.99E+05	3.21E+06
0.750	0.725	0.00E+00	1.22E+04	4.02E-01	0.00E+00	0.00E+00	9.99E+05	3.21E+06

Table 3-18. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ac-227	Am-241	Am-243	Cd-109	Cf-252	Cm-244	Cm-248
0.775	0.750	0.00E+00	2.79E+04	4.02E-01	0.00E+00	0.00E+00	9.99E+05	3.21E+06
0.800	0.775	0.00E+00	8.86E+02	4.02E-01	0.00E+00	0.00E+00	9.99E+05	3.21E+06
0.825	0.800	0.00E+00	3.18E+03	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.850	0.825	0.00E+00	3.01E+02	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.875	0.850	0.00E+00	2.40E+03	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.900	0.875	0.00E+00	3.72E+02	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.925	0.900	0.00E+00	9.37E+02	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.950	0.925	0.00E+00	1.41E+02	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
0.975	0.950	0.00E+00	7.31E+02	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
1.000	0.975	0.00E+00	1.10E-01	3.43E-01	0.00E+00	0.00E+00	8.51E+05	2.74E+06
1.250	1.000	0.00E+00	5.76E-01	1.80E+00	0.00E+00	0.00E+00	4.46E+06	1.44E+07
1.500	1.250	0.00E+00	5.47E-01	1.71E+00	0.00E+00	0.00E+00	4.24E+06	1.36E+07
1.750	1.500	0.00E+00	2.89E-01	9.01E-01	0.00E+00	0.00E+00	2.24E+06	7.20E+06
2.000	1.750	0.00E+00	2.26E-01	7.05E-01	0.00E+00	0.00E+00	1.75E+06	5.63E+06
2.250	2.000	0.00E+00	1.54E-01	4.80E-01	0.00E+00	0.00E+00	1.19E+06	3.84E+06
2.500	2.250	0.00E+00	1.43E-01	4.44E-01	0.00E+00	0.00E+00	1.10E+06	3.55E+06
2.750	2.500	0.00E+00	1.03E-01	3.20E-01	0.00E+00	0.00E+00	7.94E+05	2.56E+06
3.000	2.750	0.00E+00	8.49E-02	2.65E-01	0.00E+00	0.00E+00	6.58E+05	2.12E+06
3.500	3.000	0.00E+00	8.70E-02	2.71E-01	0.00E+00	0.00E+00	6.73E+05	2.17E+06
4.000	3.500	0.00E+00	5.90E-02	1.84E-01	0.00E+00	0.00E+00	4.57E+05	1.47E+06
4.500	4.000	0.00E+00	2.18E-02	6.79E-02	0.00E+00	0.00E+00	1.69E+05	5.43E+05
5.000	4.500	0.00E+00	1.72E-02	5.35E-02	0.00E+00	0.00E+00	1.33E+05	4.27E+05
5.500	5.000	0.00E+00	7.16E-03	2.23E-02	0.00E+00	0.00E+00	5.55E+04	1.78E+05
6.000	5.500	0.00E+00	6.48E-03	2.02E-02	0.00E+00	0.00E+00	5.02E+04	1.61E+05
6.500	6.000	0.00E+00	3.01E-03	9.37E-03	0.00E+00	0.00E+00	2.33E+04	7.49E+04
7.000	6.500	0.00E+00	2.84E-03	8.84E-03	0.00E+00	0.00E+00	2.20E+04	7.06E+04
7.500	7.000	0.00E+00	2.62E-04	8.15E-04	0.00E+00	0.00E+00	2.03E+03	6.52E+03
8.000	7.500	0.00E+00	2.59E-04	8.06E-04	0.00E+00	0.00E+00	2.00E+03	6.44E+03
9.000	8.000	0.00E+00	5.16E-04	1.61E-03	0.00E+00	0.00E+00	3.99E+03	1.28E+04
10.000	9.000	0.00E+00	5.15E-04	1.61E-03	0.00E+00	0.00E+00	3.99E+03	1.28E+04
	Total	2.27E+10	1.36E+11	6.80E+09	9.15E+13	1.47E+12	3.18E+11	2.20E+08

Table 3-19. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Co-60	Cs-137	Eu-152	Fe-59	Gd-153	Hf-181	Ho-166m
0.020	0.010	1.75E+11	6.73E+10	7.38E+10	9.61E+12	2.00E+10	1.51E+13	2.72E+08
0.030	0.020	8.05E+10	3.31E+10	3.74E+10	4.53E+12	0.00E+00	4.71E+12	1.26E+08
0.040	0.030	4.56E+10	2.02E+10	1.59E+12	2.64E+12	0.00E+00	2.76E+12	7.48E+07
0.050	0.040	2.85E+10	1.36E+10	3.31E+12	1.70E+12	1.50E+14	1.79E+12	2.28E+10
0.060	0.050	1.89E+10	9.74E+09	1.20E+10	1.17E+12	0.00E+00	1.72E+14	5.47E+09
0.070	0.060	1.30E+10	7.27E+09	9.20E+09	8.34E+11	3.39E+12	4.47E+13	2.83E+07
0.080	0.070	9.17E+09	5.59E+09	7.29E+09	6.12E+11	1.01E+11	6.45E+11	2.24E+07
0.090	0.080	6.57E+09	4.39E+09	5.91E+09	4.59E+11	3.58E+11	4.83E+11	8.04E+09
0.100	0.090	4.75E+09	3.50E+09	4.87E+09	3.49E+11	3.96E+13	3.67E+11	1.09E+08
0.110	0.100	3.47E+09	2.83E+09	4.08E+09	2.69E+11	2.71E+13	2.81E+11	1.25E+07
0.120	0.110	2.54E+09	2.31E+09	3.45E+09	2.09E+11	0.00E+00	2.17E+11	1.37E+08
0.130	0.120	1.86E+09	1.90E+09	1.81E+12	1.64E+11	0.00E+00	1.69E+11	1.80E+08
0.140	0.130	1.36E+09	1.57E+09	2.54E+09	1.29E+11	0.00E+00	3.17E+14	7.56E+07
0.150	0.140	9.92E+08	1.31E+09	4.84E+09	1.82E+13	0.00E+00	1.03E+11	3.50E+07
0.160	0.150	7.21E+08	1.10E+09	1.92E+09	8.14E+10	0.00E+00	8.05E+10	5.85E+06
0.170	0.160	5.20E+08	9.24E+08	1.69E+09	6.50E+10	0.00E+00	6.30E+10	1.43E+08
0.180	0.170	3.73E+08	7.79E+08	1.51E+09	5.21E+10	5.79E+10	4.92E+10	4.51E+06
0.190	0.180	2.64E+08	6.59E+08	1.32E+09	4.18E+10	0.00E+00	3.83E+10	4.94E+10
0.200	0.190	1.85E+08	5.58E+08	1.61E+09	5.45E+13	0.00E+00	2.97E+10	1.49E+08
0.210	0.200	1.29E+08	4.74E+08	1.87E+09	2.72E+10	0.00E+00	2.30E+10	3.15E+06
0.220	0.210	8.82E+07	4.03E+08	2.20E+09	2.19E+10	0.00E+00	1.77E+10	2.14E+09
0.230	0.220	5.99E+07	3.43E+08	8.39E+08	1.77E+10	0.00E+00	1.35E+10	2.52E+06
0.240	0.230	4.05E+07	2.93E+08	1.37E+09	1.43E+10	0.00E+00	1.02E+10	1.62E+08
0.250	0.240	2.76E+07	2.50E+08	4.90E+11	1.16E+10	0.00E+00	7.66E+09	2.04E+06
0.260	0.250	1.91E+07	2.13E+08	4.65E+09	9.36E+09	0.00E+00	5.69E+09	7.61E+08
0.270	0.260	1.38E+07	1.82E+08	1.10E+09	7.56E+09	0.00E+00	4.17E+09	1.66E+06
0.280	0.270	1.06E+07	1.56E+08	7.31E+09	6.10E+09	0.00E+00	3.01E+09	1.50E+06
0.290	0.280	8.73E+06	1.34E+08	1.19E+09	4.91E+09	0.00E+00	2.13E+09	1.99E+10
0.300	0.290	7.61E+06	1.15E+08	2.86E+10	3.95E+09	0.00E+00	1.48E+09	1.24E+06
0.325	0.300	1.63E+07	2.21E+08	9.59E+09	6.84E+09	0.00E+00	1.89E+09	2.45E+09
0.350	0.325	3.28E+09	1.52E+08	1.78E+12	4.93E+12	0.00E+00	9.04E+13	1.18E+08
0.375	0.350	1.10E+07	1.05E+08	5.87E+10	2.45E+09	0.00E+00	1.29E+08	1.72E+09
0.400	0.375	9.27E+06	7.58E+07	1.12E+09	3.64E+11	0.00E+00	2.75E+07	1.35E+06
0.425	0.400	7.71E+06	5.51E+07	1.53E+11	1.24E+09	0.00E+00	1.01E+07	7.83E+09
0.450	0.425	7.92E+06	4.04E+07	2.08E+11	1.26E+09	0.00E+00	2.22E+06	8.57E+05
0.475	0.450	5.51E+06	3.32E+07	2.65E+08	8.57E+08	0.00E+00	1.77E+06	2.86E+09
0.500	0.475	4.63E+06	2.63E+07	3.28E+10	7.26E+08	0.00E+00	5.38E+14	5.83E+05
0.525	0.500	3.95E+06	2.14E+07	1.79E+10	6.24E+08	0.00E+00	2.13E+05	4.80E+05
0.550	0.525	3.34E+06	1.71E+07	4.06E+09	5.31E+08	0.00E+00	1.31E+05	6.81E+09
0.575	0.550	2.86E+06	1.39E+07	4.27E+10	4.58E+08	0.00E+00	1.01E+05	3.95E+09
0.600	0.575	2.43E+06	1.12E+07	1.08E+08	3.93E+08	0.00E+00	7.66E+04	4.80E+08
0.625	0.600	2.06E+06	8.84E+06	6.79E+08	3.35E+08	0.00E+00	1.77E+12	9.40E+08
0.650	0.625	1.76E+06	7.10E+06	4.62E+08	2.89E+08	0.00E+00	4.29E+04	2.32E+08
0.675	0.650	1.49E+06	5.57E+06	1.64E+10	2.47E+08	0.00E+00	3.11E+04	3.96E+09
0.700	0.675	1.27E+06	4.38E+06	3.19E+10	2.12E+08	0.00E+00	2.25E+04	1.04E+09
0.725	0.700	1.08E+06	3.45E+06	2.81E+10	1.83E+08	0.00E+00	1.62E+04	3.97E+10
0.750	0.725	9.11E+05	2.64E+06	1.14E+09	1.56E+08	0.00E+00	1.11E+04	6.77E+07

Table 3-19. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Co-60	Cs-137	Eu-152	Fe-59	Gd-153	Hf-181	Ho-166m
0.775	0.750	7.75E+05	2.04E+06	1.78E+10	1.34E+08	0.00E+00	7.64E+03	8.75E+09
0.800	0.775	6.50E+05	1.53E+06	8.39E+11	1.14E+08	0.00E+00	4.93E+03	2.21E+09
0.825	0.800	5.51E+05	1.16E+06	2.18E+10	9.75E+07	0.00E+00	3.17E+03	4.24E+10
0.850	0.825	3.14E+09	8.49E+05	1.18E+10	8.29E+07	0.00E+00	1.90E+03	7.12E+09
0.875	0.850	3.84E+05	6.04E+05	2.77E+11	6.99E+07	0.00E+00	1.05E+03	2.35E+04
0.900	0.875	3.22E+05	4.32E+05	1.24E+07	5.95E+07	0.00E+00	5.56E+02	5.28E+08
0.925	0.900	2.65E+05	2.92E+05	3.56E+10	4.98E+07	0.00E+00	2.47E+02	1.39E+04
0.950	0.925	2.18E+05	1.94E+05	2.20E+10	4.18E+07	0.00E+00	9.46E+01	1.05E+04
0.975	0.950	1.80E+05	1.26E+05	9.59E+11	3.52E+07	0.00E+00	2.84E+01	2.03E+09
1.000	0.975	1.45E+05	7.50E+04	2.03E+09	2.90E+07	0.00E+00	4.21E+00	5.73E+03
1.250	1.000	4.36E+13	2.77E+04	1.80E+12	1.01E+15	0.00E+00	9.29E-02	1.11E+09
1.500	1.250	4.05E+13	0.00E+00	1.54E+12	7.55E+14	0.00E+00	0.00E+00	9.39E+08
1.750	1.500	0.00E+00	0.00E+00	1.75E+10	1.57E+03	0.00E+00	0.00E+00	0.00E+00
2.000	1.750	0.00E+00	0.00E+00	5.40E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.250	2.000	4.68E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.500	2.250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.750	2.500	1.44E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.000	2.750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.500	3.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.000	3.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.500	4.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.000	4.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.500	5.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.000	5.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.500	6.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.000	6.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.500	7.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.000	7.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.000	8.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.000	9.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	8.45E+13	1.82E+11	1.54E+13	1.86E+15	2.21E+14	1.19E+15	2.47E+11

Table 3-20. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ir-192	Mn-54	Np-237	Pb-210	Pm-147	Po-210	Pu-238
0.020	0.010	1.67E+13	0.00E+00	1.52E+07	5.45E+11	1.88E+11	4.25E+06	6.46E+10
0.030	0.020	4.44E+12	0.00E+00	4.59E+06	7.50E+07	8.13E+10	0.00E+00	6.59E+09
0.040	0.030	2.68E+12	0.00E+00	9.31E-06	1.46E+07	4.34E+10	0.00E+00	2.06E+02
0.050	0.040	1.80E+12	0.00E+00	3.77E+04	1.18E+11	2.56E+10	0.00E+00	2.38E+08
0.060	0.050	1.29E+12	0.00E+00	1.13E+05	5.71E+04	1.54E+10	0.00E+00	1.02E+02
0.070	0.060	3.74E+13	0.00E+00	7.36E+03	2.10E+01	9.70E+09	0.00E+00	2.75E+02
0.080	0.070	1.08E+13	0.00E+00	4.03E+03	0.00E+00	6.20E+09	1.06E+07	1.02E+02
0.090	0.080	5.72E+11	0.00E+00	3.39E+06	0.00E+00	3.98E+09	3.09E+06	1.02E+02
0.100	0.090	4.55E+11	0.00E+00	1.41E+06	0.00E+00	2.55E+09	0.00E+00	5.11E+07
0.110	0.100	3.66E+11	0.00E+00	3.14E+05	0.00E+00	1.62E+09	0.00E+00	1.52E+02
0.120	0.110	6.74E+11	0.00E+00	1.34E+05	0.00E+00	1.01E+09	0.00E+00	3.97E+05
0.130	0.120	2.45E+11	0.00E+00	7.29E-06	0.00E+00	1.56E+09	0.00E+00	1.52E+02
0.140	0.130	8.24E+11	0.00E+00	3.94E+04	0.00E+00	3.62E+08	0.00E+00	1.52E+02
0.150	0.140	1.68E+11	0.00E+00	1.12E+05	0.00E+00	2.05E+08	0.00E+00	1.89E+02
0.160	0.150	1.40E+11	0.00E+00	9.08E+04	0.00E+00	1.10E+08	0.00E+00	6.25E+06
0.170	0.160	1.18E+11	0.00E+00	3.02E+04	0.00E+00	5.43E+07	0.00E+00	1.52E+02
0.180	0.170	9.89E+10	0.00E+00	1.22E+04	0.00E+00	2.42E+07	0.00E+00	1.74E+02
0.190	0.180	8.34E+10	0.00E+00	7.96E+03	0.00E+00	9.18E+06	0.00E+00	1.52E+02
0.200	0.190	7.05E+10	0.00E+00	8.32E+04	0.00E+00	2.82E+06	0.00E+00	1.52E+02
0.210	0.200	1.29E+13	0.00E+00	1.76E+04	0.00E+00	4.98E+05	0.00E+00	2.57E+04
0.220	0.210	1.92E+11	0.00E+00	4.79E+04	0.00E+00	2.85E+04	0.00E+00	1.44E+02
0.230	0.220	4.29E+10	0.00E+00	4.55E+02	0.00E+00	4.94E+01	0.00E+00	1.44E+02
0.240	0.230	3.64E+10	0.00E+00	2.15E+04	0.00E+00	0.00E+00	0.00E+00	2.10E+02
0.250	0.240	3.09E+10	0.00E+00	1.34E+03	0.00E+00	0.00E+00	0.00E+00	1.44E+02
0.260	0.250	2.63E+10	0.00E+00	1.69E+03	0.00E+00	0.00E+00	0.00E+00	8.74E+02
0.270	0.260	2.23E+10	0.00E+00	1.71E+03	0.00E+00	0.00E+00	0.00E+00	1.44E+02
0.280	0.270	1.89E+10	0.00E+00	4.67E+02	0.00E+00	0.00E+00	0.00E+00	1.44E+02
0.290	0.280	9.00E+11	0.00E+00	6.90E-06	0.00E+00	0.00E+00	0.00E+00	1.44E+02
0.300	0.290	9.90E+13	0.00E+00	6.90E-06	0.00E+00	0.00E+00	0.00E+00	5.77E+02
0.325	0.300	3.86E+14	0.00E+00	1.97E-05	0.00E+00	0.00E+00	0.00E+00	4.12E+02
0.350	0.325	6.90E+10	0.00E+00	1.97E-05	0.00E+00	0.00E+00	0.00E+00	4.12E+02
0.375	0.350	2.58E+12	0.00E+00	1.97E-05	0.00E+00	0.00E+00	0.00E+00	4.12E+02
0.400	0.375	6.77E+09	0.00E+00	1.97E-05	0.00E+00	0.00E+00	0.00E+00	4.12E+02
0.425	0.400	2.98E+12	0.00E+00	1.98E-05	0.00E+00	0.00E+00	0.00E+00	4.13E+02
0.450	0.425	1.45E+09	0.00E+00	1.98E-05	0.00E+00	0.00E+00	0.00E+00	4.13E+02
0.475	0.450	1.65E+14	0.00E+00	1.98E-05	0.00E+00	0.00E+00	0.00E+00	4.13E+02
0.500	0.475	1.21E+13	0.00E+00	1.98E-05	0.00E+00	0.00E+00	0.00E+00	4.13E+02
0.525	0.500	4.36E+08	0.00E+00	1.87E-05	0.00E+00	0.00E+00	0.00E+00	3.91E+02
0.550	0.525	2.07E+08	0.00E+00	1.87E-05	0.00E+00	0.00E+00	0.00E+00	3.91E+02
0.575	0.550	9.24E+07	0.00E+00	1.87E-05	0.00E+00	0.00E+00	0.00E+00	3.91E+02
0.600	0.575	1.56E+13	0.00E+00	1.87E-05	0.00E+00	0.00E+00	0.00E+00	3.91E+02
0.625	0.600	4.57E+13	0.00E+00	1.68E-05	0.00E+00	0.00E+00	0.00E+00	3.51E+02
0.650	0.625	1.19E+06	0.00E+00	1.68E-05	0.00E+00	0.00E+00	0.00E+00	3.51E+02
0.675	0.650	1.53E+04	0.00E+00	1.68E-05	0.00E+00	0.00E+00	0.00E+00	3.51E+02
0.700	0.675	0.00E+00	0.00E+00	1.68E-05	0.00E+00	0.00E+00	0.00E+00	3.51E+02
0.725	0.700	1.95E+10	0.00E+00	1.38E-05	0.00E+00	0.00E+00	0.00E+00	3.56E+03
0.750	0.725	0.00E+00	0.00E+00	1.38E-05	0.00E+00	0.00E+00	0.00E+00	4.85E+04

Table 3-20. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Ir-192	Mn-54	Np-237	Pb-210	Pm-147	Po-210	Pu-238
0.775	0.750	0.00E+00	0.00E+00	1.38E-05	0.00E+00	0.00E+00	0.00E+00	2.13E+05
0.800	0.775	0.00E+00	0.00E+00	1.38E-05	0.00E+00	0.00E+00	0.00E+00	3.05E+04
0.825	0.800	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	1.74E+09	2.85E+04
0.850	0.825	0.00E+00	2.86E+14	1.18E-05	0.00E+00	0.00E+00	0.00E+00	2.46E+02
0.875	0.850	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	1.20E+04
0.900	0.875	1.02E+12	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	8.52E+03
0.925	0.900	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	8.65E+02
0.950	0.925	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	1.05E+04
0.975	0.950	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	2.46E+02
1.000	0.975	0.00E+00	0.00E+00	1.18E-05	0.00E+00	0.00E+00	0.00E+00	7.47E+02
1.250	1.000	1.84E+11	0.00E+00	6.18E-05	0.00E+00	0.00E+00	0.00E+00	1.13E+04
1.500	1.250	4.24E+09	0.00E+00	5.87E-05	0.00E+00	0.00E+00	0.00E+00	1.22E+03
1.750	1.500	0.00E+00	0.00E+00	3.10E-05	0.00E+00	0.00E+00	0.00E+00	6.47E+02
2.000	1.750	0.00E+00	0.00E+00	2.42E-05	0.00E+00	0.00E+00	0.00E+00	5.06E+02
2.250	2.000	0.00E+00	0.00E+00	1.65E-05	0.00E+00	0.00E+00	0.00E+00	3.45E+02
2.500	2.250	0.00E+00	0.00E+00	1.53E-05	0.00E+00	0.00E+00	0.00E+00	3.19E+02
2.750	2.500	0.00E+00	0.00E+00	1.10E-05	0.00E+00	0.00E+00	0.00E+00	2.30E+02
3.000	2.750	0.00E+00	0.00E+00	9.10E-06	0.00E+00	0.00E+00	0.00E+00	1.90E+02
3.500	3.000	0.00E+00	0.00E+00	9.32E-06	0.00E+00	0.00E+00	0.00E+00	1.95E+02
4.000	3.500	0.00E+00	0.00E+00	6.33E-06	0.00E+00	0.00E+00	0.00E+00	1.32E+02
4.500	4.000	0.00E+00	0.00E+00	2.34E-06	0.00E+00	0.00E+00	0.00E+00	4.88E+01
5.000	4.500	0.00E+00	0.00E+00	1.84E-06	0.00E+00	0.00E+00	0.00E+00	3.84E+01
5.500	5.000	0.00E+00	0.00E+00	7.68E-07	0.00E+00	0.00E+00	0.00E+00	1.60E+01
6.000	5.500	0.00E+00	0.00E+00	6.94E-07	0.00E+00	0.00E+00	0.00E+00	1.45E+01
6.500	6.000	0.00E+00	0.00E+00	3.22E-07	0.00E+00	0.00E+00	0.00E+00	6.73E+00
7.000	6.500	0.00E+00	0.00E+00	3.04E-07	0.00E+00	0.00E+00	0.00E+00	6.35E+00
7.500	7.000	0.00E+00	0.00E+00	2.80E-08	0.00E+00	0.00E+00	0.00E+00	5.86E-01
8.000	7.500	0.00E+00	0.00E+00	2.77E-08	0.00E+00	0.00E+00	0.00E+00	5.79E-01
9.000	8.000	0.00E+00	0.00E+00	5.53E-08	0.00E+00	0.00E+00	0.00E+00	1.15E+00
10.000	9.000	0.00E+00	0.00E+00	5.52E-08	0.00E+00	0.00E+00	0.00E+00	1.15E+00
	Total	8.23E+14	2.86E+14	2.57E+07	6.64E+11	3.81E+11	1.76E+09	7.15E+10

Table 3-21. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Pu-239	Pu-240	Pu-241	Pu-242	Ra-226	Ru-106	Sc-46
0.020	0.010	8.75E+07	8.16E+08	2.38E+08	1.18E+07	2.56E+08	1.26E+10	4.81E+12
0.030	0.020	9.05E+06	8.35E+07	2.21E+07	1.21E+06	0.00E+00	8.20E+08	2.25E+12
0.040	0.030	1.51E+05	7.93E+01	4.13E+05	1.33E+02	0.00E+00	5.87E+06	1.29E+12
0.050	0.040	1.49E+04	3.80E+06	1.88E+05	5.26E+04	0.00E+00	0.00E+00	8.22E+11
0.060	0.050	4.74E+05	4.14E+01	1.37E+05	6.96E+01	0.00E+00	0.00E+00	5.55E+11
0.070	0.060	1.87E+04	4.14E+01	1.91E-03	6.96E+01	0.00E+00	0.00E+00	3.89E+11
0.080	0.070	1.51E+04	4.14E+01	9.71E+05	6.96E+01	0.00E+00	0.00E+00	2.79E+11
0.090	0.080	6.30E+02	4.14E+01	1.91E-03	6.96E+01	1.70E+08	0.00E+00	2.04E+11
0.100	0.090	1.80E+05	6.03E+03	3.33E+07	1.78E+02	5.12E+07	0.00E+00	1.52E+11
0.110	0.100	4.03E+03	5.84E+05	3.80E+06	1.14E+04	0.00E+00	0.00E+00	1.13E+11
0.120	0.110	7.35E+04	1.78E+03	9.82E+06	1.35E+02	0.00E+00	0.00E+00	8.52E+10
0.130	0.120	1.50E+05	6.21E+01	2.54E+04	1.04E+02	0.00E+00	0.00E+00	6.43E+10
0.140	0.130	1.27E-03	6.21E+01	2.87E-03	1.04E+02	0.00E+00	0.00E+00	4.86E+10
0.150	0.140	9.97E+03	6.21E+01	7.30E+06	1.04E+02	0.00E+00	0.00E+00	3.67E+10
0.160	0.150	1.88E+02	6.21E+01	2.65E+05	7.83E+02	0.00E+00	0.00E+00	2.77E+10
0.170	0.160	3.12E+03	3.43E+04	2.87E-03	1.04E+02	0.00E+00	0.00E+00	2.08E+10
0.180	0.170	4.04E+03	6.21E+01	2.87E-03	1.04E+02	0.00E+00	0.00E+00	1.56E+10
0.190	0.180	2.08E+03	6.21E+01	2.87E-03	1.04E+02	1.21E+09	0.00E+00	1.16E+10
0.200	0.190	2.58E+03	6.21E+01	2.87E-03	1.04E+02	0.00E+00	0.00E+00	8.52E+09
0.210	0.200	1.28E+04	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	6.22E+09
0.220	0.210	1.16E-03	2.46E+03	2.71E-03	9.88E+01	0.00E+00	0.00E+00	4.48E+09
0.230	0.220	3.75E+02	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	3.18E+09
0.240	0.230	3.48E+02	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	2.22E+09
0.250	0.240	1.01E+03	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	1.51E+09
0.260	0.250	1.85E+03	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	1.01E+09
0.270	0.260	6.52E+02	5.87E+01	2.71E-03	9.88E+01	1.96E+06	0.00E+00	6.49E+08
0.280	0.270	1.16E-03	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	4.03E+08
0.290	0.280	8.20E+01	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	2.39E+08
0.300	0.290	1.16E+03	5.87E+01	2.71E-03	9.88E+01	0.00E+00	0.00E+00	1.34E+08
0.325	0.300	5.23E+03	1.68E+02	7.76E-03	2.82E+02	0.00E+00	0.00E+00	1.10E+08
0.350	0.325	2.87E+04	1.68E+02	7.76E-03	2.82E+02	0.00E+00	0.00E+00	2.32E+07
0.375	0.350	4.40E+03	1.68E+02	7.76E-03	2.82E+02	0.00E+00	0.00E+00	1.60E+07
0.400	0.375	6.70E+04	1.68E+02	7.76E-03	2.82E+02	0.00E+00	0.00E+00	1.35E+07
0.425	0.400	3.77E+04	1.68E+02	7.78E-03	2.83E+02	1.43E+05	0.00E+00	1.13E+07
0.450	0.425	1.05E+03	1.68E+02	7.78E-03	2.83E+02	1.01E+05	0.00E+00	1.23E+07
0.475	0.450	4.39E+03	1.68E+02	7.78E-03	2.83E+02	0.00E+00	0.00E+00	8.08E+06
0.500	0.475	1.34E+02	1.68E+02	7.78E-03	2.83E+02	0.00E+00	0.00E+00	6.80E+06
0.525	0.500	3.18E-03	1.60E+02	7.37E-03	2.68E+02	0.00E+00	0.00E+00	5.82E+06
0.550	0.525	6.91E+00	1.72E+02	7.37E-03	2.68E+02	0.00E+00	0.00E+00	4.92E+06
0.575	0.550	1.04E+01	1.60E+02	7.37E-03	2.68E+02	0.00E+00	0.00E+00	4.21E+06
0.600	0.575	8.13E+01	1.60E+02	7.37E-03	2.68E+02	0.00E+00	0.00E+00	3.59E+06
0.625	0.600	1.45E+02	1.43E+02	6.61E-03	2.41E+02	2.19E+05	0.00E+00	3.04E+06
0.650	0.625	8.30E+02	1.24E+03	6.61E-03	2.41E+02	0.00E+00	0.00E+00	2.61E+06
0.675	0.650	4.57E+02	1.43E+02	6.61E-03	2.41E+02	0.00E+00	0.00E+00	2.20E+06
0.700	0.675	3.31E+01	4.37E+02	6.61E-03	2.41E+02	0.00E+00	0.00E+00	1.88E+06
0.725	0.700	1.64E+02	1.18E+02	5.44E-03	1.98E+02	0.00E+00	0.00E+00	1.60E+06
0.750	0.725	2.47E+01	1.18E+02	5.44E-03	1.98E+02	0.00E+00	0.00E+00	1.35E+06

Table 3-21. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Pu-239	Pu-240	Pu-241	Pu-242	Ra-226	Ru-106	Sc-46
0.775	0.750	3.31E+02	1.18E+02	5.44E-03	1.98E+02	0.00E+00	0.00E+00	1.15E+06
0.800	0.775	6.27E+00	1.18E+02	5.44E-03	1.98E+02	0.00E+00	0.00E+00	9.67E+05
0.825	0.800	6.96E+00	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	8.20E+05
0.850	0.825	8.33E+00	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	6.88E+05
0.875	0.850	1.95E-03	1.50E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	5.72E+05
0.900	0.875	2.91E+00	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	1.26E+15
0.925	0.900	1.95E-03	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	3.94E+05
0.950	0.925	9.69E-01	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	3.25E+05
0.975	0.950	1.28E+00	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	2.68E+05
1.000	0.975	1.33E+00	1.00E+02	4.64E-03	1.69E+02	0.00E+00	0.00E+00	2.16E+05
1.250	1.000	1.23E+00	5.26E+02	2.43E-02	8.84E+02	0.00E+00	0.00E+00	1.25E+15
1.500	1.250	9.36E-03	4.99E+02	2.31E-02	8.40E+02	0.00E+00	0.00E+00	7.90E+03
1.750	1.500	5.11E-03	2.64E+02	1.22E-02	4.44E+02	0.00E+00	0.00E+00	0.00E+00
2.000	1.750	3.92E-03	2.06E+02	9.53E-03	3.47E+02	0.00E+00	0.00E+00	0.00E+00
2.250	2.000	2.66E-03	1.41E+02	6.50E-03	2.36E+02	0.00E+00	0.00E+00	1.42E+08
2.500	2.250	2.47E-03	1.30E+02	6.01E-03	2.19E+02	0.00E+00	0.00E+00	0.00E+00
2.750	2.500	1.76E-03	9.36E+01	4.33E-03	1.57E+02	0.00E+00	0.00E+00	0.00E+00
3.000	2.750	1.51E-03	7.75E+01	3.58E-03	1.30E+02	0.00E+00	0.00E+00	0.00E+00
3.500	3.000	1.57E-03	7.94E+01	3.67E-03	1.33E+02	0.00E+00	0.00E+00	0.00E+00
4.000	3.500	1.22E-03	5.39E+01	2.49E-03	9.06E+01	0.00E+00	0.00E+00	0.00E+00
4.500	4.000	5.08E-04	1.99E+01	9.19E-04	3.34E+01	0.00E+00	0.00E+00	0.00E+00
5.000	4.500	4.35E-04	1.57E+01	7.24E-04	2.63E+01	0.00E+00	0.00E+00	0.00E+00
5.500	5.000	1.66E-04	6.53E+00	3.02E-04	1.10E+01	0.00E+00	0.00E+00	0.00E+00
6.000	5.500	1.54E-04	5.91E+00	2.73E-04	9.94E+00	0.00E+00	0.00E+00	0.00E+00
6.500	6.000	6.03E-05	2.74E+00	1.27E-04	4.61E+00	0.00E+00	0.00E+00	0.00E+00
7.000	6.500	5.81E-05	2.59E+00	1.20E-04	4.35E+00	0.00E+00	0.00E+00	0.00E+00
7.500	7.000	2.80E-06	2.39E-01	1.10E-05	4.01E-01	0.00E+00	0.00E+00	0.00E+00
8.000	7.500	2.78E-06	2.36E-01	1.09E-05	3.97E-01	0.00E+00	0.00E+00	0.00E+00
9.000	8.000	5.56E-06	4.70E-01	2.17E-05	7.91E-01	0.00E+00	0.00E+00	0.00E+00
10.000	9.000	5.55E-06	4.70E-01	2.17E-05	7.91E-01	0.00E+00	0.00E+00	0.00E+00
	Total	9.79E+07	9.04E+08	3.16E+08	1.31E+07	1.69E+09	1.34E+10	2.51E+15

Table 3-22. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Se-75	Sm-145	Sr-90	Tm-170	Yb-169	Zn-65	Zr-95
0.020	0.010	2.13E+14	0.00E+00	7.62E+10	1.03E+13	0.00E+00	3.24E+10	7.26E+12
0.030	0.020	1.34E+11	0.00E+00	3.75E+10	5.21E+12	1.76E+12	1.54E+10	3.03E+12
0.040	0.030	0.00E+00	1.22E+14	2.28E+10	3.25E+12	0.00E+00	8.99E+09	1.77E+12
0.050	0.040	0.00E+00	2.71E+13	1.53E+10	2.46E+12	5.21E+14	5.80E+09	1.14E+12
0.060	0.050	0.00E+00	0.00E+00	1.10E+10	1.08E+13	1.12E+15	3.96E+09	7.82E+11
0.070	0.060	6.04E+12	1.18E+13	8.18E+09	1.67E+12	3.61E+14	2.80E+09	5.57E+11
0.080	0.070	0.00E+00	0.00E+00	6.27E+09	1.01E+12	0.00E+00	2.02E+09	4.08E+11
0.090	0.080	4.25E+10	0.00E+00	4.91E+09	7.94E+12	0.00E+00	1.49E+09	3.04E+11
0.100	0.090	1.92E+13	0.00E+00	3.91E+09	6.60E+11	2.24E+13	1.10E+09	2.30E+11
0.110	0.100	0.00E+00	0.00E+00	3.15E+09	5.49E+11	1.62E+14	8.25E+08	1.76E+11
0.120	0.110	0.00E+00	0.00E+00	2.56E+09	4.61E+11	1.78E+13	6.18E+08	1.35E+11
0.130	0.120	9.22E+13	6.57E+08	2.10E+09	3.92E+11	0.00E+00	4.63E+08	1.05E+11
0.140	0.130	3.28E+14	0.00E+00	1.73E+09	3.35E+11	9.91E+13	3.47E+08	8.16E+10
0.150	0.140	0.00E+00	0.00E+00	1.44E+09	2.88E+11	0.00E+00	2.58E+08	6.37E+10
0.160	0.150	0.00E+00	0.00E+00	1.20E+09	2.50E+11	7.45E+10	1.92E+08	4.98E+10
0.170	0.160	0.00E+00	0.00E+00	1.00E+09	2.17E+11	0.00E+00	1.41E+08	3.90E+10
0.180	0.170	0.00E+00	0.00E+00	8.39E+08	1.90E+11	2.02E+14	1.03E+08	3.05E+10
0.190	0.180	0.00E+00	0.00E+00	7.05E+08	1.66E+11	0.00E+00	7.40E+07	2.39E+10
0.200	0.190	8.23E+12	0.00E+00	5.92E+08	1.46E+11	3.25E+14	5.25E+07	1.87E+10
0.210	0.200	1.02E+10	0.00E+00	4.98E+08	1.29E+11	0.00E+00	3.66E+07	1.47E+10
0.220	0.210	0.00E+00	0.00E+00	4.19E+08	1.14E+11	0.00E+00	2.49E+07	1.15E+10
0.230	0.220	0.00E+00	0.00E+00	3.52E+08	1.01E+11	0.00E+00	1.65E+07	8.98E+09
0.240	0.230	0.00E+00	0.00E+00	2.96E+08	9.01E+10	0.00E+00	1.06E+07	7.03E+09
0.250	0.240	0.00E+00	0.00E+00	2.49E+08	8.02E+10	1.07E+12	6.55E+06	5.52E+09
0.260	0.250	0.00E+00	0.00E+00	2.08E+08	7.15E+10	0.00E+00	3.84E+06	4.35E+09
0.270	0.260	3.19E+14	0.00E+00	1.74E+08	6.38E+10	1.48E+13	2.10E+06	3.44E+09
0.280	0.270	1.38E+14	0.00E+00	1.45E+08	5.70E+10	0.00E+00	1.05E+06	2.75E+09
0.290	0.280	0.00E+00	0.00E+00	1.21E+08	5.10E+10	0.00E+00	4.59E+05	2.22E+09
0.300	0.290	1.90E+09	0.00E+00	1.00E+08	4.57E+10	0.00E+00	1.65E+05	1.81E+09
0.325	0.300	6.86E+12	0.00E+00	1.81E+08	9.49E+10	8.68E+13	2.77E+04	3.31E+09
0.350	0.325	2.24E+09	0.00E+00	1.08E+08	7.25E+10	1.04E+11	9.32E+09	2.27E+09
0.375	0.350	5.60E+09	0.00E+00	6.07E+07	5.48E+10	9.51E+09	0.00E+00	1.66E+09
0.400	0.375	0.00E+00	0.00E+00	3.36E+07	4.24E+10	6.33E+09	0.00E+00	1.29E+09
0.425	0.400	5.93E+13	0.00E+00	1.61E+07	3.21E+10	0.00E+00	0.00E+00	9.81E+08
0.450	0.425	0.00E+00	0.00E+00	3.51E+06	2.06E+10	0.00E+00	0.00E+00	7.75E+08
0.475	0.450	1.72E+09	0.00E+00	2.62E+06	1.88E+10	4.44E+09	0.00E+00	5.82E+08
0.500	0.475	1.26E+09	2.71E+09	6.33E+05	1.41E+10	1.33E+10	0.00E+00	4.38E+08
0.525	0.500	0.00E+00	0.00E+00	8.47E+04	1.07E+10	3.77E+10	8.87E+12	3.34E+08
0.550	0.525	6.12E+07	0.00E+00	8.33E+02	7.87E+09	1.07E+09	0.00E+00	2.47E+08
0.575	0.550	2.06E+11	0.00E+00	0.00E+00	5.88E+09	1.29E+10	0.00E+00	1.85E+08
0.600	0.575	0.00E+00	0.00E+00	0.00E+00	4.29E+09	1.68E+10	0.00E+00	1.35E+08
0.625	0.600	2.48E+10	0.00E+00	0.00E+00	3.04E+09	5.57E+10	0.00E+00	9.59E+07
0.650	0.625	0.00E+00	0.00E+00	0.00E+00	2.18E+09	7.11E+08	0.00E+00	6.87E+07
0.675	0.650	0.00E+00	0.00E+00	0.00E+00	1.49E+09	1.83E+09	0.00E+00	4.68E+07
0.700	0.675	0.00E+00	0.00E+00	0.00E+00	1.01E+09	0.00E+00	0.00E+00	3.16E+07
0.725	0.700	0.00E+00	0.00E+00	0.00E+00	6.73E+08	3.51E+08	0.00E+00	3.60E+14
0.750	0.725	0.00E+00	0.00E+00	0.00E+00	4.19E+08	0.00E+00	0.00E+00	1.33E+07

Table 3-22. Photon Source from RASTA (Decay Time = 0 days)

Energy (MeV)		Photon Source (p/s/g)						
Upper	Lower	Se-75	Sm-145	Sr-90	Tm-170	Yb-169	Zn-65	Zr-95
0.775	0.750	0.00E+00	0.00E+00	0.00E+00	2.60E+08	1.98E+09	9.25E+09	4.34E+14
0.800	0.775	0.00E+00	0.00E+00	0.00E+00	1.46E+08	0.00E+00	0.00E+00	5.10E+06
0.825	0.800	7.11E+08	0.00E+00	0.00E+00	8.04E+07	0.00E+00	0.00E+00	3.20E+06
0.850	0.825	0.00E+00	0.00E+00	0.00E+00	3.94E+07	0.00E+00	0.00E+00	2.01E+06
0.875	0.850	0.00E+00	0.00E+00	0.00E+00	1.63E+07	0.00E+00	0.00E+00	1.29E+06
0.900	0.875	0.00E+00	0.00E+00	0.00E+00	5.89E+06	0.00E+00	0.00E+00	8.66E+05
0.925	0.900	0.00E+00	0.00E+00	0.00E+00	1.33E+06	0.00E+00	0.00E+00	5.45E+05
0.950	0.925	0.00E+00	0.00E+00	0.00E+00	1.34E+05	0.00E+00	0.00E+00	3.32E+05
0.975	0.950	0.00E+00	0.00E+00	0.00E+00	1.27E+03	0.00E+00	0.00E+00	1.94E+05
1.000	0.975	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.90E+04
1.250	1.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E+14	2.57E+04
1.500	1.250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.750	1.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.000	1.750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.250	2.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.500	2.250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.750	2.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.000	2.750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.500	3.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.000	3.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.500	4.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.000	4.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.500	5.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.000	5.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.500	6.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.000	6.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.500	7.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.000	7.500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.000	8.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.000	9.000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	1.19E+15	1.61E+14	2.04E+11	4.75E+13	2.93E+15	1.62E+14	8.10E+14

Table 3-23. Photon Source from ORIGEN-S (Decay Time = 30 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.020	0.010	1.29E+12	7.42E+09	2.66E+07	8.26E+11	3.69E+08	1.16E+10	1.28E+12	1.90E+13
0.030	0.020	1.26E+11	8.55E+07	4.79E+06	1.24E+11	4.07E+07	3.64E+09	7.02E+11	7.20E+12
0.040	0.030	7.63E+10	5.22E+07	4.15E+04	7.35E+10	1.00E+06	2.18E+09	4.25E+11	3.89E+12
0.050	0.040	1.61E+11	4.79E+08	6.47E+04	1.79E+11	7.45E+05	1.82E+09	3.58E+11	2.88E+12
0.060	0.050	1.12E+11	2.85E+07	1.19E+05	3.43E+10	2.28E+08	1.43E+09	2.06E+11	1.50E+12
0.070	0.060	4.15E+10	1.14E+08	1.70E+04	3.21E+10	1.21E+06	9.79E+08	1.96E+11	1.29E+12
0.080	0.070	9.25E+10	5.03E+09	2.00E+05	2.51E+10	9.67E+05	7.50E+09	1.56E+11	9.12E+11
0.090	0.080	5.74E+11	3.49E+07	3.59E+06	2.01E+10	2.74E+04	2.70E+09	1.28E+11	6.60E+11
0.100	0.090	1.87E+11	1.20E+09	4.79E+06	2.04E+10	4.71E+07	7.18E+08	1.32E+11	5.96E+11
0.110	0.100	2.92E+10	3.83E+09	4.32E+05	1.07E+10	2.56E+07	3.38E+08	6.98E+10	2.98E+11
0.120	0.110	2.93E+10	8.09E+08	1.09E+06	1.20E+10	1.97E+07	3.86E+08	8.08E+10	2.86E+11
0.130	0.120	2.51E+10	1.12E+08	2.16E+03	1.11E+10	5.84E+04	3.55E+08	7.43E+10	2.63E+11
0.140	0.130	1.16E+10	2.48E+06	4.22E+04	8.73E+09	3.26E+03	3.09E+08	6.10E+10	1.66E+11
0.150	0.140	4.78E+10	1.10E+07	1.13E+05	8.13E+09	7.26E+06	2.81E+08	5.68E+10	1.55E+11
0.160	0.150	7.67E+10	1.53E+06	8.58E+04	6.54E+09	1.31E+05	2.20E+08	4.76E+10	9.82E+10
0.170	0.160	7.71E+09	2.81E+06	2.80E+04	6.14E+09	1.75E+06	2.07E+08	4.47E+10	9.22E+10
0.180	0.170	8.89E+09	9.59E+05	1.03E+04	5.01E+09	4.78E+02	1.73E+08	3.81E+10	5.83E+10
0.190	0.180	5.99E+09	6.78E+06	6.38E+03	4.74E+09	3.65E+02	1.45E+09	3.60E+10	5.51E+10
0.200	0.190	9.14E+09	1.28E+06	7.38E+04	7.83E+09	3.11E+02	2.97E+08	6.22E+10	6.88E+10
0.210	0.200	2.04E+10	1.30E+08	1.80E+04	7.45E+09	1.91E+07	2.65E+08	5.91E+10	3.00E+11
0.220	0.210	2.29E+10	1.23E+08	5.06E+04	0.00E+00	1.62E-02	0.00E+00	0.00E+00	0.00E+00
0.230	0.220	9.51E+08	8.65E+08	2.38E+03	0.00E+00	1.78E+04	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	2.08E+11	2.25E-03	1.74E+04	0.00E+00	1.78E+04	0.00E+00	0.00E+00	1.63E+12
0.250	0.240	4.20E+09	2.96E+01	9.71E+03	1.19E+03	1.72E+01	2.68E+09	0.00E+00	0.00E+00
0.260	0.250	1.52E+11	8.84E+06	2.72E+03	7.44E+09	3.02E+00	4.85E+08	6.48E+10	3.47E+10
0.270	0.260	1.64E+11	7.05E+05	2.22E+03	7.16E+09	6.41E+05	2.73E+08	6.23E+10	3.34E+10
0.280	0.270	1.18E+11	1.08E+09	4.48E+04	0.00E+00	3.87E+01	1.82E+08	0.00E+00	0.00E+00
0.290	0.280	3.54E+10	5.84E+07	3.05E-05	0.00E+00	1.91E-12	4.08E+07	0.00E+00	0.00E+00
0.300	0.290	2.92E+10	7.77E-03	4.77E+05	0.00E+00	2.24E+03	6.98E+09	0.00E+00	0.00E+00
0.325	0.300	1.10E+11	1.20E+08	5.85E+06	8.10E+09	1.02E+03	3.95E+08	8.21E+10	1.31E+10
0.350	0.325	1.10E+11	1.51E+08	6.36E+05	0.00E+00	1.13E+06	9.48E+07	0.00E+00	0.00E+00
0.375	0.350	1.45E+11	1.54E-01	4.93E+04	0.00E+00	1.36E+05	1.31E+10	0.00E+00	0.00E+00
0.400	0.375	7.53E+09	2.26E+05	2.49E+05	4.40E+09	8.59E+02	5.11E+08	5.29E+10	3.82E+09
0.425	0.400	1.14E+11	2.49E-01	2.46E+05	0.00E+00	1.72E+02	6.00E+07	0.00E+00	0.00E+00
0.450	0.425	3.80E+10	1.24E+06	1.99E+01	2.62E+09	1.47E+02	1.97E+08	3.81E+10	1.98E+09
0.475	0.450	4.73E+06	1.98E+05	8.13E-07	0.00E+00	9.74E+01	2.50E+08	0.00E+00	0.00E+00
0.500	0.475	2.38E+09	1.00E+06	1.73E+00	1.05E+09	7.22E+00	3.76E+08	1.88E+10	6.82E+08
0.525	0.500	2.22E+09	7.69E+03	1.65E+00	9.97E+08	2.35E+01	1.17E+08	1.79E+10	6.49E+08
0.550	0.525	8.61E+08	8.84E-05	2.16E-07	0.00E+00	6.05E+00	1.50E+08	0.00E+00	0.00E+00
0.575	0.550	5.85E+07	3.76E-05	1.09E-07	0.00E+00	1.01E+01	3.03E+07	0.00E+00	3.28E+10
0.600	0.575	2.14E+09	1.57E+03	1.03E-03	6.37E+08	6.00E+01	1.93E+08	1.58E+10	3.90E+09

Table 3-23. Photon Source from ORIGEN-S (Decay Time = 30 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.625	0.600	2.16E+09	1.50E+03	9.88E-04	6.11E+08	3.02E+02	1.68E+10	1.52E+10	3.03E+08
0.650	0.625	4.06E+06	2.19E+04	0.00E+00	0.00E+00	4.50E+01	6.28E+07	0.00E+00	0.00E+00
0.675	0.650	3.71E+07	8.86E+04	8.46E-08	0.00E+00	2.00E+03	5.87E+08	0.00E+00	0.00E+00
0.700	0.675	6.34E+08	1.92E+01	1.26E-10	2.48E+08	2.28E+02	8.23E+07	9.99E+09	7.00E+07
0.725	0.700	5.86E+09	1.85E+01	7.86E-08	2.39E+08	1.03E+03	3.96E+08	9.64E+09	2.58E+14
0.750	0.725	2.19E+07	1.51E+01	5.12E-02	5.97E+02	5.21E+01	3.71E+07	0.00E+00	0.00E+00
0.775	0.750	8.05E+09	1.46E+01	4.95E-02	5.77E+02	1.11E+02	1.87E+09	0.00E+00	6.10E+14
0.800	0.775	3.80E+08	4.93E-05	5.94E-11	8.68E+07	1.21E+01	5.44E+08	6.48E+09	1.04E+09
0.825	0.800	3.86E+08	5.11E-05	1.94E-09	8.73E+07	1.45E+01	5.46E+08	6.28E+09	3.37E+07
0.850	0.825	4.20E+10	5.89E-05	0.00E+00	0.00E+00	3.82E+00	2.62E+08	0.00E+00	8.08E+05
0.875	0.850	8.16E+07	3.06E-22	5.97E-08	0.00E+00	8.29E+00	0.00E+00	0.00E+00	0.00E+00
0.900	0.875	2.86E+09	2.11E-05	2.69E-11	2.48E+07	1.46E+00	1.54E+07	4.26E+09	1.89E+04
0.925	0.900	1.48E+08	4.62E-06	2.62E-11	2.41E+07	3.71E+00	6.12E+07	4.14E+09	1.84E+04
0.950	0.925	1.58E+06	9.76E-06	0.00E+00	0.00E+00	5.58E-01	1.15E+09	0.00E+00	0.00E+00
0.975	0.950	2.40E+08	1.40E-05	0.00E+00	0.00E+00	2.89E+00	1.40E+08	0.00E+00	0.00E+00
1.000	0.975	4.40E+07	1.49E-05	1.18E-07	4.80E+06	7.36E-15	2.30E+07	2.82E+09	0.00E+00
1.250	1.000	2.28E+09	8.24E+00	2.80E-02	4.92E+06	9.30E-01	9.18E+09	8.67E+09	0.00E+00
1.500	1.250	9.25E+07	6.74E+00	2.29E-02	2.67E+02	5.24E-01	3.83E+09	2.82E+09	0.00E+00
1.750	1.500	3.26E+03	4.00E+00	1.36E-02	1.59E+02	3.11E-01	3.21E+09	8.32E+08	0.00E+00
2.000	1.750	2.83E+03	3.47E+00	1.18E-02	1.38E+02	2.70E-01	6.59E+09	1.59E+08	0.00E+00
2.250	2.000	1.61E+03	1.98E+00	6.72E-03	7.84E+01	1.54E-01	2.46E+09	1.86E+07	0.00E+00
2.500	2.250	1.44E+03	1.77E+00	6.02E-03	7.01E+01	1.37E-01	7.35E+08	7.35E+04	0.00E+00
2.750	2.500	7.98E+02	9.90E-01	3.34E-03	3.89E+01	7.63E-02	1.56E+07	0.00E+00	0.00E+00
3.000	2.750	7.29E+02	9.04E-01	3.05E-03	3.55E+01	6.96E-02	3.27E+07	0.00E+00	0.00E+00
3.500	3.000	7.64E+02	9.55E-01	3.20E-03	3.72E+01	7.31E-02	1.24E+07	0.00E+00	0.00E+00
4.000	3.500	3.83E+02	4.83E-01	1.60E-03	1.87E+01	3.67E-02	8.96E+00	0.00E+00	0.00E+00
4.500	4.000	1.92E+02	2.45E-01	8.04E-04	9.37E+00	1.84E-02	4.49E+00	0.00E+00	0.00E+00
5.000	4.500	9.64E+01	1.24E-01	4.03E-04	4.70E+00	9.24E-03	2.25E+00	0.00E+00	0.00E+00
5.500	5.000	4.84E+01	6.30E-02	2.02E-04	2.36E+00	4.64E-03	1.13E+00	0.00E+00	0.00E+00
6.000	5.500	2.43E+01	3.20E-02	1.01E-04	1.18E+00	2.33E-03	5.67E-01	0.00E+00	0.00E+00
6.500	6.000	1.22E+01	1.63E-02	5.09E-05	5.93E-01	1.17E-03	2.84E-01	0.00E+00	0.00E+00
7.000	6.500	6.10E+00	8.34E-03	2.55E-05	2.97E-01	5.88E-04	1.43E-01	0.00E+00	0.00E+00
7.500	7.000	3.06E+00	4.27E-03	1.28E-05	1.49E-01	2.96E-04	7.16E-02	0.00E+00	0.00E+00
8.000	7.500	1.54E+00	2.19E-03	6.42E-06	7.48E-02	1.49E-04	3.59E-02	0.00E+00	0.00E+00
9.000	8.000	1.15E+00	1.70E-03	4.79E-06	5.58E-02	1.11E-04	2.68E-02	0.00E+00	0.00E+00
10.000	9.000	2.88E-01	4.56E-04	1.21E-06	1.41E-02	2.82E-05	6.74E-03	0.00E+00	0.00E+00
	Total	4.26E+12	2.18E+10	4.97E+07	1.46E+12	7.64E+08	1.12E+11	4.64E+12	9.10E+14

Table 3-24. Photon Source from ORIGEN-S (Decay Time = 100 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.020	0.010	2.27E+12	7.42E+09	3.38E+07	8.25E+11	7.86E+08	1.17E+10	1.27E+12	1.06E+13
0.030	0.020	2.81E+11	8.55E+07	4.87E+06	1.25E+11	1.17E+08	3.66E+09	6.99E+11	3.96E+12
0.040	0.030	1.69E+11	5.22E+07	7.14E+04	7.42E+10	2.53E+06	2.20E+09	4.23E+11	2.10E+12
0.050	0.040	2.78E+11	4.79E+08	9.06E+04	1.78E+11	1.61E+06	1.84E+09	3.57E+11	1.51E+12
0.060	0.050	1.87E+11	2.85E+07	1.30E+05	3.47E+10	6.83E+08	1.44E+09	2.06E+11	7.71E+11
0.070	0.060	8.68E+10	1.14E+08	2.59E+04	3.24E+10	1.29E+06	9.86E+08	1.95E+11	6.57E+11
0.080	0.070	1.89E+11	5.03E+09	3.39E+05	2.54E+10	9.83E+05	7.54E+09	1.55E+11	4.54E+11
0.090	0.080	1.21E+12	3.49E+07	3.79E+06	2.03E+10	2.85E+04	2.71E+09	1.27E+11	3.23E+11
0.100	0.090	3.91E+11	1.20E+09	7.20E+06	2.06E+10	4.76E+07	7.23E+08	1.32E+11	2.88E+11
0.110	0.100	5.13E+10	3.83E+09	5.20E+05	1.08E+10	2.67E+07	3.40E+08	6.95E+10	1.43E+11
0.120	0.110	5.32E+10	8.09E+08	1.77E+06	1.21E+10	2.01E+07	3.89E+08	8.04E+10	1.35E+11
0.130	0.120	5.62E+10	1.12E+08	3.72E+03	1.12E+10	1.18E+05	3.58E+08	7.40E+10	1.24E+11
0.140	0.130	2.54E+10	2.48E+06	4.32E+04	8.82E+09	3.45E+03	3.11E+08	6.07E+10	7.79E+10
0.150	0.140	1.05E+11	1.10E+07	1.14E+05	8.21E+09	7.20E+06	2.83E+08	5.66E+10	7.26E+10
0.160	0.150	1.73E+11	1.53E+06	8.64E+04	6.60E+09	1.30E+05	2.22E+08	4.74E+10	4.60E+10
0.170	0.160	1.64E+10	2.81E+06	2.85E+04	6.20E+09	1.81E+06	2.08E+08	4.45E+10	4.32E+10
0.180	0.170	1.93E+10	9.59E+05	1.07E+04	5.07E+09	7.05E+02	1.75E+08	3.79E+10	2.73E+10
0.190	0.180	1.29E+10	6.78E+06	6.74E+03	4.79E+09	3.80E+02	1.45E+09	3.59E+10	2.58E+10
0.200	0.190	2.04E+10	1.28E+06	7.43E+04	7.91E+09	5.97E+02	2.98E+08	6.19E+10	3.23E+10
0.210	0.200	3.61E+10	1.30E+08	1.84E+04	7.52E+09	1.98E+07	2.67E+08	5.89E+10	2.00E+11
0.220	0.210	3.31E+10	1.23E+08	5.06E+04	0.00E+00	1.58E-01	0.00E+00	0.00E+00	0.00E+00
0.230	0.220	1.93E+09	8.65E+08	2.38E+03	0.00E+00	1.90E+04	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	3.01E+11	8.18E-03	1.74E+04	0.00E+00	1.86E+04	0.00E+00	0.00E+00	7.65E+11
0.250	0.240	6.49E+09	2.97E+01	1.57E+04	4.05E+03	5.64E+01	2.69E+09	0.00E+00	0.00E+00
0.260	0.250	2.28E+11	8.84E+06	3.46E+03	7.52E+09	7.46E+00	4.88E+08	6.45E+10	1.63E+10
0.270	0.260	3.68E+11	7.05E+05	2.56E+03	7.23E+09	6.67E+05	2.75E+08	6.21E+10	1.56E+10
0.280	0.270	2.59E+11	1.08E+09	7.66E+04	0.00E+00	1.28E+02	1.83E+08	0.00E+00	0.00E+00
0.290	0.280	5.26E+10	5.84E+07	2.15E-04	0.00E+00	1.54E-10	4.10E+07	0.00E+00	0.00E+00
0.300	0.290	4.28E+10	2.82E-02	8.21E+05	0.00E+00	2.53E+03	7.01E+09	0.00E+00	0.00E+00
0.325	0.300	2.04E+11	1.20E+08	1.01E+07	8.18E+09	2.88E+03	3.97E+08	8.18E+10	6.15E+09
0.350	0.325	1.88E+11	1.51E+08	1.09E+06	0.00E+00	1.18E+06	9.52E+07	0.00E+00	0.00E+00
0.375	0.350	3.26E+11	5.61E-01	8.48E+04	0.00E+00	1.45E+05	1.32E+10	0.00E+00	0.00E+00
0.400	0.375	1.58E+10	2.26E+05	4.29E+05	4.45E+09	2.85E+03	5.14E+08	5.27E+10	1.79E+09
0.425	0.400	2.57E+11	9.03E-01	4.22E+05	0.00E+00	5.71E+02	6.02E+07	0.00E+00	0.00E+00
0.450	0.425	8.59E+10	1.24E+06	3.42E+01	2.65E+09	4.86E+02	1.98E+08	3.80E+10	9.27E+08
0.475	0.450	6.84E+06	1.98E+05	7.26E-06	0.00E+00	3.23E+02	2.51E+08	0.00E+00	0.00E+00
0.500	0.475	5.36E+09	1.00E+06	2.97E+00	1.06E+09	2.39E+01	3.78E+08	1.87E+10	3.20E+08
0.525	0.500	5.01E+09	7.69E+03	2.83E+00	1.01E+09	7.79E+01	1.17E+08	1.78E+10	3.04E+08
0.550	0.525	1.93E+09	3.21E-04	1.53E-06	0.00E+00	2.01E+01	1.51E+08	0.00E+00	0.00E+00
0.575	0.550	1.16E+08	1.37E-04	7.66E-07	0.00E+00	3.36E+01	3.04E+07	0.00E+00	3.85E+10
0.600	0.575	4.82E+09	1.57E+03	1.77E-03	6.44E+08	1.99E+02	1.94E+08	1.57E+10	1.83E+09

Table 3-24. Photon Source from ORIGEN-S (Decay Time = 100 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.625	0.600	4.87E+09	1.50E+03	1.70E-03	6.18E+08	1.00E+03	1.69E+10	1.51E+10	1.42E+08
0.650	0.625	5.88E+06	2.19E+04	0.00E+00	0.00E+00	1.49E+02	6.31E+07	0.00E+00	0.00E+00
0.675	0.650	8.30E+07	8.86E+04	6.58E-07	0.00E+00	6.63E+03	5.90E+08	0.00E+00	0.00E+00
0.700	0.675	1.43E+09	1.92E+01	1.48E-08	2.51E+08	7.57E+02	8.27E+07	9.95E+09	3.28E+07
0.725	0.700	1.32E+10	1.85E+01	5.68E-07	2.42E+08	3.42E+03	3.98E+08	9.60E+09	1.21E+14
0.750	0.725	2.76E+07	1.51E+01	5.12E-02	2.03E+03	1.72E+02	3.73E+07	0.00E+00	0.00E+00
0.775	0.750	1.80E+10	1.46E+01	4.95E-02	1.96E+03	3.69E+02	1.88E+09	0.00E+00	4.98E+14
0.800	0.775	7.09E+08	1.79E-04	6.96E-09	8.76E+07	4.03E+01	5.46E+08	6.45E+09	4.91E+08
0.825	0.800	7.38E+08	1.85E-04	2.27E-07	9.58E+07	4.81E+01	5.48E+08	6.25E+09	1.58E+07
0.850	0.825	9.48E+10	2.14E-04	0.00E+00	0.00E+00	1.27E+01	2.63E+08	0.00E+00	3.80E+05
0.875	0.850	1.75E+08	8.87E-20	4.21E-07	0.00E+00	2.75E+01	0.00E+00	0.00E+00	0.00E+00
0.900	0.875	6.42E+09	7.68E-05	3.15E-09	2.51E+07	4.85E+00	1.55E+07	4.24E+09	8.85E+03
0.925	0.900	2.98E+08	1.68E-05	3.07E-09	2.44E+07	1.23E+01	6.15E+07	4.13E+09	8.61E+03
0.950	0.925	2.28E+06	3.54E-05	0.00E+00	0.00E+00	1.85E+00	1.16E+09	0.00E+00	0.00E+00
0.975	0.950	5.40E+08	5.10E-05	0.00E+00	0.00E+00	9.60E+00	1.40E+08	0.00E+00	0.00E+00
1.000	0.975	9.87E+07	5.39E-05	8.31E-07	4.85E+06	5.95E-13	2.31E+07	2.81E+09	0.00E+00
1.250	1.000	5.15E+09	8.24E+00	2.81E-02	4.97E+06	2.86E+00	9.22E+09	8.63E+09	0.00E+00
1.500	1.250	2.09E+08	6.74E+00	2.29E-02	9.08E+02	1.55E+00	3.85E+09	2.81E+09	0.00E+00
1.750	1.500	6.60E+03	4.00E+00	1.36E-02	5.40E+02	9.22E-01	3.23E+09	8.28E+08	0.00E+00
2.000	1.750	5.72E+03	3.47E+00	1.18E-02	4.68E+02	7.99E-01	6.62E+09	1.58E+08	0.00E+00
2.250	2.000	3.25E+03	1.98E+00	6.72E-03	2.66E+02	4.55E-01	2.47E+09	1.85E+07	0.00E+00
2.500	2.250	2.91E+03	1.77E+00	6.02E-03	2.38E+02	4.07E-01	7.38E+08	7.31E+04	0.00E+00
2.750	2.500	1.61E+03	9.90E-01	3.34E-03	1.32E+02	2.26E-01	1.57E+07	0.00E+00	0.00E+00
3.000	2.750	1.47E+03	9.04E-01	3.05E-03	1.21E+02	2.06E-01	3.28E+07	0.00E+00	0.00E+00
3.500	3.000	1.55E+03	9.55E-01	3.20E-03	1.26E+02	2.16E-01	1.24E+07	0.00E+00	0.00E+00
4.000	3.500	7.75E+02	4.83E-01	1.60E-03	6.34E+01	1.09E-01	8.99E+00	0.00E+00	0.00E+00
4.500	4.000	3.89E+02	2.45E-01	8.04E-04	3.18E+01	5.45E-02	4.51E+00	0.00E+00	0.00E+00
5.000	4.500	1.95E+02	1.24E-01	4.03E-04	1.60E+01	2.74E-02	2.26E+00	0.00E+00	0.00E+00
5.500	5.000	9.78E+01	6.30E-02	2.02E-04	8.01E+00	1.38E-02	1.13E+00	0.00E+00	0.00E+00
6.000	5.500	4.91E+01	3.20E-02	1.01E-04	4.02E+00	6.91E-03	5.69E-01	0.00E+00	0.00E+00
6.500	6.000	2.46E+01	1.63E-02	5.09E-05	2.01E+00	3.47E-03	2.86E-01	0.00E+00	0.00E+00
7.000	6.500	1.23E+01	8.34E-03	2.55E-05	1.01E+00	1.74E-03	1.43E-01	0.00E+00	0.00E+00
7.500	7.000	6.19E+00	4.27E-03	1.28E-05	5.07E-01	8.77E-04	7.18E-02	0.00E+00	0.00E+00
8.000	7.500	3.11E+00	2.19E-03	6.42E-06	2.54E-01	4.41E-04	3.60E-02	0.00E+00	0.00E+00
9.000	8.000	2.32E+00	1.70E-03	4.79E-06	1.90E-01	3.30E-04	2.69E-02	0.00E+00	0.00E+00
10.000	9.000	5.83E-01	4.56E-04	1.21E-06	4.77E-02	8.39E-05	6.77E-03	0.00E+00	0.00E+00
	Total	8.16E+12	2.18E+10	6.61E+07	1.46E+12	1.72E+09	1.12E+11	4.61E+12	6.41E+14

Table 3-25. Photon Source from ORIGEN-S (Decay Time = 30,000 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.020	0.010	1.75E+11	7.36E+09	3.52E+07	6.47E+10	4.03E+10	2.09E+10	1.70E+11	0.00E+00
0.030	0.020	2.20E+10	8.49E+07	4.88E+06	9.81E+09	7.39E+09	4.99E+09	9.31E+10	0.00E+00
0.040	0.030	1.33E+10	5.18E+07	7.73E+04	5.83E+09	1.46E+08	2.98E+09	5.64E+10	0.00E+00
0.050	0.040	2.14E+10	4.75E+08	9.58E+04	1.40E+10	8.30E+07	3.86E+09	4.75E+10	0.00E+00
0.060	0.050	1.44E+10	2.83E+07	1.32E+05	2.72E+09	4.38E+10	1.79E+09	2.74E+10	0.00E+00
0.070	0.060	6.77E+09	1.13E+08	2.77E+04	2.55E+09	2.43E+06	1.33E+09	2.60E+10	0.00E+00
0.080	0.070	1.47E+10	4.99E+09	3.67E+05	1.99E+09	2.24E+06	7.57E+09	2.07E+10	0.00E+00
0.090	0.080	9.41E+10	3.46E+07	3.84E+06	1.60E+09	3.55E+05	2.86E+09	1.69E+10	0.00E+00
0.100	0.090	3.05E+10	1.19E+09	7.68E+06	1.62E+09	2.66E+07	9.38E+08	1.75E+10	0.00E+00
0.110	0.100	3.95E+09	3.80E+09	5.38E+05	8.48E+08	2.44E+07	4.54E+08	9.26E+09	0.00E+00
0.120	0.110	4.11E+09	8.03E+08	1.91E+06	9.53E+08	1.61E+06	5.17E+08	1.07E+10	0.00E+00
0.130	0.120	4.40E+09	1.11E+08	4.03E+03	8.77E+08	5.74E+06	4.75E+08	9.86E+09	0.00E+00
0.140	0.130	1.98E+09	2.46E+06	4.34E+04	6.92E+08	1.02E+04	4.02E+08	8.09E+09	0.00E+00
0.150	0.140	8.24E+09	1.09E+07	1.14E+05	6.44E+08	7.15E+05	3.69E+08	7.53E+09	0.00E+00
0.160	0.150	1.36E+10	1.52E+06	8.65E+04	5.18E+08	5.30E+04	2.91E+08	6.32E+09	0.00E+00
0.170	0.160	1.28E+09	2.79E+06	2.86E+04	4.87E+08	3.45E+05	2.73E+08	5.93E+09	0.00E+00
0.180	0.170	1.51E+09	9.52E+05	1.08E+04	3.98E+08	2.15E+04	2.27E+08	5.05E+09	0.00E+00
0.190	0.180	1.00E+09	6.73E+06	6.81E+03	3.76E+08	6.36E+02	1.46E+09	4.78E+09	0.00E+00
0.200	0.190	1.60E+09	1.27E+06	7.44E+04	6.21E+08	3.38E+04	3.80E+08	8.25E+09	0.00E+00
0.210	0.200	2.78E+09	1.29E+08	1.85E+04	5.91E+08	1.29E+06	3.45E+08	7.84E+09	0.00E+00
0.220	0.210	2.51E+09	1.22E+08	5.06E+04	0.00E+00	4.67E+03	0.00E+00	0.00E+00	0.00E+00
0.230	0.220	1.50E+08	8.58E+08	2.38E+03	0.00E+00	4.76E+04	0.00E+00	0.00E+00	0.00E+00
0.240	0.230	2.27E+10	2.53E+00	1.74E+04	0.00E+00	7.83E+03	0.00E+00	0.00E+00	0.00E+00
0.250	0.240	4.94E+08	3.72E+01	1.69E+04	8.64E+02	5.35E+03	2.60E+09	0.00E+00	0.00E+00
0.260	0.250	1.73E+10	8.77E+06	3.61E+03	5.90E+08	7.59E+02	5.58E+08	8.59E+09	0.00E+00
0.270	0.260	2.89E+10	6.99E+05	2.62E+03	5.68E+08	5.44E+04	3.49E+08	8.27E+09	0.00E+00
0.280	0.270	2.03E+10	1.07E+09	8.29E+04	0.00E+00	1.63E+04	1.76E+08	0.00E+00	0.00E+00
0.290	0.280	3.99E+09	5.80E+07	1.15E-01	0.00E+00	4.20E-03	3.96E+07	0.00E+00	0.00E+00
0.300	0.290	3.24E+09	8.71E+00	8.89E+05	0.00E+00	1.01E+05	6.77E+09	0.00E+00	0.00E+00
0.325	0.300	1.58E+10	1.19E+08	1.09E+07	6.42E+08	1.18E+06	4.79E+08	1.09E+10	0.00E+00
0.350	0.325	1.45E+10	1.50E+08	1.18E+06	0.00E+00	8.62E+05	9.19E+07	0.00E+00	0.00E+00
0.375	0.350	2.55E+10	1.73E+02	9.19E+04	0.00E+00	3.25E+05	1.27E+10	0.00E+00	0.00E+00
0.400	0.375	1.24E+09	2.25E+05	4.64E+05	3.49E+08	2.35E+05	5.48E+08	7.02E+09	0.00E+00
0.425	0.400	2.01E+10	2.79E+02	4.57E+05	0.00E+00	8.08E+04	5.81E+07	0.00E+00	0.00E+00
0.450	0.425	6.73E+09	1.23E+06	4.59E+01	2.08E+08	3.28E+04	2.22E+08	5.06E+09	0.00E+00
0.475	0.450	5.18E+05	1.96E+05	7.24E-01	0.00E+00	2.18E+04	2.42E+08	0.00E+00	0.00E+00
0.500	0.475	4.20E+08	9.92E+05	3.25E+00	8.31E+07	1.62E+03	3.77E+08	2.50E+09	0.00E+00
0.525	0.500	3.92E+08	7.63E+03	3.09E+00	7.90E+07	5.26E+03	1.25E+08	2.38E+09	0.00E+00
0.550	0.525	1.51E+08	9.92E-02	4.01E-03	0.00E+00	1.36E+03	1.46E+08	0.00E+00	0.00E+00
0.575	0.550	9.02E+06	4.22E-02	3.59E-04	0.00E+00	2.27E+03	2.93E+07	0.00E+00	0.00E+00
0.600	0.575	3.78E+08	1.56E+03	1.62E-02	5.05E+07	1.35E+04	1.95E+08	2.10E+09	0.00E+00

Table 3-25. Photon Source from ORIGEN-S (Decay Time = 30,000 days)

Energy (MeV)		Photon Source (p/s/g)							
Upper	Lower	Ac-227	Am-243	Np-237	Pb-210	Pu-241	Ra-226	Sr-90	Zr-95
0.625	0.600	3.82E+08	1.49E+03	1.53E-02	4.85E+07	6.76E+04	1.63E+10	2.01E+09	0.00E+00
0.650	0.625	4.45E+05	2.18E+04	0.00E+00	0.00E+00	1.01E+04	6.09E+07	0.00E+00	0.00E+00
0.675	0.650	6.50E+06	8.79E+04	2.94E-02	0.00E+00	4.48E+05	5.69E+08	0.00E+00	0.00E+00
0.700	0.675	1.12E+08	1.94E+01	6.55E-03	1.97E+07	5.11E+04	8.28E+07	1.33E+09	0.00E+00
0.725	0.700	1.04E+09	1.97E+01	6.58E-03	1.90E+07	2.31E+05	3.87E+08	1.28E+09	0.00E+00
0.750	0.725	2.08E+06	1.51E+01	5.12E-02	4.32E+02	1.16E+04	3.60E+07	0.00E+00	0.00E+00
0.775	0.750	1.41E+09	1.73E+01	4.95E-02	4.18E+02	2.49E+04	1.81E+09	0.00E+00	0.00E+00
0.800	0.775	5.49E+07	5.53E-02	3.08E-03	6.88E+06	2.72E+03	5.28E+08	8.59E+08	0.00E+00
0.825	0.800	5.73E+07	5.73E-02	1.01E-01	8.97E+06	3.25E+03	5.30E+08	8.33E+08	0.00E+00
0.850	0.825	7.43E+09	6.61E-02	0.00E+00	0.00E+00	8.56E+02	2.54E+08	0.00E+00	0.00E+00
0.875	0.850	1.36E+07	1.19E-08	1.97E-04	0.00E+00	1.86E+03	0.00E+00	0.00E+00	0.00E+00
0.900	0.875	5.03E+08	2.37E-02	1.39E-03	1.97E+06	3.27E+02	1.52E+07	5.65E+08	0.00E+00
0.925	0.900	2.32E+07	5.19E-03	1.36E-03	1.91E+06	8.32E+02	5.96E+07	5.50E+08	0.00E+00
0.950	0.925	1.73E+05	1.09E-02	0.00E+00	0.00E+00	1.25E+02	1.12E+09	0.00E+00	0.00E+00
0.975	0.950	4.23E+07	1.58E-02	0.00E+00	0.00E+00	6.48E+02	1.36E+08	0.00E+00	0.00E+00
1.000	0.975	7.73E+06	1.67E-02	9.80E-04	3.81E+05	2.82E-05	2.23E+07	3.74E+08	0.00E+00
1.250	1.000	4.03E+08	8.21E+00	1.23E-01	3.90E+05	1.87E+02	8.90E+09	1.15E+09	0.00E+00
1.500	1.250	1.64E+07	6.71E+00	2.30E-02	1.94E+02	9.94E+01	3.71E+09	3.74E+08	0.00E+00
1.750	1.500	5.13E+02	3.98E+00	6.95E-01	1.15E+02	5.91E+01	3.12E+09	1.10E+08	0.00E+00
2.000	1.750	4.45E+02	3.45E+00	1.18E-02	9.97E+01	5.12E+01	6.39E+09	2.11E+07	0.00E+00
2.250	2.000	2.53E+02	1.97E+00	6.73E-03	5.67E+01	2.91E+01	2.39E+09	2.47E+06	0.00E+00
2.500	2.250	2.26E+02	1.77E+00	6.02E-03	5.07E+01	2.61E+01	7.12E+08	9.74E+03	0.00E+00
2.750	2.500	1.26E+02	9.85E-01	3.34E-03	2.81E+01	1.45E+01	1.51E+07	0.00E+00	0.00E+00
3.000	2.750	1.15E+02	8.99E-01	3.05E-03	2.57E+01	1.32E+01	3.17E+07	0.00E+00	0.00E+00
3.500	3.000	1.20E+02	9.50E-01	3.20E-03	2.70E+01	1.39E+01	1.20E+07	0.00E+00	0.00E+00
4.000	3.500	6.03E+01	4.80E-01	1.60E-03	1.35E+01	6.96E+00	1.07E+01	0.00E+00	0.00E+00
4.500	4.000	3.02E+01	2.43E-01	8.04E-04	6.78E+00	3.50E+00	5.37E+00	0.00E+00	0.00E+00
5.000	4.500	1.52E+01	1.23E-01	4.03E-04	3.40E+00	1.76E+00	2.69E+00	0.00E+00	0.00E+00
5.500	5.000	7.61E+00	6.26E-02	2.02E-04	1.71E+00	8.82E-01	1.35E+00	0.00E+00	0.00E+00
6.000	5.500	3.82E+00	3.19E-02	1.01E-04	8.56E-01	4.43E-01	6.77E-01	0.00E+00	0.00E+00
6.500	6.000	1.91E+00	1.62E-02	5.09E-05	4.29E-01	2.23E-01	3.40E-01	0.00E+00	0.00E+00
7.000	6.500	9.60E-01	8.29E-03	2.55E-05	2.15E-01	1.12E-01	1.70E-01	0.00E+00	0.00E+00
7.500	7.000	4.82E-01	4.24E-03	1.28E-05	1.08E-01	5.63E-02	8.54E-02	0.00E+00	0.00E+00
8.000	7.500	2.42E-01	2.18E-03	6.42E-06	5.42E-02	2.83E-02	4.29E-02	0.00E+00	0.00E+00
9.000	8.000	1.80E-01	1.69E-03	4.79E-06	4.04E-02	2.12E-02	3.20E-02	0.00E+00	0.00E+00
10.000	9.000	4.54E-02	4.53E-04	1.21E-06	1.02E-02	5.38E-03	8.05E-03	0.00E+00	0.00E+00
	Total	6.33E+11	2.16E+10	6.93E+07	1.15E+11	9.18E+10	1.25E+11	6.15E+11	0.00E+00

Table 3-26. Total Photon Source Strength

Isotope	Total Photon Source (p/s/g)				
	RASTA	ORIGEN-S			
		0.01 d	30 d	100 d	30000 d
Ac-227	2.27E+10	3.38E+10	4.26E+12	8.16E+12	6.33E+11
Am-241	1.36E+11	1.03E+11	1.03E+11	1.03E+11	9.07E+10
Am-243	6.80E+09	7.51E+09	2.18E+10	2.18E+10	2.16E+10
Cd-109	9.15E+13	8.93E+13	8.54E+13	7.69E+13	2.69E+06
Cf-252	1.47E+12	1.01E+13	9.90E+12	9.43E+12	1.80E+08
Cm-244	3.18E+11	3.66E+11	3.65E+11	3.63E+11	1.66E+10
Cm-248	2.20E+08	1.89E+08	1.89E+08	1.89E+08	1.89E+08
Co-60	8.45E+13	8.59E+13	8.50E+13	8.28E+13	1.75E+09
Cs-137	1.82E+11	3.19E+12	3.24E+12	3.23E+12	4.87E+11
Eu-152	1.54E+13	1.56E+13	1.55E+13	1.53E+13	2.17E+11
Fe-59	1.86E+15	1.95E+15	1.22E+15	4.11E+14	0.00E+00
Gd-153	2.21E+14	2.24E+14	2.05E+14	1.68E+14	0.00E+00
Hf-181	1.19E+15	1.16E+15	7.10E+14	2.26E+14	0.00E+00
Ho-166m	2.47E+11	2.35E+11	2.35E+11	2.35E+11	2.24E+11
Ir-192	8.23E+14	7.38E+13	5.57E+13	2.89E+13	0.00E+00
Mn-54	2.86E+14	2.86E+14	2.67E+14	2.29E+14	3.35E-15
Np-237	2.57E+07	2.71E+07	4.97E+07	6.61E+07	6.93E+07
Pb-210	6.64E+11	7.16E+11	1.46E+12	1.46E+12	1.15E+11
Pm-147	3.81E+11	7.69E+11	7.53E+11	7.15E+11	2.89E+02
Po-210	1.76E+09	1.76E+09	1.52E+09	1.07E+09	0.00E+00
Pu-238	7.15E+10	7.69E+10	7.68E+10	7.67E+10	4.02E+10
Pu-239	9.79E+07	1.11E+08	1.11E+08	1.11E+08	1.11E+08
Pu-240	9.04E+08	8.83E+08	8.83E+08	8.83E+08	8.76E+08
Pu-241	3.16E+08	1.96E+08	7.64E+08	1.72E+09	9.18E+10
Pu-242	1.31E+07	1.31E+07	1.31E+07	1.31E+07	1.31E+07
Ra-226	1.69E+09	1.84E+09	1.12E+11	1.12E+11	1.25E+11
Ru-106	1.34E+10	1.96E+14	1.86E+14	1.63E+14	9.84E-11
Sc-46	2.51E+15	2.58E+15	2.00E+15	1.12E+15	0.00E+00
Se-75	1.19E+15	1.18E+15	9.96E+14	6.64E+14	0.00E+00
Sm-145	1.61E+14	1.61E+14	1.51E+14	1.32E+14	1.81E+11
Sr-90	2.04E+11	5.93E+11	4.64E+12	4.61E+12	6.15E+11
Tm-170	4.75E+13	4.56E+13	3.88E+13	2.66E+13	0.00E+00
Yb-169	2.93E+15	2.93E+15	1.53E+15	3.36E+14	0.00E+00
Zn-65	1.62E+14	1.63E+14	1.51E+14	1.23E+14	0.00E+00
Zr-95	8.10E+14	8.31E+14	9.10E+14	6.41E+14	0.00E+00

Shaded values indicate that RASTA source is greater than
ORIGEN-S source

Table 3-27 Photons from Nuclides with Bremsstrahlung

Energy (MeV)		Photon Source (photons/sec/g)								
Upper	Lower	Ac-227			Cs-137			Pb-210		
		(Decay)	(Brem.)	(Total)	(Decay)	(Brem.)	(Total)	(Decay)	(Brem.)	(Total)
2.00E-02	1.00E-02	1.11E+12	5.10E+11	1.62E+12	0.00E+00	6.73E+10	6.73E+10	2.72E+04	1.24E+11	1.24E+11
3.00E-02	2.00E-02	1.34E+10	2.62E+11	2.75E+11	0.00E+00	3.31E+10	3.31E+10	0.00E+00	6.33E+10	6.33E+10
4.00E-02	3.00E-02	2.18E+09	1.66E+11	1.68E+11	2.14E+11	2.02E+10	2.34E+11	0.00E+00	3.98E+10	3.98E+10
5.00E-02	4.00E-02	1.46E+10	1.16E+11	1.31E+11	0.00E+00	1.36E+10	1.36E+10	0.00E+00	2.78E+10	2.78E+10
6.00E-02	5.00E-02	2.13E+11	8.70E+10	3.00E+11	0.00E+00	9.74E+09	9.74E+09	0.00E+00	2.06E+10	2.06E+10
7.00E-02	6.00E-02	1.17E+10	6.77E+10	7.95E+10	0.00E+00	7.27E+09	7.27E+09	0.00E+00	1.59E+10	1.59E+10
8.00E-02	7.00E-02	1.64E+11	5.43E+10	2.18E+11	0.00E+00	5.59E+09	5.59E+09	6.81E+04	1.27E+10	1.27E+10
9.00E-02	8.00E-02	1.52E+11	4.45E+10	1.97E+11	0.00E+00	4.39E+09	4.39E+09	1.98E+04	1.03E+10	1.03E+10
1.00E-01	9.00E-02	5.18E+10	3.71E+10	8.89E+10	0.00E+00	3.50E+09	3.50E+09	0.00E+00	8.55E+09	8.55E+09
1.10E-01	1.00E-01	3.00E+10	3.14E+10	6.14E+10	0.00E+00	2.83E+09	2.83E+09	0.00E+00	7.18E+09	7.18E+09
1.20E-01	1.10E-01	2.36E+10	2.68E+10	5.04E+10	0.00E+00	2.31E+09	2.31E+09	0.00E+00	6.09E+09	6.09E+09
1.30E-01	1.20E-01	5.31E+08	2.32E+10	2.37E+10	0.00E+00	1.90E+09	1.90E+09	0.00E+00	5.22E+09	5.22E+09
1.40E-01	1.30E-01	4.15E+09	2.02E+10	2.43E+10	0.00E+00	1.57E+09	1.57E+09	0.00E+00	4.51E+09	4.51E+09
1.50E-01	1.40E-01	4.62E+09	1.77E+10	2.23E+10	0.00E+00	1.31E+09	1.31E+09	0.00E+00	3.92E+09	3.92E+09
1.60E-01	1.50E-01	0.00E+00	1.56E+10	1.56E+10	0.00E+00	1.10E+09	1.10E+09	0.00E+00	3.43E+09	3.43E+09
1.70E-01	1.60E-01	1.04E+09	1.38E+10	1.48E+10	0.00E+00	9.24E+08	9.24E+08	0.00E+00	3.02E+09	3.02E+09
1.80E-01	1.70E-01	1.10E+09	1.23E+10	1.34E+10	0.00E+00	7.79E+08	7.79E+08	0.00E+00	2.67E+09	2.67E+09
1.90E-01	1.80E-01	9.68E+08	1.10E+10	1.19E+10	0.00E+00	6.59E+08	6.59E+08	0.00E+00	2.36E+09	2.36E+09
2.00E-01	1.90E-01	3.11E+08	9.84E+09	1.02E+10	0.00E+00	5.58E+08	5.58E+08	0.00E+00	2.10E+09	2.10E+09
2.10E-01	2.00E-01	1.73E+10	8.86E+09	2.61E+10	0.00E+00	4.74E+08	4.74E+08	0.00E+00	1.88E+09	1.88E+09
2.20E-01	2.10E-01	3.33E+10	7.99E+09	4.13E+10	0.00E+00	4.03E+08	4.03E+08	0.00E+00	1.68E+09	1.68E+09
2.30E-01	2.20E-01	1.16E+09	7.24E+09	8.40E+09	0.00E+00	3.43E+08	3.43E+08	0.00E+00	1.51E+09	1.51E+09
2.40E-01	2.30E-01	3.03E+11	6.56E+09	3.10E+11	0.00E+00	2.93E+08	2.93E+08	0.00E+00	1.36E+09	1.36E+09
2.50E-01	2.40E-01	1.30E+09	5.97E+09	7.27E+09	0.00E+00	2.50E+08	2.50E+08	0.00E+00	1.22E+09	1.22E+09
2.60E-01	2.50E-01	2.13E+11	5.44E+09	2.18E+11	0.00E+00	2.13E+08	2.13E+08	0.00E+00	1.11E+09	1.11E+09
2.70E-01	2.60E-01	2.77E+09	4.47E+09	7.24E+09	0.00E+00	1.82E+08	1.82E+08	0.00E+00	1.00E+09	1.00E+09
2.80E-01	2.70E-01	2.72E+11	4.99E+09	2.77E+11	0.00E+00	1.56E+08	1.56E+08	0.00E+00	9.06E+08	9.06E+08
2.90E-01	2.80E-01	4.82E+10	3.74E+09	5.20E+10	0.00E+00	1.34E+08	1.34E+08	0.00E+00	8.22E+08	8.22E+08
3.00E-01	2.90E-01	6.75E+10	4.19E+09	7.17E+10	0.00E+00	1.15E+08	1.15E+08	0.00E+00	7.47E+08	7.47E+08
3.25E-01	3.00E-01	5.82E+10	8.25E+09	6.64E+10	0.00E+00	2.21E+08	2.21E+08	0.00E+00	1.59E+09	1.59E+09
3.50E-01	3.25E-01	1.04E+11	6.72E+09	1.10E+11	0.00E+00	1.52E+08	1.52E+08	0.00E+00	1.26E+09	1.26E+09
3.75E-01	3.50E-01	3.27E+11	5.46E+09	3.32E+11	0.00E+00	1.05E+08	1.05E+08	3.69E+01	9.98E+08	9.98E+08
4.00E-01	3.75E-01	2.19E+09	4.53E+09	6.71E+09	0.00E+00	7.58E+07	7.58E+07	0.00E+00	8.06E+08	8.06E+08
4.25E-01	4.00E-01	2.47E+11	3.71E+09	2.50E+11	0.00E+00	5.51E+07	5.51E+07	0.00E+00	6.41E+08	6.41E+08
4.50E-01	4.25E-01	3.74E+10	2.99E+09	4.03E+10	0.00E+00	4.04E+07	4.04E+07	0.00E+00	4.91E+08	4.91E+08
4.75E-01	4.50E-01	6.70E+06	2.34E+09	2.34E+09	0.00E+00	3.32E+07	3.32E+07	0.00E+00	4.18E+08	4.18E+08
5.00E-01	4.75E-01	2.45E+07	1.93E+09	1.96E+09	0.00E+00	2.63E+07	2.63E+07	0.00E+00	3.33E+08	3.33E+08
5.25E-01	5.00E-01	1.09E+09	1.62E+09	2.71E+09	0.00E+00	2.14E+07	2.14E+07	0.00E+00	2.70E+08	2.70E+08
5.50E-01	5.25E-01	1.87E+08	1.34E+09	1.53E+09	0.00E+00	1.71E+07	1.71E+07	0.00E+00	2.15E+08	2.15E+08
5.75E-01	5.50E-01	4.09E+08	1.13E+09	1.54E+09	0.00E+00	1.39E+07	1.39E+07	0.00E+00	1.73E+08	1.73E+08
6.00E-01	5.75E-01	8.17E+06	9.44E+08	9.52E+08	0.00E+00	1.12E+07	1.12E+07	0.00E+00	1.38E+08	1.38E+08
6.25E-01	6.00E-01	7.91E+08	7.82E+08	1.57E+09	0.00E+00	8.84E+06	8.84E+06	0.00E+00	1.09E+08	1.09E+08
6.50E-01	6.25E-01	5.80E+06	6.56E+08	6.62E+08	0.00E+00	7.10E+06	7.10E+06	0.00E+00	8.69E+07	8.69E+07
6.75E-01	6.50E-01	2.26E+08	5.42E+08	7.68E+08	2.73E+12	5.57E+06	2.73E+12	0.00E+00	6.77E+07	6.77E+07
7.00E-01	6.75E-01	4.23E+08	4.50E+08	8.73E+08	0.00E+00	4.38E+06	4.38E+06	0.00E+00	5.28E+07	5.28E+07
7.25E-01	7.00E-01	8.65E+09	3.76E+08	9.02E+09	0.00E+00	3.45E+06	3.45E+06	0.00E+00	4.13E+07	4.13E+07
7.50E-01	7.25E-01	2.73E+07	3.08E+08	3.35E+08	0.00E+00	2.64E+06	2.64E+06	0.00E+00	3.13E+07	3.13E+07
7.75E-01	7.50E-01	1.29E+10	2.56E+08	1.32E+10	0.00E+00	2.04E+06	2.04E+06	0.00E+00	2.40E+07	2.40E+07
8.00E-01	7.75E-01	2.41E+08	2.08E+08	4.49E+08	0.00E+00	1.53E+06	1.53E+06	0.00E+00	1.78E+07	1.78E+07
8.25E-01	8.00E-01	1.94E+08	1.71E+08	3.65E+08	0.00E+00	1.16E+06	1.16E+06	1.08E+07	1.33E+07	2.41E+07
8.50E-01	8.25E-01	7.34E+10	1.39E+08	7.35E+10	0.00E+00	8.49E+05	8.49E+05	0.00E+00	9.65E+06	9.65E+06
8.75E-01	8.50E-01	1.23E+08	1.11E+08	2.35E+08	0.00E+00	6.04E+05	6.04E+05	0.00E+00	6.76E+06	6.76E+06
9.00E-01	8.75E-01	6.45E+09	9.02E+07	6.54E+09	0.00E+00	4.32E+05	4.32E+05	0.00E+00	4.75E+06	4.75E+06
9.25E-01	9.00E-01	5.89E+07	7.11E+07	1.30E+08	0.00E+00	2.92E+05	2.92E+05	0.00E+00	3.15E+06	3.15E+06
9.50E-01	9.25E-01	2.28E+06	5.62E+07	5.85E+07	0.00E+00	1.94E+05	1.94E+05	0.00E+00	2.04E+06	2.04E+06
9.75E-01	9.50E-01	4.60E+08	4.44E+07	5.04E+08	0.00E+00	1.26E+05	1.26E+05	0.00E+00	1.29E+06	1.29E+06
1.00E+00	9.75E-01	1.85E+06	3.40E+07	3.58E+07	0.00E+00	7.50E+04	7.50E+04	0.00E+00	7.40E+05	7.40E+05

Table 3-27 Photons from Nuclides with Bremsstrahlung

Energy (MeV)		Photon Source (photons/sec/g)								
		Ac-227			Cs-137			Pb-210		
Upper	Lower	(Decay)	(Brem.)	(Total)	(Decay)	(Brem.)	(Total)	(Decay)	(Brem.)	(Total)
1.25E+00	1.00E+00	3.14E+09	6.33E+07	3.21E+09	0.00E+00	2.77E+04	2.77E+04	0.00E+00	2.48E+05	2.48E+05
1.50E+00	1.25E+00	1.26E+08	2.79E+05	1.26E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E+00	2.39E+00
1.75E+00	1.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.85E-05	5.85E-05
2.00E+00	1.75E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.25E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.50E+00	2.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.75E+00	2.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.00E+00	2.75E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.50E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.00E+00	3.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.50E+00	4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.00E+00	4.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.50E+00	5.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.00E+00	5.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.50E+00	6.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.00E+00	6.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.50E+00	7.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.00E+00	7.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.00E+00	8.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.00E+01	9.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		3.64E+12	1.63E+12	5.27E+12	2.94E+12	1.82E+11	3.12E+12	1.09E+07	3.83E+11	3.83E+11
Bremsstrahlung Fraction			3.10E-01			5.83E-02			1.00E+00	

Table 3-27 Photons from Nuclides with Bremsstrahlung (Continued)							
Energy (MeV)		Photon Source (photons/sec/g)					
		Ru-106			Sr-90		
Upper	Lower	(Decay)	(Brem.)	(Total)	(Decay)	(Brem.)	(Total)
2.00E-02	1.00E-02	0.00E+00	1.91E+13	1.91E+13	5.85E+08	5.25E+11	5.26E+11
3.00E-02	2.00E-02	1.16E+11	1.02E+13	1.03E+13	0.00E+00	2.74E+11	2.74E+11
4.00E-02	3.00E-02	0.00E+00	6.67E+12	6.67E+12	0.00E+00	1.76E+11	1.76E+11
5.00E-02	4.00E-02	0.00E+00	4.83E+12	4.83E+12	0.00E+00	1.26E+11	1.26E+11
6.00E-02	5.00E-02	0.00E+00	3.71E+12	3.71E+12	0.00E+00	9.49E+10	9.49E+10
7.00E-02	6.00E-02	0.00E+00	2.97E+12	2.97E+12	0.00E+00	7.48E+10	7.48E+10
8.00E-02	7.00E-02	0.00E+00	2.45E+12	2.45E+12	0.00E+00	6.07E+10	6.07E+10
9.00E-02	8.00E-02	0.00E+00	2.06E+12	2.06E+12	0.00E+00	5.04E+10	5.04E+10
1.00E-01	9.00E-02	0.00E+00	1.76E+12	1.76E+12	0.00E+00	4.25E+10	4.25E+10
1.10E-01	1.00E-01	0.00E+00	1.53E+12	1.53E+12	0.00E+00	3.64E+10	3.64E+10
1.20E-01	1.10E-01	0.00E+00	1.34E+12	1.34E+12	0.00E+00	3.15E+10	3.15E+10
1.30E-01	1.20E-01	0.00E+00	1.19E+12	1.19E+12	0.00E+00	2.76E+10	2.76E+10
1.40E-01	1.30E-01	0.00E+00	1.06E+12	1.06E+12	0.00E+00	2.43E+10	2.43E+10
1.50E-01	1.40E-01	0.00E+00	9.54E+11	9.54E+11	0.00E+00	2.16E+10	2.16E+10
1.60E-01	1.50E-01	0.00E+00	8.63E+11	8.63E+11	0.00E+00	1.93E+10	1.93E+10
1.70E-01	1.60E-01	0.00E+00	7.84E+11	7.84E+11	0.00E+00	1.73E+10	1.73E+10
1.80E-01	1.70E-01	0.00E+00	7.16E+11	7.16E+11	0.00E+00	1.56E+10	1.56E+10
1.90E-01	1.80E-01	0.00E+00	6.57E+11	6.57E+11	0.00E+00	1.42E+10	1.42E+10
2.00E-01	1.90E-01	0.00E+00	6.04E+11	6.04E+11	0.00E+00	1.29E+10	1.29E+10
2.10E-01	2.00E-01	0.00E+00	5.58E+11	5.58E+11	0.00E+00	1.18E+10	1.18E+10
2.20E-01	2.10E-01	0.00E+00	5.16E+11	5.16E+11	0.00E+00	1.08E+10	1.08E+10
2.30E-01	2.20E-01	0.00E+00	4.80E+11	4.80E+11	0.00E+00	9.92E+09	9.92E+09
2.40E-01	2.30E-01	0.00E+00	4.46E+11	4.46E+11	0.00E+00	9.14E+09	9.14E+09
2.50E-01	2.40E-01	0.00E+00	4.17E+11	4.17E+11	0.00E+00	8.45E+09	8.45E+09
2.60E-01	2.50E-01	0.00E+00	3.90E+11	3.90E+11	0.00E+00	7.82E+09	7.82E+09
2.70E-01	2.60E-01	0.00E+00	3.65E+11	3.65E+11	0.00E+00	7.26E+09	7.26E+09
2.80E-01	2.70E-01	1.80E+09	3.43E+11	3.44E+11	0.00E+00	6.75E+09	6.75E+09
2.90E-01	2.80E-01	0.00E+00	3.22E+11	3.22E+11	0.00E+00	6.29E+09	6.29E+09
3.00E-01	2.90E-01	0.00E+00	3.03E+11	3.03E+11	0.00E+00	5.87E+09	5.87E+09
3.25E-01	3.00E-01	5.30E+09	6.87E+11	6.92E+11	0.00E+00	1.31E+10	1.31E+10
3.50E-01	3.25E-01	6.20E+09	5.98E+11	6.05E+11	0.00E+00	1.12E+10	1.12E+10
3.75E-01	3.50E-01	0.00E+00	5.22E+11	5.22E+11	0.00E+00	9.54E+09	9.54E+09
4.00E-01	3.75E-01	9.39E+09	4.63E+11	4.73E+11	0.00E+00	8.30E+09	8.30E+09
4.25E-01	4.00E-01	1.07E+10	4.09E+11	4.20E+11	0.00E+00	7.19E+09	7.19E+09
4.50E-01	4.25E-01	1.94E+11	4.56E+11	6.50E+11	0.00E+00	9.41E+09	9.41E+09
4.75E-01	4.50E-01	3.80E+09	3.28E+11	3.32E+11	0.00E+00	5.57E+09	5.57E+09
5.00E-01	4.75E-01	5.17E+09	2.94E+11	2.99E+11	0.00E+00	4.89E+09	4.89E+09
5.25E-01	5.00E-01	2.52E+13	2.66E+11	2.55E+13	0.00E+00	4.36E+09	4.36E+09
5.50E-01	5.25E-01	7.61E+09	2.40E+11	2.48E+11	0.00E+00	3.85E+09	3.85E+09
5.75E-01	5.50E-01	9.08E+09	2.19E+11	2.28E+11	0.00E+00	3.45E+09	3.45E+09
6.00E-01	5.75E-01	1.48E+10	1.99E+11	2.14E+11	0.00E+00	3.08E+09	3.08E+09
6.25E-01	6.00E-01	1.31E+13	1.81E+11	1.33E+13	0.00E+00	2.74E+09	2.74E+09
6.50E-01	6.25E-01	2.77E+09	1.66E+11	1.69E+11	0.00E+00	2.47E+09	2.47E+09
6.75E-01	6.50E-01	1.89E+10	1.52E+11	1.71E+11	0.00E+00	2.21E+09	2.21E+09
7.00E-01	6.75E-01	1.20E+10	1.39E+11	1.51E+11	0.00E+00	1.99E+09	1.99E+09
7.25E-01	7.00E-01	2.08E+10	1.28E+11	1.49E+11	0.00E+00	1.80E+09	1.80E+09
7.50E-01	7.25E-01	5.10E+09	1.18E+11	1.23E+11	0.00E+00	1.61E+09	1.61E+09
7.75E-01	7.50E-01	7.96E+09	1.09E+11	1.17E+11	0.00E+00	1.46E+09	1.46E+09
8.00E-01	7.75E-01	1.79E+09	1.00E+11	1.02E+11	0.00E+00	1.32E+09	1.32E+09
8.25E-01	8.00E-01	0.00E+00	9.28E+10	9.28E+10	0.00E+00	1.19E+09	1.19E+09
8.50E-01	8.25E-01	0.00E+00	8.59E+10	8.59E+10	0.00E+00	1.08E+09	1.08E+09
8.75E-01	8.50E-01	5.17E+11	7.93E+10	5.96E+11	0.00E+00	9.72E+08	9.72E+08
9.00E-01	8.75E-01	0.00E+00	7.37E+10	7.37E+10	0.00E+00	8.83E+08	8.83E+08
9.25E-01	9.00E-01	0.00E+00	6.82E+10	6.82E+10	0.00E+00	7.96E+08	7.96E+08
9.50E-01	9.25E-01	0.00E+00	6.33E+10	6.33E+10	0.00E+00	7.21E+08	7.21E+08
9.75E-01	9.50E-01	4.83E+09	5.90E+10	6.38E+10	0.00E+00	6.55E+08	6.55E+08

Table 3-27 Photons from Nuclides with Bremsstrahlung (Continued)							
Energy (MeV)		Photon Source (photons/sec/g)					
		Ru-106			Sr-90		
1.00E+00	9.75E-01	0.00E+00	5.47E+10	5.47E+10	0.00E+00	5.90E+08	5.90E+08
1.25E+00	1.00E+00	2.29E+12	3.71E+11	2.66E+12	0.00E+00	3.39E+09	3.39E+09
1.50E+00	1.25E+00	7.26E+10	1.86E+11	2.59E+11	0.00E+00	1.15E+09	1.15E+09
1.75E+00	1.50E+00	2.00E+11	9.39E+10	2.94E+11	0.00E+00	3.10E+08	3.10E+08
2.00E+00	1.75E+00	1.08E+11	4.60E+10	1.54E+11	0.00E+00	4.99E+07	4.99E+07
2.25E+00	2.00E+00	6.16E+10	2.13E+10	8.29E+10	7.51E+04	1.50E+06	1.57E+06
2.50E+00	2.25E+00	7.16E+10	8.91E+09	8.05E+10	0.00E+00	4.92E+01	4.92E+01
2.75E+00	2.50E+00	1.44E+10	3.19E+09	1.75E+10	0.00E+00	0.00E+00	0.00E+00
3.00E+00	2.75E+00	3.43E+09	8.71E+08	4.31E+09	0.00E+00	0.00E+00	0.00E+00
3.50E+00	3.00E+00	2.82E+09	7.15E+07	2.89E+09	0.00E+00	0.00E+00	0.00E+00
4.00E+00	3.50E+00	0.00E+00	3.75E+02	3.75E+02	0.00E+00	0.00E+00	0.00E+00
4.50E+00	4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.00E+00	4.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.50E+00	5.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.00E+00	5.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.50E+00	6.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.00E+00	6.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.50E+00	7.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.00E+00	7.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.00E+00	8.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.00E+01	9.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		4.21E+13	7.46E+13	1.17E+14	5.85E+08	1.84E+12	1.84E+12
Bremsstrahlung Fraction			6.39E-01			1.00E+00	

Table 3-28. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - No Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	1.12E-09	1.20E-03	1.13E-09	1.78E-11	1.04E-02	1.83E-11	3.76E-10	5.00E-04	3.77E-10
4.14E-07	1.00E-07	1.48E-09	1.00E-03	1.48E-09	3.18E-11	7.50E-03	3.25E-11	5.32E-10	4.00E-04	5.32E-10
8.76E-07	4.14E-07	1.65E-09	1.00E-03	1.66E-09	4.18E-11	6.70E-03	4.27E-11	6.13E-10	3.00E-04	6.13E-10
1.86E-06	8.76E-07	1.78E-09	9.00E-04	1.79E-09	5.02E-11	6.20E-03	5.12E-11	6.73E-10	3.00E-04	6.73E-10
5.04E-06	1.86E-06	1.90E-09	9.00E-04	1.90E-09	5.92E-11	5.80E-03	6.03E-11	7.32E-10	3.00E-04	7.33E-10
1.07E-05	5.04E-06	1.98E-09	9.00E-04	1.98E-09	6.55E-11	5.50E-03	6.65E-11	7.76E-10	3.00E-04	7.77E-10
3.73E-05	1.07E-05	2.03E-09	9.00E-04	2.03E-09	7.29E-11	5.20E-03	7.40E-11	8.15E-10	3.00E-04	8.16E-10
1.01E-04	3.73E-05	2.04E-09	8.00E-04	2.04E-09	7.78E-11	5.00E-03	7.89E-11	8.35E-10	3.00E-04	8.36E-10
2.14E-04	1.01E-04	2.02E-09	8.00E-04	2.03E-09	7.94E-11	4.90E-03	8.05E-11	8.40E-10	3.00E-04	8.40E-10
4.54E-04	2.14E-04	1.98E-09	9.00E-04	1.99E-09	7.89E-11	5.10E-03	8.02E-11	8.22E-10	3.00E-04	8.23E-10
1.58E-03	4.54E-04	1.90E-09	8.00E-04	1.91E-09	7.81E-11	4.90E-03	7.93E-11	8.13E-10	3.00E-04	8.13E-10
3.35E-03	1.58E-03	1.90E-09	8.00E-04	1.91E-09	7.64E-11	5.00E-03	7.76E-11	8.07E-10	3.00E-04	8.08E-10
7.10E-03	3.35E-03	1.88E-09	8.00E-04	1.88E-09	7.92E-11	4.90E-03	8.03E-11	7.99E-10	3.00E-04	8.00E-10
1.50E-02	7.10E-03	1.84E-09	8.00E-04	1.85E-09	8.40E-11	4.60E-03	8.51E-11	7.95E-10	3.00E-04	7.96E-10
2.19E-02	1.50E-02	2.02E-09	8.00E-04	2.02E-09	1.00E-10	4.20E-03	1.01E-10	8.59E-10	3.00E-04	8.60E-10
2.42E-02	2.19E-02	2.11E-09	7.00E-04	2.12E-09	1.30E-10	3.60E-03	1.31E-10	9.17E-10	2.00E-04	9.17E-10
2.61E-02	2.42E-02	2.18E-09	7.00E-04	2.19E-09	1.44E-10	3.40E-03	1.45E-10	9.46E-10	2.00E-04	9.46E-10
3.18E-02	2.61E-02	2.47E-09	8.00E-04	2.48E-09	1.34E-10	3.90E-03	1.35E-10	9.61E-10	3.00E-04	9.62E-10
4.09E-02	3.18E-02	2.96E-09	8.00E-04	2.97E-09	1.41E-10	4.40E-03	1.43E-10	1.02E-09	3.00E-04	1.03E-09
6.74E-02	4.09E-02	3.55E-09	8.00E-04	3.56E-09	1.64E-10	4.10E-03	1.66E-10	1.28E-09	3.00E-04	1.28E-09
1.11E-01	6.74E-02	5.32E-09	8.00E-04	5.33E-09	2.49E-10	4.10E-03	2.52E-10	1.82E-09	3.00E-04	1.82E-09
1.83E-01	1.11E-01	8.71E-09	7.00E-04	8.72E-09	4.26E-10	3.80E-03	4.31E-10	2.93E-09	3.00E-04	2.93E-09
2.97E-01	1.83E-01	1.40E-08	7.00E-04	1.40E-08	6.22E-10	4.00E-03	6.30E-10	4.89E-09	3.00E-04	4.90E-09
3.69E-01	2.97E-01	1.92E-08	7.00E-04	1.92E-08	9.20E-10	3.60E-03	9.30E-10	6.88E-09	2.00E-04	6.89E-09
4.98E-01	3.69E-01	2.51E-08	7.00E-04	2.51E-08	1.09E-09	3.90E-03	1.10E-09	8.97E-09	2.00E-04	8.98E-09
6.08E-01	4.98E-01	3.16E-08	6.00E-04	3.16E-08	1.54E-09	3.40E-03	1.55E-09	1.16E-08	2.00E-04	1.16E-08
7.43E-01	6.08E-01	3.58E-08	6.00E-04	3.59E-08	1.80E-09	3.20E-03	1.81E-09	1.35E-08	2.00E-04	1.35E-08
8.21E-01	7.43E-01	4.04E-08	6.00E-04	4.05E-08	1.78E-09	3.30E-03	1.80E-09	1.50E-08	2.00E-04	1.50E-08
1.00E+00	8.21E-01	4.23E-08	6.00E-04	4.24E-08	2.07E-09	3.20E-03	2.09E-09	1.64E-08	2.00E-04	1.64E-08
1.35E+00	1.00E+00	4.53E-08	6.00E-04	4.54E-08	2.16E-09	3.30E-03	2.19E-09	1.77E-08	2.00E-04	1.77E-08
1.65E+00	1.35E+00	4.62E-08	6.00E-04	4.63E-08	2.14E-09	3.30E-03	2.16E-09	1.82E-08	2.00E-04	1.82E-08
1.92E+00	1.65E+00	4.63E-08	6.00E-04	4.64E-08	2.16E-09	3.20E-03	2.18E-09	1.85E-08	2.00E-04	1.85E-08
2.23E+00	1.92E+00	4.69E-08	6.00E-04	4.70E-08	2.17E-09	3.30E-03	2.19E-09	1.88E-08	2.00E-04	1.88E-08
2.35E+00	2.23E+00	4.67E-08	6.00E-04	4.68E-08	2.14E-09	3.20E-03	2.16E-09	1.87E-08	2.00E-04	1.88E-08
2.37E+00	2.35E+00	4.59E-08	6.00E-04	4.60E-08	2.16E-09	3.10E-03	2.18E-09	1.86E-08	2.00E-04	1.86E-08
2.47E+00	2.37E+00	4.61E-08	6.00E-04	4.61E-08	2.06E-09	3.20E-03	2.08E-09	1.87E-08	2.00E-04	1.87E-08
2.73E+00	2.47E+00	4.69E-08	6.00E-04	4.69E-08	2.10E-09	3.40E-03	2.12E-09	1.88E-08	2.00E-04	1.88E-08
3.01E+00	2.73E+00	4.75E-08	6.00E-04	4.76E-08	2.16E-09	3.40E-03	2.18E-09	1.92E-08	2.00E-04	1.92E-08
3.68E+00	3.01E+00	4.87E-08	6.00E-04	4.88E-08	2.21E-09	3.60E-03	2.23E-09	1.96E-08	2.00E-04	1.96E-08
4.97E+00	3.68E+00	5.20E-08	7.00E-04	5.21E-08	2.31E-09	3.60E-03	2.34E-09	2.09E-08	2.00E-04	2.09E-08
6.07E+00	4.97E+00	5.31E-08	7.00E-04	5.32E-08	2.32E-09	3.90E-03	2.35E-09	2.14E-08	2.00E-04	2.14E-08
7.41E+00	6.07E+00	5.13E-08	7.00E-04	5.14E-08	2.27E-09	4.00E-03	2.30E-09	2.07E-08	2.00E-04	2.07E-08
8.61E+00	7.41E+00	5.03E-08	7.00E-04	5.04E-08	2.25E-09	3.80E-03	2.27E-09	2.04E-08	2.00E-04	2.04E-08
1.00E+01	8.61E+00	4.96E-08	7.00E-04	4.97E-08	2.21E-09	3.70E-03	2.23E-09	2.01E-08	2.00E-04	2.01E-08
1.22E+01	1.00E+01	5.35E-08	7.00E-04	5.36E-08	2.35E-09	3.60E-03	2.37E-09	2.15E-08	2.00E-04	2.15E-08
1.42E+01	1.22E+01	6.24E-08	7.00E-04	6.25E-08	2.70E-09	3.50E-03	2.73E-09	2.48E-08	2.00E-04	2.49E-08
1.96E+01	1.42E+01	7.05E-08	6.00E-04	7.06E-08	3.09E-09	3.30E-03	3.12E-09	2.83E-08	2.00E-04	2.83E-08

Table 3-29. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - No Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	9.00E-10	0.0022	9.06E-10	4.78E-11	0.0073	4.89E-11	4.95E-10	0.0006	4.95E-10
4.14E-07	1.00E-07	5.40E-10	0.0029	5.45E-10	3.79E-11	0.0082	3.89E-11	3.27E-10	0.0008	3.28E-10
8.76E-07	4.14E-07	3.99E-10	0.0033	4.03E-10	3.31E-11	0.0082	3.39E-11	2.54E-10	0.0010	2.55E-10
1.86E-06	8.76E-07	3.13E-10	0.0037	3.17E-10	2.93E-11	0.0093	3.01E-11	2.08E-10	0.0010	2.09E-10
5.04E-06	1.86E-06	2.36E-10	0.0042	2.39E-10	2.49E-11	0.0105	2.57E-11	1.63E-10	0.0012	1.64E-10
1.07E-05	5.04E-06	1.80E-10	0.0047	1.83E-10	2.09E-11	0.0106	2.16E-11	1.30E-10	0.0013	1.31E-10
3.73E-05	1.07E-05	1.27E-10	0.0054	1.29E-10	1.68E-11	0.0118	1.74E-11	9.74E-11	0.0015	9.78E-11
1.01E-04	3.73E-05	9.20E-11	0.0063	9.38E-11	1.37E-11	0.0126	1.42E-11	7.31E-11	0.0017	7.34E-11
2.14E-04	1.01E-04	7.10E-11	0.0070	7.25E-11	1.20E-11	0.0143	1.26E-11	5.87E-11	0.0019	5.90E-11
4.54E-04	2.14E-04	8.49E-11	0.0062	8.65E-11	1.24E-11	0.0146	1.30E-11	6.39E-11	0.0018	6.42E-11
1.58E-03	4.54E-04	7.13E-11	0.0063	7.26E-11	1.03E-11	0.0145	1.08E-11	5.27E-11	0.0018	5.29E-11
3.35E-03	1.58E-03	4.79E-11	0.0084	4.91E-11	8.99E-12	0.0155	9.41E-12	3.83E-11	0.0023	3.86E-11
7.10E-03	3.35E-03	3.87E-11	0.0093	3.98E-11	6.92E-12	0.0162	7.25E-12	3.16E-11	0.0025	3.18E-11
1.50E-02	7.10E-03	3.20E-11	0.0100	3.29E-11	6.09E-12	0.0188	6.43E-12	2.60E-11	0.0027	2.62E-11
2.19E-02	1.50E-02	2.44E-11	0.0111	2.52E-11	5.00E-12	0.0190	5.29E-12	2.07E-11	0.0030	2.09E-11
2.42E-02	2.19E-02	2.19E-11	0.0109	2.27E-11	4.84E-12	0.0210	5.15E-12	1.89E-11	0.0030	1.91E-11
2.61E-02	2.42E-02	2.01E-11	0.0116	2.08E-11	4.66E-12	0.0192	4.93E-12	1.76E-11	0.0031	1.78E-11
3.18E-02	2.61E-02	2.58E-11	0.0105	2.66E-11	5.09E-12	0.0193	5.39E-12	2.07E-11	0.0029	2.09E-11
4.09E-02	3.18E-02	2.87E-11	0.0102	2.96E-11	5.14E-12	0.0216	5.48E-12	2.21E-11	0.0029	2.23E-11
6.74E-02	4.09E-02	1.96E-11	0.0122	2.03E-11	4.26E-12	0.0241	4.57E-12	1.61E-11	0.0033	1.63E-11
1.11E-01	6.74E-02	1.60E-11	0.0131	1.66E-11	3.54E-12	0.0243	3.80E-12	1.33E-11	0.0036	1.35E-11
1.83E-01	1.11E-01	1.23E-11	0.0143	1.28E-11	2.81E-12	0.0278	3.05E-12	1.01E-11	0.0040	1.03E-11
2.97E-01	1.83E-01	8.77E-12	0.0159	9.19E-12	2.27E-12	0.0330	2.50E-12	7.33E-12	0.0045	7.43E-12
3.69E-01	2.97E-01	6.60E-12	0.0177	6.95E-12	1.70E-12	0.0297	1.85E-12	5.55E-12	0.0049	5.64E-12
4.98E-01	3.69E-01	6.19E-12	0.0187	6.54E-12	1.63E-12	0.0424	1.84E-12	5.05E-12	0.0053	5.13E-12
6.08E-01	4.98E-01	5.10E-12	0.0204	5.42E-12	1.14E-12	0.0371	1.26E-12	3.98E-12	0.0056	4.05E-12
7.43E-01	6.08E-01	5.43E-12	0.0178	5.72E-12	1.07E-12	0.0388	1.20E-12	3.88E-12	0.0052	3.95E-12
8.21E-01	7.43E-01	5.88E-12	0.0162	6.16E-12	9.92E-13	0.0371	1.10E-12	4.04E-12	0.0048	4.10E-12
1.00E+00	8.21E-01	9.22E-12	0.0100	9.50E-12	1.13E-12	0.0353	1.25E-12	5.46E-12	0.0036	5.52E-12
1.35E+00	1.00E+00	2.36E-11	0.0045	2.40E-11	1.72E-12	0.0225	1.84E-12	1.23E-11	0.0017	1.24E-11
1.65E+00	1.35E+00	4.18E-11	0.0031	4.22E-11	2.44E-12	0.0158	2.55E-12	2.08E-11	0.0011	2.08E-11
1.92E+00	1.65E+00	5.03E-11	0.0029	5.07E-11	2.90E-12	0.0141	3.02E-12	2.50E-11	0.0010	2.51E-11
2.23E+00	1.92E+00	6.14E-11	0.0026	6.19E-11	3.56E-12	0.0137	3.71E-12	3.04E-11	0.0009	3.05E-11
2.35E+00	2.23E+00	6.45E-11	0.0025	6.50E-11	3.85E-12	0.0124	3.99E-12	3.22E-11	0.0009	3.23E-11
2.37E+00	2.35E+00	6.60E-11	0.0025	6.65E-11	3.84E-12	0.0112	3.97E-12	3.27E-11	0.0009	3.28E-11
2.47E+00	2.37E+00	7.10E-11	0.0024	7.15E-11	4.15E-12	0.0117	4.30E-12	3.52E-11	0.0008	3.53E-11
2.73E+00	2.47E+00	8.38E-11	0.0023	8.43E-11	4.73E-12	0.0120	4.90E-12	4.16E-11	0.0008	4.17E-11
3.01E+00	2.73E+00	9.88E-11	0.0021	9.94E-11	5.41E-12	0.0112	5.59E-12	4.89E-11	0.0007	4.90E-11
3.68E+00	3.01E+00	1.45E-10	0.0020	1.46E-10	7.80E-12	0.0098	8.03E-12	7.13E-11	0.0006	7.14E-11
4.97E+00	3.68E+00	2.10E-10	0.0018	2.11E-10	1.13E-11	0.0083	1.16E-11	1.03E-10	0.0006	1.03E-10
6.07E+00	4.97E+00	2.99E-10	0.0018	3.00E-10	1.58E-11	0.0078	1.61E-11	1.47E-10	0.0006	1.47E-10
7.41E+00	6.07E+00	3.83E-10	0.0017	3.85E-10	2.00E-11	0.0076	2.05E-11	1.89E-10	0.0006	1.89E-10
8.61E+00	7.41E+00	4.68E-10	0.0017	4.71E-10	2.55E-11	0.0075	2.61E-11	2.33E-10	0.0005	2.33E-10
1.00E+01	8.61E+00	5.13E-10	0.0017	5.16E-10	2.85E-11	0.0075	2.92E-11	2.56E-10	0.0006	2.57E-10
1.22E+01	1.00E+01	5.58E-10	0.0018	5.61E-10	3.22E-11	0.0076	3.30E-11	2.80E-10	0.0006	2.81E-10
1.42E+01	1.22E+01	4.87E-10	0.0019	4.90E-10	2.97E-11	0.0081	3.04E-11	2.46E-10	0.0006	2.47E-10
1.96E+01	1.42E+01	3.48E-10	0.0019	3.50E-10	2.16E-11	0.0086	2.22E-11	1.77E-10	0.0006	1.77E-10

Table 3-30. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container - No Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.020	0.010	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.030	0.020	3.31E-29	0.0226	3.53E-29	0.00E+00	0.0000	0.00E+00	2.47E-45	0.0778	3.05E-45
0.040	0.030	2.41E-19	0.0257	2.60E-19	8.70E-44	0.3420	1.76E-43	2.27E-25	0.3778	4.85E-25
0.050	0.040	1.59E-15	0.0328	1.75E-15	3.35E-31	0.2740	6.10E-31	1.23E-18	0.0832	1.54E-18
0.060	0.050	1.15E-13	0.0440	1.30E-13	2.75E-24	0.6894	8.43E-24	2.58E-16	0.0378	2.87E-16
0.070	0.060	1.06E-12	0.0063	1.08E-12	1.77E-21	0.2032	2.85E-21	6.79E-15	0.0111	7.01E-15
0.080	0.070	4.10E-12	0.0051	4.17E-12	3.92E-19	0.2412	6.75E-19	5.77E-14	0.0051	5.86E-14
0.090	0.080	9.75E-12	0.0030	9.84E-12	7.37E-18	0.0885	9.33E-18	2.45E-13	0.0033	2.47E-13
0.100	0.090	1.73E-11	0.0021	1.74E-11	7.91E-17	0.0518	9.14E-17	6.65E-13	0.0020	6.69E-13
0.110	0.100	2.62E-11	0.0022	2.63E-11	5.50E-16	0.1456	7.90E-16	1.38E-12	0.0016	1.39E-12
0.120	0.110	3.61E-11	0.0021	3.63E-11	2.21E-15	0.0967	2.85E-15	2.39E-12	0.0013	2.40E-12
0.130	0.120	4.67E-11	0.0007	4.68E-11	1.34E-14	0.0535	1.55E-14	4.17E-12	0.0005	4.18E-12
0.140	0.130	5.73E-11	0.0007	5.74E-11	2.48E-14	0.0394	2.77E-14	5.86E-12	0.0005	5.87E-12
0.150	0.140	6.77E-11	0.0006	6.78E-11	4.22E-14	0.0297	4.59E-14	7.69E-12	0.0004	7.70E-12
0.160	0.150	7.80E-11	0.0006	7.82E-11	6.94E-14	0.0286	7.53E-14	9.66E-12	0.0004	9.67E-12
0.170	0.160	8.85E-11	0.0006	8.87E-11	1.00E-13	0.0233	1.07E-13	1.17E-11	0.0004	1.17E-11
0.180	0.170	9.88E-11	0.0006	9.90E-11	1.36E-13	0.0192	1.43E-13	1.39E-11	0.0004	1.39E-11
0.190	0.180	1.09E-10	0.0006	1.09E-10	1.79E-13	0.0167	1.88E-13	1.60E-11	0.0003	1.60E-11
0.200	0.190	1.19E-10	0.0006	1.19E-10	2.33E-13	0.0156	2.44E-13	1.82E-11	0.0003	1.82E-11
0.210	0.200	1.29E-10	0.0006	1.29E-10	2.87E-13	0.0142	3.00E-13	2.04E-11	0.0003	2.05E-11
0.220	0.210	1.38E-10	0.0006	1.39E-10	3.48E-13	0.0134	3.62E-13	2.27E-11	0.0003	2.27E-11
0.230	0.220	1.48E-10	0.0006	1.48E-10	4.10E-13	0.0123	4.25E-13	2.49E-11	0.0003	2.49E-11
0.240	0.230	1.58E-10	0.0006	1.58E-10	4.88E-13	0.0116	5.05E-13	2.71E-11	0.0003	2.71E-11
0.250	0.240	1.67E-10	0.0005	1.67E-10	5.66E-13	0.0113	5.85E-13	2.93E-11	0.0003	2.94E-11
0.260	0.250	1.76E-10	0.0005	1.76E-10	6.35E-13	0.0106	6.56E-13	3.15E-11	0.0003	3.16E-11
0.270	0.260	1.85E-10	0.0005	1.85E-10	7.17E-13	0.0101	7.38E-13	3.37E-11	0.0003	3.38E-11
0.280	0.270	1.94E-10	0.0005	1.94E-10	8.08E-13	0.0098	8.32E-13	3.59E-11	0.0003	3.60E-11
0.290	0.280	2.03E-10	0.0005	2.03E-10	8.94E-13	0.0096	9.19E-13	3.81E-11	0.0003	3.82E-11
0.300	0.290	2.12E-10	0.0005	2.12E-10	9.79E-13	0.0092	1.01E-12	4.03E-11	0.0003	4.03E-11
0.325	0.300	2.26E-10	0.0005	2.27E-10	1.13E-12	0.0088	1.16E-12	4.40E-11	0.0003	4.41E-11
0.350	0.325	2.47E-10	0.0005	2.47E-10	1.38E-12	0.0082	1.41E-12	4.93E-11	0.0003	4.93E-11
0.375	0.350	2.66E-10	0.0005	2.67E-10	1.60E-12	0.0074	1.63E-12	5.44E-11	0.0003	5.44E-11
0.400	0.375	2.85E-10	0.0005	2.85E-10	1.86E-12	0.0072	1.90E-12	5.93E-11	0.0002	5.94E-11
0.425	0.400	3.02E-10	0.0005	3.03E-10	2.10E-12	0.0070	2.15E-12	6.41E-11	0.0002	6.42E-11
0.450	0.425	3.19E-10	0.0005	3.19E-10	2.39E-12	0.0067	2.43E-12	6.88E-11	0.0002	6.88E-11
0.475	0.450	3.35E-10	0.0005	3.35E-10	2.66E-12	0.0065	2.72E-12	7.33E-11	0.0002	7.34E-11
0.500	0.475	3.51E-10	0.0005	3.51E-10	2.92E-12	0.0062	2.97E-12	7.77E-11	0.0002	7.78E-11
0.525	0.500	3.66E-10	0.0005	3.67E-10	3.18E-12	0.0060	3.24E-12	8.22E-11	0.0002	8.22E-11

Table 3-30. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container - No Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.550	0.525	3.82E-10	0.0005	3.83E-10	3.45E-12	0.0057	3.51E-12	8.66E-11	0.0002	8.67E-11
0.575	0.550	3.97E-10	0.0005	3.98E-10	3.71E-12	0.0056	3.78E-12	9.10E-11	0.0002	9.11E-11
0.600	0.575	4.12E-10	0.0005	4.13E-10	3.97E-12	0.0055	4.04E-12	9.53E-11	0.0002	9.53E-11
0.625	0.600	4.26E-10	0.0005	4.27E-10	4.26E-12	0.0053	4.32E-12	9.94E-11	0.0002	9.95E-11
0.650	0.625	4.39E-10	0.0005	4.40E-10	4.53E-12	0.0052	4.60E-12	1.03E-10	0.0002	1.04E-10
0.675	0.650	4.53E-10	0.0005	4.53E-10	4.81E-12	0.0051	4.88E-12	1.07E-10	0.0002	1.08E-10
0.700	0.675	4.66E-10	0.0005	4.66E-10	5.11E-12	0.0050	5.19E-12	1.11E-10	0.0002	1.12E-10
0.725	0.700	4.79E-10	0.0005	4.80E-10	5.39E-12	0.0049	5.47E-12	1.15E-10	0.0002	1.15E-10
0.750	0.725	4.92E-10	0.0005	4.93E-10	5.68E-12	0.0048	5.76E-12	1.19E-10	0.0002	1.19E-10
0.775	0.750	5.05E-10	0.0005	5.06E-10	5.94E-12	0.0048	6.03E-12	1.23E-10	0.0002	1.23E-10
0.800	0.775	5.18E-10	0.0005	5.18E-10	6.22E-12	0.0046	6.31E-12	1.27E-10	0.0002	1.27E-10
0.825	0.800	5.30E-10	0.0005	5.31E-10	6.52E-12	0.0046	6.61E-12	1.31E-10	0.0002	1.31E-10
0.850	0.825	5.42E-10	0.0005	5.43E-10	6.83E-12	0.0046	6.93E-12	1.35E-10	0.0002	1.35E-10
0.875	0.850	5.54E-10	0.0005	5.55E-10	7.14E-12	0.0045	7.23E-12	1.39E-10	0.0002	1.39E-10
0.900	0.875	5.66E-10	0.0005	5.67E-10	7.41E-12	0.0044	7.51E-12	1.42E-10	0.0002	1.42E-10
0.925	0.900	5.78E-10	0.0005	5.79E-10	7.69E-12	0.0043	7.79E-12	1.46E-10	0.0002	1.46E-10
0.950	0.925	5.90E-10	0.0005	5.91E-10	8.00E-12	0.0043	8.10E-12	1.50E-10	0.0002	1.50E-10
0.975	0.950	6.02E-10	0.0005	6.03E-10	8.31E-12	0.0042	8.42E-12	1.54E-10	0.0002	1.54E-10
1.000	0.975	6.14E-10	0.0005	6.14E-10	8.59E-12	0.0042	8.70E-12	1.57E-10	0.0002	1.57E-10
1.250	1.000	6.74E-10	0.0005	6.75E-10	1.03E-11	0.0040	1.04E-11	1.77E-10	0.0002	1.77E-10
1.500	1.250	7.79E-10	0.0005	7.80E-10	1.32E-11	0.0037	1.33E-11	2.12E-10	0.0002	2.12E-10
1.750	1.500	8.79E-10	0.0005	8.80E-10	1.61E-11	0.0034	1.62E-11	2.45E-10	0.0002	2.45E-10
2.000	1.750	9.72E-10	0.0005	9.74E-10	1.88E-11	0.0033	1.89E-11	2.76E-10	0.0002	2.77E-10
2.250	2.000	1.06E-09	0.0005	1.06E-09	2.14E-11	0.0032	2.16E-11	3.06E-10	0.0002	3.07E-10
2.500	2.250	1.14E-09	0.0005	1.15E-09	2.40E-11	0.0032	2.42E-11	3.35E-10	0.0002	3.35E-10
2.750	2.500	1.23E-09	0.0005	1.23E-09	2.63E-11	0.0031	2.66E-11	3.62E-10	0.0002	3.63E-10
3.000	2.750	1.30E-09	0.0005	1.31E-09	2.86E-11	0.0031	2.89E-11	3.89E-10	0.0002	3.89E-10
3.500	3.000	1.41E-09	0.0005	1.41E-09	3.17E-11	0.0030	3.20E-11	4.26E-10	0.0002	4.26E-10
4.000	3.500	1.55E-09	0.0005	1.55E-09	3.54E-11	0.0030	3.57E-11	4.72E-10	0.0002	4.73E-10
4.500	4.000	1.68E-09	0.0005	1.68E-09	3.90E-11	0.0030	3.93E-11	5.16E-10	0.0002	5.16E-10
5.000	4.500	1.81E-09	0.0005	1.81E-09	4.22E-11	0.0030	4.25E-11	5.57E-10	0.0002	5.57E-10
5.500	5.000	1.93E-09	0.0005	1.94E-09	4.54E-11	0.0030	4.58E-11	5.99E-10	0.0002	5.99E-10
6.000	5.500	2.05E-09	0.0005	2.06E-09	4.82E-11	0.0031	4.87E-11	6.38E-10	0.0002	6.38E-10
6.500	6.000	2.17E-09	0.0005	2.18E-09	5.10E-11	0.0031	5.14E-11	6.76E-10	0.0002	6.76E-10
7.000	6.500	2.29E-09	0.0005	2.30E-09	5.37E-11	0.0031	5.42E-11	7.14E-10	0.0002	7.14E-10
7.500	7.000	2.41E-09	0.0005	2.41E-09	5.63E-11	0.0032	5.68E-11	7.51E-10	0.0002	7.52E-10
8.000	7.500	2.53E-09	0.0005	2.53E-09	5.89E-11	0.0032	5.95E-11	7.89E-10	0.0002	7.89E-10
9.000	8.000	2.70E-09	0.0005	2.71E-09	6.28E-11	0.0032	6.34E-11	8.44E-10	0.0002	8.44E-10
10.000	9.000	2.94E-09	0.0005	2.95E-09	6.81E-11	0.0033	6.88E-11	9.18E-10	0.0002	9.19E-10

**Table 3-31. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups –
No Shielded Container - PuO₂ Self-shielding**

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	7.13E-08	8.00E-04	7.14E-08	3.29E-09	4.70E-03	3.33E-09	2.84E-08	3.00E-04	2.84E-08
4.14E-07	1.00E-07	6.64E-08	8.00E-04	6.66E-08	3.06E-09	4.40E-03	3.10E-09	2.65E-08	3.00E-04	2.65E-08
8.76E-07	4.14E-07	3.40E-08	1.00E-03	3.41E-08	1.53E-09	5.60E-03	1.55E-09	1.35E-08	4.00E-04	1.35E-08
1.86E-06	8.76E-07	1.22E-08	1.60E-03	1.23E-08	5.29E-10	8.80E-03	5.43E-10	4.82E-09	6.00E-04	4.83E-09
5.04E-06	1.86E-06	6.13E-09	1.90E-03	6.17E-09	2.55E-10	1.11E-02	2.64E-10	2.43E-09	8.00E-04	2.44E-09
1.07E-05	5.04E-06	1.01E-08	1.40E-03	1.01E-08	4.40E-10	8.10E-03	4.50E-10	4.02E-09	6.00E-04	4.03E-09
3.73E-05	1.07E-05	1.16E-08	1.30E-03	1.16E-08	5.08E-10	7.10E-03	5.18E-10	4.62E-09	5.00E-04	4.63E-09
1.01E-04	3.73E-05	1.53E-08	1.30E-03	1.54E-08	6.86E-10	6.90E-03	7.01E-10	6.12E-09	5.00E-04	6.13E-09
2.14E-04	1.01E-04	8.43E-09	1.50E-03	8.46E-09	3.67E-10	8.10E-03	3.76E-10	3.39E-09	6.00E-04	3.39E-09
4.54E-04	2.14E-04	6.39E-09	1.70E-03	6.42E-09	2.81E-10	9.10E-03	2.89E-10	2.57E-09	7.00E-04	2.58E-09
1.58E-03	4.54E-04	4.57E-09	1.80E-03	4.60E-09	1.99E-10	9.60E-03	2.04E-10	1.88E-09	7.00E-04	1.89E-09
3.35E-03	1.58E-03	3.44E-09	1.80E-03	3.46E-09	1.45E-10	1.03E-02	1.50E-10	1.42E-09	7.00E-04	1.43E-09
7.10E-03	3.35E-03	2.90E-09	1.80E-03	2.92E-09	1.25E-10	9.50E-03	1.28E-10	1.21E-09	7.00E-04	1.21E-09
1.50E-02	7.10E-03	2.69E-09	1.80E-03	2.70E-09	1.23E-10	9.90E-03	1.27E-10	1.14E-09	7.00E-04	1.14E-09
2.19E-02	1.50E-02	2.75E-09	1.60E-03	2.77E-09	1.32E-10	8.30E-03	1.36E-10	1.16E-09	6.00E-04	1.16E-09
2.42E-02	2.19E-02	2.76E-09	1.50E-03	2.78E-09	1.58E-10	7.00E-03	1.62E-10	1.19E-09	5.00E-04	1.19E-09
2.61E-02	2.42E-02	2.84E-09	1.50E-03	2.85E-09	1.73E-10	6.50E-03	1.77E-10	1.22E-09	5.00E-04	1.22E-09
3.18E-02	2.61E-02	3.21E-09	1.50E-03	3.22E-09	1.67E-10	6.90E-03	1.70E-10	1.26E-09	6.00E-04	1.26E-09
4.09E-02	3.18E-02	3.65E-09	1.40E-03	3.66E-09	1.71E-10	7.00E-03	1.74E-10	1.31E-09	6.00E-04	1.31E-09
6.74E-02	4.09E-02	4.17E-09	1.10E-03	4.18E-09	1.92E-10	6.40E-03	1.96E-10	1.55E-09	5.00E-04	1.55E-09
1.11E-01	6.74E-02	5.91E-09	1.00E-03	5.92E-09	2.76E-10	5.20E-03	2.80E-10	2.08E-09	4.00E-04	2.08E-09
1.83E-01	1.11E-01	9.20E-09	8.00E-04	9.22E-09	4.44E-10	4.30E-03	4.50E-10	3.18E-09	3.00E-04	3.18E-09
2.97E-01	1.83E-01	1.44E-08	7.00E-04	1.44E-08	6.42E-10	4.20E-03	6.51E-10	5.13E-09	3.00E-04	5.13E-09
3.69E-01	2.97E-01	1.94E-08	7.00E-04	1.95E-08	9.26E-10	3.70E-03	9.36E-10	7.11E-09	3.00E-04	7.12E-09
4.98E-01	3.69E-01	2.51E-08	7.00E-04	2.52E-08	1.10E-09	4.00E-03	1.11E-09	9.18E-09	3.00E-04	9.19E-09
6.08E-01	4.98E-01	3.17E-08	6.00E-04	3.17E-08	1.53E-09	3.50E-03	1.54E-09	1.18E-08	2.00E-04	1.18E-08
7.43E-01	6.08E-01	3.59E-08	6.00E-04	3.60E-08	1.78E-09	3.20E-03	1.79E-09	1.37E-08	2.00E-04	1.38E-08
8.21E-01	7.43E-01	4.04E-08	6.00E-04	4.05E-08	1.78E-09	3.40E-03	1.80E-09	1.52E-08	2.00E-04	1.52E-08
1.00E+00	8.21E-01	4.23E-08	6.00E-04	4.24E-08	2.04E-09	3.30E-03	2.06E-09	1.66E-08	2.00E-04	1.66E-08
1.35E+00	1.00E+00	4.54E-08	6.00E-04	4.54E-08	2.14E-09	3.30E-03	2.16E-09	1.79E-08	2.00E-04	1.79E-08
1.65E+00	1.35E+00	4.64E-08	6.00E-04	4.65E-08	2.14E-09	3.40E-03	2.17E-09	1.85E-08	2.00E-04	1.85E-08
1.92E+00	1.65E+00	4.65E-08	6.00E-04	4.66E-08	2.15E-09	3.30E-03	2.17E-09	1.88E-08	2.00E-04	1.88E-08
2.23E+00	1.92E+00	4.71E-08	6.00E-04	4.72E-08	2.17E-09	3.40E-03	2.20E-09	1.90E-08	2.00E-04	1.90E-08
2.35E+00	2.23E+00	4.69E-08	6.00E-04	4.70E-08	2.12E-09	3.20E-03	2.14E-09	1.90E-08	2.00E-04	1.90E-08
2.37E+00	2.35E+00	4.62E-08	6.00E-04	4.62E-08	2.17E-09	3.20E-03	2.19E-09	1.88E-08	2.00E-04	1.88E-08
2.47E+00	2.37E+00	4.63E-08	6.00E-04	4.64E-08	2.08E-09	3.30E-03	2.10E-09	1.89E-08	2.00E-04	1.90E-08
2.73E+00	2.47E+00	4.70E-08	6.00E-04	4.71E-08	2.11E-09	3.40E-03	2.13E-09	1.91E-08	2.00E-04	1.91E-08
3.01E+00	2.73E+00	4.78E-08	6.00E-04	4.78E-08	2.15E-09	3.40E-03	2.17E-09	1.94E-08	2.00E-04	1.94E-08
3.68E+00	3.01E+00	4.88E-08	7.00E-04	4.89E-08	2.19E-09	3.60E-03	2.22E-09	1.98E-08	2.00E-04	1.98E-08
4.97E+00	3.68E+00	5.21E-08	7.00E-04	5.22E-08	2.31E-09	3.60E-03	2.33E-09	2.11E-08	2.00E-04	2.11E-08
6.07E+00	4.97E+00	5.33E-08	7.00E-04	5.34E-08	2.34E-09	3.90E-03	2.37E-09	2.16E-08	2.00E-04	2.16E-08
7.41E+00	6.07E+00	5.16E-08	7.00E-04	5.17E-08	2.27E-09	3.90E-03	2.29E-09	2.10E-08	2.00E-04	2.10E-08
8.61E+00	7.41E+00	5.09E-08	7.00E-04	5.10E-08	2.27E-09	3.90E-03	2.30E-09	2.08E-08	3.00E-04	2.08E-08
1.00E+01	8.61E+00	5.02E-08	7.00E-04	5.03E-08	2.24E-09	3.80E-03	2.27E-09	2.05E-08	2.00E-04	2.05E-08
1.22E+01	1.00E+01	5.41E-08	7.00E-04	5.42E-08	2.36E-09	3.70E-03	2.39E-09	2.19E-08	2.00E-04	2.19E-08
1.42E+01	1.22E+01	6.29E-08	7.00E-04	6.30E-08	2.71E-09	3.50E-03	2.73E-09	2.53E-08	2.00E-04	2.53E-08
1.96E+01	1.42E+01	7.11E-08	6.00E-04	7.12E-08	3.08E-09	3.30E-03	3.11E-09	2.88E-08	2.00E-04	2.88E-08

Table 3-32. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – No Shielded Container - PuO₂ Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	2.62E-09	0.0012	2.63E-09	6.01E-11	0.0078	6.15E-11	9.84E-10	0.0004	9.85E-10
4.14E-07	1.00E-07	2.69E-09	0.0011	2.70E-09	6.05E-11	0.0076	6.19E-11	9.95E-10	0.0004	9.96E-10
8.76E-07	4.14E-07	1.41E-09	0.0015	1.41E-09	4.34E-11	0.0081	4.45E-11	5.78E-10	0.0006	5.79E-10
1.86E-06	8.76E-07	6.13E-10	0.0023	6.17E-10	3.25E-11	0.0096	3.35E-11	3.06E-10	0.0008	3.06E-10
5.04E-06	1.86E-06	3.59E-10	0.0032	3.62E-10	2.63E-11	0.0098	2.70E-11	2.03E-10	0.0010	2.04E-10
1.07E-05	5.04E-06	4.88E-10	0.0023	4.92E-10	2.56E-11	0.0104	2.64E-11	2.35E-10	0.0009	2.35E-10
3.73E-05	1.07E-05	5.05E-10	0.0021	5.09E-10	2.34E-11	0.0107	2.41E-11	2.27E-10	0.0008	2.27E-10
1.01E-04	3.73E-05	5.71E-10	0.0019	5.75E-10	2.21E-11	0.0107	2.28E-11	2.41E-10	0.0008	2.42E-10
2.14E-04	1.01E-04	3.29E-10	0.0025	3.31E-10	1.60E-11	0.0116	1.65E-11	1.49E-10	0.0010	1.50E-10
4.54E-04	2.14E-04	2.82E-10	0.0027	2.84E-10	1.56E-11	0.0116	1.61E-11	1.33E-10	0.0011	1.33E-10
1.58E-03	4.54E-04	1.82E-10	0.0033	1.84E-10	1.21E-11	0.0127	1.26E-11	9.17E-11	0.0012	9.20E-11
3.35E-03	1.58E-03	1.16E-10	0.0042	1.17E-10	1.01E-11	0.0148	1.05E-11	6.26E-11	0.0016	6.29E-11
7.10E-03	3.35E-03	8.44E-11	0.0048	8.56E-11	7.95E-12	0.0167	8.35E-12	4.77E-11	0.0018	4.79E-11
1.50E-02	7.10E-03	6.45E-11	0.0054	6.55E-11	6.78E-12	0.0168	7.12E-12	3.79E-11	0.0020	3.81E-11
2.19E-02	1.50E-02	5.13E-11	0.0060	5.22E-11	5.66E-12	0.0189	5.98E-12	3.03E-11	0.0022	3.05E-11
2.42E-02	2.19E-02	4.58E-11	0.0059	4.66E-11	5.42E-12	0.0191	5.73E-12	2.75E-11	0.0022	2.76E-11
2.61E-02	2.42E-02	4.42E-11	0.0061	4.50E-11	5.15E-12	0.0196	5.46E-12	2.62E-11	0.0022	2.63E-11
3.18E-02	2.61E-02	5.10E-11	0.0060	5.20E-11	5.77E-12	0.0208	6.13E-12	2.96E-11	0.0022	2.98E-11
4.09E-02	3.18E-02	5.21E-11	0.0062	5.30E-11	5.37E-12	0.0198	5.69E-12	3.04E-11	0.0022	3.06E-11
6.74E-02	4.09E-02	4.09E-11	0.0066	4.18E-11	4.55E-12	0.0206	4.83E-12	2.38E-11	0.0024	2.40E-11
1.11E-01	6.74E-02	3.64E-11	0.0064	3.71E-11	4.04E-12	0.0210	4.29E-12	2.06E-11	0.0024	2.08E-11
1.83E-01	1.11E-01	3.17E-11	0.0067	3.23E-11	3.27E-12	0.0242	3.51E-12	1.69E-11	0.0025	1.71E-11
2.97E-01	1.83E-01	2.80E-11	0.0065	2.85E-11	2.62E-12	0.0275	2.84E-12	1.42E-11	0.0025	1.43E-11
3.69E-01	2.97E-01	2.55E-11	0.0059	2.60E-11	2.07E-12	0.0252	2.22E-12	1.25E-11	0.0025	1.26E-11
4.98E-01	3.69E-01	2.52E-11	0.0059	2.56E-11	1.96E-12	0.0270	2.12E-12	1.20E-11	0.0025	1.21E-11
6.08E-01	4.98E-01	2.36E-11	0.0056	2.40E-11	1.52E-12	0.0268	1.64E-12	1.08E-11	0.0024	1.09E-11
7.43E-01	6.08E-01	2.43E-11	0.0056	2.47E-11	1.39E-12	0.0309	1.52E-12	1.07E-11	0.0023	1.08E-11
8.21E-01	7.43E-01	2.53E-11	0.0055	2.57E-11	1.49E-12	0.0310	1.63E-12	1.11E-11	0.0022	1.11E-11
1.00E+00	8.21E-01	2.87E-11	0.0047	2.91E-11	1.59E-12	0.0271	1.72E-12	1.26E-11	0.0020	1.26E-11
1.35E+00	1.00E+00	4.53E-11	0.0034	4.58E-11	2.19E-12	0.0196	2.32E-12	2.00E-11	0.0013	2.01E-11
1.65E+00	1.35E+00	6.53E-11	0.0028	6.58E-11	2.81E-12	0.0149	2.93E-12	2.92E-11	0.0010	2.93E-11
1.92E+00	1.65E+00	7.51E-11	0.0026	7.57E-11	3.35E-12	0.0134	3.48E-12	3.40E-11	0.0009	3.41E-11
2.23E+00	1.92E+00	8.77E-11	0.0024	8.84E-11	4.01E-12	0.0121	4.16E-12	3.98E-11	0.0008	3.99E-11
2.35E+00	2.23E+00	9.18E-11	0.0023	9.25E-11	4.31E-12	0.0117	4.46E-12	4.17E-11	0.0008	4.18E-11
2.37E+00	2.35E+00	9.27E-11	0.0022	9.33E-11	4.47E-12	0.0121	4.63E-12	4.22E-11	0.0008	4.23E-11
2.47E+00	2.37E+00	9.81E-11	0.0022	9.87E-11	4.57E-12	0.0110	4.72E-12	4.48E-11	0.0008	4.49E-11
2.73E+00	2.47E+00	1.11E-10	0.0021	1.12E-10	5.12E-12	0.0106	5.29E-12	5.12E-11	0.0007	5.13E-11
3.01E+00	2.73E+00	1.27E-10	0.0020	1.27E-10	5.82E-12	0.0101	5.99E-12	5.86E-11	0.0007	5.87E-11
3.68E+00	3.01E+00	1.73E-10	0.0019	1.74E-10	8.09E-12	0.0096	8.32E-12	8.09E-11	0.0006	8.11E-11
4.97E+00	3.68E+00	2.38E-10	0.0018	2.39E-10	1.17E-11	0.0081	1.20E-11	1.13E-10	0.0006	1.13E-10
6.07E+00	4.97E+00	3.26E-10	0.0017	3.28E-10	1.60E-11	0.0078	1.64E-11	1.56E-10	0.0006	1.57E-10
7.41E+00	6.07E+00	4.11E-10	0.0017	4.13E-10	2.03E-11	0.0077	2.08E-11	1.99E-10	0.0006	1.99E-10
8.61E+00	7.41E+00	4.98E-10	0.0017	5.01E-10	2.56E-11	0.0075	2.61E-11	2.43E-10	0.0005	2.44E-10
1.00E+01	8.61E+00	5.46E-10	0.0017	5.49E-10	2.89E-11	0.0076	2.95E-11	2.67E-10	0.0006	2.67E-10
1.22E+01	1.00E+01	5.93E-10	0.0018	5.96E-10	3.19E-11	0.0075	3.26E-11	2.92E-10	0.0006	2.92E-10
1.42E+01	1.22E+01	5.24E-10	0.0018	5.27E-10	2.92E-11	0.0076	2.99E-11	2.59E-10	0.0006	2.59E-10
1.96E+01	1.42E+01	3.89E-10	0.0018	3.91E-10	2.20E-11	0.0082	2.25E-11	1.91E-10	0.0006	1.91E-10

Table 3-33. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container – PuO₂ Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.020	0.010	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.030	0.020	2.53E-30	0.0575	2.97E-30	0.00E+00	0.0000	0.00E+00	4.60E-46	0.2019	7.39E-46
0.040	0.030	3.94E-20	0.0401	4.41E-20	1.49E-44	0.7034	4.62E-44	3.97E-26	0.6744	1.20E-25
0.050	0.040	4.37E-16	0.0224	4.67E-16	9.25E-32	0.3829	1.99E-31	5.45E-19	0.2514	9.56E-19
0.060	0.050	4.53E-14	0.0136	4.72E-14	1.34E-25	0.3352	2.69E-25	2.00E-16	0.2183	3.32E-16
0.070	0.060	5.81E-13	0.0076	5.94E-13	2.57E-21	0.4779	6.27E-21	4.65E-15	0.0176	4.89E-15
0.080	0.070	2.65E-12	0.0060	2.70E-12	2.17E-19	0.1939	3.44E-19	4.40E-14	0.0070	4.50E-14
0.090	0.080	7.00E-12	0.0032	7.07E-12	2.33E-17	0.7250	7.39E-17	1.99E-13	0.0031	2.01E-13
0.100	0.090	1.34E-11	0.0027	1.36E-11	6.16E-17	0.0709	7.47E-17	5.74E-13	0.0022	5.77E-13
0.110	0.100	2.15E-11	0.0028	2.16E-11	4.33E-16	0.0786	5.35E-16	1.23E-12	0.0017	1.23E-12
0.120	0.110	3.06E-11	0.0027	3.09E-11	1.87E-15	0.1071	2.47E-15	2.18E-12	0.0014	2.19E-12
0.130	0.120	4.12E-11	0.0007	4.13E-11	1.02E-14	0.0533	1.18E-14	3.86E-12	0.0006	3.87E-12
0.140	0.130	5.15E-11	0.0007	5.16E-11	2.02E-14	0.0420	2.28E-14	5.48E-12	0.0005	5.49E-12
0.150	0.140	6.17E-11	0.0007	6.18E-11	3.61E-14	0.0402	4.05E-14	7.27E-12	0.0004	7.28E-12
0.160	0.150	7.19E-11	0.0006	7.20E-11	5.88E-14	0.0289	6.39E-14	9.19E-12	0.0004	9.20E-12
0.170	0.160	8.22E-11	0.0006	8.23E-11	8.98E-14	0.0230	9.59E-14	1.12E-11	0.0004	1.12E-11
0.180	0.170	9.24E-11	0.0006	9.25E-11	1.24E-13	0.0195	1.32E-13	1.33E-11	0.0004	1.33E-11
0.190	0.180	1.02E-10	0.0006	1.02E-10	1.68E-13	0.0181	1.77E-13	1.55E-11	0.0003	1.55E-11
0.200	0.190	1.12E-10	0.0006	1.12E-10	2.19E-13	0.0166	2.30E-13	1.76E-11	0.0003	1.76E-11
0.210	0.200	1.22E-10	0.0006	1.22E-10	2.74E-13	0.0148	2.86E-13	1.98E-11	0.0003	1.98E-11
0.220	0.210	1.31E-10	0.0006	1.32E-10	3.30E-13	0.0142	3.45E-13	2.20E-11	0.0003	2.20E-11
0.230	0.220	1.41E-10	0.0006	1.41E-10	3.99E-13	0.0134	4.15E-13	2.42E-11	0.0003	2.42E-11
0.240	0.230	1.50E-10	0.0006	1.50E-10	4.63E-13	0.0123	4.80E-13	2.64E-11	0.0003	2.64E-11
0.250	0.240	1.59E-10	0.0006	1.60E-10	5.28E-13	0.0117	5.46E-13	2.86E-11	0.0003	2.86E-11
0.260	0.250	1.68E-10	0.0006	1.69E-10	6.01E-13	0.0113	6.21E-13	3.08E-11	0.0003	3.08E-11
0.270	0.260	1.77E-10	0.0005	1.78E-10	6.80E-13	0.0107	7.02E-13	3.30E-11	0.0003	3.30E-11
0.280	0.270	1.86E-10	0.0005	1.86E-10	7.61E-13	0.0103	7.85E-13	3.52E-11	0.0003	3.52E-11
0.290	0.280	1.95E-10	0.0005	1.95E-10	8.35E-13	0.0097	8.60E-13	3.73E-11	0.0003	3.73E-11
0.300	0.290	2.03E-10	0.0005	2.04E-10	9.26E-13	0.0094	9.52E-13	3.95E-11	0.0003	3.95E-11
0.325	0.300	2.18E-10	0.0005	2.18E-10	1.08E-12	0.0088	1.11E-12	4.32E-11	0.0003	4.32E-11
0.350	0.325	2.38E-10	0.0005	2.38E-10	1.30E-12	0.0082	1.33E-12	4.84E-11	0.0003	4.84E-11
0.375	0.350	2.57E-10	0.0005	2.57E-10	1.54E-12	0.0078	1.58E-12	5.34E-11	0.0003	5.35E-11
0.400	0.375	2.75E-10	0.0005	2.76E-10	1.76E-12	0.0073	1.80E-12	5.83E-11	0.0003	5.84E-11
0.425	0.400	2.92E-10	0.0005	2.93E-10	2.02E-12	0.0071	2.06E-12	6.31E-11	0.0002	6.32E-11
0.450	0.425	3.09E-10	0.0005	3.09E-10	2.27E-12	0.0068	2.32E-12	6.77E-11	0.0002	6.78E-11
0.475	0.450	3.25E-10	0.0005	3.25E-10	2.53E-12	0.0067	2.58E-12	7.22E-11	0.0002	7.23E-11
0.500	0.475	3.40E-10	0.0005	3.40E-10	2.79E-12	0.0067	2.85E-12	7.66E-11	0.0002	7.67E-11
0.525	0.500	3.55E-10	0.0005	3.56E-10	3.03E-12	0.0061	3.09E-12	8.10E-11	0.0002	8.11E-11

Table 3-33. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – No Shielded Container – PuO₂ Self-shielding

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.550	0.525	3.71E-10	0.0005	3.71E-10	3.29E-12	0.0060	3.35E-12	8.54E-11	0.0002	8.55E-11
0.575	0.550	3.86E-10	0.0005	3.86E-10	3.54E-12	0.0057	3.60E-12	8.98E-11	0.0002	8.98E-11
0.600	0.575	4.00E-10	0.0005	4.01E-10	3.80E-12	0.0055	3.86E-12	9.40E-11	0.0002	9.41E-11
0.625	0.600	4.14E-10	0.0005	4.15E-10	4.09E-12	0.0055	4.15E-12	9.81E-11	0.0002	9.82E-11
0.650	0.625	4.27E-10	0.0005	4.28E-10	4.37E-12	0.0054	4.44E-12	1.02E-10	0.0002	1.02E-10
0.675	0.650	4.40E-10	0.0005	4.41E-10	4.66E-12	0.0053	4.73E-12	1.06E-10	0.0002	1.06E-10
0.700	0.675	4.53E-10	0.0005	4.54E-10	4.92E-12	0.0052	5.00E-12	1.10E-10	0.0002	1.10E-10
0.725	0.700	4.66E-10	0.0005	4.67E-10	5.19E-12	0.0051	5.27E-12	1.14E-10	0.0002	1.14E-10
0.750	0.725	4.79E-10	0.0005	4.80E-10	5.45E-12	0.0049	5.53E-12	1.18E-10	0.0002	1.18E-10
0.775	0.750	4.92E-10	0.0005	4.92E-10	5.71E-12	0.0048	5.79E-12	1.22E-10	0.0002	1.22E-10
0.800	0.775	5.04E-10	0.0005	5.05E-10	5.99E-12	0.0048	6.07E-12	1.26E-10	0.0002	1.26E-10
0.825	0.800	5.16E-10	0.0005	5.17E-10	6.25E-12	0.0047	6.34E-12	1.29E-10	0.0002	1.30E-10
0.850	0.825	5.28E-10	0.0005	5.29E-10	6.53E-12	0.0046	6.62E-12	1.33E-10	0.0002	1.33E-10
0.875	0.850	5.40E-10	0.0005	5.41E-10	6.83E-12	0.0045	6.93E-12	1.37E-10	0.0002	1.37E-10
0.900	0.875	5.52E-10	0.0005	5.53E-10	7.15E-12	0.0045	7.25E-12	1.41E-10	0.0002	1.41E-10
0.925	0.900	5.64E-10	0.0005	5.65E-10	7.41E-12	0.0045	7.51E-12	1.45E-10	0.0002	1.45E-10
0.950	0.925	5.76E-10	0.0005	5.76E-10	7.69E-12	0.0043	7.79E-12	1.48E-10	0.0002	1.48E-10
0.975	0.950	5.87E-10	0.0005	5.88E-10	7.95E-12	0.0043	8.05E-12	1.52E-10	0.0002	1.52E-10
1.000	0.975	5.99E-10	0.0005	5.99E-10	8.21E-12	0.0042	8.31E-12	1.56E-10	0.0002	1.56E-10
1.250	1.000	6.59E-10	0.0005	6.60E-10	9.83E-12	0.0040	9.94E-12	1.75E-10	0.0002	1.75E-10
1.500	1.250	7.63E-10	0.0005	7.64E-10	1.27E-11	0.0037	1.29E-11	2.10E-10	0.0002	2.10E-10
1.750	1.500	8.61E-10	0.0005	8.62E-10	1.55E-11	0.0035	1.57E-11	2.43E-10	0.0002	2.43E-10
2.000	1.750	9.54E-10	0.0005	9.55E-10	1.83E-11	0.0034	1.85E-11	2.74E-10	0.0002	2.74E-10
2.250	2.000	1.04E-09	0.0005	1.04E-09	2.08E-11	0.0033	2.10E-11	3.04E-10	0.0002	3.04E-10
2.500	2.250	1.12E-09	0.0005	1.13E-09	2.34E-11	0.0032	2.36E-11	3.32E-10	0.0002	3.33E-10
2.750	2.500	1.20E-09	0.0005	1.21E-09	2.57E-11	0.0032	2.60E-11	3.60E-10	0.0002	3.60E-10
3.000	2.750	1.28E-09	0.0005	1.28E-09	2.79E-11	0.0031	2.82E-11	3.86E-10	0.0002	3.86E-10
3.500	3.000	1.39E-09	0.0005	1.39E-09	3.09E-11	0.0031	3.12E-11	4.23E-10	0.0002	4.23E-10
4.000	3.500	1.53E-09	0.0005	1.53E-09	3.47E-11	0.0031	3.50E-11	4.69E-10	0.0002	4.69E-10
4.500	4.000	1.66E-09	0.0005	1.66E-09	3.82E-11	0.0031	3.86E-11	5.13E-10	0.0002	5.13E-10
5.000	4.500	1.78E-09	0.0005	1.78E-09	4.14E-11	0.0031	4.18E-11	5.53E-10	0.0002	5.54E-10
5.500	5.000	1.91E-09	0.0005	1.91E-09	4.46E-11	0.0031	4.50E-11	5.95E-10	0.0002	5.95E-10
6.000	5.500	2.02E-09	0.0005	2.03E-09	4.73E-11	0.0031	4.77E-11	6.33E-10	0.0002	6.34E-10
6.500	6.000	2.14E-09	0.0005	2.14E-09	5.01E-11	0.0032	5.06E-11	6.71E-10	0.0002	6.72E-10
7.000	6.500	2.26E-09	0.0005	2.26E-09	5.29E-11	0.0032	5.34E-11	7.09E-10	0.0002	7.09E-10
7.500	7.000	2.37E-09	0.0005	2.38E-09	5.53E-11	0.0032	5.58E-11	7.46E-10	0.0002	7.46E-10
8.000	7.500	2.49E-09	0.0005	2.49E-09	5.80E-11	0.0032	5.85E-11	7.83E-10	0.0002	7.83E-10
9.000	8.000	2.66E-09	0.0005	2.67E-09	6.18E-11	0.0033	6.24E-11	8.38E-10	0.0002	8.38E-10
10.000	9.000	2.90E-09	0.0005	2.90E-09	6.70E-11	0.0034	6.77E-11	9.11E-10	0.0002	9.12E-10

Table 3-34. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC1 Lead Shielded Container

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.020	0.010	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.030	0.020	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.040	0.030	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.050	0.040	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.060	0.050	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.070	0.060	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.080	0.070	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.090	0.080	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.100	0.090	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.110	0.100	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.120	0.110	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.130	0.120	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.140	0.130	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.150	0.140	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.160	0.150	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.170	0.160	5.06E-50	0.2062	8.19E-50	3.18E-49	0.7881	1.07E-48	2.83E-50	0.8003	9.63E-50
0.180	0.170	2.57E-44	0.0555	3.00E-44	2.95E-44	0.6366	8.57E-44	6.00E-45	0.0240	6.43E-45
0.190	0.180	3.01E-40	0.0613	3.56E-40	2.02E-40	0.6295	5.82E-40	8.28E-41	0.0550	9.64E-41
0.200	0.190	6.70E-36	0.8960	2.47E-35	1.20E-37	0.0716	1.46E-37	2.02E-37	0.0328	2.22E-37
0.210	0.200	4.99E-33	0.9071	1.86E-32	5.97E-35	0.0748	7.31E-35	1.53E-34	0.0475	1.75E-34
0.220	0.210	1.98E-31	0.3913	4.30E-31	1.09E-32	0.0766	1.35E-32	3.95E-32	0.0350	4.36E-32
0.230	0.220	2.62E-29	0.3800	5.61E-29	1.32E-30	0.1971	2.10E-30	4.62E-30	0.0383	5.15E-30
0.240	0.230	1.54E-27	0.3845	3.31E-27	6.63E-29	0.2470	1.15E-28	2.81E-28	0.0426	3.16E-28
0.250	0.240	3.22E-26	0.2308	5.46E-26	1.96E-27	0.2425	3.38E-27	1.39E-26	0.2422	2.40E-26
0.260	0.250	7.35E-25	0.2209	1.22E-24	3.27E-26	0.2592	5.82E-26	3.06E-25	0.2275	5.15E-25
0.270	0.260	1.11E-23	0.1964	1.76E-23	2.84E-25	0.0352	3.14E-25	4.53E-24	0.1723	6.87E-24
0.280	0.270	9.13E-23	0.0744	1.12E-22	3.53E-24	0.2463	6.14E-24	4.70E-23	0.1831	7.28E-23
0.290	0.280	8.08E-22	0.0962	1.04E-21	2.40E-23	0.1061	3.16E-23	4.73E-22	0.1822	7.32E-22
0.300	0.290	5.51E-21	0.1067	7.27E-21	1.28E-22	0.0916	1.64E-22	2.98E-21	0.2023	4.79E-21
0.325	0.300	1.20E-19	0.1397	1.70E-19	3.41E-21	0.2180	5.64E-21	5.39E-20	0.1426	7.70E-20
0.350	0.325	2.31E-18	0.1039	3.03E-18	5.38E-20	0.1772	8.23E-20	1.23E-18	0.1615	1.83E-18
0.375	0.350	4.84E-17	0.3214	9.50E-17	4.70E-19	0.1507	6.82E-19	3.09E-17	0.3995	6.79E-17
0.400	0.375	3.91E-16	0.2887	7.30E-16	4.98E-18	0.2504	8.72E-18	1.65E-16	0.1177	2.24E-16
0.425	0.400	1.23E-15	0.2717	2.24E-15	2.38E-17	0.2609	4.24E-17	6.13E-16	0.0470	6.99E-16
0.450	0.425	3.17E-15	0.0547	3.69E-15	1.15E-16	0.2319	1.96E-16	2.11E-15	0.0318	2.31E-15
0.475	0.450	9.03E-15	0.0622	1.07E-14	2.15E-16	0.1594	3.17E-16	7.06E-15	0.1287	9.79E-15
0.500	0.475	2.07E-14	0.0698	2.51E-14	5.05E-16	0.1199	6.87E-16	1.43E-14	0.0194	1.52E-14
0.525	0.500	4.14E-14	0.0224	4.42E-14	9.44E-16	0.0689	1.14E-15	2.96E-14	0.0153	3.09E-14

Table 3-34. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC1 Lead Shielded Container

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.550	0.525	7.74E-14	0.0211	8.23E-14	2.90E-15	0.2958	5.48E-15	5.45E-14	0.0094	5.61E-14
0.575	0.550	1.37E-13	0.0240	1.47E-13	3.95E-15	0.2156	6.51E-15	9.43E-14	0.0093	9.69E-14
0.600	0.575	2.21E-13	0.0202	2.34E-13	6.32E-15	0.1521	9.21E-15	1.54E-13	0.0079	1.58E-13
0.625	0.600	3.35E-13	0.0161	3.51E-13	9.03E-15	0.1125	1.21E-14	2.36E-13	0.0097	2.43E-13
0.650	0.625	4.72E-13	0.0102	4.87E-13	1.38E-14	0.0927	1.77E-14	3.45E-13	0.0103	3.56E-13
0.675	0.650	6.62E-13	0.0098	6.81E-13	1.90E-14	0.0717	2.31E-14	4.76E-13	0.0052	4.84E-13
0.700	0.675	9.06E-13	0.0098	9.33E-13	2.52E-14	0.0578	2.95E-14	6.48E-13	0.0044	6.56E-13
0.725	0.700	1.18E-12	0.0081	1.21E-12	3.21E-14	0.0453	3.65E-14	8.56E-13	0.0045	8.67E-13
0.750	0.725	1.51E-12	0.0068	1.54E-12	4.09E-14	0.0421	4.61E-14	1.09E-12	0.0030	1.10E-12
0.775	0.750	1.90E-12	0.0061	1.93E-12	4.89E-14	0.0312	5.34E-14	1.37E-12	0.0024	1.38E-12
0.800	0.775	2.33E-12	0.0051	2.37E-12	7.56E-14	0.0307	8.26E-14	1.83E-12	0.0013	1.83E-12
0.825	0.800	2.83E-12	0.0047	2.87E-12	9.10E-14	0.0290	9.89E-14	2.22E-12	0.0012	2.23E-12
0.850	0.825	3.40E-12	0.0043	3.44E-12	1.09E-13	0.0258	1.18E-13	2.66E-12	0.0011	2.66E-12
0.875	0.850	4.00E-12	0.0041	4.05E-12	1.31E-13	0.0245	1.40E-13	3.13E-12	0.0011	3.14E-12
0.900	0.875	4.66E-12	0.0039	4.71E-12	1.56E-13	0.0233	1.67E-13	3.66E-12	0.0010	3.67E-12
0.925	0.900	5.38E-12	0.0037	5.44E-12	1.77E-13	0.0216	1.89E-13	4.23E-12	0.0009	4.24E-12
0.950	0.925	6.15E-12	0.0035	6.21E-12	2.03E-13	0.0199	2.15E-13	4.84E-12	0.0009	4.86E-12
0.975	0.950	6.97E-12	0.0033	7.04E-12	2.32E-13	0.0190	2.45E-13	5.49E-12	0.0008	5.51E-12
1.000	0.975	7.85E-12	0.0031	7.92E-12	2.65E-13	0.0182	2.79E-13	6.18E-12	0.0008	6.20E-12
1.250	1.000	1.36E-11	0.0025	1.37E-11	4.88E-13	0.0145	5.10E-13	1.08E-11	0.0007	1.08E-11
1.500	1.250	2.56E-11	0.0021	2.57E-11	9.91E-13	0.0110	1.02E-12	2.06E-11	0.0005	2.06E-11
1.750	1.500	3.75E-11	0.0019	3.77E-11	1.58E-12	0.0094	1.63E-12	3.06E-11	0.0005	3.06E-11
2.000	1.750	4.85E-11	0.0018	4.88E-11	2.21E-12	0.0087	2.26E-12	3.99E-11	0.0004	4.00E-11
2.250	2.000	5.79E-11	0.0017	5.82E-11	2.78E-12	0.0083	2.84E-12	4.82E-11	0.0004	4.82E-11
2.500	2.250	6.62E-11	0.0017	6.66E-11	3.32E-12	0.0081	3.40E-12	5.55E-11	0.0004	5.55E-11
2.750	2.500	7.33E-11	0.0017	7.37E-11	3.84E-12	0.0080	3.93E-12	6.19E-11	0.0004	6.19E-11
3.000	2.750	7.96E-11	0.0018	8.00E-11	4.27E-12	0.0079	4.38E-12	6.74E-11	0.0004	6.75E-11
3.500	3.000	8.72E-11	0.0018	8.77E-11	4.94E-12	0.0079	5.06E-12	7.43E-11	0.0004	7.44E-11
4.000	3.500	9.53E-11	0.0019	9.59E-11	5.65E-12	0.0081	5.78E-12	8.17E-11	0.0005	8.18E-11
4.500	4.000	1.02E-10	0.0019	1.02E-10	6.24E-12	0.0083	6.39E-12	8.76E-11	0.0005	8.77E-11
5.000	4.500	1.07E-10	0.0020	1.08E-10	6.69E-12	0.0085	6.86E-12	9.23E-11	0.0005	9.24E-11
5.500	5.000	1.12E-10	0.0021	1.12E-10	7.06E-12	0.0088	7.25E-12	9.65E-11	0.0005	9.66E-11
6.000	5.500	1.16E-10	0.0022	1.17E-10	7.39E-12	0.0090	7.59E-12	1.00E-10	0.0005	1.00E-10
6.500	6.000	1.20E-10	0.0022	1.21E-10	7.68E-12	0.0093	7.89E-12	1.04E-10	0.0006	1.04E-10
7.000	6.500	1.24E-10	0.0023	1.25E-10	7.90E-12	0.0096	8.13E-12	1.07E-10	0.0006	1.08E-10
7.500	7.000	1.28E-10	0.0024	1.29E-10	8.15E-12	0.0099	8.40E-12	1.11E-10	0.0006	1.11E-10
8.000	7.500	1.32E-10	0.0024	1.33E-10	8.39E-12	0.0102	8.65E-12	1.15E-10	0.0006	1.15E-10
9.000	8.000	1.39E-10	0.0025	1.40E-10	8.78E-12	0.0105	9.05E-12	1.20E-10	0.0006	1.21E-10
10.000	9.000	1.49E-10	0.0026	1.50E-10	9.47E-12	0.0107	9.78E-12	1.28E-10	0.0006	1.28E-10

Table 3-35. Neutron Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – SC2 Polyethylene Shielded Container

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	1.90E-10	0.0043	1.93E-10	4.69E-12	0.0306	5.12E-12	1.21E-10	0.0012	1.22E-10
4.14E-07	1.00E-07	2.02E-10	0.0042	2.05E-10	4.79E-12	0.0310	5.23E-12	1.28E-10	0.0012	1.28E-10
8.76E-07	4.14E-07	2.11E-10	0.0042	2.14E-10	4.91E-12	0.0321	5.39E-12	1.32E-10	0.0012	1.32E-10
1.86E-06	8.76E-07	2.19E-10	0.0041	2.21E-10	5.04E-12	0.0313	5.52E-12	1.35E-10	0.0012	1.36E-10
5.04E-06	1.86E-06	2.25E-10	0.0040	2.28E-10	5.19E-12	0.0300	5.65E-12	1.40E-10	0.0011	1.40E-10
1.07E-05	5.04E-06	2.32E-10	0.0041	2.35E-10	5.51E-12	0.0325	6.05E-12	1.44E-10	0.0011	1.44E-10
3.73E-05	1.07E-05	2.42E-10	0.0040	2.45E-10	5.79E-12	0.0324	6.35E-12	1.50E-10	0.0011	1.50E-10
1.01E-04	3.73E-05	2.53E-10	0.0040	2.56E-10	5.73E-12	0.0303	6.25E-12	1.56E-10	0.0011	1.56E-10
2.14E-04	1.01E-04	2.60E-10	0.0040	2.63E-10	5.76E-12	0.0301	6.28E-12	1.61E-10	0.0011	1.62E-10
4.54E-04	2.14E-04	2.66E-10	0.0039	2.69E-10	6.30E-12	0.0289	6.84E-12	1.66E-10	0.0011	1.66E-10
1.58E-03	4.54E-04	2.77E-10	0.0040	2.80E-10	6.42E-12	0.0307	7.01E-12	1.73E-10	0.0011	1.74E-10
3.35E-03	1.58E-03	2.90E-10	0.0040	2.93E-10	6.30E-12	0.0283	6.83E-12	1.80E-10	0.0011	1.81E-10
7.10E-03	3.35E-03	2.97E-10	0.0040	3.01E-10	6.88E-12	0.0290	7.48E-12	1.87E-10	0.0011	1.88E-10
1.50E-02	7.10E-03	3.05E-10	0.0039	3.09E-10	7.15E-12	0.0286	7.76E-12	1.94E-10	0.0011	1.95E-10
2.19E-02	1.50E-02	3.15E-10	0.0038	3.18E-10	7.14E-12	0.0260	7.70E-12	2.00E-10	0.0011	2.01E-10
2.42E-02	2.19E-02	3.18E-10	0.0038	3.22E-10	7.42E-12	0.0252	7.98E-12	2.03E-10	0.0011	2.04E-10
2.61E-02	2.42E-02	3.20E-10	0.0038	3.24E-10	7.49E-12	0.0260	8.07E-12	2.05E-10	0.0011	2.05E-10
3.18E-02	2.61E-02	3.23E-10	0.0038	3.27E-10	7.65E-12	0.0277	8.29E-12	2.06E-10	0.0011	2.07E-10
4.09E-02	3.18E-02	3.29E-10	0.0038	3.33E-10	7.69E-12	0.0276	8.33E-12	2.10E-10	0.0011	2.11E-10
6.74E-02	4.09E-02	3.36E-10	0.0038	3.40E-10	8.10E-12	0.0281	8.78E-12	2.16E-10	0.0011	2.17E-10
1.11E-01	6.74E-02	3.63E-10	0.0039	3.67E-10	8.56E-12	0.0288	9.30E-12	2.31E-10	0.0011	2.32E-10
1.83E-01	1.11E-01	4.18E-10	0.0042	4.24E-10	1.07E-11	0.0491	1.23E-11	2.63E-10	0.0011	2.64E-10
2.97E-01	1.83E-01	5.67E-10	0.0050	5.76E-10	1.49E-11	0.0347	1.64E-11	3.42E-10	0.0014	3.43E-10
3.69E-01	2.97E-01	8.13E-10	0.0057	8.27E-10	2.30E-11	0.0457	2.61E-11	4.71E-10	0.0016	4.74E-10
4.98E-01	3.69E-01	1.21E-09	0.0060	1.23E-09	3.37E-11	0.0363	3.73E-11	6.78E-10	0.0017	6.81E-10
6.08E-01	4.98E-01	1.82E-09	0.0055	1.85E-09	6.06E-11	0.0391	6.77E-11	1.03E-09	0.0017	1.04E-09
7.43E-01	6.08E-01	2.56E-09	0.0051	2.60E-09	8.82E-11	0.0268	9.53E-11	1.47E-09	0.0015	1.48E-09
8.21E-01	7.43E-01	3.24E-09	0.0047	3.28E-09	1.08E-10	0.0295	1.18E-10	1.89E-09	0.0015	1.90E-09
1.00E+00	8.21E-01	4.13E-09	0.0044	4.19E-09	1.56E-10	0.0282	1.69E-10	2.46E-09	0.0013	2.47E-09
1.35E+00	1.00E+00	5.83E-09	0.0037	5.90E-09	2.27E-10	0.0242	2.43E-10	3.59E-09	0.0011	3.60E-09
1.65E+00	1.35E+00	7.67E-09	0.0032	7.74E-09	3.06E-10	0.0179	3.22E-10	4.86E-09	0.0009	4.87E-09
1.92E+00	1.65E+00	8.96E-09	0.0029	9.03E-09	3.92E-10	0.0170	4.12E-10	5.83E-09	0.0008	5.85E-09
2.23E+00	1.92E+00	1.01E-08	0.0027	1.01E-08	4.24E-10	0.0138	4.42E-10	6.62E-09	0.0008	6.64E-09
2.35E+00	2.23E+00	1.08E-08	0.0025	1.09E-08	4.94E-10	0.0139	5.15E-10	7.21E-09	0.0007	7.23E-09
2.37E+00	2.35E+00	1.10E-08	0.0025	1.11E-08	5.23E-10	0.0118	5.41E-10	7.40E-09	0.0007	7.42E-09
2.47E+00	2.37E+00	1.11E-08	0.0024	1.12E-08	5.07E-10	0.0127	5.26E-10	7.54E-09	0.0007	7.56E-09
2.73E+00	2.47E+00	1.17E-08	0.0024	1.17E-08	5.26E-10	0.0127	5.46E-10	7.86E-09	0.0007	7.87E-09
3.01E+00	2.73E+00	1.20E-08	0.0023	1.21E-08	5.53E-10	0.0123	5.74E-10	8.22E-09	0.0007	8.23E-09
3.68E+00	3.01E+00	1.31E-08	0.0022	1.32E-08	6.02E-10	0.0111	6.22E-10	9.05E-09	0.0006	9.06E-09
4.97E+00	3.68E+00	1.59E-08	0.0019	1.60E-08	8.20E-10	0.0095	8.44E-10	1.12E-08	0.0005	1.12E-08
6.07E+00	4.97E+00	1.79E-08	0.0017	1.80E-08	1.06E-09	0.0077	1.09E-09	1.29E-08	0.0005	1.29E-08
7.41E+00	6.07E+00	1.86E-08	0.0016	1.87E-08	1.22E-09	0.0070	1.25E-09	1.36E-08	0.0004	1.36E-08
8.61E+00	7.41E+00	1.86E-08	0.0016	1.86E-08	1.27E-09	0.0067	1.30E-09	1.38E-08	0.0004	1.38E-08
1.00E+01	8.61E+00	1.87E-08	0.0015	1.88E-08	1.40E-09	0.0059	1.42E-09	1.40E-08	0.0004	1.41E-08
1.22E+01	1.00E+01	2.03E-08	0.0014	2.04E-08	1.64E-09	0.0054	1.67E-09	1.54E-08	0.0004	1.54E-08
1.42E+01	1.22E+01	2.32E-08	0.0013	2.32E-08	1.99E-09	0.0048	2.02E-09	1.76E-08	0.0003	1.76E-08
1.96E+01	1.42E+01	2.65E-08	0.0013	2.66E-08	2.48E-09	0.0044	2.52E-09	2.04E-08	0.0003	2.04E-08

Table 3-36. Secondary Photon Dose Rate per Unit Neutron Source in Each of the 47 Source Groups – SC2 Polyethylene Shielded Container

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
1.00E-07	1.00E-11	3.76E-10	0.0042	3.81E-10	2.30E-11	0.0151	2.41E-11	3.17E-10	0.0011	3.18E-10
4.14E-07	1.00E-07	3.88E-10	0.0045	3.93E-10	2.30E-11	0.0145	2.40E-11	3.22E-10	0.0011	3.23E-10
8.76E-07	4.14E-07	3.87E-10	0.0043	3.92E-10	2.35E-11	0.0159	2.46E-11	3.25E-10	0.0011	3.26E-10
1.86E-06	8.76E-07	3.91E-10	0.0042	3.96E-10	2.34E-11	0.0152	2.45E-11	3.27E-10	0.0011	3.28E-10
5.04E-06	1.86E-06	3.94E-10	0.0043	4.00E-10	2.39E-11	0.0147	2.49E-11	3.28E-10	0.0011	3.29E-10
1.07E-05	5.04E-06	3.97E-10	0.0044	4.03E-10	2.35E-11	0.0140	2.45E-11	3.30E-10	0.0011	3.31E-10
3.73E-05	1.07E-05	3.94E-10	0.0043	3.99E-10	2.42E-11	0.0148	2.53E-11	3.31E-10	0.0011	3.32E-10
1.01E-04	3.73E-05	3.99E-10	0.0044	4.04E-10	2.35E-11	0.0139	2.44E-11	3.33E-10	0.0011	3.34E-10
2.14E-04	1.01E-04	3.99E-10	0.0044	4.04E-10	2.43E-11	0.0158	2.55E-11	3.33E-10	0.0011	3.34E-10
4.54E-04	2.14E-04	3.95E-10	0.0043	4.00E-10	2.45E-11	0.0152	2.56E-11	3.33E-10	0.0011	3.34E-10
1.58E-03	4.54E-04	3.95E-10	0.0044	4.00E-10	2.43E-11	0.0157	2.55E-11	3.34E-10	0.0012	3.35E-10
3.35E-03	1.58E-03	3.94E-10	0.0044	3.99E-10	2.37E-11	0.0146	2.47E-11	3.32E-10	0.0012	3.34E-10
7.10E-03	3.35E-03	3.93E-10	0.0045	3.99E-10	2.37E-11	0.0161	2.49E-11	3.32E-10	0.0012	3.33E-10
1.50E-02	7.10E-03	3.88E-10	0.0046	3.93E-10	2.39E-11	0.0159	2.50E-11	3.30E-10	0.0012	3.31E-10
2.19E-02	1.50E-02	3.90E-10	0.0044	3.95E-10	2.39E-11	0.0138	2.49E-11	3.29E-10	0.0012	3.30E-10
2.42E-02	2.19E-02	3.88E-10	0.0045	3.94E-10	2.38E-11	0.0140	2.48E-11	3.29E-10	0.0012	3.30E-10
2.61E-02	2.42E-02	3.88E-10	0.0046	3.93E-10	2.41E-11	0.0142	2.51E-11	3.28E-10	0.0012	3.30E-10
3.18E-02	2.61E-02	3.86E-10	0.0045	3.91E-10	2.39E-11	0.0139	2.49E-11	3.27E-10	0.0012	3.28E-10
4.09E-02	3.18E-02	3.86E-10	0.0046	3.91E-10	2.38E-11	0.0153	2.49E-11	3.27E-10	0.0012	3.28E-10
6.74E-02	4.09E-02	3.81E-10	0.0046	3.86E-10	2.39E-11	0.0167	2.51E-11	3.25E-10	0.0012	3.26E-10
1.11E-01	6.74E-02	3.74E-10	0.0045	3.79E-10	2.38E-11	0.0150	2.49E-11	3.21E-10	0.0012	3.22E-10
1.83E-01	1.11E-01	3.66E-10	0.0045	3.71E-10	2.30E-11	0.0149	2.40E-11	3.12E-10	0.0012	3.13E-10
2.97E-01	1.83E-01	3.49E-10	0.0046	3.54E-10	2.29E-11	0.0145	2.39E-11	3.00E-10	0.0012	3.01E-10
3.69E-01	2.97E-01	3.36E-10	0.0046	3.40E-10	2.20E-11	0.0165	2.31E-11	2.89E-10	0.0012	2.90E-10
4.98E-01	3.69E-01	3.20E-10	0.0045	3.24E-10	2.17E-11	0.0149	2.27E-11	2.76E-10	0.0012	2.77E-10
6.08E-01	4.98E-01	3.05E-10	0.0048	3.09E-10	2.07E-11	0.0156	2.16E-11	2.61E-10	0.0012	2.62E-10
7.43E-01	6.08E-01	2.87E-10	0.0047	2.91E-10	2.01E-11	0.0169	2.11E-11	2.48E-10	0.0012	2.49E-10
8.21E-01	7.43E-01	2.74E-10	0.0048	2.78E-10	1.96E-11	0.0162	2.05E-11	2.37E-10	0.0012	2.38E-10
1.00E+00	8.21E-01	2.61E-10	0.0049	2.65E-10	1.89E-11	0.0155	1.97E-11	2.25E-10	0.0013	2.26E-10
1.35E+00	1.00E+00	2.36E-10	0.0049	2.40E-10	1.73E-11	0.0142	1.80E-11	2.05E-10	0.0013	2.06E-10
1.65E+00	1.35E+00	2.12E-10	0.0051	2.15E-10	1.60E-11	0.0161	1.68E-11	1.84E-10	0.0013	1.85E-10
1.92E+00	1.65E+00	1.94E-10	0.0050	1.96E-10	1.51E-11	0.0164	1.58E-11	1.70E-10	0.0013	1.70E-10
2.23E+00	1.92E+00	1.81E-10	0.0049	1.84E-10	1.43E-11	0.0166	1.50E-11	1.59E-10	0.0013	1.60E-10
2.35E+00	2.23E+00	1.74E-10	0.0052	1.77E-10	1.37E-11	0.0172	1.44E-11	1.51E-10	0.0013	1.52E-10
2.37E+00	2.35E+00	1.71E-10	0.0053	1.73E-10	1.37E-11	0.0179	1.44E-11	1.49E-10	0.0013	1.49E-10
2.47E+00	2.37E+00	1.67E-10	0.0050	1.69E-10	1.34E-11	0.0145	1.40E-11	1.47E-10	0.0013	1.48E-10
2.73E+00	2.47E+00	1.64E-10	0.0051	1.66E-10	1.30E-11	0.0152	1.36E-11	1.44E-10	0.0013	1.45E-10
3.01E+00	2.73E+00	1.62E-10	0.0050	1.64E-10	1.31E-11	0.0163	1.38E-11	1.42E-10	0.0013	1.43E-10
3.68E+00	3.01E+00	1.56E-10	0.0048	1.59E-10	1.31E-11	0.0163	1.38E-11	1.39E-10	0.0013	1.39E-10
4.97E+00	3.68E+00	1.49E-10	0.0046	1.51E-10	1.23E-11	0.0138	1.28E-11	1.31E-10	0.0012	1.32E-10
6.07E+00	4.97E+00	1.68E-10	0.0040	1.70E-10	1.45E-11	0.0127	1.50E-11	1.47E-10	0.0010	1.47E-10
7.41E+00	6.07E+00	1.94E-10	0.0035	1.96E-10	1.67E-11	0.0111	1.73E-11	1.70E-10	0.0009	1.70E-10
8.61E+00	7.41E+00	2.26E-10	0.0032	2.29E-10	1.99E-11	0.0105	2.05E-11	1.97E-10	0.0008	1.98E-10
1.00E+01	8.61E+00	2.36E-10	0.0031	2.38E-10	2.20E-11	0.0101	2.26E-11	2.07E-10	0.0008	2.07E-10
1.22E+01	1.00E+01	2.62E-10	0.0031	2.65E-10	2.57E-11	0.0096	2.64E-11	2.31E-10	0.0008	2.31E-10
1.42E+01	1.22E+01	2.46E-10	0.0030	2.49E-10	2.54E-11	0.0103	2.62E-11	2.19E-10	0.0008	2.19E-10
1.96E+01	1.42E+01	1.95E-10	0.0031	1.97E-10	2.13E-11	0.0097	2.20E-11	1.73E-10	0.0008	1.74E-10

**Table 3-37. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC2
Polyethylene Shielded Container**

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.020	0.010	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.030	0.020	3.52E-30	0.0060	3.58E-30	0.00E+00	0.0000	0.00E+00	4.28E-43	0.0552	4.99E-43
0.040	0.030	3.81E-20	0.2247	6.38E-20	2.34E-47	0.9962	9.33E-47	2.59E-26	0.3118	5.02E-26
0.050	0.040	2.37E-16	0.0712	2.88E-16	4.69E-34	0.0952	6.03E-34	1.85E-19	0.6205	5.30E-19
0.060	0.050	1.88E-14	0.0419	2.12E-14	6.67E-26	0.6540	1.98E-25	1.47E-16	0.2077	2.39E-16
0.070	0.060	1.85E-13	0.0127	1.92E-13	1.47E-20	0.6896	4.50E-20	5.85E-15	0.0157	6.12E-15
0.080	0.070	7.95E-13	0.0122	8.24E-13	2.11E-19	0.1175	2.85E-19	6.10E-14	0.0096	6.27E-14
0.090	0.080	1.96E-12	0.0073	2.01E-12	9.44E-18	0.2279	1.59E-17	2.74E-13	0.0043	2.77E-13
0.100	0.090	3.67E-12	0.0077	3.76E-12	6.88E-17	0.1360	9.69E-17	7.37E-13	0.0024	7.42E-13
0.110	0.100	5.71E-12	0.0056	5.81E-12	3.65E-16	0.1064	4.81E-16	1.51E-12	0.0020	1.51E-12
0.120	0.110	8.20E-12	0.0061	8.35E-12	1.39E-15	0.1684	2.09E-15	2.57E-12	0.0017	2.59E-12
0.130	0.120	1.07E-11	0.0036	1.09E-11	5.72E-15	0.4214	1.30E-14	3.88E-12	0.0015	3.90E-12
0.140	0.130	1.33E-11	0.0015	1.34E-11	1.50E-14	0.0466	1.70E-14	5.85E-12	0.0005	5.85E-12
0.150	0.140	1.61E-11	0.0014	1.62E-11	2.41E-14	0.0385	2.69E-14	7.62E-12	0.0005	7.64E-12
0.160	0.150	1.90E-11	0.0013	1.90E-11	4.21E-14	0.0339	4.64E-14	9.52E-12	0.0004	9.53E-12
0.170	0.160	2.19E-11	0.0013	2.20E-11	6.22E-14	0.0292	6.77E-14	1.15E-11	0.0004	1.15E-11
0.180	0.170	2.49E-11	0.0012	2.50E-11	8.56E-14	0.0254	9.22E-14	1.36E-11	0.0004	1.36E-11
0.190	0.180	2.78E-11	0.0012	2.79E-11	1.14E-13	0.0240	1.23E-13	1.57E-11	0.0004	1.57E-11
0.200	0.190	3.08E-11	0.0012	3.09E-11	1.48E-13	0.0210	1.57E-13	1.79E-11	0.0003	1.79E-11
0.210	0.200	3.38E-11	0.0011	3.39E-11	1.81E-13	0.0181	1.90E-13	2.00E-11	0.0003	2.01E-11
0.220	0.210	3.68E-11	0.0011	3.69E-11	2.24E-13	0.0169	2.35E-13	2.23E-11	0.0003	2.23E-11
0.230	0.220	3.98E-11	0.0011	3.99E-11	2.70E-13	0.0159	2.82E-13	2.45E-11	0.0003	2.45E-11
0.240	0.230	4.28E-11	0.0011	4.29E-11	3.19E-13	0.0148	3.33E-13	2.67E-11	0.0003	2.67E-11
0.250	0.240	4.57E-11	0.0011	4.59E-11	3.69E-13	0.0137	3.84E-13	2.89E-11	0.0003	2.90E-11
0.260	0.250	4.87E-11	0.0011	4.89E-11	4.27E-13	0.0135	4.45E-13	3.12E-11	0.0003	3.12E-11
0.270	0.260	5.16E-11	0.0010	5.18E-11	4.81E-13	0.0128	4.99E-13	3.34E-11	0.0003	3.34E-11
0.280	0.270	5.45E-11	0.0010	5.47E-11	5.35E-13	0.0121	5.55E-13	3.56E-11	0.0003	3.57E-11
0.290	0.280	5.75E-11	0.0010	5.76E-11	5.93E-13	0.0117	6.14E-13	3.79E-11	0.0003	3.79E-11
0.300	0.290	6.04E-11	0.0010	6.06E-11	6.57E-13	0.0110	6.79E-13	4.01E-11	0.0003	4.01E-11
0.325	0.300	6.53E-11	0.0010	6.55E-11	7.73E-13	0.0105	7.98E-13	4.39E-11	0.0003	4.39E-11
0.350	0.325	7.22E-11	0.0010	7.25E-11	9.48E-13	0.0096	9.76E-13	4.93E-11	0.0003	4.94E-11
0.375	0.350	7.90E-11	0.0010	7.92E-11	1.14E-12	0.0091	1.17E-12	5.47E-11	0.0003	5.47E-11
0.400	0.375	8.54E-11	0.0010	8.57E-11	1.34E-12	0.0086	1.37E-12	5.98E-11	0.0003	5.99E-11
0.425	0.400	9.17E-11	0.0009	9.19E-11	1.54E-12	0.0082	1.58E-12	6.49E-11	0.0002	6.49E-11
0.450	0.425	9.77E-11	0.0009	9.79E-11	1.77E-12	0.0079	1.81E-12	6.98E-11	0.0002	6.98E-11
0.475	0.450	1.03E-10	0.0009	1.04E-10	1.98E-12	0.0076	2.03E-12	7.46E-11	0.0002	7.46E-11
0.500	0.475	1.09E-10	0.0009	1.09E-10	2.20E-12	0.0076	2.25E-12	7.92E-11	0.0002	7.93E-11
0.525	0.500	1.15E-10	0.0009	1.15E-10	2.45E-12	0.0070	2.50E-12	8.39E-11	0.0002	8.39E-11

**Table 3-37. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC2
Polyethylene Shielded Container**

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.550	0.525	1.21E-10	0.0009	1.21E-10	2.69E-12	0.0068	2.74E-12	8.86E-11	0.0002	8.86E-11
0.575	0.550	1.26E-10	0.0009	1.26E-10	2.95E-12	0.0066	3.00E-12	9.32E-11	0.0002	9.33E-11
0.600	0.575	1.31E-10	0.0009	1.32E-10	3.16E-12	0.0063	3.22E-12	9.77E-11	0.0002	9.78E-11
0.625	0.600	1.37E-10	0.0009	1.37E-10	3.41E-12	0.0061	3.47E-12	1.02E-10	0.0002	1.02E-10
0.650	0.625	1.41E-10	0.0009	1.42E-10	3.68E-12	0.0059	3.74E-12	1.06E-10	0.0002	1.06E-10
0.675	0.650	1.46E-10	0.0009	1.47E-10	3.96E-12	0.0058	4.02E-12	1.11E-10	0.0002	1.11E-10
0.700	0.675	1.51E-10	0.0009	1.52E-10	4.23E-12	0.0056	4.30E-12	1.15E-10	0.0002	1.15E-10
0.725	0.700	1.56E-10	0.0009	1.57E-10	4.50E-12	0.0055	4.57E-12	1.19E-10	0.0002	1.19E-10
0.750	0.725	1.61E-10	0.0009	1.61E-10	4.76E-12	0.0054	4.84E-12	1.23E-10	0.0002	1.23E-10
0.775	0.750	1.66E-10	0.0009	1.66E-10	5.05E-12	0.0053	5.13E-12	1.27E-10	0.0002	1.27E-10
0.800	0.775	1.70E-10	0.0008	1.71E-10	5.34E-12	0.0051	5.42E-12	1.31E-10	0.0002	1.31E-10
0.825	0.800	1.75E-10	0.0008	1.75E-10	5.61E-12	0.0051	5.70E-12	1.35E-10	0.0002	1.35E-10
0.850	0.825	1.80E-10	0.0008	1.80E-10	5.89E-12	0.0049	5.98E-12	1.39E-10	0.0002	1.39E-10
0.875	0.850	1.84E-10	0.0008	1.85E-10	6.20E-12	0.0049	6.29E-12	1.43E-10	0.0002	1.43E-10
0.900	0.875	1.89E-10	0.0008	1.89E-10	6.47E-12	0.0048	6.56E-12	1.47E-10	0.0002	1.47E-10
0.925	0.900	1.93E-10	0.0008	1.93E-10	6.78E-12	0.0047	6.88E-12	1.51E-10	0.0002	1.51E-10
0.950	0.925	1.97E-10	0.0008	1.98E-10	7.08E-12	0.0046	7.18E-12	1.55E-10	0.0002	1.55E-10
0.975	0.950	2.02E-10	0.0008	2.02E-10	7.35E-12	0.0045	7.45E-12	1.59E-10	0.0002	1.59E-10
1.000	0.975	2.06E-10	0.0008	2.06E-10	7.65E-12	0.0045	7.76E-12	1.63E-10	0.0002	1.63E-10
1.250	1.000	2.28E-10	0.0008	2.29E-10	9.45E-12	0.0042	9.57E-12	1.83E-10	0.0002	1.83E-10
1.500	1.250	2.68E-10	0.0008	2.68E-10	1.27E-11	0.0038	1.28E-11	2.19E-10	0.0002	2.19E-10
1.750	1.500	3.05E-10	0.0008	3.05E-10	1.60E-11	0.0035	1.62E-11	2.53E-10	0.0002	2.53E-10
2.000	1.750	3.40E-10	0.0008	3.41E-10	1.92E-11	0.0034	1.94E-11	2.85E-10	0.0002	2.86E-10
2.250	2.000	3.73E-10	0.0008	3.74E-10	2.24E-11	0.0032	2.26E-11	3.17E-10	0.0002	3.17E-10
2.500	2.250	4.04E-10	0.0008	4.05E-10	2.54E-11	0.0031	2.56E-11	3.46E-10	0.0002	3.46E-10
2.750	2.500	4.35E-10	0.0008	4.36E-10	2.83E-11	0.0030	2.86E-11	3.75E-10	0.0002	3.75E-10
3.000	2.750	4.64E-10	0.0008	4.65E-10	3.12E-11	0.0030	3.15E-11	4.02E-10	0.0002	4.03E-10
3.500	3.000	5.05E-10	0.0008	5.07E-10	3.51E-11	0.0029	3.54E-11	4.41E-10	0.0002	4.42E-10
4.000	3.500	5.58E-10	0.0008	5.59E-10	3.99E-11	0.0029	4.03E-11	4.91E-10	0.0002	4.91E-10
4.500	4.000	6.07E-10	0.0008	6.09E-10	4.45E-11	0.0029	4.49E-11	5.37E-10	0.0002	5.38E-10
5.000	4.500	6.54E-10	0.0008	6.56E-10	4.86E-11	0.0028	4.90E-11	5.82E-10	0.0002	5.82E-10
5.500	5.000	7.03E-10	0.0008	7.05E-10	5.27E-11	0.0028	5.31E-11	6.27E-10	0.0002	6.27E-10
6.000	5.500	7.48E-10	0.0008	7.50E-10	5.63E-11	0.0029	5.68E-11	6.69E-10	0.0002	6.69E-10
6.500	6.000	7.93E-10	0.0008	7.95E-10	5.99E-11	0.0029	6.04E-11	7.10E-10	0.0002	7.10E-10
7.000	6.500	8.38E-10	0.0008	8.40E-10	6.34E-11	0.0029	6.39E-11	7.51E-10	0.0002	7.52E-10
7.500	7.000	8.83E-10	0.0008	8.85E-10	6.66E-11	0.0029	6.72E-11	7.92E-10	0.0002	7.92E-10
8.000	7.500	9.27E-10	0.0008	9.29E-10	7.00E-11	0.0030	7.06E-11	8.33E-10	0.0002	8.33E-10
9.000	8.000	9.93E-10	0.0009	9.96E-10	7.48E-11	0.0030	7.54E-11	8.93E-10	0.0002	8.94E-10
10.000	9.000	1.08E-09	0.0009	1.09E-09	8.14E-11	0.0030	8.22E-11	9.75E-10	0.0002	9.75E-10

Table 3-38. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC3 Tungsten Shielded Container

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.020	0.010	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.030	0.020	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.040	0.030	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.050	0.040	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.060	0.050	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.070	0.060	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.080	0.070	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.090	0.080	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.100	0.090	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.110	0.100	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.120	0.110	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.130	0.120	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.140	0.130	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.150	0.140	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.160	0.150	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.170	0.160	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00	0.00E+00	0.0000	0.00E+00
0.180	0.170	1.04E-48	0.1447	1.49E-48	8.94E-52	0.7976	3.03E-51	1.89E-49	0.2113	3.09E-49
0.190	0.180	9.73E-44	0.0643	1.16E-43	1.10E-46	0.0773	1.36E-46	2.85E-44	0.0722	3.47E-44
0.200	0.190	5.38E-40	0.1536	7.86E-40	7.68E-43	0.1125	1.03E-42	2.23E-40	0.2699	4.04E-40
0.210	0.200	7.56E-37	0.1521	1.10E-36	1.21E-39	0.1501	1.75E-39	3.32E-37	0.2488	5.80E-37
0.220	0.210	2.84E-34	0.0834	3.54E-34	5.11E-37	0.0207	5.42E-37	1.53E-34	0.2292	2.59E-34
0.230	0.220	4.71E-32	0.0410	5.29E-32	1.03E-34	0.0321	1.13E-34	2.70E-32	0.2140	4.43E-32
0.240	0.230	3.81E-30	0.0373	4.23E-30	1.07E-32	0.1187	1.45E-32	4.03E-30	0.6073	1.14E-29
0.250	0.240	1.76E-28	0.0723	2.14E-28	4.92E-31	0.0606	5.81E-31	1.84E-28	0.5969	5.13E-28
0.260	0.250	4.96E-27	0.0665	5.95E-27	1.42E-29	0.0431	1.60E-29	2.39E-27	0.1109	3.18E-27
0.270	0.260	9.05E-26	0.0511	1.04E-25	3.23E-28	0.1042	4.24E-28	5.09E-26	0.1150	6.85E-26
0.280	0.270	1.40E-24	0.0874	1.77E-24	1.95E-26	0.7501	6.35E-26	5.74E-25	0.0965	7.40E-25
0.290	0.280	1.19E-23	0.0618	1.41E-23	2.12E-25	0.7354	6.79E-25	5.30E-24	0.0789	6.56E-24
0.300	0.290	9.83E-23	0.1050	1.29E-22	5.79E-24	0.9148	2.17E-23	4.10E-23	0.0775	5.05E-23
0.325	0.300	1.85E-20	0.8130	6.37E-20	1.01E-22	0.7844	3.39E-22	1.62E-21	0.1849	2.52E-21
0.350	0.325	1.77E-19	0.3870	3.83E-19	4.29E-22	0.2049	6.93E-22	4.87E-20	0.1893	7.63E-20
0.375	0.350	3.34E-17	0.9626	1.30E-16	6.69E-21	0.2626	1.20E-20	9.10E-19	0.3402	1.84E-18
0.400	0.375	7.17E-18	0.0608	8.47E-18	5.93E-20	0.1877	9.27E-20	1.15E-17	0.2242	1.93E-17
0.425	0.400	5.68E-17	0.1548	8.32E-17	4.50E-19	0.2960	8.50E-19	4.22E-17	0.1040	5.54E-17
0.450	0.425	2.15E-16	0.0814	2.67E-16	3.04E-18	0.4133	6.80E-18	2.13E-16	0.1303	2.96E-16
0.475	0.450	7.58E-16	0.0821	9.44E-16	1.29E-17	0.3041	2.47E-17	5.86E-16	0.0938	7.52E-16
0.500	0.475	4.39E-15	0.4714	1.06E-14	3.74E-17	0.3228	7.37E-17	1.48E-15	0.0523	1.71E-15
0.525	0.500	4.56E-15	0.0713	5.54E-15	6.34E-17	0.1714	9.59E-17	3.22E-15	0.0306	3.51E-15

**Table 3-38. Photon Dose Rate per Unit Source in Each of the 77 Source Groups – SC3
Tungsten Shielded Container**

Energy (MeV)		Bottom Dose Rate (rem/hr)			Top Dose Rate (rem/hr)			Side Dose Rate (rem/hr)		
Upper	Lower	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ	mean	FSD	mean+3 σ
0.550	0.525	8.67E-15	0.0482	9.93E-15	1.25E-16	0.1497	1.81E-16	6.78E-15	0.0295	7.38E-15
0.575	0.550	1.84E-14	0.0842	2.30E-14	3.27E-16	0.2457	5.69E-16	1.21E-14	0.0167	1.27E-14
0.600	0.575	2.83E-14	0.0423	3.19E-14	4.73E-16	0.1674	7.10E-16	2.05E-14	0.0137	2.14E-14
0.625	0.600	4.67E-14	0.0448	5.30E-14	8.07E-16	0.1555	1.18E-15	3.46E-14	0.0158	3.63E-14
0.650	0.625	6.77E-14	0.0276	7.33E-14	1.22E-15	0.1116	1.63E-15	5.72E-14	0.1071	7.56E-14
0.675	0.650	1.02E-13	0.0278	1.11E-13	1.60E-15	0.0566	1.87E-15	7.40E-14	0.0086	7.59E-14
0.700	0.675	1.39E-13	0.0159	1.45E-13	2.25E-15	0.0367	2.49E-15	1.08E-13	0.0237	1.15E-13
0.725	0.700	1.91E-13	0.0232	2.05E-13	4.33E-15	0.2626	7.75E-15	1.45E-13	0.0093	1.49E-13
0.750	0.725	2.44E-13	0.0166	2.57E-13	5.82E-15	0.1515	8.47E-15	2.06E-13	0.0042	2.09E-13
0.775	0.750	3.23E-13	0.0147	3.37E-13	8.03E-15	0.1258	1.11E-14	2.68E-13	0.0037	2.71E-13
0.800	0.775	4.18E-13	0.0131	4.34E-13	1.11E-14	0.1002	1.45E-14	3.41E-13	0.0033	3.44E-13
0.825	0.800	5.23E-13	0.0119	5.42E-13	1.50E-14	0.0876	1.90E-14	4.25E-13	0.0030	4.29E-13
0.850	0.825	6.36E-13	0.0108	6.56E-13	1.74E-14	0.0778	2.14E-14	5.23E-13	0.0027	5.28E-13
0.875	0.850	7.76E-13	0.0099	7.99E-13	2.05E-14	0.0696	2.47E-14	6.35E-13	0.0025	6.40E-13
0.900	0.875	9.23E-13	0.0092	9.48E-13	2.66E-14	0.0603	3.14E-14	7.61E-13	0.0023	7.67E-13
0.925	0.900	1.11E-12	0.0084	1.14E-12	3.07E-14	0.0577	3.60E-14	9.03E-13	0.0022	9.09E-13
0.950	0.925	1.29E-12	0.0080	1.32E-12	3.72E-14	0.0560	4.35E-14	1.06E-12	0.0020	1.07E-12
0.975	0.950	1.50E-12	0.0075	1.53E-12	4.16E-14	0.0530	4.82E-14	1.23E-12	0.0019	1.24E-12
1.000	0.975	1.72E-12	0.0071	1.76E-12	4.97E-14	0.0517	5.74E-14	1.42E-12	0.0018	1.43E-12
1.250	1.000	3.34E-12	0.0055	3.39E-12	1.07E-13	0.0334	1.18E-13	2.78E-12	0.0014	2.79E-12
1.500	1.250	7.19E-12	0.0041	7.28E-12	2.55E-13	0.0235	2.73E-13	6.06E-12	0.0010	6.08E-12
1.750	1.500	1.18E-11	0.0035	1.19E-11	4.63E-13	0.0182	4.88E-13	9.93E-12	0.0009	9.96E-12
2.000	1.750	1.64E-11	0.0032	1.65E-11	6.88E-13	0.0160	7.21E-13	1.39E-11	0.0008	1.39E-11
2.250	2.000	2.05E-11	0.0030	2.07E-11	9.32E-13	0.0152	9.74E-13	1.76E-11	0.0008	1.76E-11
2.500	2.250	2.44E-11	0.0030	2.46E-11	1.09E-12	0.0147	1.13E-12	2.10E-11	0.0007	2.10E-11
2.750	2.500	2.78E-11	0.0029	2.81E-11	1.30E-12	0.0140	1.36E-12	2.40E-11	0.0007	2.41E-11
3.000	2.750	3.07E-11	0.0030	3.09E-11	1.52E-12	0.0139	1.58E-12	2.66E-11	0.0007	2.67E-11
3.500	3.000	3.42E-11	0.0030	3.46E-11	1.75E-12	0.0138	1.82E-12	2.98E-11	0.0007	2.99E-11
4.000	3.500	3.80E-11	0.0031	3.83E-11	2.02E-12	0.0139	2.11E-12	3.31E-11	0.0008	3.32E-11
4.500	4.000	4.05E-11	0.0032	4.09E-11	2.21E-12	0.0143	2.31E-12	3.56E-11	0.0008	3.57E-11
5.000	4.500	4.23E-11	0.0033	4.27E-11	2.37E-12	0.0148	2.47E-12	3.74E-11	0.0008	3.75E-11
5.500	5.000	4.40E-11	0.0035	4.44E-11	2.52E-12	0.0152	2.63E-12	3.89E-11	0.0009	3.90E-11
6.000	5.500	4.52E-11	0.0036	4.57E-11	2.58E-12	0.0157	2.71E-12	4.02E-11	0.0009	4.03E-11
6.500	6.000	4.65E-11	0.0037	4.70E-11	2.68E-12	0.0162	2.81E-12	4.12E-11	0.0009	4.13E-11
7.000	6.500	4.79E-11	0.0038	4.84E-11	2.77E-12	0.0168	2.91E-12	4.23E-11	0.0009	4.24E-11
7.500	7.000	4.91E-11	0.0040	4.97E-11	2.82E-12	0.0173	2.96E-12	4.33E-11	0.0010	4.35E-11
8.000	7.500	5.03E-11	0.0041	5.09E-11	2.87E-12	0.0177	3.02E-12	4.44E-11	0.0010	4.45E-11
9.000	8.000	5.20E-11	0.0042	5.27E-11	3.02E-12	0.0182	3.19E-12	4.61E-11	0.0010	4.62E-11
10.000	9.000	5.52E-11	0.0043	5.59E-11	3.12E-12	0.0189	3.30E-12	4.85E-11	0.0011	4.87E-11

Table 3-39. Actinide Total Dose Rate - No Shielded Container

% Be	Dose Rate from 1 gram of Isotope (rem/hr)				
	Am-241	Am-243	Cf-252	Cm-244	Cm-248
Neutron					
0	5.31E-08	1.67E-07	1.00E+05	4.72E-01	1.72E+00
10	1.27E-01	6.47E-03		4.17E+00	
20	2.03E-01	1.03E-02		6.36E+00	
30	2.53E-01	1.28E-02		7.82E+00	
40	2.89E-01	1.46E-02		8.85E+00	
50	3.16E-01	1.60E-02		9.63E+00	
60	3.36E-01	1.70E-02		1.02E+01	
70	3.53E-01	1.78E-02		1.07E+01	
80	3.66E-01	1.85E-02		1.11E+01	
90	3.78E-01	1.91E-02		1.14E+01	
Secondary Photon					
0	1.04E-10	3.04E-10	2.15E+02	9.00E-04	2.96E-03
10	6.60E-04	3.28E-05		2.10E-02	
20	1.05E-03	5.22E-05		3.28E-02	
30	1.31E-03	6.50E-05		4.07E-02	
40	1.50E-03	7.41E-05		4.63E-02	
50	1.64E-03	8.09E-05		5.05E-02	
60	1.75E-03	8.62E-05		5.38E-02	
70	1.83E-03	9.04E-05		5.64E-02	
80	1.90E-03	9.39E-05		5.86E-02	
90	1.96E-03	9.68E-05		6.03E-02	
Primary Photon					
0	9.11E-03	2.52E-02	4.38E+03	3.54E-02	9.24E-02
10	9.11E-03	2.52E-02		3.54E-02	
20	9.11E-03	2.52E-02		3.54E-02	
30	9.11E-03	2.52E-02		3.54E-02	
40	9.11E-03	2.52E-02		3.54E-02	
50	9.11E-03	2.52E-02		3.54E-02	
60	9.11E-03	2.52E-02		3.54E-02	
70	9.11E-03	2.52E-02		3.54E-02	
80	9.11E-03	2.52E-02		3.54E-02	
90	9.11E-03	2.52E-02		3.54E-02	
Total					
0	9.11E-03	2.52E-02	1.05E+05	5.08E-01	1.82E+00
10	1.37E-01	3.17E-02		4.23E+00	
20	2.13E-01	3.56E-02		6.43E+00	
30	2.64E-01	3.81E-02		7.90E+00	
40	2.99E-01	3.99E-02		8.94E+00	
50	3.26E-01	4.13E-02		9.71E+00	
60	3.47E-01	4.23E-02		1.03E+01	
70	3.64E-01	4.31E-02		1.08E+01	
80	3.77E-01	4.38E-02		1.12E+01	
90	3.89E-01	4.44E-02		1.15E+01	

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-39. Actinide Total Dose Rate - No Shielded Container (Continued)

% Be	Dose Rate from 1 gram of Isotope (rem/hr)					
	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
Neutron						
0	4.74E-12	1.10E-04	9.28E-10	4.38E-05	2.09E-09	7.34E-05
10	1.51E-05	6.37E-01	1.84E-03	6.84E-03	6.12E-05	1.71E-04
20	2.40E-05	1.02E+00	2.93E-03	1.09E-02	9.72E-05	2.29E-04
30	2.99E-05	1.27E+00	3.65E-03	1.35E-02	1.21E-04	2.67E-04
40	3.41E-05	1.45E+00	4.16E-03	1.54E-02	1.38E-04	2.94E-04
50	3.73E-05	1.58E+00	4.54E-03	1.68E-02	1.50E-04	3.14E-04
60	3.97E-05	1.69E+00	4.84E-03	1.79E-02	1.60E-04	3.30E-04
70	4.16E-05	1.77E+00	5.08E-03	1.88E-02	1.68E-04	3.42E-04
80	4.32E-05	1.84E+00	5.27E-03	1.95E-02	1.74E-04	3.52E-04
90	4.45E-05	1.89E+00	5.43E-03	2.01E-02	1.80E-04	3.60E-04
Secondary Photon						
0	8.34E-15	1.98E-07	1.73E-12	7.42E-08	3.71E-12	1.27E-07
10	7.44E-08	3.31E-03	9.21E-06	3.42E-05	3.03E-07	6.12E-07
20	1.18E-07	5.28E-03	1.47E-05	5.44E-05	4.81E-07	8.98E-07
30	1.48E-07	6.59E-03	1.83E-05	6.77E-05	5.99E-07	1.09E-06
40	1.68E-07	7.52E-03	2.09E-05	7.72E-05	6.82E-07	1.22E-06
50	1.84E-07	8.22E-03	2.28E-05	8.43E-05	7.44E-07	1.32E-06
60	1.96E-07	8.76E-03	2.43E-05	8.97E-05	7.93E-07	1.39E-06
70	2.05E-07	9.20E-03	2.55E-05	9.41E-05	8.31E-07	1.46E-06
80	2.13E-07	9.55E-03	2.64E-05	9.77E-05	8.62E-07	1.51E-06
90	2.20E-07	9.85E-03	2.73E-05	1.01E-04	8.88E-07	1.55E-06
Primary Photon						
0	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
10	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
20	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
30	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
40	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
50	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
60	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
70	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
80	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
90	1.14E-04	1.69E-03	5.71E-05	2.34E-05	1.53E-03	5.87E-06
Total						
0	1.14E-04	1.80E-03	5.71E-05	6.74E-05	1.53E-03	7.94E-05
10	1.29E-04	6.42E-01	1.90E-03	6.90E-03	1.59E-03	1.78E-04
20	1.38E-04	1.02E+00	3.00E-03	1.09E-02	1.63E-03	2.36E-04
30	1.44E-04	1.28E+00	3.72E-03	1.36E-02	1.65E-03	2.74E-04
40	1.48E-04	1.46E+00	4.24E-03	1.55E-02	1.67E-03	3.01E-04
50	1.51E-04	1.59E+00	4.62E-03	1.69E-02	1.68E-03	3.21E-04
60	1.54E-04	1.70E+00	4.92E-03	1.80E-02	1.69E-03	3.37E-04
70	1.56E-04	1.78E+00	5.16E-03	1.89E-02	1.70E-03	3.49E-04
80	1.57E-04	1.85E+00	5.36E-03	1.96E-02	1.71E-03	3.59E-04
90	1.59E-04	1.90E+00	5.52E-03	2.02E-02	1.71E-03	3.68E-04

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-40. Effect of PuO₂ Self-shielding

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)								
	10% Be	20% Be	30% Be	40% Be	50% Be	60% Be	70% Be	80% Be	90% Be
No Self-shielding									
Am-241	1.37E-01	2.13E-01	2.64E-01	2.99E-01	3.26E-01	3.47E-01	3.64E-01	3.77E-01	3.89E-01
Am-243	7.59E-01	8.35E-01	8.86E-01	9.21E-01	9.48E-01	9.69E-01	9.86E-01	9.99E-01	1.01E+00
Cm-244	4.23E+00	6.43E+00	7.90E+00	8.94E+00	9.71E+00	1.03E+01	1.08E+01	1.12E+01	1.15E+01
Np-237	3.58E-03	3.59E-03	3.60E-03	3.60E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03
Pu-238	6.42E-01	1.02E+00	1.28E+00	1.46E+00	1.59E+00	1.70E+00	1.78E+00	1.85E+00	1.90E+00
Pu-239	1.91E-03	3.00E-03	3.73E-03	4.24E-03	4.63E-03	4.93E-03	5.16E-03	5.36E-03	5.52E-03
Pu-240	6.90E-03	1.09E-02	1.36E-02	1.55E-02	1.69E-02	1.80E-02	1.89E-02	1.96E-02	2.02E-02
Pu-241	1.23E-01	1.90E-01	2.35E-01	2.67E-01	2.91E-01	3.09E-01	3.24E-01	3.36E-01	3.46E-01
Pu-242	1.78E-04	2.36E-04	2.74E-04	3.01E-04	3.21E-04	3.37E-04	3.49E-04	3.59E-04	3.68E-04
Self-shielding by PuO ₂									
Am-241	1.38E-01	2.14E-01	2.65E-01	3.01E-01	3.28E-01	3.49E-01	3.66E-01	3.79E-01	3.91E-01
Am-243	7.60E-01	8.36E-01	8.87E-01	9.23E-01	9.50E-01	9.71E-01	9.88E-01	1.00E+00	1.01E+00
Cm-244	4.25E+00	6.47E+00	7.94E+00	8.99E+00	9.77E+00	1.04E+01	1.09E+01	1.13E+01	1.16E+01
Np-237	3.58E-03	3.59E-03	3.60E-03	3.60E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03
Pu-238	6.45E-01	1.03E+00	1.28E+00	1.46E+00	1.60E+00	1.71E+00	1.79E+00	1.86E+00	1.92E+00
Pu-239	1.92E-03	3.02E-03	3.75E-03	4.27E-03	4.65E-03	4.95E-03	5.19E-03	5.39E-03	5.55E-03
Pu-240	6.93E-03	1.10E-02	1.37E-02	1.56E-02	1.70E-02	1.81E-02	1.90E-02	1.97E-02	2.03E-02
Pu-241	1.23E-01	1.91E-01	2.37E-01	2.68E-01	2.92E-01	3.11E-01	3.26E-01	3.38E-01	3.48E-01
Pu-242	1.79E-04	2.37E-04	2.75E-04	3.03E-04	3.23E-04	3.39E-04	3.51E-04	3.61E-04	3.70E-04

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-41. Actinide Total Dose Rate – SC2 Polyethylene Shielded Container

% Be	Dose Rate from 1 gram of Isotope (rem/hr)				
	Am-241	Am-243	Cf-252	Cm-244	Cm-248
Neutron					
0	1.085E-08	5.581E-09	2.119E+04	9.547E-02	3.349E-01
10	3.905E-02	1.968E-03		1.250E+00	
20	6.229E-02	3.132E-03		1.933E+00	
30	7.770E-02	3.901E-03		2.388E+00	
40	8.866E-02	4.447E-03		2.710E+00	
50	9.688E-02	4.855E-03		2.952E+00	
60	1.032E-01	5.171E-03		3.142E+00	
70	1.083E-01	5.424E-03		3.290E+00	
80	1.125E-01	5.630E-03		3.413E+00	
90	1.159E-01	5.802E-03		3.514E+00	
Secondary Photon					
0	2.735E-10	1.477E-10	5.029E+02	2.448E-03	9.236E-03
10	4.750E-04	2.423E-05		1.627E-02	
20	7.575E-04	3.856E-05		2.444E-02	
30	9.448E-04	4.803E-05		2.989E-02	
40	1.078E-03	5.475E-05		3.375E-02	
50	1.178E-03	5.977E-05		3.663E-02	
60	1.255E-03	6.366E-05		3.890E-02	
70	1.317E-03	6.677E-05		4.067E-02	
80	1.367E-03	6.931E-05		4.214E-02	
90	1.409E-03	7.141E-05		4.335E-02	
Primary Photon					
0	1.727E-03	5.191E-03	1.464E+03	1.148E-02	3.088E-02
10	1.727E-03	5.191E-03		1.148E-02	
20	1.727E-03	5.191E-03		1.148E-02	
30	1.727E-03	5.191E-03		1.148E-02	
40	1.727E-03	5.191E-03		1.148E-02	
50	1.727E-03	5.191E-03		1.148E-02	
60	1.727E-03	5.191E-03		1.148E-02	
70	1.727E-03	5.191E-03		1.148E-02	
80	1.727E-03	5.191E-03		1.148E-02	
90	1.727E-03	5.191E-03		1.148E-02	
Total					
0	1.727E-03	5.191E-03	2.316E+04	1.094E-01	3.750E-01
10	4.126E-02	7.183E-03		1.278E+00	
20	6.478E-02	8.362E-03		1.969E+00	
30	8.037E-02	9.140E-03		2.429E+00	
40	9.147E-02	9.693E-03		2.756E+00	
50	9.978E-02	1.011E-02		3.000E+00	
60	1.062E-01	1.043E-02		3.192E+00	
70	1.114E-01	1.068E-02		3.342E+00	
80	1.156E-01	1.089E-02		3.466E+00	
90	1.191E-01	1.106E-02		3.569E+00	

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-41. Actinide Total Dose Rate - SC2 Polyethylene Shielded Container (Continued)

% Be	Dose Rate from 1 gram of Isotope (rem/hr)					
	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
Neutron						
0	9.294E-13	2.182E-05	1.269E-10	8.470E-06	1.718E-11	1.429E-05
10	4.519E-06	1.956E-01	5.567E-04	2.065E-03	1.884E-05	4.372E-05
20	7.196E-06	3.121E-01	8.868E-04	3.281E-03	2.994E-05	6.103E-05
30	8.967E-06	3.894E-01	1.105E-03	4.086E-03	3.726E-05	7.243E-05
40	1.022E-05	4.445E-01	1.260E-03	4.657E-03	4.244E-05	8.050E-05
50	1.116E-05	4.857E-01	1.376E-03	5.083E-03	4.631E-05	8.652E-05
60	1.189E-05	5.177E-01	1.466E-03	5.414E-03	4.931E-05	9.118E-05
70	1.247E-05	5.433E-01	1.538E-03	5.678E-03	5.170E-05	9.489E-05
80	1.295E-05	5.642E-01	1.596E-03	5.894E-03	5.365E-05	9.792E-05
90	1.334E-05	5.816E-01	1.645E-03	6.073E-03	5.527E-05	1.004E-04
Secondary Photon						
0	2.525E-14	5.826E-07	3.313E-12	2.359E-07	4.638E-13	3.931E-07
10	5.745E-08	2.378E-03	6.912E-06	2.575E-05	2.382E-07	7.652E-07
20	9.148E-08	3.794E-03	1.101E-05	4.085E-05	3.785E-07	9.841E-07
30	1.140E-07	4.733E-03	1.372E-05	5.083E-05	4.710E-07	1.128E-06
40	1.300E-07	5.402E-03	1.564E-05	5.791E-05	5.366E-07	1.230E-06
50	1.419E-07	5.903E-03	1.708E-05	6.320E-05	5.855E-07	1.306E-06
60	1.512E-07	6.292E-03	1.820E-05	6.730E-05	6.234E-07	1.365E-06
70	1.586E-07	6.602E-03	1.909E-05	7.058E-05	6.536E-07	1.412E-06
80	1.646E-07	6.856E-03	1.981E-05	7.325E-05	6.782E-07	1.450E-06
90	1.697E-07	7.067E-03	2.042E-05	7.547E-05	6.987E-07	1.482E-06
Primary Photon						
0	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
10	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
20	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
30	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
40	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
50	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
60	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
70	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
80	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
90	2.597E-05	4.015E-04	1.606E-05	5.726E-06	3.478E-04	1.947E-06
Total						
0	2.597E-05	4.239E-04	1.606E-05	1.443E-05	3.478E-04	1.663E-05
10	3.055E-05	1.983E-01	5.797E-04	2.096E-03	3.669E-04	4.644E-05
20	3.326E-05	3.163E-01	9.138E-04	3.328E-03	3.782E-04	6.396E-05
30	3.505E-05	3.945E-01	1.135E-03	4.142E-03	3.856E-04	7.551E-05
40	3.632E-05	4.503E-01	1.292E-03	4.720E-03	3.908E-04	8.367E-05
50	3.727E-05	4.920E-01	1.409E-03	5.152E-03	3.947E-04	8.977E-05
60	3.801E-05	5.244E-01	1.500E-03	5.487E-03	3.978E-04	9.449E-05
70	3.860E-05	5.503E-01	1.573E-03	5.754E-03	4.002E-04	9.824E-05
80	3.908E-05	5.715E-01	1.632E-03	5.972E-03	4.022E-04	1.013E-04
90	3.948E-05	5.891E-01	1.682E-03	6.154E-03	4.038E-04	1.039E-04

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-42. Dose Rate from Actinides as a Function of Time

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)							
	No Beryllium				90% Beryllium Added			
	0 days	30 days	100 days	30000 days	0 days	30 days	100 days	30000 days
No Shielded Container								
Am-241	9.11E-03	9.11E-03	9.11E-03	8.43E-03	3.89E-01	3.89E-01	3.88E-01	3.41E-01
Am-243	2.52E-02	6.31E-01	6.31E-01	6.26E-01	4.44E-02	1.01E+00	6.50E-01	6.45E-01
Cf-252	1.05E+05	1.03E+05	9.79E+04	4.38E+03				
Cm-244	5.08E-01	5.07E-01	5.03E-01	2.19E-02	1.15E+01	1.15E+01	1.14E+01	5.15E-01
Cm-248	1.82E+00	1.82E+00	1.82E+00	1.82E+00				
Np-237	1.14E-04	4.93E-03	3.31E-03	3.57E-03	1.59E-04	2.01E-03	3.36E-03	3.61E-03
Pu-238	1.80E-03	1.80E-03	1.79E-03	9.42E-04	1.90E+00	1.90E+00	1.90E+00	9.95E-01
Pu-239	5.71E-05	5.73E-05	5.73E-05	5.70E-05	5.52E-03	5.52E-03	5.52E-03	5.51E-03
Pu-240	6.74E-05	6.73E-05	6.73E-05	6.68E-05	2.02E-02	2.02E-02	2.02E-02	2.00E-02
Pu-241	1.53E-03	5.81E-03	6.04E-03	8.54E-03	1.71E-03	7.50E-03	1.12E-02	3.46E-01
Pu-242	7.94E-05	7.93E-05	7.93E-05	7.94E-05	3.68E-04	3.68E-04	3.68E-04	3.68E-04
SC2 Polyethylene Shielded Container								
Am-241	1.73E-03	1.73E-03	1.73E-03	1.64E-03	1.19E-01	1.19E-01	1.19E-01	1.05E-01
Am-243	5.19E-03	1.65E-01	1.65E-01	1.64E-01	1.11E-02	1.71E-01	1.71E-01	1.69E-01
Cf-252	2.32E+04	2.27E+04	2.17E+04	1.46E+03				
Cm-244	1.09E-01	1.09E-01	1.08E-01	4.72E-03	3.57E+00	3.56E+00	3.53E+00	1.59E-01
Cm-248	3.75E-01	3.75E-01	3.75E-01	3.75E-01				
Np-237	2.60E-05	5.57E-04	9.41E-04	1.01E-03	3.95E-05	5.70E-04	9.55E-04	1.03E-03
Pu-238	4.24E-04	4.24E-04	4.23E-04	2.22E-04	5.89E-01	5.89E-01	5.88E-01	3.08E-01
Pu-239	1.61E-05	1.61E-05	1.61E-05	1.60E-05	1.68E-03	1.68E-03	1.68E-03	1.68E-03
Pu-240	1.44E-05	1.44E-05	1.44E-05	1.43E-05	6.15E-03	6.15E-03	6.15E-03	6.10E-03
Pu-241	3.48E-04	1.43E-03	1.49E-03	1.66E-03	4.04E-04	1.95E-03	3.09E-03	1.06E-01
Pu-242	1.66E-05	1.66E-05	1.66E-05	1.66E-05	1.04E-04	1.04E-04	1.04E-04	1.04E-04

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-43. Primary Photon Dose Rate

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)			
	No Shielded Container	SC1 Lead Shielded Container	SC2 Polyethylene Shielded Container	SC3 Tungsten Shielded Container
Ac-227	4.84E+02	3.80E-01	1.41E+02	7.48E-02
Am-241	9.11E-03	8.87E-07	1.73E-03	1.51E-07
Am-243	6.31E-01	1.06E-07	1.65E-01	2.32E-08
Cd-109	3.52E+01	0.00E+00	7.18E+00	0.00E+00
Cf-252	4.38E+03	1.15E+02	1.46E+03	3.90E+01
Cm-244	3.54E-02	7.68E-04	1.15E-02	2.58E-04
Cm-248	1.02E-01	2.55E-03	3.40E-02	8.56E-04
Co-60	6.10E+04	1.64E+03	2.09E+04	4.43E+02
Cs-137	1.24E+03	1.86E+00	4.01E+02	3.03E-01
Eu-152	4.52E+03	7.54E+01	1.49E+03	1.97E+01
Fe-59	1.28E+06	3.32E+04	4.37E+05	8.90E+03
Gd-153	1.44E+03	3.34E-33	3.14E+02	5.80E-38
Hf-181	2.21E+05	1.33E+01	6.69E+04	5.45E+00
Ho-166m	7.56E+01	2.78E-01	2.41E+01	5.47E-02
Ir-192	1.98E+05	2.92E+01	5.93E+04	4.83E+00
Mn-54	1.55E+05	9.84E+02	5.15E+04	1.88E+02
Np-237	3.57E-03	1.38E-09	1.01E-03	5.66E-11
Pb-210	7.12E+00	6.67E-04	1.92E+00	1.16E-04
Pm-147	7.50E-01	9.72E-22	1.66E-01	3.21E-22
Po-210	9.25E-01	5.02E-03	3.06E-01	9.51E-04
Pu-238	1.69E-03	1.19E-06	4.02E-04	2.73E-07
Pu-239	5.71E-05	2.37E-09	1.61E-05	4.43E-10
Pu-240	2.34E-05	9.24E-08	5.73E-06	3.11E-08
Pu-241	8.54E-03	7.87E-07	1.66E-03	1.34E-07
Pu-242	5.87E-06	1.51E-07	1.95E-06	5.11E-08
Ra-226	3.79E+01	8.61E-01	1.25E+01	2.73E-01
Ru-106	2.15E+04	8.59E+01	6.79E+03	2.35E+01
Sc-46	1.56E+06	2.31E+04	5.24E+05	5.43E+03
Se-75	1.30E+05	1.25E-01	3.56E+04	8.07E-03
Sm-145	1.39E+01	8.54E-05	2.63E+00	3.61E-05
Sr-90	6.92E+01	1.42E-01	2.00E+01	3.43E-02
Tm-170	7.43E+02	2.73E-02	1.97E+02	4.52E-03
Yb-169	9.43E+04	2.05E-02	2.46E+04	3.15E-03
Zn-65	1.06E+05	2.10E+03	3.60E+04	5.19E+02
Zr-95	4.33E+05	1.49E+03	1.42E+05	2.59E+02

Table 3-44. Effect of Self-shielding by Iron on Primary Photon Dose Rate

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)	
	No Self-shielding	Self-shielding by Iron
Ac-227	4.84E+02	4.64E+02
Am-241	9.11E-03	4.69E-03
Am-243	6.31E-01	5.76E-01
Cd-109	3.52E+01	2.53E+01
Cf-252	4.38E+03	4.27E+03
Cm-244	3.17E-02	3.09E-02
Cm-248	1.02E-01	9.927E-02
Co-60	6.10E+04	5.97E+04
Cs-137	1.24E+03	1.20E+03
Eu-152	4.52E+03	4.39E+03
Fe-59	1.28E+06	1.25E+06
Gd-153	1.44E+03	1.15E+03
Hf-181	2.21E+05	2.12E+05
Ho-166m	7.56E+01	7.326E+01
Ir-192	1.98E+05	1.91E+05
Mn-54	1.55E+05	1.51E+05
Np-237	3.57E-03	3.39E-03
Pb-210	7.12E+00	6.63E+00
Pm-147	7.50E-01	6.10E-01
Po-210	9.25E-01	9.01E-01
Pu-238	1.69E-03	1.44E-03
Pu-239	5.71E-05	5.36E-05
Pu-240	2.34E-05	2.02E-05
Pu-241	8.54E-03	4.58E-03
Pu-242	5.87E-06	5.71E-06
Ra-226	3.79E+01	3.69E+01
Ru-106	2.15E+04	2.08E+04
Sc-46	1.56E+06	1.52E+06
Se-75	1.30E+05	1.23E+05
Sm-145	1.39E+01	8.13E+00
Sr-90	6.92E+01	6.57E+01
Tm-170	7.43E+02	6.89E+02
Yb-169	9.43E+04	8.80E+04
Zn-65	1.06E+05	1.04E+05
Zr-95	4.33E+05	4.21E+05

Table 3-45. Maximum Dose Rate without Impurities

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)			
	No Shielded Container	SC1 Lead Shielded Container	SC2 Polyethylene Shielded Container	SC3 Tungsten Shielded Container
Ac-227	4.84E+02	3.80E-01	1.41E+02	7.48E-02
Am-241	9.11E-03		1.73E-03	
Am-243	6.31E-01		1.65E-01	
Cd-109	3.52E+01	0.00E+00	7.18E+00	0.00E+00
Cf-252	1.05E+05		2.32E+04	
Cm-244	5.08E-01		1.09E-01	
Cm-248	1.83E+00		3.78E-01	
Co-60	6.10E+04	1.64E+03	2.09E+04	4.43E+02
Cs-137	1.24E+03	1.86E+00	4.01E+02	3.03E-01
Eu-152	4.52E+03	7.54E+01	1.49E+03	1.97E+01
Fe-59	1.28E+06	3.32E+04	4.37E+05	8.90E+03
Gd-153	1.44E+03	3.34E-33	3.14E+02	5.80E-38
Hf-181	2.21E+05	1.33E+01	6.69E+04	5.45E+00
Ho-166m	7.56E+01	2.78E-01	2.41E+01	5.47E-02
Ir-192	1.98E+05	2.92E+01	5.93E+04	4.83E+00
Mn-54	1.55E+05	9.84E+02	5.15E+04	1.88E+02
Np-237	6.27E-03		1.01E-03	
Pb-210	7.12E+00	6.67E-04	1.92E+00	1.16E-04
Pm-147	7.50E-01	9.72E-22	1.66E-01	3.21E-22
Po-210	9.25E-01	5.02E-03	3.06E-01	9.51E-04
Pu-238	1.80E-03		4.24E-04	
Pu-239	5.73E-05		1.61E-05	
Pu-240	6.74E-05		1.44E-05	
Pu-241	8.54E-03		1.66E-03	
Pu-242	7.94E-05		1.66E-05	
Ra-226	3.79E+01	8.61E-01	1.25E+01	2.73E-01
Ru-106	2.15E+04	8.59E+01	6.79E+03	2.35E+01
Sc-46	1.56E+06	2.31E+04	5.24E+05	5.43E+03
Se-75	1.30E+05	1.25E-01	3.56E+04	8.07E-03
Sm-145	1.39E+01	8.54E-05	2.63E+00	3.61E-05
Sr-90	6.92E+01	1.42E-01	2.00E+01	3.43E-02
Tm-170	7.43E+02	2.73E-02	1.97E+02	4.52E-03
Yb-169	9.43E+04	2.05E-02	2.46E+04	3.15E-03
Zn-65	1.06E+05	2.10E+03	3.60E+04	5.19E+02
Zr-95	4.33E+05	1.49E+03	1.42E+05	2.59E+02

Table 3-46. Maximum Dose Rate with Impurities

Isotope	Dose Rate from 1 gram of Isotope (rem/hr)								
	10% Be	20% Be	30% Be	40% Be	50% Be	60% Be	70% Be	80% Be	90% Be
No Shielded Container									
Am-241	1.37E-01	2.13E-01	2.64E-01	2.99E-01	3.26E-01	3.47E-01	3.64E-01	3.77E-01	3.89E-01
Am-243	7.59E-01	8.35E-01	8.86E-01	9.21E-01	9.48E-01	9.69E-01	9.86E-01	9.99E-01	1.01E+00
Cm-244	4.23E+00	6.43E+00	7.90E+00	8.94E+00	9.71E+00	1.03E+01	1.08E+01	1.12E+01	1.15E+01
Np-237	3.58E-03	3.59E-03	3.60E-03	3.60E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03
Pu-238	6.42E-01	1.02E+00	1.28E+00	1.46E+00	1.59E+00	1.70E+00	1.78E+00	1.85E+00	1.90E+00
Pu-239	1.91E-03	3.00E-03	3.73E-03	4.24E-03	4.63E-03	4.93E-03	5.16E-03	5.36E-03	5.52E-03
Pu-240	6.90E-03	1.09E-02	1.36E-02	1.55E-02	1.69E-02	1.80E-02	1.89E-02	1.96E-02	2.02E-02
Pu-241	1.23E-01	1.90E-01	2.35E-01	2.67E-01	2.91E-01	3.09E-01	3.24E-01	3.36E-01	3.46E-01
Pu-242	1.78E-04	2.36E-04	2.74E-04	3.01E-04	3.21E-04	3.37E-04	3.49E-04	3.59E-04	3.68E-04
SC2 Polyethylene Shielded Container									
Am-241	4.13E-02	6.48E-02	8.04E-02	9.15E-02	9.98E-02	1.06E-01	1.11E-01	1.16E-01	1.19E-01
Am-243	1.67E-01	1.68E-01	1.69E-01	1.70E-01	1.70E-01	1.70E-01	1.70E-01	1.71E-01	1.71E-01
Cm-244	1.28E+00	1.97E+00	2.43E+00	2.76E+00	3.00E+00	3.19E+00	3.34E+00	3.47E+00	3.57E+00
Np-237	1.02E-03	1.02E-03	1.02E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03
Pu-238	1.98E-01	3.16E-01	3.95E-01	4.50E-01	4.92E-01	5.24E-01	5.50E-01	5.71E-01	5.89E-01
Pu-239	5.80E-04	9.14E-04	1.13E-03	1.29E-03	1.41E-03	1.50E-03	1.57E-03	1.63E-03	1.68E-03
Pu-240	2.10E-03	3.33E-03	4.14E-03	4.72E-03	5.15E-03	5.49E-03	5.75E-03	5.97E-03	6.15E-03
Pu-241	3.70E-02	5.79E-02	7.17E-02	8.16E-02	8.89E-02	9.46E-02	9.92E-02	1.03E-01	1.06E-01
Pu-242	4.64E-05	6.40E-05	7.55E-05	8.37E-05	8.98E-05	9.45E-05	9.82E-05	1.01E-04	1.04E-04

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-47. Allowed Mass for Shipment – NCT without Impurities

Isotope	Allowed Mass of Isotope (g)			
	No Shielded Container	SC1 Lead Shielded Container	SC2 Polyethylene Shielded Container	SC3 Tungsten Shielded Container
Ac-227	4.1E-04	5.3E-01	1.4E-03	2.7E+00
Am-241	2.2E+01		1.2E+02	
Am-243	3.2E-01		1.2E+00	
Cd-109	5.7E-03	Unlimited*	2.8E-02	Unlimited*
Cf-252	1.9E-06		8.6E-06	
Cm-244	3.9E-01		1.8E+00	
Cm-248	1.1E-01		5.3E-01	
Co-60	3.3E-06	1.2E-04	9.6E-06	4.5E-04
Cs-137	1.6E-04	1.1E-01	5.0E-04	6.6E-01
Eu-152	4.4E-05	2.7E-03	1.3E-04	1.0E-02
Fe-59	1.6E-07	6.0E-06	4.6E-07	2.2E-05
Gd-153	1.4E-04	Unlimited*	6.4E-04	Unlimited*
Hf-181	9.1E-07	1.5E-02	3.0E-06	3.7E-02
Ho-166m	2.6E-03	7.2E-01	8.3E-03	3.7E+00
Ir-192	1.0E-06	6.8E-03	3.4E-06	4.1E-02
Mn-54	1.3E-06	2.0E-04	3.9E-06	1.1E-03
Np-237	3.2E+01		2.0E+02	
Pb-210	2.8E-02	3.0E+02	1.0E-01	1.7E+03
Pm-147	2.7E-01	Unlimited*	1.2E+00	Unlimited*
Po-210	2.2E-01	4.0E+01	6.5E-01	2.1E+02
Pu-238	1.1E+02		4.7E+02	
Pu-239	3.5E+03		1.2E+04	
Pu-240	3.0E+03		1.4E+04	
Pu-241	2.3E+01		1.2E+02	
Pu-242	2.5E+03		1.2E+04	
Ra-226	5.3E-03	2.3E-01	1.6E-02	7.3E-01
Ru-106	9.3E-06	2.3E-03	2.9E-05	8.5E-03
Sc-46	1.3E-07	8.7E-06	3.8E-07	3.7E-05
Se-75	1.5E-06	1.6E+00	5.6E-06	2.5E+01
Sm-145	1.4E-02	2.3E+03	7.6E-02	5.5E+03
Sr-90	2.9E-03	1.4E+00	1.0E-02	5.8E+00
Tm-170	2.7E-04	7.3E+00	1.0E-03	4.4E+01
Yb-169	2.1E-06	9.8E+00	8.1E-06	6.3E+01
Zn-65	1.9E-06	9.5E-05	5.5E-06	3.9E-04
Zr-95	4.6E-07	1.3E-04	1.4E-06	7.7E-04

* Unlimited denotes that the allowed mass of the isotope is restricted only by the capacity of the container.

Table 3-48. Allowed Mass for Shipment – Exclusive Use without Impurities

Isotope	Allowed Mass of Isotope (g)			
	No Shielded Container	SC1 Lead Shielded Container	SC2 Polyethylene Shielded Container	SC3 Tungsten Shielded Container
Ac-227	2.1E-03	2.6E+00	7.1E-03	1.3E+01
Am-241	1.1E+02		5.8E+02	
Am-243	1.6E+00		6.1E+00	
Cd-109	2.8E-02	Unlimited*	1.4E-01	Unlimited*
Cf-252	9.5E-06		4.3E-05	
Cm-244	2.0E+00		9.1E+00	
Cm-248	5.5E-01		2.6E+00	
Co-60	1.6E-05	6.1E-04	4.8E-05	2.3E-03
Cs-137	8.1E-04	5.4E-01	2.5E-03	3.3E+00
Eu-152	2.2E-04	1.3E-02	6.7E-04	5.1E-02
Fe-59	7.8E-07	3.0E-05	2.3E-06	1.1E-04
Gd-153	6.9E-04	Unlimited*	3.2E-03	Unlimited*
Hf-181	4.5E-06	7.5E-02	1.5E-05	1.8E-01
Ho-166m	1.3E-02	3.6E+00	4.2E-02	1.8E+01
Ir-192	5.0E-06	3.4E-02	1.7E-05	2.1E-01
Mn-54	6.4E-06	1.0E-03	1.9E-05	5.3E-03
Np-237	1.6E+02		9.9E+02	
Pb-210	1.4E-01	1.5E+03	5.2E-01	8.6E+03
Pm-147	1.3E+00	Unlimited*	6.0E+00	Unlimited*
Po-210	1.1E+00	2.0E+02	3.3E+00	1.1E+03
Pu-238	5.6E+02		2.4E+03	
Pu-239	1.7E+04		6.2E+04	
Pu-240	1.5E+04		6.9E+04	
Pu-241	1.2E+02		6.0E+02	
Pu-242	1.3E+04		6.0E+04	
Ra-226	2.6E-02	1.2E+00	8.0E-02	3.7E+00
Ru-106	4.7E-05	1.2E-02	1.5E-04	4.3E-02
Sc-46	6.4E-07	4.3E-05	1.9E-06	1.8E-04
Se-75	7.7E-06	8.0E+00	2.8E-05	1.2E+02
Sm-145	7.2E-02	1.2E+04	3.8E-01	2.8E+04
Sr-90	1.4E-02	7.1E+00	5.0E-02	2.9E+01
Tm-170	1.3E-03	3.7E+01	5.1E-03	2.2E+02
Yb-169	1.1E-05	4.9E+01	4.1E-05	3.2E+02
Zn-65	9.4E-06	4.8E-04	2.8E-05	1.9E-03
Zr-95	2.3E-06	6.7E-04	7.0E-06	3.9E-03

* Unlimited denotes that the allowed mass of the isotope is restricted only by the capacity of the container.

Table 3-49. Allowed Actinide Mass for Shipment – NCT with Impurities

Isotope	Allowed Mass of Isotope (g)								
	10% Be	20% Be	30% Be	40% Be	50% Be	60% Be	70% Be	80% Be	90% Be
No Shielded Container									
Am-241	1.5E+00	9.4E-01	7.6E-01	6.7E-01	6.1E-01	5.8E-01	5.5E-01	5.3E-01	5.1E-01
Am-243	2.6E-01	2.4E-01	2.3E-01	2.2E-01	2.1E-01	2.1E-01	2.0E-01	2.0E-01	2.0E-01
Cm-244	4.7E-02	3.1E-02	2.5E-02	2.2E-02	2.1E-02	1.9E-02	1.9E-02	1.8E-02	1.7E-02
Np-237	5.6E+01	5.6E+01	5.6E+01	5.6E+01	5.5E+01	5.5E+01	5.5E+01	5.5E+01	5.5E+01
Pu-238	3.1E-01	2.0E-01	1.6E-01	1.4E-01	1.3E-01	1.2E-01	1.1E-01	1.1E-01	1.0E-01
Pu-239	1.0E+02	6.7E+01	5.4E+01	4.7E+01	4.3E+01	4.1E+01	3.9E+01	3.7E+01	3.6E+01
Pu-240	2.9E+01	1.8E+01	1.5E+01	1.3E+01	1.2E+01	1.1E+01	1.1E+01	1.0E+01	9.9E+00
Pu-241	1.6E+00	1.1E+00	8.5E-01	7.5E-01	6.9E-01	6.5E-01	6.2E-01	6.0E-01	5.8E-01
Pu-242	1.1E+03	8.5E+02	7.3E+02	6.6E+02	6.2E+02	5.9E+02	5.7E+02	5.6E+02	5.4E+02
SC2 Polyethylene Shielded Container									
Am-241	4.8E+00	3.1E+00	2.5E+00	2.2E+00	2.0E+00	1.9E+00	1.8E+00	1.7E+00	1.7E+00
Am-243	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00
Cm-244	1.6E-01	1.0E-01	8.2E-02	7.3E-02	6.7E-02	6.3E-02	6.0E-02	5.8E-02	5.6E-02
Np-237	2.0E+02	2.0E+02	2.0E+02	2.0E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02
Pu-238	1.0E+00	6.3E-01	5.1E-01	4.4E-01	4.1E-01	3.8E-01	3.6E-01	3.5E-01	3.4E-01
Pu-239	3.4E+02	2.2E+02	1.8E+02	1.5E+02	1.4E+02	1.3E+02	1.3E+02	1.2E+02	1.2E+02
Pu-240	9.5E+01	6.0E+01	4.8E+01	4.2E+01	3.9E+01	3.6E+01	3.5E+01	3.3E+01	3.2E+01
Pu-241	5.4E+00	3.5E+00	2.8E+00	2.5E+00	2.2E+00	2.1E+00	2.0E+00	1.9E+00	1.9E+00
Pu-242	4.3E+03	3.1E+03	2.6E+03	2.4E+03	2.2E+03	2.1E+03	2.0E+03	2.0E+03	1.9E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

Table 3-50. Allowed Actinide Mass for Shipment – Exclusive Use with Impurities

Isotope	Allowed Mass of Isotope (g)								
	10% Be	20% Be	30% Be	40% Be	50% Be	60% Be	70% Be	80% Be	90% Be
No Shielded Container									
Am-241	7.3E+00	4.7E+00	3.8E+00	3.3E+00	3.1E+00	2.9E+00	2.7E+00	2.7E+00	2.6E+00
Am-243	1.3E+00	1.2E+00	1.1E+00	1.1E+00	1.1E+00	1.0E+00	1.0E+00	1.0E+00	9.9E-01
Cm-244	2.4E-01	1.6E-01	1.3E-01	1.1E-01	1.0E-01	9.7E-02	9.3E-02	8.9E-02	8.7E-02
Np-237	2.8E+02	2.8E+02	2.8E+02	2.8E+02	2.8E+02	2.8E+02	2.8E+02	2.8E+02	2.8E+02
Pu-238	1.6E+00	9.8E-01	7.8E-01	6.9E-01	6.3E-01	5.9E-01	5.6E-01	5.4E-01	5.2E-01
Pu-239	5.2E+02	3.3E+02	2.7E+02	2.4E+02	2.2E+02	2.0E+02	1.9E+02	1.9E+02	1.8E+02
Pu-240	1.5E+02	9.1E+01	7.4E+01	6.5E+01	5.9E+01	5.6E+01	5.3E+01	5.1E+01	5.0E+01
Pu-241	8.1E+00	5.3E+00	4.3E+00	3.7E+00	3.4E+00	3.2E+00	3.1E+00	3.0E+00	2.9E+00
Pu-242	5.6E+03	4.2E+03	3.6E+03	3.3E+03	3.1E+03	3.0E+03	2.9E+03	2.8E+03	2.7E+03
SC2 Polyethylene Shielded Container									
Am-241	2.4E+01	1.5E+01	1.2E+01	1.1E+01	1.0E+01	9.4E+00	9.0E+00	8.7E+00	8.4E+00
Am-243	6.0E+00	5.9E+00	5.9E+00	5.9E+00	5.9E+00	5.9E+00	5.9E+00	5.9E+00	5.9E+00
Cm-244	7.8E-01	5.1E-01	4.1E-01	3.6E-01	3.3E-01	3.1E-01	3.0E-01	2.9E-01	2.8E-01
Np-237	9.8E+02	9.8E+02	9.8E+02	9.8E+02	9.7E+02	9.7E+02	9.7E+02	9.7E+02	9.7E+02
Pu-238	5.0E+00	3.2E+00	2.5E+00	2.2E+00	2.0E+00	1.9E+00	1.8E+00	1.7E+00	1.7E+00
Pu-239	1.7E+03	1.1E+03	8.8E+02	7.7E+02	7.1E+02	6.7E+02	6.4E+02	6.1E+02	5.9E+02
Pu-240	4.8E+02	3.0E+02	2.4E+02	2.1E+02	1.9E+02	1.8E+02	1.7E+02	1.7E+02	1.6E+02
Pu-241	2.7E+01	1.7E+01	1.4E+01	1.2E+01	1.1E+01	1.1E+01	1.0E+01	9.7E+00	9.4E+00
Pu-242	2.2E+04	1.6E+04	1.3E+04	1.2E+04	1.1E+04	1.1E+04	1.0E+04	9.9E+03	9.6E+03

Note: 90% Beryllium is modeled as 1 gram of actinide and 0.9 grams of beryllium.

4.0 Conclusions

Bounding shielding calculations for a set of proposed SGQ isotopes were performed using the MCNP transport code to develop a set of response multipliers for “dose per particle” for each neutron and photon spectral group. The source spectrum for each isotope generated using the ORIGEN-S and RASTA computer codes was folded with the response multipliers to generate the dose rate per gram of each isotope in the 9977 shipping package and its associated shielded containers.

Table 3-47 through Table 3-50 present the maximum amount of a single isotope that could be shipped in the Model 9977 Package (or packagings having the same or larger external dimensions as well as similar structural materials) and have the external radiation level within the regulatory dose limits at the surface of the package. The estimates of the mass limits presented would also serve as conservative limits for both the Models 9975 and 9978 packages. If a package contains a mixture of isotopes, the acceptability for shipment can be determined by a sum of fractions approach.

For the cases of actinides mixed with light elements, beryllium represents the bounding light element. The added beryllium (10 to 90 percent of the actinide mass) in the cases studied represents between 9 and 47 percent concentration of the total mixture mass. For beryllium concentrations larger than 50 percent, the increase in the neutron source term and dose rate tend to increase at a much lower rate than at concentrations lower than 50%. Previous studies [LLNL-TR-461255] have indicated that the limiting mass drops by approximately 55% for an increase in concentration from 10 to 30 percent, while the decrease is only about 11 percent when the concentration changes from 70 to 90 percent. The intimately mixed actinide-beryllium form used in these models is very conservative and thus the limits presented in this report are practical bounds on the mass that can be safely shipped.

Some of the quantities that were derived may not really qualify to be termed as “small gram.” However, several of these instances are when there is a shielded container employed within the Model 9977 packaging and consequently only the amount that would fit into the cavity of the shielded container would be shippable. Consequently, it may be fair to term these smaller amounts as the real small gram quantity limit for the Model 9977 Package (or packagings having the same or larger external dimensions) from a standpoint of the external radiation levels allowed under 10CFR Part 71 regulations.

It should be noted that the SGQ masses presented in this report represent limits that would comply with the external radiation limits under 10CFR Part 71. They do not necessarily bound lower limits that may be required to comply with other factors such as heat load of the package.

5.0 References

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Appendix A Radiation Source Input Files

ORIGEN-S input files were divided into three categories: light element (*origenle.nnn.in*), actinides without beryllium (*origenac.nnn.in*), and actinides with beryllium (*origen_be.nnn.yy.in*). These files are described in Table A-1.

RASTA input files were divided into two sets to avoid problems with the maximum number of groups allowed in RASTA. Cases were run without beryllium (*rastax.nnn.in*) and with beryllium (*rasta_bex.nnn.yy.in*) where x is either 1 ($10 \text{ MeV} \geq E \geq 0.45 \text{ MeV}$) or 2 ($0.45 \text{ MeV} \geq E \geq 0.01 \text{ MeV}$). These files are described in Table A-2.

Sample listings are provided below for files marked with an asterisk (*).

Table A-1 ORIGEN-S Input Files

File Name	Description
origenle.101.in	Cd-109
origenle.102.in*	Co-60
origenle.103.in	Cs-137
origenle.104.in	Eu-152
origenle.105.in	Fe-59
origenle.106.in	Gd-153
origenle.107.in	Hf-181
origenle.108.in	Ho-166m
origenle.109.in	Ir-192
origenle.110.in	Mn-54
origenle.112.in	Pm-147
origenle.113.in	Ru-106
origenle.114.in	Sc-46
origenle.115.in	Se-75
origenle.116.in	Sm-145
origenle.117.in	Sr-90
origenle.118.in	Tm-170
origenle.119.in	Yb-169
origenle.120.in	Zn-65
origenle.121.in	Zr-95
origenle.122.in	Pd-103
origenac.101.in	Ac-227
origenac.102.in*	Am-241
origenac.103.in	Am-243
origenac.104.in	Cf-252
origenac.105.in	Cm-244
origenac.106.in	Cm-248
origenac.107.in	Np-237
origenac.108.in	Pb-210
origenac.109.in	Po-210
origenac.110.in	Pu-238
origenac.111.in	Pu-239
origenac.112.in	Pu-240
origenac.113.in	Pu-241
origenac.114.in	Pu-242
origenac.115.in	Ra-226
origen_be.137.yy.in	Am-241 with yy percent added beryllium
origen_be.138.yy.in	Am-243 with yy percent added beryllium
origen_be.139.yy.in	Cm-244 with yy percent added beryllium
origen_be.140.yy.in	Np-237 with yy percent added beryllium
origen_be.141.yy.in*	Pu-238 with yy percent added beryllium
origen_be.142.yy.in	Pu-239 with yy percent added beryllium
origen_be.143.yy.in	Pu-240 with yy percent added beryllium
origen_be.144.yy.in	Pu-241 with yy percent added beryllium
origen_be.145.yy.in	Pu-242 with yy percent added beryllium

Note: yy% Beryllium is modeled as 1 gram of actinide and 0.yy grams of beryllium.

Table A-2. RASTA Input Files

File Name	Description
rastax.101.in	Ac-227
rastax.102.in*	Am-241
rastax.103.in	Am-243
rastax.104.in	Cd-109
rastax.105.in	Cf-252
rastax.106.in	Cm-244
rastax.107.in	Cm-248
rastax.108.in*	Co-60
rastax.109.in	Cs-137
rastax.110.in	Eu-152
rastax.111.in	Fe-59
rastax.112.in	Gd-153
rastax.113.in	Hf-181
rastax.114.in	Ho-166m
rastax.115.in	Ir-192
rastax.116.in	Mn-54
rastax.117.in	Np-237
rastax.118.in	Pb-210
rastax.119.in	Pm-147
rastax.120.in	Po-210
rastax.121.in	Pu-238
rastax.122.in	Pu-239
rastax.123.in	Pu-240
rastax.124.in	Pu-241
rastax.125.in	Pu-242
rastax.126.in	Ra-226
rastax.127.in	Ru-106
rastax.128.in	Sc-46
rastax.129.in	Se-75
rastax.130.in	Sm-145
rastax.131.in	Sr-90
rastax.132.in	Tm-170
rastax.133.in	Yb-169
rastax.134.in	Zn-65
rastax.135.in	Zr-95
rastax.136.in	Pd-103
rasta_bex.137.yy.in	Am-241 with yy percent added beryllium
rasta_bex.138.yy.in	Am-243 with yy percent added beryllium
rasta_bex.139.yy.in	Cm-244 with yy percent added beryllium
rasta_bex.140.yy.in	Np-237 with yy percent added beryllium
rasta_bex.141.yy.in*	Pu-238 with yy percent added beryllium
rasta_bex.142.yy.in	Pu-239 with yy percent added beryllium
rasta_bex.143.yy.in	Pu-240 with yy percent added beryllium
rasta_bex.144.yy.in	Pu-241 with yy percent added beryllium
rasta_bex.145.yy.in	Pu-242 with yy percent added beryllium

Note: yy% Beryllium is modeled as 1 gram of actinide and 0.yy grams of beryllium.

Table A-3. RASTA Input Files for Bremsstrahlung Cases

File Name	Description
ac227_x	Ac-227
cs137_0dx	Cs-137
pb210_x	Pb-210
ru106_0dx*	Ru-106
sr90_30dx	Sr-90

File origenle.102.in

```

'This SCALE input file was generated by
'OrigenArp Version 6.0.13.12 January 12, 2010
=origens
0$$ a11 71 e t
Decay Case Co-60
3$$ 21 1 1 0 a16 2 a33 77 e t
35$$ 0 t
54$$ a8 1 a11 0 e
56$$ a2 14 a6 1 a10 0 a13 1 a15 3 a17 2 e
57** 0 a3 1e-05 e
95$$ 1 t
Case 1 Co-60
0 MTU
60** 0.01 0.03 0.1 0.3 1 3 10 30 100 300 1000 3000 10000 30000
61** fle-20
65$$
'Gram-Atoms Grams Curies Watts-All Watts-Gamma
3z 1 0 0 1 0 0 3z 3z 6z
3z 0 0 0 0 0 0 3z 3z 6z
3z 0 0 0 0 0 0 3z 3z 6z
81$$ 2 0 26 1 a7 200 e
82$$ 2 2 2 2 2 2 2 2 2 2 2 2 2 2 e
83**
1.0000000E+07 9.0000000E+06 8.0000000E+06 7.5000000E+06 7.0000000E+06
6.5000000E+06 6.0000000E+06 5.5000000E+06 5.0000000E+06 4.5000000E+06
4.0000000E+06 3.5000000E+06 3.0000000E+06 2.7500000E+06 2.5000000E+06
2.2500000E+06 2.0000000E+06 1.7500000E+06 1.5000000E+06 1.2500000E+06
1.0000000E+06 9.7500000E+05 9.5000000E+05 9.2500000E+05 9.0000000E+05
8.7500000E+05 8.5000000E+05 8.2500000E+05 8.0000000E+05 7.7500000E+05
7.5000000E+05 7.2500000E+05 7.0000000E+05 6.7500000E+05 6.5000000E+05
6.2500000E+05 6.0000000E+05 5.7500000E+05 5.5000000E+05 5.2500000E+05
5.0000000E+05 4.7500000E+05 4.5000000E+05 4.2500000E+05 4.0000000E+05
3.7500000E+05 3.5000000E+05 3.2500000E+05 3.0000000E+05 2.9000000E+05
2.8000000E+05 2.7000000E+05 2.6000000E+05 2.5000000E+05 2.4000000E+05
2.3000000E+05 2.2000000E+05 2.1000000E+05 2.0000000E+05 1.9000000E+05
1.8000000E+05 1.7000000E+05 1.6000000E+05 1.5000000E+05 1.4000000E+05
1.3000000E+05 1.2000000E+05 1.1000000E+05 1.0000000E+05 9.0000000E+04
8.0000000E+04 7.0000000E+04 6.0000000E+04 5.0000000E+04 4.0000000E+04
3.0000000E+04 2.0000000E+04 1.0000000E+04 e
73$$ 270600
74** 1
75$$ 1
t
56$$ 0 0 a10 1 e t
56$$ 0 0 a10 2 e t
56$$ 0 0 a10 3 e t
56$$ 0 0 a10 4 e t
56$$ 0 0 a10 5 e t
56$$ 0 0 a10 6 e t
56$$ 0 0 a10 7 e t
56$$ 0 0 a10 8 e t
56$$ 0 0 a10 9 e t
56$$ 0 0 a10 10 e t
56$$ 0 0 a10 11 e t
56$$ 0 0 a10 12 e t
56$$ 0 0 a10 13 e t
56$$ 0 0 a10 14 e t
56$$ f0 t
end
=shell
copy ft71f001 "D:\Projects\pcp_method\sources\origen\single\origenle.102.f71"
del ft71f001
end

```

File origenac.102.in

```

'This SCALE input file was generated by
'OrigenArp Version 6.0.13.12 January 12, 2010
=origens
0$$ a11 71 e t
Decay Case      Am-241
3$$ 21 1 1 47 a16 2 a33 77 e t
35$$ 0 t
54$$ a8 1 a11 2 e
56$$ a2 14 a6 1 a10 0 a13 1 a15 3 a17 2 e
57** 0 a3 1e-05 e
95$$ 1 t
Case 1          Am-241
0 MTU
60** 0.01 0.03 0.1 0.3 1 3 10 30 100 300 1000 3000 10000 30000
61** fle-20
65$$
'Gram-Atoms    Grams    Curies    Watts-All    Watts-Gamma
3z  0  0  0  0  0  0  0  3z  3z  6z
3z  1  0  0  1  0  0  3z  3z  6z
3z  0  0  0  0  0  0  3z  3z  6z
81$$ 2 0 26 1 a7 200 e
82$$ 2 2 2 2 2 2 2 2 2 2 2 2 2 2 e
83**
1.0000000E+07 9.0000000E+06 8.0000000E+06 7.5000000E+06 7.0000000E+06
6.5000000E+06 6.0000000E+06 5.5000000E+06 5.0000000E+06 4.5000000E+06
4.0000000E+06 3.5000000E+06 3.0000000E+06 2.7500000E+06 2.5000000E+06
2.2500000E+06 2.0000000E+06 1.7500000E+06 1.5000000E+06 1.2500000E+06
1.0000000E+06 9.7500000E+05 9.5000000E+05 9.2500000E+05 9.0000000E+05
8.7500000E+05 8.5000000E+05 8.2500000E+05 8.0000000E+05 7.7500000E+05
7.5000000E+05 7.2500000E+05 7.0000000E+05 6.7500000E+05 6.5000000E+05
6.2500000E+05 6.0000000E+05 5.7500000E+05 5.5000000E+05 5.2500000E+05
5.0000000E+05 4.7500000E+05 4.5000000E+05 4.2500000E+05 4.0000000E+05
3.7500000E+05 3.5000000E+05 3.2500000E+05 3.0000000E+05 2.9000000E+05
2.8000000E+05 2.7000000E+05 2.6000000E+05 2.5000000E+05 2.4000000E+05
2.3000000E+05 2.2000000E+05 2.1000000E+05 2.0000000E+05 1.9000000E+05
1.8000000E+05 1.7000000E+05 1.6000000E+05 1.5000000E+05 1.4000000E+05
1.3000000E+05 1.2000000E+05 1.1000000E+05 1.0000000E+05 9.0000000E+04
8.0000000E+04 7.0000000E+04 6.0000000E+04 5.0000000E+04 4.0000000E+04
3.0000000E+04 2.0000000E+04 1.0000000E+04 e
84**
1.9640300e+07 1.4190700e+07 1.2214000e+07 1.0000000e+07
8.6070800e+06 7.4081800e+06 6.0653100e+06 4.9658500e+06 3.6787900e+06
3.0119400e+06 2.7253200e+06 2.4659700e+06 2.3652500e+06 2.3457000e+06
2.2313000e+06 1.9205000e+06 1.6529900e+06 1.3533500e+06 1.0025900e+06
8.2085000e+05 7.4273600e+05 6.0810100e+05 4.9787100e+05 3.6883200e+05
2.9721100e+05 1.8315600e+05 1.1109000e+05 6.7379370e+04 4.0867700e+04
3.1827800e+04 2.6058400e+04 2.4175500e+04 2.1874900e+04 1.5034400e+04
7.1017380e+03 3.3546300e+03 1.5846100e+03 4.5399900e+02 2.1445400e+02
1.0130100e+02 3.7266490e+01 1.0677000e+01 5.0434800e+00 1.8553900e+00
8.7642500e-01 4.1399400e-01 1.0000100e-01 1.0000100e-05 e
73$$ 952410
74** 1
75$$ 2
t
56$$ 0 0 a10 1 e t
56$$ 0 0 a10 2 e t
56$$ 0 0 a10 3 e t
56$$ 0 0 a10 4 e t
56$$ 0 0 a10 5 e t
56$$ 0 0 a10 6 e t
56$$ 0 0 a10 7 e t
56$$ 0 0 a10 8 e t
56$$ 0 0 a10 9 e t
56$$ 0 0 a10 10 e t
56$$ 0 0 a10 11 e t
56$$ 0 0 a10 12 e t
56$$ 0 0 a10 13 e t

```

```

56$$ 0 0 a10 14 e t
56$$ f0 t
end
=shell
copy ft71f001 "D:\Projects\pcp_method\sources\origen\single\origenac.102.f71"
del ft71f001
end

```

File origen_be.141.90.in

```

'This SCALE input file was generated by
'OrigenArp Version 6.0.13.12 January 12, 2010
=origens
0$$ a11 71 e t
Decay Case Pu-238Be
3$$ 21 1 1 47 a16 2 a33 77 e t
35$$ 0 t
54$$ a8 1 a11 2 e
56$$ a2 14 a6 1 a10 0 a13 2 a15 3 a17 2 e
57** 0 a3 1e-05 e
95$$ 1 t
case 1 Pu-238Be
0 MTU
60** 0.01 0.03 0.1 0.3 1 3 10 30 100 300 1000 3000 10000 30000
61** fle-20
65$$
'Gram-Atoms Grams Curies Watts-All Watts-Gamma
3z 0 0 0 0 0 0 3z 3z 6z
3z 1 0 0 1 0 0 3z 3z 6z
3z 0 0 0 0 0 0 3z 3z 6z
81$$ 2 0 26 1 a7 200 e
82$$ 2 2 2 2 2 2 2 2 2 2 2 2 2 2 e
83**
1.0000000E+07 9.0000000E+06 8.0000000E+06 7.5000000E+06 7.0000000E+06
6.5000000E+06 6.0000000E+06 5.5000000E+06 5.0000000E+06 4.5000000E+06
4.0000000E+06 3.5000000E+06 3.0000000E+06 2.7500000E+06 2.5000000E+06
2.2500000E+06 2.0000000E+06 1.7500000E+06 1.5000000E+06 1.2500000E+06
1.0000000E+06 9.7500000E+05 9.5000000E+05 9.2500000E+05 9.0000000E+05
8.7500000E+05 8.5000000E+05 8.2500000E+05 8.0000000E+05 7.7500000E+05
7.5000000E+05 7.2500000E+05 7.0000000E+05 6.7500000E+05 6.5000000E+05
6.2500000E+05 6.0000000E+05 5.7500000E+05 5.5000000E+05 5.2500000E+05
5.0000000E+05 4.7500000E+05 4.5000000E+05 4.2500000E+05 4.0000000E+05
3.7500000E+05 3.5000000E+05 3.2500000E+05 3.0000000E+05 2.9000000E+05
2.8000000E+05 2.7000000E+05 2.6000000E+05 2.5000000E+05 2.4000000E+05
2.3000000E+05 2.2000000E+05 2.1000000E+05 2.0000000E+05 1.9000000E+05
1.8000000E+05 1.7000000E+05 1.6000000E+05 1.5000000E+05 1.4000000E+05
1.3000000E+05 1.2000000E+05 1.1000000E+05 1.0000000E+05 9.0000000E+04
8.0000000E+04 7.0000000E+04 6.0000000E+04 5.0000000E+04 4.0000000E+04
3.0000000E+04 2.0000000E+04 1.0000000E+04 e
84**
1.9640300e+07 1.4190700e+07 1.2214000e+07 1.0000000e+07
8.6070800e+06 7.4081800e+06 6.0653100e+06 4.9658500e+06 3.6787900e+06
3.0119400e+06 2.7253200e+06 2.4659700e+06 2.3652500e+06 2.3457000e+06
2.2313000e+06 1.9205000e+06 1.6529900e+06 1.3533500e+06 1.0025900e+06
8.2085000e+05 7.4273600e+05 6.0810100e+05 4.9787100e+05 3.6883200e+05
2.9721100e+05 1.8315600e+05 1.1109000e+05 6.7379370e+04 4.0867700e+04
3.1827800e+04 2.6058400e+04 2.4175500e+04 2.1874900e+04 1.5034400e+04
7.1017380e+03 3.3546300e+03 1.5846100e+03 4.5399900e+02 2.1445400e+02
1.0130100e+02 3.7266490e+01 1.0677000e+01 5.0434800e+00 1.8553900e+00
8.7642500e-01 4.1399400e-01 1.0000100e-01 1.0000100e-05 e
73$$ 942380 40000
74** 1 0.9
75$$ 2 4
t
56$$ 0 0 a10 1 e t
56$$ 0 0 a10 2 e t
56$$ 0 0 a10 3 e t
56$$ 0 0 a10 4 e t
56$$ 0 0 a10 5 e t
56$$ 0 0 a10 6 e t

```

```

56$$ 0 0 a10 7 e t
56$$ 0 0 a10 8 e t
56$$ 0 0 a10 9 e t
56$$ 0 0 a10 10 e t
56$$ 0 0 a10 11 e t
56$$ 0 0 a10 12 e t
56$$ 0 0 a10 13 e t
56$$ 0 0 a10 14 e t
56$$ f0 t
end
=shell
copy ft71f001 "D:\Projects\pcp_method\sources\origen\single\origen_be.141.90.f71"
del ft71f001
end

```

File rasta1.102.in

```

SGQ PCP Methodology
1 gram of      Am-241
/nng  npg  cmf  wsbi  keff  sog  ebeam  idd
-1   43   1    0    0    0    0    1
/ni   iu
1     2
      952410    1
/ni   iu
0     2
/Photon Energy Groups
10.000   9.000   8.000   7.500   7.000   6.500
 6.000   5.500   5.000   4.500   4.000   3.500
 3.000   2.750   2.500   2.250   2.000   1.750
 1.500   1.250   1.000   0.975   0.950   0.925
 0.900   0.875   0.850   0.825   0.800   0.775
 0.750   0.725   0.700   0.675   0.650   0.625
 0.600   0.575   0.550   0.525   0.500   0.475
 0.450   0.001

```

File rasta2.108.in

```

SGQ PCP Methodology
1 gram of      Co-60
/nng  npg  cmf  wsbi  keff  sog  ebeam  idd
-1   35   1    0    0    0    0    1
/ni   iu
1     2
      270600    1
/ni   iu
0     2
/Photon Energy Groups
0.450   0.425   0.400   0.375   0.350   0.325
0.300   0.290   0.280   0.270   0.260   0.250
0.240   0.230   0.220   0.210   0.200   0.190
0.180   0.170   0.160   0.150   0.140   0.130
0.120   0.110   0.100   0.090   0.080   0.070
0.060   0.050   0.040   0.030   0.020   0.010

```

File rasta_bel1.141.90.in

```

SGQ PCP Methodology
1 gram of Pu-238Be
/nng npg cmf wsbi keff sog ebeam idd
-1 43 1 0 0 0 0 1
/ni iu
1 2
942380 1
/ni iu
1 2
40090 0.9
/Photon Energy Groups
10.000 9.000 8.000 7.500 7.000 6.500
6.000 5.500 5.000 4.500 4.000 3.500
3.000 2.750 2.500 2.250 2.000 1.750
1.500 1.250 1.000 0.975 0.950 0.925
0.900 0.875 0.850 0.825 0.800 0.775
0.750 0.725 0.700 0.675 0.650 0.625
0.600 0.575 0.550 0.525 0.500 0.475
0.450 0.001

```

File ru106_0d2

```

SGQ PCP Methodology
1 gram of Ru-106
/nng npg cmf wsbi keff sog ebeam idd
-1 35 1 0 0 0 0 1
/ni iu
3 2
441060 9.99981E-01
451060 9.28043E-07
461060 1.77230E-05
/ni iu
0 2
/Photon Energy Groups
0.450 0.425 0.400 0.375 0.350 0.325
0.300 0.290 0.280 0.270 0.260 0.250
0.240 0.230 0.220 0.210 0.200 0.190
0.180 0.170 0.160 0.150 0.140 0.130
0.120 0.110 0.100 0.090 0.080 0.070
0.060 0.050 0.040 0.030 0.020 0.010

```

Appendix B Radiation Transport Input Files

The MCNP input files are described in Table B-1. The file naming convention used is *case.grp.in* where “*case*” is the case name and “*grp*” is one hundred plus the group number.

Sample listings are provided below for files marked with an asterisk (*).

Table B-1. MCNP Input Files

File Name	Description
No Shielded Container	
neut.1nn.in	Neutron sources – surface detectors no self-shielding, nn = 1 – 47
neutpuo.1nn.in*	Neutron sources – surface detectors PuO ₂ self-shielding, nn = 1 – 47
phot.1pp.in	Photon sources – surface detectors no self-shielding, pp = 1 – 77
photpt.1pp.in	Photon sources – point detectors no self-shielding, pp = 1 – 11
photfe.1pp.in	Photon sources – surface detectors iron self-shielding, pp = 1 – 77
photfept.1pp.in	Photon sources – point detectors iron self-shielding, pp = 1 – 11
SC1 Lead Shielded Container	
sc1.1pp.in*	Photon sources – surface detectors no self-shielding, pp = 1 – 77
sc1pt.1pp.in	Photon sources – point detectors no self-shielding, pp = 1 – 48
SC2 Polyethylene Shielded Container	
sc2n.1nn.in*	Neutron sources – surface detectors no self-shielding, nn = 1 – 47
sc2.1pp.in	Photon sources – surface detectors no self-shielding, pp = 1 – 77
sc2pt.1pp.in	Photon sources – point detectors no self-shielding, pp = 1 – 12
SC3 Tungsten Shielded Container	
sc3.1pp.in	Photon sources – surface detectors no self-shielding, pp = 1 – 77
sc3pt.1pp.in*	Photon sources – point detectors no self-shielding, pp = 1 – 46

File neutpuo.147.in

```

9977 NCT neutrons Source in group 47
c drum bottom
1 101 -7.9 1 -2 -6
c drum side
2 101 -7.9 5 -6 2 -3
c drum lid
3 101 -7.9 3 -4 -6 145
C c upper liner
C 4 101 -7.9 7 -3 9 -10
C c upper liner base
C 5 101 -7.9 7 -8 -9
C c upper foam
C 6 1 -0.256 8 -9 -3
c lower liner
7 101 -7.9 13 -3 11 -12 $ -MHB Change
c lower liner base
8 101 -7.9 -11 13 -14
c Foam
9 1 -0.256 -3 -5 10 2
c Foam
10 1 -0.256 12 -10 -3 2 (155:-150) $ -MHB Change
c Foam
11 1 -0.256 2 -150 -12 $ -MHB Change
c torque bar
12 0 15 -16 24 -25 14 -26 $ MHB - remove torque bar
c lower load distrib assy side
13 151 -2.7 (22 -23 20 -21 ) (27 )
14 151 -2.7 (-23 14 -20 ) (26 :-24 :25 )
16 0 23 -11 14 -3 (140:-7)
17 0 (24 -25 14 -26 -23 ) (-24 :25 :-14 :19 :-15 :16 )
c anti rotation bar
18 0 20 -32 30 -31 28 -29 $ MHB - remove bar
c upper load distr assy side
19 151 -2.7 -23 34 37 -33
c upper load distr assy
20 151 -2.7 (((-23 33 -7 ) (35 )) (36 )) (-38 :39 :-40 :41 )
c upper load distr assy penet
21 0 33 -7 -35
c upper load distr assy penet
22 0 33 -7 -36
c vessel support skirt
23 101 -7.9 -42 43 20 -49 44 47
c cv end cap
24 101 -7.9 -47 48 -49
25 0 ((-43 -49 20 ) (47 )) (44 :-45 :46 :-30 :31 )
26 0 ((20 -49 42 -22 ) (47 )) (44 :-45 :46 :-30 :31 )
27 0 -27 22 -23
c 28 0 43 -42 32 -44 28 -29
c CV cylindrical portion
29 101 -7.9 49 -52 50 -51
30 0 51 -22 49 -21
31 0 21 -52 51 -23
c cv transition portion
32 101 -7.9 -54 53 -55
c cv upper cylinder
33 101 -7.9 55 -58 56 -57
34 0 52 -37 -23 54
35 0 37 54 -34 -55
36 0 55 -58 -34 57
37 106 -7.584 -58 59 -56 66
38 106 -7.584 58 -64 60 -61 62 -63 66
39 106 -7.584 -65 64 60 -61 62 -63 67
40 0 58 -33 -34 66 #38
41 0 -64 33 38 -39 40 -41 66 #38
42 0 64 -65 38 -39 40 -41 69 #39
43 0 -7 65 38 -39 40 -41
44 101 -7.9 (-70 68 69 )
45 101 -7.9 -69 68 -76

```

```

46 101 -7.9      -69 -75 76 73
47 101 -7.9      -69 75 -74 72
48 101 -7.9      -69 74 -65 71
49 0 59 -64 69 -66
50 0 76 -75 -73
51 0 -74 75 -72 77
52 0 74 -65 -71 77
53 0 80 -65 -78
54 101 -7.9      -65 75 -77 78
55 101 -7.9      -64 75 -78
56 0 55 -59 -56 70
57 0 68 -55 -53 70
58 0 -53 -68
59 0 -50 49 -52 88
60 0 -48 -49 88
62 0 4 -82 -84 (-4:100:130)
63 0 1 -4 -84 6
64 0 83 -1 -84
65 0 20 -44 30 -31 45 -28
66 0 20 -44 30 -31 29 -46
67 0 32 -44 30 -31 28 -29
68 0 (43 -42 20 -44 ) (-45 :46 )

c
c MHB
100 4 -0.3204 -135 110 -105 $ Min-K 2000
105 3 -0.3684 -145 115 -4 $ Vermiculite
110 5 -0.2563 -145 120 -115 $ FiberFrax
115 101 -7.9 4 -100 -130 (135:-110:105) $ steel liner
120 101 -7.9 -140 125 -3 (145:-120:4) $ steel liner
125 5 -0.2563 -3 150 -155 (12:-13) $ fiberfrax
116 0 -140 7 -125 $void above top fixture
c external void
999 0 -83 :82 :84
c source
1000 2 -1.273 -88 $ 25 grams PuO2 in source volume

1 pz 0.0
2 pz 0.121
3 pz 86.161 $drum lid bottom
4 pz 86.283 $drum lid top
5 cz 23.178 $drum IR
6 cz 23.299 $drum OR
7 pz 73.639
8 pz 73.829 $base of upper liner
9 cz 18.035
10 cz 18.225 $upper liner
11 cz 10.478
12 cz 10.667 $lower liner
13 pz 10.461 $lower liner base
14 pz 10.583
15 px -9.208
16 px 9.208
19 pz 11.345
20 pz 11.523 $top of lower load distrib assy - MHB change
21 pz 27.093 $lower load dist assy top of sides - MHB change
22 cz 8.573
23 cz 10.16 $lower load distrib assy side
24 py -0.635
25 py 0.635
26 pz 11.231 $ - MHB change
27 c/x 0 24.553 1.27 $lower load dist assy penetration - MHB
change
28 px -0.635
29 px 0.635
30 py -7.976
31 py 7.976
32 pz 12.805
33 pz 72.242
34 cz 9.801
35 c/z -6.172 0 1.588

```

```

36      c/z      6.172      0      1.588
37      pz      67.797
38      px      -3.493
39      px       3.493
40      py      -3.493
41      py       3.493
42      cz       7.065
43      cz       6.41
44      pz      12.958
45      px      -0.8
46      px       0.8
47      sq       1      1      4      0      0
      0      -70.795      0      0      17.342
48      sq       1      1      4      0      0
      0      -59.336      0      0      17.342
49      pz      17.342
50      cz       7.703
51      cz       8.414
52      pz      67.746
53      trc      0      0      67.746      0      0
      2.2098      7.703      8.001
54      trc      0      0      67.746      0      0
      2.2098      8.414      9.042
55      pz      69.955
56      cz       8.255
57      cz       9.042
58      pz      71.86
59      pz      70.26
60      px      -3.175
61      px       3.175
62      py      -3.175
63      py       3.175
64      pz      72.673
65      pz      73.13
66      cz       1.626
67      cz       2.07
68      pz      68.355
69      cz       1.588
70      trc      0      0      68.35      0      0
      1.91      7.739      8.014
71      cz       1.143
72      cz       0.724
73      cz       0.1194
74      pz      71.708
75      pz      70.59
76      pz      69.675
77      cz       0.572
78      cz       0.237
80      pz      72.673
81      so       0
82      pz      189.065824 $top scoring plane
83      pz      -100.
84      cz      123.3
85      cz       5 $segmenting surface for top and bottom planes
86      pz      16.200 $segmenting plane for side scoring plane
87      pz      26.200 $segmenting plane for side scoring plane
88      rcc      0 0 13.542 0 0 4.0 1.25 $source cylinder 2.5 cm dia by 4 cm
tall
c
c  MHB add
c
c  lid
100     pz 89.065824
105     pz 88.944412
110     pz 86.404412
115     pz 75.361
120     pz 74.009214
125     pz 73.8878
130     cz 17.901412
135     cz 17.78

```

```

140      cz 10.230612
145      cz 10.1092
c
c fiberfrax
c
150      pz 7.921
155      cz 13.764006

mode n p
m1 1001.      -0.041 $Polyurethane
6000.      -0.544 8016.      -0.294 7014.      -0.121
m3 14000.     -21.22 $ Vermiculite
13027.     -5.47 20000.     -12.17 26000.      -5.4
22000.     -0.82 12000.     -8.9 11023.      -1.09
19000.     -1.22 16000.     -0.18 8016.      -45.53
m4 14000.     -37.71 $ Min-K 2000
22000.     -5.53 13027.     -6.39 6000.      -1.28
1001.      -0.84 8016.     -48.01 51000.     -0.09
31000.     -0.15
m5 13027.     -26.46 $FiberFlax
14000.     -23.14 11023.     -0.37 8016.      -50.03
m101 6000.    -0.0003 $SS304L
14000.     -0.01 15031.     -0.00045 16000.    -0.0003
24000.     -0.19 25055.     -0.02 26000.     -0.67895
28000.     -0.1
m151 13027.   -97.9 $6061 Al
14000.     -0.6 29000.      -0.28 12000.      -1
24000.     -0.2
m106 25055.   -8 $Nitronic 60
14000.     -4 24000.      -17 7014.      -0.14
28000.     -8.5 26000.     -62.36
m2 94239.     1 8016 2 $Pu Oxide
imp:n 1      68r      0      1      $ 1, 1000
imp:p 1      68r      0      1      $ 1, 1000
sdef erg d1 rad d2 axs 0 0 1 ext d3
pos 0 0 13.542
si2 0.0 1.25
si3 0.0 4.0
c Neutron Group 47
sil 1.4200e1 1.9600e1
c Neutron source spectrum
spl 0.00000E+00 1.0
ctme 120
f112:p 1 4 83 82
fs112 -85
sd112 78.5398 1.e40
78.5398 1.e40
78.5398 1.e40
78.5398 1.e40
fm112 1.0 $ Unit source
tf112 4 2j 1
de112 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
.7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
5.75 6.25 6.75 7.5 9. 11. 13. 15.
df112 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
f122:p 6 84
fs122 -86 -87
sd122 1.e40 1463.9181 1.e40
1.e40 7747.16094 1.e40
fm122 1.0 $ Unit source
tf122 2 2j 2
de122 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
.7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
5.75 6.25 6.75 7.5 9. 11. 13. 15.
df122 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &

```

```

1.52e-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
4.41e-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
7.11e-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
f212:n 1 4 83 82
fs212 -85
sd212 78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
fm212 1.0 $ Unit source
tf212 4 2j 1
f222:n 6 84
fs222 -86 -87
sd222 1.e40 1463.9181 1.e40
      1.e40 7747.16094 1.e40
fm222 1.0 $ Unit source
tf222 2 2j 2
fq0 f s
c f05:p 0 0 -1 1
c      0 0 -99.9 1
c      0 0 90.1 1
c      0 0 189. 1
c f15z:p 21.200 24.2994 1
c      21.200 123.2994 1
c fm05 1.0 $ Unit source
c fm15 1.0 $ Unit source
c de05 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
c      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
c      5.75 6.25 6.75 7.5 9. 11. 13. 15.
c df05 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
c      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
c      1.52e-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
c      4.41e-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
c      7.11e-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
c de15 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
c      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
c      5.75 6.25 6.75 7.5 9. 11. 13. 15.
c df15 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
c      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
c      1.52e-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
c      4.41e-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
c      7.11e-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
c f205:n 0 0 -1 1
c      0 0 -99.9 1
c      0 0 90.1 1
c      0 0 189. 1
c f215z:n 21.200 24.2994 1
c      21.200 123.2994 1
c fm205 1.0 $ Unit source
c fm215 1.0 $ Unit source
c dose factors for Neutrons from ANS 6.1.1-1977, rem/hr
de0 2.5e-08 1.0e-07 1.0e-06 1.0e-05 1.0e-04 1.0e-03 1.0e-02 1.0e-01
    5.0e-01 1.0 2.5 5.0 7.0 10.0 14.0 20.0
df0 3.67e-6 3.67e-6 4.46e-6 4.54e-6 4.18e-6 3.76e-6 3.56e-6 2.17e-5
    9.26e-5 1.32e-4 1.25e-4 1.56e-4 1.47e-4 1.47e-4 2.08e-4 2.27e-4
prdmp 2j 1

```

File scl101.in

```

SGQ-SC1 photons Source in group 1 No self shielding
C
C Based on File bRTGp from 9977 SARP Shielding Analysis
C N-CLC-G-00119 Rev 2
C Modified by Steve Nathan SRNS
C Jan 2010
C
C drum bottom
1 101 -7.9 1 -2 -6
c drum side

```

```

2  101 -7.9      5 -6 2 -3
c  drum lid
3  101 -7.9      3 -4 -6 145
C  c  upper liner
C  4  101 -7.9      7 -3 9 -10
C  c  upper liner base
C  5  101 -7.9      7 -8 -9
C  c  upper foam
C  6  1 -0.256      8 -9 -3
c  lower liner
7  101 -7.9      13 -3 11 -12  $ -MHB Change
c  lower liner base
8  101 -7.9      -11 13 -14
c  Foam
9  1 -0.256      -3 -5 10 2
c  Foam
10 1 -0.256      12 -10 -3 2 (155:-150)  $ -MHB Change
c  Foam
11 1 -0.256      2 -150 -12  $ -MHB Change
c  torque bar
12 0 15 -16 24 -25 14 -26  $ MHB - remove torque bar
c  lower load distrib assy side
13 151 -2.7      (22 -23 20 -21 ) (27 )
14 151 -2.7      (-23 14 -20 ) (26 :-24 :25 )
16 0 23 -11 14 -3 (140:-7)
17 0 (24 -25 14 -26 -23 ) (-24 :25 :-14 :19 :-15 :16 )
c  anti rotation bar
18 0 20 -32 30 -31 28 -29  $ MHB - remove bar
c  upper load distr assy side
19 151 -2.7      -23 34 37 -33
c  upper load distr assy
20 151 -2.7      (((-23 33 -7 ) (35 )) (36 )) (-38 :39 :-40 :41 )
c  upper load distr assy penet
21 0 33 -7 -35
c  upper load distr assy penet
22 0 33 -7 -36
c  vessel support skirt
23 101 -7.9      -42 43 20 -49 44 47
c  cv end cap
24 101 -7.9      -47 48 -49
25 0 ((-43 -49 20 ) (47 )) (44 :-45 :46 :-30 :31 )
26 0 ((20 -49 42 -22 ) (47 )) (44 :-45 :46 :-30 :31 )
27 0 -27 22 -23
c  28 0 43 -42 32 -44 28 -29
c  CV cylindrical portion
29 101 -7.9      49 -52 50 -51
30 0 51 -22 49 -21
31 0 21 -52 51 -23
c  cv transition portion
32 101 -7.9      -54 53 -55
c  cv upper cylinder
33 101 -7.9      55 -58 56 -57
34 0 52 -37 -23 54
35 0 37 54 -34 -55
36 0 55 -58 -34 57
37 106 -7.584      -58 59 -56 66
38 106 -7.584      58 -64 60 -61 62 -63 66
39 106 -7.584      -65 64 60 -61 62 -63 67
40 0 58 -33 -34 66 #38
41 0 -64 33 38 -39 40 -41 66 #38
42 0 64 -65 38 -39 40 -41 69 #39
43 0 -7 65 38 -39 40 -41
44 101 -7.9      (-70 68 69 )
45 101 -7.9      -69 68 -76
46 101 -7.9      -69 -75 76 73
47 101 -7.9      -69 75 -74 72
48 101 -7.9      -69 74 -65 71
49 0 59 -64 69 -66
50 0 76 -75 -73
51 0 -74 75 -72 77

```

```

52    0  74  -65  -71  77
53    0  80  -65  -78
54   101 -7.9      -65  75  -77  78
55   101 -7.9      -64  75  -78
56    0  55  -59  -56  70
57    0  68  -55  -53  70
58    0  -53  -68
59    0  -50  200  -52  49
60    0  -48  -49
62    0  4  -82  -84  (-4:100:130)
63    0  1  -4  -84  6
64    0  83  -1  -84
65    0  20  -44  30  -31  45  -28
66    0  20  -44  30  -31  29  -46
67    0  32  -44  30  -31  28  -29
68    0  (43  -42  20  -44  ) (-45  :46  )

c
c  MHB
100   4 -0.3204 -135 110 -105  $ Min-K 2000
105   3 -0.3684 -145 115 -4    $ Vermiculite
110   5 -0.2563 -145 120 -115  $ FiberFrax
115  101 -7.9   4 -100 -130 (135:-110:105) $ steel liner
120  101 -7.9 -140 125 -3    (145:-120:4)  $ steel liner
125   5 -0.2563 -3 150 -155 (12:-13)       $ fiberfrax
116   0      -140 7 -125     $void above top fixture

c  external void
999   0  -83  :82  :84

c  Canister
1110  200 -11.34 -200 210

c  Canister interior
1140   0  -210 220

c  Source Region
1150   0  -220

1      pz      0.0
2      pz      0.121
3      pz      86.161 $drum lid bottom
4      pz      86.283 $drum lid top
5      cz      23.178 $drum IR
6      cz      23.299 $drum OR
7      pz      73.639
8      pz      73.829 $base of upper liner
9      cz      18.035
10     cz      18.225 $upper liner
11     cz      10.478
12     cz      10.667 $lower liner
13     pz      10.461 $lower liner base
14     pz      10.583
15     px      -9.208
16     px      9.208
19     pz      11.345
20     pz      11.523 $top of lower load distrib assy - MHB change
21     pz      27.093 $lower load dist assy top of sides - MHB change
22     cz      8.573
23     cz      10.16 $lower load distrib assy side
24     py      -0.635
25     py      0.635
26     pz      11.231 $ - MHB change
27     c/x      0      24.553  1.27  $lower load dist assy penetration - MHB
change
28     px      -0.635
29     px      0.635
30     py      -7.976
31     py      7.976
32     pz      12.805
33     pz      72.242
34     cz      9.801
35     c/z      -6.172      0      1.588
36     c/z      6.172      0      1.588
37     pz      67.797

```

```

38      px      -3.493
39      px       3.493
40      py      -3.493
41      py       3.493
42      cz       7.065
43      cz       6.41
44      pz      12.958
45      px      -0.8
46      px       0.8
47      sq       1          1          4          0          0
      0      -70.795          0          0      17.342
48      sq       1          1          4          0          0
      0      -59.336          0          0      17.342
49      pz      17.342
50      cz       7.703
51      cz       8.414
52      pz      67.746
53      trc      0          0      67.746          0          0
      2.2098          7.703          8.001
54      trc      0          0      67.746          0          0
      2.2098          8.414          9.042
55      pz      69.955
56      cz       8.255
57      cz       9.042
58      pz      71.86
59      pz      70.26
60      px      -3.175
61      px       3.175
62      py      -3.175
63      py       3.175
64      pz      72.673
65      pz      73.13
66      cz       1.626
67      cz       2.07
68      pz      68.355
69      cz       1.588
70      trc      0          0      68.35          0          0
      1.91          7.739          8.014
71      cz       1.143
72      cz       0.724
73      cz       0.1194
74      pz      71.708
75      pz      70.59
76      pz      69.675
77      cz       0.572
78      cz       0.237
80      pz      72.673
81      so       0
82      pz      189.065824 $top scoring plane
83      pz      -100.
84      cz      123.3
85      cz       5 $segmenting surface for top and bottom planes
86      pz      18.42 $segmenting plane for side scoring plane
87      pz      28.42 $segmenting plane for side scoring plane
c
c MHB add
c
c lid
100     pz      89.065824
105     pz      88.944412
110     pz      86.404412
115     pz      75.361
120     pz      74.009214
125     pz      73.8878
130     cz      17.901412
135     cz      17.78
140     cz      10.230612
145     cz      10.1092
c
c fiberfrax

```

```

c
  150      pz 7.921
  155      cz 13.764006
c shielded canister
  200      rcc 0.0 0 17.3421 0 0 23.7236 7.14375 $SC-1 Outside
  210      rcc 0.0 0 22.4221 0 0 13.97 2.0574 $SC-1 Inside
  220      rcc 0.0 0 22.4221 0 0 2.00 0.5 $Source region

mode p
m1 1001. -0.041 $Polyurethane
   6000. -0.544 8016. -0.294 7014. -0.121
m3 14000 -21.22 $ Vermiculite
   13000 -5.47
   20000 -12.17
   26000 -5.40
   22000 -0.82
   12000 -8.90
   11000 -1.09
   19000 -1.22
   16000 -0.18
   8000 -45.53
m4 14000 -37.71 $ Min-K 2000
   22000 -5.53
   13000 -6.39
   6000 -1.28
   1001 -0.84
   8000 -48.01
   51000 -0.09
   31000 -0.15
m5 13000 -26.46 $FiberFlax
   14000 -23.14
   11000 -0.37
   8000 -50.03
m101 6000. -0.0003 $SS304L
     14000. -0.01 15000. -0.00045 16000. -0.0003
     24000. -0.19 25000. -0.02 26000. -0.67895
     28000. -0.1
m151 13000. -97.9 $6061 Al
     14000. -0.6 29000. -0.28 12000. -1
     24000. -0.2
m106 25000. -8 $Nitronic 60
     14000. -4 24000. -17 7000. -0.14
     28000. -8.5 26000. -62.36
m200 82000 -1.0 $Lead Metal
m250 92238 -0.1269 $Triso Fuel Compact
     92235 -0.0048
     92236 -0.0044
     94239 -0.0091
     6000 -0.7543
     8000 -0.0153
     14000 -0.0851
m260 74000 -0.90 $ring
     28000 -0.06
     29000 -0.04
imp:p 1 68r 0 1 1 1 $ 1, 1000
sdef erg d1 rad d2 ext d3 axs 0 0 1
     pos 0.0 0 22.4221
si2 0.0 0.5
si3 0.0 2.0
c Photon Group 1
sil 0.010 0.020
c Photon source strength
spl 0.00000E+00 1.0
ctme 120
fl12:p 1 4 83 82
fs112 -85
sdl12 78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40

```

```

fm112 1.0 $ Unit source
tf112 4 2j 1
f122:p 6 84
fs122 -86 -87
sd122 1.e40 1463.9181 1.e40
      1.e40 7747.16094 1.e40
fm122 1.0 $ Unit source
tf122 2 2j 2
fq0 f s
c f5:p 0 0 -1 1
c      0 0 -99.9 1
c      0 0 90.1 1
c      0 0 189. 1
c f15z:p 23.4221 24.2994 1
c      23.4221 123.2994 1
c fm5 1.0 $ Unit source
c fm15 1.0 $ Unit source
de0 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
     .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
     5.75 6.25 6.75 7.5 9. 11. 13. 15.
df0 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
     7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
     1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
     4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
     7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
prdm 2j 1

```

File sc2n.107.in

```

SGQ-SC2 Neutron Source in group 7
C
C Based on File bRTGp from 9977 SARP Shielding Analysis
C N-CLC-G-00119 Rev 2
C Modified by Steve Nathan SRNS
C Jan 2010
C
c drum bottom
1 101 -7.9 1 -2 -6
c drum side
2 101 -7.9 5 -6 2 -3
c drum lid
3 101 -7.9 3 -4 -6 145
C c upper liner
C 4 101 -7.9 7 -3 9 -10
C c upper liner base
C 5 101 -7.9 7 -8 -9
C c upper foam
C 6 1 -0.256 8 -9 -3
c lower liner
7 101 -7.9 13 -3 11 -12 $ -MHB Change
c lower liner base
8 101 -7.9 -11 13 -14
c Foam
9 1 -0.256 -3 -5 10 2
c Foam
10 1 -0.256 12 -10 -3 2 (155:-150) $ -MHB Change
c Foam
11 1 -0.256 2 -150 -12 $ -MHB Change
c torque bar
12 0 15 -16 24 -25 14 -26 $ MHB - remove torque bar
c lower load distrib assy side
13 151 -2.7 (22 -23 20 -21 ) (27 )
14 151 -2.7 (-23 14 -20 ) (26 :-24 :25 )
16 0 23 -11 14 -3 (140:-7)
17 0 (24 -25 14 -26 -23 ) (-24 :25 :-14 :19 :-15 :16 )
c anti rotation bar
18 0 20 -32 30 -31 28 -29 $ MHB - remove bar
c upper load distr assy side
19 151 -2.7 -23 34 37 -33
c upper load distr assy

```

```

20 151 -2.7      (((-23 33 -7 )(35 ))(36 ))(-38 :39 :-40 :41 )
c  upper load distr assy penet
21 0 33 -7 -35
c  upper load distr assy penet
22 0 33 -7 -36
c  vessel support skirt
23 101 -7.9      -42 43 20 -49 44 47
c  cv end cap
24 101 -7.9      -47 48 -49
25 0 ((-43 -49 20 )(47 ))(44 :-45 :46 :-30 :31 )
26 0 ((20 -49 42 -22 )(47 ))(44 :-45 :46 :-30 :31 )
27 0 -27 22 -23
c 28 0 43 -42 32 -44 28 -29
c  CV cylindrical portion
29 101 -7.9      49 -52 50 -51
30 0 51 -22 49 -21
31 0 21 -52 51 -23
c  cv transition portion
32 101 -7.9      -54 53 -55
c  cv upper cylinder
33 101 -7.9      55 -58 56 -57
34 0 52 -37 -23 54
35 0 37 54 -34 -55
36 0 55 -58 -34 57
37 106 -7.584     -58 59 -56 66
38 106 -7.584     58 -64 60 -61 62 -63 66
39 106 -7.584     -65 64 60 -61 62 -63 67
40 0 58 -33 -34 66 #38
41 0 -64 33 38 -39 40 -41 66 #38
42 0 64 -65 38 -39 40 -41 69 #39
43 0 -7 65 38 -39 40 -41
44 101 -7.9      (-70 68 69 )
45 101 -7.9      -69 68 -76
46 101 -7.9      -69 -75 76 73
47 101 -7.9      -69 75 -74 72
48 101 -7.9      -69 74 -65 71
49 0 59 -64 69 -66
50 0 76 -75 -73
51 0 -74 75 -72 77
52 0 74 -65 -71 77
53 0 80 -65 -78
54 101 -7.9      -65 75 -77 78
55 101 -7.9      -64 75 -78
56 0 55 -59 -56 70
57 0 68 -55 -53 70
58 0 -53 -68
59 0 -50 200 -52 49
60 0 -48 -49
62 0 4 -82 -84 (-4:100:130)
63 0 1 -4 -84 6
64 0 83 -1 -84
65 0 20 -44 30 -31 45 -28
66 0 20 -44 30 -31 29 -46
67 0 32 -44 30 -31 28 -29
68 0 (43 -42 20 -44 )(-45 :46 )
c
c  MHB
100 4 -0.3204 -135 110 -105 $ Min-K 2000
105 3 -0.3684 -145 115 -4 $ Vermiculite
110 5 -0.2563 -145 120 -115 $ FiberFrax
115 101 -7.9 4 -100 -130 (135:-110:105) $ steel liner
120 101 -7.9 -140 125 -3 (145:-120:4) $ steel liner
125 5 -0.2563 -3 150 -155 (12:-13) $ fiberfrax
116 0 -140 7 -125 $void above top fixture
c  external void
999 0 -83 :82 :84
c  Canister
1110 260 -0.95 -200 210
c  Canister interior
1140 0 -210 220

```

c	Source	Region						
1150	0	-220						
1	pz	0.0						
2	pz	0.121						
3	pz	86.161	\$drum lid bottom					
4	pz	86.283	\$drum lid top					
5	cz	23.178	\$drum IR					
6	cz	23.299	\$drum OR					
7	pz	73.639						
8	pz	73.829	\$base of upper liner					
9	cz	18.035						
10	cz	18.225	\$upper liner					
11	cz	10.478						
12	cz	10.667	\$lower liner					
13	pz	10.461	\$lower liner base					
14	pz	10.583						
15	px	-9.208						
16	px	9.208						
19	pz	11.345						
20	pz	11.523	\$top of lower load distrib assy - MHB change					
21	pz	27.093	\$lower load dist assy top of sides - MHB change					
22	cz	8.573						
23	cz	10.16	\$lower load distrib assy side					
24	py	-0.635						
25	py	0.635						
26	pz	11.231	\$ - MHB change					
27	c/x	0	24.553	1.27	\$lower load dist assy penetration - MHB			
change								
28	px	-0.635						
29	px	0.635						
30	py	-7.976						
31	py	7.976						
32	pz	12.805						
33	pz	72.242						
34	cz	9.801						
35	c/z	-6.172	0	1.588				
36	c/z	6.172	0	1.588				
37	pz	67.797						
38	px	-3.493						
39	px	3.493						
40	py	-3.493						
41	py	3.493						
42	cz	7.065						
43	cz	6.41						
44	pz	12.958						
45	px	-0.8						
46	px	0.8						
47	sq	1	1	4	0	0	0	
		0	-70.795	0	0	17.342		
48	sq	1	1	4	0	0	0	
		0	-59.336	0	0	17.342		
49	pz	17.342						
50	cz	7.703						
51	cz	8.414						
52	pz	67.746						
53	trc	0	0	67.746	0	0	0	
		2.2098	7.703	8.001				
54	trc	0	0	67.746	0	0	0	
		2.2098	8.414	9.042				
55	pz	69.955						
56	cz	8.255						
57	cz	9.042						
58	pz	71.86						
59	pz	70.26						
60	px	-3.175						
61	px	3.175						
62	py	-3.175						
63	py	3.175						
64	pz	72.673						

```

65      pz      73.13
66      cz      1.626
67      cz      2.07
68      pz      68.355
69      cz      1.588
70      trc      0          0      68.35          0          0
          1.91      7.739      8.014
71      cz      1.143
72      cz      0.724
73      cz      0.1194
74      pz      71.708
75      pz      70.59
76      pz      69.675
77      cz      0.572
78      cz      0.237
80      pz      72.673
81      so      0
82      pz      189.065824 $top scoring plane
83      pz      -100.
84      cz      123.3
85      cz      5 $segmenting surface for top and bottom planes
86      pz      9.8 $segmenting plane for side scoring plane
87      pz      19.8 $segmenting plane for side scoring plane

c
c MHB add
c
c lid
100     pz 89.065824
105     pz 88.944412
110     pz 86.404412
115     pz 75.361
120     pz 74.009214
125     pz 73.8878
130     cz 17.901412
135     cz 17.78
140     cz 10.230612
145     cz 10.1092

c
c fiberfrax
c
150     pz 7.921
155     cz 13.764006
c shielded canister
200     rcc 0.0 0 17.3421 0 0 31.115 7.46125 $SC-2 Outside
210     rcc 0.0 0 22.4221 0 0 20.32 2.06375 $SC-2 Inside
220     rcc 0.0 0 22.4221 0 0 4.00 1.25 $Source region

mode n p
m1     1001.60c      -0.041 $Polyurethane
        6000.60c      -0.544 8016.60c      -0.294 7014.60c      -0.121
m3     14000.60c     -21.22 $ Vermiculite
        13027.60c     -5.47
        20000.60c     -12.17
        26000.55c     -5.40
        22000.60c     -0.82
        12000.60c     -8.90
        11023.60c     -1.09
        19000.60c     -1.22
        16000.60c     -0.18
        8016.60c      -45.53
m4     14000.60c     -37.71 $ Min-K 2000
        22000.60c     -5.53
        13027.60c     -6.39
        6000.60c      -1.28
        1001.60c      -0.84
        8016.60c      -48.01
        51000.42c     -0.09
        31000.60c     -0.15
m5     13027.60c     -26.46 $FiberFlax
        14000.60c     -23.14

```

```

11023.60c          -0.37
8016.60c           -50.03
m101 6000.60c      -0.0003 $SS304L
14000.60c          -0.01 15031.60c      -0.00045 16000.60c      -0.0003
24000.50c          -0.19 25055.60c      -0.02 26000.55c      -0.67895
28000.50c          -0.1
m151 13027.60c     -97.9 $6061 Al
14000.60c          -0.6 29000.50c      -0.28 12000.60c      -1
24000.50c          -0.2
m106 25055.60c     -8 $Nitronic 60
14000.60c          -4 24000.50c      -17 7014.60c      -0.14
28000.50c          -8.5 26000.55c      -62.36
m200 82000.50c     -1.0 $Lead Metal
m250 92238.60c     -0.1269 $Triso Fuel Compact
92235.60c          -0.0048
92236.60c          -0.0044
94239.60c          -0.0091
6000.60c           -0.7543
8016.60c           -0.0153
14000.60c          -0.0851
m260 1001.60c      2 $HDPE (CH2)
6000.60c           1
imp:p,n 1          68r          0          1          1          1          $ 1, 1000
sdef  erg d1      rad d2      ext d3  ax 0 0 1
      pos 0.0      0      22.4221
si2   0.0  1.25
si3   0.0  4.0
c Neutron Group 7
si1   1.0700e-5    3.7300e-5
c Neutron source spectrum
spl   0.00000E+00 1.0
ctme 120
fl12:p 1  4  83  82
fs112 -85
sd112  78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
fm112 1.0 $ Unit source
tf112 4  2j  1
de112 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
      5.75 6.25 6.75 7.5 9. 11. 13. 15.
df112 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
      1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
      4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
      7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
fl122:p 6  84
fs122 -86 -87
sd122 1.e40 1463.9181 1.e40
      1.e40 7747.16094 1.e40
fm122 1.0 $ Unit source
tf122 2  2j  2
de122 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
      5.75 6.25 6.75 7.5 9. 11. 13. 15.
df122 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
      1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
      4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
      7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
f212:n 1  4  83  82
fs212 -85
sd212 78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
fm212 1.0 $ Unit source
tf212 4  2j  1

```

```

f222:n 6 84
fs222 -86 -87
sd222 1.e40 1463.9181 1.e40
      1.e40 7747.16094 1.e40
fm222 1.0 $ Unit source
tf222 2 2j 2
fq0 f s
c f05:p 0 0 -1 1
c      0 0 -99.9 1
c      0 0 90.1 1
c      0 0 189. 1
c f15z:p 21.200 24.2994 1
c      21.200 123.2994 1
c fm05 1.0 $ Unit source
c fm15 1.0 $ Unit source
c de05 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
c      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
c      5.75 6.25 6.75 7.5 9. 11. 13. 15.
c df05 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
c      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
c      1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
c      4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
c      7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
c de15 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
c      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
c      5.75 6.25 6.75 7.5 9. 11. 13. 15.
c df15 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
c      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
c      1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
c      4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
c      7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
c f205:n 0 0 -1 1
c      0 0 -99.9 1
c      0 0 90.1 1
c      0 0 189. 1
c f215z:n 21.200 24.2994 1
c      21.200 123.2994 1
c fm205 1.0 $ Unit source
c fm215 1.0 $ Unit source
c dose factors for Neutrons from ANS 6.1.1-1977, rem/hr
de0 2.5e-08 1.0e-07 1.0e-06 1.0e-05 1.0e-04 1.0e-03 1.0e-02 1.0e-01
    5.0e-01 1.0 2.5 5.0 7.0 10.0 14.0 20.0
df0 3.67e-6 3.67e-6 4.46e-6 4.54e-6 4.18e-6 3.76e-6 3.56e-6 2.17e-5
    9.26e-5 1.32e-4 1.25e-4 1.56e-4 1.47e-4 1.47e-4 2.08e-4 2.27e-4
prdmp 2j 1

```

File sc3pt.120.in

```

SGQ-SC2 photons Source in group 20 No self shielding
C
C Based on File bRTGp from 9977 SARP Shielding Analysis
C N-CLC-G-00119 Rev 2
C Modified by Steve Nathan SRNS
C May 2009
C
c drum bottom
1 101 -7.9 1 -2 -6
c drum side
2 101 -7.9 5 -6 2 -3
c drum lid
3 101 -7.9 3 -4 -6 145
C c upper liner
C 4 101 -7.9 7 -3 9 -10
C c upper liner base
C 5 101 -7.9 7 -8 -9
C c upper foam
C 6 1 -0.256 8 -9 -3
c lower liner

```

```

7  101 -7.9      13 -3 11 -12  $ -MHB Change
c  lower liner base
8  101 -7.9      -11 13 -14
c  Foam
9  1 -0.256     -3 -5 10 2
c  Foam
10 1 -0.256     12 -10 -3 2 (155:-150)  $ -MHB Change
c  Foam
11 1 -0.256     2 -150 -12  $ -MHB Change
c  torque bar
12 0      15 -16 24 -25 14 -26  $ MHB - remove torque bar
c  lower load distrib assy side
13 151 -2.7      (22 -23 20 -21 ) (27 )
14 151 -2.7      (-23 14 -20 ) (26 :-24 :25 )
16 0 23 -11 14 -3 (140:-7)
17 0 (24 -25 14 -26 -23 ) (-24 :25 :-14 :19 :-15 :16 )
c  anti rotation bar
18 0      20 -32 30 -31 28 -29  $ MHB - remove bar
c  upper load distr assy side
19 151 -2.7      -23 34 37 -33
c  upper load distr assy
20 151 -2.7      (((-23 33 -7 ) (35 )) (36 )) (-38 :39 :-40 :41 )
c  upper load distr assy penet
21 0 33 -7 -35
c  upper load distr assy penet
22 0 33 -7 -36
c  vessel support skirt
23 101 -7.9      -42 43 20 -49 44 47
c  cv end cap
24 101 -7.9      -47 48 -49
25 0 ((-43 -49 20 ) (47 )) (44 :-45 :46 :-30 :31 )
26 0 ((20 -49 42 -22 ) (47 )) (44 :-45 :46 :-30 :31 )
27 0 -27 22 -23
c 28 0 43 -42 32 -44 28 -29
c  CV cylindrical portion
29 101 -7.9      49 -52 50 -51
30 0 51 -22 49 -21
31 0 21 -52 51 -23
c  cv transition portion
32 101 -7.9      -54 53 -55
c  cv upper cylinder
33 101 -7.9      55 -58 56 -57
34 0 52 -37 -23 54
35 0 37 54 -34 -55
36 0 55 -58 -34 57
37 106 -7.584     -58 59 -56 66
38 106 -7.584     58 -64 60 -61 62 -63 66
39 106 -7.584     -65 64 60 -61 62 -63 67
40 0 58 -33 -34 66 #38
41 0 -64 33 38 -39 40 -41 66 #38
42 0 64 -65 38 -39 40 -41 69 #39
43 0 -7 65 38 -39 40 -41
44 101 -7.9      (-70 68 69 )
45 101 -7.9      -69 68 -76
46 101 -7.9      -69 -75 76 73
47 101 -7.9      -69 75 -74 72
48 101 -7.9      -69 74 -65 71
49 0 59 -64 69 -66
50 0 76 -75 -73
51 0 -74 75 -72 77
52 0 74 -65 -71 77
53 0 80 -65 -78
54 101 -7.9      -65 75 -77 78
55 101 -7.9      -64 75 -78
56 0 55 -59 -56 70
57 0 68 -55 -53 70
58 0 -53 -68
59 0 -50 49 -52 300
60 0 -48 -49
62 0 4 -82 -84 (-4:100:130)

```

```

63      0  1  -4  -84  6
64      0  83  -1  -84
65      0  20  -44  30  -31  45  -28
66      0  20  -44  30  -31  29  -46
67      0  32  -44  30  -31  28  -29
68      0  (43  -42  20  -44  ) (-45  :46  )

c
c  MHB
100     4 -0.3204 -135 110 -105  $ Min-K 2000
105     3 -0.3684 -145 115  -4  $ Vermiculite
110     5 -0.2563 -145 120 -115  $ FiberFrax
115    101 -7.9   4 -100 -130 (135:-110:105) $ steel liner
120    101 -7.9 -140 125 -3  (145:-120:4)  $ steel liner
125     5 -0.2563 -3 150 -155 (12:-13)      $ fiberfrax
116     0      -140 7 -125      $void above top fixture
c  external void
999     0  -83  :82  :84
c  Source region
1050    0      -320
c  Interior of tungsten pig
1100    0      -310  320
c  Tungsten pig
1150    260 -17.0      -300  310

1      pz      0.0
2      pz      0.121
3      pz      86.161 $drum lid bottom
4      pz      86.283 $drum lid top
5      cz      23.178 $drum IR
6      cz      23.299 $drum OR
7      pz      73.639
8      pz      73.829 $base of upper liner
9      cz      18.035
10     cz      18.225 $upper liner
11     cz      10.478
12     cz      10.667 $lower liner
13     pz      10.461 $lower liner base
14     pz      10.583
15     px      -9.208
16     px       9.208
19     pz      11.345
20     pz      11.523 $top of lower load distrib assy - MHB change
21     pz      27.093 $lower load dist assy top of sides - MHB change
22     cz       8.573
23     cz      10.16 $lower load distrib assy side
24     py      -0.635
25     py       0.635
26     pz      11.231 $ - MHB change
27     c/x      0      24.553  1.27  $lower load dist assy penetration - MHB
change
28     px      -0.635
29     px       0.635
30     py      -7.976
31     py       7.976
32     pz      12.805
33     pz      72.242
34     cz       9.801
35     c/z      -6.172      0      1.588
36     c/z       6.172      0      1.588
37     pz      67.797
38     px      -3.493
39     px       3.493
40     py      -3.493
41     py       3.493
42     cz       7.065
43     cz       6.41
44     pz      12.958
45     px      -0.8
46     px       0.8
47     sq       1      1      4      0      0

```

```

      0      -70.795      0      0      17.342
48      sq      1      1      4      0      0
      0      -59.336      0      0      17.342
49      pz      17.342
50      cz      7.703
51      cz      8.414
52      pz      67.746
53      trc      0      0      67.746      0      0
      2.2098      7.703      8.001
54      trc      0      0      67.746      0      0
      2.2098      8.414      9.042
55      pz      69.955
56      cz      8.255
57      cz      9.042
58      pz      71.86
59      pz      70.26
60      px      -3.175
61      px      3.175
62      py      -3.175
63      py      3.175
64      pz      72.673
65      pz      73.13
66      cz      1.626
67      cz      2.07
68      pz      68.355
69      cz      1.588
70      trc      0      0      68.35      0      0
      1.91      7.739      8.014
71      cz      1.143
72      cz      0.724
73      cz      0.1194
74      pz      71.708
75      pz      70.59
76      pz      69.675
77      cz      0.572
78      cz      0.237
80      pz      72.673
81      so      0
82      pz      189.065824 $top scoring plane
83      pz      -100.
84      cz      123.3
85      cz      5 $segmenting surface for top and bottom planes
86      pz      18.6125 $segmenting plane for side scoring plane
87      pz      28.6125 $segmenting plane for side scoring plane
c
c MHB add
c
c lid
100      pz 89.065824
105      pz 88.944412
110      pz 86.404412
115      pz 75.361
120      pz 74.009214
125      pz 73.8878
130      cz 17.901412
135      cz 17.78
140      cz 10.230612
145      cz 10.1092
c
c fiberfrax
c
150      pz 7.921
155      cz 13.764006
c shielded canister
200      cz 2.623 $ 2.0 inch thick side
210      pz 22.422 $ 2.0 inch thick bottom
220      pz 36.392 $ 5.5 inch high cavity
230      pz 41.472 $ 2.0 inch thick top
300      rcc 0 0 17.342 0 0 18.161 6.858 $tung-pig outside
310      rcc 0 0 22.6125 0 0 7.62 1.5875 $tung-pig inside

```

```

320      rcc    0    0  22.6125    0    0  2.00    0.50    $source region

mode p
m1  1001.      -0.041 $Polyurethane
    6000.      -0.544 8016.      -0.294 7014.      -0.121
m3  14000      -21.22 $ Vermiculite
    13000      -5.47
    20000      -12.17
    26000      -5.40
    22000      -0.82
    12000      -8.90
    11000      -1.09
    19000      -1.22
    16000      -0.18
    8000       -45.53
m4  14000      -37.71 $ Min-K 2000
    22000      -5.53
    13000      -6.39
    6000       -1.28
    1001       -0.84
    8000       -48.01
    51000      -0.09
    31000      -0.15
m5  13000      -26.46 $FiberFlax
    14000      -23.14
    11000      -0.37
    8000       -50.03
m101 6000.     -0.0003 $SS304L
    14000.     -0.01 15000.     -0.00045 16000.     -0.0003
    24000.     -0.19 25000.     -0.02 26000.     -0.67895
    28000.     -0.1
m151 13000.    -97.9 $6061 Al
    14000.     -0.6 29000.     -0.28 12000.     -1
    24000.     -0.2
m106 25000.    -8 $Nitronic 60
    14000.     -4 24000.     -17 7000.     -0.14
    28000.     -8.5 26000.     -62.36
m200 82000     -1.0 $Lead Metal
m250 92238     -0.1269 $Triso Fuel Compact
    92235      -0.0048
    92236      -0.0044
    94239      -0.0091
    6000       -0.7543
    8000       -0.0153
    14000      -0.0851
m260 74000     -0.90 $ring
    28000      -0.06
    29000      -0.04
imp:p 1        68r        0        1    1 1        $ 1, 1000
sdef   erg d1   rad d2   ext d3   axs 0 0 1
      pos 0.0   0  22.6125
si2    0.0   0.5
si3    0.0   2.0
c Photon Group 20
si1    0.200   0.210
c Photon source strength
sp1    0.00000E+00 1.0
ctme 360
fl12:p 1  4  83  82
fs112 -85
sdl12  78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
      78.5398 1.e40
fm112 1.0 $ Unit source
tf112 3  2j  1
fl22:p 6  84
fs122 -86 -87
sdl22  1.e40 1463.9181 1.e40
      1.e40 7747.16094 1.e40

```

```

fm122 1.0 $ Unit source
tf122 1 2j 2
fq0 f s
f5:p 0 0 -1 1
      0 0 -99.9 1
      0 0 90.1 1
      0 0 189. 1
f15z:p 23.6125 24.2994 1
        23.6125 123.2994 1
fm5 1.0 $ Unit source
fm15 1.0 $ Unit source
de0 .01 .03 .05 .07 .1 .15 .2 .25 .3 .35 .4 .45 .5 .55 .6 .65 &
      .7 .8 1. 1.4 1.8 2.2 2.6 2.8 3.25 3.75 4.25 4.75 5.0 5.25 &
      5.75 6.25 6.75 7.5 9. 11. 13. 15.
df0 3.96E-6 5.82E-7 2.9E-7 2.58E-7 2.83E-7 3.79E-7 5.01E-7 6.31E-7 &
      7.59E-7 8.78E-7 9.85E-7 1.08E-6 1.17E-6 1.27E-6 1.36E-6 1.44E-6 &
      1.52E-6 1.68E-6 1.98E-6 2.51E-6 2.99E-6 3.42E-6 3.82E-6 4.01E-6 &
      4.41E-6 4.83E-6 5.23E-6 5.6E-6 5.8E-6 6.01E-6 6.37E-6 6.74E-6 &
      7.11E-6 7.66E-6 8.77E-6 1.03E-5 1.18E-5 1.33E-5
prdmp 2j 1

```

Appendix C Python Scripts

The Python scripts used to extract data from the MCNP output files are listed in Table C-1.

Sample listings are provided below for files marked with an asterisk (*).

Table C-1. Python Scripts

File Name	Description
mctal_reader_ver01.py*	Python script to read an MCNP MCTAL file and create a dictionary containing the tally data for surface tallies.
mctal_reader_ver02.py*	Python script to read an MCNP MCTAL file and create a dictionary containing the tally data for point detector tallies.
neutpuo_tally_212.py	Python script to read an MCNP MCTAL file and extract data for surface tally 212, neutron top and bottom surfaces from MCNP case neutpuo.
neutpuo_tally_222.py*	Python script to read an MCNP MCTAL file and extract data for surface tally 222, neutron side surface from MCNP case neutpuo.
neutpuo_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, secondary photon top and bottom surfaces from MCNP case neutpuo.
neutpuo_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, secondary photon side surface from MCNP case neutpuo.
neut_tally_212.py	Python script to read an MCNP MCTAL file and extract data for surface tally 212, neutron top and bottom surfaces from MCNP case neut.
neut_tally_222.py	Python script to read an MCNP MCTAL file and extract data for surface tally 222, neutron side surface from MCNP case neut.
neut_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, secondary photon top and bottom surfaces from MCNP case neut.
neut_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, secondary photon side surface from MCNP case neut.
photfe_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, photon top and bottom surfaces from MCNP case photfe.
photfe_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, photon side surface from MCNP case photfe.
phot_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, photon top and bottom surfaces from MCNP case phot.
phot_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, photon side surface from MCNP case phot.
photfept_15.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 15, photon side surface from MCNP case photfept.
photfept_5.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 5, photon top and bottom surfaces from MCNP case photfept.
photpt_15.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 15, photon side surface from MCNP case photpt.
photpt_5.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 5, photon top and bottom surfaces from MCNP case photpt.
sc1_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, photon top and bottom surfaces from MCNP case sc1.
sc1_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, photon side surface from MCNP case sc1.
sc1pt_15.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 15, photon side surface from MCNP case sc1pt.
sc1pt_5.py*	Python script to read an MCNP MCTAL file and extract data for point detector tally 5, photon top and bottom surfaces from MCNP case sc1pt.

File Name	Description
sc2n_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, secondary photon top and bottom surfaces from MCNP case sc2n.
sc2n_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, secondary photon side surface from MCNP case sc2n.
sc2n_tally_212.py	Python script to read an MCNP MCTAL file and extract data for surface tally 212, neutron top and bottom surfaces from MCNP case sc2n.
sc2n_tally_222.py	Python script to read an MCNP MCTAL file and extract data for surface tally 222, neutron side surface from MCNP case sc2n.
sc2_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, photon top and bottom surfaces from MCNP case sc2p.
sc2_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, photon side surface from MCNP case sc2p.
sc2ppt_15.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 15, photon side surface from MCNP case sc2ppt.
sc2ppt_5.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 5, photon top and bottom surfaces from MCNP case sc2ppt.
sc3_tally_112.py	Python script to read an MCNP MCTAL file and extract data for surface tally 112, photon top and bottom surfaces from MCNP case sc3.
sc3_tally_122.py	Python script to read an MCNP MCTAL file and extract data for surface tally 122, photon side surface from MCNP case sc3.
sc3pt_15.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 15, photon side surface from MCNP case sc3pt.
sc3pt_5.py	Python script to read an MCNP MCTAL file and extract data for point detector tally 5, photon top and bottom surfaces from MCNP case sc3pt.

Python Script mctal_reader_ver01.py

```

#
#####
#
# Python script to read an MCNP mctal file and create a dictionary containing
# the tally data. This is not a 'fully-functional' mctal parser. It is only
# set up to handle tallies with cell/surface bins and segmenting surfaces.
# There is some coding included that recognizes the presence of other types
# of bins (e.g., energy), but the dictionary that is returned has only been
# tested and used with tallies that have surface bins and segmenting surfaces.
# The structure of the MCNP mctal file is described on pages B-25 through B-28
# of the MCNP manual.
#
# Version 0.1 (Developmental)
#
# 2010/12/22
#
# J. M. Risner
# Oak Ridge National Laboratory
# Reactor and Nuclear Systems Division / Radiation Transport
#
#####

# The arguments passed to this procedure are the name of the MCNP mctal file
# and the number of the tally for which the data will be extracted.

def get_tally( mctal_file, requested_tally ) :

    mc = open( mctal_file, 'r' )

    num_tallies_read = 0 ; tally_nums = []

    first_line = mc.readline() # code name, version, etc. are on the first line
    id_line = mc.readline() # the problem id line from the input file
    ntal_line = mc.readline().split()
    ntal = int( ntal_line[1] ) # number of tallies in the problem

    while ( num_tallies_read < ntal ) :
        tally_numbers = mc.readline().split()
        tally_nums.extend(tally_numbers)
        num_tallies_read += len(tally_numbers)

    for i in range( 0, len(tally_nums) ) :

        line_1 = mc.readline().split()
        tally_number = int( line_1[1] )
        particle_type = int( line_1[2] )
        tally_type = int( line_1[3] )

        next_line = mc.readline()

        if ( next_line.startswith(' ') ) : # possible FC card line
            tally_title = next_line
            num_f_bins = int( mc.readline().split()[1] )
            f_bin_numbers = []
        else :
            num_f_bins = int( next_line.split()[1] )
            f_bin_numbers = []

        if ( num_f_bins != 0 and tally_type == 0 ) :
            num_bins_read = 0
            while ( num_bins_read < num_f_bins ) :
                bin_vals = mc.readline().split()
                f_bin_numbers.extend(bin_vals)
                num_bins_read += len(bin_vals)

        num_d_bins = int( mc.readline().split()[1] )
        num_u_bins = int( mc.readline().split()[1] )
        num_s_bins = int( mc.readline().split()[1] )

```

```

num_m_bins = int( mc.readline().split()[1] )

num_c_bins = int( mc.readline().split()[1] )
if ( num_c_bins != 0 ) :
    num_bins_read = 0
    c_bin_numbers = []
    while ( num_bins_read < num_c_bins ) :
        bin_vals = mc.readline().split()
        c_bin_numbers.extend(bin_vals)
        num_bins_read += len(bin_vals)

e_bin_line = mc.readline()
num_e_bins = int( e_bin_line.split()[1] )
if ( num_e_bins != 0 ) :
    num_bins_read = 0
    e_bin_bndys = []
    if ( e_bin_line.split()[0] == 'et' ) :
        num_e_bndys = num_e_bins - 1
    else :
        num_e_bndys = num_e_bins
    while ( num_bins_read < num_e_bndys ) :
        bin_vals = mc.readline().split()
        e_bin_bndys.extend(bin_vals)
        num_bins_read += len(bin_vals)

num_t_bins = int( mc.readline().split()[1] )

if ( num_t_bins != 0 ) :
    num_bins_read = 0
    t_bin_numbers = []
    while ( num_bins_read < num_t_bins ) :
        bin_vals = mc.readline().split()
        t_bin_numbers.extend(bin_vals)
        num_bins_read += len(bin_vals)

val_header_1 = mc.readline()
val_header = val_header_1[0:(len(val_header_1) - 1)]

if ( val_header != 'vals' ) :
    print
    print "ERROR: Expecting to read the line 'vals', but found " + '\n' + \
    val_header
    exit(-1)

num_tally_vals = int(num_f_bins) * 2
num_tally_vals = int(num_f_bins) * 2 * max( [1, int( num_e_bins ) ] )

num_tally_vals = max( [ 1, int(num_t_bins) ] ) * \
    max( [ 1, int(num_e_bins) ] ) * \
    max( [ 1, int(num_c_bins) ] ) * \
    max( [ 1, int(num_s_bins) ] ) * \
    max( [ 1, int(num_m_bins) ] ) * \
    max( [ 1, int(num_u_bins) ] ) * \
    max( [ 1, int(num_d_bins) ] ) * \
    max( [ 1, int(num_f_bins) ] )

num_vals_read = 0
tally_value = []
error_value = []

while ( num_vals_read < (2 * num_tally_vals) ) :
    tally_vals = mc.readline().split()
    for i in range(0, len(tally_vals), 2) :
        tally_value.append( tally_vals[i] )
        error_value.append( tally_vals[i+1] )
    num_vals_read += len(tally_vals)

tally_values = map( float, tally_value )
error_values = map( float, error_value )

```

```

tfc_line = mc.readline()
if ( not tfc_line.startswith('tfc ') ) :
    print
    print "ERROR:  Expecting to read a 'tfc' line, but found " + '\n' + \
    tfc_line
    exit(-1)
else :
    num_tfc_sets = int( tfc_line.split()[1] )
    for i in range( 0, num_tfc_sets ) :
        tfc_vals = mc.readline()

if ( int( tally_number ) == int( requested_tally ) ) :

    if ( num_f_bins == 1 ) :
        tally_vals_2 = tally_values
        error_vals_2 = error_values
    else :
        start_loc = 0
        stop_loc = num_s_bins
        bin_number = str( f_bin_numbers[0] )
        tally_vals_2 = { bin_number : tally_values[0:2] }
        error_vals_2 = { bin_number : error_values[0:2] }

        for k in range( num_f_bins - 1 ) :
            start_loc += num_s_bins
            stop_loc += num_s_bins
            bin_number = str( f_bin_numbers[k+1] )
            new_tally = { bin_number : tally_values[start_loc : stop_loc] }
            new_error = { bin_number : error_values[start_loc : stop_loc] }

            tally_vals_2.update(new_tally)
            error_vals_2.update(new_error)

    tally_data = {
        'particle_type'      : particle_type,
        'num_t_bins'         : num_t_bins,
        'num_e_bins'         : num_e_bins,
        'num_c_bins'         : num_c_bins,
        'num_s_bins'         : num_s_bins,
        'num_m_bins'         : num_m_bins,
        'num_u_bins'         : num_u_bins,
        'num_d_bins'         : num_d_bins,
        'num_f_bins'         : num_f_bins,
        'bin_cell_numbers'   : f_bin_numbers,
        'tally_values'       : tally_vals_2,
        'sigma_values'       : error_vals_2,
    }

    return tally_data

```

Python Script mctal_reader_ver02.py

```

#
#####
#
# Python script to read an MCNP mctal file and create a dictionary containing
# the tally data.  This is not a 'fully-functional' mctal parser.  It is only
# set up to handle tallies with cell/surface bins and segmenting surfaces.
# There is some coding included that recognizes the presence of other types
# of bins (e.g., energy), but the dictionary that is returned has only been
# tested and used with tallies that have surface bins and segmenting surfaces.
# The structure of the MCNP mctal file is described on pages B-25 through B-28
# of the MCNP manual.
#
# Version 0.2  (Developmental)
#
# Revision Log:

```

```

#
# Version 0.1:
#   2010/12/22   Original
#
# Version 0.2:
#   2011/01/20   Revised to process point detector and ring detector tallies.
#                 In the mctal file, these are designated on the 'tally'
#                 line by the 'j' parameter, which is 0 for a nondetector,
#                 1 for a point detector, and 2 for a ring detector.
#                 Version 0.2 was tested with point and ring detectors.
#                 The point detectors in the test mctal files had 4 detector
#                 bins. Note that detectors by default have 2 'D' bins,
#                 corresponding to the total and uncollided responses.
#
#####
#!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
#
# NOTE: This is developmental software, and must be verified by the end user
#       for their application.
#
#!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
#
# J. M. Risner
# Oak Ridge National Laboratory
# Reactor and Nuclear Systems Division / Radiation Transport
#
#####

# The arguments passed to this procedure are the name of the MCNP mctal file
# and the number of the tally for which the data will be extracted.

def get_tally( mctal_file, requested_tally ) :

    mc = open( mctal_file, 'r' )

    num_tallies_read = 0 ; tally_nums = []

    first_line = mc.readline() # code name, version, etc. are on the first line
    id_line     = mc.readline() # the problem id line from the input file
    ntal_line   = mc.readline().split()
    ntal        = int( ntal_line[1] ) # number of tallies in the problem

    while ( num_tallies_read < ntal ) :
        tally_numbers = mc.readline().split()
        tally_nums.extend(tally_numbers)
        num_tallies_read += len(tally_numbers)

    for i in range( 0, len(tally_nums) ) :

        line_1 = mc.readline().split()
        tally_number = int( line_1[1] )
        particle_type = int( line_1[2] )
        tally_type    = int( line_1[3] )

        next_line = mc.readline()

        if ( next_line.startswith(' ') ) : # possible FC card line
            tally_title = next_line
            num_f_bins = int( mc.readline().split()[1] )
            f_bin_numbers = []
        else :
            num_f_bins = int( next_line.split()[1] )
            f_bin_numbers = []

        if ( num_f_bins != 0 ) :

            if ( tally_type == 1 or tally_type == 2 ) :
                f_bin_numbers = [ ]
                for i_bin in range( num_f_bins ) :
                    f_bin_numbers.append(i_bin + 1 )

```

```

else :
    num_bins_read = 0
    while ( num_bins_read < num_f_bins ) :
        bin_vals = mc.readline().split()
        f_bin_numbers.extend(bin_vals)
        num_bins_read += len(bin_vals)

num_d_bins = int( mc.readline().split()[1] )
num_u_bins = int( mc.readline().split()[1] )
num_s_bins = int( mc.readline().split()[1] )
num_m_bins = int( mc.readline().split()[1] )

num_c_bins = int( mc.readline().split()[1] )
if ( num_c_bins != 0 ) :
    num_bins_read = 0
    c_bin_numbers = []
    while ( num_bins_read < num_c_bins ) :
        bin_vals = mc.readline().split()
        c_bin_numbers.extend(bin_vals)
        num_bins_read += len(bin_vals)

e_bin_line = mc.readline()
num_e_bins = int( e_bin_line.split()[1] )
if ( num_e_bins != 0 ) :
    num_bins_read = 0
    e_bin_bndys = []
    if ( e_bin_line.split()[0] == 'et' ) :
        num_e_bndys = num_e_bins - 1
    else :
        num_e_bndys = num_e_bins
    while ( num_bins_read < num_e_bndys ) :
        bin_vals = mc.readline().split()
        e_bin_bndys.extend(bin_vals)
        num_bins_read += len(bin_vals)

num_t_bins = int( mc.readline().split()[1] )

if ( num_t_bins != 0 ) :
    num_bins_read = 0
    t_bin_numbers = []
    while ( num_bins_read < num_t_bins ) :
        bin_vals = mc.readline().split()
        t_bin_numbers.extend(bin_vals)
        num_bins_read += len(bin_vals)

val_header_1 = mc.readline()
val_header = val_header_1[0:(len(val_header_1) - 1)]

if ( val_header != 'vals' ) :
    print
    print "ERROR:  Expecting to read the line 'vals', but found " + '\n' + \
        val_header
    exit(-1)

num_tally_vals = int(num_f_bins) * 2
num_tally_vals = int(num_f_bins) * 2 * max( [1, int( num_e_bins ) ] )

num_tally_vals = max( [ 1, int(num_t_bins) ] ) * \
    max( [ 1, int(num_e_bins) ] ) * \
    max( [ 1, int(num_c_bins) ] ) * \
    max( [ 1, int(num_s_bins) ] ) * \
    max( [ 1, int(num_m_bins) ] ) * \
    max( [ 1, int(num_u_bins) ] ) * \
    max( [ 1, int(num_d_bins) ] ) * \
    max( [ 1, int(num_f_bins) ] )

num_vals_read = 0
tally_value = []
error_value = []

```

```

while ( num_vals_read < ( 2 * num_tally_vals ) ) :
    tally_vals = mc.readline().split()
    for i in range(0, len(tally_vals), 2) :
        tally_value.append( tally_vals[i] )
        error_value.append( tally_vals[i+1] )
    num_vals_read += len(tally_vals)

tally_values = map( float, tally_value )
error_values = map( float, error_value )

tfc_line = mc.readline()
if ( not tfc_line.startswith('tfc ') ) :
    print
    print "ERROR: Expecting to read a 'tfc' line, but found " + '\n' + \
    tfc_line
    exit(-1)
else :
    num_tfc_sets = int( tfc_line.split()[1] )
    for i in range( 0, num_tfc_sets ) :
        tfc_vals = mc.readline()

if ( int( tally_number ) == int( requested_tally ) ) :

#     if ( num_f_bins == 1 or tally_type == 1 ) :
#         if ( num_f_bins == 1 ) :
#             tally_vals_2 = tally_values
#             error_vals_2 = error_values
#         else :
#             start_loc = 0
#             if ( tally_type == 1 or tally_type == 2 ) :
#                 n_bins = num_d_bins
#             else :
#                 n_bins = num_s_bins

#             stop_loc = n_bins

#             bin_number = str( f_bin_numbers[0] )
#             tally_vals_2 = { bin_number : tally_values[ 0 : n_bins ] }
#             error_vals_2 = { bin_number : error_values[ 0 : n_bins ] }

#             for k in range( num_f_bins - 1 ) :

#                 start_loc += n_bins
#                 stop_loc += n_bins

#                 bin_number = str( f_bin_numbers[k+1] )
#                 new_tally = { bin_number : tally_values[start_loc : stop_loc] }
#                 new_error = { bin_number : error_values[start_loc : stop_loc] }

#                 tally_vals_2.update(new_tally)
#                 error_vals_2.update(new_error)

tally_data = {
    'particle_type' : particle_type,
    'num_t_bins' : num_t_bins,
    'num_e_bins' : num_e_bins,
    'num_c_bins' : num_c_bins,
    'num_s_bins' : num_s_bins,
    'num_m_bins' : num_m_bins,
    'num_u_bins' : num_u_bins,
    'num_d_bins' : num_d_bins,
    'num_f_bins' : num_f_bins,
    'bin_cell_numbers' : f_bin_numbers,
    'tally_values' : tally_vals_2,
    'sigma_values' : error_vals_2,
}

return tally_data

```

Python Script neutpuo_tally_222.py

```

#
#####
#
# Python script to read an MCNP mctal file and extract data for
# a specified tally.
#
# This script was developed for use in analyzing small gram quantity (SGQ)
# shipments in the 9977 shipping container.
#
# Version 0.1 (Developmental)
#
# 2010/12/22
#
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#
#####
#
# Import 'mctal_reader.py', which reads the mctal file
#
import mctal_reader_ver01 as mctal_reader

# Set the 'base name' format for the tally files. The group information
# is appended to the end of the 'base name'.

# Tally number 222 is a segmented surface tally with information for the
# side of the 9977 container. Neutrons
# The two bins in this tally are:
# '6' - the surface of the 9977
# '84' - one meter from the surface
#
# Each bin has three segments:
# 1) below the 'region of interest'
# 2) the 'region of interest'
# 3) above the 'region of interest'
# The second segment is the one being considered. If additional axial
# segments are added, the first and last segment numbers (see below)
# would be 2 and the next-to-last segment number.

# Note that the tally number and the bin numbers are string variables,
# while the first and last segment numbers are integers. If there is
# only a single segment to be evaluated, the 'first_segment' and
# 'last_segment' are set to that single value.

base_name = 'neutpuo'

n_tally_num = str(222)
num_neutron_groups = 47

# num_neutron_groups = 5

# Bin 6 is the surface of the container. Bin 84 is one meter off the surface.

bin_list = [ '6' ]

first_segment = 2 # first segment to extract
last_segment = 2 # last segment to extract

#
#####
#
# Extract the bins that have the on-surface tallies for
# the side of the 9977.

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for j_bin in range( len( bin_list ) ) :

    bin_name = bin_list[j_bin]

    for i_segment in range ( first_segment, last_segment + 1 ) :

        neutron_tally = []
        neutron_error = []

        neutron_file = base_name + '_tally_' + n_tally_num + \
                        '_bin_' + bin_name + '_segment_' + str(i_segment)

        n_file = open( neutron_file, 'w' )

        for i_neutron in range( 1, ( num_neutron_groups + 1 ) ) :

            tally_file = base_name + '.' + str( i_neutron + 100 ) + '.mct'
            com_str_g = "mctal_reader.get_tally( '" + tally_file + \
                        "', " + n_tally_num + " )"
            n_tally = eval( com_str_g )

            neutron_tally.append( n_tally['tally_values'][bin_name][i_segment - 1] )
            neutron_error.append( n_tally['sigma_values'][bin_name][i_segment - 1] )

# Write the neutron tally and error data to the 'neutron tally' file

j = 0
for i_g in range ( num_neutron_groups ) :
    j += 1
    n_file.write( '%14.6e' % neutron_tally[i_g] )
    n_file.write( '%8.4f' % neutron_error[i_g] )
    n_file.write( '\n' )

n_file.close

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Python Script sc1pt_5.py

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#
#####
#
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#####
#
# Import 'mctal_reader.py', which reads the mctal file
#
import mctal_reader_ver02 as mctal_reader

# Set the 'base name' format for the tally files. The group information
# is appended to the end of the 'base name'.
# Tally number 112 is a segmented surface tally with information for the
# bottom and top of the 9977 container. The four bins in this tally
# are:

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#      '1' - bottom surface
#      '3' - top surface
#      '2' - 1 meter below the bottom
#      '4' - 1 meter above the top
#
# Each bin has two segments. The first segment is a circular region
# with a radius of 5 cm. The second segment is 'outside' that circle.
# The first segment is the one of interest for this application.

# Note that the tally number and the bin numbers are string variables,
# while the first and last segment numbers are integers. If there is
# only a single segment to be evaluated, the 'first_segment' and
# 'last_segment' are set to that single value.

base_name = 'sclpt'

g_tally_num      = str(5)
num_gamma_groups = 48

bin_list          = [ '1', '3' ]

first_segment     = 1   # first segment to extract
last_segment      = 1   # last segment to extract

#
#####
#

# Extract the bins that have the on-surface tallies for
# the bottom and top of the 9977.

for j_bin in range( len( bin_list ) ) :

    bin_name = bin_list[j_bin]

    for i_segment in range ( first_segment, last_segment + 1 ) :

        gamma_tally = []
        gamma_error = []

        gamma_file = base_name + '_tally_' + g_tally_num + \
                      '_bin_' + bin_name + '_segment_' + str(i_segment)

        g_file      = open( gamma_file, 'w' )

        for i_gamma in range( 1, ( num_gamma_groups + 1 ) ) :

            tally_file = base_name + '.' + str( i_gamma + 100 ) + '.mct'
            com_str_g   = "mctal_reader.get_tally( '" + tally_file + \
                          "', " + g_tally_num + " )"
            g_tally      = eval( com_str_g )

            gamma_tally.append( g_tally['tally_values'][bin_name][i_segment - 1] )
            gamma_error.append( g_tally['sigma_values'][bin_name][i_segment - 1] )

# Write the gamma tally and error data to the 'gamma tally' file

j = 0
for i_g in range ( num_gamma_groups ) :
    j += 1
    g_file.write( '%14.6e' % gamma_tally[i_g] )
    g_file.write( '%8.4f' % gamma_error[i_g] )
    g_file.write( '\n' )

g_file.close

```

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