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TO: Environmental Dosimetry Group Files, 999-W

FROM: M.G. Laird and G.T. Jannik, 999-W

TECHNICAL REVIEW B. H. Stagich, 999-W

Updated External Exposure Dose Coefficients

In 2018, the Environmental Protection Agency (EPA) updated and expanded the Federal Guidance Report (FGR) No. 12 to No. 15; tabulating age-specific external exposure effective dose rate coefficients for 1,252 radionuclides in the air, water, and soil (EPA 2018). However, the EPA discovered errors in the tables of dose coefficients for soil which led to the report being retracted for correction. This led to the adoption of "a uniform method of data-smoothing and extrapolation of monoenergetic organ doses at low energies across all exposure pathways; the originally-published dose coefficients utilized different methods for each media type" (EPA 2019). This resulted in all the external exposure dose coefficients being updated and FGR 15 being republished in August 2019 with corrected tables.

Previously, formulae were created for calculating reference person dose coefficients based on the initial FGR 15 dose coefficients published in June 2018 (Willey 2018). These formulae are specific to the Savannah River Site (SRS) to calculate for both U.S. and South Carolina/Georgia (SC/GA) reference persons. For this report, the corrected FGR 15 dose coefficients published in August 2019 were used with these formulae to update the external exposure dose coefficients for U.S. reference person for air submersion, water immersion, and ground shine for use in environmental dosimetry models at SRS. Also used, were the decay data from ICRP 107 (ICRP 2008) and the SRS-specific radionuclide progeny list documented in Minter (2016), with recent corrections that will be documented in the next revision of the Minter (2016) report.

Appendix A includes the updated external dose coefficients. For the radionuclides whose progeny needed to be considered, the ingrowth dose coefficient was calculated as a product of the source term added to ratios of relevant progenies dose coefficients. Equation 1 provides Cm-250 as an example

where 18% of Cm-250 decays into Pu-246 followed by 100% of Pu-246 decays into Am-246m, at which point 8% of Am-246m decays into Bk-250.

Equation 1. External Dose Coefficient (DC) for Water Immersion of Cm-250 Calculations

$$\mathrm{DC(Cm\text{-}250)} + 0.1800\left[\mathrm{DC(Pu\text{-}246)} + 1.000\left(\mathrm{DC(Am\text{-}246m)} + \left(0.0800\left(\mathrm{DC(Bk\text{-}250)}\right)\right)\right)\right] =$$

$$164\,\frac{\mathrm{mrem\ m^3}}{\mu\mathrm{Ci\ yr}} + 0.1800\left[1.23\,\frac{\mathrm{mrem\ m^3}}{\mu\mathrm{Ci\ yr}} + 1.000\left(11.5\,\frac{\mathrm{mrem\ m^3}}{\mu\mathrm{Ci\ yr}} + \left(0.0800\left(10.5\,\frac{\mathrm{mrem\ m^3}}{\mu\mathrm{Ci\ yr}}\right)\right)\right)\right] = 166\,\frac{\mathrm{mrem\ m^3}}{\mu\mathrm{Ci\ yr}}$$

Dose Models Using Updated External Dose Coefficients

Water immersion and ground shine dose coefficients are used in LADTAP XL© which is two EXCEL© spreadsheets (LADTAP and IRRIDOSE) used at SRS to estimate dose to offsite individuals and populations resulting from routine releases of radioactive materials to the Savannah River (Jannik and Minter 2017). Appendix B includes the dose coefficients for the radionuclides used in LADTAP XL© and compares the previously used Maximally Exposed Individual (FGR 12) dose coefficients to the updated Reference Person (FGR 15) dose coefficients which now account for decay chain series in the denoted radionuclides (Minter 2016). Inclusion of decay chain dose contributions caused the dose coefficients to increase significantly.

Air submersion and ground shine dose coefficients are used in MAXDOSE and POPDOSE to calculate dose to the offsite reference person and the surrounding SRS population following routine releases of atmospheric radioactivity (Jannik and Trimor 2017). Appendix C includes the dose coefficients for the radionuclides used in MAXDOSE and POPDOSE and compares the previously used Maximally Exposed Individual (FGR 12) dose coefficients to the updated Reference Person (FGR 15) dose coefficients which now account for progeny in the denoted radionuclides. MAXDOSE and POPDOSE also consider certain noble gases and these are included in Appendix C.

MAXINE is another EXCEL© dosimetry model used for estimating dose to exposed individuals following routine releases of radioactive materials to the atmosphere (Dixon 2020). Like MAXDOSE/POPDOSE, air submersion and ground shine dose coefficients are also used in MAXINE and are included in Appendix D.

Air submersion dose coefficients are used in VENTSAR, which is a dosimetry model used to analyze wake effects on contaminant concentrations on or near buildings from a release at a nearby location and calculate inhalation and plume shine doses (Laird and Dixon 2020). VENTSAR can be used to model all 1,252 nuclides included in ICRP 107 which are provided in Appendix A.

References:

EPA. Federal Guidance Report No. 15: External Exposure to Radionuclides in Air, Water and Soil. EPA 402-R-19-002. Oak Ridge National Laboratory. Oak Ridge, TN; 2019.

EPA. Federal Guidance Report No. 15: External Exposure to Radionuclides in Air, Water and Soil. EPA 402-R-18-001. Oak Ridge National Laboratory. Oak Ridge, TN; 2018.

ICRP. International Commission of Radiological Protection. Nuclear Decay Data for Dosimetric Calculations. ICRP Publication 107. Ann. ICRP 38 (3); 2008.

Dixon, K.L., Dose Factor Update for MAXINE Version 2020. SRNL-L3200-2020-00040. Savannah River National Laboratory. Aiken, SC; 2020.

Jannik, G. T. and Minter, K. M. LADTAP XL© Version 2013: A Spreadsheet for Estimating Dose Resulting from Aqueous Releases. SRNL-STI-2013-00697 Rev. 1. Savannah River National Laboratory. Aiken, SC; 2017.

Jannik, G. T. and Trimor, P. P. MAXDOSE-SR and POPDOSE-SR Routine-Release Atmospheric Dose Models Used at SRS. SRNL-STI-2013-00722 Rev. 1. Savannah River National Laboratory. Aiken, SC; 2017.

Laird, M. G. and Dixon, K. L. VENTSAR V3.0: A Python GUI for Estimating Contaminant Concentrations On or Near Buildings Due to Building Effects and Plume Rise and For Calculating Inhalation and Plume Shine Doses. SRNL-TR-2019-00191 Rev 0. Savannah River National Laboratory. Aiken, SC; 2020.

Minter, K. M. CAP88-PC V4: Atmospheric Dose Model used at the Savannah River Site to Demonstrate NESHAP Compliance. SRNL-STI-2016-00374 Rev. 0. Savannah River National Laboratory. Aiken, SC; 2016.

Willey, A. H. External Reference Person Dose Coefficients. SRNL-L3230-2018-00003. Savannah River National Laboratory. Aiken, SC; 2018.

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APPENDIX A

Table A.1. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
H-3	4.57E-03	1.07E-09	7.97E-05	Ar-43	9.47E+03	1.90E+01	1.33E+02
Be-7	2.63E+02	5.37E-01	3.84E+00	Ar-44	1.14E+04	2.39E+01	1.47E+02
Be-10	6.66E+01	1.78E-02	1.20E+00	K-38	1.89E+04	3.91E+01	2.51E+02
C-10	9.65E+03	1.94E+01	1.49E+02	K-40	1.08E+03	1.97E+00	2.08E+01
C-11	5.53E+03	1.11E+01	8.36E+01	K-42	2.29E+03	3.65E+00	4.50E+01
C-14	4.64E+00	3.32E-04	7.33E-02	K-43	5.21E+03	1.05E+01	7.65E+01
N-13	5.58E+03	1.11E+01	8.66E+01	K-44	1.47E+04	3.02E+01	1.92E+02
N-16	3.30E+04	6.55E+01	3.08E+02	K-45	1.11E+04	2.28E+01	1.48E+02
O-14	1.95E+04	4.09E+01	2.51E+02	K-46	1.85E+04	3.73E+01	2.34E+02
O-15	5.70E+03	1.12E+01	9.26E+01	Ca-41	0.00E+00	0.00E+00	0.00E+00
O-19	6.14E+03	1.13E+01	9.75E+01	Ca-45	1.11E+01	1.91E-03	1.57E-01
F-17	5.70E+03	1.12E+01	9.26E+01	Ca-47*	6.65E+03	1.38E+01	8.93E+01
F-18	5.31E+03	1.08E+01	7.76E+01	Ca-49	2.00E+04	4.25E+01	2.21E+02
Ne-19	5.81E+03	1.12E+01	9.70E+01	Sc-42m	2.39E+04	4.95E+01	3.35E+02
Ne-24	3.19E+03	5.98E+00	5.67E+01	Sc-43	5.35E+03	1.07E+01	8.23E+01
Na-22	1.21E+04	2.54E+01	1.65E+02	Sc-44	1.19E+04	2.46E+01	1.72E+02
Na-24	2.49E+04	5.31E+01	2.92E+02	Sc-44m*	1.32E+04	2.72E+01	1.90E+02
Mg-27	5.17E+03	1.04E+01	8.01E+01	Sc-46	1.12E+04	2.37E+01	1.50E+02
Mg-28*	1.86E+04	3.85E+01	2.49E+02	Sc-47	5.84E+02	1.07E+00	7.96E+00
Al-26	1.54E+04	3.22E+01	2.03E+02	Sc-48	1.89E+04	4.00E+01	2.49E+02
Al-28	1.10E+04	2.25E+01	1.49E+02	Sc-49	3.24E+02	1.05E-01	1.55E+01
Al-29	8.29E+03	1.70E+01	1.18E+02	Sc-50	1.89E+04	3.87E+01	2.64E+02
Si-31	2.15E+02	7.03E-02	1.08E+01	Ti-44*	1.24E+04	2.57E+01	1.81E+02
Si-32*	2.66E+02	7.47E-02	1.31E+01	Ti-45	4.73E+03	9.49E+00	7.26E+01
P-30	6.09E+03	1.13E+01	1.04E+02	Ti-51	2.28E+03	4.02E+00	4.34E+01
P-32	2.57E+02	7.34E-02	1.29E+01	Ti-52	8.92E+02	1.23E+00	2.22E+01
P-33	1.08E+01	1.82E-03	1.53E-01	V-47	5.60E+03	1.09E+01	9.20E+01
S-35	4.72E+00	3.90E-04	7.37E-02	V-48	1.62E+04	3.43E+01	2.18E+02
S-37	1.85E+04	3.93E+01	2.04E+02	V-49	0.00E+00	0.00E+00	0.00E+00
S-38*	1.96E+04	4.02E+01	2.52E+02	V-50	8.19E+03	1.75E+01	1.03E+02
Cl-34	6.50E+03	1.14E+01	1.13E+02	V-52	8.74E+03	1.78E+01	1.25E+02
Cl-34m*	1.54E+04	3.11E+01	2.08E+02	V-53	6.19E+03	1.24E+01	9.60E+01
Cl-36	7.70E+01	2.22E-02	2.21E+00	Cr-48	2.21E+03	4.36E+00	3.09E+01
Cl-38	9.36E+03	1.86E+01	1.26E+02	Cr-49	5.72E+03	1.13E+01	9.11E+01
Cl-39	8.55E+03	1.76E+01	1.21E+02	Cr-51	1.64E+02	3.30E-01	2.32E+00
Cl-40	2.54E+04	5.32E+01	3.02E+02	Cr-55	4.71E+02	1.48E-01	2.04E+01
Ar-37	7.15E-02[1]	0.00E+00	0.00E+00	Cr-56	5.24E+02	7.24E-01	1.58E+01
Ar-39	5.57E+01	1.47E-02	9.70E-01	Mn-50m	2.65E+04	5.46E+01	3.73E+02
Ar-41	7.44E+03	1.56E+01	1.01E+02	Mn-51	5.67E+03	1.10E+01	9.46E+01
Ar-42*	2.35E+03	3.66E+00	4.62E+01	Mn-52	1.93E+04	4.08E+01	2.57E+02

*Includes progeny ingrowth for FGR 15

[1]DOE-STD-1196-2011, Table A-3

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Mn-52m	1.38E+04	2.83E+01	2.00E+02	Zn-60	8.58E+03	1.68E+01	1.37E+02
Mn-53	0.00E+00	0.00E+00	0.00E+00	Zn-61	9.34E+03	1.77E+01	1.47E+02
Mn-54	4.57E+03	9.62E+00	6.30E+01	Zn-62*	8.22E+03	1.59E+01	1.34E+02
Mn-56	9.98E+03	2.06E+01	1.37E+02	Zn-63	6.23E+03	1.21E+01	1.01E+02
Mn-57	9.79E+02	1.20E+00	2.72E+01	Zn-65	3.24E+03	6.88E+00	4.29E+01
Mn-58m	1.43E+04	2.88E+01	2.05E+02	Zn-69	9.50E+01	2.61E-02	3.58E+00
Fe-52*	1.78E+04	3.62E+01	2.58E+02	Zn-69m*	2.28E+03	4.48E+00	3.55E+01
Fe-53	6.72E+03	1.29E+01	1.11E+02	Zn-71	2.14E+03	3.66E+00	4.31E+01
Fe-53m	1.72E+04	3.64E+01	2.25E+02	Zn-71m	8.52E+03	1.72E+01	1.28E+02
Fe-55	7.93E-07	1.50E-09	1.08E-08	Zn-72*	1.64E+04	3.45E+01	2.13E+02
Fe-59	6.71E+03	1.43E+01	8.77E+01	Ga-64	2.03E+04	4.12E+01	2.71E+02
Fe-60*	3.02E+01	4.88E-02	4.45E-01	Ga-65	6.47E+03	1.26E+01	1.03E+02
Fe-61	8.30E+03	1.68E+01	1.22E+02	Ga-66	1.51E+04	3.13E+01	1.89E+02
Fe-62	3.00E+03	5.59E+00	5.46E+01	Ga-67	7.66E+02	1.51E+00	1.08E+01
Co-54m	2.28E+04	4.61E+01	3.27E+02	Ga-68	5.33E+03	1.04E+01	8.70E+01
Co-55	1.10E+04	2.28E+01	1.58E+02	Ga-70	2.75E+02	1.51E-01	1.24E+01
Co-56	2.10E+04	4.47E+01	2.63E+02	Ga-72	1.57E+04	3.31E+01	2.03E+02
Co-57	5.91E+02	1.12E+00	8.03E+00	Ga-73	1.94E+03	3.67E+00	3.21E+01
Co-58	5.30E+03	1.11E+01	7.40E+01	Ga-74	1.87E+04	3.91E+01	2.42E+02
Co-58m	5.81E-03	1.42E-05	8.17E-05	Ge-66	3.53E+03	7.17E+00	5.09E+01
Co-60	1.42E+04	3.03E+01	1.84E+02	Ge-67	8.17E+03	1.59E+01	1.28E+02
Co-60m	2.26E+01	4.79E-02	3.31E-01	Ge-68*	5.33E+03	1.04E+01	8.70E+01
Co-61	5.50E+02	9.23E-01	1.39E+01	Ge-69	5.25E+03	1.10E+01	7.30E+01
Co-62	1.00E+04	2.00E+01	1.43E+02	Ge-71	1.49E-02	4.71E-05	3.60E-08
Co-62m	1.58E+04	3.29E+01	2.16E+02	Ge-75	3.16E+02	3.98E-01	8.79E+00
Ni-56	9.32E+03	1.94E+01	1.28E+02	Ge-77	6.06E+03	1.20E+01	9.06E+01
Ni-57	1.10E+04	2.31E+01	1.43E+02	Ge-78	1.50E+03	2.87E+00	2.12E+01
Ni-59	8.25E-02	1.69E-04	1.20E-03	As-68	2.18E+04	4.40E+01	3.08E+02
Ni-63	5.56E-01	1.05E-06	9.56E-03	As-69	6.65E+03	1.28E+01	1.09E+02
Ni-65	3.41E+03	6.84E+00	5.15E+01	As-70	2.41E+04	5.01E+01	3.32E+02
Ni-66*	1.00E+03	1.29E+00	2.70E+01	As-71	3.05E+03	6.17E+00	4.36E+01
Cu-57	8.99E+03	1.35E+01	1.45E+02	As-72	1.01E+04	2.03E+01	1.54E+02
Cu-59	8.48E+03	1.63E+01	1.36E+02	As-73	1.51E+01	3.43E-02	2.77E-01
Cu-60	2.26E+04	4.72E+01	3.02E+02	As-74	4.13E+03	8.34E+00	6.20E+01
Cu-61	4.48E+03	9.03E+00	6.79E+01	As-76	2.72E+03	4.86E+00	5.09E+01
Cu-62	5.91E+03	1.11E+01	1.01E+02	As-77	1.02E+02	1.02E-01	1.95E+00
Cu-64	1.01E+03	2.02E+00	1.48E+01	As-78	7.92E+03	1.57E+01	1.18E+02
Cu-66	9.95E+02	1.29E+00	2.68E+01	As-79*	5.70E+02	5.54E-01	1.95E+01
Cu-67	5.96E+02	1.11E+00	8.20E+00	Se-70	3.77E+03	7.59E+00	5.66E+01
Cu-69	3.28E+03	6.30E+00	5.56E+01	Se-71	9.30E+03	1.81E+01	1.46E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Se-72*	1.02E+04	2.04E+01	1.55E+02	Kr-87	5.19E+03	9.85E+00	7.90E+01
Se-73	5.78E+03	1.16E+01	8.88E+01	Kr-88*	1.65E+04	3.30E+01	2.20E+02
Se-73m	1.44E+03	2.85E+00	2.27E+01	Kr-89	1.19E+04	2.40E+01	1.60E+02
Se-75	1.95E+03	3.85E+00	2.69E+01	Rb-77	9.03E+03	1.72E+01	1.45E+02
Se-77m	4.37E+02	8.46E-01	5.86E+00	Rb-78	2.47E+04	5.11E+01	3.06E+02
Se-79	5.19E+00	3.88E-04	8.15E-02	Rb-78m	1.86E+04	3.77E+01	2.64E+02
Se-79m	4.13E+01	7.89E-02	5.87E-01	Rb-79	8.00E+03	1.59E+01	1.24E+02
Se-81	2.61E+02	1.49E-01	1.16E+01	Rb-80	7.41E+03	1.34E+01	1.25E+02
Se-81m*	3.26E+02	2.71E-01	1.25E+01	Rb-81*	3.34E+03	6.72E+00	4.87E+01
Se-83	1.48E+04	3.09E+01	1.99E+02	Rb-81m	1.26E+02	2.59E-01	1.87E+00
Se-83m	6.11E+03	1.19E+01	9.46E+01	Rb-82	6.56E+03	1.23E+01	1.10E+02
Se-84	2.39E+03	4.52E+00	4.15E+01	Rb-82m	1.60E+04	3.36E+01	2.20E+02
Br-72	1.82E+04	3.49E+01	2.66E+02	Rb-83*	2.57E+03	5.29E+00	3.74E+01
Br-73	8.20E+03	1.59E+01	1.33E+02	Rb-84	4.97E+03	1.03E+01	7.08E+01
Br-74	2.76E+04	5.79E+01	3.38E+02	Rb-84m	1.98E+03	3.96E+00	2.78E+01
Br-74m	2.42E+04	5.00E+01	3.21E+02	Rb-86	7.68E+02	1.18E+00	1.90E+01
Br-75	6.52E+03	1.29E+01	1.00E+02	Rb-86m	2.91E+03	5.99E+00	4.22E+01
Br-76	1.62E+04	3.36E+01	2.13E+02	Rb-87	2.08E+01	4.50E-03	2.79E-01
Br-76m	1.03E+02	2.24E-01	1.77E+00	Rb-88	4.89E+03	8.35E+00	7.90E+01
Br-77	1.67E+03	3.39E+00	2.35E+01	Rb-89	1.33E+04	2.76E+01	1.78E+02
Br-77m	7.03E+01	1.32E-01	9.52E-01	Rb-90	1.37E+04	2.73E+01	1.65E+02
Br-78	5.92E+03	1.14E+01	9.88E+01	Rb-90m	1.99E+04	4.12E+01	2.49E+02
Br-80	6.84E+02	9.18E-01	1.93E+01	Sr-79	7.11E+03	1.29E+01	1.20E+02
Br-80m*	7.08E+02	9.73E-01	1.97E+01	Sr-80*	9.71E+03	1.80E+01	1.58E+02
Br-82	1.46E+04	3.05E+01	2.00E+02	Sr-81	7.76E+03	1.52E+01	1.23E+02
Br-82m	2.94E+01	3.71E-02	7.57E-01	Sr-82*	6.56E+03	1.23E+01	1.10E+02
Br-83*	1.33E+02	1.02E-01	4.28E+00	Sr-83	4.44E+03	9.16E+00	6.34E+01
Br-84	1.10E+04	2.24E+01	1.43E+02	Sr-85	2.61E+03	5.35E+00	3.80E+01
Br-84m	1.59E+04	3.28E+01	2.21E+02	Sr-85m	1.10E+03	2.18E+00	1.50E+01
Br-85	8.02E+02	9.05E-01	2.40E+01	Sr-87m	1.67E+03	3.38E+00	2.40E+01
Kr-74	5.73E+03	1.13E+01	9.05E+01	Sr-89	2.09E+02	6.00E-02	1.05E+01
Kr-75	7.51E+03	1.41E+01	1.23E+02	Sr-90*	4.28E+02	1.25E-01	1.80E+01
Kr-76	2.16E+03	4.36E+00	3.06E+01	Sr-91*	5.78E+03	1.17E+01	8.82E+01
Kr-77	5.70E+03	1.11E+01	9.09E+01	Sr-92	7.67E+03	1.63E+01	9.87E+01
Kr-79	1.32E+03	2.69E+00	1.87E+01	Sr-93	1.30E+04	2.68E+01	1.80E+02
Kr-81	4.57E+00	9.42E-03	5.83E-02	Sr-94	8.49E+03	1.76E+01	1.19E+02
Kr-81m	6.54E+02	1.28E+00	8.84E+00	Y-81	7.10E+03	1.28E+01	1.20E+02
Kr-83m	1.52E-01	4.30E-04	3.66E-04	Y-83	7.79E+03	1.50E+01	1.25E+02
Kr-85	7.99E+01	4.25E-02	1.97E+00	Y-83m	4.74E+03	9.06E+00	7.73E+01
Kr-85m	8.57E+02	1.57E+00	1.31E+01	Y-84m	2.24E+04	4.60E+01	3.21E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Y-85*	7.02E+03	1.40E+01	1.07E+02	Nb-96	1.35E+04	2.83E+01	1.87E+02
Y-85m*	7.58E+03	1.54E+01	1.10E+02	Nb-97	3.74E+03	7.50E+00	5.85E+01
Y-86	2.01E+04	4.23E+01	2.68E+02	Nb-98m	1.60E+04	3.32E+01	2.23E+02
Y-86m	1.13E+03	2.23E+00	1.53E+01	Nb-99	1.48E+03	1.77E+00	3.66E+01
Y-87*	3.99E+03	8.11E+00	5.77E+01	Nb-99m*	5.13E+03	9.66E+00	7.76E+01
Y-87m	1.61E+03	3.23E+00	2.30E+01	Mo-89	7.57E+03	1.38E+01	1.25E+02
Y-88	1.55E+04	3.30E+01	1.94E+02	Mo-90	4.37E+03	8.82E+00	6.18E+01
Y-89m	4.96E+03	1.05E+01	6.78E+01	Mo-91	5.87E+03	1.09E+01	1.01E+02
Y-90	3.80E+02	1.12E-01	1.73E+01	Mo-91m	7.87E+03	1.61E+01	1.14E+02
Y-90m	3.32E+03	6.69E+00	4.76E+01	Mo-93*	2.13E+00	5.81E-03	1.02E-02
Y-91	2.34E+02	9.91E-02	1.11E+01	Mo-93m	1.30E+04	2.75E+01	1.70E+02
Y-91m	2.81E+03	5.79E+00	4.11E+01	Mo-99*	1.46E+03	2.73E+00	2.43E+01
Y-92	2.09E+03	3.18E+00	4.36E+01	Mo-101*	1.03E+04	2.11E+01	1.48E+02
Y-93	1.06E+03	1.29E+00	2.79E+01	Mo-102*	1.66E+03	1.47E+00	4.41E+01
Y-94	5.26E+03	9.46E+00	8.75E+01	Tc-91	1.50E+04	3.00E+01	2.09E+02
Y-95	7.32E+03	1.44E+01	9.97E+01	Tc-91m*	1.63E+04	3.17E+01	2.52E+02
Zr-85	8.49E+03	1.64E+01	1.36E+02	Tc-92	2.20E+04	4.45E+01	3.13E+02
Zr-86*	2.15E+04	4.51E+01	2.87E+02	Tc-93	8.89E+03	1.89E+01	1.14E+02
Zr-87	5.28E+03	1.03E+01	8.65E+01	Tc-93m	5.54E+03	1.17E+01	6.65E+01
Zr-88	2.00E+03	4.04E+00	2.88E+01	Tc-94	1.45E+04	3.04E+01	2.01E+02
Zr-89	6.33E+03	1.32E+01	8.80E+01	Tc-94m	1.11E+04	2.27E+01	1.60E+02
Zr-89m	3.43E+03	7.12E+00	4.89E+01	Tc-95	4.28E+03	8.98E+00	5.95E+01
Zr-93*	9.79E-01	8.75E-04	1.29E-02	Tc-95m*	3.80E+03	7.86E+00	5.29E+01
Zr-95*	4.04E+03	8.43E+00	5.68E+01	Tc-96	1.36E+04	2.87E+01	1.88E+02
Zr-97*	8.80E+03	1.76E+01	1.38E+02	Tc-96m	2.31E+02	4.89E-01	3.11E+00
Nb-87	7.20E+03	1.32E+01	1.20E+02	Tc-97	2.30E+00	6.19E-03	1.43E-02
Nb-88	2.36E+04	4.83E+01	3.42E+02	Tc-97m	3.92E+00	8.81E-03	3.62E-02
Nb-88m	2.33E+04	4.76E+01	3.32E+02	Tc-98	7.67E+03	1.60E+01	1.08E+02
Nb-89	8.11E+03	1.61E+01	1.20E+02	Tc-99	1.75E+01	3.62E-03	2.36E-01
Nb-89m*	1.07E+04	2.14E+01	1.64E+02	Tc-99m	6.23E+02	1.20E+00	8.49E+00
Nb-90	2.45E+04	5.18E+01	3.06E+02	Tc-101	1.91E+03	3.56E+00	3.21E+01
Nb-91	1.00E+01	2.15E-02	1.29E-01	Tc-102	1.46E+03	1.26E+00	3.84E+01
Nb-91m	1.42E+02	3.03E-01	1.83E+00	Tc-102m*	1.43E+04	2.97E+01	1.96E+02
Nb-92	8.15E+03	1.71E+01	1.13E+02	Tc-104	1.37E+04	2.74E+01	1.88E+02
Nb-92m	5.30E+03	1.12E+01	7.18E+01	Tc-105	4.90E+03	9.19E+00	8.00E+01
Nb-93m	3.29E-01	8.96E-04	1.57E-03	Ru-92	1.14E+04	2.31E+01	1.63E+02
Nb-94	8.53E+03	1.79E+01	1.19E+02	Ru-94	2.71E+03	5.59E+00	3.80E+01
Nb-94m	2.60E+01	5.45E-02	3.71E-01	Ru-95	6.78E+03	1.42E+01	9.26E+01
Nb-95	4.16E+03	8.72E+00	5.82E+01	Ru-97	1.17E+03	2.31E+00	1.59E+01
Nb-95m	3.37E+02	6.46E-01	4.67E+00	Ru-103*	2.63E+03	5.38E+00	3.84E+01

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Ru-105	4.14E+03	8.34E+00	6.27E+01	Pd-112*	4.54E+03	8.39E+00	7.44E+01
Ru-106*	1.77E+03	2.50E+00	4.06E+01	Pd-114*	2.91E+03	3.73E+00	6.46E+01
Ru-107	2.35E+03	4.09E+00	4.49E+01	Ag-99	1.33E+04	2.67E+01	1.94E+02
Ru-108*	3.07E+03	4.38E+00	6.66E+01	Ag-100m	1.66E+04	3.30E+01	2.43E+02
Rh-94	2.29E+04	4.50E+01	3.24E+02	Ag-101	8.82E+03	1.77E+01	1.33E+02
Rh-95	1.47E+04	3.03E+01	2.04E+02	Ag-102	1.94E+04	3.99E+01	2.68E+02
Rh-95m	5.14E+03	1.07E+01	6.75E+01	Ag-102m	1.17E+04	2.45E+01	1.49E+02
Rh-96	2.18E+04	4.53E+01	3.09E+02	Ag-103	4.56E+03	9.30E+00	6.50E+01
Rh-96m	7.37E+03	1.51E+01	1.04E+02	Ag-104	1.48E+04	3.12E+01	2.03E+02
Rh-97	8.01E+03	1.62E+01	1.18E+02	Ag-104m	1.03E+04	2.10E+01	1.47E+02
Rh-97m*	1.31E+04	2.77E+01	1.65E+02	Ag-105	2.61E+03	5.33E+00	3.68E+01
Rh-98	1.04E+04	2.04E+01	1.61E+02	Ag-105m	5.22E+00	1.06E-02	7.30E-02
Rh-99	2.87E+03	5.88E+00	4.09E+01	Ag-106	3.87E+03	7.60E+00	6.29E+01
Rh-99m	3.44E+03	7.08E+00	4.79E+01	Ag-106m	1.53E+04	3.22E+01	2.09E+02
Rh-100	1.57E+04	3.32E+01	1.98E+02	Ag-108	3.17E+02	2.63E-01	1.24E+01
Rh-100m	2.35E+02	4.99E-01	3.30E+00	Ag-108m*	8.63E+03	1.78E+01	1.24E+02
Rh-101	1.38E+03	2.69E+00	1.88E+01	Ag-109m	1.66E+01	3.51E-02	2.44E-01
Rh-101m	1.43E+03	2.85E+00	1.99E+01	Ag-110	6.81E+02	5.00E-01	2.38E+01
Rh-102	2.71E+03	5.48E+00	4.07E+01	Ag-110m*	1.53E+04	3.21E+01	2.08E+02
Rh-102m	1.16E+04	2.43E+01	1.63E+02	Ag-111	2.45E+02	3.05E-01	6.48E+00
Rh-103m	5.42E-01	1.38E-03	5.84E-03	Ag-111m	1.95E+01	4.00E-02	2.80E-01
Rh-104	4.72E+02	2.56E-01	1.92E+01	Ag-112	4.53E+03	8.39E+00	7.42E+01
Rh-104m*	5.64E+02	4.60E-01	2.07E+01	Ag-113	6.73E+02	8.60E-01	1.94E+01
Rh-105	4.35E+02	8.10E-01	6.16E+00	Ag-113m	1.18E+03	2.28E+00	1.91E+01
Rh-106	1.77E+03	2.50E+00	4.06E+01	Ag-114	2.60E+03	3.43E+00	5.37E+01
Rh-106m	1.58E+04	3.29E+01	2.18E+02	Ag-115	3.20E+03	5.90E+00	5.39E+01
Rh-107	1.77E+03	3.31E+00	2.96E+01	Ag-116	1.33E+04	2.68E+01	1.82E+02
Rh-108	2.61E+03	3.74E+00	5.49E+01	Ag-117	8.17E+03	1.63E+01	1.13E+02
Rh-109	1.92E+03	3.19E+00	3.88E+01	Cd-101	1.43E+04	2.92E+01	2.00E+02
Pd-96*	1.52E+04	3.12E+01	2.15E+02	Cd-102	4.45E+03	9.17E+00	6.32E+01
Pd-97	1.36E+04	2.79E+01	1.87E+02	Cd-103	1.20E+04	2.53E+01	1.56E+02
Pd-98*	1.25E+04	2.47E+01	1.90E+02	Cd-104*	1.15E+04	2.34E+01	1.64E+02
Pd-99	7.13E+03	1.45E+01	1.03E+02	Cd-105*	7.37E+03	1.54E+01	9.82E+01
Pd-100*	1.61E+04	3.40E+01	2.04E+02	Cd-107	5.47E+01	1.15E-01	7.60E-01
Pd-101	1.76E+03	3.63E+00	2.46E+01	Cd-109	2.33E+01	5.17E-02	3.25E-01
Pd-103*	5.74E+00	1.45E-02	6.05E-02	Cd-111m	1.41E+03	2.78E+00	1.92E+01
Pd-107	9.16E-02	5.37E-08	1.59E-03	Cd-113	1.54E+01	3.14E-03	2.11E-01
Pd-109	1.31E+02	7.29E-02	5.01E+00	Cd-113m	4.48E+01	1.21E-02	7.49E-01
Pd-109m	5.40E+02	1.05E+00	7.26E+00	Cd-115*	1.93E+03	3.74E+00	3.01E+01
Pd-111*	6.13E+02	6.85E-01	1.95E+01	Cd-115m	4.00E+02	4.50E-01	1.33E+01

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Cd-117*	7.00E+03	1.42E+01	1.01E+02	Sn-113m	9.81E+00	2.35E-02	1.49E-01
Cd-117m*	1.18E+04	2.51E+01	1.50E+02	Sn-117m	7.21E+02	1.40E+00	9.71E+00
Cd-118*	1.45E+03	1.26E+00	3.76E+01	Sn-119m	8.83E+00	2.16E-02	1.27E-01
Cd-119	9.71E+03	2.00E+01	1.31E+02	Sn-121	2.21E+01	5.03E-03	2.92E-01
Cd-119m*	1.78E+04	3.70E+01	2.48E+02	Sn-121m*	2.67E+01	1.51E-02	3.65E-01
In-103	1.61E+04	3.24E+01	2.28E+02	Sn-123	2.19E+02	1.33E-01	9.54E+00
In-105	1.10E+04	2.21E+01	1.61E+02	Sn-123m	8.48E+02	1.40E+00	1.68E+01
In-106	1.98E+04	4.05E+01	2.88E+02	Sn-125	2.20E+03	4.07E+00	3.91E+01
In-106m	1.67E+04	3.37E+01	2.34E+02	Sn-125m	2.12E+03	3.73E+00	4.02E+01
In-107	8.63E+03	1.79E+01	1.17E+02	Sn-126*	8.74E+03	1.77E+01	1.33E+02
In-108	2.17E+04	4.55E+01	2.93E+02	Sn-127	1.09E+04	2.27E+01	1.47E+02
In-108m	1.63E+04	3.38E+01	2.08E+02	Sn-127m	3.54E+03	6.48E+00	6.36E+01
In-109	3.40E+03	7.04E+00	4.61E+01	Sn-128*	1.37E+04	2.77E+01	2.06E+02
In-109m	3.27E+03	6.79E+00	4.73E+01	Sn-129	6.10E+03	1.18E+01	9.81E+01
In-110	1.69E+04	3.54E+01	2.33E+02	Sn-130	5.02E+03	1.02E+01	7.48E+01
In-110m	8.84E+03	1.79E+01	1.30E+02	Sn-130m	5.47E+03	1.04E+01	8.88E+01
In-111	1.98E+03	3.90E+00	2.68E+01	Sb-111	8.53E+03	1.64E+01	1.36E+02
In-111m	2.50E+03	5.13E+00	3.69E+01	Sb-113	7.02E+03	1.39E+01	1.10E+02
In-112	1.47E+03	2.89E+00	2.35E+01	Sb-114	1.55E+04	3.17E+01	2.21E+02
In-112m*	1.59E+03	3.11E+00	2.50E+01	Sb-115	4.75E+03	9.60E+00	7.18E+01
In-113m	1.34E+03	2.71E+00	1.92E+01	Sb-116	1.30E+04	2.71E+01	1.77E+02
In-114	3.11E+02	1.13E-01	1.46E+01	Sb-116m	1.71E+04	3.60E+01	2.30E+02
In-114m*	6.86E+02	8.87E-01	1.94E+01	Sb-117	8.54E+02	1.68E+00	1.17E+01
In-115	3.37E+01	8.40E-03	4.62E-01	Sb-118	4.63E+03	8.85E+00	7.76E+01
In-115m	8.20E+02	1.63E+00	1.15E+01	Sb-118m	1.43E+04	3.04E+01	1.89E+02
In-116m	1.41E+04	2.98E+01	1.84E+02	Sb-119	1.44E+01	3.51E-02	2.12E-01
In-117	3.71E+03	7.43E+00	5.38E+01	Sb-120	2.46E+03	4.86E+00	3.98E+01
In-117m*	2.32E+03	4.42E+00	3.79E+01	Sb-120m	1.35E+04	2.86E+01	1.80E+02
In-118	1.41E+03	1.25E+00	3.71E+01	Sb-122	2.58E+03	4.97E+00	4.39E+01
In-118m	1.58E+04	3.30E+01	2.18E+02	Sb-122m	1.69E+02	3.91E-01	3.16E+00
In-119	4.38E+03	8.81E+00	6.89E+01	Sb-124	1.06E+04	2.22E+01	1.42E+02
In-119m*	1.03E+03	1.38E+00	2.71E+01	Sb-124m	2.39E+03	4.87E+00	3.55E+01
In-121	5.50E+03	1.09E+01	8.78E+01	Sb-124n*	2.39E+03	4.87E+00	3.55E+01
In-121m*	1.06E+03	9.56E-01	3.10E+01	Sb-125*	2.28E+03	4.64E+00	3.28E+01
Sn-106	6.45E+03	1.32E+01	9.10E+01	Sb-126	1.50E+04	3.09E+01	2.15E+02
Sn-108	3.50E+03	7.12E+00	4.94E+01	Sb-126m	8.54E+03	1.73E+01	1.30E+02
Sn-109*	1.34E+04	2.85E+01	1.73E+02	Sb-127*	3.87E+03	7.78E+00	5.77E+01
Sn-110*	1.03E+04	2.07E+01	1.50E+02	Sb-128	1.69E+04	3.50E+01	2.42E+02
Sn-111	2.68E+03	5.47E+00	3.95E+01	Sb-128m	1.07E+04	2.15E+01	1.61E+02
Sn-113*	1.38E+03	2.79E+00	1.97E+01	Sb-129*	8.62E+03	1.77E+01	1.25E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Sb-130	1.82E+04	3.75E+01	2.57E+02	I-129	3.28E+01	6.55E-02	5.60E-01
Sb-130m	1.53E+04	3.15E+01	2.21E+02	I-130	1.16E+04	2.39E+01	1.66E+02
Sb-131	1.19E+04	2.48E+01	1.62E+02	I-130m	6.27E+02	1.19E+00	1.08E+01
Sb-133	1.60E+04	3.36E+01	2.10E+02	I-131	2.04E+03	4.05E+00	2.93E+01
Te-113	1.32E+04	2.61E+01	1.93E+02	I-132	1.25E+04	2.60E+01	1.79E+02
Te-114*	2.26E+04	4.65E+01	3.15E+02	I-132m	1.81E+03	3.71E+00	2.63E+01
Te-115	1.27E+04	2.61E+01	1.82E+02	I-133	3.41E+03	6.82E+00	5.31E+01
Te-115m	1.48E+04	3.07E+01	2.05E+02	I-134	1.46E+04	3.03E+01	2.04E+02
Te-116*	1.34E+04	2.79E+01	1.83E+02	I-134m*	1.56E+04	3.24E+01	2.19E+02
Te-117	8.69E+03	1.82E+01	1.17E+02	I-135*	8.47E+04	1.99E+01	2.75E+02
Te-118*	4.65E+03	8.88E+00	7.78E+01	Xe-120	1.95E+03	4.04E+00	2.76E+01
Te-119	4.09E+03	8.52E+00	5.72E+01	Xe-121	8.43E+03	1.73E+01	1.16E+02
Te-119m	8.29E+03	1.75E+01	1.09E+02	Xe-122*	5.86E+03	1.12E+01	9.70E+01
Te-121	2.98E+03	6.15E+00	4.32E+01	Xe-123	3.43E+03	7.00E+00	4.87E+01
Te-121m*	3.70E+03	7.56E+00	5.26E+01	Xe-125	1.27E+03	2.54E+00	1.75E+01
Te-123	2.54E-02	6.10E-05	3.96E-04	Xe-127	1.32E+03	2.62E+00	1.83E+01
Te-123m	6.84E+02	1.33E+00	9.26E+00	Xe-127m	7.74E+02	1.49E+00	1.05E+01
Te-125m	3.31E+01	7.67E-02	5.25E-01	Xe-129m	9.89E+01	2.04E-01	1.41E+00
Te-127	8.41E+01	6.70E-02	1.76E+00	Xe-131m	3.85E+01	7.77E-02	5.19E-01
Te-127m*	9.44E+01	9.07E-02	1.93E+00	Xe-133	1.53E+02	2.99E-01	2.55E+00
Te-129	4.90E+02	6.88E-01	1.34E+01	Xe-133m	1.47E+02	2.88E-01	1.93E+00
Te-129m*	5.51E+02	8.04E-01	1.45E+01	Xe-135	1.36E+03	2.55E+00	2.08E+01
Te-131	2.48E+03	4.64E+00	4.31E+01	Xe-135m	2.25E+03	4.60E+00	3.37E+01
Te-131m*	8.55E+03	1.77E+01	1.18E+02	Xe-137	1.87E+03	2.39E+00	4.32E+01
Te-132*	1.36E+04	2.82E+01	1.94E+02	Xe-138	6.69E+03	1.37E+01	9.05E+01
Te-133	6.94E+03	1.40E+01	9.97E+01	Cs-121	7.10E+03	1.30E+01	1.18E+02
Te-133m*	1.16E+04	2.41E+01	1.60E+02	Cs-121m	6.90E+03	1.30E+01	1.11E+02
Te-134	4.62E+03	9.44E+00	6.55E+01	Cs-123	6.13E+03	1.19E+01	9.88E+01
I-118	1.20E+04	2.30E+01	1.86E+02	Cs-124	7.28E+03	1.31E+01	1.21E+02
I-118m	2.08E+04	4.24E+01	3.05E+02	Cs-125	4.11E+03	8.25E+00	6.31E+01
I-119	4.96E+03	9.77E+00	7.71E+01	Cs-126	6.78E+03	1.28E+01	1.11E+02
I-120	1.56E+04	3.20E+01	2.13E+02	Cs-127	2.19E+03	4.45E+00	3.14E+01
I-120m	1.97E+04	4.06E+01	2.80E+02	Cs-128	5.09E+03	9.79E+00	8.39E+01
I-121	2.01E+03	4.04E+00	2.86E+01	Cs-129	1.33E+03	2.69E+00	1.91E+01
I-122	5.61E+03	1.06E+01	9.34E+01	Cs-130	2.77E+03	5.43E+00	4.52E+01
I-123	7.70E+02	1.51E+00	1.05E+01	Cs-130m	2.11E+02	4.50E-01	3.43E+00
I-124	6.14E+03	1.27E+01	8.59E+01	Cs-131	2.35E+01	5.53E-02	4.04E-01
I-125	3.68E+01	8.74E-02	6.03E-01	Cs-132	3.75E+03	7.82E+00	5.35E+01
I-126	2.32E+03	4.71E+00	3.42E+01	Cs-134	8.46E+03	1.76E+01	1.19E+02
I-128	6.41E+02	8.00E-01	1.89E+01	Cs-134m	9.24E+01	1.79E-01	1.27E+00

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Cs-135	1.42E+01	2.73E-03	1.96E-01	Ce-130*	1.52E+04	3.07E+01	2.21E+02
Cs-135m	8.73E+03	1.84E+01	1.21E+02	Ce-131	9.02E+03	1.84E+01	1.31E+02
Cs-136	1.17E+04	2.46E+01	1.58E+02	Ce-132	1.28E+03	2.54E+00	1.78E+01
Cs-137*	3.08E+03	6.30E+00	4.50E+01	Ce-133	2.78E+03	5.48E+00	4.51E+01
Cs-138	1.41E+04	2.90E+01	1.93E+02	Ce-133m*	1.02E+04	2.14E+01	1.38E+02
Cs-138m	2.37E+03	4.76E+00	3.43E+01	Ce-134*	4.17E+03	7.99E+00	6.96E+01
Cs-139	2.59E+03	4.04E+00	4.96E+01	Ce-135	4.27E+03	8.80E+00	6.02E+01
Cs-140	1.14E+04	2.23E+01	1.57E+02	Ce-137	9.36E+01	2.01E-01	1.47E+00
Ba-124*	1.03E+04	1.93E+01	1.66E+02	Ce-137m*	3.16E+02	6.44E-01	4.49E+00
Ba-126*	9.81E+03	1.91E+01	1.52E+02	Ce-139	6.98E+02	1.38E+00	9.59E+00
Ba-127	4.08E+03	7.98E+00	6.51E+01	Ce-141	3.93E+02	7.08E-01	5.41E+00
Ba-128*	5.34E+03	1.03E+01	8.74E+01	Ce-143	1.50E+03	2.84E+00	2.54E+01
Ba-129	1.74E+03	3.52E+00	2.58E+01	Ce-144*	7.88E+02	6.74E-01	2.49E+01
Ba-129m	8.56E+03	1.79E+01	1.16E+02	Ce-145	4.50E+03	8.99E+00	7.12E+01
Ba-131*	2.39E+03	4.86E+00	3.43E+01	Pr-134	1.75E+04	3.55E+01	2.55E+02
Ba-131m	3.09E+02	5.88E-01	4.32E+00	Pr-134m	1.35E+04	2.68E+01	1.97E+02
Ba-133	1.89E+03	3.82E+00	2.73E+01	Pr-135	4.78E+03	9.44E+00	7.48E+01
Ba-133m	2.89E+02	5.70E-01	3.89E+00	Pr-136	1.21E+04	2.46E+01	1.73E+02
Ba-135m	2.49E+02	4.92E-01	3.35E+00	Pr-137	1.97E+03	3.95E+00	3.07E+01
Ba-137m	3.21E+03	6.66E+00	4.66E+01	Pr-138	4.86E+03	9.02E+00	8.28E+01
Ba-139	5.86E+02	5.53E-01	1.97E+01	Pr-138m	1.35E+04	2.82E+01	1.88E+02
Ba-140*	1.43E+04	2.98E+01	1.93E+02	Pr-139	6.10E+02	1.24E+00	9.25E+00
Ba-141	5.42E+03	1.06E+01	8.47E+01	Pr-140	3.08E+03	5.91E+00	5.17E+01
Ba-142	5.84E+03	1.20E+01	8.24E+01	Pr-142	6.57E+02	8.13E-01	1.90E+01
La-128	1.60E+04	3.21E+01	2.34E+02	Pr-142m	0.00E+00	0.00E+00	0.00E+00
La-129	5.07E+03	9.94E+00	7.99E+01	Pr-143	9.29E+01	2.54E-02	3.53E+00
La-130	1.27E+04	2.55E+01	1.86E+02	Pr-144	6.99E+02	5.15E-01	2.38E+01
La-131	3.46E+03	6.95E+00	5.15E+01	Pr-144m	2.67E+01	5.93E-02	4.38E-01
La-132	1.13E+04	2.33E+01	1.56E+02	Pr-145	3.51E+02	2.83E-01	1.38E+01
La-132m	3.52E+03	7.21E+00	5.02E+01	Pr-146	6.33E+03	1.22E+01	9.69E+01
La-133	7.61E+02	1.56E+00	1.13E+01	Pr-147	2.82E+03	5.30E+00	4.97E+01
La-134	4.13E+03	7.90E+00	6.89E+01	Pr-148	6.36E+03	1.19E+01	1.00E+02
La-135	8.55E+01	1.84E-01	1.34E+00	Pr-148m	5.81E+03	1.05E+01	9.80E+01
La-136	2.21E+03	4.35E+00	3.59E+01	Nd-134	2.79E+03	5.56E+00	4.14E+01
La-137	3.04E+01	7.06E-02	5.34E-01	Nd-135	7.02E+03	1.36E+01	1.11E+02
La-138	6.93E+03	1.47E+01	8.96E+01	Nd-136*	1.34E+04	2.73E+01	1.92E+02
La-140	1.33E+04	2.79E+01	1.77E+02	Nd-137	6.41E+03	1.32E+01	9.19E+01
La-141	5.62E+02	4.49E-01	2.02E+01	Nd-138*	4.98E+03	9.27E+00	8.46E+01
La-142	1.44E+04	3.00E+01	1.81E+02	Nd-139	2.38E+03	4.78E+00	3.66E+01
La-143	2.10E+03	3.39E+00	4.18E+01	Nd-139m*	8.90E+03	1.87E+01	1.22E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Nd-140*	3.12E+03	6.01E+00	5.25E+01	Sm-148*	0.00E+00	0.00E+00	0.00E+00
Nd-141	3.08E+02	6.45E-01	4.50E+00	Sm-151	7.56E-01	8.21E-06	1.29E-02
Nd-141m	3.77E+03	7.90E+00	5.39E+01	Sm-153	2.81E+02	4.60E-01	4.80E+00
Nd-144	0.00E+00	0.00E+00	0.00E+00	Sm-155	6.63E+02	9.54E-01	1.62E+01
Nd-147	7.17E+02	1.35E+00	1.15E+01	Sm-156	5.78E+02	1.07E+00	8.42E+00
Nd-149	2.03E+03	3.83E+00	3.37E+01	Sm-157	2.52E+03	4.54E+00	4.51E+01
Nd-151	4.83E+03	9.69E+00	7.24E+01	Eu-142	8.29E+03	1.39E+01	1.36E+02
Nd-152*	3.10E+03	5.19E+00	5.91E+01	Eu-142m	1.95E+04	3.92E+01	2.88E+02
Pm-136	1.58E+04	3.05E+01	2.41E+02	Eu-143	6.78E+03	1.29E+01	1.07E+02
Pm-137m	9.88E+03	1.95E+01	1.51E+02	Eu-144	7.07E+03	1.25E+01	1.17E+02
Pm-139	5.47E+03	1.04E+01	8.94E+01	Eu-145	7.08E+03	1.50E+01	9.33E+01
Pm-140	6.74E+03	1.19E+01	1.14E+02	Eu-146	1.31E+04	2.77E+01	1.79E+02
Pm-140m	1.69E+04	3.45E+01	2.46E+02	Eu-147	2.39E+03	5.00E+00	3.32E+01
Pm-141	4.18E+03	8.22E+00	6.62E+01	Eu-148	1.20E+04	2.50E+01	1.68E+02
Pm-142	5.18E+03	9.55E+00	8.79E+01	Eu-149	2.28E+02	4.75E-01	3.46E+00
Pm-143	1.60E+03	3.36E+00	2.27E+01	Eu-150	8.22E+03	1.70E+01	1.16E+02
Pm-144	8.28E+03	1.72E+01	1.19E+02	Eu-150m	3.47E+02	5.46E-01	7.47E+00
Pm-145	5.44E+01	1.24E-01	9.89E-01	Eu-152	6.42E+03	1.35E+01	8.65E+01
Pm-146	3.97E+03	8.20E+00	5.71E+01	Eu-152m	1.77E+03	3.40E+00	3.08E+01
Pm-147	7.66E+00	1.11E-03	1.12E-01	Eu-152n	2.88E+02	5.77E-01	4.44E+00
Pm-148	3.51E+03	6.90E+00	5.52E+01	Eu-154	6.93E+03	1.45E+01	9.43E+01
Pm-148m*	1.09E+04	2.25E+01	1.54E+02	Eu-154m	2.27E+02	4.75E-01	3.75E+00
Pm-149	1.74E+02	1.56E-01	5.73E+00	Eu-155	2.44E+02	4.77E-01	3.70E+00
Pm-150	8.53E+03	1.74E+01	1.22E+02	Eu-156	7.18E+03	1.50E+01	9.60E+01
Pm-151	1.75E+03	3.43E+00	2.65E+01	Eu-157	1.53E+03	2.94E+00	2.57E+01
Pm-152	2.17E+03	3.50E+00	4.38E+01	Eu-158	7.56E+03	1.55E+01	1.11E+02
Pm-152m	8.64E+03	1.75E+01	1.26E+02	Eu-159	1.79E+03	3.16E+00	3.64E+01
Pm-153	5.81E+02	7.29E-01	1.69E+01	Gd-142*	1.42E+04	2.57E+01	2.27E+02
Pm-154	1.06E+04	2.21E+01	1.43E+02	Gd-143m	1.20E+04	2.40E+01	1.77E+02
Pm-154m	1.04E+04	2.12E+01	1.47E+02	Gd-144*	1.23E+04	2.30E+01	1.94E+02
Sm-139	8.28E+03	1.61E+01	1.28E+02	Gd-145	1.41E+04	2.99E+01	1.78E+02
Sm-140*	9.77E+03	1.81E+01	1.58E+02	Gd-145m	3.70E+03	7.64E+00	5.44E+01
Sm-141	7.94E+03	1.60E+01	1.18E+02	Gd-146*	1.41E+04	2.97E+01	1.94E+02
Sm-141m*	1.49E+04	3.03E+01	2.17E+02	Gd-147	7.46E+03	1.55E+01	1.03E+02
Sm-142*	5.68E+03	1.06E+01	9.57E+01	Gd-148	0.00E+00	0.00E+00	0.00E+00
Sm-143	2.97E+03	5.74E+00	4.91E+01	Gd-149	2.64E+03	5.38E+00	3.72E+01
Sm-143m	3.71E+03	7.78E+00	5.32E+01	Gd-150	0.00E+00	0.00E+00	0.00E+00
Sm-145	1.22E+02	2.78E-01	2.23E+00	Gd-151	2.40E+02	4.92E-01	3.60E+00
Sm-146	0.00E+00	0.00E+00	0.00E+00	Gd-152	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	Gd-153	3.43E+02	6.89E-01	5.28E+00

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Gd-159	3.40E+02	5.36E-01	7.01E+00	Dy-165m	8.35E+01	1.65E-01	1.25E+00
Gd-162*	8.37E+03	1.69E+01	1.25E+02	Dy-166*	5.44E+02	6.62E-01	1.66E+01
Tb-146	2.14E+04	4.38E+01	2.87E+02	Dy-167	3.02E+03	5.74E+00	5.14E+01
Tb-147	1.22E+04	2.55E+01	1.65E+02	Dy-168*	7.18E+03	1.42E+01	1.14E+02
Tb-147m	1.09E+04	2.30E+01	1.44E+02	Ho-150	1.13E+04	2.14E+01	1.76E+02
Tb-148	1.35E+04	2.77E+01	1.89E+02	Ho-153	5.62E+03	1.12E+01	8.56E+01
Tb-148m	1.70E+04	3.53E+01	2.42E+02	Ho-153m	5.81E+03	1.14E+01	9.05E+01
Tb-149	7.47E+03	1.56E+01	9.97E+01	Ho-154	1.07E+04	2.12E+01	1.59E+02
Tb-149m	7.43E+03	1.54E+01	1.07E+02	Ho-154m	1.32E+04	2.66E+01	1.93E+02
Tb-150	1.40E+04	2.95E+01	1.79E+02	Ho-155	3.25E+03	6.60E+00	4.72E+01
Tb-150m	1.34E+04	2.77E+01	1.94E+02	Ho-156	1.18E+04	2.43E+01	1.64E+02
Tb-151	5.14E+03	1.06E+01	7.22E+01	Ho-157	2.89E+03	5.94E+00	4.13E+01
Tb-151m	3.74E+02	7.77E-01	5.44E+00	Ho-159	1.77E+03	3.59E+00	2.51E+01
Tb-152	8.35E+03	1.74E+01	1.12E+02	Ho-160	9.08E+03	1.91E+01	1.26E+02
Tb-152m	3.87E+03	7.90E+00	5.48E+01	Ho-161	1.37E+02	2.98E-01	2.34E+00
Tb-153	1.58E+03	3.24E+00	2.23E+01	Ho-162	7.60E+02	1.61E+00	1.10E+01
Tb-154	1.32E+04	2.80E+01	1.61E+02	Ho-162m*	3.39E+03	7.15E+00	4.62E+01
Tb-155	7.12E+02	1.43E+00	1.05E+01	Ho-163	0.00E+00	0.00E+00	0.00E+00
Tb-156	1.05E+04	2.22E+01	1.41E+02	Ho-164	1.10E+02	1.71E-01	2.69E+00
Tb-156m	9.13E+01	2.05E-01	1.66E+00	Ho-164m*	2.14E+02	4.07E-01	4.59E+00
Tb-156n	1.03E+01	2.19E-02	1.72E-01	Ho-166	3.89E+02	3.74E-01	1.40E+01
Tb-157	9.81E+00	2.20E-02	1.78E-01	Ho-166m	8.67E+03	1.79E+01	1.21E+02
Tb-158	4.29E+03	9.05E+00	5.89E+01	Ho-167	1.91E+03	3.77E+00	2.80E+01
Tb-160	6.22E+03	1.31E+01	8.45E+01	Ho-168	5.05E+03	1.01E+01	8.00E+01
Tb-161	1.18E+02	1.97E-01	1.99E+00	Ho-168m	1.48E+01	3.34E-02	2.71E-01
Tb-162	6.10E+03	1.24E+01	8.99E+01	Ho-170	9.52E+03	1.95E+01	1.39E+02
Tb-163	4.24E+03	8.44E+00	6.35E+01	Er-154	2.50E+02	5.25E-01	4.10E+00
Tb-164	1.37E+04	2.83E+01	1.94E+02	Er-156	1.81E+02	3.90E-01	3.00E+00
Tb-165*	5.15E+03	1.03E+01	7.80E+01	Er-159*	6.95E+03	1.44E+01	9.63E+01
Dy-148	3.75E+03	7.77E+00	5.40E+01	Er-161*	5.43E+03	1.15E+01	7.49E+01
Dy-149*	1.22E+04	2.56E+01	1.65E+02	Er-163	9.81E+01	2.20E-01	1.76E+00
Dy-150	1.38E+03	2.82E+00	2.02E+01	Er-165	8.91E+01	2.00E-01	1.62E+00
Dy-151*	7.62E+03	1.60E+01	1.03E+02	Er-167m	4.69E+02	9.23E-01	6.39E+00
Dy-152	1.37E+03	2.73E+00	1.91E+01	Er-169	1.75E+01	3.74E-03	2.35E-01
Dy-153	4.50E+03	9.43E+00	6.16E+01	Er-171	1.97E+03	3.75E+00	3.09E+01
Dy-154*	0.00E+00	0.00E+00	0.00E+00	Er-172	2.66E+03	5.43E+00	3.88E+01
Dy-155	3.50E+03	7.27E+00	4.74E+01	Er-173	4.59E+03	9.07E+00	7.12E+01
Dy-157	1.68E+03	3.39E+00	2.40E+01	Tm-161	6.98E+03	1.47E+01	9.34E+01
Dy-159	9.99E+01	2.25E-01	1.81E+00	Tm-162	1.10E+04	2.30E+01	1.47E+02
Dy-165	2.70E+02	3.00E-01	8.75E+00	Tm-163*	7.23E+03	1.53E+01	9.60E+01

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Tm-164	4.42E+03	8.78E+00	6.76E+01	Lu-178m	5.39E+03	1.07E+01	8.00E+01
Tm-165*	2.90E+03	5.98E+00	4.12E+01	Lu-179	3.15E+02	3.45E-01	1.01E+01
Tm-166	1.10E+04	2.35E+01	1.42E+02	Lu-180	8.59E+03	1.78E+01	1.21E+02
Tm-167	6.19E+02	1.26E+00	8.98E+00	Lu-181	3.27E+03	6.25E+00	5.61E+01
Tm-168	6.53E+03	1.36E+01	9.17E+01	Hf-167	3.38E+03	6.53E+00	5.47E+01
Tm-170	1.07E+02	5.38E-02	3.84E+00	Hf-169*	3.31E+03	6.72E+00	5.02E+01
Tm-171	2.89E+00	3.75E-03	5.19E-02	Hf-170	2.14E+03	4.38E+00	3.11E+01
Tm-172	2.85E+03	5.76E+00	4.26E+01	Hf-172*	3.17E+02	6.86E-01	5.39E+00
Tm-173	2.10E+03	4.11E+00	3.23E+01	Hf-173	1.87E+03	3.75E+00	2.66E+01
Tm-174	9.63E+03	1.97E+01	1.36E+02	Hf-174	0.00E+00	0.00E+00	0.00E+00
Tm-175	6.00E+03	1.23E+01	8.84E+01	Hf-175	1.70E+03	3.45E+00	2.47E+01
Tm-176	1.14E+04	2.35E+01	1.56E+02	Hf-177m	1.15E+04	2.31E+01	1.63E+02
Yb-162	1.16E+03	2.35E+00	1.67E+01	Hf-178m	1.15E+04	2.34E+01	1.66E+02
Yb-163	3.97E+03	8.15E+00	5.77E+01	Hf-179m	4.60E+03	9.28E+00	6.62E+01
Yb-164*	4.59E+03	9.15E+00	7.05E+01	Hf-180m	5.02E+03	1.01E+01	7.20E+01
Yb-165	1.59E+03	3.33E+00	2.36E+01	Hf-181	2.76E+03	5.55E+00	4.00E+01
Yb-166*	1.13E+04	2.40E+01	1.47E+02	Hf-182*	8.30E+03	1.74E+01	1.11E+02
Yb-167	1.07E+03	2.17E+00	1.59E+01	Hf-182m	4.72E+03	9.64E+00	6.72E+01
Yb-169	1.31E+03	2.69E+00	1.98E+01	Hf-183	4.24E+03	8.64E+00	6.46E+01
Yb-175	2.24E+02	4.04E-01	3.18E+00	Hf-184	1.22E+03	2.28E+00	1.96E+01
Yb-177	1.18E+03	2.22E+00	2.07E+01	Ta-170	6.42E+03	1.18E+01	1.05E+02
Yb-178*	1.22E+03	1.97E+00	2.61E+01	Ta-172	9.42E+03	1.95E+01	1.33E+02
Yb-179	5.41E+03	1.07E+01	8.62E+01	Ta-173	3.02E+03	6.32E+00	4.28E+01
Lu-165*	7.62E+03	1.57E+01	1.09E+02	Ta-174	5.39E+03	1.10E+01	7.70E+01
Lu-167*	1.05E+04	2.22E+01	1.38E+02	Ta-175	6.00E+03	1.27E+01	7.92E+01
Lu-169	7.18E+03	1.52E+01	9.47E+01	Ta-176	1.27E+04	2.71E+01	1.59E+02
Lu-169m	3.99E-03	1.24E-05	4.60E-06	Ta-177	2.26E+02	4.91E-01	3.79E+00
Lu-170	1.48E+04	3.17E+01	1.80E+02	Ta-178	5.29E+02	1.14E+00	7.83E+00
Lu-171	3.29E+03	6.92E+00	4.70E+01	Ta-178m	5.73E+03	1.16E+01	8.26E+01
Lu-171m	9.45E-01	2.18E-03	1.77E-02	Ta-179	6.68E+01	1.54E-01	1.26E+00
Lu-172	1.06E+04	2.25E+01	1.44E+02	Ta-180	1.45E+02	3.11E-01	2.69E+00
Lu-172m	4.42E-03	1.11E-05	5.64E-05	Ta-182	7.09E+03	1.50E+01	9.42E+01
Lu-173	7.09E+02	1.48E+00	1.10E+01	Ta-182m	1.20E+03	2.39E+00	1.71E+01
Lu-174	5.01E+02	1.09E+00	7.25E+00	Ta-183	1.40E+03	2.74E+00	2.04E+01
Lu-174m	1.81E+02	4.03E-01	3.14E+00	Ta-184	8.48E+03	1.73E+01	1.22E+02
Lu-176	2.45E+03	4.80E+00	3.43E+01	Ta-185	9.46E+02	1.50E+00	2.18E+01
Lu-176m	1.93E+02	1.43E-01	7.67E+00	Ta-186	7.95E+03	1.56E+01	1.23E+02
Lu-177	1.96E+02	3.37E-01	2.71E+00	W-177	4.67E+03	9.72E+00	6.57E+01
Lu-177m*	4.99E+03	9.96E+00	7.06E+01	W-178*	5.70E+02	1.23E+00	8.62E+00
Lu-178	9.75E+02	1.56E+00	2.24E+01	W-179	1.38E+02	3.20E-01	2.63E+00

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
W-179m	2.10E+02	4.43E-01	3.32E+00	Ir-183	6.48E+03	1.37E+01	8.70E+01
W-181	1.10E+02	2.54E-01	2.09E+00	Ir-184	1.07E+04	2.23E+01	1.47E+02
W-185	2.58E+01	6.47E-03	3.41E-01	Ir-185	4.64E+03	9.86E+00	6.05E+01
W-185m	1.03E+02	2.07E-01	1.53E+00	Ir-186	9.03E+03	1.89E+01	1.22E+02
W-187	2.42E+03	4.88E+00	3.67E+01	Ir-186m	6.90E+03	1.45E+01	9.24E+01
W-188*	6.36E+02	7.50E-01	1.88E+01	Ir-187	1.63E+03	3.43E+00	2.37E+01
W-190*	8.05E+03	1.60E+01	1.25E+02	Ir-188	1.20E+04	2.56E+01	1.49E+02
Re-178	9.86E+03	2.04E+01	1.30E+02	Ir-189*	2.73E+02	5.97E-01	4.67E+00
Re-179*	5.82E+03	1.21E+01	7.95E+01	Ir-190	7.70E+03	1.58E+01	1.11E+02
Re-180	6.47E+03	1.36E+01	9.06E+01	Ir-190m	1.86E-02	5.68E-05	8.04E-07
Re-181	4.12E+03	8.56E+00	5.85E+01	Ir-190n*	7.82E+03	1.60E+01	1.13E+02
Re-182	9.53E+03	2.00E+01	1.29E+02	Ir-191m	2.85E+02	5.92E-01	4.55E+00
Re-182m	6.59E+03	1.40E+01	8.81E+01	Ir-192	4.30E+03	8.62E+00	6.14E+01
Re-183	5.97E+02	1.25E+00	9.40E+00	Ir-192m	3.40E-01	7.19E-04	4.99E-03
Re-184	4.72E+03	9.96E+00	6.59E+01	Ir-192n*	4.31E+03	8.63E+00	6.15E+01
Re-184m*	5.46E+03	1.15E+01	7.66E+01	Ir-193m	1.00E+00	2.29E-03	1.82E-02
Re-186	1.86E+02	2.05E-01	5.41E+00	Ir-194	8.03E+02	1.09E+00	2.16E+01
Re-186m*	2.28E+02	2.99E-01	6.17E+00	Ir-194m	1.23E+04	2.53E+01	1.77E+02
Re-187	0.00E+00	0.00E+00	0.00E+00	Ir-195	3.03E+02	4.67E-01	7.49E+00
Re-188	6.10E+02	7.28E-01	1.84E+01	Ir-195m*	1.96E+03	3.91E+00	2.94E+01
Re-188m	2.29E+02	4.98E-01	4.00E+00	Ir-196	1.76E+03	2.74E+00	3.82E+01
Re-189*	3.66E+02	5.75E-01	7.30E+00	Ir-196m	1.32E+04	2.67E+01	1.90E+02
Re-190	7.35E+03	1.47E+01	1.12E+02	Pt-184	3.48E+03	7.18E+00	5.13E+01
Re-190m*	8.34E+03	1.67E+01	1.26E+02	Pt-186*	9.16E+03	1.92E+01	1.26E+02
Os-180*	6.98E+03	1.47E+01	9.87E+01	Pt-187	3.10E+03	6.44E+00	4.52E+01
Os-181	7.45E+03	1.57E+01	1.00E+02	Pt-188*	1.29E+04	2.74E+01	1.63E+02
Os-182*	8.71E+03	1.84E+01	1.19E+02	Pt-189	2.38E+03	4.99E+00	3.48E+01
Os-183	3.08E+03	6.36E+00	4.49E+01	Pt-190	0.00E+00	0.00E+00	0.00E+00
Os-183m	5.48E+03	1.17E+01	7.37E+01	Pt-191	1.33E+03	2.77E+00	2.05E+01
Os-185	3.61E+03	7.55E+00	5.20E+01	Pt-193	4.51E-02	1.37E-04	2.84E-06
Os-186	0.00E+00	0.00E+00	0.00E+00	Pt-193m	3.57E+01	7.83E-02	6.24E-01
Os-189m	1.68E-02	5.20E-05	2.01E-06	Pt-195m	2.47E+02	5.37E-01	4.32E+00
Os-190m	8.36E+03	1.71E+01	1.20E+02	Pt-197	1.42E+02	2.12E-01	2.48E+00
Os-191	3.19E+02	6.57E-01	5.10E+00	Pt-197m	3.60E+02	7.36E-01	5.42E+00
Os-191m	1.72E+01	4.02E-02	3.34E-01	Pt-199	1.23E+03	2.20E+00	2.39E+01
Os-193	4.32E+02	6.93E-01	9.36E+00	Pt-200*	2.08E+03	3.79E+00	3.77E+01
Os-194*	8.09E+02	1.10E+00	2.17E+01	Pt-202*	1.65E+03	2.19E+00	4.40E+01
Os-196*	2.27E+03	3.58E+00	4.89E+01	Au-186	8.53E+03	1.68E+01	1.28E+02
Ir-180	9.04E+03	1.76E+01	1.39E+02	Au-187	5.87E+03	1.24E+01	7.83E+01
Ir-182	7.96E+03	1.56E+01	1.21E+02	Au-190	1.38E+04	2.91E+01	1.69E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Au-191	2.97E+03	6.13E+00	4.33E+01	Tl-199	1.17E+03	2.43E+00	1.75E+01
Au-192	1.10E+04	2.33E+01	1.39E+02	Tl-200	7.07E+03	1.49E+01	9.65E+01
Au-193	7.01E+02	1.46E+00	1.09E+01	Tl-201	3.33E+02	7.22E-01	5.68E+00
Au-193m	9.70E+02	1.94E+00	1.35E+01	Tl-202	2.33E+03	4.78E+00	3.46E+01
Au-194	5.68E+03	1.20E+01	7.48E+01	Tl-204	6.86E+01	2.63E-02	2.01E+00
Au-195	2.66E+02	5.93E-01	4.84E+00	Tl-206	1.89E+02	5.40E-02	9.35E+00
Au-195m	9.87E+02	1.97E+00	1.38E+01	Tl-206m	1.29E+04	2.68E+01	1.81E+02
Au-196	2.35E+03	4.78E+00	3.43E+01	Tl-207	1.82E+02	7.46E-02	8.45E+00
Au-196m	1.09E+03	2.20E+00	1.59E+01	Tl-208	2.01E+04	4.25E+01	2.43E+02
Au-198	2.21E+03	4.31E+00	3.41E+01	Tl-209	1.23E+04	2.55E+01	1.68E+02
Au-198m	2.54E+03	5.05E+00	3.58E+01	Tl-210	1.61E+04	3.31E+01	2.21E+02
Au-199	4.69E+02	9.03E-01	6.55E+00	Pb-194	5.82E+03	1.23E+01	7.88E+01
Au-200	1.80E+03	3.28E+00	3.32E+01	Pb-195m	8.79E+03	1.82E+01	1.26E+02
Au-200m*	1.08E+04	2.21E+01	1.56E+02	Pb-196	2.44E+03	5.00E+00	3.56E+01
Au-201	3.14E+02	4.05E-01	8.95E+00	Pb-197	8.46E+03	1.79E+01	1.12E+02
Au-202	1.41E+03	2.12E+00	3.21E+01	Pb-197m*	7.77E+03	1.62E+01	1.08E+02
Hg-190	8.61E+02	1.75E+00	1.29E+01	Pb-198	2.15E+03	4.39E+00	3.11E+01
Hg-191m	7.95E+03	1.66E+01	1.09E+02	Pb-199	5.66E+03	1.19E+01	7.59E+01
Hg-192	1.24E+03	2.54E+00	1.83E+01	Pb-200	9.07E+02	1.86E+00	1.37E+01
Hg-193	4.48E+03	9.48E+00	6.05E+01	Pb-201	3.92E+03	8.13E+00	5.53E+01
Hg-193m*	6.66E+03	1.39E+01	9.13E+01	Pb-201m	1.93E+03	4.00E+00	3.16E+01
Hg-194*	5.68E+03	1.20E+01	7.48E+01	Pb-202*	2.31E+03	4.73E+00	3.43E+01
Hg-195	9.31E+02	1.99E+00	1.39E+01	Pb-202m	1.08E+04	2.26E+01	1.51E+02
Hg-195m*	1.47E+03	3.05E+00	2.15E+01	Pb-203	1.50E+03	3.03E+00	2.17E+01
Hg-197	2.32E+02	5.24E-01	4.30E+00	Pb-204m	1.12E+04	2.37E+01	1.56E+02
Hg-197m	4.21E+02	8.42E-01	6.16E+00	Pb-205	7.88E-02	2.42E-04	4.59E-06
Hg-199m	8.56E+02	1.71E+00	1.23E+01	Pb-209	4.92E+01	1.29E-02	9.71E-01
Hg-203	1.22E+03	2.41E+00	1.70E+01	Pb-210*	1.28E+02	4.49E-02	5.65E+00
Hg-205	2.13E+02	1.05E-01	9.66E+00	Pb-211*	7.39E+02	1.25E+00	1.56E+01
Hg-206*	9.33E+02	1.33E+00	2.37E+01	Pb-212*	6.10E+03	1.24E+01	8.26E+01
Hg-207	1.54E+04	3.22E+01	2.06E+02	Pb-214*	1.00E+04	2.06E+01	1.39E+02
Tl-190	7.72E+03	1.44E+01	1.23E+02	Bi-197*	1.41E+04	2.97E+01	1.93E+02
Tl-190m	1.35E+04	2.73E+01	2.00E+02	Bi-200	1.30E+04	2.71E+01	1.85E+02
Tl-194	5.06E+03	9.93E+00	7.92E+01	Bi-201	9.62E+03	2.04E+01	1.27E+02
Tl-194m	1.35E+04	2.78E+01	1.94E+02	Bi-202	1.51E+04	3.15E+01	2.07E+02
Tl-195	6.79E+03	1.44E+01	8.82E+01	Bi-203	1.33E+04	2.85E+01	1.74E+02
Tl-196	1.05E+04	2.20E+01	1.40E+02	Bi-204*	1.71E+04	3.61E+01	2.31E+02
Tl-197	2.35E+03	4.93E+00	3.32E+01	Bi-205	9.47E+03	2.01E+01	1.23E+02
Tl-198	1.13E+04	2.38E+01	1.46E+02	Bi-206	1.79E+04	3.77E+01	2.44E+02
Tl-198m	6.34E+03	1.30E+01	9.15E+01	Bi-207	8.34E+03	1.75E+01	1.16E+02

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Bi-208	1.60E+04	3.44E+01	1.77E+02	Rn-207	5.28E+03	1.08E+01	7.68E+01
Bi-210	1.23E+02	3.41E-02	5.56E+00	Rn-209	6.49E+03	1.36E+01	8.92E+01
Bi-210m*	1.52E+03	2.73E+00	2.80E+01	Rn-210	3.20E+02	6.64E-01	4.53E+00
Bi-211	2.43E+02	4.89E-01	3.48E+00	Rn-211*	1.17E+04	2.47E+01	1.60E+02
Bi-212*	7.61E+02	1.26E+00	1.67E+01	Rn-212	1.82E+00	3.81E-03	2.60E-02
Bi-212n*	6.60E+02	1.07E+00	1.46E+01	Rn-215	0.00E+00	0.00E+00	0.00E+00
Bi-213*	8.09E+02	1.40E+00	1.63E+01	Rn-216*	0.00E+00	0.00E+00	0.00E+00
Bi-214*	8.65E+03	1.80E+01	1.19E+02	Rn-217*	2.04E-01	4.28E-04	2.86E-03
Bi-215*	1.56E+03	2.81E+00	2.94E+01	Rn-218*	4.51E+00	9.35E-03	6.47E-02
Bi-216*	4.51E+03	8.20E+00	7.99E+01	Rn-219*	3.03E+02	6.07E-01	4.28E+00
Po-203	8.97E+03	1.90E+01	1.21E+02	Rn-220*	3.43E+00	7.06E-03	4.97E-02
Po-204	6.06E+03	1.27E+01	8.49E+01	Rn-222*	2.07E+00	4.23E-03	3.00E-02
Po-205	8.66E+03	1.84E+01	1.17E+02	Rn-223*	2.31E+03	4.26E+00	4.24E+01
Po-206*	2.33E+04	4.88E+01	3.19E+02	Fr-212	6.25E+03	1.31E+01	8.37E+01
Po-207	6.94E+03	1.47E+01	9.53E+01	Fr-219*	1.94E+01	3.91E-02	2.78E-01
Po-208	1.10E-01	2.28E-04	1.58E-03	Fr-220*	4.92E+01	9.98E-02	7.66E-01
Po-209	3.25E+01	6.78E-02	4.51E-01	Fr-221*	1.47E+02	2.91E-01	2.02E+00
Po-210	5.30E-02	1.12E-04	7.38E-04	Fr-222*	1.19E+03	1.98E+00	2.41E+01
Po-211	4.44E+01	9.30E-02	6.23E-01	Fr-223	3.19E+02	4.72E-01	7.77E+00
Po-212	0.00E+00	0.00E+00	0.00E+00	Fr-224	3.37E+03	6.45E+00	5.47E+01
Po-212m	4.73E+02	1.01E+00	5.42E+00	Fr-227	2.55E+03	4.76E+00	4.58E+01
Po-213	2.04E-01	4.28E-04	2.86E-03	Ra-219*	8.62E+02	1.73E+00	1.22E+01
Po-214	4.52E-01	9.52E-04	6.30E-03	Ra-220*	2.46E+01	5.02E-02	3.59E-01
Po-215	9.27E-01	1.88E-03	1.35E-02	Ra-221*	1.69E+02	3.32E-01	2.38E+00
Po-216	8.35E-02	1.75E-04	1.16E-03	Ra-222*	5.20E+01	1.05E-01	7.34E-01
Po-218	1.98E-03	3.30E-07	2.82E-05	Ra-223*	9.60E+02	1.93E+00	1.38E+01
At-204	1.25E+04	2.55E+01	1.84E+02	Ra-224*	5.61E+01	1.11E-01	7.69E-01
At-205	6.24E+03	1.30E+01	8.85E+01	Ra-225*	2.49E+02	4.73E-01	3.56E+00
At-206	1.35E+04	2.78E+01	1.91E+02	Ra-226*	3.84E+01	7.55E-02	5.26E-01
At-207	1.11E+04	2.34E+01	1.48E+02	Ra-227	8.42E+02	1.49E+00	1.56E+01
At-208	1.66E+04	3.48E+01	2.26E+02	Ra-228*	4.87E+03	1.00E+01	6.94E+01
At-209	1.22E+04	2.56E+01	1.71E+02	Ra-230*	3.86E+03	7.41E+00	6.17E+01
At-210	1.66E+04	3.52E+01	2.14E+02	Ac-223*	1.04E+02	2.08E-01	1.48E+00
At-211*	1.58E+02	3.35E-01	2.56E+00	Ac-224	1.08E+03	2.11E+00	1.51E+01
At-215	8.91E-01	1.81E-03	1.29E-02	Ac-225*	2.12E+02	4.20E-01	2.95E+00
At-216	1.04E+01	2.14E-02	1.60E-01	Ac-226*	7.95E+02	1.43E+00	1.28E+01
At-217	1.22E+00	2.48E-03	1.74E-02	Ac-227*	6.04E+02	1.20E+00	8.48E+00
At-218	4.71E-01	1.42E-04	1.99E-02	Ac-228	4.86E+03	1.00E+01	6.94E+01
At-219	0.00E+00	0.00E+00	0.00E+00	Ac-230	3.44E+03	6.64E+00	5.53E+01
At-220*	3.19E+03	5.46E+00	5.91E+01	Ac-231	2.30E+03	4.24E+00	3.88E+01

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Ac-232	7.01E+03	1.42E+01	9.96E+01	U-240*	2.00E+03	3.70E+00	3.60E+01
Ac-233	2.98E+03	5.54E+00	5.36E+01	U-242*	2.19E+03	3.73E+00	4.39E+01
Th-223	3.14E+02	6.17E-01	4.57E+00	Np-232	6.36E+03	1.32E+01	8.79E+01
Th-224*	1.39E+02	2.76E-01	1.93E+00	Np-233	3.94E+02	7.51E-01	5.53E+00
Th-226*	8.95E+01	1.77E-01	1.25E+00	Np-234	6.22E+03	1.32E+01	7.98E+01
Th-227*	1.57E+03	3.14E+00	2.23E+01	Np-235	3.24E+00	6.85E-03	3.85E-02
Th-228*	6.54E+01	1.30E-01	9.03E-01	Np-236*	6.53E+02	1.25E+00	8.95E+00
Th-229*	6.25E+02	1.21E+00	9.00E+00	Np-236m	2.35E+02	4.25E-01	3.33E+00
Th-230*	4.00E+01	7.90E-02	5.51E-01	Np-237*	1.19E+03	2.34E+00	1.68E+01
Th-231	5.93E+01	1.02E-01	8.92E-01	Np-238	3.29E+03	6.86E+00	4.61E+01
Th-232*	4.87E+03	1.00E+01	6.94E+01	Np-239	8.80E+02	1.67E+00	1.21E+01
Th-233	3.05E+02	4.03E-01	8.32E+00	Np-240	5.70E+03	1.17E+01	8.15E+01
Th-234*	4.48E+02	3.52E-01	1.69E+01	Np-240m	1.96E+03	3.65E+00	3.55E+01
Th-235	5.35E+02	6.65E-01	1.62E+01	Np-241	3.10E+02	3.79E-01	8.54E+00
Th-236*	5.67E+03	1.13E+01	8.72E+01	Np-242	1.87E+03	3.29E+00	3.56E+01
Pa-227*	1.51E+02	3.02E-01	2.24E+00	Np-242m	5.10E+03	1.03E+01	7.72E+01
Pa-228*	7.41E+03	1.55E+01	1.00E+02	Pu-232*	5.17E+03	1.07E+01	7.15E+01
Pa-229	2.66E+02	5.13E-01	3.85E+00	Pu-234	2.92E+02	5.52E-01	4.06E+00
Pa-230	3.56E+03	7.43E+00	4.92E+01	Pu-235	4.05E+02	7.76E-01	5.65E+00
Pa-231*	7.87E+02	1.57E+00	1.10E+01	Pu-236	4.71E-01	1.17E-03	4.23E-03
Pa-232	5.09E+03	1.07E+01	7.02E+01	Pu-237	2.08E+02	3.95E-01	2.92E+00
Pa-233	1.10E+03	2.15E+00	1.53E+01	Pu-238	3.64E-01	9.37E-04	2.78E-03
Pa-234	7.98E+03	1.66E+01	1.10E+02	Pu-239*	4.25E-01	9.37E-04	5.14E-03
Pa-234m	4.10E+02	2.82E-01	1.62E+01	Pu-240	3.58E-01	9.12E-04	2.85E-03
Pa-235	1.60E+02	4.49E-02	7.78E+00	Pu-241	1.33E-02	1.37E-05	2.08E-04
Pa-236	5.39E+03	1.09E+01	8.02E+01	Pu-242	7.51E-01	1.70E-03	8.44E-03
Pa-237	3.51E+03	6.99E+00	5.59E+01	Pu-243	1.32E+02	2.07E-01	2.08E+00
U-227*	8.78E+02	1.72E+00	1.24E+01	Pu-244*	2.12E+03	3.94E+00	3.75E+01
U-228*	1.54E+02	3.05E-01	2.14E+00	Pu-245*	2.42E+03	4.71E+00	3.64E+01
U-230*	9.45E+01	1.87E-01	1.32E+00	Pu-246*	6.20E+03	1.27E+01	8.88E+01
U-231	3.03E+02	5.87E-01	4.36E+00	Am-237	1.84E+03	3.65E+00	2.57E+01
U-232*	6.65E+01	1.32E-01	9.19E-01	Am-238	4.87E+03	1.02E+01	6.60E+01
U-233*	6.26E+02	1.22E+00	9.02E+00	Am-239	1.10E+03	2.12E+00	1.51E+01
U-234*	4.07E+01	8.05E-02	5.59E-01	Am-240	5.59E+03	1.18E+01	7.58E+01
U-235*	8.67E+02	1.68E+00	1.19E+01	Am-241	6.40E+01	1.49E-01	1.21E+00
U-235m	0.00E+00	0.00E+00	0.00E+00	Am-242	1.01E+02	1.28E-01	1.62E+00
U-236	4.19E-01	9.98E-04	4.22E-03	Am-242m*	1.03E+02	1.33E-01	1.63E+00
U-237	6.11E+02	1.19E+00	8.72E+00	Am-243*	1.07E+03	2.09E+00	1.55E+01
U-238*	4.48E+02	3.53E-01	1.69E+01	Am-244	4.29E+03	8.93E+00	6.01E+01
U-239	3.14E+02	4.51E-01	8.96E+00	Am-244m	2.52E+02	2.18E-01	9.58E+00

*Includes progeny ingrowth for FGR 15

Table A.1. cont. External Dose Coefficients for U.S. Reference Person (FGR 15)

Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]	Nuclide	Air Submersion [mrem m^3 μCi^{-1} yr^{-1}]	Water Immersion [mrem m^3 μCi^{-1} yr^{-1}]	Ground Shine [mrem m^2 μCi^{-1} yr^{-1}]
Am-245	2.25E+02	3.15E-01	4.39E+00	Es-253	1.75E+00	3.58E-03	2.45E-02
Am-246	3.98E+03	8.00E+00	5.96E+01	Es-254*	5.05E+03	1.06E+01	6.94E+01
Am-246m	5.56E+03	1.15E+01	8.00E+01	Es-254m*	2.64E+03	5.39E+00	3.84E+01
Am-247	8.06E+02	1.31E+00	1.64E+01	Es-255*	5.96E+01	8.84E-02	9.50E-01
Cm-238*	5.04E+03	1.05E+01	6.84E+01	Es-256	2.03E+02	6.00E-02	9.99E+00
Cm-239	1.24E+03	2.38E+00	1.68E+01	Fm-251*	7.62E+02	1.50E+00	1.05E+01
Cm-240	4.79E-01	1.22E-03	4.11E-03	Fm-252	1.97E+00	4.26E-03	2.48E-02
Cm-241	2.52E+03	5.07E+00	3.63E+01	Fm-253	2.74E+02	5.23E-01	3.70E+00
Cm-242	4.09E-01	1.05E-03	3.41E-03	Fm-254	4.20E+01	8.70E-02	5.58E-01
Cm-243	6.25E+02	1.21E+00	8.54E+00	Fm-255	9.72E+00	2.23E-02	1.36E-01
Cm-244	4.32E-01	1.07E-03	4.00E-03	Fm-256	7.42E+04	1.52E+02	9.94E+02
Cm-245*	4.71E+02	8.93E-01	6.45E+00	Fm-257*	7.27E+02	1.41E+00	9.84E+00
Cm-246	2.19E+01	4.50E-02	2.91E-01				
Cm-247*	1.78E+03	3.52E+00	2.57E+01				
Cm-248	7.89E+03	1.60E+01	1.06E+02				
Cm-249	1.79E+02	2.31E-01	4.11E+00				
Cm-250*	8.18E+04	1.66E+02	1.11E+03				
Cm-251	7.23E+02	1.23E+00	1.48E+01				
Bk-245	1.09E+03	2.11E+00	1.50E+01				
Bk-246	4.56E+03	9.53E+00	6.25E+01				
Bk-247	6.87E+02	1.36E+00	9.74E+00				
Bk-248m	3.08E+02	5.26E-01	5.23E+00				
Bk-249	2.17E+00	6.09E-05	3.61E-02				
Bk-250	5.03E+03	1.05E+01	6.92E+01				
Bk-251	4.83E+02	7.81E-01	8.40E+00				
Cf-244	4.36E-01	1.14E-03	3.70E-03				
Cf-246	5.28E-01	1.25E-03	5.64E-03				
Cf-247	4.22E+02	8.03E-01	5.77E+00				
Cf-248	2.35E+00	5.05E-03	2.96E-02				
Cf-249	1.69E+03	3.40E+00	2.41E+01				
Cf-250	5.88E+01	1.21E-01	7.85E-01				
Cf-251	5.70E+02	1.09E+00	7.69E+00				
Cf-252	2.73E+03	5.59E+00	3.67E+01				
Cf-253	1.19E+01	6.05E-03	1.66E-01				
Cf-254	1.01E+05	2.07E+02	1.37E+03				
Cf-255	5.65E+01	1.50E-02	1.36E+00				
Es-249	2.09E+03	4.23E+00	2.93E+01				
Es-250	6.23E+03	1.29E+01	8.63E+01				
Es-250m	2.96E+03	6.20E+00	3.98E+01				
Es-251	4.23E+02	8.01E-01	5.74E+00				

*Includes progeny ingrowth for FGR 15

APPENDIX B

Table B.1. LADTAP XL© Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Water Immersion Dose Coefficients [mrem m^3 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	1.07E-09	100%	Nb-94	1.81E+01	1.79E+01	-1%
Be-7	5.61E-01	5.37E-01	-4%	Nb-95	8.82E+00	8.72E+00	-1%
Be-10	1.81E-02	1.78E-02	-1%	Mo-93*	4.66E-03	5.81E-03	25%
C-14	3.37E-04	3.32E-04	-2%	Mo-99*	1.73E+00	2.73E+00	58%
Na-22	2.57E+01	2.54E+01	-1%	Tc-96	2.89E+01	2.87E+01	-1%
Na-24	5.26E+01	5.31E+01	1%	Tc-97	6.07E-03	6.19E-03	2%
Al-26	3.24E+01	3.22E+01	-1%	Tc-98	1.62E+01	1.60E+01	-1%
Si-32*	1.33E-03	7.47E-02	5519%	Tc-99	3.66E-03	3.62E-03	-1%
P-32	7.53E-02	7.34E-02	-2%	Ru-97	2.54E+00	2.31E+00	-9%
S-35	3.97E-04	3.90E-04	-2%	Ru-103*	5.60E+00	5.38E+00	-4%
Cl-36	2.26E-02	2.22E-02	-2%	Ru-106*	0.00E+00	2.50E+00	100%
K-40	1.96E+00	1.97E+00	1%	Pd-107	0.00E+00	5.37E-08	100%
K-43	1.10E+01	1.05E+01	-4%	Ag-108m*	1.83E+01	1.78E+01	-3%
Ca-41	0.00E+00	0.00E+00	0%	Ag-110m*	3.23E+01	3.21E+01	-1%
Ca-45	1.94E-03	1.91E-03	-1%	Cd-113m	1.24E-02	1.21E-02	-2%
Ca-47*	1.26E+01	1.38E+01	9%	Cd-115m	4.52E-01	4.50E-01	0%
Ti-44*	1.28E+00	2.57E+01	1900%	In-115	8.51E-03	8.40E-03	-1%
V-49	0.00E+00	0.00E+00	0%	Sn-126*	4.77E-01	1.77E+01	3612%
Cr-51	3.56E-01	3.30E-01	-7%	Sb-122	5.12E+00	4.97E+00	-3%
Mn-53	0.00E+00	0.00E+00	0%	Sb-124	2.22E+01	2.22E+01	0%
Mn-54	9.68E+00	9.62E+00	-1%	Sb-125*	4.81E+00	4.64E+00	-3%
Fe-55	1.74E-09	1.50E-09	-14%	Te-123	7.22E-05	6.10E-05	-16%
Fe-60*	8.86E-04	4.88E-02	5411%	Te-125m	9.08E-02	7.67E-02	-15%
Co-58	1.12E+01	1.11E+01	-1%	I-129	7.79E-02	6.55E-02	-16%
Co-60	3.01E+01	3.03E+01	1%	I-131	4.31E+00	4.05E+00	-6%
Ni-59	1.75E-04	1.69E-04	-4%	Cs-134	1.79E+01	1.76E+01	-2%
Ni-63	0.00E+00	1.05E-06	100%	Cs-135	2.77E-03	2.73E-03	-1%
Cu-64	2.10E+00	2.02E+00	-4%	Cs-137*	6.81E+00	6.30E+00	-8%
Zn-65	6.86E+00	6.88E+00	0%	Ba-140*	2.03E+00	2.98E+01	1370%
Ge-68*	2.39E-05	1.04E+01	43567195%	La-137	8.40E-02	7.06E-02	-16%
Se-75	4.25E+00	3.85E+00	-9%	La-138	1.47E+01	1.47E+01	0%
Se-79	3.94E-04	3.88E-04	-2%	La-140	2.79E+01	2.79E+01	0%
Rb-87	4.55E-03	4.50E-03	-1%	Ce-141	8.02E-01	7.08E-01	-12%
Sr-89	6.14E-02	6.00E-02	-2%	Ce-144*	1.88E-01	6.74E-01	259%
Sr-90*	1.28E-01	1.25E-01	-3%	Pm-147	1.12E-03	1.11E-03	-2%
Y-90	1.15E-01	1.12E-01	-3%	Sm-146	0.00E+00	0.00E+00	0%
Y-91	1.00E-01	9.91E-02	-1%	Sm-147	0.00E+00	0.00E+00	0%
Zr-93*	7.88E-08	8.75E-04	1110941%	Sm-151	7.23E-06	8.21E-06	14%
Zr-95*	8.44E+00	8.43E+00	0%	Eu-152	1.37E+01	1.35E+01	-1%
Nb-93m	8.32E-04	8.96E-04	8%	Eu-154	1.46E+01	1.45E+01	0%

*Includes progeny ingrowth for FGR 15

Table B.1 cont. LADTAP XL© Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Water Immersion Dose Coefficients [mrem m^3 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Eu-155	5.68E-01	4.77E-01	-16%	U-237	1.37E+00	1.19E+00	-13%
Gd-152	0.00E+00	0.00E+00	0%	U-238*	8.54E-04	3.53E-01	41238%
Ho-166m	1.86E+01	1.79E+01	-3%	Np-236*	1.44E+00	1.25E+00	-13%
Lu-176	5.27E+00	4.80E+00	-9%	Np-237*	2.25E-01	2.34E+00	941%
Hf-182*	2.65E+00	1.74E+01	558%	Np-239	1.89E+00	1.67E+00	-12%
Ta-180	3.76E-01	3.11E-01	-17%	Pu-237	4.67E-01	3.95E-01	-15%
Re-186m*	1.13E-01	2.99E-01	164%	Pu-238	9.11E-04	9.37E-04	3%
Re-187	0.00E+00	0.00E+00	0%	Pu-239*	9.93E-04	9.37E-04	-6%
Ir-192n*	1.12E-02	8.63E+00	76921%	Pu-240	8.94E-04	9.12E-04	2%
Pt-193	7.67E-05	1.37E-04	78%	Pu-241	1.60E-05	1.37E-05	-14%
Hg-194*	1.21E-04	1.20E+01	9852509%	Pu-242	1.67E-03	1.70E-03	2%
Hg-203	2.65E+00	2.41E+00	-9%	Pu-244*	2.44E-01	3.94E+00	1514%
Pb-202*	1.31E-04	4.73E+00	3620877%	Am-237	3.98E+00	3.65E+00	-8%
Pb-205	1.33E-04	2.42E-04	82%	Am-241	1.80E-01	1.49E-01	-17%
Pb-210*	1.27E-02	4.49E-02	253%	Am-242m*	5.29E-03	1.33E-01	2407%
Bi-207	1.79E+01	1.75E+01	-2%	Am-243*	5.06E-01	2.09E+00	313%
Bi-210	3.48E-02	3.41E-02	-2%	Cm-241	5.40E+00	5.07E+00	-6%
Bi-210m*	2.91E+00	2.73E+00	-6%	Cm-242	1.06E-03	1.05E-03	-1%
Po-210	1.13E-04	1.12E-04	-1%	Cm-243	1.37E+00	1.21E+00	-11%
Ra-223*	1.48E+00	1.93E+00	30%	Cm-244	1.08E-03	1.07E-03	0%
Ra-224*	1.15E-01	1.11E-01	-3%	Cm-245*	1.04E+00	8.93E-01	-14%
Ra-225*	6.34E-02	4.73E-01	647%	Cm-246	4.52E-02	4.50E-02	0%
Ra-226*	7.98E-02	7.55E-02	-5%	Cm-247*	3.51E+00	3.52E+00	0%
Ra-228*	7.91E-04	1.00E+01	1267101%	Cm-248	1.62E+01	1.60E+01	-1%
Ac-227*	9.63E-04	1.20E+00	124695%	Cm-250*	1.65E+02	1.66E+02	1%
Th-227*	1.34E+00	3.14E+00	134%	Bk-247	1.54E+00	1.36E+00	-12%
Th-228*	2.15E-02	1.30E-01	505%	Bk-249	6.32E-05	6.09E-05	-4%
Th-229*	8.63E-01	1.21E+00	41%	Cf-249	3.63E+00	3.40E+00	-6%
Th-230*	3.99E-03	7.90E-02	1880%	Cf-250	1.21E-01	1.21E-01	0%
Th-231	1.19E-01	1.02E-01	-15%	Cf-251	1.25E+00	1.09E+00	-13%
Th-232*	2.10E-03	1.00E+01	477301%	Cf-252	5.61E+00	5.59E+00	0%
Th-234*	8.42E-02	3.52E-01	318%	Es-253	3.85E-03	3.58E-03	-7%
Pa-230	7.58E+00	7.43E+00	-2%	Ap-239*	9.93E-04	9.37E-04	-6%
Pa-231*	3.71E-01	1.57E+00	323%	Bg-90*	1.28E-01	1.25E-01	-3%
Pa-233	2.37E+00	2.15E+00	-9%				
U-232*	2.84E-03	1.32E-01	4573%				
U-233*	2.74E-03	1.22E+00	44299%				
U-234*	1.63E-03	8.05E-02	4830%				
U-235*	1.76E+00	1.68E+00	-5%				
U-236	1.01E-03	9.98E-04	-2%				

*Includes progeny ingrowth for FGR 15

Table B.2. LADTAP XL© Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	7.97E-05	100%	Nb-94	1.73E+02	1.19E+02	-31%
Be-7	5.55E+00	3.84E+00	-31%	Nb-95	8.47E+01	5.82E+01	-31%
Be-10	4.01E-01	1.20E+00	199%	Mo-93*	4.47E-01	1.02E-02	-98%
C-14	1.49E-03	7.33E-02	4810%	Mo-99*	2.07E+01	2.43E+01	18%
Na-22	2.39E+02	1.65E+02	-31%	Tc-96	2.75E+02	1.88E+02	-32%
Na-24	4.19E+02	2.92E+02	-30%	Tc-97	5.32E-01	1.43E-02	-97%
Al-26	2.88E+02	2.03E+02	-30%	Tc-98	1.56E+02	1.08E+02	-31%
Si-32*	3.35E-03	1.31E+01	389968%	Tc-99	7.64E-03	2.36E-01	2988%
P-32	9.94E+00	1.29E+01	30%	Ru-97	2.53E+01	1.59E+01	-37%
S-35	1.55E-03	7.37E-02	4649%	Ru-103*	5.53E+01	3.84E+01	-31%
Cl-36	1.30E+00	2.21E+00	71%	Ru-106*	0.00E+00	4.06E+01	100%
K-40	2.38E+01	2.08E+01	-12%	Pd-107	0.00E+00	1.59E-03	100%
K-43	1.09E+02	7.65E+01	-30%	Ag-108m*	1.80E+02	1.24E+02	-31%
Ca-41	0.00E+00	0.00E+00	0%	Ag-110m*	3.02E+02	2.08E+02	-31%
Ca-45	4.41E-03	1.57E-01	3460%	Cd-113m	2.08E-01	7.49E-01	261%
Ca-47*	1.16E+02	8.93E+01	-23%	Cd-115m	1.19E+01	1.33E+01	12%
Ti-44*	1.44E+01	1.81E+02	1159%	In-115	4.36E-02	4.62E-01	959%
V-49	0.00E+00	0.00E+00	0%	Sn-126*	5.62E+00	1.33E+02	2271%
Cr-51	3.49E+00	2.32E+00	-34%	Sb-122	5.69E+01	4.39E+01	-23%
Mn-53	0.00E+00	0.00E+00	0%	Sb-124	2.02E+02	1.42E+02	-30%
Mn-54	9.21E+01	6.30E+01	-32%	Sb-125*	4.83E+01	3.28E+01	-32%
Fe-55	1.69E-08	1.08E-08	-36%	Te-123	2.88E-03	3.96E-04	-86%
Fe-60*	2.67E-03	4.45E-01	16536%	Te-125m	3.13E+00	5.25E-01	-83%
Co-58	1.08E+02	7.40E+01	-31%	I-129	2.32E+00	5.60E-01	-76%
Co-60	2.68E+02	1.84E+02	-31%	I-131	4.26E+01	2.93E+01	-31%
Ni-59	1.73E-03	1.20E-03	-31%	Cs-134	1.73E+02	1.19E+02	-31%
Ni-63	0.00E+00	9.56E-03	100%	Cs-135	5.90E-03	1.96E-01	3212%
Cu-64	2.08E+01	1.48E+01	-29%	Cs-137*	6.77E+01	4.50E+01	-34%
Zn-65	6.27E+01	4.29E+01	-32%	Ba-140*	2.23E+01	1.93E+02	767%
Ge-68*	4.21E-03	8.70E+01	2065913%	La-137	2.35E+00	5.34E-01	-77%
Se-75	4.15E+01	2.69E+01	-35%	La-138	1.31E+02	8.96E+01	-31%
Se-79	1.69E-03	8.15E-02	4718%	La-140	2.51E+02	1.77E+02	-30%
Rb-87	9.21E-03	2.79E-01	2933%	Ce-141	8.13E+00	5.41E+00	-33%
Sr-89	8.03E+00	1.05E+01	30%	Ce-144*	2.02E+00	2.49E+01	1134%
Sr-90*	1.30E+01	1.80E+01	39%	Pm-147	3.28E-03	1.12E-01	3325%
Y-90	1.28E+01	1.73E+01	35%	Sm-146	0.00E+00	0.00E+00	0%
Y-91	8.67E+00	1.11E+01	28%	Sm-147	0.00E+00	0.00E+00	0%
Zr-93*	0.00E+00	1.29E-02	100%	Sm-151	4.45E-04	1.29E-02	2812%
Zr-95*	8.12E+01	5.68E+01	-30%	Eu-152	1.27E+02	8.65E+01	-32%
Nb-93m	7.97E-02	1.57E-03	-98%	Eu-154	1.37E+02	9.43E+01	-31%

*Includes progeny ingrowth for FGR 15

Table B.2 cont. LADTAP XL© Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Eu-155	6.29E+00	3.70E+00	-41%	U-237	1.44E+01	8.72E+00	-39%
Gd-152	0.00E+00	0.00E+00	0%	U-238*	4.56E-02	1.69E+01	36855%
Ho-166m	1.79E+02	1.21E+02	-32%	Np-236*	1.49E+01	8.95E+00	-40%
Lu-176	5.22E+01	3.43E+01	-34%	Np-237*	2.85E+00	1.68E+01	488%
Hf-182*	2.60E+01	1.11E+02	327%	Np-239	1.89E+01	1.21E+01	-36%
Ta-180	4.88E+00	2.69E+00	-45%	Pu-237	4.98E+00	2.92E+00	-41%
Re-186m*	1.53E+00	6.17E+00	304%	Pu-238	6.99E-02	2.78E-03	-96%
Re-187	0.00E+00	0.00E+00	0%	Pu-239*	3.57E-02	5.14E-03	-86%
Ir-192n*	9.91E-02	6.15E+01	61960%	Pu-240	6.63E-02	2.85E-03	-96%
Pt-193	1.25E-02	2.84E-06	-100%	Pu-241	1.67E-04	2.08E-04	25%
Hg-194*	1.89E-02	7.48E+01	395848%	Pu-242	6.49E-02	8.44E-03	-87%
Hg-203	2.59E+01	1.70E+01	-35%	Pu-244*	2.24E+00	3.75E+01	1576%
Pb-202*	2.19E-02	3.43E+01	156259%	Am-237	3.94E+01	2.57E+01	-35%
Pb-205	2.22E-02	4.59E-06	-100%	Am-241	2.54E+00	1.21E+00	-52%
Pb-210*	2.53E-01	5.65E+00	2130%	Am-242m*	2.42E-01	1.63E+00	576%
Bi-207	1.69E+02	1.16E+02	-31%	Am-243*	5.79E+00	1.55E+01	168%
Bi-210	4.10E+00	5.56E+00	36%	Cm-241	5.41E+01	3.63E+01	-33%
Bi-210m*	2.85E+01	2.80E+01	-2%	Cm-242	7.79E-02	3.41E-03	-96%
Po-210	1.08E-03	7.38E-04	-31%	Cm-243	1.38E+01	8.54E+00	-38%
Ra-223*	1.48E+01	1.38E+01	-7%	Cm-244	6.83E-02	4.00E-03	-94%
Ra-224*	1.12E+00	7.69E-01	-31%	Cm-245*	1.06E+01	6.45E+00	-39%
Ra-225*	1.28E+00	3.56E+00	177%	Cm-246	4.52E-01	2.91E-01	-36%
Ra-226*	7.79E-01	5.26E-01	-33%	Cm-247*	3.48E+01	2.57E+01	-26%
Ra-228*	8.56E-02	6.94E+01	80927%	Cm-248	1.46E+02	1.06E+02	-27%
Ac-227*	2.77E-02	8.48E+00	30565%	Cm-250*	1.48E+03	1.11E+03	-25%
Th-227*	1.34E+01	2.23E+01	66%	Bk-247	1.54E+01	9.74E+00	-37%
Th-228*	2.52E-01	9.03E-01	258%	Bk-249	6.62E-04	3.61E-02	5350%
Th-229*	9.04E+00	9.00E+00	0%	Cf-249	3.59E+01	2.41E+01	-33%
Th-230*	7.48E-02	5.51E-01	637%	Cf-250	1.14E+00	7.85E-01	-31%
Th-231	1.77E+00	8.92E-01	-50%	Cf-251	1.25E+01	7.69E+00	-38%
Th-232*	5.29E-02	6.94E+01	131213%	Cf-252	5.04E+01	3.67E+01	-27%
Th-234*	9.56E-01	1.69E+01	1664%	Es-253	5.83E-02	2.45E-02	-58%
Pa-230	7.26E+01	4.92E+01	-32%	Ap-239*	3.57E-02	5.14E-03	-86%
Pa-231*	4.05E+00	1.10E+01	173%	Bg-90*	1.30E+01	1.80E+01	39%
Pa-233	2.36E+01	1.53E+01	-35%				
U-232*	8.52E-02	9.19E-01	979%				
U-233*	5.55E-02	9.02E+00	16134%				
U-234*	6.77E-02	5.59E-01	726%				
U-235*	1.74E+01	1.19E+01	-32%				
U-236	5.62E-02	4.22E-03	-92%				

*Includes progeny ingrowth for FGR 15

APPENDIX C

Table C.1. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	4.57E-09	100%	V-50	8.02E-03	8.19E-03	2%
Be-7	2.58E-04	2.63E-04	2%	Cr-48	2.20E-03	2.21E-03	1%
Be-10	1.62E-05	6.66E-05	310%	Cr-49	5.46E-03	5.72E-03	5%
C-11	5.32E-03	5.53E-03	4%	Cr-51	1.63E-04	1.64E-04	1%
C-14	3.04E-07	4.64E-06	1428%	Mn-51	5.28E-03	5.67E-03	7%
F-18	5.15E-03	5.31E-03	3%	Mn-52	1.89E-02	1.93E-02	2%
Na-22	1.19E-02	1.21E-02	2%	Mn-52m	1.32E-02	1.38E-02	5%
Na-24	2.43E-02	2.49E-02	2%	Mn-53	0.00E+00	0.00E+00	0%
Mg-28*	7.45E-03	1.86E-02	150%	Mn-54	4.47E-03	4.57E-03	2%
Al-26	1.49E-02	1.54E-02	3%	Mn-56	9.54E-03	9.98E-03	5%
Si-31	5.64E-05	2.15E-04	282%	Fe-52*	3.83E-03	1.78E-02	364%
Si-32*	1.23E-06	2.66E-04	21600%	Fe-55	7.81E-13	7.93E-13	2%
P-32	6.26E-05	2.57E-04	311%	Fe-59	6.56E-03	6.71E-03	2%
P-33	1.68E-06	1.08E-05	544%	Fe-60*	8.09E-07	3.02E-05	3633%
S-35	3.58E-07	4.72E-06	1217%	Co-55	1.07E-02	1.10E-02	3%
S-38*	9.89E-03	1.96E-02	98%	Co-56	2.06E-02	2.10E-02	2%
Cl-34m*	1.20E-02	1.54E-02	28%	Co-57	5.81E-04	5.91E-04	2%
Cl-36	1.94E-05	7.70E-05	297%	Co-58	5.18E-03	5.30E-03	2%
Cl-38	8.59E-03	9.36E-03	9%	Co-58m	7.11E-09	5.81E-09	-18%
Cl-39	8.14E-03	8.55E-03	5%	Co-60	1.39E-02	1.42E-02	2%
K-40	9.27E-04	1.08E-03	17%	Co-60m	2.27E-05	2.26E-05	0%
K-42	1.74E-03	2.29E-03	31%	Co-61	4.74E-04	5.50E-04	16%
K-43	5.06E-03	5.21E-03	3%	Co-62m	1.52E-02	1.58E-02	4%
K-44	1.39E-02	1.47E-02	6%	Ni-56	9.13E-03	9.32E-03	2%
K-45	1.06E-02	1.11E-02	5%	Ni-57	1.07E-02	1.10E-02	2%
Ca-41	0.00E+00	0.00E+00	0%	Ni-59	8.08E-08	8.25E-08	2%
Ca-45	1.77E-06	1.11E-05	527%	Ni-63	0.00E+00	5.56E-07	100%
Ca-47*	5.86E-03	6.65E-03	13%	Ni-65	3.18E-03	3.41E-03	7%
Sc-43	5.15E-03	5.35E-03	4%	Ni-66*	1.59E-06	1.00E-03	63184%
Sc-44	1.15E-02	1.19E-02	3%	Cu-60	2.20E-02	2.26E-02	3%
Sc-44m*	1.42E-03	1.32E-02	828%	Cu-61	4.32E-03	4.48E-03	4%
Sc-46	1.09E-02	1.12E-02	2%	Cu-64	9.68E-04	1.01E-03	4%
Sc-47	5.49E-04	5.84E-04	6%	Cu-67	5.73E-04	5.96E-04	4%
Sc-48	1.84E-02	1.89E-02	2%	Zn-62*	2.27E-03	8.22E-03	263%
Sc-49	8.33E-05	3.24E-04	289%	Zn-63	5.83E-03	6.23E-03	7%
Ti-44*	5.70E-04	1.24E-02	2075%	Zn-65	3.18E-03	3.24E-03	2%
Ti-45	4.55E-03	4.73E-03	4%	Zn-69	2.34E-05	9.50E-05	307%
V-47	5.25E-03	5.60E-03	7%	Zn-69m*	2.15E-03	2.28E-03	6%
V-48	1.59E-02	1.62E-02	2%	Zn-71m	8.22E-03	8.52E-03	4%
V-49	0.00E+00	0.00E+00	0%	Zn-72*	7.22E-04	1.64E-02	2180%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ga-65	6.11E-03	6.47E-03	6%	Br-82	1.42E-02	1.46E-02	2%
Ga-66	1.45E-02	1.51E-02	4%	Br-83*	5.95E-05	1.33E-04	124%
Ga-67	7.67E-04	7.66E-04	0%	Br-84	1.04E-02	1.10E-02	6%
Ga-68	5.01E-03	5.33E-03	6%	Rb-78	2.38E-02	2.47E-02	3%
Ga-70	9.66E-05	2.75E-04	185%	Rb-79	7.61E-03	8.00E-03	5%
Ga-72	1.53E-02	1.57E-02	3%	Rb-81*	2.63E-03	3.34E-03	27%
Ga-73	1.82E-03	1.94E-03	7%	Rb-81m	1.25E-04	1.26E-04	1%
Ge-66	3.47E-03	3.53E-03	2%	Rb-82m	1.56E-02	1.60E-02	2%
Ge-67	7.64E-03	8.17E-03	7%	Rb-83*	2.52E-03	2.57E-03	2%
Ge-68*	1.04E-08	5.33E-03	51485587%	Rb-84	4.82E-03	4.97E-03	3%
Ge-69	5.11E-03	5.25E-03	3%	Rb-84m	1.96E-03	1.98E-03	1%
Ge-71	1.05E-08	1.49E-08	42%	Rb-86	5.70E-04	7.68E-04	35%
Ge-75	2.14E-04	3.16E-04	48%	Rb-87	4.17E-06	2.08E-05	400%
Ge-77	5.78E-03	6.06E-03	5%	Rb-88	3.93E-03	4.89E-03	24%
Ge-78	1.44E-03	1.50E-03	4%	Rb-89	1.27E-02	1.33E-02	5%
As-69	6.13E-03	6.65E-03	9%	Sr-80*	2.24E-03	9.71E-03	333%
As-70	2.34E-02	2.41E-02	3%	Sr-81	7.31E-03	7.76E-03	6%
As-71	2.98E-03	3.05E-03	3%	Sr-82*	5.52E-07	6.56E-03	1187729%
As-72	9.59E-03	1.01E-02	6%	Sr-83	4.32E-03	4.44E-03	3%
As-73	1.80E-05	1.51E-05	-16%	Sr-85	2.56E-03	2.61E-03	2%
As-74	3.97E-03	4.13E-03	4%	Sr-85m	1.10E-03	1.10E-03	0%
As-76	2.34E-03	2.72E-03	17%	Sr-87m	1.65E-03	1.67E-03	1%
As-77	5.67E-05	1.02E-04	79%	Sr-89	5.13E-05	2.09E-04	308%
As-78	7.32E-03	7.92E-03	8%	Sr-90*	1.15E-05	4.28E-04	3633%
Se-70	3.67E-03	3.77E-03	3%	Sr-91*	3.88E-03	5.78E-03	49%
Se-72*	7.12E-05	1.02E-02	14194%	Sr-92	7.48E-03	7.67E-03	2%
Se-73	5.62E-03	5.78E-03	3%	Y-84m	2.15E-02	2.24E-02	4%
Se-73m	1.38E-03	1.44E-03	4%	Y-85*	5.66E-03	7.02E-03	24%
Se-75	1.94E-03	1.95E-03	1%	Y-85m*	7.22E-03	7.58E-03	5%
Se-79	3.56E-07	5.19E-06	1357%	Y-86	1.96E-02	2.01E-02	2%
Se-81	9.53E-05	2.61E-04	174%	Y-86m	1.12E-03	1.13E-03	1%
Se-81m*	6.47E-05	3.26E-04	404%	Y-87*	2.27E-03	3.99E-03	76%
Se-83	1.45E-02	1.48E-02	2%	Y-87m	1.58E-03	1.61E-03	2%
Br-74	2.69E-02	2.76E-02	3%	Y-88	1.52E-02	1.55E-02	2%
Br-74m	2.34E-02	2.42E-02	4%	Y-90	9.24E-05	3.80E-04	312%
Br-75	6.26E-03	6.52E-03	4%	Y-90m	3.27E-03	3.32E-03	2%
Br-76	1.56E-02	1.62E-02	4%	Y-91	7.02E-05	2.34E-04	234%
Br-77	1.63E-03	1.67E-03	2%	Y-91m	2.76E-03	2.81E-03	2%
Br-80	4.65E-04	6.84E-04	47%	Y-92	1.54E-03	2.09E-03	36%
Br-80m*	2.78E-05	7.08E-04	2447%	Y-93	6.57E-04	1.06E-03	61%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Y-94	4.46E-03	5.26E-03	18%	Tc-97m	4.30E-06	3.92E-06	-9%
Y-95	6.67E-03	7.32E-03	10%	Tc-98	7.48E-03	7.67E-03	2%
Zr-86*	1.40E-03	2.15E-02	1434%	Tc-99	3.36E-06	1.75E-05	419%
Zr-87	4.93E-03	5.28E-03	7%	Tc-99m	6.15E-04	6.23E-04	1%
Zr-88	1.97E-03	2.00E-03	2%	Tc-101	1.77E-03	1.91E-03	7%
Zr-89	6.18E-03	6.33E-03	2%	Tc-104	1.28E-02	1.37E-02	6%
Zr-93*	7.53E-11	9.79E-07	1300424%	Ru-94	2.66E-03	2.71E-03	2%
Zr-95*	3.89E-03	4.04E-03	4%	Ru-95	6.63E-03	6.78E-03	2%
Zr-97*	4.75E-03	8.80E-03	85%	Ru-97	1.16E-03	1.17E-03	0%
Nb-88	2.27E-02	2.36E-02	4%	Ru-103*	2.58E-03	2.63E-03	2%
Nb-89	7.60E-03	8.11E-03	7%	Ru-105	3.96E-03	4.14E-03	5%
Nb-89m*	6.87E-03	1.07E-02	56%	Ru-106*	0.00E+00	1.77E-03	100%
Nb-90	2.39E-02	2.45E-02	2%	Rh-97	7.71E-03	8.01E-03	4%
Nb-91	9.87E-06	1.00E-05	2%	Rh-97m*	1.24E-02	1.31E-02	6%
Nb-91m	1.40E-04	1.42E-04	1%	Rh-99	2.83E-03	2.87E-03	2%
Nb-92	7.97E-03	8.15E-03	2%	Rh-99m	3.37E-03	3.44E-03	2%
Nb-92m	5.18E-03	5.30E-03	2%	Rh-100	1.54E-02	1.57E-02	2%
Nb-93m	3.55E-07	3.29E-07	-7%	Rh-101	1.37E-03	1.38E-03	1%
Nb-94	8.33E-03	8.53E-03	3%	Rh-101m	1.41E-03	1.43E-03	1%
Nb-95	4.08E-03	4.16E-03	2%	Rh-102	2.62E-03	2.71E-03	4%
Nb-95m	3.30E-04	3.37E-04	2%	Rh-102m	1.14E-02	1.16E-02	2%
Nb-96	1.32E-02	1.35E-02	2%	Rh-103m	6.55E-07	5.42E-07	-17%
Nb-97	3.55E-03	3.74E-03	5%	Rh-105	4.05E-04	4.35E-04	7%
Nb-98m	1.54E-02	1.60E-02	4%	Rh-106m	1.54E-02	1.58E-02	2%
Mo-90	4.27E-03	4.37E-03	2%	Rh-107	1.65E-03	1.77E-03	8%
Mo-91	5.25E-03	5.87E-03	12%	Pd-98*	2.06E-03	1.25E-02	509%
Mo-93*	1.98E-06	2.13E-06	7%	Pd-99	6.87E-03	7.13E-03	4%
Mo-93m	1.27E-02	1.30E-02	2%	Pd-100*	4.25E-04	1.61E-02	3683%
Mo-99*	8.08E-04	1.46E-03	81%	Pd-101	1.73E-03	1.76E-03	2%
Mo-101*	8.14E-03	1.03E-02	27%	Pd-103*	6.18E-06	5.74E-06	-7%
Mo-102*	1.19E-04	1.66E-03	1295%	Pd-107	0.00E+00	9.16E-08	100%
Tc-93	8.71E-03	8.89E-03	2%	Pd-109	4.90E-05	1.31E-04	167%
Tc-93m	5.44E-03	5.54E-03	2%	Pd-111*	3.37E-04	6.13E-04	82%
Tc-94	1.41E-02	1.45E-02	2%	Pd-112*	3.13E-06	4.54E-03	144928%
Tc-94m	1.06E-02	1.11E-02	4%	Ag-101	8.40E-03	8.82E-03	5%
Tc-95	4.19E-03	4.28E-03	2%	Ag-102	1.87E-02	1.94E-02	4%
Tc-95m*	3.57E-03	3.80E-03	6%	Ag-103	4.43E-03	4.56E-03	3%
Tc-96	1.33E-02	1.36E-02	2%	Ag-104	1.45E-02	1.48E-02	2%
Tc-96m	2.27E-04	2.31E-04	2%	Ag-104m	9.87E-03	1.03E-02	4%
Tc-97	2.58E-06	2.30E-06	-11%	Ag-105	2.58E-03	2.61E-03	1%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ag-106	3.65E-03	3.87E-03	6%	Sn-113*	4.03E-05	1.38E-03	3325%
Ag-108m*	8.44E-03	8.63E-03	2%	Sn-113m	1.19E-05	9.81E-06	-18%
Ag-110m*	1.49E-02	1.53E-02	2%	Sn-117m	7.16E-04	7.21E-04	1%
Ag-111	1.62E-04	2.45E-04	51%	Sn-119m	1.08E-05	8.83E-06	-18%
Ag-112	3.96E-03	4.53E-03	14%	Sn-121	4.65E-06	2.21E-05	376%
Ag-113	4.47E-04	6.73E-04	50%	Sn-121m*	6.20E-06	2.67E-05	331%
Ag-115	2.80E-03	3.20E-03	14%	Sn-123	8.19E-05	2.19E-04	168%
Cd-104*	1.18E-03	1.15E-02	873%	Sn-123m	7.25E-04	8.48E-04	17%
Cd-105*	7.16E-03	7.37E-03	3%	Sn-125	1.91E-03	2.20E-03	15%
Cd-107	5.72E-05	5.47E-05	-4%	Sn-126*	2.13E-04	8.74E-03	4015%
Cd-109	2.65E-05	2.33E-05	-12%	Sn-127	1.05E-02	1.09E-02	3%
Cd-111m	1.40E-03	1.41E-03	1%	Sn-128*	2.94E-03	1.37E-02	365%
Cd-113	2.91E-06	1.54E-05	431%	Sb-115	4.60E-03	4.75E-03	3%
Cd-113m	1.08E-05	4.48E-05	314%	Sb-116	1.26E-02	1.30E-02	3%
Cd-115*	1.02E-03	1.93E-03	90%	Sb-116m	1.67E-02	1.71E-02	2%
Cd-115m	2.32E-04	4.00E-04	72%	Sb-117	8.44E-04	8.54E-04	1%
Cd-117*	5.97E-03	7.00E-03	17%	Sb-118m	1.41E-02	1.43E-02	1%
Cd-117m*	1.15E-02	1.18E-02	3%	Sb-119	1.76E-05	1.44E-05	-18%
Cd-118*	8.47E-06	1.45E-03	17013%	Sb-120	2.34E-03	2.46E-03	5%
In-107	8.38E-03	8.63E-03	3%	Sb-120m	1.32E-02	1.35E-02	2%
In-108	2.11E-02	2.17E-02	2%	Sb-122	2.38E-03	2.58E-03	8%
In-108m	1.58E-02	1.63E-02	3%	Sb-124	1.03E-02	1.06E-02	3%
In-109	3.34E-03	3.40E-03	2%	Sb-124n*	6.57E-10	2.39E-03	363460712%
In-110	1.65E-02	1.69E-02	2%	Sb-125*	2.22E-03	2.28E-03	3%
In-110m	8.48E-03	8.84E-03	4%	Sb-126	1.46E-02	1.50E-02	3%
In-111	1.97E-03	1.98E-03	0%	Sb-126m	8.20E-03	8.54E-03	4%
In-112	1.39E-03	1.47E-03	6%	Sb-127*	3.67E-03	3.87E-03	6%
In-112m*	1.15E-04	1.59E-03	1279%	Sb-128	1.65E-02	1.69E-02	3%
In-113m	1.32E-03	1.34E-03	2%	Sb-128m	1.02E-02	1.07E-02	5%
In-114m*	3.81E-04	6.86E-04	80%	Sb-129*	7.97E-03	8.62E-03	8%
In-115	7.71E-06	3.37E-05	338%	Sb-130	1.76E-02	1.82E-02	3%
In-115m	8.10E-04	8.20E-04	1%	Te-114*	6.91E-03	2.26E-02	227%
In-116m	1.38E-02	1.41E-02	2%	Te-116*	4.27E-04	1.34E-02	3037%
In-117	3.60E-03	3.71E-03	3%	Te-117	8.47E-03	8.69E-03	3%
In-117m*	4.76E-04	2.32E-03	388%	Te-118*	1.76E-05	4.65E-03	26254%
In-119m*	4.54E-04	1.03E-03	126%	Te-119	4.00E-03	4.09E-03	2%
Sn-108	3.46E-03	3.50E-03	1%	Te-119m	8.14E-03	8.29E-03	2%
Sn-109*	1.23E-02	1.34E-02	9%	Te-121	2.93E-03	2.98E-03	2%
Sn-110*	1.41E-03	1.03E-02	627%	Te-121m*	1.05E-03	3.70E-03	252%
Sn-111	2.58E-03	2.68E-03	4%	Te-123	3.07E-08	2.54E-08	-17%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Te-123m	6.78E-04	6.84E-04	1%	Cs-137*	1.10E-05	3.08E-03	27920%
Te-125m	3.92E-05	3.31E-05	-16%	Cs-138	1.34E-02	1.41E-02	5%
Te-127	3.91E-05	8.41E-05	115%	Ba-124*	2.93E-03	1.03E-02	252%
Te-127m*	1.31E-05	9.44E-05	622%	Ba-126*	2.99E-03	9.81E-03	228%
Te-129	3.49E-04	4.90E-04	40%	Ba-127	3.83E-03	4.08E-03	6%
Te-129m*	1.83E-04	5.51E-04	201%	Ba-128*	2.48E-04	5.34E-03	2056%
Te-131	2.24E-03	2.48E-03	11%	Ba-129	1.68E-03	1.74E-03	3%
Te-131m*	7.81E-03	8.55E-03	9%	Ba-129m	8.41E-03	8.56E-03	2%
Te-132	1.09E-03	1.36E-02	1149%	Ba-131*	2.34E-03	2.39E-03	2%
Te-133	6.62E-03	6.94E-03	5%	Ba-131m	3.09E-04	3.09E-04	0%
Te-133m*	1.01E-02	1.16E-02	15%	Ba-133	1.89E-03	1.89E-03	0%
Te-134	4.52E-03	4.62E-03	2%	Ba-133m	2.91E-04	2.89E-04	-1%
I-118	1.10E-02	1.20E-02	9%	Ba-135m	2.52E-04	2.49E-04	-1%
I-119	4.74E-03	4.96E-03	5%	Ba-139	3.12E-04	5.86E-04	88%
I-120	1.49E-02	1.56E-02	5%	Ba-140*	9.41E-04	1.43E-02	1423%
I-120m	1.90E-02	1.97E-02	4%	Ba-141	5.04E-03	5.42E-03	7%
I-121	1.97E-03	2.01E-03	2%	Ba-142	5.65E-03	5.84E-03	3%
I-123	7.65E-04	7.70E-04	1%	La-129	4.80E-03	5.07E-03	6%
I-124	5.97E-03	6.14E-03	3%	La-131	3.36E-03	3.46E-03	3%
I-125	4.41E-05	3.68E-05	-17%	La-132	1.09E-02	1.13E-02	4%
I-126	2.24E-03	2.32E-03	3%	La-132m	3.44E-03	3.52E-03	2%
I-129	3.34E-05	3.28E-05	-2%	La-133	7.46E-04	7.61E-04	2%
I-130	1.13E-02	1.16E-02	3%	La-135	9.03E-05	8.55E-05	-5%
I-131	1.98E-03	2.04E-03	3%	La-137	3.58E-05	3.04E-05	-15%
I-132	1.21E-02	1.25E-02	3%	La-138	6.80E-03	6.93E-03	2%
I-132m	1.75E-03	1.81E-03	3%	La-140	1.30E-02	1.33E-02	3%
I-133	3.25E-03	3.41E-03	5%	La-141	2.50E-04	5.62E-04	125%
I-134	1.41E-02	1.46E-02	3%	La-142	1.39E-02	1.44E-02	3%
I-135*	8.84E-03	8.47E-02	859%	La-143	1.62E-03	2.10E-03	29%
Cs-125	3.93E-03	4.11E-03	5%	Ce-130*	2.50E-03	1.52E-02	508%
Cs-127	2.15E-03	2.19E-03	2%	Ce-131	8.68E-03	9.02E-03	4%
Cs-129	1.31E-03	1.33E-03	2%	Ce-132	1.27E-03	1.28E-03	1%
Cs-130	2.60E-03	2.77E-03	7%	Ce-133	2.66E-03	2.78E-03	5%
Cs-131	2.80E-05	2.35E-05	-16%	Ce-133m*	9.28E-03	1.02E-02	10%
Cs-132	3.68E-03	3.75E-03	2%	Ce-134	4.90E-05	4.17E-03	8400%
Cs-134	8.26E-03	8.46E-03	3%	Ce-135	4.22E-03	4.27E-03	1%
Cs-134m	9.34E-05	9.24E-05	-1%	Ce-137	9.90E-05	9.36E-05	-5%
Cs-135	2.53E-06	1.42E-05	462%	Ce-137m*	2.27E-04	3.16E-04	39%
Cs-135m	8.54E-03	8.73E-03	2%	Ce-139	6.98E-04	6.98E-04	0%
Cs-136	1.15E-02	1.17E-02	2%	Ce-141	3.65E-04	3.93E-04	7%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ce-143	1.39E-03	1.50E-03	8%	Sm-140*	2.95E-03	9.77E-03	231%
Ce-144*	8.58E-05	7.88E-04	818%	Sm-141	7.55E-03	7.94E-03	5%
Pr-134	1.68E-02	1.75E-02	4%	Sm-141m*	1.04E-02	1.49E-02	43%
Pr-134m	1.26E-02	1.35E-02	7%	Sm-142*	4.87E-04	5.68E-03	1067%
Pr-135	4.54E-03	4.78E-03	5%	Sm-145	1.44E-04	1.22E-04	-15%
Pr-136	1.16E-02	1.21E-02	5%	Sm-146	0.00E+00	0.00E+00	0%
Pr-137	1.89E-03	1.97E-03	4%	Sm-147	0.00E+00	0.00E+00	0%
Pr-138m	1.32E-02	1.35E-02	2%	Sm-148*	0.00E+00	0.00E+00	0%
Pr-139	5.95E-04	6.10E-04	2%	Sm-151	3.09E-09	7.56E-07	24341%
Pr-142	4.08E-04	6.57E-04	61%	Sm-153	2.48E-04	2.81E-04	13%
Pr-142m	0.00E+00	0.00E+00	0%	Sm-155	5.17E-04	6.63E-04	28%
Pr-143	2.28E-05	9.29E-05	308%	Sm-156	5.52E-04	5.78E-04	5%
Pr-144	2.93E-04	6.99E-04	138%	Eu-145	6.95E-03	7.08E-03	2%
Pr-145	1.60E-04	3.51E-04	120%	Eu-146	1.30E-02	1.31E-02	1%
Pr-146	5.74E-03	6.33E-03	10%	Eu-147	2.37E-03	2.39E-03	1%
Pr-147	2.55E-03	2.82E-03	11%	Eu-148	1.18E-02	1.20E-02	2%
Nd-135	6.57E-03	7.02E-03	7%	Eu-149	2.37E-04	2.28E-04	-4%
Nd-136*	1.28E-03	1.34E-02	947%	Eu-150	8.08E-03	8.22E-03	2%
Nd-137	6.22E-03	6.41E-03	3%	Eu-150m	2.72E-04	3.47E-04	27%
Nd-138*	1.26E-04	4.98E-03	3848%	Eu-152	6.28E-03	6.42E-03	2%
Nd-139	2.28E-03	2.38E-03	4%	Eu-152m	1.60E-03	1.77E-03	11%
Nd-139m*	8.40E-03	8.90E-03	6%	Eu-152n	3.07E-04	2.88E-04	-6%
Nd-140*	5.18E-05	3.12E-03	5922%	Eu-154	6.75E-03	6.93E-03	3%
Nd-141	3.08E-04	3.08E-04	0%	Eu-154m	2.51E-04	2.27E-04	-10%
Nd-144	0.00E+00	0.00E+00	0%	Eu-155	2.53E-04	2.44E-04	-4%
Nd-147	6.70E-04	7.17E-04	7%	Eu-156	6.94E-03	7.18E-03	3%
Nd-149	1.90E-03	2.03E-03	7%	Eu-157	1.44E-03	1.53E-03	6%
Nd-151	4.59E-03	4.83E-03	5%	Eu-158	7.17E-03	7.56E-03	6%
Nd-152*	8.51E-04	3.10E-03	264%	Eu-159	1.54E-03	1.79E-03	16%
Pm-141	3.91E-03	4.18E-03	7%	Gd-145	1.38E-02	1.41E-02	3%
Pm-143	1.58E-03	1.60E-03	1%	Gd-146*	1.02E-03	1.41E-02	1285%
Pm-144	8.12E-03	8.28E-03	2%	Gd-147	7.34E-03	7.46E-03	2%
Pm-145	6.42E-05	5.44E-05	-15%	Gd-148	0.00E+00	0.00E+00	0%
Pm-146	3.89E-03	3.97E-03	2%	Gd-149	2.62E-03	2.64E-03	1%
Pm-147	1.01E-06	7.66E-06	658%	Gd-150	0.00E+00	0.00E+00	0%
Pm-148	3.22E-03	3.51E-03	9%	Gd-151	2.51E-04	2.40E-04	-4%
Pm-148m*	1.05E-02	1.09E-02	4%	Gd-152	0.00E+00	0.00E+00	0%
Pm-149	8.87E-05	1.74E-04	96%	Gd-153	3.63E-04	3.43E-04	-5%
Pm-150	8.14E-03	8.53E-03	5%	Gd-159	2.74E-04	3.40E-04	24%
Pm-151	1.68E-03	1.75E-03	4%	Tb-147	1.19E-02	1.22E-02	2%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Tb-148	1.30E-02	1.35E-02	4%	Er-156	2.01E-04	1.81E-04	-10%
Tb-149	7.33E-03	7.47E-03	2%	Er-159*	5.09E-03	6.95E-03	37%
Tb-150	1.37E-02	1.40E-02	3%	Er-161*	5.21E-03	5.43E-03	4%
Tb-151	5.07E-03	5.14E-03	1%	Er-163	1.15E-04	9.81E-05	-14%
Tb-152	8.15E-03	8.35E-03	2%	Er-165	1.05E-04	8.91E-05	-15%
Tb-153	1.58E-03	1.58E-03	0%	Er-169	3.44E-06	1.75E-05	407%
Tb-154	1.30E-02	1.32E-02	2%	Er-171	1.88E-03	1.97E-03	5%
Tb-155	7.36E-04	7.12E-04	-3%	Er-172	2.62E-03	2.66E-03	2%
Tb-156	1.04E-02	1.05E-02	2%	Tm-161	6.88E-03	6.98E-03	2%
Tb-156m	1.08E-04	9.13E-05	-15%	Tm-162	1.07E-02	1.10E-02	3%
Tb-156n	1.16E-05	1.03E-05	-11%	Tm-163*	7.04E-03	7.23E-03	3%
Tb-157	1.15E-05	9.81E-06	-15%	Tm-165*	2.80E-03	2.90E-03	3%
Tb-158	4.22E-03	4.29E-03	2%	Tm-166	1.09E-02	1.10E-02	2%
Tb-160	6.07E-03	6.22E-03	2%	Tm-167	6.41E-04	6.19E-04	-3%
Tb-161	1.07E-04	1.18E-04	11%	Tm-168	6.43E-03	6.53E-03	2%
Tb-163	4.10E-03	4.24E-03	3%	Tm-170	3.79E-05	1.07E-04	182%
Dy-151*	7.33E-03	7.62E-03	4%	Tm-171	1.98E-06	2.89E-06	45%
Dy-152	1.38E-03	1.37E-03	-1%	Tm-172	2.67E-03	2.85E-03	6%
Dy-153	4.46E-03	4.50E-03	1%	Tm-173	2.01E-03	2.10E-03	5%
Dy-154*	0.00E+00	0.00E+00	0%	Tm-175	5.79E-03	6.00E-03	4%
Dy-155	3.46E-03	3.50E-03	1%	Yb-162	1.17E-03	1.16E-03	0%
Dy-157	1.68E-03	1.68E-03	0%	Yb-163	3.84E-03	3.97E-03	3%
Dy-159	1.17E-04	9.99E-05	-14%	Yb-164*	1.88E-04	4.59E-03	2342%
Dy-165	1.62E-04	2.70E-04	66%	Yb-166*	2.77E-04	1.13E-02	3975%
Dy-166*	1.53E-04	5.44E-04	255%	Yb-167	1.12E-03	1.07E-03	-4%
Ho-154	1.01E-02	1.07E-02	6%	Yb-169	1.39E-03	1.31E-03	-5%
Ho-155	3.16E-03	3.25E-03	3%	Yb-175	2.02E-04	2.24E-04	11%
Ho-156	1.14E-02	1.18E-02	3%	Yb-177	1.06E-03	1.18E-03	11%
Ho-157	2.87E-03	2.89E-03	1%	Yb-178*	2.06E-04	1.22E-03	493%
Ho-159	1.77E-03	1.77E-03	0%	Lu-165	5.86E-03	7.62E-03	30%
Ho-160	8.92E-03	9.08E-03	2%	Lu-167	9.27E-03	1.05E-02	13%
Ho-161	1.55E-04	1.37E-04	-12%	Lu-169	7.09E-03	7.18E-03	1%
Ho-162	7.64E-04	7.60E-04	-1%	Lu-170	1.46E-02	1.48E-02	2%
Ho-162m*	2.90E-03	3.39E-03	17%	Lu-171	3.26E-03	3.29E-03	1%
Ho-163	0.00E+00	0.00E+00	0%	Lu-172	1.05E-02	1.06E-02	2%
Ho-164	9.39E-05	1.10E-04	17%	Lu-173	7.55E-04	7.09E-04	-6%
Ho-164m*	1.24E-04	2.14E-04	73%	Lu-174	5.21E-04	5.01E-04	-4%
Ho-166	2.04E-04	3.89E-04	91%	Lu-174m	2.08E-04	1.81E-04	-13%
Ho-166m	8.51E-03	8.67E-03	2%	Lu-176	2.42E-03	2.45E-03	1%
Ho-167	1.87E-03	1.91E-03	2%	Lu-176m	9.00E-05	1.93E-04	115%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Lu-177	1.75E-04	1.96E-04	12%	W-188*	1.28E-05	6.36E-04	4854%
Lu-177m*	4.94E-03	4.99E-03	1%	W-190*	6.71E-04	8.05E-03	1098%
Lu-178	7.52E-04	9.75E-04	30%	Re-178	9.54E-03	9.86E-03	3%
Lu-178m	5.29E-03	5.39E-03	2%	Re-179*	5.72E-03	5.82E-03	2%
Lu-179	1.90E-04	3.15E-04	65%	Re-181	4.11E-03	4.12E-03	0%
Hf-170	2.14E-03	2.14E-03	0%	Re-182	9.46E-03	9.53E-03	1%
Hf-172*	3.61E-04	3.17E-04	-12%	Re-182m	6.53E-03	6.59E-03	1%
Hf-173	1.89E-03	1.87E-03	-1%	Re-183	6.46E-04	5.97E-04	-7%
Hf-174	0.00E+00	0.00E+00	0%	Re-184	4.66E-03	4.72E-03	1%
Hf-175	1.72E-03	1.70E-03	-1%	Re-184m*	1.91E-03	5.46E-03	185%
Hf-177m	1.15E-02	1.15E-02	0%	Re-186	1.16E-04	1.86E-04	60%
Hf-178m	1.14E-02	1.15E-02	1%	Re-186m*	4.97E-05	2.28E-04	358%
Hf-179m	4.58E-03	4.60E-03	1%	Re-187	0.00E+00	0.00E+00	0%
Hf-180m	4.99E-03	5.02E-03	1%	Re-188	3.84E-04	6.10E-04	59%
Hf-181	2.71E-03	2.76E-03	2%	Re-188m	2.64E-04	2.29E-04	-13%
Hf-182*	1.21E-03	8.30E-03	584%	Re-189*	2.98E-04	3.66E-04	23%
Hf-182m	4.66E-03	4.72E-03	1%	Re-190m*	4.82E-03	8.34E-03	73%
Hf-183	4.09E-03	4.24E-03	4%	Os-180*	5.45E-04	6.98E-03	1180%
Hf-184	1.15E-03	1.22E-03	6%	Os-181	7.37E-03	7.45E-03	1%
Ta-172	9.13E-03	9.42E-03	3%	Os-182*	2.13E-03	8.71E-03	310%
Ta-173	2.99E-03	3.02E-03	1%	Os-183	3.11E-03	3.08E-03	-1%
Ta-174	5.21E-03	5.39E-03	3%	Os-183m	5.41E-03	5.48E-03	1%
Ta-175	5.94E-03	6.00E-03	1%	Os-185	3.57E-03	3.61E-03	1%
Ta-176	1.25E-02	1.27E-02	2%	Os-186	0.00E+00	0.00E+00	0%
Ta-177	2.53E-04	2.26E-04	-11%	Os-189m	1.20E-08	1.68E-08	40%
Ta-178m	5.73E-03	5.73E-03	0%	Os-191	3.44E-04	3.19E-04	-7%
Ta-179	8.13E-05	6.68E-05	-18%	Os-191m	2.13E-05	1.72E-05	-19%
Ta-180	1.66E-04	1.45E-04	-12%	Os-193	3.54E-04	4.32E-04	22%
Ta-182	6.98E-03	7.09E-03	2%	Os-194*	5.94E-06	8.09E-04	13506%
Ta-182m	1.23E-03	1.20E-03	-2%	Os-196*	4.25E-04	2.27E-03	433%
Ta-183	1.40E-03	1.40E-03	0%	Ir-182	7.50E-03	7.96E-03	6%
Ta-184	8.26E-03	8.48E-03	3%	Ir-183	6.40E-03	6.48E-03	1%
Ta-185	7.82E-04	9.46E-04	21%	Ir-184	1.05E-02	1.07E-02	2%
Ta-186	7.51E-03	7.95E-03	6%	Ir-185	4.61E-03	4.64E-03	1%
W-177	4.66E-03	4.67E-03	0%	Ir-186	8.91E-03	9.03E-03	1%
W-178*	5.06E-05	5.70E-04	1027%	Ir-186m	6.78E-03	6.90E-03	2%
W-179	1.69E-04	1.38E-04	-18%	Ir-187	1.63E-03	1.63E-03	-1%
W-181	1.34E-04	1.10E-04	-18%	Ir-188	1.18E-02	1.20E-02	2%
W-185	5.79E-06	2.58E-05	346%	Ir-189*	3.12E-04	2.73E-04	-12%
W-187	2.34E-03	2.42E-03	4%	Ir-190	7.60E-03	7.70E-03	1%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ir-190m	1.33E-08	1.86E-08	40%	Hg-192	1.28E-03	1.24E-03	-3%
Ir-190n*	2.13E-04	7.82E-03	3579%	Hg-193	4.45E-03	4.48E-03	1%
Ir-192	4.22E-03	4.30E-03	2%	Hg-193m*	5.45E-03	6.66E-03	22%
Ir-192n*	7.76E-06	4.31E-03	55366%	Hg-194*	5.24E-08	5.68E-03	10831866%
Ir-193m	1.21E-06	1.00E-06	-17%	Hg-195	9.61E-04	9.31E-04	-3%
Ir-194	5.57E-04	8.03E-04	44%	Hg-195m*	9.77E-04	1.47E-03	50%
Ir-194m	1.21E-02	1.23E-02	2%	Hg-197	2.79E-04	2.32E-04	-17%
Ir-195	2.57E-04	3.03E-04	18%	Hg-197m	4.38E-04	4.21E-04	-4%
Ir-195m*	1.90E-03	1.96E-03	3%	Hg-199m	8.79E-04	8.56E-04	-3%
Pt-184	3.53E-03	3.48E-03	-1%	Hg-203	1.21E-03	1.22E-03	1%
Pt-186*	3.49E-03	9.16E-03	162%	Tl-194	4.79E-03	5.06E-03	6%
Pt-187	3.11E-03	3.10E-03	0%	Tl-194m	1.32E-02	1.35E-02	2%
Pt-188*	9.39E-04	1.29E-02	1272%	Tl-195	6.70E-03	6.79E-03	1%
Pt-189	2.41E-03	2.38E-03	-1%	Tl-196	1.03E-02	1.05E-02	2%
Pt-190	0.00E+00	0.00E+00	0%	Tl-197	2.36E-03	2.35E-03	0%
Pt-191	1.38E-03	1.33E-03	-3%	Tl-198	1.11E-02	1.13E-02	1%
Pt-193	3.30E-08	4.51E-08	36%	Tl-198m	6.26E-03	6.34E-03	1%
Pt-193m	4.30E-05	3.57E-05	-17%	Tl-199	1.20E-03	1.17E-03	-3%
Pt-195m	2.86E-04	2.47E-04	-14%	Tl-200	6.98E-03	7.07E-03	1%
Pt-197	1.16E-04	1.42E-04	23%	Tl-201	3.81E-04	3.33E-04	-12%
Pt-197m	3.81E-04	3.60E-04	-5%	Tl-202	2.32E-03	2.33E-03	0%
Pt-199	1.08E-03	1.23E-03	14%	Tl-204	2.04E-05	6.86E-05	236%
Pt-202*	5.87E-05	1.65E-03	2706%	Pb-194	5.77E-03	5.82E-03	1%
Au-186	8.02E-03	8.53E-03	6%	Pb-195m	8.64E-03	8.79E-03	2%
Au-190	1.35E-02	1.38E-02	2%	Pb-196	2.45E-03	2.44E-03	-1%
Au-191	2.98E-03	2.97E-03	0%	Pb-197m*	6.10E-03	7.77E-03	27%
Au-192	1.08E-02	1.10E-02	2%	Pb-198	2.17E-03	2.15E-03	-1%
Au-193	7.48E-04	7.01E-04	-6%	Pb-199	5.59E-03	5.66E-03	1%
Au-194	5.62E-03	5.68E-03	1%	Pb-200	9.53E-04	9.07E-04	-5%
Au-195	3.15E-04	2.66E-04	-16%	Pb-201	3.90E-03	3.92E-03	0%
Au-196	2.36E-03	2.35E-03	0%	Pb-202*	5.66E-08	2.31E-03	4070368%
Au-196m	1.13E-03	1.09E-03	-3%	Pb-202m	1.06E-02	1.08E-02	2%
Au-198	2.10E-03	2.21E-03	5%	Pb-203	1.53E-03	1.50E-03	-2%
Au-198m	2.58E-03	2.54E-03	-2%	Pb-204m	1.10E-02	1.12E-02	2%
Au-199	4.64E-04	4.69E-04	1%	Pb-205	5.74E-08	7.88E-08	37%
Au-200	1.55E-03	1.80E-03	16%	Pb-209	1.17E-05	4.92E-05	322%
Au-200m*	1.03E-02	1.08E-02	5%	Pb-210*	5.50E-06	1.28E-04	2226%
Au-201	2.09E-04	3.14E-04	50%	Pb-211*	3.76E-04	7.39E-04	96%
Hg-190	9.04E-04	8.61E-04	-5%	Pb-212*	7.13E-04	6.10E-03	755%
Hg-191m	7.86E-03	7.95E-03	1%	Pb-214*	1.30E-03	1.00E-02	671%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Bi-200	1.28E-02	1.30E-02	2%	Ac-225*	6.61E-05	2.12E-04	220%
Bi-201	9.47E-03	9.62E-03	2%	Ac-226*	6.63E-04	7.95E-04	20%
Bi-202	1.47E-02	1.51E-02	2%	Ac-227*	4.26E-07	6.04E-04	141592%
Bi-203	1.32E-02	1.33E-02	1%	Ac-228	4.68E-03	4.86E-03	4%
Bi-204*	1.58E-02	1.71E-02	9%	Th-228*	9.63E-06	6.54E-05	578%
Bi-205	9.33E-03	9.47E-03	1%	Th-229*	3.88E-04	6.25E-04	61%
Bi-206	1.76E-02	1.79E-02	2%	Th-230*	1.77E-06	4.00E-05	2154%
Bi-207	8.21E-03	8.34E-03	2%	Th-232*	9.22E-07	4.87E-03	527421%
Bi-208	1.58E-02	1.60E-02	1%	Th-234*	3.76E-05	4.48E-04	1092%
Bi-210	3.01E-05	1.23E-04	309%	Pa-227*	8.38E-05	1.51E-04	80%
Bi-210m*	1.33E-03	1.52E-03	14%	Pa-228*	7.25E-03	7.41E-03	2%
Bi-212*	6.04E-04	7.61E-04	26%	Pa-229	2.72E-04	2.66E-04	-2%
Bi-213*	6.94E-04	8.09E-04	17%	Pa-230	3.49E-03	3.56E-03	2%
Bi-214*	8.30E-03	8.65E-03	4%	Pa-231*	1.69E-04	7.87E-04	365%
Po-203	8.82E-03	8.97E-03	2%	Pa-232	4.97E-03	5.09E-03	2%
Po-204	6.02E-03	6.06E-03	1%	Pa-233	1.08E-03	1.10E-03	1%
Po-205	8.54E-03	8.66E-03	1%	Pa-234	7.79E-03	7.98E-03	2%
Po-206*	6.22E-03	2.33E-02	274%	Pa-235	3.91E-05	1.60E-04	310%
Po-207	6.84E-03	6.94E-03	1%	U-230*	5.32E-06	9.45E-05	1676%
Po-208	1.09E-07	1.10E-07	1%	U-231	3.11E-04	3.03E-04	-2%
Po-209	3.22E-05	3.25E-05	1%	U-232*	1.26E-06	6.65E-05	5176%
Po-210	5.20E-08	5.30E-08	2%	U-233*	1.24E-06	6.26E-04	50472%
At-205	6.10E-03	6.24E-03	2%	U-234*	7.17E-07	4.07E-05	5575%
At-206	1.31E-02	1.35E-02	3%	U-235*	8.02E-04	8.67E-04	8%
At-207	1.09E-02	1.11E-02	2%	U-235m	0.00E+00	0.00E+00	0%
At-208	1.63E-02	1.66E-02	2%	U-236	4.41E-07	4.19E-07	-5%
At-209	1.20E-02	1.22E-02	1%	U-237	6.17E-04	6.11E-04	-1%
At-210	1.63E-02	1.66E-02	1%	U-238*	3.74E-07	4.48E-04	119918%
At-211*	1.48E-04	1.58E-04	6%	U-239	2.45E-04	3.14E-04	28%
Fr-212	6.14E-03	6.25E-03	2%	U-240*	2.42E-05	2.00E-03	8179%
Fr-222*	9.54E-04	1.19E-03	24%	U-242*	2.29E-04	2.19E-03	855%
Fr-223	2.51E-04	3.19E-04	27%	Np-232	6.25E-03	6.36E-03	2%
Ra-223*	6.70E-04	9.60E-04	43%	Np-233	3.95E-04	3.94E-04	0%
Ra-224*	5.27E-05	5.61E-05	7%	Np-234	6.11E-03	6.22E-03	2%
Ra-225*	2.88E-05	2.49E-04	763%	Np-235	3.32E-06	3.24E-06	-2%
Ra-226*	3.63E-05	3.84E-05	6%	Np-236*	6.50E-04	6.53E-04	0%
Ra-227	7.44E-04	8.42E-04	13%	Np-236m	2.22E-04	2.35E-04	6%
Ra-228*	3.37E-07	4.87E-03	1441675%	Np-237*	1.00E-04	1.19E-03	1087%
Ra-230*	3.89E-04	3.86E-03	893%	Np-238	3.18E-03	3.29E-03	3%
Ac-224	1.09E-03	1.08E-03	-1%	Np-239	8.58E-04	8.80E-04	3%

*Includes progeny ingrowth for FGR 15

Table C.1 cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Np-240	5.52E-03	5.70E-03	3%	Bk-246	4.46E-03	4.56E-03	2%
Np-241	2.09E-04	3.10E-04	48%	Bk-247	6.99E-04	6.87E-04	-2%
Pu-232*	2.70E-04	5.17E-03	1816%	Bk-248m	2.66E-04	3.08E-04	16%
Pu-234	2.92E-04	2.92E-04	0%	Bk-249	5.10E-08	2.17E-06	4145%
Pu-235	4.04E-04	4.05E-04	0%	Bk-250	4.88E-03	5.03E-03	3%
Pu-236	5.06E-07	4.71E-07	-7%	Bk-251	4.16E-04	4.83E-04	16%
Pu-237	2.09E-04	2.08E-04	-1%	Cf-244	5.04E-07	4.36E-07	-14%
Pu-238	3.92E-07	3.64E-07	-7%	Cf-246	5.72E-07	5.28E-07	-8%
Pu-239*	4.40E-07	4.25E-07	-4%	Cf-247	4.18E-04	4.22E-04	1%
Pu-240	3.84E-07	3.58E-07	-7%	Cf-248	2.34E-06	2.35E-06	1%
Pu-241	7.18E-09	1.33E-08	86%	Cf-249	1.67E-03	1.69E-03	1%
Pu-242	7.51E-07	7.51E-07	0%	Cf-250	5.63E-05	5.88E-05	4%
Pu-243	1.13E-04	1.32E-04	17%	Cf-251	5.65E-04	5.70E-04	1%
Pu-244*	1.13E-04	2.12E-03	1770%	Cf-252	2.60E-03	2.73E-03	5%
Pu-245*	2.11E-03	2.42E-03	15%	Cf-253	3.68E-06	1.19E-05	224%
Pu-246*	6.34E-04	6.20E-03	877%	Cf-254	9.62E-02	1.01E-01	5%
Am-237	1.81E-03	1.84E-03	2%	Cf-255	1.35E-05	5.65E-05	317%
Am-238	4.78E-03	4.87E-03	2%	Es-249	2.07E-03	2.09E-03	1%
Am-239	1.09E-03	1.10E-03	1%	Es-250	6.13E-03	6.23E-03	2%
Am-240	5.48E-03	5.59E-03	2%	Es-250m	2.91E-03	2.96E-03	2%
Am-241	7.85E-05	6.40E-05	-18%	Es-251	4.18E-04	4.23E-04	1%
Am-242	7.13E-05	1.01E-04	42%	Es-253	1.75E-06	1.75E-06	0%
Am-242m*	2.31E-06	1.03E-04	4361%	Es-254*	1.72E-05	5.05E-03	29306%
Am-243*	2.24E-04	1.07E-03	376%	Es-254m*	2.49E-03	2.64E-03	6%
Am-244	4.18E-03	4.29E-03	3%	Es-255*	5.78E-06	5.96E-05	931%
Am-244m	1.21E-04	2.52E-04	107%	Es-256	5.06E-05	2.03E-04	302%
Am-245	1.69E-04	2.25E-04	33%	Fm-251*	7.41E-04	7.62E-04	3%
Am-246	3.82E-03	3.98E-03	4%	Fm-252	2.00E-06	1.97E-06	-1%
Am-246m	5.34E-03	5.56E-03	4%	Fm-253	2.71E-04	2.74E-04	1%
Am-247	6.83E-04	8.06E-04	18%	Fm-254	4.05E-05	4.20E-05	4%
Cm-238*	3.56E-04	5.04E-03	1315%	Fm-255	1.11E-05	9.72E-06	-12%
Cm-239	1.23E-03	1.24E-03	1%	Fm-256	7.09E-02	7.42E-02	5%
Cm-240	5.30E-07	4.79E-07	-10%	Fm-257*	7.03E-04	7.27E-04	3%
Cm-241	2.48E-03	2.52E-03	2%	Ap-239*	4.40E-07	4.25E-07	-4%
Cm-242	4.55E-07	4.09E-07	-10%	Bg-90*	1.15E-05	4.28E-04	3633%
Cm-243	6.22E-04	6.25E-04	1%				
Cm-244	4.67E-07	4.32E-07	-7%				
Cm-246	2.09E-05	2.19E-05	5%				
Cm-248	7.48E-03	7.89E-03	5%				
Bk-245	1.08E-03	1.09E-03	1%				

*Includes progeny ingrowth for FGR 15

Table C.2. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	9.09E-15	100%	V-50	1.70E-08	1.18E-08	-31%
Be-7	6.34E-10	4.38E-10	-31%	Cr-48	5.39E-09	3.52E-09	-35%
Be-10	4.58E-11	1.37E-10	199%	Cr-49	1.43E-08	1.04E-08	-27%
C-11	1.33E-08	9.53E-09	-28%	Cr-51	3.98E-10	2.64E-10	-34%
C-14	1.70E-13	8.37E-12	4806%	Mn-51	1.43E-08	1.08E-08	-24%
F-18	1.26E-08	8.85E-09	-30%	Mn-52	4.28E-08	2.93E-08	-31%
Na-22	2.73E-08	1.88E-08	-31%	Mn-52m	3.14E-08	2.28E-08	-27%
Na-24	4.78E-08	3.34E-08	-30%	Mn-53	0.00E+00	0.00E+00	0%
Mg-28*	1.68E-08	2.84E-08	69%	Mn-54	1.05E-08	7.19E-09	-32%
Al-26	3.29E-08	2.31E-08	-30%	Mn-56	2.16E-08	1.57E-08	-27%
Si-31	9.50E-10	1.23E-09	29%	Fe-52*	9.46E-09	2.94E-08	211%
Si-32*	3.82E-13	1.49E-09	389701%	Fe-55	1.93E-18	1.23E-18	-36%
P-32	1.13E-09	1.48E-09	30%	Fe-59	1.47E-08	1.00E-08	-32%
P-33	4.85E-13	1.75E-11	3511%	Fe-60*	3.05E-13	5.07E-11	16525%
S-35	1.77E-13	8.41E-12	4646%	Co-55	2.56E-08	1.80E-08	-30%
S-38*	2.02E-08	2.88E-08	42%	Co-56	4.36E-08	3.00E-08	-31%
Cl-34m*	2.54E-08	2.37E-08	-7%	Co-57	1.45E-09	9.16E-10	-37%
Cl-36	1.48E-10	2.52E-10	70%	Co-58	1.23E-08	8.44E-09	-31%
Cl-38	1.86E-08	1.44E-08	-23%	Co-58m	8.90E-14	9.32E-15	-90%
Cl-39	1.89E-08	1.38E-08	-27%	Co-60	3.06E-08	2.10E-08	-31%
K-40	2.72E-09	2.38E-09	-12%	Co-60m	5.65E-11	3.78E-11	-33%
K-42	5.33E-09	5.14E-09	-4%	Co-61	1.81E-09	1.59E-09	-12%
K-43	1.25E-08	8.73E-09	-30%	Co-62m	3.42E-08	2.46E-08	-28%
K-44	2.97E-08	2.19E-08	-26%	Ni-56	2.14E-08	1.46E-08	-32%
K-45	2.32E-08	1.68E-08	-27%	Ni-57	2.37E-08	1.64E-08	-31%
Ca-41	0.00E+00	0.00E+00	0%	Ni-59	1.97E-13	1.36E-13	-31%
Ca-45	5.03E-13	1.79E-11	3457%	Ni-63	0.00E+00	1.09E-12	100%
Ca-47*	1.32E-08	1.02E-08	-23%	Ni-65	7.69E-09	5.87E-09	-24%
Sc-43	1.31E-08	9.38E-09	-28%	Ni-66*	4.60E-13	3.08E-09	670008%
Sc-44	2.77E-08	1.96E-08	-29%	Cu-60	4.86E-08	3.44E-08	-29%
Sc-44m*	3.41E-09	2.16E-08	534%	Cu-61	1.09E-08	7.74E-09	-29%
Sc-46	2.50E-08	1.71E-08	-32%	Cu-64	2.37E-09	1.69E-09	-29%
Sc-47	1.33E-09	9.08E-10	-32%	Cu-67	1.40E-09	9.35E-10	-33%
Sc-48	4.14E-08	2.84E-08	-31%	Zn-62*	5.58E-09	1.53E-08	174%
Sc-49	1.35E-09	1.77E-09	31%	Zn-63	1.55E-08	1.16E-08	-25%
Ti-44*	1.64E-09	2.06E-08	1158%	Zn-65	7.15E-09	4.89E-09	-32%
Ti-45	1.15E-08	8.28E-09	-28%	Zn-69	2.78E-10	4.08E-10	47%
V-47	1.40E-08	1.05E-08	-25%	Zn-69m*	5.30E-09	4.05E-09	-24%
V-48	3.61E-08	2.48E-08	-31%	Zn-71m	2.05E-08	1.46E-08	-29%
V-49	0.00E+00	0.00E+00	0%	Zn-72*	1.77E-09	2.43E-08	1271%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ga-65	1.60E-08	1.18E-08	-26%	Br-82	3.30E-08	2.28E-08	-31%
Ga-66	3.01E-08	2.16E-08	-28%	Br-83*	3.84E-10	4.88E-10	27%
Ga-67	1.90E-09	1.23E-09	-36%	Br-84	2.20E-08	1.63E-08	-26%
Ga-68	1.33E-08	9.93E-09	-25%	Rb-78	4.89E-08	3.49E-08	-29%
Ga-70	1.13E-09	1.41E-09	25%	Rb-79	1.94E-08	1.42E-08	-27%
Ga-72	3.30E-08	2.31E-08	-30%	Rb-81*	6.53E-09	5.56E-09	-15%
Ga-73	4.94E-09	3.66E-09	-26%	Rb-81m	3.24E-10	2.13E-10	-34%
Ge-66	8.54E-09	5.81E-09	-32%	Rb-82m	3.65E-08	2.51E-08	-31%
Ge-67	1.96E-08	1.46E-08	-26%	Rb-83*	6.18E-09	4.27E-09	-31%
Ge-68*	4.81E-13	9.93E-09	2064499%	Rb-84	1.16E-08	8.08E-09	-30%
Ge-69	1.20E-08	8.32E-09	-31%	Rb-84m	4.77E-09	3.17E-09	-34%
Ge-71	4.88E-13	4.11E-18	-100%	Rb-86	2.20E-09	2.17E-09	-1%
Ge-75	9.72E-10	1.00E-09	3%	Rb-87	1.05E-12	3.19E-11	2931%
Ge-77	1.44E-08	1.03E-08	-28%	Rb-88	9.96E-09	9.02E-09	-10%
Ge-78	3.54E-09	2.41E-09	-32%	Rb-89	2.82E-08	2.03E-08	-28%
As-69	1.63E-08	1.24E-08	-23%	Sr-80*	5.50E-09	1.81E-08	229%
As-70	5.38E-08	3.79E-08	-30%	Sr-81	1.90E-08	1.40E-08	-26%
As-71	7.25E-09	4.98E-09	-31%	Sr-82*	2.02E-11	1.26E-08	61971%
As-72	2.40E-08	1.76E-08	-27%	Sr-83	1.04E-08	7.23E-09	-30%
As-73	6.85E-11	3.15E-11	-54%	Sr-85	6.29E-09	4.33E-09	-31%
As-74	9.94E-09	7.07E-09	-29%	Sr-85m	2.66E-09	1.71E-09	-36%
As-76	6.83E-09	5.80E-09	-15%	Sr-87m	4.04E-09	2.74E-09	-32%
As-77	1.77E-10	2.23E-10	26%	Sr-89	9.16E-10	1.19E-09	30%
As-78	1.77E-08	1.34E-08	-24%	Sr-90*	2.18E-11	2.06E-09	9324%
Se-70	9.27E-09	6.46E-09	-30%	Sr-91*	9.79E-09	1.01E-08	3%
Se-72*	3.24E-10	1.77E-08	5370%	Sr-92	1.63E-08	1.13E-08	-31%
Se-73	1.44E-08	1.01E-08	-30%	Y-84m	5.14E-08	3.66E-08	-29%
Se-73m	3.56E-09	2.59E-09	-27%	Y-85*	1.45E-08	1.22E-08	-16%
Se-75	4.74E-09	3.07E-09	-35%	Y-85m*	1.72E-08	1.25E-08	-27%
Se-79	1.93E-13	9.30E-12	4714%	Y-86	4.41E-08	3.05E-08	-31%
Se-81	1.07E-09	1.33E-09	24%	Y-86m	2.70E-09	1.75E-09	-35%
Se-81m*	1.69E-10	1.43E-09	745%	Y-87*	5.59E-09	6.59E-09	18%
Se-83	3.26E-08	2.28E-08	-30%	Y-87m	3.88E-09	2.63E-09	-32%
Br-74	5.46E-08	3.85E-08	-29%	Y-88	3.21E-08	2.22E-08	-31%
Br-74m	5.13E-08	3.66E-08	-29%	Y-90	1.47E-09	1.97E-09	34%
Br-75	1.60E-08	1.14E-08	-28%	Y-90m	8.02E-09	5.43E-09	-32%
Br-76	3.44E-08	2.43E-08	-29%	Y-91	9.90E-10	1.27E-09	28%
Br-77	3.98E-09	2.69E-09	-33%	Y-91m	6.77E-09	4.69E-09	-31%
Br-80	2.13E-09	2.20E-09	3%	Y-92	5.10E-09	4.98E-09	-2%
Br-80m*	1.84E-10	2.25E-09	1121%	Y-93	2.89E-09	3.18E-09	10%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Y-94	1.19E-08	9.98E-09	-16%	Tc-97m	5.82E-11	4.13E-12	-93%
Y-95	1.45E-08	1.14E-08	-22%	Tc-98	1.78E-08	1.24E-08	-31%
Zr-86*	3.50E-09	3.27E-08	835%	Tc-99	8.72E-13	2.69E-11	2986%
Zr-87	1.31E-08	9.87E-09	-24%	Tc-99m	1.52E-09	9.68E-10	-36%
Zr-88	4.88E-09	3.29E-09	-33%	Tc-101	4.88E-09	3.66E-09	-25%
Zr-89	1.47E-08	1.00E-08	-31%	Tc-104	2.89E-08	2.15E-08	-26%
Zr-93*	0.00E+00	1.47E-12	100%	Ru-94	6.46E-09	4.33E-09	-33%
Zr-95*	9.27E-09	6.48E-09	-30%	Ru-95	1.55E-08	1.06E-08	-32%
Zr-97*	1.22E-08	1.58E-08	29%	Ru-97	2.89E-09	1.82E-09	-37%
Nb-88	5.47E-08	3.90E-08	-29%	Ru-103*	6.31E-09	4.38E-09	-31%
Nb-89	1.82E-08	1.37E-08	-25%	Ru-105	9.96E-09	7.15E-09	-28%
Nb-89m*	1.78E-08	1.87E-08	5%	Ru-106*	0.00E+00	4.63E-09	100%
Nb-90	5.03E-08	3.49E-08	-31%	Rh-97	1.89E-08	1.35E-08	-29%
Nb-91	6.31E-11	1.47E-11	-77%	Rh-97m*	2.62E-08	1.89E-08	-28%
Nb-91m	3.49E-10	2.09E-10	-40%	Rh-99	6.97E-09	4.66E-09	-33%
Nb-92	1.89E-08	1.29E-08	-32%	Rh-99m	8.10E-09	5.46E-09	-33%
Nb-92m	1.20E-08	8.19E-09	-32%	Rh-100	3.28E-08	2.26E-08	-31%
Nb-93m	9.10E-12	1.79E-13	-98%	Rh-101	3.42E-09	2.14E-09	-37%
Nb-94	1.97E-08	1.35E-08	-31%	Rh-101m	3.53E-09	2.27E-09	-36%
Nb-95	9.67E-09	6.64E-09	-31%	Rh-102	6.58E-09	4.65E-09	-29%
Nb-95m	8.33E-10	5.33E-10	-36%	Rh-102m	2.70E-08	1.86E-08	-31%
Nb-96	3.10E-08	2.13E-08	-31%	Rh-103m	1.10E-11	6.66E-13	-94%
Nb-97	9.08E-09	6.67E-09	-27%	Rh-105	9.83E-10	7.03E-10	-29%
Nb-98m	3.61E-08	2.55E-08	-29%	Rh-106m	3.58E-08	2.48E-08	-31%
Mo-90	1.04E-08	7.05E-09	-32%	Rh-107	4.50E-09	3.38E-09	-25%
Mo-91	1.44E-08	1.15E-08	-20%	Pd-98*	5.09E-09	2.17E-08	327%
Mo-93*	5.10E-11	1.16E-12	-98%	Pd-99	1.65E-08	1.17E-08	-29%
Mo-93m	2.84E-08	1.94E-08	-32%	Pd-100*	1.33E-09	2.33E-08	1652%
Mo-99*	2.36E-09	2.78E-09	18%	Pd-101	4.28E-09	2.81E-09	-34%
Mo-101*	1.86E-08	1.69E-08	-9%	Pd-103*	1.02E-10	6.90E-12	-93%
Mo-102*	5.87E-10	5.03E-09	757%	Pd-107	0.00E+00	1.82E-13	100%
Tc-93	1.89E-08	1.30E-08	-31%	Pd-109	4.96E-10	5.72E-10	15%
Tc-93m	1.11E-08	7.59E-09	-31%	Pd-111*	1.94E-09	2.22E-09	14%
Tc-94	3.34E-08	2.29E-08	-31%	Pd-112*	2.96E-11	8.48E-09	28586%
Tc-94m	2.54E-08	1.83E-08	-28%	Ag-101	2.09E-08	1.51E-08	-28%
Tc-95	9.96E-09	6.79E-09	-32%	Ag-102	4.32E-08	3.06E-08	-29%
Tc-95m*	8.56E-09	6.03E-09	-30%	Ag-103	1.07E-08	7.41E-09	-31%
Tc-96	3.14E-08	2.15E-08	-32%	Ag-104	3.38E-08	2.32E-08	-31%
Tc-96m	5.54E-10	3.55E-10	-36%	Ag-104m	2.32E-08	1.67E-08	-28%
Tc-97	6.07E-11	1.63E-12	-97%	Ag-105	6.37E-09	4.20E-09	-34%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ag-106	9.70E-09	7.18E-09	-26%	Sn-113*	2.26E-10	2.25E-09	894%
Ag-108m*	2.05E-08	1.42E-08	-31%	Sn-113m	1.24E-10	1.70E-11	-86%
Ag-110m*	3.45E-08	2.38E-08	-31%	Sn-117m	1.86E-09	1.11E-09	-41%
Ag-111	7.05E-10	7.40E-10	5%	Sn-119m	1.31E-10	1.45E-11	-89%
Ag-112	1.03E-08	8.46E-09	-18%	Sn-121	1.21E-12	3.34E-11	2667%
Ag-113	2.12E-09	2.21E-09	4%	Sn-121m*	4.86E-11	4.17E-11	-14%
Ag-115	7.38E-09	6.14E-09	-17%	Sn-123	8.72E-10	1.09E-09	25%
Cd-104*	3.05E-09	1.87E-08	513%	Sn-123m	2.33E-09	1.92E-09	-18%
Cd-105*	1.60E-08	1.12E-08	-30%	Sn-125	5.34E-09	4.46E-09	-16%
Cd-107	3.04E-10	8.67E-11	-71%	Sn-126*	6.42E-10	1.52E-08	2270%
Cd-109	2.20E-10	3.70E-11	-83%	Sn-127	2.40E-08	1.68E-08	-30%
Cd-111m	3.46E-09	2.19E-09	-37%	Sn-128*	7.55E-09	2.34E-08	210%
Cd-113	7.65E-13	2.40E-11	3045%	Sb-115	1.16E-08	8.19E-09	-30%
Cd-113m	2.37E-11	8.54E-11	260%	Sb-116	2.86E-08	2.02E-08	-30%
Cd-115*	2.76E-09	3.44E-09	25%	Sb-116m	3.85E-08	2.62E-08	-32%
Cd-115m	1.36E-09	1.52E-09	12%	Sb-117	2.21E-09	1.33E-09	-40%
Cd-117*	1.37E-08	1.15E-08	-16%	Sb-118m	3.21E-08	2.16E-08	-33%
Cd-117m*	2.45E-08	1.71E-08	-30%	Sb-119	2.08E-10	2.42E-11	-88%
Cd-118*	7.73E-12	4.29E-09	55457%	Sb-120	6.22E-09	4.54E-09	-27%
In-107	1.90E-08	1.33E-08	-30%	Sb-120m	3.04E-08	2.05E-08	-32%
In-108	4.88E-08	3.35E-08	-31%	Sb-122	6.50E-09	5.01E-09	-23%
In-108m	3.36E-08	2.38E-08	-29%	Sb-124	2.30E-08	1.62E-08	-30%
In-109	7.91E-09	5.26E-09	-34%	Sb-124n*	7.58E-15	4.05E-09	53393853%
In-110	3.89E-08	2.66E-08	-32%	Sb-125*	5.51E-09	3.74E-09	-32%
In-110m	2.06E-08	1.48E-08	-28%	Sb-126	3.53E-08	2.45E-08	-30%
In-111	4.92E-09	3.06E-09	-38%	Sb-126m	2.06E-08	1.48E-08	-28%
In-112	3.65E-09	2.68E-09	-27%	Sb-127*	9.06E-09	6.58E-09	-27%
In-112m*	3.73E-10	2.85E-09	665%	Sb-128	3.97E-08	2.76E-08	-30%
In-113m	3.28E-09	2.19E-09	-33%	Sb-128m	2.56E-08	1.84E-08	-28%
In-114m*	9.70E-10	2.22E-09	128%	Sb-129*	1.85E-08	1.42E-08	-23%
In-115	4.98E-12	5.27E-11	958%	Sb-130	4.20E-08	2.94E-08	-30%
In-115m	2.02E-09	1.32E-09	-35%	Te-114*	1.57E-08	3.60E-08	129%
In-116m	3.02E-08	2.10E-08	-31%	Te-116*	1.29E-09	2.09E-08	1514%
In-117	8.86E-09	6.14E-09	-31%	Te-117	1.93E-08	1.34E-08	-31%
In-117m*	1.67E-09	4.32E-09	159%	Te-118*	1.89E-10	8.87E-09	4592%
In-119m*	2.36E-09	3.09E-09	31%	Te-119	9.60E-09	6.52E-09	-32%
Sn-108	8.52E-09	5.64E-09	-34%	Te-119m	1.84E-08	1.24E-08	-33%
Sn-109*	2.65E-08	1.98E-08	-25%	Te-121	7.29E-09	4.92E-09	-32%
Sn-110*	3.57E-09	1.71E-08	379%	Te-121m*	2.64E-09	6.00E-09	127%
Sn-111	6.37E-09	4.50E-09	-29%	Te-123	3.29E-13	4.52E-14	-86%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Te-123m	1.76E-09	1.06E-09	-40%	Cs-137*	4.17E-11	5.13E-09	12204%
Te-125m	3.57E-10	5.99E-11	-83%	Cs-138	3.01E-08	2.20E-08	-27%
Te-127	1.40E-10	2.00E-10	43%	Ba-124*	7.37E-09	1.89E-08	157%
Te-127m*	1.14E-10	2.21E-10	94%	Ba-126*	7.19E-09	1.74E-08	142%
Te-129	1.55E-09	1.52E-09	-1%	Ba-127	1.00E-08	7.43E-09	-26%
Te-129m*	7.77E-10	1.66E-09	113%	Ba-128*	7.81E-10	9.97E-09	1177%
Te-131	6.29E-09	4.92E-09	-22%	Ba-129	4.30E-09	2.95E-09	-31%
Te-131m*	1.81E-08	1.35E-08	-25%	Ba-129m	1.96E-08	1.32E-08	-33%
Te-132	2.84E-09	2.22E-08	681%	Ba-131*	5.93E-09	3.91E-09	-34%
Te-133	1.57E-08	1.14E-08	-28%	Ba-131m	8.96E-10	4.92E-10	-45%
Te-133m*	2.34E-08	1.82E-08	-22%	Ba-133	4.97E-09	3.11E-09	-37%
Te-134	1.10E-08	7.48E-09	-32%	Ba-133m	8.10E-10	4.43E-10	-45%
I-118	2.77E-08	2.12E-08	-23%	Ba-135m	7.17E-10	3.83E-10	-47%
I-119	1.23E-08	8.79E-09	-28%	Ba-139	1.98E-09	2.25E-09	13%
I-120	3.36E-08	2.43E-08	-28%	Ba-140*	2.54E-09	2.21E-08	767%
I-120m	4.52E-08	3.20E-08	-29%	Ba-141	1.29E-08	9.67E-09	-25%
I-121	5.00E-09	3.26E-09	-35%	Ba-142	1.35E-08	9.40E-09	-30%
I-123	2.05E-09	1.20E-09	-41%	La-129	1.25E-08	9.12E-09	-27%
I-124	1.40E-08	9.80E-09	-30%	La-131	8.58E-09	5.88E-09	-32%
I-125	4.25E-10	6.88E-11	-84%	La-132	2.52E-08	1.78E-08	-29%
I-126	5.63E-09	3.91E-09	-31%	La-132m	8.47E-09	5.73E-09	-32%
I-129	2.65E-10	6.39E-11	-76%	La-133	2.01E-09	1.29E-09	-36%
I-130	2.73E-08	1.90E-08	-31%	La-135	4.06E-10	1.53E-10	-62%
I-131	4.86E-09	3.34E-09	-31%	La-137	2.68E-10	6.10E-11	-77%
I-132	2.90E-08	2.05E-08	-30%	La-138	1.49E-08	1.02E-08	-31%
I-132m	4.36E-09	3.00E-09	-31%	La-140	2.86E-08	2.01E-08	-30%
I-133	8.29E-09	6.06E-09	-27%	La-141	1.86E-09	2.31E-09	24%
I-134	3.32E-08	2.33E-08	-30%	La-142	2.88E-08	2.06E-08	-28%
I-135*	1.96E-08	3.14E-08	60%	La-143	5.01E-09	4.77E-09	-5%
Cs-125	1.00E-08	7.20E-09	-28%	Ce-130*	6.19E-09	2.53E-08	308%
Cs-127	5.43E-09	3.58E-09	-34%	Ce-131	2.10E-08	1.50E-08	-29%
Cs-129	3.46E-09	2.18E-09	-37%	Ce-132	3.32E-09	2.03E-09	-39%
Cs-130	6.99E-09	5.16E-09	-26%	Ce-133	7.31E-09	5.14E-09	-30%
Cs-131	2.40E-10	4.60E-11	-81%	Ce-133m*	2.14E-08	1.58E-08	-26%
Cs-132	9.02E-09	6.10E-09	-32%	Ce-134	3.06E-10	7.94E-09	2492%
Cs-134	1.97E-08	1.36E-08	-31%	Ce-135	1.03E-08	6.86E-09	-34%
Cs-134m	3.00E-10	1.45E-10	-51%	Ce-137	4.33E-10	1.68E-10	-61%
Cs-135	6.74E-13	2.23E-11	3210%	Ce-137m*	6.62E-10	5.12E-10	-23%
Cs-135m	2.02E-08	1.38E-08	-32%	Ce-139	1.90E-09	1.09E-09	-43%
Cs-136	2.65E-08	1.81E-08	-32%	Ce-141	9.28E-10	6.18E-10	-33%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ce-143	3.98E-09	2.90E-09	-27%	Sm-140*	7.29E-09	1.80E-08	147%
Ce-144*	2.30E-10	2.84E-09	1133%	Sm-141	1.86E-08	1.34E-08	-28%
Pr-134	4.10E-08	2.91E-08	-29%	Sm-141m*	2.48E-08	2.47E-08	0%
Pr-134m	3.05E-08	2.25E-08	-26%	Sm-142*	1.41E-09	1.09E-08	673%
Pr-135	1.18E-08	8.53E-09	-28%	Sm-145	7.27E-10	2.55E-10	-65%
Pr-136	2.77E-08	1.98E-08	-29%	Sm-146	0.00E+00	0.00E+00	0%
Pr-137	4.94E-09	3.50E-09	-29%	Sm-147	0.00E+00	0.00E+00	0%
Pr-138m	3.13E-08	2.15E-08	-31%	Sm-148*	0.00E+00	0.00E+00	0%
Pr-139	1.65E-09	1.06E-09	-36%	Sm-151	5.07E-14	1.48E-12	2810%
Pr-142	1.96E-09	2.17E-09	11%	Sm-153	8.33E-10	5.48E-10	-34%
Pr-142m	0.00E+00	0.00E+00	0%	Sm-155	2.06E-09	1.84E-09	-11%
Pr-143	2.77E-10	4.03E-10	45%	Sm-156	1.43E-09	9.61E-10	-33%
Pr-144	2.14E-09	2.72E-09	27%	Eu-145	1.57E-08	1.06E-08	-32%
Pr-145	1.31E-09	1.57E-09	20%	Eu-146	2.98E-08	2.04E-08	-31%
Pr-146	1.41E-08	1.10E-08	-22%	Eu-147	5.83E-09	3.78E-09	-35%
Pr-147	7.33E-09	5.67E-09	-23%	Eu-148	2.80E-08	1.91E-08	-32%
Nd-135	1.73E-08	1.27E-08	-27%	Eu-149	7.79E-10	3.95E-10	-49%
Nd-136*	3.45E-09	2.19E-08	535%	Eu-150	1.96E-08	1.32E-08	-33%
Nd-137	1.51E-08	1.05E-08	-30%	Eu-150m	9.34E-10	8.52E-10	-9%
Nd-138*	5.06E-10	9.65E-09	1807%	Eu-152	1.45E-08	9.87E-09	-32%
Nd-139	5.90E-09	4.17E-09	-29%	Eu-152m	4.48E-09	3.51E-09	-22%
Nd-139m*	1.97E-08	1.39E-08	-29%	Eu-152n	8.66E-10	5.07E-10	-41%
Nd-140*	3.41E-09	5.99E-09	76%	Eu-154	1.56E-08	1.08E-08	-31%
Nd-141	9.24E-10	5.13E-10	-44%	Eu-154m	7.97E-10	4.28E-10	-46%
Nd-144	0.00E+00	0.00E+00	0%	Eu-155	7.18E-10	4.22E-10	-41%
Nd-147	1.86E-09	1.31E-09	-30%	Eu-156	1.55E-08	1.10E-08	-29%
Nd-149	5.25E-09	3.84E-09	-27%	Eu-157	4.06E-09	2.94E-09	-28%
Nd-151	1.14E-08	8.26E-09	-28%	Eu-158	1.73E-08	1.26E-08	-27%
Nd-152*	2.33E-09	6.74E-09	189%	Eu-159	5.06E-09	4.16E-09	-18%
Pm-141	1.01E-08	7.55E-09	-25%	Gd-145	2.92E-08	2.03E-08	-31%
Pm-143	3.96E-09	2.59E-09	-35%	Gd-146*	2.98E-09	2.21E-08	640%
Pm-144	1.98E-08	1.35E-08	-32%	Gd-147	1.74E-08	1.17E-08	-33%
Pm-145	3.52E-10	1.13E-10	-68%	Gd-148	0.00E+00	0.00E+00	0%
Pm-146	9.55E-09	6.52E-09	-32%	Gd-149	6.58E-09	4.24E-09	-36%
Pm-147	3.74E-13	1.28E-11	3322%	Gd-150	0.00E+00	0.00E+00	0%
Pm-148	8.14E-09	6.30E-09	-23%	Gd-151	8.22E-10	4.10E-10	-50%
Pm-148m*	2.53E-08	1.76E-08	-30%	Gd-152	0.00E+00	0.00E+00	0%
Pm-149	5.51E-10	6.53E-10	18%	Gd-153	1.23E-09	6.03E-10	-51%
Pm-150	1.92E-08	1.39E-08	-27%	Gd-159	9.28E-10	8.00E-10	-14%
Pm-151	4.33E-09	3.03E-09	-30%	Tb-147	2.73E-08	1.88E-08	-31%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Tb-148	3.01E-08	2.15E-08	-29%	Er-156	7.55E-10	3.42E-10	-55%
Tb-149	1.68E-08	1.14E-08	-32%	Er-159*	1.20E-08	1.10E-08	-8%
Tb-150	2.94E-08	2.04E-08	-31%	Er-161*	1.23E-08	8.54E-09	-31%
Tb-151	1.24E-08	8.23E-09	-34%	Er-163	4.62E-10	2.01E-10	-56%
Tb-152	1.85E-08	1.28E-08	-31%	Er-165	4.33E-10	1.85E-10	-57%
Tb-153	4.06E-09	2.55E-09	-37%	Er-169	9.30E-13	2.68E-11	2783%
Tb-154	2.69E-08	1.84E-08	-32%	Er-171	5.02E-09	3.53E-09	-30%
Tb-155	2.12E-09	1.20E-09	-43%	Er-172	6.53E-09	4.43E-09	-32%
Tb-156	2.38E-08	1.61E-08	-32%	Tm-161	1.59E-08	1.07E-08	-33%
Tb-156m	4.36E-10	1.90E-10	-56%	Tm-162	2.37E-08	1.67E-08	-29%
Tb-156n	4.28E-11	1.96E-11	-54%	Tm-163*	1.60E-08	1.10E-08	-31%
Tb-157	5.38E-11	2.03E-11	-62%	Tm-165*	6.97E-09	4.70E-09	-32%
Tb-158	1.00E-08	6.72E-09	-33%	Tm-166	2.38E-08	1.62E-08	-32%
Tb-160	1.41E-08	9.64E-09	-32%	Tm-167	1.77E-09	1.02E-09	-42%
Tb-161	4.04E-10	2.27E-10	-44%	Tm-168	1.56E-08	1.05E-08	-33%
Tb-163	1.03E-08	7.24E-09	-30%	Tm-170	3.32E-10	4.39E-10	32%
Dy-151*	1.69E-08	1.18E-08	-31%	Tm-171	7.07E-12	5.92E-12	-16%
Dy-152	3.52E-09	2.18E-09	-38%	Tm-172	6.45E-09	4.87E-09	-25%
Dy-153	1.07E-08	7.03E-09	-34%	Tm-173	5.14E-09	3.69E-09	-28%
Dy-154*	0.00E+00	0.00E+00	0%	Tm-175	1.43E-08	1.01E-08	-29%
Dy-155	8.23E-09	5.41E-09	-34%	Yb-162	3.06E-09	1.91E-09	-38%
Dy-157	4.32E-09	2.74E-09	-36%	Yb-163	9.38E-09	6.59E-09	-30%
Dy-159	5.21E-10	2.07E-10	-60%	Yb-164*	6.35E-10	8.04E-09	1165%
Dy-165	9.24E-10	9.98E-10	8%	Yb-166*	9.98E-10	1.67E-08	1575%
Dy-166*	5.01E-10	1.89E-09	277%	Yb-167	3.17E-09	1.81E-09	-43%
Ho-154	2.50E-08	1.81E-08	-28%	Yb-169	3.93E-09	2.26E-09	-42%
Ho-155	7.85E-09	5.38E-09	-31%	Yb-175	4.92E-10	3.62E-10	-26%
Ho-156	2.66E-08	1.87E-08	-30%	Yb-177	2.97E-09	2.36E-09	-20%
Ho-157	7.26E-09	4.71E-09	-35%	Yb-178*	5.21E-10	2.98E-09	472%
Ho-159	4.69E-09	2.87E-09	-39%	Lu-165	1.41E-08	1.25E-08	-12%
Ho-160	2.12E-08	1.44E-08	-32%	Lu-167	2.04E-08	1.57E-08	-23%
Ho-161	6.45E-10	2.67E-10	-59%	Lu-169	1.60E-08	1.08E-08	-32%
Ho-162	2.01E-09	1.25E-09	-38%	Lu-170	3.01E-08	2.05E-08	-32%
Ho-162m*	6.86E-09	5.27E-09	-23%	Lu-171	8.09E-09	5.36E-09	-34%
Ho-163	0.00E+00	0.00E+00	0%	Lu-172	2.42E-08	1.64E-08	-32%
Ho-164	4.48E-10	3.06E-10	-32%	Lu-173	2.18E-09	1.25E-09	-43%
Ho-164m*	5.14E-10	5.24E-10	2%	Lu-174	1.37E-09	8.27E-10	-40%
Ho-166	1.41E-09	1.60E-09	13%	Lu-174m	6.93E-10	3.58E-10	-48%
Ho-166m	2.04E-08	1.38E-08	-32%	Lu-176	5.95E-09	3.91E-09	-34%
Ho-167	4.69E-09	3.20E-09	-32%	Lu-176m	7.49E-10	8.74E-10	17%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Lu-177	4.28E-10	3.10E-10	-28%	W-188*	2.41E-11	2.14E-09	8791%
Lu-177m*	1.23E-08	8.06E-09	-35%	W-190*	2.05E-09	1.42E-08	593%
Lu-178	2.66E-09	2.55E-09	-4%	Re-178	2.10E-08	1.48E-08	-30%
Lu-178m	1.35E-08	9.13E-09	-32%	Re-179*	1.33E-08	9.07E-09	-32%
Lu-179	1.06E-09	1.15E-09	8%	Re-181	9.99E-09	6.67E-09	-33%
Hf-170	5.45E-09	3.55E-09	-35%	Re-182	2.20E-08	1.47E-08	-33%
Hf-172*	1.19E-09	6.15E-10	-48%	Re-182m	1.49E-08	1.00E-08	-33%
Hf-173	4.84E-09	3.03E-09	-37%	Re-183	1.82E-09	1.07E-09	-41%
Hf-174	0.00E+00	0.00E+00	0%	Re-184	1.11E-08	7.51E-09	-32%
Hf-175	4.38E-09	2.82E-09	-36%	Re-184m*	4.69E-09	8.74E-09	86%
Hf-177m	2.84E-08	1.86E-08	-35%	Re-186	5.78E-10	6.17E-10	7%
Hf-178m	2.81E-08	1.89E-08	-33%	Re-186m*	1.74E-10	7.04E-10	304%
Hf-179m	1.15E-08	7.55E-09	-34%	Re-187	0.00E+00	0.00E+00	0%
Hf-180m	1.24E-08	8.21E-09	-34%	Re-188	1.97E-09	2.10E-09	7%
Hf-181	6.69E-09	4.56E-09	-32%	Re-188m	7.91E-10	4.57E-10	-42%
Hf-182*	2.97E-09	1.27E-08	326%	Re-189*	9.51E-10	8.33E-10	-12%
Hf-182m	1.14E-08	7.66E-09	-33%	Re-190m*	1.22E-08	1.44E-08	18%
Hf-183	1.03E-08	7.37E-09	-28%	Os-180*	1.49E-09	1.13E-08	655%
Hf-184	3.14E-09	2.23E-09	-29%	Os-181	1.69E-08	1.14E-08	-32%
Ta-172	2.16E-08	1.51E-08	-30%	Os-182*	5.35E-09	1.36E-08	154%
Ta-173	7.22E-09	4.88E-09	-32%	Os-183	7.77E-09	5.12E-09	-34%
Ta-174	1.25E-08	8.79E-09	-30%	Os-183m	1.24E-08	8.41E-09	-32%
Ta-175	1.35E-08	9.03E-09	-33%	Os-185	8.71E-09	5.93E-09	-32%
Ta-176	2.66E-08	1.81E-08	-32%	Os-186	0.00E+00	0.00E+00	0%
Ta-177	7.85E-10	4.32E-10	-45%	Os-189m	5.37E-13	2.29E-16	-100%
Ta-178m	1.44E-08	9.42E-09	-35%	Os-191	9.47E-10	5.82E-10	-39%
Ta-179	2.82E-10	1.44E-10	-49%	Os-191m	6.71E-11	3.81E-11	-43%
Ta-180	5.57E-10	3.06E-10	-45%	Os-193	1.20E-09	1.07E-09	-11%
Ta-182	1.59E-08	1.07E-08	-32%	Os-194*	2.94E-11	2.47E-09	8291%
Ta-182m	3.16E-09	1.95E-09	-38%	Os-196*	1.40E-09	5.58E-09	299%
Ta-183	3.60E-09	2.33E-09	-35%	Ir-182	1.89E-08	1.38E-08	-27%
Ta-184	2.01E-08	1.40E-08	-31%	Ir-183	1.45E-08	9.92E-09	-32%
Ta-185	2.86E-09	2.49E-09	-13%	Ir-184	2.45E-08	1.68E-08	-31%
Ta-186	1.93E-08	1.41E-08	-27%	Ir-185	1.02E-08	6.91E-09	-32%
W-177	1.13E-08	7.49E-09	-34%	Ir-186	2.04E-08	1.39E-08	-32%
W-178*	1.70E-10	9.84E-10	477%	Ir-186m	1.53E-08	1.05E-08	-31%
W-179	6.05E-10	2.99E-10	-50%	Ir-187	4.08E-09	2.70E-09	-34%
W-181	4.53E-10	2.39E-10	-47%	Ir-188	2.48E-08	1.70E-08	-31%
W-185	2.22E-12	3.89E-11	1651%	Ir-189*	8.98E-10	5.32E-10	-41%
W-187	5.87E-09	4.19E-09	-29%	Ir-190	1.86E-08	1.26E-08	-32%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Ir-190m	5.90E-13	9.17E-17	-100%	Hg-192	3.29E-09	2.09E-09	-36%
Ir-190n*	6.49E-10	1.29E-08	1884%	Hg-193	1.02E-08	6.90E-09	-32%
Ir-192	1.03E-08	7.01E-09	-32%	Hg-193m*	1.26E-08	1.04E-08	-18%
Ir-192n*	1.13E-11	7.01E-09	61917%	Hg-194*	2.16E-12	8.54E-09	395577%
Ir-193m	4.24E-12	2.07E-12	-51%	Hg-195	2.41E-09	1.58E-09	-34%
Ir-194	2.41E-09	2.46E-09	2%	Hg-195m*	2.44E-09	2.45E-09	1%
Ir-194m	2.96E-08	2.02E-08	-32%	Hg-197	8.11E-10	4.90E-10	-40%
Ir-195	9.83E-10	8.55E-10	-13%	Hg-197m	1.12E-09	7.03E-10	-37%
Ir-195m*	4.80E-09	3.36E-09	-30%	Hg-199m	2.18E-09	1.40E-09	-36%
Pt-184	8.90E-09	5.85E-09	-34%	Hg-203	2.96E-09	1.93E-09	-35%
Pt-186*	8.56E-09	1.44E-08	68%	Tl-194	1.23E-08	9.04E-09	-27%
Pt-187	7.69E-09	5.16E-09	-33%	Tl-194m	3.21E-08	2.21E-08	-31%
Pt-188*	2.45E-09	1.85E-08	657%	Tl-195	1.48E-08	1.01E-08	-32%
Pt-189	5.98E-09	3.97E-09	-34%	Tl-196	2.29E-08	1.59E-08	-30%
Pt-190	0.00E+00	0.00E+00	0%	Tl-197	5.62E-09	3.79E-09	-33%
Pt-191	3.60E-09	2.34E-09	-35%	Tl-198	2.42E-08	1.66E-08	-31%
Pt-193	1.43E-12	3.24E-16	-100%	Tl-198m	1.53E-08	1.04E-08	-32%
Pt-193m	1.21E-10	7.12E-11	-41%	Tl-199	3.05E-09	2.00E-09	-35%
Pt-195m	8.26E-10	4.92E-10	-40%	Tl-200	1.63E-08	1.10E-08	-32%
Pt-197	3.22E-10	2.83E-10	-12%	Tl-201	1.06E-09	6.48E-10	-39%
Pt-197m	9.68E-10	6.18E-10	-36%	Tl-202	5.82E-09	3.95E-09	-32%
Pt-199	3.28E-09	2.73E-09	-17%	Tl-204	1.45E-10	2.29E-10	58%
Pt-202*	1.04E-09	5.02E-09	384%	Pb-194	1.33E-08	8.99E-09	-32%
Au-186	2.00E-08	1.46E-08	-27%	Pb-195m	2.09E-08	1.44E-08	-31%
Au-190	2.81E-08	1.93E-08	-31%	Pb-196	6.10E-09	4.06E-09	-33%
Au-191	7.38E-09	4.94E-09	-33%	Pb-197m*	1.47E-08	1.24E-08	-16%
Au-192	2.30E-08	1.58E-08	-31%	Pb-198	5.39E-09	3.55E-09	-34%
Au-193	1.98E-09	1.25E-09	-37%	Pb-199	1.27E-08	8.66E-09	-32%
Au-194	1.26E-08	8.54E-09	-32%	Pb-200	2.46E-09	1.56E-09	-37%
Au-195	9.23E-10	5.52E-10	-40%	Pb-201	9.39E-09	6.31E-09	-33%
Au-196	5.90E-09	3.91E-09	-34%	Pb-202*	2.50E-12	3.91E-09	156152%
Au-196m	2.88E-09	1.81E-09	-37%	Pb-202m	2.52E-08	1.72E-08	-32%
Au-198	5.39E-09	3.89E-09	-28%	Pb-203	3.82E-09	2.47E-09	-35%
Au-198m	6.42E-09	4.08E-09	-36%	Pb-204m	2.61E-08	1.78E-08	-32%
Au-199	1.15E-09	7.47E-10	-35%	Pb-205	2.53E-12	5.23E-16	-100%
Au-200	4.49E-09	3.78E-09	-16%	Pb-209	4.25E-11	1.11E-10	161%
Au-200m*	2.50E-08	1.78E-08	-29%	Pb-210*	2.89E-11	6.44E-10	2129%
Au-201	9.74E-10	1.02E-09	5%	Pb-211*	1.44E-09	1.78E-09	23%
Hg-190	2.36E-09	1.48E-09	-37%	Pb-212*	1.76E-09	9.42E-09	436%
Hg-191m	1.84E-08	1.25E-08	-32%	Pb-214*	3.24E-09	1.59E-08	390%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Bi-200	3.08E-08	2.11E-08	-32%	Ac-225*	1.76E-10	3.37E-10	92%
Bi-201	2.10E-08	1.45E-08	-31%	Ac-226*	1.82E-09	1.47E-09	-20%
Bi-202	3.44E-08	2.36E-08	-31%	Ac-227*	3.16E-12	9.67E-10	30544%
Bi-203	2.89E-08	1.99E-08	-31%	Ac-228	1.12E-08	7.92E-09	-29%
Bi-204*	3.61E-08	2.64E-08	-27%	Th-228*	2.88E-11	1.03E-10	258%
Bi-205	2.04E-08	1.40E-08	-31%	Th-229*	1.03E-09	1.03E-09	-1%
Bi-206	4.06E-08	2.78E-08	-31%	Th-230*	8.54E-12	6.29E-11	636%
Bi-207	1.93E-08	1.32E-08	-31%	Th-232*	6.03E-12	7.92E-09	131123%
Bi-208	2.94E-08	2.02E-08	-31%	Th-234*	1.09E-10	1.92E-09	1663%
Bi-210	4.68E-10	6.35E-10	36%	Pa-227*	2.40E-10	2.55E-10	6%
Bi-210m*	3.25E-09	3.19E-09	-2%	Pa-228*	1.68E-08	1.14E-08	-32%
Bi-212*	2.05E-09	1.90E-09	-7%	Pa-229	7.27E-10	4.39E-10	-40%
Bi-213*	2.18E-09	1.86E-09	-15%	Pa-230	8.29E-09	5.61E-09	-32%
Bi-214*	1.89E-08	1.36E-08	-28%	Pa-231*	4.62E-10	1.26E-09	172%
Po-203	2.02E-08	1.38E-08	-32%	Pa-232	1.17E-08	8.01E-09	-32%
Po-204	1.44E-08	9.68E-09	-33%	Pa-233	2.69E-09	1.75E-09	-35%
Po-205	1.96E-08	1.34E-08	-32%	Pa-234	1.84E-08	1.25E-08	-32%
Po-206*	1.48E-08	3.64E-08	146%	Pa-235	6.73E-10	8.88E-10	32%
Po-207	1.60E-08	1.09E-08	-32%	U-230*	2.02E-11	1.51E-10	644%
Po-208	2.66E-13	1.81E-13	-32%	U-231	8.88E-10	4.97E-10	-44%
Po-209	7.69E-11	5.15E-11	-33%	U-232*	9.72E-12	1.05E-10	978%
Po-210	1.23E-13	8.42E-14	-31%	U-233*	6.34E-12	1.03E-09	16122%
At-205	1.45E-08	1.01E-08	-30%	U-234*	7.73E-12	6.38E-11	726%
At-206	3.14E-08	2.18E-08	-31%	U-235*	1.98E-09	1.36E-09	-32%
At-207	2.46E-08	1.69E-08	-31%	U-235m	0.00E+00	0.00E+00	0%
At-208	3.77E-08	2.58E-08	-32%	U-236	6.42E-12	4.81E-13	-93%
At-209	2.86E-08	1.95E-08	-32%	U-237	1.64E-09	9.95E-10	-39%
At-210	3.60E-08	2.44E-08	-32%	U-238*	5.21E-12	1.92E-09	36830%
At-211*	4.08E-10	2.92E-10	-28%	U-239	1.09E-09	1.02E-09	-6%
Fr-212	1.40E-08	9.55E-09	-32%	U-240*	7.45E-11	4.10E-09	5411%
Fr-222*	3.14E-09	2.75E-09	-12%	U-242*	9.60E-10	5.01E-09	421%
Fr-223	1.03E-09	8.87E-10	-14%	Np-232	1.49E-08	1.00E-08	-33%
Ra-223*	1.69E-09	1.57E-09	-7%	Np-233	1.03E-09	6.31E-10	-39%
Ra-224*	1.28E-10	8.77E-11	-31%	Np-234	1.33E-08	9.10E-09	-32%
Ra-225*	1.47E-10	4.06E-10	177%	Np-235	2.88E-11	4.39E-12	-85%
Ra-226*	8.90E-11	6.00E-11	-33%	Np-236*	1.70E-09	1.02E-09	-40%
Ra-227	2.25E-09	1.78E-09	-21%	Np-236m	5.75E-10	3.80E-10	-34%
Ra-228*	9.78E-12	7.92E-09	80872%	Np-237*	3.25E-10	1.91E-09	488%
Ra-230*	1.00E-09	7.04E-09	601%	Np-238	7.50E-09	5.26E-09	-30%
Ac-224	2.73E-09	1.73E-09	-37%	Np-239	2.16E-09	1.38E-09	-36%

*Includes progeny ingrowth for FGR 15

Table C.2. cont. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 pCi^{-1} h^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
Np-240	1.33E-08	9.30E-09	-30%	Bk-246	1.06E-08	7.13E-09	-32%
Np-241	9.70E-10	9.74E-10	0%	Bk-247	1.76E-09	1.11E-09	-37%
Pu-232*	7.07E-10	8.15E-09	1053%	Bk-248m	7.66E-10	5.96E-10	-22%
Pu-234	7.69E-10	4.63E-10	-40%	Bk-249	7.55E-14	4.11E-12	5347%
Pu-235	1.06E-09	6.44E-10	-39%	Bk-250	1.13E-08	7.90E-09	-30%
Pu-236	8.91E-12	4.82E-13	-95%	Bk-251	1.25E-09	9.58E-10	-23%
Pu-237	5.69E-10	3.33E-10	-42%	Cf-244	1.01E-11	4.23E-13	-96%
Pu-238	7.98E-12	3.18E-13	-96%	Cf-246	7.53E-12	6.44E-13	-91%
Pu-239*	4.08E-12	5.87E-13	-86%	Cf-247	1.13E-09	6.58E-10	-42%
Pu-240	7.57E-12	3.25E-13	-96%	Cf-248	1.26E-11	3.38E-12	-73%
Pu-241	1.90E-14	2.37E-14	24%	Cf-249	4.10E-09	2.75E-09	-33%
Pu-242	7.41E-12	9.63E-13	-87%	Cf-250	1.30E-10	8.95E-11	-31%
Pu-243	3.02E-10	2.38E-10	-21%	Cf-251	1.43E-09	8.78E-10	-38%
Pu-244*	2.56E-10	4.28E-09	1575%	Cf-252	5.75E-09	4.19E-09	-27%
Pu-245*	5.21E-09	4.15E-09	-20%	Cf-253	2.82E-11	1.89E-11	-33%
Pu-246*	1.67E-09	1.01E-08	508%	Cf-254	2.13E-07	1.56E-07	-27%
Am-237	4.50E-09	2.93E-09	-35%	Cf-255	7.70E-11	1.55E-10	102%
Am-238	1.11E-08	7.53E-09	-32%	Es-249	5.06E-09	3.34E-09	-34%
Am-239	2.78E-09	1.72E-09	-38%	Es-250	1.49E-08	9.85E-09	-34%
Am-240	1.28E-08	8.64E-09	-32%	Es-250m	6.77E-09	4.54E-09	-33%
Am-241	2.90E-10	1.38E-10	-52%	Es-251	1.11E-09	6.55E-10	-41%
Am-242	2.14E-10	1.84E-10	-14%	Es-253	6.66E-12	2.80E-12	-58%
Am-242m*	2.76E-11	1.86E-10	575%	Es-254*	1.18E-10	7.92E-09	6620%
Am-243*	6.61E-10	1.77E-09	168%	Es-254m*	6.11E-09	4.38E-09	-28%
Am-244	1.01E-08	6.86E-09	-32%	Es-255*	9.10E-12	1.08E-10	1091%
Am-244m	9.34E-10	1.09E-09	17%	Es-256	8.87E-10	1.14E-09	28%
Am-245	5.46E-10	5.01E-10	-8%	Fm-251*	1.86E-09	1.20E-09	-36%
Am-246	9.70E-09	6.80E-09	-30%	Fm-252	1.20E-11	2.83E-12	-76%
Am-246m	1.28E-08	9.13E-09	-29%	Fm-253	7.47E-10	4.22E-10	-44%
Am-247	2.25E-09	1.87E-09	-17%	Fm-254	9.66E-11	6.37E-11	-34%
Cm-238*	9.30E-10	7.80E-09	739%	Fm-255	9.54E-11	1.55E-11	-84%
Cm-239	3.06E-09	1.92E-09	-37%	Fm-256	1.56E-07	1.13E-07	-27%
Cm-240	9.98E-12	4.69E-13	-95%	Fm-257*	1.76E-09	1.12E-09	-36%
Cm-241	6.18E-09	4.14E-09	-33%	Ap-239*	4.08E-12	5.87E-13	-86%
Cm-242	8.90E-12	3.89E-13	-96%	Bg-90*	2.18E-11	2.06E-09	9324%
Cm-243	1.57E-09	9.75E-10	-38%				
Cm-244	7.79E-12	4.56E-13	-94%				
Cm-246	5.15E-11	3.32E-11	-36%				
Cm-248	1.67E-08	1.21E-08	-27%				
Bk-245	2.74E-09	1.71E-09	-38%				

*Includes progeny ingrowth for FGR 15

Table C.3. MAXDOSE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients of Noble Gases [mrem m^3 pCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change
Ar-37†		7.15E-08[1]	
Ar-39†		5.57E-05	
Ar-41	7.18E-03	7.44E-03	4%
Ar-42*†		2.35E-03	
Kr-81†		4.57E-06	
Kr-83m	1.28E-07	1.52E-07	18%
Kr-85m	8.00E-04	8.57E-04	7%
Kr-85	2.81E-05	7.99E-05	184%
Kr-87	4.64E-03	5.19E-03	12%
Kr-88*	1.13E-02	1.65E-02	46%
Kr-89	1.12E-02	1.19E-02	6%
Xe-127†		1.32E-03	
Xe-131m	4.17E-05	3.85E-05	-8%
Xe-133m	1.51E-04	1.47E-04	-2%
Xe-133	1.60E-04	1.53E-04	-4%
Xe-135m	2.21E-03	2.25E-03	2%
Xe-135	1.28E-03	1.36E-03	6%
Xe-137	1.21E-03	1.87E-03	54%
Xe-138	6.39E-03	6.69E-03	5%

*Includes progeny ingrowth for FGR 15

†Added in FGR 15

[1]DOE-STD-1196-2011, Table A-3

APPENDIX D

Table D.1. MAXINE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Air Submersion Dose Coefficients [mrem m^3 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	4.57E-03	100%	U-238*	3.74E-01	4.48E+02	100%
C-14	3.04E-01	4.64E+00	93%	Np-237*	1.00E+02	1.19E+03	92%
Ar-37	7.15E-02	7.15E-02[1]	0%	Pu-238	3.92E-01	3.64E-01	-8%
Ar-39	1.34E+01	5.57E+01	76%	Pu-239*	4.40E-01	4.25E-01	-4%
Ar-41	7.18E+03	7.44E+03	4%	Am-241	7.85E+01	6.40E+01	-23%
Ar-42*	1.47E+01	2.35E+03	99%	Am-243*	2.24E+02	1.07E+03	79%
Cr-51	1.63E+02	1.64E+02	1%	Cm-242	4.55E-01	4.09E-01	-11%
Co-60	1.39E+04	1.42E+04	2%	Cm-244	4.67E-01	4.32E-01	-8%
Zn-65	3.18E+03	3.24E+03	2%	Cf-252	2.60E+03	2.73E+03	5%
Se-75	1.94E+03	1.95E+03	1%				
Kr-81	4.46E+00	4.57E+00	2%				
Kr-85	2.81E+01	7.99E+01	65%				
Kr-85m	8.00E+02	8.57E+02	7%				
Kr-87	4.64E+03	5.19E+03	11%				
Kr-88*	1.13E+04	1.65E+04	31%				
Sr-90*	1.15E+01	4.28E+02	97%				
Zr-95*	3.89E+03	4.04E+03	4%				
Nb-95	4.08E+03	4.16E+03	2%				
Ru-103*	2.58E+03	2.63E+03	2%				
Ru-106	0.00E+00	1.77E+03	100%				
Sb-125*	2.22E+03	2.28E+03	3%				
I-129	3.34E+01	3.28E+01	-2%				
I-131	1.98E+03	2.04E+03	3%				
I-133	3.25E+03	3.41E+03	5%				
I-135*	8.84E+03	8.47E+04	90%				
Xe-127	1.32E+03	1.32E+03	0%				
Xe-133	1.60E+02	1.53E+02	-5%				
Xe-135	1.28E+03	1.36E+03	6%				
Cs-134	8.26E+03	8.46E+03	2%				
Cs-137*	1.10E+01	3.08E+03	100%				
Ce-141	3.65E+02	3.93E+02	7%				
Ce-144*	8.58E+01	7.88E+02	89%				
Pm-147	1.01E+00	7.66E+00	87%				
Eu-154	6.75E+03	6.93E+03	3%				
Eu-155	2.53E+02	2.44E+02	-4%				
Os-185	3.57E+03	3.61E+03	1%				
Hg-194*	5.24E-02	5.68E+03	100%				
Hg-203	1.21E+03	1.22E+03	1%				
U-234*	7.17E-01	4.07E+01	98%				
U-235*	8.02E+02	8.67E+02	7%				

*Includes progeny ingrowth for FGR 15

[1]DOE-STD-1196-2011, Table A-3

Table D.2. MAXINE Maximally Exposed Individual (FGR 12) vs. Reference Person (FGR 15) Ground Shine Dose Coefficients [mrem m^2 μCi^{-1} yr^{-1}]

Nuclide	FGR 12	FGR 15	% Change	Nuclide	FGR 12	FGR 15	% Change
H-3	0.00E+00	7.97E-05	100%	U-238*	4.56E-02	1.69E+01	100%
C-14	1.49E-03	7.33E-02	98%	Np-237*	2.85E+00	1.68E+01	83%
Ar-37†				Pu-238	6.99E-02	2.78E-03	-2410%
Ar-39	2.94E-01	9.70E-01	70%	Pu-239*	3.57E-02	5.14E-03	-594%
Ar-41	1.42E+02	1.01E+02	-41%	Am-241	2.54E+00	1.21E+00	-110%
Ar-42*	4.76E-01	4.62E+01	99%	Am-243*	5.79E+00	1.55E+01	63%
Cr-51	3.49E+00	2.32E+00	-51%	Cm-242	7.79E-02	3.41E-03	-2184%
Co-60	2.68E+02	1.84E+02	-46%	Cm-244	6.83E-02	4.00E-03	-1608%
Zn-65	6.27E+01	4.29E+01	-46%	Cf-252	5.04E+01	3.67E+01	-37%
Se-75	4.15E+01	2.69E+01	-54%				
Kr-81	1.83E-01	5.83E-02	-214%				
Kr-85	1.23E+00	1.97E+00	38%				
Kr-85m	1.82E+01	1.31E+01	-39%				
Kr-87	9.78E+01	7.90E+01	-24%				
Kr-88*	2.01E+02	2.20E+02	9%				
Sr-90*	1.91E-01	1.80E+01	99%				
Zr-95*	8.12E+01	5.68E+01	-43%				
Nb-95	8.47E+01	5.82E+01	-46%				
Ru-103*	5.53E+01	3.84E+01	-44%				
Ru-106	0.00E+00	4.06E+01	100%				
Sb-125*	4.83E+01	3.28E+01	-47%				
I-129	2.32E+00	5.60E-01	-314%				
I-131	4.26E+01	2.93E+01	-45%				
I-133	7.26E+01	5.31E+01	-37%				
I-135*	1.72E+02	2.75E+02	38%				
Xe-127	2.99E+01	1.83E+01	-63%				
Xe-133	4.74E+00	2.55E+00	-86%				
Xe-135	2.92E+01	2.08E+01	-41%				
Cs-134	1.73E+02	1.19E+02	-45%				
Cs-137*	6.41E+01	4.50E+01	-42%				
Ce-141	8.13E+00	5.41E+00	-50%				
Ce-144*	2.02E+00	2.49E+01	92%				
Pm-147	3.28E-03	1.12E-01	97%				
Eu-154	1.37E+02	9.43E+01	-45%				
Eu-155	6.29E+00	3.70E+00	-70%				
Os-185	7.63E+01	5.20E+01	-47%				
Hg-194*	1.89E-02	7.48E+01	100%				
Hg-203	2.59E+01	1.70E+01	-53%				
U-234*	6.77E-02	5.59E-01	88%				
U-235*	1.74E+01	1.19E+01	-46%				

*Includes progeny ingrowth for FGR 15

†Considered only for Air Submersion